

HOT-ROLLED STEEL SHEETS

1. Scope

This standard covers hot-rolled steel sheets for automotive parts (hereinafter referred to as "steel sheets").

2. Classification of Steel Sheets and Steel Codes

The classification of steel sheets and steel codes shall be as specified in Table 1.

Table 1

Steel code	(Reference) Corresponding old code	(Reference) JIS code	Usage
SPH270C	SHP270C	SPHC	For general forming
SPH270D	SHP270D, E	SPHD, E	For drawing
SPH270E	SHP270E2	---	For deep drawing
SPH370	SHP370	SAPH370	For structural members
SPH440	SHP440	SAPH440	
SPH440HY			High yield point type for structural members
SPH440SF	SHP440SF	---	Stretch flangeability type for structural members
SPH490	SHP490	SPFH490	For structural members
SPH490HY			High yield point type for structural members
SPH490SF	SHP490SF	---	Stretch flangeability type for structural members
SPH540	SHP540, 540C	SPFH540	For structural members
SPH540HY	SHP540		High yield point type for structural members
SPH590	SHP590, 590C	SPFH590	For structural members
SPH590DU	SHP590DU	SPFH590Y	Low yield point type for structural members
SPH590SF	SHP590SF	---	Stretch flangeability type for structural members
SPH780	SHP780		For structural members
SPH780DU	SHP780DU		Low yield point type for structural members
SPH780SF	---		High yield point type for structural members
(SPH310)	SHP310	SAPH310	For structural members
(SPH400)	SHP400	SAPH400	
(SPH440JH)	SHP440	SAPH440	High yield point type for structural members
(SPH490JH)	SHP490	SPFH490	

Remark:

Since the types of steel mentioned in () are planned to be disused in future, any of those materials may not be newly adopted.

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STANDARD	TSG3101G
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3. Division and Division Codes

3.1 Division by Surface Finish

Division by surface finish and division codes for steel sheets shall be as specified in Table 2.

Table 2

Finish	Code	Application
Mill scale	---	Applicable mainly to parts produced by semi-automatic CO ₂ arc welding process Frames
Descaling by pickling	OD	Hot-rolled steel sheets shall as a rule be subjected to descaling by pickling.
Shot blast	SB	Special applications

4. Quality

4.1 Mechanical Properties

The mechanical properties of steel sheets shall be as specified in Table 3.

Table 3

Steel code	Tensile strength (Mpa)	Yield point or 0.2% yield strength (MPa)							
		Thickness (mm)							
		1.2 and over to 1.6 excl.	1.6 and over to 2.0 excl.	2.0 and over to 2.5 excl.	2.5 and over to 3.2 excl.	3.2 and over to 4.0 excl.	4.0 and over to 6.3 excl.	6.3 and over to 8.0 excl.	8.0 and over to 14.0 excl.
SPH270C	270 min.	205 to 325	195 to 305	185 to 295	175 to 285	165 to 275	155 to 265	145 to 245	135 to 235
SPH270D		195 to 305	185 to 295	175 to 285	165 to 275	155 to 265	145 to 245	135 to 235	125 to 225
SPH270E		175 to 275	165 to 265	155 to 255	145 to 245	135 to 235	125 to 225	115 to 215	105 to 205
SPH370	370 min.	235 to 355	225 to 345	215 to 335	205 to 325	195 to 315	185 to 305	175 to 295	165 to 285
SPH440	440 min.	295 to 410	285 to 400	275 to 390	265 to 380	255 to 370	245 to 360	235 to 350	225 to 340
SPH440HY		345 to 460	335 to 450	325 to 440	315 to 430	305 to 420	295 to 410	285 to 400	275 to 390
SPH440SF		295 to 410	285 to 400	275 to 390	265 to 380	255 to 370	245 to 360	235 to 350	225 to 340
SPH490	490 min.	345 to 470	335 to 460	325 to 450	315 to 440	305 to 430	295 to 420	285 to 410	275 to 400
SPH490HY		385 to 510	375 to 500	365 to 490	355 to 480	345 to 470	335 to 460	325 to 450	315 to 440
SPH490SF		345 to 470	335 to 460	325 to 450	315 to 440	305 to 430	295 to 420	285 to 410	275 to 400
SPH540	540 min.	385 to 520	375 to 510	365 to 500	355 to 490	345 to 480	335 to 470	325 to 460	315 to 450
SPH540HY		440 to 580	430 to 570	420 to 560	410 to 550	400 to 540	390 to 530	380 to 520	370 to 510
SPH540SF		385 to 520	375 to 510	365 to 500	355 to 490	345 to 480	335 to 470	325 to 460	315 to 450
SPH590	590 min.	470 to 615	460 to 610	450 to 600	440 to 590	430 to 580	420 to 570	410 to 560	400 to 550
SPH590DU		335 to 500	325 to 490	315 to 480	305 to 470	295 to 460	285 to 450	275 to 440	265 to 430
SPH590SF		---	460 to 610	450 to 600	440 to 590	430 to 580	420 to 570	410 to 560	400 to 550
SPH780	780 min.	---	---	685 to 835	675 to 825	665 to 815	655 to 805	645 to 795	635 to 785
SPH780DU		---	---	390 to 635	380 to 625	370 to 615	360 to 605	350 to 595	340 to 585
SPH780SF		---	---	685 to 835	675 to 825	665 to 815	655 to 805	645 to 795	635 to 785
(SPH310)	310 min.	205 to 325	195 to 315	185 to 305	175 to 295	165 to 285	155 to 275	145 to 265	135 to 255
(SPH400)	400 min.	255 to 375	245 to 365	235 to 355	225 to 345	215 to 335	205 to 325	195 to 315	185 to 305
(SPH440JE)	440 min.	---	---	385 to 500	375 to 490	365 to 480	355 to 470	345 to 460	335 to 450
(SPH490JE)	490 min.	---	---	---	430 to 560	420 to 550	410 to 540	400 to 530	390 to 520

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ANDARD	TSG3101G
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Table 3 (Continued)

Steel code	Total elongation (%)								Hole expansion ratio (%)	
	Thickness (mm)									
	1.2 and over to 1.6 excl.	1.6 and over to 2.0 excl.	2.0 and over to 2.5 excl.	2.5 and over to 3.2 excl.	3.2 and over to 4.0 excl.	4.0 and over to 6.3 excl.	6.3 and over to 8.0 excl.	8.0 and over to 14.0 excl.		
SPH270C	35 to 49	36 to 50	37 to 51		38 to 52		39 min.		---	
SPH270D	37 to 51	38 to 52	39 to 53		40 to 54 41 to 55		41 min.			
SPH270E	40 to 53	41 to 54	42 to 55		43 to 56		44 min.			
SPH370	33 to 46	34 to 47	35 to 48		36 to 49	37 to 50		40 min.		
SPH440	28 to 41	29 to 42	30 to 43	32 to 45	33 to 46	34 to 47		35 min.		
SPH440HY	25 to 38	26 to 39	27 to 40		28 to 41		29 min.		100 min.	
SPH440SF	28 to 41	29 to 42	30 to 43	32 to 45	33 to 46	34 to 47		---		
SPH490	24 to 38	25 to 39	26 to 40		27 to 41		28 min.		---	
SPH490HY	21 to 35	22 to 36	23 to 37		24 to 38		25 min.			
SPH490SF	24 to 38	25 to 39	26 to 40		27 to 41		---		90 min.	
SPH540	21 to 35	22 to 36	23 to 37		24 to 38		25 min.		---	
SPH540HY	18 to 32	19 to 33	20 to 34		21 to 35		22 min.			
SPH590	16 to 30	17 to 31	18 to 32		19 to 33		20 min.			
SPH590DU	21 to 36	22 to 37	23 to 38		24 to 39		---			75 min.
SPH590SF	---	17 to 31	18 to 32		19 to 33					
SPH780	---		14 to 29		15 to 30		---		---	
SPH780DU			16 to 30		17 to 31				---	
SPH780SF			14 to 29		15 to 30				65 min.	
(SPH310)	36 to 50	37 to 51	38 to 52		39 to 53	40 to 54		41 min.	---	
(SPH400)	31 to 44	32 to 45	33 to 46	34 to 47	35 to 48	36 to 49		38 min.		
(SPH440JH)	---	26 to 39	27 to 40		28 to 41		---			
(SPH490JH)	---		---		24 to 38		---			

4.2 Surface and Internal abnormalities

Steel sheets shall have no surface or internal abnormality causing problems during actual use.

4.3 Chemical Composition

The chemical composition of steel sheets shall be as specified in Table 4. For reference, an example of chemical composition values of representative elements are shown in Table 5, based on actual testing.

Table 4 (Unit: mass%)

Steel code	P	S
SPH270C	0.050 max.	0.050 max.
SPH270D	0.030 max.	0.035 max.
SPH270E		
SPH440SF	0.050 max.	0.020 max.
SPH490SF		
SPH590SF		
SPH780SF		
Steel other than above		0.030 max.

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STANDARD	TSG3101G
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Table 5 (Unit: mass%)

Steel code	C	Si	Mn	P	S	Al
SPH270C	0.04	0.01	0.24	0.011	0.010	0.02 to 0.05
SPH270D						
SPH270E	0.03	0.02	0.15	0.012	0.006	
SPH370	0.10		0.45			
SPH440	0.15		0.70			
SPH440HY	0.05	0.02	0.68	0.40	0.04	
SPH440SF	0.08		1.35	0.020	0.003	
SPH490	0.16	0.10	0.65	0.017	0.002	
SPH490HY	0.12	0.02	0.70	0.014	0.003	
SPH490SF	0.07	0.35	1.40	0.007	0.001	
SPH540	0.14	0.09	1.23	0.017	0.002	
SPH540HY	---					
SPH590	0.09	0.44	1.50	0.010	0.003	
SPH590SF	0.04	0.70	1.88		0.002	
SPH780	---					
SPH780DU	0.09	0.97	1.77	0.010	0.002	
SPH780SF	0.03	0.99	1.36	0.007	0.001	
(SPH310)	0.05	0.01	0.24	0.010	0.008	
(SPH400)	0.09	0.04	0.74	0.012	0.003	

5. Standard Dimensions

5.1 Standard Thickness

The standard thickness of steel sheets shall be as specified in Table 6.

Table 6 (Unit: mm)

Standard thickness	(1.2)	(1.4)	1.6	1.8	2.0	2.3	2.5	2.6	2.8	2.9	3.2	3.4	3.6
	3.8	4.0	4.5	5.0	5.6	6.0	6.3	7.0	8.0	9.0	10.0	11.0	12.0

Remark:

(1.2), (1.4) may be indicated on drawings when material codes are from SPH270 to SPH440. However, consult with concerned departments since the availability of sheet thickness are limited for certain types (strength level).

5.2 Permissible Deviation on Steel Sheet Thickness

The permissible deviation on the thickness of steel sheets shall be as specified in Table 7.

Established/ 10 Revised: Dec.2001

STANDARD	TSG3101G
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Table 7

(Unit: mm)

Division by tensile strength	Width		Under 1200	1200 and over to 1500 excl.	1500 and over to 1800 excl.	1800 min.
	Thickness	Thickness				
Specification lower limit of tensile strength is equal to or less than 440 MPa	1.20 and over to 1.60 excl.	1.20 and over to 1.60 excl.	±0.14	±0.15	±0.16	---
	1.60 and over to 2.00 excl.	1.60 and over to 2.00 excl.	±0.16	±0.17	±0.18	±0.21
	2.00 and over to 2.50 excl.	2.00 and over to 2.50 excl.	±0.17	±0.19	±0.21	±0.25
	2.50 and over to 3.15 excl.	2.50 and over to 3.15 excl.	±0.19	±0.21	±0.24	±0.26
	3.15 and over to 4.00 excl.	3.15 and over to 4.00 excl.	±0.21	±0.23	±0.26	±0.27
	4.00 and over to 5.00 excl.	4.00 and over to 5.00 excl.	±0.24	±0.26	±0.28	±0.29
	5.00 and over to 6.00 excl.	5.00 and over to 6.00 excl.	±0.26	±0.28	±0.29	±0.31
	6.00 and over to 8.00 excl.	6.00 and over to 8.00 excl.	±0.29	±0.30	±0.31	±0.35
	8.00 and over to 10.00 excl.	8.00 and over to 10.00 excl.	±0.32	±0.33	±0.34	±0.40
	10.00 and over to 12.50 excl.	10.00 and over to 12.50 excl.	±0.35	±0.36	±0.37	±0.45
12.50 and over to 14.00 incl.	12.50 and over to 14.00 incl.	±0.38	±0.39	±0.40	±0.50	
Specification lower limit of tensile strength is more than 440 MPa	1.20 and over to 1.60 excl.	1.20 and over to 1.60 excl.	±0.14	±0.17	±0.18	---
	1.60 and over to 2.00 excl.	1.60 and over to 2.00 excl.	±0.16	±0.19	±0.20	
	2.00 and over to 2.50 excl.	2.00 and over to 2.50 excl.	±0.18	±0.22	±0.23	
	2.50 and over to 3.15 excl.	2.50 and over to 3.15 excl.	±0.20	±0.24	±0.26	
	3.15 and over to 4.00 excl.	3.15 and over to 4.00 excl.	±0.23	±0.26	±0.28	±0.30
	4.00 and over to 5.00 excl.	4.00 and over to 5.00 excl.	±0.26	±0.29	±0.31	±0.32
	5.00 and over to 6.00 excl.	5.00 and over to 6.00 excl.	±0.29	±0.31	±0.32	±0.34
	6.00 and over to 8.00 excl.	6.00 and over to 8.00 excl.	±0.32	±0.33	±0.34	±0.38
	8.00 and over to 10.00 excl.	8.00 and over to 10.00 excl.	±0.35	±0.36	±0.37	±0.43
	10.00 and over to 12.00 incl.	10.00 and over to 12.00 incl.	±0.38	±0.39	±0.40	±0.48

Remark 1:

Thickness shall be measured at any point not less than 25 mm from a side edge in the case of mill edge, and not less than 15 mm from a side edge in the case of cut edge.

Remark 2:

The permissible deviation on the thickness of steel sheets other than above shall be decided, as required, as agreed upon elsewhere with departments concerned.

6. Test Methods

6.1 Tensile Test

Use #5 test piece specified in TSG2204G as the steel sheet for the tensile test conducted in accordance with TSG2300G. The test piece shall be sampled parallel to the rolling direction if the specification lower limit of tensile strength is 440 MPa or less, and perpendicularly to the rolling direction if the specification lower limit of tensile strength is over 490 MPa.

6.2 Hole Expanding Test

The hole expanding test for steel sheets shall be conducted in accordance with TSG2300G.

Established/ 10 Revised: Dec.2001

6.3 Chemical Composition

The chemical composition of steel sheets shall be analyzed in accordance with TSG1000G.

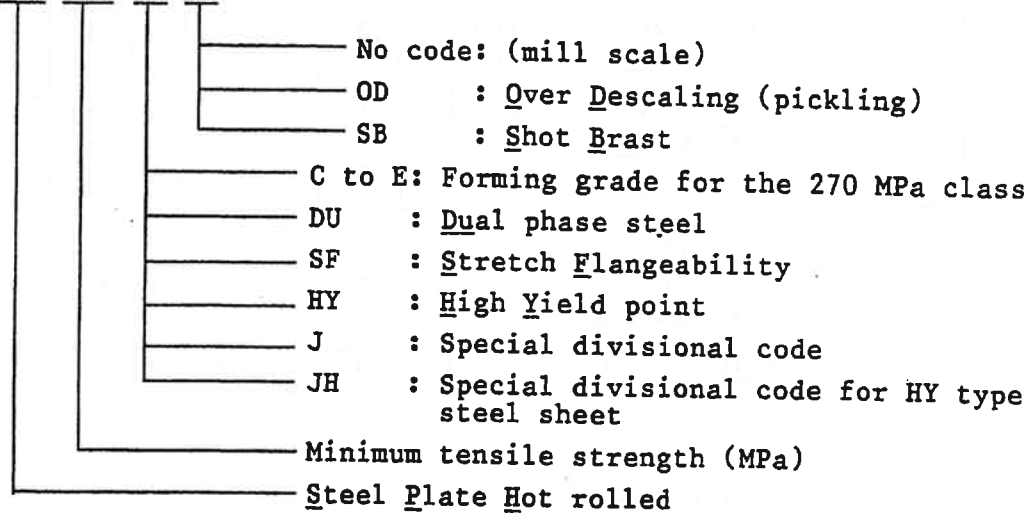
7. Indication in Drawings, and Explanation of Code

The indication in drawings, and the explanation of code of steel sheets shall be as shown below.

Example

SPH 440 -OD

SPH 590 DU-OD



Applicable Standards

TSG1000G	General Rule for Chemical Analysis of Steel Materials
TSG2204G	Test Pieces for Tensile Test Materials
TSG2300G	Method of Tensile Test for Metal Sheet
TSG2309G	Method of Hole Expansion Test for Steel Sheet

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