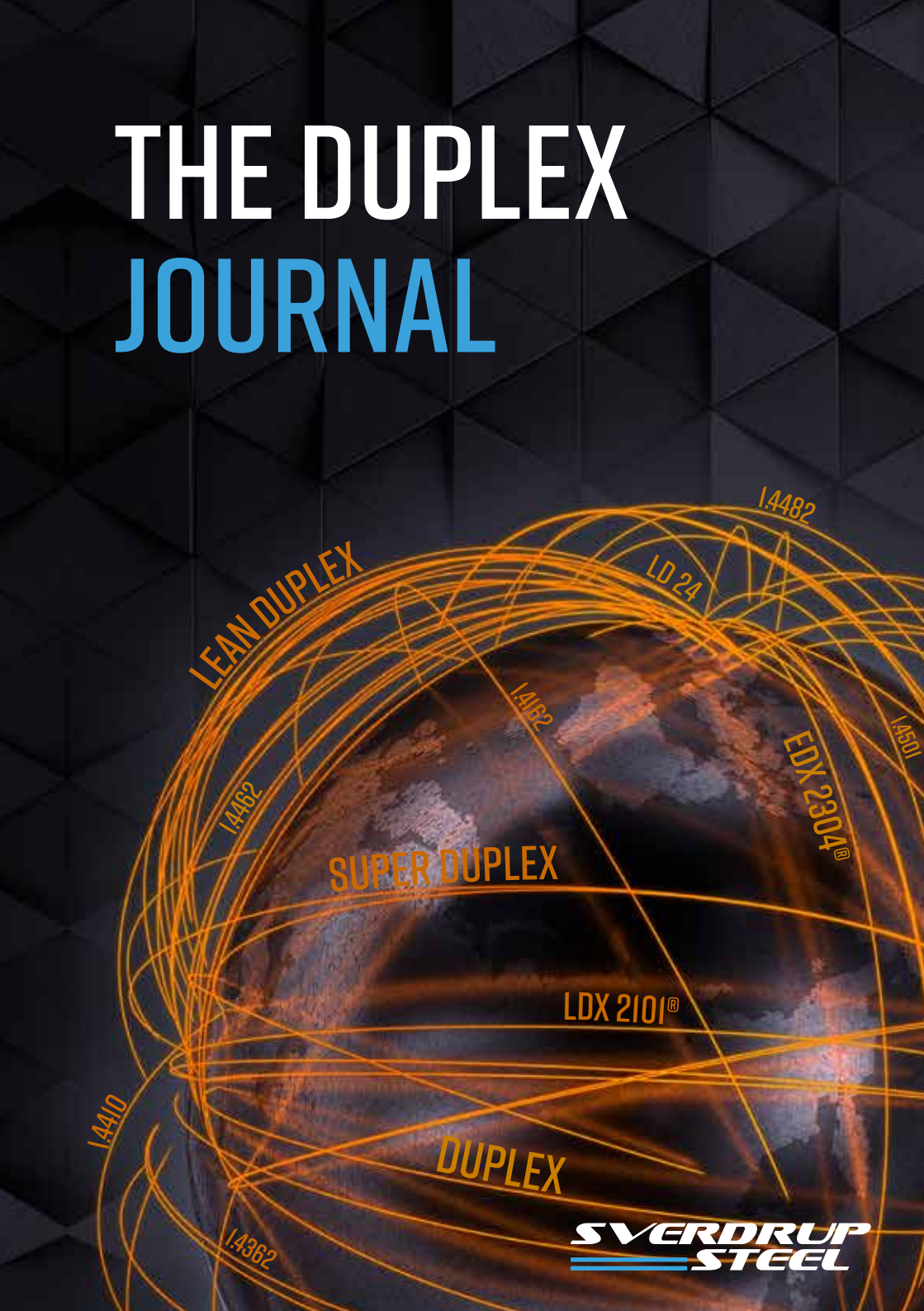
THE DUPLEX JOURNAL



SVERDRUP STEEL

YOUR MATERIAL SOLUTION PROVIDER

Sverdrup Steel is a leading supplier of Duplex material, providing one of the world's most extensive stocks of coils, plates, bars, and profiles ready for delivery to your next project. In addition, our technical department and metallurgists are prepared to help you with advice and guidance.

STOCK LOCATIONS

Norway
Germany
Sweden
UK
Korea

SERVICE CENTRE LOCATIONS

Germany
Sweden
Korea

OUR SERVICES

Round bar cut to length
Boring of round bar
Coil cut to length
Waterjet cutting
Laser cutting
Plasma cutting
Press brake profiles
Centrifugal castings
Forgings
Bevelling
Material testing

CONTACT

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DUPLEX – UTILIZE STRENGTH, OPTIMIZE COST

Duplex stainless steel is a preferred material choice for applications such as storage tanks, pressure vessels, heat exchangers, bridges, railings, aquaculture, water treatment systems, pipe support, fire- and blastwalls on offshore platforms.

By utilizing the strength of Duplex compared to carbon steel and ordinary stainless steel, means less cost due to weight saving by reducing the thickness in addition to less handling, fabrication, and welding.

Duplex stainless steel is known for improved balanced chemistry of chromium, molybdenum, and nitrogen content, allowing less nickel content and better price stability. These are some of the reasons why Duplex material outperforms the more traditional 304 and 316L steel grades.

ADVANTAGES OF DUPLEX MATERIALS

- High strength
- Good corrosion resistance
- More predictable price level
- Good fatigue strength
- More than 30 % weight saving on most applications
- Low life cycle cost due to no need of regular painting
- 100 % recycable and made from more than 85 % recycled material

EN 1.4482 / UNS S32001 / SS LD24

Sverdrup Steel SS LD24 is a low alloyed Lean Duplex stainless steel developed with increased Cr, Mo and N content to achieve a PRE of ≥24. The microstructure consists of a phase balance of approximately 50 % ferrite and 50 % austenite that provides much higher yield strength than AISI 304 and AISI 316. Also, it exhibits good formability and corrosion resistance.

PRE value (%Cr + 3.3%Mo + 16%N) of ≥24.

UNS S32001 IS CHARACTERIZED BY:

- Good resistance to stress corrosion cracking.
- Good resistance to general corrosion.
- High mechanical strength.
- High resistance to erosion corrosion and corrosion fatigue.

Corrosion Resistance
Sverdrups Steel has created a Lean Duplex with guaranteed PRE ≥ 24. In general SS LD24 exhibits good corrosion resistance, better than AISI 304 austenitic and can even be compared with 316 in most cases.

Stress Corrosion Cracking
SS LD24 is more resistant to stress corrosion cracking than austenitic stainless steels.

Atmospheric Corrosion
SS LD24 is more resistant to atmospheric corrosion than AISI 304, being similar to AISI 316.

Welding
SS LD24 can be welded using most of the conventional welding methods, such as MMA/SMAW, TIG, MIG, SAW, FCAW, laser, etc. Due to its two-phase structure, it is resistant to hot cracking, grain coarsening embrittlement and martensite formation. Set up recommendations for proper welds conditions include over alloyed filler material, a heat input of 2 KJ/mm maximum and nitrogen addition in the shielding gas. As for other duplex stainless steels, preheating or after welding process heat treatments are not recommended for SS LD24.

CHEMICAL COMPOSITIONS

Weight %	C	Si	Mn	Cr	Ni	Mo	N	S	P
Min.			4,00	19,5	1,5		0,05		
Max.	0,03	1,00	6,00	21,50	3,0	0,60	0,17	0,015	0,035

Product Standards: EN 1,4482, UNS S32001, EN 10088-2, EN 10088–4, EN 10028–7, ASTM A240, ASTM A480, ASME SA240

Approvals: Sverdrup Steel MDS SS LD24

MECHANICAL PROPERTIES

	Yield Rp0.2, MPa	Tensile Rm, MPa	Elongation [%]	Hardness [HB]	Pre	Surf.
CR (Coil)	≥ 530	700-900	≥ 25		24	2B
HR (Coil)	≥ 480	660-900	≥ 30	≤ 290	24	1D
PLATE	≥ 450	650-850	≥ 30	≤ 290	24	1D

PLATE

Thickness	1,5	2	2,5	3	4	5	6	8	10	12	15	20	25	30

Our standard stock formats are 1500 x 3000 mm and 1500 x 6000 mm

COIL

1500 mm	1	1,5	2	2,5	3	4	5	6

EN 1.4162 / UNS S32101 / LDX 2101®

LDX 2101® is a low Ni-alloyed duplex with balanced chemistry of chromium, molybdenum and nitrogen content to achieve good resistance to localized and uniform corrosion. The duplex microstructure contributes to the high strength and high resistance to stress corrosion cracking. Duplex steels have good weldability. Due to risk of embrittlement, LDX 2101® should not be used at temperatures above 250°C. Very price stable high strength alloy.

The main applications are for details with corrosion resistance better than 304L.

S32101 IS CHARACTERIZED BY:

- Good resistance to stress corrosion cracking.
- Good resistance to general corrosion.
- High mechanical strength.
- High resistance to erosion corrosion and corrosion fatigue.

Heat Treatment

Solution annealing at 1020 – 1100°C followed by water quenching.

Weldability

Very good.

CHEMICAL COMPOSITIONS

Weight %	C	Si	Mn	S	P	Cr	Ni	N	Cu	Mo
Min.			4,00			21,00	1,35	0,20	0,10	0,10
Max.	0,040	1,00	6,00	0,015	0,035	22,00	1,90	0,25	0,80	0,80

Product Standards: EN 10088-2, EN 10088–4, EN 100287-7, ASTM A240

Approvals: NACE MR0175/ ISO 15156-3:2015, PED 97/ 23/ EC, CPR 305/ 2011/ EU

MECHANICAL PROPERTIES

	Yield Rp0.2, MPa	Tensile Rm, MPa	Elongation [%]	Hardness [HB]	Charpy-V -40ºC [J]	Pre	Surf.
CR (Coil)	≥ 530	≥ 700	≥ 30		≥ 50	26	2B/2E
HR (Coil)	≥ 450	≥ 650	≥ 30	≤ 290	≥ 50	26	1D
PLATE	≥ 450	≥ 650	≥ 30	≤ 290	≥ 27	26	1D

PLATE

Thickness	1	1,5	2	2,5	3	4	5	6	7	8	9	10	12	15	16	20
	25	30	35	40	45	50	60									

Our standard stock formats are 1500 x 3000 mm, 1500 x 6000 mm, 2000 x 1000 mm, 2000 x 4000 mm and 2000 x 6000 mm.

COIL

1500 mm	1	1,5	2	2,5	3	4	5	6	
2000 mm	3	4	5	6					

1.4362 / UNS S32304 / EDX 2304®

EDX 2304® according to MDS D35 has an improved balanced chemistry of chromium, molybdenum and nitrogen content, resulting in a PRE value ≥ 28 and increased mechanical strength compared to the standard UNS 32304. EDX 2304® outruns both 1.4404 and 1.4436 with respect to pitting corrosion resistance. Due to risk of embrittlement, duplex steels should not be used at temperatures above 250 – 325°C.

The main applications are for details with special requirements for high corrosion resistance.

S32304 IS CHARACTERIZED BY:

- Good resistance to stress corrosion cracking.
- Good resistance to pitting and crevice corrosion.
- High resistance to general corrosion.
- High mechanical strength.
- High resistance to erosion corrosion and corrosion fatigue.

Heat Treatment
Solution annealing at 1020 – 1100°C followed by water quenching.

Weldability
Very good.

CHEMICAL COMPOSITIONS

Weight %	C	Si	Mn	S	P	Cr	Ni	Mo	N	Cu	B
Min.						22,00	0,10	0,10	0,05	1,10	
Max.	0,030	1,00	2,00	0,015	0,035	24,00	0,60	0,60	0,20	0,60	35ppm

Product Standards: EN 10088-2, EN 10088-4, EN 10028–7, ASTM A240
Approvals: NORSOK M650, Internal MDS D35 by Aker Solutions AS

MECHANICAL PROPERTIES

	Yield Rp0.2, MPa	Tensile Rm, MPa	Elongation [%]	Hardness [HB]	Charpy-V -40ºC [J]	Pre
PLATE CR (COIL)	≥ 500	≥ 690	≥ 25		≥ 45	≥ 28
PLATE HR (COIL)	≥ 500	≥ 690	≥ 25	≤ 290	≥ 45	≥ 28
PLATE	≥ 420	≥ 630	≥ 25	≤ 290	≥ 45	≥ 28
ANGLE BAR	≥ 450	≥ 600	≥ 25	≤ 290	≥ 45	≥ 28

PLATE

Thickness	1,5	2	3	4	5	6	8	10	12	15	20	25	30
	35	40	50										

Our standard stock formats are 1500 x 3000 mm, 1500 x 6000 mm, 2000 x 1000 mm, 2000 x 4000 mm and 2000 x 6000 mm.

COIL

1500 mm	1,5	2	3	4	5	6		
2000 mm	3	4	5	6				

HOLLOW SECTION

50 x 50 x 4 mm
60 x 60 x 4 mm
80 x 80 x 5 mm
100 x 100 x 6 mm
120 x 120 x 6 mm
150 x 100 x 6 mm
150 x 150 x 6 mm
200 x 200 x 8 mm
250 x 250 x 8 mm

According to NORSOK MDS YD37

HOT ROLLED ANGLE BAR

50 x 50 x 5 mm
60 x 60 x 6 mm
80 x 80 x 8 mm
100 x 100 x 10 mm

According to NORSOK MDS YD36

1.4462 / UNS S31803 / UNS S32205 / F51 / F60

Duplex UNS S31803/ S32205 are the most common duplex grades in the market. They have very good resistance to localized corrosion and stress corrosion cracking in combination with high mechanical strength. They are widely used in oil & gas, hydro power, pressure vessels, pulp & paper, structural components and chemical tankers. The alloys are not intended to be used at temperatures above 300°C due to embrittlement.

The main applications are for details with special requirements for high corrosion resistance.

S31803/ S32205 ARE CHARACTERIZED BY:

- High resistance to stress corrosion cracking in halide containing environments.
- High resistance to pitting and crevice corrosion.
- High resistance to general corrosion.
- High mechanical strength.
- High resistance to erosion corrosion and corrosion fatigue.

Heat Treatment
Solution annealing at 1020 – 1100°C followed by water quenching.

Weldability
Very good.

CHEMICAL COMPOSITIONS

Weight %	C	Si	Mn	S	P	Cr	Ni	Mo	N
Min.						21,00	4,50	2,50	0,10
Max.	0,030	1,00	2,00	0,015	0,030	23,00	6,50	3,50	0,22

NORSOK: N: 0,14 – 0,20%
Product Standards: EN 10088-3, ASTM A276, ASTM A479, ASTM A182–11A (Chemical composition and mechanical properties only)
Approvals: NACE MR0175, NORSOK M650, NORSOK M630 MDS D41/D43/ D44/ D45/ D47

MECHANICAL PROPERTIES

	Yield Rp0.2, MPa	Tensile Rm, MPa	Elongation [%]	Hardness [HB]	Charpy-V, -46 ºC [J]	Pre
BAR	≥ 450	650 - 880	≥ 25	≤ 270	≥ 45	≥ 34
PLATE CR (COIL)	≥ 500	700 - 950	≥ 25		≥ 45	≥ 34
PLATE HR (COIL)	≥ 480	700 - 950	≥ 25		≥ 45	≥ 34
PLATE	≥ 480	680 - 840	≥ 25		≥ 45	≥ 34

PLATE

Thickness	0,5	1	1,5	2	3	4	5	6	8	10	12	15	16
	20	22	25	30	35	40	45	50	60	80			

Our standard stock formats are 2000 x 1000 mm, 1500 x 3000 mm, 1500 x 6000 mm, 2000 x 4000 mm and 2000 x 6000 mm.

COIL

1300 mm	0,4	0,5	0,6	0,7					
1500 mm	0,8	1	1,5	2	3	4	5	6	
2000 mm	3	4	5	6					

ROUND BAR

Ø/mm	6,00	8,00	10,00	12,00	16,00	20,00	25,00	30,00	35,00
	40,00	50,00	60,00	70,00	80,00	85,00	90,00	100,00	110,00
	120,00	125,00	130,00	140,00	150,00	160,00	170,00	180,00	185,00
	190,00	200,00	220,00	225,00	230,00	250,00	265,00	275,00	280,00
	300,00	310,00	320,00	330,00	350,00	355,00	365,00	380,00	410,00

1.4410/ UNS S32750 / F53 / 2507

Super Duplex UNS S32750 is the most common super duplex grade in the market. UNS S32750 is a duplex stainless steel especially designed for service in aggressive chloride-containing environments. It has very good resistance to localized corrosion and stress corrosion cracking in combination with high mechanical strength. It is widely used in oil & gas, hydropower, pressure vessels, pulp & paper, structural components and chemical tankers.

The main applications are for details with special requirements for high corrosion resistance.

UNS S32750 IS CHARACTERIZED BY:

- High resistance to stress corrosion cracking in halide containing environments.
- High resistance to pitting and crevice corrosion.
- High resistance to general corrosion.
- High mechanical strength.
- High resistance to erosion corrosion and corrosion fatigue.

Heat Treatment
Solution annealing at min. 1100°C followed by water quenching.

Weldability
Very good.

CHEMICAL COMPOSITIONS

Weight %	C	Si	Mn	S	P	Cr	Ni	Mo	N	Cu
Min.						24,00	6,00	3,00	0,24	
Max.	0,030	0,80	1,20	0,020	0,035	26,00	8,00	5,00	0,32	0,50

NORSOK: PREN = (Cr% + 3.3Mo% + 16N%) ≥ 40
Product Standards: EN 10088-3, ASTM A276, ASTM A479, ASTM A182–11A (Chemical composition and mechanical properties only)
Approvals: NACE MR0175, NORSOK M650, NORSOK M630 MDS D51/ D53/ D54/ D55/ D57/ D58

MECHANICAL PROPERTIES

	Yield Rp0.2, MPa	Tensile Rm, MPa	Elongation [%]	Hardness [HB]	Charpy-V, -46 ºC [J]	Pre
BAR	≥ 550	≥ 750	≥ 25	≤ 310	≥ 45	≥ 40
PLATE CR (COIL)	≥ 550	750 - 1000	≥ 25	≤ 310	≥ 45	≥ 40
PLATE HR (COIL)	≥ 550	750 - 930	≥ 25	≤ 310	≥ 45	≥ 40
PLATE	≥ 550	750 - 930	≥ 25	≤ 310	≥ 45	≥ 40

PLATE

Thickness	0,5	1	1,5	2	3	4	5	6	8	10	12	15	16
	20	25	30	35	40	50	60						

Our standard stock formats are 1500 x 3000 mm, 1500 x 6000 mm, 2000x1000 mm, 2000 x 4000 mm and 2000 x 6000 mm.

COIL

1300 mm	0,4	0,5	0,6	0,7	0,8	1			
1500 mm	1,5	2	3	4	5	6			
2000 mm	3	4	5	6					

ROUND BAR

Ø/mm	16,00	20,00	25,00	30,00	35,00	40,00	45,00	50,00	60,00
	70,00	80,00	90,00	91,00	110,00	120,00	125,00	130,00	140,00
	150,00	160,00	170,00	180,00	200,00	225,00	250,00	280,00	300,00
	330,00	350,00	355,60	380,00	406,40				

1.4501/ UNS S32760/ F55

Super Duplex UNS S32760 is among the most common super duplex grade in the market. UNS S32760 is a duplex stainless steel especially designed for service in aggressive chloride-containing environments and has additions of W and Cu compared to UNS S32750. It has very good resistance to localized corrosion and stress corrosion cracking in combination with high mechanical strength.

The main applications are for details with special requirements for high corrosion resistance.

UNS S32760 IS CHARACTERIZED BY:

- High resistance to stress corrosion cracking in halide containing environments.
- High resistance to pitting and crevice corrosion.
- High resistance to general corrosion.
- High mechanical strength.
- High resistance to erosion corrosion and corrosion fatigue.

It is widely used in oil & gas, hydropower, pressure vessels, pulp & paper, structural components and chemical tankers.

Heat Treatment
Solution annealing at 1100°C followed by water quenching.

Weldability
Very good.

CHEMICAL COMPOSITIONS

Weight %	C	Si	Mn	S	P	Cr	Ni	Mo	N	Cu	W
Min.						24,00	6,00	3,00	0,20	0,50	0,50
Max.	0,030	1,00	1,00	0,010	0,030	26,00	8,00	4,00	0,30	1,00	1,00

PREN= (Cr%+3.3Mo%+16N%) ≥ 40
Product Standards: EN 10088-3, ASTM A276, ASTM A479, ASTM A182–11A (Chemical composition and mechanical properties only)
Approvals: NACE MR0175, NORSOK M650, NORSOK M630 MDS D53/ D54/ D55/ D57

MECHANICAL PROPERTIES

	Yield Rp0.2, MPa	Tensile Rm, MPa	Elongation [%]	Hardness [HB]	Charpy-V, -46 ºC [J]	Pre
BAR	≥ 550	≥ 750	≥ 25	≤ 310	≥ 45	≥ 40

ROUND BAR

Ø/mm	12,70	15,87	19,05	25,40	31,75	38,10	44,50	50,80	60,00
	70,00	76,20	80,00	90,00	101,60	120,00	130,00	140,00	152,00
	160,00	170,00	180,00	203,30	210,00	220,00	230,00	254,00	280,00
	304,80	330,00	355,60	380,00	406,40	558,8			

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