

# Austenite-Ferrite stainless steel

## Duplex grades

Lean Duplex / Duplex / Super Duplex



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### Introduction

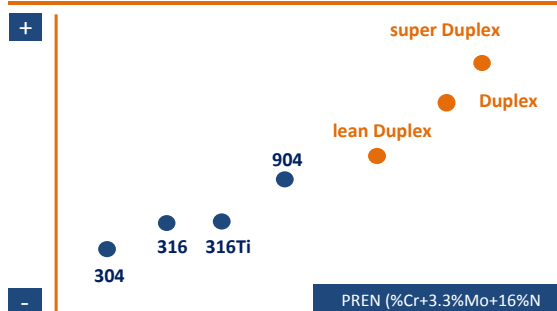
The Austenite-Ferrite microstructure of Duplex steels have 2 crystallographic phases, each with a composition sufficient to make it highly corrosion resistant at best mechanical and physical properties. Chromium makes it stainless, Nickel adds toughness, Nitrogen adds strength and resistance against pitting and crevice corrosion. Furthermore, Nitrogen stabilises the austenite phase + improves welding properties. Molybdenum improves corrosion resistance due to acids/chlorides.

### General

Duplex series austenite-ferrite stainless steels are:

Werkstoff	Werkstoff	Werkstoff	Werkstoff
<i>lean Duplex</i>		<i>Duplex</i>	
1.4635	S82012	1.4460	S31803
1.4637	S82031	1.4462	S32205
1.4162	S32101	<i>super Duplex</i>	
1.4602	S32202	1.4410	S32750
1.4362	S32304	1.4507	S32520
1.4662	S82441	1.4501	S32760

### Corrosion



### Chemical

The mechanical properties are beneficial characteristics of all Duplex steels. These properties are superior compared to standard austenitic or ferritic stainless steels. This is a clear advantage specifically for structural applications, such as e.g. pressure vessels and beam constructions. Duplex stainless steels, are partly listed in NEN-EN 10088 and / or EN 10028-7.

### Mechanical

Elements	%:	C	N	Cr	Ni	Mo	Others	Werkstoff	min.	R <sub>m</sub>	max.	Re/R <sub>p</sub> min.	AO min.
1.4162		0.03	0.23	20.2	1.4	0.4	MnCu	1.4162	450 (MPa)	610	650 (MPa)	30 %	
1.4362		0.02	0.10	23.0	4.8	0.3	Cu	1.4362	400 (MPa)	620	630 (MPa)	25 %	
1.4662		0.02	0.28	24.0	3.6	1.6	MnCu	1.4662	480 (MPa)	645	680 (MPa)	25 %	
1.4462		0.02	0.16	22.0	5.7	3.0	--	1.4462	460 (MPa)	630	690 (MPa)	25 %	
1.4501		0.02	0.26	25.0	6.9	3.8	W Cu	1.4501	520 (MPa)	720	700 (MPa)	20 %	
1.4410		0.02	0.26	25.0	7.0	4.0	--	1.4410	530 (MPa)	730	730 (MPa)	20 %	
<i>compared:</i>													
1.4307	(304L)	0.02	--	18.1	8.1	--	--	1.4307	580 (MPa)	660	300 (MPa)	50 %	
1.4404	(316L)	0.02	--	17.2	10.1	8.05	--	1.4404	600 (MPa)	680	300 (MPa)	45 %	

### Welding

Due to its unique physical properties, it is important to have the right welding consumables and procedures. Therefore, the following general instructions should be considered:

- Weld without preheating and allow the material to cool between passes, preferably to below 150°C. For 2507 ≤ 100°C
- Duplex filler material is required and recommended with the exception for 1.4162 in some cases
- Arc energy should be kept within specified limits, incl. heat input adapted to the steel grade and material thickness
- Edge preparation angle should be about 10° greater compared to welding standard stainless steels (AISI 300 series)
- Annealing is not necessary. In case heat treatment, e.g. for stress relieve, it should be carried out acc. T-specifications

### Forming

Due to its unique composition of high strength, yield and elongation, Duplex series are perfectly suitable to stimulate weight reduction of steel structures. See e.g.

- Forming of Duplex is suitable for all forming techniques.
- Be aware, higher strength and lower elongation causes:
  - different behaviour while forming, drawing and cutting therefore, generally higher force is needed
  - though duplex design often implies downgauging due to, the force level can be similar to austenitics

### Weight reduction

