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Cold rolled special steel strip

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by the Japan Iron and Steel Federation (JISF) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS G 3311 : 1998** is replaced with this Standard.

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Cold rolled special steel strip

1 Scope This Japanese Industrial Standard specifies the cold rolled special steel strip (hereafter referred to as "steel strip"). This Standard also applies to cut pieces of steel strip.

2 Normative references The standards given in attached table 1 contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) shall be applied.

3 Type symbols The steel strip shall be classified into 38 kinds and the type symbols shall be as given in table 1.

Table 1 Type symbol

Division	Type symbol	Division	Type symbol	Division	Type symbol
Carbon steel	S 30 CM	Alloy tool steel	SKS 2 M	Manganese steel	SMn 438 M
	S 35 CM		SKS 5 M		SMn 443 M
	S 45 CM		SKS 51 M		
	S 50 CM		SKS 7 M		
	S 55 CM		SKS 81 M		
	S 60 CM		SKS 95 M		
	S 65 CM	Chrome steel	SCr 420 M		
	S 70 CM		SCr 435 M		
Carbon tool steel	S 75 CM	Nickel chrome steel	SCr 440 M		
	SK 120 M (SK 2 M)		SNC 415 M		
	SK 105 M (SK 3 M)		SNC 631 M		
	SK 95 M (SK 4 M)	Nickel chrome molybdenum steel	SNC 836 M		
	SK 85 M (SK 5 M)		SNCM 220 M		
	SK 75 M (SK 6 M)	Chrome molybdenum steel	SNCM 415 M		
	SK 65 M (SK 7 M)		SCM 415 M		
		Spring steel	SCM 430 M		
			SCM 435 M		
			SCM 440 M		
			SUP 6 M		
			SUP 9 M		
			SUP 10 M		

Remarks : The parentheses indicate the type symbols specified in the former edition of this JIS.

Information : SK 75 M and SK 65 M are scheduled to be eliminated in reviewing after five years.

4 Manufacturing method For the manufacturing method of steel strip, carry out cold rolling after hot rolling and allow it to be as cold rolled, or annealed after cold rolling.

5 Chemical composition

5.1 Cast analysis The steel strip shall be tested in accordance with 10.1 and the cast analysis shall be as given in table 2.

5.2 Product analysis When the product analysis is requested by the purchaser, the test shall be carried out in accordance with 10.1. The values given in table 2 and tolerance values in attached table 3 or 4 of **JIS G 0321** shall be applied. However, attached table 3 shall be applied to carbon steel and carbon tool steel, and the attached table 4 to alloy tool steel, chromium steel, nickel chromium steel, nickel chromium molybdenum steel, chromium molybdenum steel, spring steel and manganese steel.

Table 2 Chemical composition

Unit: %

Division	Class symbol	C	Si	Mn	P	S	Cu	Ni	Cr	Ni+Cr	Mo	W	V	Example of use for reference
Carbon steel	S 30 CM	0.27 to 0.33	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.	0.30 max.	0.20 max.	0.20 max.	0.35 max.	—	—	—	Retainer
	S 35 CM	0.32 to 0.38	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.	0.30 max.	0.20 max.	0.20 max.	0.35 max.	—	—	—	Business machine parts, friction plate
	S 45 CM	0.42 to 0.48	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.	0.30 max.	0.20 max.	0.20 max.	0.35 max.	—	—	—	Clutch parts, chain parts, retainer, washer
	S 50 CM	0.47 to 0.53	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.	0.30 max.	0.20 max.	0.20 max.	0.35 max.	—	—	—	Structural parts of camera, chain parts, spring, clutch parts, washer, safety buckle
	S 55 CM	0.52 to 0.58	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.	0.30 max.	0.20 max.	0.20 max.	0.35 max.	—	—	—	Spring, safety boots, can opener, Thomson blade, structural parts of camera and others
	S 60 CM	0.55 to 0.65	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.	0.30 max.	0.20 max.	0.20 max.	—	—	—	—	Chain parts, wood-working handsaws, safety boots, spring, business machine parts, washer
	S 65 CM	0.60 to 0.70	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.	0.30 max.	0.20 max.	0.20 max.	—	—	—	—	Safety boots, clutch parts, spring, washer
	S 70 CM	0.65 to 0.75	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.	0.30 max.	0.20 max.	0.20 max.	—	—	—	—	Washer, woodworking handsaw, business machine parts, spring
	S 75 CM	0.70 to 0.80	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.035 max.	0.30 max.	0.20 max.	0.20 max.	—	—	—	—	Clutch parts, washer, spring

Table 2 (continued)

Unit: %

Division	Class symbol	C	Si	Mn	P	S	Cu	Ni	Cr	Ni+Cr	Mo	W	V	Example of use for reference
Carbon tool steel	SK 120 M	1.10 to 1.30	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.30 max.	—	—	—	—	Razor blade, cutlery, hacksaw blade, shutter, spiral spring
	SK 105 M	1.00 to 1.10	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.30 max.	—	—	—	—	Hacksaw blade, cutlery, spring
	SK 95 M	0.90 to 1.00	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.30 max.	—	—	—	—	Pen point, spiral spring, gauge, spring, cutlery, knitting needle
	SK 85 M	0.80 to 0.90	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.30 max.	—	—	—	—	Spiral spring, spring, cutlery, knitting needle, gauge, clutch parts, woodworking and lumbering band saw, circular saw, business machine parts
	SK 75 M	0.70 to 0.80	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.30 max.	—	—	—	—	Spring, cutlery, clutch parts, washer, boots sole, horn
	SK 65 M	0.60 to 0.70	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.30 max.	—	—	—	—	Spring, cutlery, horn, woodworking hand saw, washer, boots sole, clutch parts

Table 2 (continued)

Unit: %

Division	Class symbol	C	Si	Mn	P	S	Cu	Ni	Cr	Ni+Cr	Mo	W	V	Example of use for reference
Alloy tool steel	SKS 2 M	1.00 to 1.10	0.35 max.	0.80 max.	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.50 to 1.00	—	—	1.00 to 1.50	Permitted within 0.20	Metal cutting band saw, hacksaw blade, cutlery
	SKS 5 M	0.75 to 0.85	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	0.70 to 1.30	0.20 to 0.50	—	—	—	—	Cutlery, circular saw, woodworking and timber working hand saw
	SKS 51 M	0.75 to 0.85	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	1.30 to 2.00	0.20 to 0.50	—	—	—	—	Cutlery, woodworking circular saw, wood-working and timber working band saws
	SKS 7 M	1.10 to 1.20	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.20 to 0.50	—	—	2.00 to 2.50	Permitted within 0.20	Metal cutting band saw, hacksaw blade, cutlery
	SKS 81 M	1.10 to 1.30	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.20 to 0.50	—	—	—	—	Razor blade, cutlery, hacksaw blade, shutter
	SKS 95 M	0.80 to 0.90	0.50 max.	0.80 to 1.10	0.030 max.	0.030 max.	0.25 max.	0.25 max.	0.20 to 0.60	—	—	—	—	Clutch parts, spring, cutlery
Chrome steel	SCr 420 M	0.18 to 0.23	0.15 to 0.35	0.60 to 0.85	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.90 to 1.20	—	—	—	—	Chain parts
	SCr 435 M	0.33 to 0.38	0.15 to 0.35	0.60 to 0.85	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.90 to 1.20	—	—	—	—	Chain parts, business machine parts
	SCr 440 M	0.38 to 0.43	0.15 to 0.35	0.60 to 0.85	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.90 to 1.20	—	—	—	—	Chain parts, business machine parts

Table 2 (continued)

Unit: %

Division	Class symbol	C	Si	Mn	P	S	Cu	Ni	Cr	Ni+Cr	Mo	W	V	Example of use for reference
Nickel chrome steel	SNC 415 M	0.12 to 0.18	0.15 to 0.35	0.35 to 0.65	0.030 max.	0.030 max.	0.30 max.	2.00 to 2.50	0.20 to 0.50	—	—	—	—	Business machine parts
	SNC 631 M	0.27 to 0.35	0.15 to 0.35	0.35 to 0.65	0.030 max.	0.030 max.	0.30 max.	2.50 to 3.00	0.60 to 1.00	—	—	—	—	Business machine parts
	SNC 836 M	0.32 to 0.40	0.15 to 0.35	0.35 to 0.65	0.030 max.	0.030 max.	0.30 max.	3.00 to 3.50	0.60 to 1.00	—	—	—	—	Business machine parts
Nickel chrome molybdenum steel	SNCM 220 M	0.17 to 0.23	0.15 to 0.35	0.60 to 0.90	0.030 max.	0.030 max.	0.30 max.	0.40 to 0.70	0.40 to 0.65	—	0.15 to 0.30	—	—	Chain parts
	SNCM 415 M	0.12 to 0.18	0.15 to 0.35	0.40 to 0.70	0.030 max.	0.030 max.	0.30 max.	1.60 to 2.00	0.40 to 0.65	—	0.15 to 0.30	—	—	Safety buckle, chain parts
Chrome molybdenum steel	SCM 415 M	0.13 to 0.18	0.15 to 0.35	0.60 to 0.85	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.90 to 1.20	—	0.15 to 0.30	—	—	Chain parts, Thomson blade
	SCM 430 M	0.28 to 0.33	0.15 to 0.35	0.60 to 0.85	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.90 to 1.20	—	0.15 to 0.30	—	—	Chain parts, business machine parts
	SCM 435 M	0.33 to 0.38	0.15 to 0.35	0.60 to 0.85	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.90 to 1.20	—	0.15 to 0.30	—	—	Chain parts, business machine parts
	SCM 440 M	0.38 to 0.43	0.15 to 0.35	0.60 to 0.85	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.90 to 1.20	—	0.15 to 0.30	—	—	Chain parts, business machine parts
Spring steel	SUP 6 M	0.56 to 0.64	1.50 to 1.80	0.70 to 1.00	0.035 max.	0.035 max.	0.30 max.	—	—	—	—	—	—	Spring
	SUP 9 M	0.52 to 0.60	0.15 to 0.35	0.65 to 0.95	0.035 max.	0.035 max.	0.30 max.	—	0.65 to 0.95	—	—	—	—	Spring
	SUP 10 M	0.47 to 0.55	0.15 to 0.35	0.65 to 0.95	0.035 max.	0.035 max.	0.30 max.	—	0.80 to 1.10	—	—	—	0.15 to 0.25	Spring

Table 2 (concluded)

Unit: %

Division	Class symbol	C	Si	Mn	P	S	Cu	Ni	Cr	Ni+Cr	Mo	W	V	Example of use for reference
Manganese steel	SMn 438 M	0.35 to 0.41	0.15 to 0.35	1.35 to 1.65	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.35 max.	—	—	—	—	Chain parts
	SMn 443 M	0.40 to 0.46	0.15 to 0.35	1.35 to 1.65	0.030 max.	0.030 max.	0.30 max.	0.25 max.	0.35 max.	—	—	—	—	Chain parts

6 Hardness Annealed steel strip shall be tested in accordance with 10.2 and the hardness shall conform to table 3. The hardness of as-cold-rolled steel strip shall be as agreed upon between the purchaser and the supplier. The range of hardness to be referred to in this case is given in informative table 1.

Table 3 Hardness of steel strip in annealed state

Classification	Symbol of class	Vickers hardness HV	Classification	Symbol of class	Vickers hardness HV
Carbon steel	S 30 CM	160 max.	Chrome steel	SCr 420 M	180 max.
	S 35 CM	170 max.		SCr 435 M	190 max.
	S 45 CM	170 max.		SCr 440 M	200 max.
	S 50 CM	180 max.	Nickel chrome steel	SNC 415 M	170 max.
	S 55 CM	180 max.		SNC 631 M	180 max.
	S 60 CM	190 max.		SNC 836 M	190 max.
	S 65 CM	190 max.	Nickel chrome molybdenum steel	SNCM 220 M	180 max.
	S 70 CM	190 max.		SNCM 415 M	170 max.
	S 75 CM	200 max.			
Carbon tool steel	SK 120 M	220 max.	Chrome molybdenum steel	SCM 415 M	170 max.
	SK 105 M	220 max.		SCM 430 M	180 max.
	SK 95 M	210 max.		SCM 435 M	190 max.
	SK 85 M	200 max.		SCM 440 M	200 max.
	SK 75 M	190 max.	Spring steel	SUP 6 M	210 max.
	SK 65 M	190 max.		SUP 9 M	200 max.
Alloy tool steel	SKS 2 M	230 max.		SUP 10 M	200 max.
	SKS 5 M	200 max.	Manganese steel	SMn 438 M	200 max.
	SKS 51 M	200 max.		SMn 443 M	200 max.
	SKS 7 M	250 max.			
	SKS 81 M	220 max.			
	SKS 95 M	200 max.			

Informative table 1 Range of hardness for as-cold-rolled strip

Classification	Symbol of class	Vickers hardness HV	Classification	Symbol of class	Vickers hardness HV
Carbon steel	S 30 CM	160 to 230	Chrome steel	SCr 420 M	180 to 270
	S 35 CM	170 to 250		SCr 435 M	180 to 270
	S 45 CM	170 to 260		SCr 440 M	200 to 290
	S 50 CM	180 to 270	Nickel chrome steel	SNC 415 M	170 to 240
	S 55 CM	180 to 270		SNC 631 M	180 to 240
	S 60 CM	190 to 280		SNC 836 M	190 to 250
	S 65 CM	190 to 280	Nickel chrome molybdenum steel	SNCM 220 M	180 to 240
	S 70 CM	190 to 280		SNCM 415 M	170 to 240
Carbon tool steel	S 75 CM	200 to 290	Chrome molybdenum steel	SCM 415 M	170 to 240
	SK 120 M	220 to 310		SCM 430 M	180 to 250
	SK 105 M	220 to 310		SCM 435 M	190 to 270
	SK 95 M	210 to 300		SCM 440 M	200 to 280
	SK 85 M	200 to 290	Spring steel	SUP 6 M	210 to 310
	SK 75 M	190 to 280		SUP 9 M	200 to 290
Alloy tool steel	SK 65 M	190 to 280	Manganese steel	SUP 10 M	200 to 290
	SKS 2 M	230 to 320		SMn 438 M	200 to 290
	SKS 5 M	200 to 290		SMn 443 M	200 to 290
	SKS 51 M	200 to 290			
	SKS 7 M	250 to 340			
	SKS 81 M	220 to 310			
	SKS 95 M	200 to 290			

7 Internal quality The steel strip shall be tested in accordance with 10.3 and 10.4 and the resulting microscopic structure shall, as a rule, be composed of uniformly distributed spherical carbide free from the residue of reticulated carbide or appreciable decarburization.

8 Appearance The steel strip shall have a smooth surface and free from harmful distortions, rust, flaws, cracks on edge, oxidized film, and the like.

9 Dimensions and tolerances on dimensions

9.1 Dimensions Dimensions shall be as agreed upon between the supplier and the purchaser.

9.2 Tolerances on thickness The tolerances on thickness of steel strip shall be divided into A and B, and in accordance with table 4. In this case, the purchaser shall specify either one of the tolerances A or B.

The location of thickness measurement shall be at an arbitrary point at least 10 mm apart from both edges, or at the centre of the width for the strip not exceeding 20 mm.

Table 4 Tolerances on thickness

Unit: mm

Thickness	Tolerance on thickness A		Tolerance on thickness B	
	Width less than 200	Width 200 or over to and excl. 500	Width less than 200	Width 200 or over to and excl. 500
Under 0.10	±0.008	—	±0.012	—
0.10 or over to and excl. 0.15	±0.010	—	±0.015	—
0.15 or over to and excl. 0.25	±0.015	±0.020	±0.020	±0.025
0.25 or over to and excl. 0.40	±0.020	±0.025	±0.025	±0.035
0.40 or over to and excl. 0.60	±0.025	±0.030	±0.035	±0.040
0.60 or over to and excl. 0.90	±0.030	±0.040	±0.045	±0.055
0.90 or over to and excl. 1.20	±0.040	±0.050	±0.055	±0.070
1.20 or over to and excl. 1.60	±0.050	±0.060	±0.070	±0.080
1.60 or over to and excl. 2.10	±0.055	±0.070	±0.075	±0.090
2.10 or over to and excl. 3.00	±0.065	±0.080	±0.080	±0.090
3.00 or over up to and incl. 4.00	±0.080	±0.090	±0.090	±0.100

Remarks : The tolerance on thickness of over 4.00 mm and the width of over 500 mm shall be in accordance with agreement between the purchaser and the supplier.

9.3 Tolerances on width The tolerances on width of the steel strip shall be in accordance with table 5.

Table 5 Tolerances on width

Unit: mm

Thickness	Tolerance on width	
	Width less than 200	Width 200 or over to and excl. 500
0.25 or over to and excl. 0.60	±0.15	±0.25
0.60 or over to and excl. 1.20	±0.20	±0.30
1.20 or over up to and incl. 4.00	±0.25	±0.40

Remarks : The width tolerance for the steel strips under 0.25 mm and over 4.00 mm in thickness, or 500 mm or over in width shall be in accordance with agreement between the purchaser and the supplier.

9.4 Tolerances on edge camber The maximum value of the edge camber⁽¹⁾ for steel strip shall be 4 mm for an arbitrary length of 2 m. However, for width of under 80 mm shall be in accordance with agreement between the purchaser and the supplier.

In the case of length of under 2 m, it may be calculated with the following formula.

$$C_2 = (l_2/l_1)^2 \times C_1$$

where, C_2 : tolerance on edge camber (mm)

C_1 : 4 mm

l_2 : length of under 2 m (m)

l_1 : 2 m

Note (1) Edge camber means the right or left camber as seen from the longitudinal direction and is measured as shown in figure 1. 1 m of both sides shall be eliminated.

The edge camber is applied when requested by the purchaser.

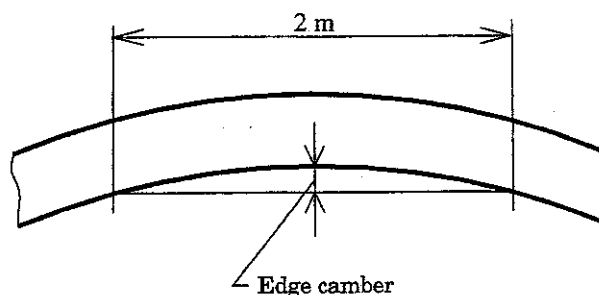


Figure 1 Edge camber for steel strip

9.5 Tolerances on length The tolerances on length of the cut steel strip shall be in accordance with table 6.

Table 6 Tolerances on length

Unit: mm

Length	Tolerance on length	
	Width less than 200	Width 200 or over to and excl. 500
Under 2 000	+5 0	+10 0
2 000 or over to and excl. 4 000	+10 0	+20 0

Remarks 1 The tolerances given in table 6 shall be applied to thickness of 0.5 mm or more.

2 Thickness of under 0.5 mm and length of 4 000 mm or more shall be in accordance with agreement between the purchaser and the supplier.

10 Tests

10.1 Chemical analysis

10.1.1 General matters of chemical analysis The chemical analysis of steel strip shall be generally determined by cast analysis and general matters of analysis shall be in accordance with clause 8 of JIS G 0404.

10.1.2 Sampling method for analyses Sampling for respective analyses shall be as follows:

- a) **Cast analysis** The sampling method for a cast analysis shall be in accordance with clause 8 of **JIS G 0404**.
- b) **Product analysis** The sampling method of product analysis when the product analysis is requested by the purchaser, shall be in accordance with clause 4 of **JIS G 0321**.

10.1.3 Analysis method The cast analysis shall be carried out in accordance with **JIS G 0320**, and the product analysis shall be carried out in accordance with **JIS G 0321**.

10.2 Hardness test

10.2.1 Sampling method and the number of test pieces For the sample for hardness test, one sample shall be taken from each lot of the same heat, the same heat treatment and the same dimensions. One test piece shall be sampled from one sample.

10.2.2 Test method The test method shall be as specified in **JIS Z 2244**.

10.3 Microscopic structural examination The sampling for microscopical structural examination, the number of test pieces and the test method shall be subjected to agreement between the manufacturer and the purchaser.

10.4 Decarburization test

10.4.1 Sampling method and number of test pieces The sampling method for decarburization test and the number of test pieces shall be based upon 10.2.1.

10.4.2 Test method The test method shall be in accordance with **JIS G 0558**.

11 Inspection Inspections shall be as follows:

- a) General matters of inspection shall be in accordance with **JIS G 0404**.
- b) Chemical composition shall comply with the requirement of clause 5.
- c) Hardness shall comply with the requirement of clause 6.
- d) Internal quality shall comply with the requirement of clause 7.
- e) Appearance shall comply with the requirement of clause 8.
- f) Dimensions shall comply with the requirement of clause 9.

12 Marking The steel strip having passed inspection shall be marked with the following items on each packing. However, with the approval of the purchaser, part of the items may be omitted.

The mass may be marked for each delivery lot.

- a) Symbol of classification
- b) Dimensions
- c) Class of thickness tolerances
- d) Serial number or test number
- e) Mass
- f) Manufacturer's name or its abbreviation

13 Report The report shall be in accordance with clause 13 of **JIS G 0404**. When preliminarily requested by the purchaser, the inspection document specified in **JIS G 0415** shall be presented. The class of inspection document shall, when not specified, be the symbol 2.3 (specific test report) or 3.1.B (inspection certificate 3.1.B) in table 1 of **JIS G 0415**.

Attached table 1 Normative references

- JIS G 0320 *Standard test methods for heat analysis of steel products*
- JIS G 0321 *Product analysis and its tolerance for wrought steel*
- JIS G 0404 *Steel and steel products—General technical delivery requirements*
- JIS G 0415 *Steel and steel products—Inspection documents*
- JIS G 0558 *Methods of measuring decarburized depth for steel*
- JIS Z 2244 *Vickers hardness test—Test method*

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