HYDROGENIUS
水素材料先端科学研究センター

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HYDROGENIUS DATABASE

— Tensile Properties —

No. A25

Database of Tensile Properties of Hydrogen-Charged
JIS-SUS316L (Type 316L) Austenitic Stainless Steel

2012

Research Center for Hydrogen Industrial Use and Storage (HYDROGENIUS)
National Institute of Advanced Industrial Science and Technology (AIST)
Kyushu University - JAPAN

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1. MATERIAL

Table 1. Processing details and related properties of SUS316L[1)].

Heat	Production Process	Product Format	Thickness (mm)	Date of Issue
B	Hot-rolling	Plate	30	2005

[1)] After issuance of the inspection certificate.

Table 2. Chemical composition of SUS316L.

	Heat		Element (mass%, *mass ppm)								
			C	Si	Mn	P	S	Ni	Cr	Mo	H*
Product Analysis[1)]	B										1.5
Ladle Analysis[2)]	B		0.010	0.53	0.77	0.023	0.001	12.13	17.16	2.86	
	Requirements[3)]	Max.	0.030	1.00	2.00	0.045	0.030	15.00	18.00	3.00	
		Min.						12.00	16.00	2.00	

[1)] As performed at HYDROGENIUS.
[2)] After issuance of the inspection certificate.
[3)] As per JIS G 4304:2005, *"Hot-rolled Stainless Steel Plate, Sheet and Strip"*.

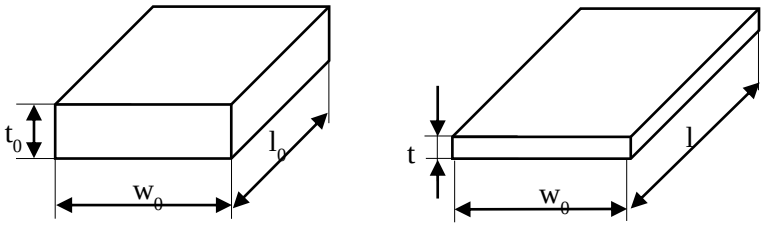
Table 3. Heat-treatment conditions of SUS316L[1), 2)].

Heat	Heat treatment	Conditions
B	Solution-treatment	1100°C, 3 min, water-quenching

[1)] After issuance of the inspection certificate.
[2)] Heat-treated material was received.

It should be noted that the following data are identical to those featuring in HYDROGENIUS DATABASE No.11: Tables 1, 3, 4 and 5 and Image 1.

Table 4. Cold-rolling process of SUS316L.

Cold-rolling reduction-ratio, *CW* (%)	$CW = ((t_0 - t)/t_0) \times 100 = 0, 30, 60\ \%$  Before cold-rolling After cold-rolling
True pre-strain, ε_{pre}	$\varepsilon_{pre} = \ln \frac{A_0}{A} = \ln \frac{1}{1-(CW/100)} = 0, 0.36, 0.92$

It should be noted that the following data are identical to those featuring in HYDROGENIUS DATABASE No.11: Tables 1, 3, 4 and 5 and Image 1.

2. MECHANICAL PROPERTIES

Table 5. Mechanical properties of SUS316L.

Heat	Tensile Properties[1)]			
	0.2% Proof stress, $\sigma_{0.2}$ (MPa)	Tensile Strength, σ_B (MPa)	Elongation, ε_f (%)	Reduction of Area, ϕ (%)
B	249	564	61	

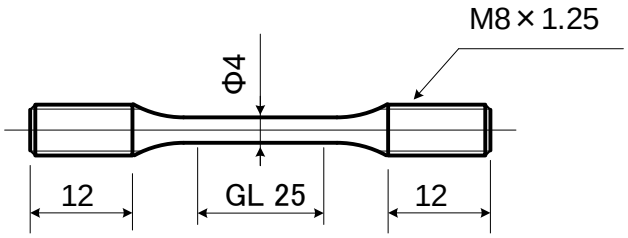
[1)] After issuance of the inspection certificate and according to JIS Z 2241:2011, *"Metallic materials -- Tensile testing -- Method of test at room temperature"*, using a No. 10-type specimen.

It should be noted that the following data are identical to those featured in HYDROGENIUS DATABASE No.11: Tables 1, 3, 4 and 5 and Image 1.

5. TENSILE PROPERTIES AND HYDROGEN CONTENT

Table 8. Tensile-test, hydrogen-exposure and hydrogen-content measurement conditions.

(a) Tensile-test conditions

Type and capacity of testing machine	Screw-type, 50 kN
Loading condition	1 mm/min
Environment	In air, RT
Specimens[1)] (dimensions in mm)	
True pre-strain	0, 0.36, 0.92

[1)] Surface-finishing was performed by circumferential-polishing with 600-grade silicon-carbide paper.

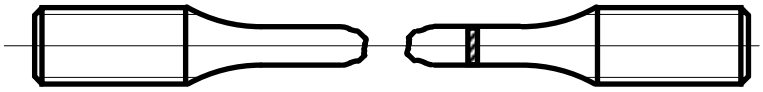
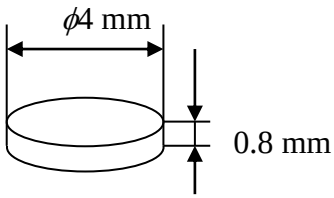
(b) Hydrogen-exposure conditions of tensile specimens

High-pressure vessel	Gases : Hydrogen, Nitrogen, Argon Maximum pressure : 100 MPa Maximum temperature : 280°C Inner volume : 0.5×10^{-3} m^3
Exposure conditions	10 MPa, 280°C, 200 h or 94 MPa, 280°C, 200 h

(Table continues on the following page)

Table 8. Tensile-test, hydrogen-exposure and hydrogen-content measurement conditions. (Continued)

(c) Hydrogen-content measurement conditions of specimens fractured by tensile tests

Type of spectroscope	TDS (Thermal Desorption Spectroscopy) Hydrogen detection accuracy : 0.01 mass ppm Amount of hydrogen molecule detection : ±5%
Measurement conditions	0.33°C/s
Specimens	 (a) Sampling of specimens[1)]  (b) Shape and dimensions of specimens

[1)] Hydrogen-measurement specimens were sampled from those fractured by tensile tests.