

**DUPLEX STAINLESS STEEL GRADE 2205 S32750****Product & Characteristic**

- High strength, with yield strength, which is twice of 18-8 stainless steel.
- Good pit corrosion resistance and chloride stress corrosion resistance.
- Small tendency of welding heat crack.
- Better heat conductivity, small linear expansion coefficient which is suitable to manufacture line of facilities, tube of heat exchange and clad plate.
- Good processing hardening rate.
- High rate of energy absorption and fine high shock resistance.

Conventional Products

Steel grade	Grade	Specifications (mm)		Weight MT	Standard	Application
		Thickness	Width			
Duplex series	TDS2101	2B/2D Surface: 0.6-5.0mm No.1 surface: 5.0-100mm	2B/2D	6-28MT	ASTMA240 JIS G EN10028-7 DIN	Chemical vessels, pulp and papermaking, Nuclear power, Petrochemical Desalination industry.
	S32304		Surface:			
	TDS2003		30-2000			
	S31803		No.1			
	SUS329J4L		surface:			
	S32750		1000-3000			
S32906						
S32760						

*Other sizes can be supply by request.

Chemical Composition

Grade	Classification	Mass Percentage (%)									
		C	Si	Mn	P	S	Cr	Ni	Mo	Cu	N
TDS2101 S32101 1.4162	ASTM	≤ 0.040	≤ 1.00	4.00- 6.00	≤ 0.040	≤ 0.030	21.0- 22.0	1.35- 1.70	0.10- 0.80	0.10- 0.80	0.20- 0.25
	Typical value	0.028	0.71	5.03	0.028	0.001	21.50	1.55	0.30	0.35	0.22
S32304 1.4362	Typical value	≤ 0.030	≤ 1.00	≤ 2.50	≤ 0.040	≤ 0.030	21.5- 24.5	3.00- 5.50	0.05- 0.60	0.05- 0.60	0.05- 0.20
	Typical value	0.026	0.50	1.28	0.028	0.001	23.50	4.05	0.30	0.35	0.12
TDS2003 S32003	ASTM	≤ 0.030	≤ 1.00	≤ 2.50	≤ 0.030	≤ 0.020	19.5- 22.5	3.00- 4.00	1.50- 2.00	-	0.14- 0.20
	Typical value	0.026	0.60	1.58	0.026	0.001	21.50	3.50	1.75	-	0.16
S31803 S32205 1.4462 SUS329J3L	ASTM	≤	≤	≤	≤	≤	21.0-	4.50-	2.50-	-	0.08-
	S31803	0.030	1.00	2.00	0.030	0.020	23.0	6.50	3.50	-	0.20
	ASTM	≤	≤	≤	≤	≤	22.0-	4.50-	3.00-	-	0.14-
S32205	0.030	1.00	2.00	0.030	0.020	23.0	6.50	3.50	-	0.20	

	Typical value	0.025	0.55	1.2	0.028	0.001	22.50	5.40	3.20	-	0.17
SUS329J4L	JIS	≤ 0.030	≤ 1.00	≤ 1.50	≤ 0.040	≤ 0.030	24.0- 26.0	5.50- 7.50	2.50- 3.50	-	0.08- 0.30
	Typical value	0.024	0.56	1.15	0.026	0.001	25.0	6.50	3.10	-	0.24
S32750 1.4410	ASTM	≤ 0.030	≤ 0.80	≤ 1.20	≤ 0.035	≤ 0.020	24.0- 26.0	6.00- 8.00	3.00- 5.00	≤ 0.50	0.24- 0.32
	Typical value	0.026	0.55	0.78	0.026	0.001	25.5	7.40	4.10	0.30	0.28
S32906	ASTM	≤ 0.030	≤ 1.00	≤ 1.20	≤ 0.030	≤ 0.030	28.0- 30.0	5.80- 7.50	1.50- 2.60	≤ 0.80	0.30- 0.40
	Typical value	0.026	0.55	0.83	0.024	0.001	29.2	6.80	2.10	0.50	0.27
S32706 1.4501	ASTM	≤ 0.030	≤ 1.00	≤ 1.00	≤ 0.030	≤ 0.010	24.0- 26.0	6.00- 8.00	3.00- 4.00	0.50- 1.00	0.20- 0.30
	Typical value	0.026	0.55	0.78	0.028	0.001	25.5	7.20	3.50	0.75	0.26

- S32706 W: 0.50-1.00, testing value 0.65

Mechanical Properties

Mechanical properties at ambient temperature

Grade	Classification	Rp0.2/MPa	Rm/MPa	A/%	HB
TDS2101 S32101 1.4162	ASTM	≥450	≥620	≥25	≤293
	Typical value	530	720	33	240
S32304 1.4362	ASTM	≥400	≥600	≥25	≤290
	Typical value	520	710	35	245
TDS2003 S32003	ASTM	≥450	≥620	≥25	≤293
	Typical value	530	730	31	235
S31803 S32205 1.4462 SUS329J3L	ASTM	≥450	≥620	≥25	≤293
	ASTM	≥450	≥655	≥25	≤293
	Typical value	550	750	33	255
SUS329J4L	ASTM	≥450	≥620	≥18	≤302
	Typical value	550	760	28	257
S32750 1.4410	ASTM	≥550	≥795	≥15	≤310
	Typical value	580	850	31	260
S32906	ASTM	≥550	≥750	≥25	≤310
	Typical value	580	850	30	260
S32706 1.4501	ASTM	≥550	≥750	≥25	-
	Typical value	600	870	29	252

The example of cost comparison is as below(The tank of “diameter 18m, height 18m” is made of material 316L, TDS2003 (S32003))

Classification	316L	TDS2003
Plate Thickness	5-16mm	5-12mm
Material Weights	72.50MT	56.66MT
Material Cost	2.46 Million RMB	1.75 Million RMB
Welding Cost	0.90 Million RMB	0.60 Million RMB
Labor Cost	1.50 Million RMB	0.90 Million RMB
Preliminary Total Cost	4.86 Million RMB	3.25 Million RMB
Calculation Method	<ul style="list-style-type: none"> ● 316L density 7.93g/cm³ ● S32003 density 7.85g/cm³ ● Due to thickness reduction the metal filling quantity, electricity power as well as manpower of lifting, polishing etc can be reduced. 	

Anti-corrosion:

$$PREN = \%Cr + 3.3\%(Mo + 0.5W) + 16\%N$$

The pitting corrosion resistances usually take PREN as an assessment standard for reference.

Classification	Grade	Cr	Mo	N	PREN
Austenite	304L	18.50	-	0.03	18.98
	316L	17.10	2.5	0.03	25.83
	317L	18.20	3.10	0.03	28.91
	904L	20.0	4.3	0.06	35.15
	254SMO	19.7	6.05	0.20	42.87
Duplex	TDS2101	21.50	0.30	0.22	26.01
	S32304	23.50	0.30	0.12	26.41
	TDS2003	21.50	1.75	0.16	32.08
	S31803	22.50	3.20	0.17	35.78
	SUS329J4L	25.00	3.10	0.24	39.07
	S32750	25.50	4.10	0.28	43.51
	S32906	29.2	2.10	0.27	44.23
	S32760	25.2	3.50	0.26	44.55

Critical pitting corrosion temperature (CPT) °C. Testing standard ASTM G150 (CPT varies according to the differences in the shape of product and the condition of surface polishing)

Welding

Keeping phases balance in heat affected zone(HAZ) is the most important for duplex stainless steel. It can successfully avoid the precipitated phases.

The most of welding methods for austenitic stainless steels are suitable to the duplex stainless steels. Such as SMAW, TIG(GTAW), MIG(GMAW), FCAW, SAW.

General rules for welding:



- No pre-heating of welding.
- Weld interpass temperature $\leq 150^{\circ}\text{C}$, temperature for 2507 $\leq 100^{\circ}\text{C}$.
- Need special welding material for duplex stainless steel.
- Heat input varies with the composition and thickness of duplex stainless steels.

Physical properties

(W/(m. $^{\circ}\text{C}$)) Thermal conductivity

Grade	Temperature $^{\circ}\text{C}$				
	20	100	200	300	400
TDS2101	15	16	18	19	20
S32304	16	17	18	19	20
S31803	19	19	21	23	24
S32750	16	17	19	20	22

Processing and molding

Hot process and heat treatment temperature (Celsius degree)

	TDS2101	S32304	S31803	S32750
Hot process Temp.	900-1100	900-1100	950-1150	1020-1200
Heat treatment Temp.	1020-1080	1020-1080	1020-1100	1050-1120

The precipitated phase in duplex stainless steel may result in the embrittlement, which will influence the operation performance. The formation temperature range of Q intermetallic phases is within 600-950C. For ferritic stainless steel, the transformation temperature is among 350-520C (475C brittleness). For this reason, the application temperature for duplex stainless steel should be below 250C.

Without Mo, 2101 duplex stainless steel is not sensitive to intermetallic phases precipitation such as Q phase and so on.

Package

- Application of waterproof and damp-proof materials.
- Damage avoided with protecting plank and shim.
- Coil loosing and scratching prevented by means of vertical and horizontal tying up between coil layers.
- Heavy plate package with water-proof material, strengthened frame to prevent plate from deformation.

Service Promise

- To provide consumers with the personalized designs on composition, properties property, packing, coil weight and quality certificate.
- Technical support to customers in material selection fabrication.
- Accurate and prompt delivery
- Response to customer' s claim within 24 hours.



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