

General presentation

Sustainable management of our heritage is an ethical and ecological necessity. It is also an economic imperative, which requires achieving the lowest possible life-cycle cost over the structure's service life.

In the most exposed parts of the structure, stainless steel reinforcing bars are the most efficient solution to ensure the durability of concrete. Stainless steel rebars are used for repairs and for new works, partially or completely replacing carbon steels, both in precast products and for the execution of cast-in-situ structures.

General properties:

In addition to their excellent corrosion resistance which ensures a long service life for structures over several decades, the UGIGRIP® range provides a guarantee of:

- **Higher mechanical properties** than with conventional steel, which allows the use of smaller cross sections or a reduction in reinforcement (meaning weight and labour savings);
- Mechanical properties – yield strength and elongation – meeting the requirements of Eurocode 8, class M for **earthquake-resistant** construction;
- A selection of **non-magnetic** stainless steels for buildings where this property is required: hospitals, banks, airports, meteorological stations, etc.
- Mechanical properties at high temperature – tensile and creep – exceeding those of conventional steels, giving improved **fire resistance**;
- **A very low thermal conductivity which gives this product exceptional properties for treating thermal bridges.**

Designation

Standard		
France	United Kingdom	United States
XP-A 35-014	BS 6744	ASTM A 955 M

- New ECIS harmonized European standard currently being prepared.

In accordance with European design codes in the construction field, the products of the UGIGRIP® range comply with Eurocode 2 (cf. prEN 1992-1-1 sub-section 4.4.1.2) and Eurocode 3 (cf. prEN 1993-1-4).

Recommended grades

Ugitech recommendations:

Three Duplex grades are to be recommended in priority for their high mechanical properties and exceptional corrosion resistance. These grades are magnetic:

Brand name	Numerical designation EN 10088	Numerical designation US and other	Recommended exposure classes as per NF EN 206-1
UGIGRIP® 4062	1.4062	S32202	XC - XD1 – XD2
UGIGRIP® 4362	1.4362	S32304	XD3-XS1-XF1-XF2-XA1
UGIGRIP® 4462	1.4462	S32205/S31804	XS2-XS3-XF3-XF4-XA2-XA3



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Conventional Ugitech products:

Austenitic stainless steels (non-magnetic grades):

Brand name	Numerical designation EN 10088	Numerical designation US and other	Recommended exposure classes as per NF EN 206-1
UGIGRIP® 4301	1.4301	304	XC2 – XC3 – XC4
UGIGRIP® 4311	1.4311	304LN	XD1 – XD2
UGIGRIP® 4401	1.4401	316	XD3 – XS1 – XS2 - XF – XA

Specific products

Brand name	Numerical designation EN 10088	Numerical designation US and other	Recommended exposure classes as per NF EN 206-1
UGIGRIP® 4406	1.4406	"316LN"	XS3 – XF – XA Non-magnetic
UGIGRIP® 4571	1.4571	316Ti	XD – XS – XF - XA Non-magnetic

Mechanical properties

Stainless steels have very interesting mechanical properties in comparison with conventional steel. Depending on the dimensions and grades, **UGIGRIP®** products can be delivered with various yield strength levels.

Min Yield Strength

Stainless steel family	Grades	Yield strength at 0.2% in MPa Cold working process			Yield strength at 0.2% in MPa Hot rolling process		
		500	650	750	500	650	750
AUSTENITIC	304	X			X		
AUSTENITIC	316	X			X		
DUPLEX	4062	X	X		X		
DUPLEX	4362	X	X		X		
DUPLEX	4462	X	X	X	X	X	

Elongations values comply with most of standards and Eurocode 2. Austenitic grades 304 and 316 present high elongations values; Their ductility is particularly adapted to seismic applications.

Ductility: Min Values : Total elongation at maximum force in % (Agt) and stress ratio Rm/Rp0.2

	DUPLEX			AUSTENITIC	
Grades	4062	4362	4462	Type 304	Type 316
Agt % Min	5	5	5	15	15
Rm/Rp0,2 Min	1,10	1,10	1,10	1,15	1,15

Physical properties

Structure	Carbon steel	Austenitic stainless steels Type 304 – 316 (4301-4401)	Duplex stainless steel 1.4062 – 1.4362 – 1.4462
Coefficient of linear expansion between 20°C and 100°C (10 ⁻⁶ K ⁻¹)	10	16	13
Thermal conductivity at 20°C (W.m ⁻¹ K ⁻¹)	40	15	15
Resistivity (Ω.mm ² m ⁻¹)	18-20	73-75	80
Modulus of elasticity at 20°C (GPa)	206	193-196	200
Magnetic	Yes	No	Yes



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Corrosion resistance

UGIGRIP® is "stainless to the core", and there are therefore no worries about durability over time and no worries concerning metal cutting locations.

The passive layer:

Stainless steels produce a very thin oxide on the surface, consisting of chromium oxides and hydroxides a few Angstroms thick. This oxide, commonly called the passive layer, protects the stainless steel from external attacks and provides it with properties ensuring the corrosion resistance of these alloys. The passive layer forms an intrinsic part of the material, unlike the zinc deposited by galvanization on steels, which explains why stainless steel has essential advantages. Once formed, this layer is perfectly stable, because its thickness remains constant. The passive layer inhibits any exchange between the metal and the outside: in the event of an incident on the material (scratch, cutting, impact, drilling, deformation, etc.), it is reformed spontaneously. This self-restructuring is also called "repassivation".

Choosing the most appropriate grade:

Only by choosing the appropriate grade for the operating environment can the durability of structures be increased depending on the areas of exposure. European standard EN 206-1 defines the five main exposure classes of concrete structures. Depending on the environment to which the part of the structure is exposed, Ugitech recommends using the following grades of stainless steel.

Note: Stainless steel grade recommendation is made irrespective of the quality (porosity and permeability) of the concrete used.

Exposure class		Recommendation TYPE GRADES	
		DUPLEX	Conventional grades AISI/EN
Class XC (carbonation)	XC	1.4062	304/4301
	XD1 and XD2	1.4062	304/4301
Class XD (chlorides other than marine chlorides, including road salt)	XD3	1.4362	316/4401
	XS1	1.4362	316/4401
Classes XS (marine chlorides)	XS2 and XS3	1.4462	*
	XF1 and XF2	1.4362	316/4401
Class XF (freezing/thawing with deicing agent)	XF3 and XF4	1.4462	*
	XA1	1.4362	316/4401
Class XA (chemical attacks)	XA2 and XA3	1.4462	*



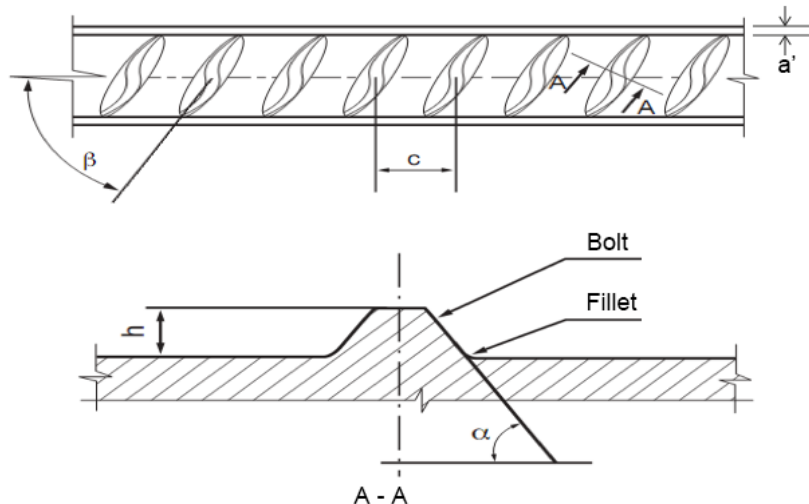
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Geometry of indented reinforcing bars

UGIGRIP® reinforcing bars are of the bolted rebar type:

Bolted rebars show at least two bolt fields with a uniform space. They can be with or without ribs; when there are ribs, their height (a') must not exceed $0.15 d$ (d = nominal diameter of the rebar).



Note: The angle of inclination of the bolts on the longitudinal axis of the product must be in a range between 35° and 75° . In any diametral plane, the angle of inclination of the sides of the bolts with the generatrix of the core contained in that plane must be greater than or equal to 45° .

Bolt height and spacing

Nominal diameter of product (d) mm	Bolt height (h) mm		Spacing between bolts (c) mm	
	Min.	Max.	Min.	Max.
5	0.25	0.50	2.5	5.0
6	0.30	0.60	3.0	6.0
7	0.35	0.70	3.5	7.0
8	0.40	0.80	4.0	8.0
9	0.45	0.90	4.5	9.0
10	0.50	1.00	5.0	10.0
12	0.60	1.20	6.0	12.0
14	0.70	1.40	7.0	14.0
16	0.80	1.60	8.0	16.0
20	1.00	2.00	10.0	20.0
25	1.25	2.50	12.5	25.0
32	1.60	3.20	16.0	32.0
40	2.00	4.00	20.0	40.0
50	2.50	5.00	25.0	50.0

The height of the bolts must be in a range between $0.05 d$ and $0.1 d$; the bolt spacing must be in a range between $0.5 d$ and $1.0 d$ (d = nominal diameter of the product).

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Form factors

The standards require rebar surface shape characteristics capable of ensuring steel/concrete bonding. The requirements cover minimum values, either for bolt height or recess depth, or the "relative surface area" of the bolts (fR). The bolt form factor must comply with the requirements given in the table below, depending on the product's nominal diameter.

Minimum form factor (fR)

Nominal diameter of the rebar (d) mm	Min. fR
5 and 6	0.039
7 and 8	0.045
9 and 10	0.052
12 to 50	0.056

Mass per unit length

Mass per unit length of stainless steel rebars

Diameter	Nominal cross section	Density 7.8 kg/dm ³ (Duplex)	Density 7.9 kg/dm ³ (austenitics)	Density 8 kg/dm ³ (austenitics)
		1.4062-1.4362-1.4462	Type 304/4301	Type 316/4401
4	12.6	0.097	0.098	0.099
5	19.6	0.151	0.153	0.155
6	28.3	0.218	0.221	0.224
8	50.3	0.387	0.392	0.397
10	78.5	0.605	0.613	0.621
12	113	0.871	0.882	0.893
14	154	1.185	1.200	1.215
16	201	1.548	1.568	1.588
20	314	2.419	2.450	2.481
25	491	3.78	3.828	3.877
32	804	6.193	6.272	6.352
40	1257	9.676	9.800	9.924

Product marking

The products manufactured by Ugitech are referenced individually according to the production plant. This mark is affixed regularly on the coils and bars produced by Ugitech:

- Cold-rolled products: 0-4-7-3
- Hot-rolled products: 0-3-7-3

Standard products

UGIGRIP® products can be delivered in various forms:

- Indented wire coils
- Indented bars
- Welded mesh
- Standardized rebars
- Customized frame shaping



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— Wire ties dia. 0.8 mm or 1.2 mm

Weldability

UGIGRIP® stainless steels are weldable by all types of processes used for welding rebar steels (electrical discharge, friction, resistance, solid wire or flux-cored wire MIG, coated-electrode arc, etc.).

Total cost of ownership

The use of stainless steel in risk zones is one's potential savings that can be identified at the structure design stage thanks to stainless steel specific properties. In the medium and long term, it is the most profitable solution allowing numerous savings: At the design stage:

- **UGIGRIP®** offers higher mechanical properties than carbon steel, so that it is possible to use smaller metal cross sections and/or smaller quantities (saving on labour costs).
- By using **UGIGRIP®**, it is possible to reduce concrete thicknesses, resulting in far lighter construction (production of precast products, significant savings on concrete and transport costs).
- Using stainless steel in only the most exposed zones suffices to increase the service life of the structure very significantly. It is therefore not necessary to design all-stainless structures.

In use:

- By using **UGIGRIP®**, subsequent maintenance is no longer required and it is possible to eliminate the costs this entails such as repeated inspections, traffic stoppages for tunnels and bridges, production shutdown for industrial buildings, etc.
- **UGIGRIP®** allows greater leeway with regard to construction procedures: the rebar can show on the surface without a subsequent risk of corrosion.



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Available products

UGIGRIP® range			Characteristics	Tolerances
Cold indented	Bars	⌀ 6 to 25	Up to 12,000 mm	+100/-0 mm
	Coils	⌀ 6 to 14	Coils, 1000/2000 kg	+/- 15%
Hot indented	Bars	⌀ 32 to 40	Up to 11,700 mm	

Other, contact us.

Packaging products

Coils

- Ø Inside : 600 mm+/-20 mm
- Ø Outside: 1200 mm Max.
- Max. height : 600 mm
- Weight : 900 or 1800 kg +/-15%
(For coils of 1800 kg : Color paint for welding part)
- De-coiling : counterclockwise

Bars

- Bare or wrapped bundles
- Weight: 500 kg to 3000 kg.



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