



HIGH PERFORMANCE REINFORCEMENT PRODUCTS

HRC 400 Series – High Performance Reinforcement Couplers:

- Proven and documented quality
- Exceed all known requirements for reinforcement couplers



General advantages of mechanical splices

- save material by eliminating lap splices
- reduce congestion, ease and speed up the reinforcing work and improve casting conditions (leading to improved quality of the finished product)
- give more flexibility for the formwork and allows for the use of alternative formwork systems
- allow flexible placement of access openings for prestressing jacks etc.
- improves construction safety and accessibility of workspace by removing protruding rebar



Special advantages of HRC 400 Series reinforcement couplers

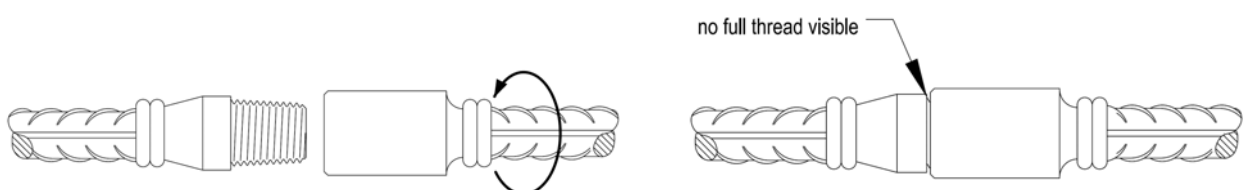
- fulfil and exceed all known requirements for rebar couplers (see also table 2)
- exceed the actual stress- and strain capacity of all reinforcing grades, independent of variable steel heats, in other words: a failure will occur outside the splice
→ full ductility is available
- tapered threads provide fast, simple, self-locking installation
- reliable quality control by easy visual inspection
- coarse threads - robust against tolerances and rough field conditions on site
- HRC 490 Position Coupler allows splice adjustment without turning the rebar (cast inn bars, pre-tied reinforcement, bend bars)
- can be combined with other HRC products



HRC 400 - Reliable quality control through visual inspection

HRC 400 reinforcement couplers utilise tapered threads. This is functional because this type of thread is easy to install and self-locking. For all tapered threads it is crucial that the threads are fully engaged to be able to activate the full capacity of the connection. Use of a torque wrench is no guarantee for this, because the threads might be blocked by sand, dirt etc. Much torque can than be applied without the threads being fully engaged.

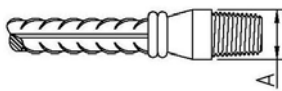
HRC 400 Series couplers offer a reliable and easy quality control by simple visual inspection: no full thread must be visible – then one knows the threads to be fully engaged. HRC recommends applying torque for specially demanding applications (fatigue loads, special slip demands, earthquake loads).



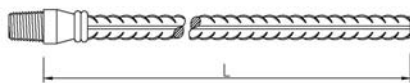
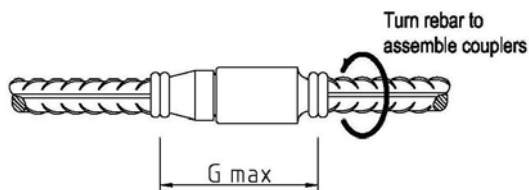
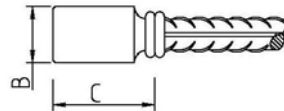
Geometry of HRC 400 Series Reinforcement Couplers

Standard Couplers

HRC 410 (Male)

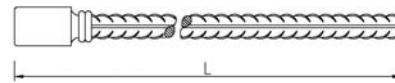
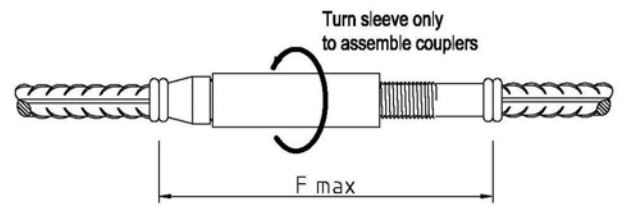
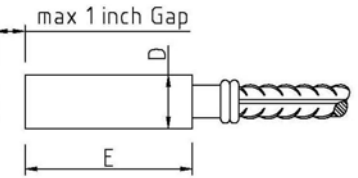
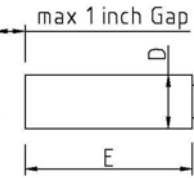


HRC 420 (Female)



Position Couplers with length adjustment

HRC 410 (Male)



Series 400 are available in length 200- 12 000mm (up to 18 000mm as special order)

Nominal diameter of reinforcement bar	Sleeve and Thread Dimensions							
	A	B	C	D	E	F max	G max	Torque
Ø mm	mm	mm	mm	mm	mm	mm	mm	Nm
12	22	22	45	-	-	-	72	160
16	25	29	50	-	-	-	76	200
20	35	35	55	-	-	-	85	200
25	35	42	76	-	-	-	113	270
32	46	56	90	55	157	330	135	270
32 < Ø ≤ 57,3	special order							

- All products are designed to exceed the actual stress and strain capacity of the rebar.
- Meets and exceeds all requirements of ISO 15835 (including fatigue and earthquake resistance)
- Transition to different reinforcing bar sizes is available.
- Mechanical properties that fulfil the ductility requirements for reinforcement steel with a characteristic yield strength of 500 MPa in accordance to EN 10080.
- Can be combined with other HRC products.
- Can be delivered with nail-on flange.

HRC 400 Series – tested and documented high performance

A good reinforcement coupler will make the reinforcement behave like continuous rebar. To achieve this, the coupler must perform adequately. The demands on the performance of reinforcement couplers are listed in standards for design and execution of concrete works and in specifications from road authorities or others. Since spring 2009 an ISO-standard for reinforcement couplers exists:

ISO 15835 “Steels for the reinforcement of concrete – Reinforcement couplers for mechanical splices of bars”.

ISO 15835 specifies requirements for reinforcement couplers. It gives both test and performance criteria of mechanical splices for different load situations. Depending of their performance rebar couplers are classified in categories. Table 1 shows detailed requirements for the properties, compared to other specifications.

Category	Designation	Properties tested
B	Basic	Strength, ductility and slip under static forces
F	Fatigue	High cycle fatigue
S1	Seismic 1 – moderate	Moderate low cycle loading (high stresses)
S2	Seismic 2 - violent	Violent low cycle loading (large strains)

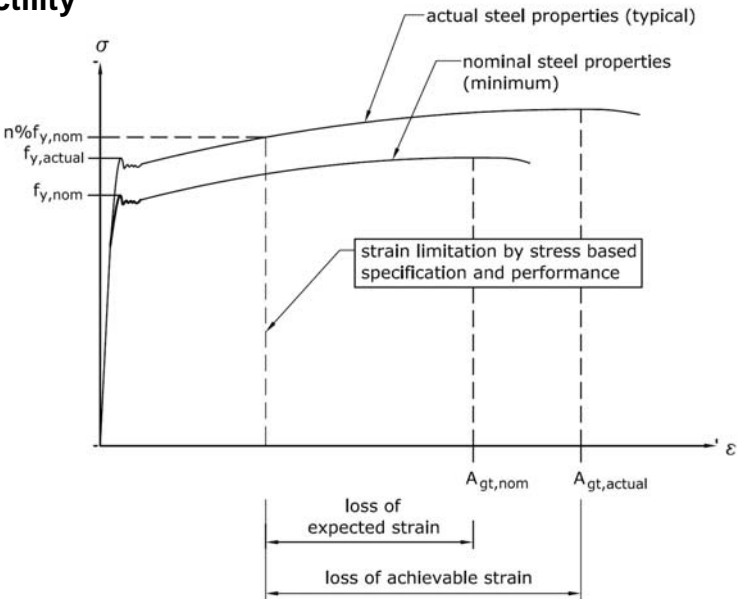
Table 1: Categories of mechanical splices according to ISO 15835

HRC 400 reinforcement couplers fulfil and exceed the performance criteria for all categories according to ISO 15835.)*

)* HRC 490 Position couplers show slightly higher slip (average slip of 0,13mm)

A remark regarding the transfer of ductility

The diagram to the right illustrates how a reinforcement coupler with insufficient capacity will hinder the utilization of the full ductility of the reinforcing steel. The stress- and strain properties of most rebar steel heats exceed the minimum requirements of the standards as $f_{y,spec}$ ($f_{y,nom}$) and $A_{gt,nom}$. If the prescribed capacity of the coupler ($xn\% \cdot f_{y,spec}$) is too low, the prescribed strength will be achieved, but the usable elongation will be limited considerably. This might be harmful for design which makes use of the full ductility of the reinforcement.



HRC 400 Series reinforcement couplers exceed the actual stress- and strain capacity of the reinforcing steel, independent of the steel heat used. Thus the full ductility (stress and strain) of the reinforcing steel can be utilized.

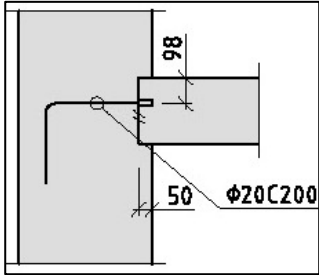
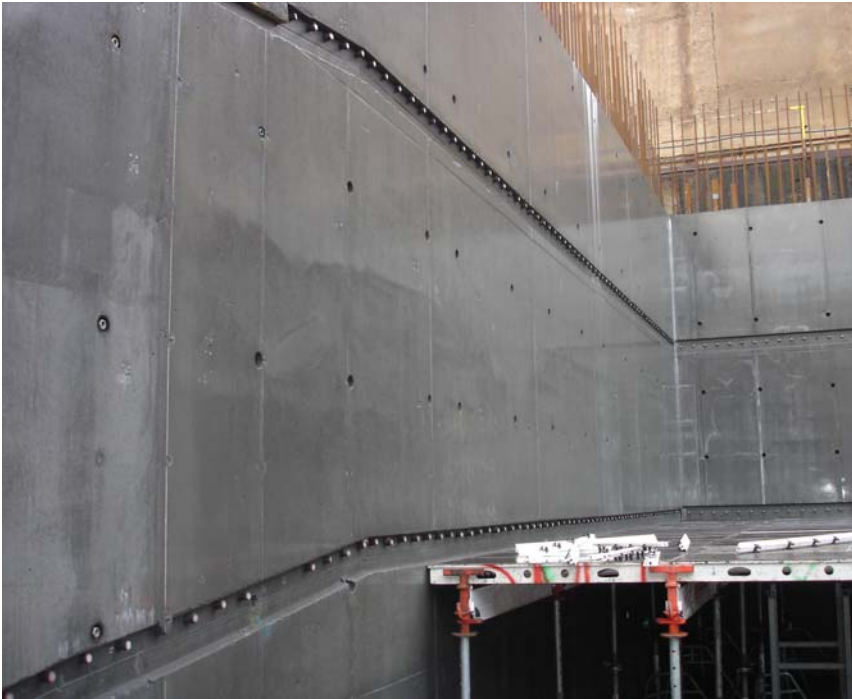
Performance of HRC 400 Series compared to different specifications

Specification	Requirements for:				Fatigue
	Strength	Slip		Low Cyclic Loading (earthquake)	
		Test procedure	Requirement		
Great Britain: BS 8110	115% $f_{y,spec}$	0,1mm	1x 0,6 f_y	-	-
USA: CALTRANS (California Test 670, Sept 2004)	95% $f_{u,act}$	0,25...0,45mm, depending on rebar diameter	1x 200 MPa	100x 0,9 f_y /0,05 f_y	±173 MPa, 10.000 cycles
USA: ICC-ES, AC 133	UBC: 0,95% $R_{m,act}$ / 160% $f_{y,spec}$ IBC: 100% $f_{u,spec}$ / 125% $f_{y,spec}$	-	-	20x 0,95 f_y / 0,5 f_y (compression) + 4x 2 e_y / 0,5 f_y (comp.) + 4x 5 e_y / 0,5 f_y (comp.) + loading to failure	-
USA: ACI 318, ACI 349	Type 1: 125% f_y Type 2: 100% $R_{m,spec}$	-	-	100x 0,9 f_y /0,05 f_y	-
Germany: Deutsches Institut für Bautechnik (DIBT): Basic requirements for testing of mech. splices for reinf. steel, May 2007	130% $f_{y,spec}$	0,1...0,2mm depending on length of coupler	1x 0,6 f_y	-	300/240MPa, 2*10 ⁶ cycles
ISO 15835	$R_{eH,spec} * (R_{m1}/R_{eH})_{spec}$	0,1mm	3x 0,6 f_y	moderate scale earthquake: 20x 0,95 f_y / 0,5 f_y (comp.) + Loading to failure → residual elongation: ≤ 0,3mm violent earthquake: 4x 2 e_y /0,5 f_y (comp.) + 4x 5 e_y /0,5 f_y (comp.) + loading to failure → residual elongation: ≤ 0,3mm and ≤ 0,6mm respectively	300/240MPa, 2*10 ⁶ cycles
Performance of HRC 400 Series when tested according to ISO 15835 (tests were performed by Stork FDO Inoteg B.V., Amsterdam):					
	100% R_m, actual (rebar failure always outside of splice)	0,01...0,04mm (Position coupler HRC490 - length 330mm average slip: 0,13mm)		Moderate scale earthquake: residual elongation max. 0,025 mm Violent earthquake: residual elongation max. 0,1/0,18 mm	fulfil requirements

Symbols: $f_{y,spec}$, R_{eH} - specified (or nominal) yield strength; $f_{u,spec}$, $R_{m,spec}$ - specified (or nominal) tensile strength; $R_{m,act}$ - actual tensile strength (real rupture strength) of rebar

Table 2: Performance and test requirements according to selected specifications

Use of HRC 400 Reinforcement couplers - examples



Drawing detail



Detail of slab-wall connection

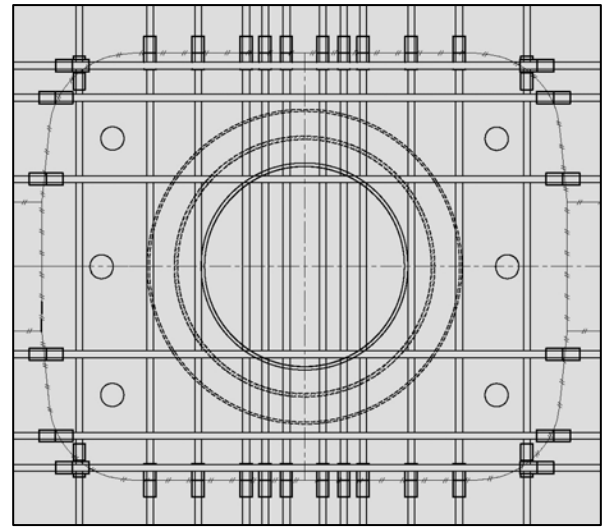
Slab-wall connection:
the use of couplers allow the wall to be cast non-stop



HRC 490 Position Couplers used to connect pre-tied reinforcement



HRC 490 Position Couplers for bend rebar

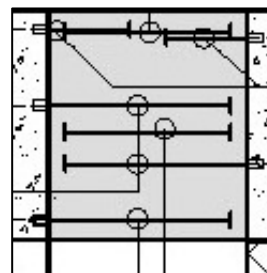
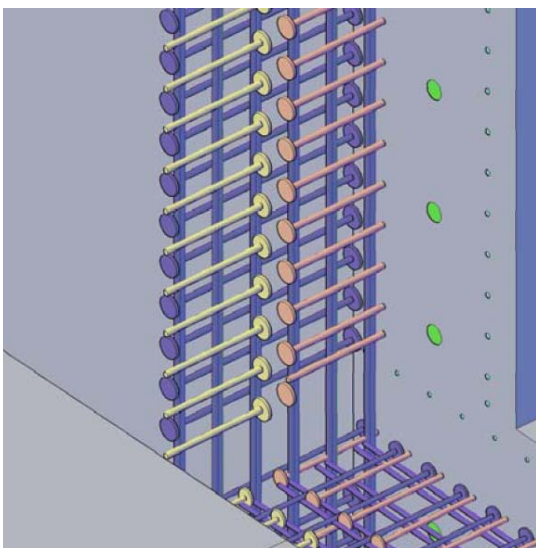


Drawing detail

Improved accessibility by avoiding protruding rebar



Subsequent closing of opening for prestressing equipment



HRC400 Series Couplers combined with HRC 100 Series T-headed bars allow short lap splices, f. ex. for joining of prefabricated elements.

DON'T MAKE THE SPLICE YOUR WEAK LINK!

Rebar splices with HRC 400 Series couplers are...

- **Safe**
Couplers can be easily inspected to ensure reliable and easy quality control by simple visual inspection.
- **Structural Performance**
HRC 400 Series couples transfer the full actual tensile capacity of the rebar – a tensile failure will occur outside the splice. The full ductility of the rebar can be utilised.
- **Material saving**
No “double” rebar in lap splices
- **Functional**
Coarse tapered threads result in robustness. The geometry allows for fast and easy installations. Position couplers enable splicing of pre-tied or bend reinforcement.



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