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Process of quenching and tempering of iron and steel

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently JIS B 6913: 1989 is replaced with JIS B 6913: 1999.

Title of Standard, scope, definitions, classification and symbol of processing, material to be processed, processing equipment, processing method, quality of processed product, etc. are altered in this revision.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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Process of quenching and tempering of iron and steel

1 Scope This Japanese Industrial Standard specifies the process of quenching and tempering of iron and steel (hereafter referred to as "processing").

Remarks: Superficial heat treatment is not included in the processing.

2 Normative references The standards listed in the **Attached Table 1** contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards listed shall be applied.

3 Definitions For the purposes of this Standard, the definitions given in **JIS B 6905** apply for the major terms used in this Standard, and the following definitions apply for the rest of the terms used.

- a) **material to be processed** The parts and materials to be subjected to the processing. The parts are finished or almost finished iron and steel products, including machine tools, jigs, equipment or their parts, and the materials are iron and steel and their semi-finished products made by rolling, forging, casting and the like.
- b) **processed product** The parts or materials which have undergone the processing as defined in this Standard.
- c) **single body** A piece or set of processed products.
- d) **heating equipment** In heating equipment for metals heat treatment use, the device to heat materials to be processed for the purpose of heat treatment.
- e) **air furnace** The furnace to heat materials to be processed in the air or in the combustion atmosphere of fuel.
- f) **hot bath vessel** The equipment to heat or cool materials to be processed in a hot bath containing oil, molten salt, molten metal and the like.
- g) **atmospheric furnace** The heating furnace capable of controlling the atmosphere in which materials to be processed are heated to suit the purpose of intended processing, by making the atmosphere reductive, inert, decarburizing or the like as required.
- h) **vacuum furnace** The equipment to heat or cool materials to be processed in the air or in inert or other gases under reduced pressure, thus capable of adjusting the pressure to suit the purpose of processing.
- i) **fluidized-bed furnace** The equipment to heat or cool materials to be processed using ceramics or other fluidized particles as heating media.

4 Classification and symbol of processing The classification and symbol of processing shall be as shown in **Table 1**, depending on the method of processing used:

Table 1 Classification and symbol of processing

Classification of processing	Symbol (1)
Water quenching and tempering	HQW-HT
Aqueous solution quenching and tempering	HQP-HT
Oil quenching and tempering	HQO-HT
Air quenching and tempering	HQA-HT
Gas quenching and tempering	HQG-HT
Hot bath quenching and tempering	HQSHT
Martempering	HQM-HT
Austempering	HQAU

Note (1) In accordance with JIS B 0122.

5 Material to be processed

5.1 Classification of materials to be processed The classification of materials to be processed shall be as defined in Table 2 or the quality of processed product shall comply with 8.

Table 2 Classification of materials to be processed

Standard number	Applicable classification symbol
a) Steel bars, sections, plates and strip JIS G 3115 JIS G 3120 JIS G 3126 JIS G 3127 JIS G 3128	SPV450, SPV490 SQV1A, SQV1B, SQV2A, SQV2B, SQV3A, SQV3B SLA325B, SLA360, SLA410 SL3N440, SL3N590, SL9N590 SHY685, SHY685N, SHY685NS
b) Steel pipes JIS G 3441 JIS G 3445 JIS G 3446 JIS G 3460 JIS G 3464	SCM430TK, SCM435TK, SCM440TK STKM15A, STKM16A, STKM17A SUS410TKA, SUS420J1TKA, SUS410TKC, SUS420J2TKA STPL690 STBL690
c) Carbon steel and alloy steel for machine structural use JIS G 4051 JIS G 4052 JIS G 4102 JIS G 4103 JIS G 4104 JIS G 4105 JIS G 4106 JIS G 4107 JIS G 4108 JIS G 4202	S28C, S30C, S33C, S35C, S38C, S40C, S43C, S45C, S48C, S50C, S53C, S55C, S58C SMn433H, SMn438H, SMn443H SMnC443H SCr430H, SCr435H, SCr440H SCM435H, SCM440H, SCM445H SNC631H SNC236, SNC631, SNC836 SNCM240, SNCM431, SNCM439, SNCM447, SNCM625, SNCM630 SCr430, SCr435, SCr440, SCr445 SCM430, SCM432, SCM435, SCM440, SCM445 SMn433, SMn438, SMn443 SMnC443 SNB5, SNB7, SNB16 SNB21, SNB22, SNB23, SNB24 SACM645

Table 2 Classification of materials to be processed (continued)

Standard number	Applicable classification symbol
d) Steel for special use	
JIS G 4303	SUS403, SUS410, SUS410J1, SUS410F2, SUS416, SUS420J1, SUS420J2, SUS420F, SUS431, SUS440A, SUS440B, SUS440C, SUS440F
JIS G 4304	SUS403, SUS410, SUS410S, SUS420J1, SUS420J2, SUS429J1, SUS440A
JIS G 4305	SUS403, SUS410, SUS410S, SUS420J1, SUS420J2, SUS429J1, SUS440A
JIS G 4308	SUS403, SUS410, SUS410F2, SUS416, SUS420J1, SUS420J2, SUS420F, SUS420F2, SUS440C
JIS G 4309	SUS403, SUS410, SUS410F2, SUS416, SUS420J1, SUS420J2, SUS420F, SUS420F2, SUS440C
JIS G 4311	SUS403, SUS410, SUS410J1, SUS431, SUH3, SUH4, SUH11, SUH600, SUH616
JIS G 4312	SUS403, SUS410
JIS G 4313	SUS420J2-CSP
JIS G 4315	SUS403, SUS410
JIS G 4401	SK1, SK2, SK3, SK4, SK5, SK6, SK7
JIS G 4403	SKH2, SKH3, SKH4, SKH10, SKH51, SKH52, SKH53, SKH54, SKH55, SKH56, SKH57, SKH58, SKH59
JIS G 4404	SKS11, SKS2, SKS21, SKS5, SKS51, SKS7, SKS8, SKS4, SKS41, SKS43, SKS44, SKS3, SKS31, SKS93, SKS94, SKS95 SKD1, SKD11, SKD12, SKD4, SKD5, SKD6, SKD61, SKD62, SKD7, SKD8 SKT3, SKT4
JIS G 4410	SKC3, SKC11, SKC24
JIS G 4801	SUP3, SUP6, SUP7, SUP9, SUP9A, SUP10, SUP11A, SUP12, SUP13
JIS G 4802	S50C-CSP, S55C-CSP, S60C-CSP, S65C-CSP, S70C-CSP SK5-CSP, SK4-CSP, SUP10-CSP
JIS G 4804	SUM41, SUM42, SUM43
JIS G 4805	SUJ1, SUJ2, SUJ3, SUJ4, SUJ5
e) Casting and forging	
JIS G 3201	SF540B, SF590B, SF640B
JIS G 3202	SFVC1, SFVC2A, SFVC2B
JIS G 3204	SFVQ1A, SFVQ1B, SFVQ2A, SFVQ2B, SFVQ3
JIS G 3205	SFL1, SFL2, SFL3
JIS G 3206	SFVCMF22B, SFVCMF22V, SFVCMF3V
JIS G 3214	SUSF410-A, SUSF410-B, SUSF410-C, SUSF410-D
JIS G 3221	SFCM590S, SFCM640S, SFCM690S, SFCM740S, SFCM780S, SFCM830S, SFCM880S, SFCM930S, SFCM980S
JIS G 3222	SFNCM690S, SFNCM740S, SFNCM780S, SFNCM830S, SFNCM880S, SFNCM930S, SFNCM980S, SFNCM1030S, SFNCM1080S
JIS G 3223	SFT590
JIS G 5101	SC410, SC450, SC480
JIS G 5102	SCW410, SCW450, SCW480, SCW550, SCW620
JIS G 5111	SCC3, SCC5 SCMn1, SCMn2, SCMn3, SCMn5 SCSiMn2 SCMnCr2, SCMnCr3, SCMnCr4 SCMnM3 SCCrM1, SCCrM3 SCMnCrM2, SCMnCrM3 SCNCRM2
JIS G 5121	SCS1, SCS2, SCS2A, SCS3, SCS4, SCS5, SCS6
JIS G 5151	SCPH1, SCPH2, SCPH11, SCPH21, SCPH22, SCPH23, SCPH32, SCPH61
JIS G 5152	SCPL1, SCPL11, SCPL21, SCPL31

Table 2 Classification of materials to be processed (concluded)

Standard number	Applicable classification symbol
JIS G 5201	SCW410-CF, SCW480-CF, SCW490-CF, SCW520-CF, SCW570-CF
JIS G 5202	SCPH1-CF, SCPH2-CF, SCPH11-CF, SCPH21-CF, SCPH32-CF
JIS G 5501	FC200, FC250, FC300, FC350
JIS G 5502	FCD400, FCD450, FCD500, FCD600, FCD700, FCD800
JIS G 5704	FCMP440, FCMP490, FCMP540, FCMP590, FCMP690

5.2 Hysteresis of material to be processed The items given in Table 3 shall be clarified as the hysteresis of material to be processed.

Table 3 Hysteresis of material to be processed

Item	Remarks
a) Results of material test for material to be processed Class of materials to be processed Chemical composition (°) Heat number (°) Results of tensile test (°) Results of hardness test (°) Results of hardenability test (°) Results of metal structure test (°)	Grain size, decarburized layer, nonmetallic inclusions, microstructure and macrostructure
b) Manufacturing method of material to be processed Casting Forging Rolling Extruding Sintering Machining Press-forming Drawing Rolled-threading Welding Fusion	Includes distinction of hot and cold workings and, if necessary, forged shaping ratio. Includes distinction of hot and cold workings. Includes distinction of hot and cold workings. Includes distinction of hot and cold bending and twisting. Includes distinction of hot and cold workings. Includes distinction of hot and cold workings. Existence of welds Existence of fusions
c) Pre-heat treatment of material to be processed and its method Normalizing Annealing Carburizing	Clarify heating temperature, duration, and cooling method, when necessary.
d) Pre-processing and straightening of material to be processed (°) Machining method and its conditions Plastic working method and its conditions Straightening	Includes distinction of hot and cold workings.

Note (°) May be omitted when there is no hindrance to processing.