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GB/T 2518—2019
Replace GB/T 2518—2008，GB/T 14978—2008

Continuously hot-dip zinc and zinc alloy coated steel sheet and strip

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（*English Translation*）

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Foreword

SAC/TC 183 (Technical Committee on Steel of Standardization Committee of China)is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

This standard is drafted in accordance with the rules given in GB/T 1.1—2009 *Directives for standardization—Part 1: Structure and drafting of standards*.

This Standard replaces GB/T 2518—2008 *Continuously hot-dip zinc coated steel sheet and strip* and GB/T 14978—2008 *Continuously hot-dip aluminum-zinc alloy coated steel sheet and strip* in whole. This standard integrates GB/T 2518—2008 and GB/T 14978—2008.

Compared with GB/T 2518—2008, the following deviations have been made:

—Add terms and definitions for coating mass(see 3.14);

—Add the types of hot dip zinc-aluminum alloy coating and aluminum-zinc alloy coating and the corresponding designations(see 4.1.5 and Table 1);

—Add some designations of dual phase steel, complex phase steel and dual phase steel with high formability, and add the corresponding chemical composition and mechanical properties requirements(see Table 1, Table 1 in GB/T 2518—2008);

—Add the default dimensional and flatness precision at the time of ordering (see 5.2);

—Add the requirement that the tolerances on dimensions and shape of steel sheet and strip shall be in accordance with GB/T 25052—2010 (see 6.2);

—Modify yield strength and tensile strength requirements (See Table 5 to Table 13, and Table 5 to Table 12 in GB/T 2518—2008);

—Divide chromium-free passivation into trivalent chromium passivation and chromium-free passivation (see 7.9, and 7.9 in GB/T 2518—2008);

—Add surface roughness and special requirements (see 7.10.4);

—Delete the requirement for thickness measurement position (see 8.3 in GB/T 2518—2008);

—Delete the requirement for sampling position in tensile test (see 8.4 in GB/T 2518—2008);

—Delete Annex A（see Annex A of GB/T 2518—2008）.

Compared with GB/T 14978—2008，the following deviations have been made：

—Add the types of hot-dip zinc coating，hot-dip zinc-iron alloy coating and hot-dip zinc-aluminium alloy coating and the corresponding designations（See 4.1.5，Table 1，and 4.1.5，Table 1 in GB/T 14978—2008）；

—Add some designations of high-strength interstitial free steel，bake hardening steel and low alloy steel，and add the corresponding chemical composition and mechanical properties requirements（See Table 1，Table 7 to 9 and Table 1 in GB/T 14978—2008）；

—Modify yield strength and tensile strength requirements（See Table 5，Table 6 and Table 5，Table 6 in GB/T 14978—2008）；

—Add the default dimensional and flatness precision at the time of ordering（see 5.2）；

—Add the requirement that the tolerances on dimensions and shape of steel sheet and strip shall be in accordance with GB/T 25052—2010（see 6.2）；

—Divide chromium-free passivation into trivalent chromium passivation and chromium-free passivation（see 7.9，and 7.9 in GB/T 14978—2008）；

—Add surface roughness and special requirements（see 7.10.4）；

—Delete the requirement for thickness measurement position（see 8.3 in GB/T 14978—2008）；

—Delete Annex A（see Annex A of GB/T 14978—2008）.

This standard was proposed by China Iron and Steel Association.

This standard was prepared by SAC/TC 183.

The previous editions are as follows：

—GB/T 2518—1981，GB/T 2518—1988，GB/T 2518—2004，GB/T 2518—2008.

—GB/T 14978—1994，GB/T 14978—2008.

Continuously hot-dip zinc and zinc alloy coated steel sheet and strip

1 Scope

This standard specifies the terms and definitions, classification, codes and designations, ordering information, dimensions, shape, mass, technical requirements, test methods, inspection rules, packaging, marking and quality certificates of continuously hot dip zinc, zinc-iron alloy, zinc-aluminium alloy and aluminum-zinc alloy coated steel sheet and strip (hereinafter referred to as steel sheet and strip).

This standard is applicable to steel sheet and strip with thickness from 0.20 mm to 6.0 mm, used in the industries of automotive, construction, home appliance, etc.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 223.5, *Steel and iron—Determination of acid-soluble silicon and total silicon content—Reduced molybdosilicate spectrophotometric method*

GB/T 223.9, *Iron, steel and alloy—Determination of aluminium content—Chrom azurol S photometric method*

GB/T 223.12, *Methodsfor chemical analysis of iron, steel and alloy—The sodium carbonate separation-diphenyl carbazide photometric method for the determination of chromium content*

GB/T 223.14, *Methods for chemical analysis of iron, steel and alloy—The N-benzoy-N-phenylhydroxylamine extraction photometric method for the determination of vanadium content*

GB/T 223.17, *Methods for chemical analysis of iron, steel and alloy—The diantipyryl methane photometric method for the determination of titanium content*

GB/T 223.26, *Iron, steel and alloy—Determination of molybdenum content—The thiocyanate spectrophotometric method*

GB/T 223.40，*Iron，steel and alloy Determination of niobium content—The sulphochlorophenol S spectrophotometric method*

GB/T 223.59，*Iron，steel and alloy—Determination of phosphorus content—Bismuth phosphomolybdate blue spectrophotometric method and antimony phosphomolybdate blue spectrophotometric method*

GB/T 223.60，*Methods for chemical analysis of iron，steel and alloy—The perchloric acid dehydration gravimetric method for the determination of silicon content*

GB/T 223.63，*Methods for chemical analysis of iron，steel and alloy—The sodium（potassium）periodate photometric method for the determination of manganese content*

GB/T 223.64，*Iron，steel and alloyed—Determination of manganese content—Flame atomic absorption spectrometric method*

GB/T 223.78，*Methods for chemical analysis of iron，steel and alloy—Curcumin spectrophotometric method for the determination of boron content*

GB/T 228.1—2010，*Metallic materials—Tensile testing—Part 1：Method of test at room temperature*

GB/T 247，*General rule of Package，mark and certification for steel plates（sheets）and strips*

GB/T 1839—2008，*Test method for gravimetric determination of the mass per unit area of galvanized coatings on steel products*

GB/T 2975，*Steel and steel products—Location and preparation of samples and test pieces for mechanical testing*（GB/T 2975—1998，eqv ISO 377：1997）

GB/T 4336，*Carbon and low-alloy steel—Determination of multi-element contents—Spark discharge atomic emission spectrometric method（routine method）*

GB/T 5027，*Metallic materials—Sheet and strip—Determination of plastic strain ratio*

GB/T 5028，*Metallic materials—Sheet and strip—Determination of tensile strain hardening exponent*

GB/T 8170，*Rules of rounding off for numerical values & expression and judgement of limiting values*

GB/T 17505，*Steel and steel products—General technical delivery requirements*

GB/T 20066，*Steel and iron—Sampling and preparation of samples for the determination of chemical composition*

GB/T 20123，*Steel and iron—Determination of total carbon and sulfur content—Infrared absorption method after combustion in an induction furnace（routine method）*

GB/T 20125，*Low-alloy steel—Determination of multi-element contents—Inductively coupled plasma atomic emission spectrometric method*

GB/T 20126，*Unalloyed steel—Determination of low carbon content—Part 2：Infrared absorption method after combustion in an induction furnace（with preheating）*

GB/T 24174，*Steel—Determination of Bake-Hardening-Index（BH）*

GB/T 25052—2010，*Continuously hot-dip coated steel sheet and strip—Tolerances on dimensions，shape and weight*

ISO 6892-1：2016，*Metallic materials—Tensiletesting—Part 1：Method of test at room temperature*

3 Terms and definitions

For the purposes of this document，the following terms and definitions apply.

3.1
hot-dip zinc coating

pure zinc coating obtained by immersing the prepared strip in a molten bath of zinc in a continuous hot-dip galvanizing production line.

NOTE 1 The zinc content in the molten bath is not less than 99%.

3.2
hot-dip zinc-iron alloy coating

zinc-iron alloy coating obtained by immersing the prepared strip in a molten bath of zinc in a continuous hot-dip galvanealing production line.

NOTE 2 The zinc content in the molten bath is not less than 99%. The alloying treatment produces an iron-zinc coating with an iron content of normally 8 % to 12 %.

3.3
hot-dip zinc-aluminum alloy coating

coating obtained by immersing the prepared strip in a molten bath of zinc-aluminumalloy in a continuous hot-dip zinc-aluminum production line.

NOTE 3 The composition of the bath is approximately 5% aluminium，small amounts of mischmetal and the balance zinc.

3.4
hot-dip aluminum-zinc alloy coating

coating obtained by immersing the prepared strip in a molten bath of aluminum-zinc alloy in a continuous hot-dip aluminum-zinc production line.

NOTE 4 The composition of the bath is approximately 55% aluminium，1，6% silicon and the balance zinc.

3.5
interstitial free steel

steel without interstitial by adding a proper amount of titanium or niobium into ultra-low carbon steel，so that the carbon interstitial and nitrogen interstitial in the steel are completely fixed into carbide and nitride.

3.6
high strength interstitial free steel

interstitial free steels which achieves the high strength and good formability by adding certain amount of strengthening elements，such as phosphorus，manganese，silicon，etc.

3.7
bake hardening steel

steel with a certain amount of solid solution carbon and nitrogen atoms retained，and with strength increased by adding strengthening elements such as phosphorus and manganese，whose yield strength is further increased due to age hardening after forming and baking at a certain temperature.

3.8
low alloy steel

steel with high strength obtained by grain refinement of the microalloying elements as well as precipitation strengthening through carbon-nitrogen compound particles obtained by adding microalloying elements such as niobium，titanium，vanadium，etc. alone or in combination in low carbon steel.

3.9
dual phase steel

steel whose microstructure consists mainly of ferrite and martensite，and possible bainite.

NOTE 5 Dual phase steel shows not only a high tensile strength，but also a low yield strength ratio and a high work hardening rate.

3.10
transformation induced plasticity steel

steel whose microstructure is ferrite，bainite and retained austenite，retained austenite is capable of transformation into martensite during the forming process.

NOTE 6 It shows high work hardening rate, uniform elongation and tensile strength, as well as higher elongation compared to dual phase steel with the same tensile strength.

3.11
complex phase steel

steel with a matrix of ferrite or bainite, on which distributed a small amount of martensite, retained austenite or pearlite, strengthened by micro-alloying element grain refinement or precipitation.

NOTE 7 Compared to dual phase steel with the same tensile strength, it shows higher yield strength and good bending properties.

3.12
dual phase steel with high formability

steel whose microstructure consists mainly of ferrite and martensite and small amounts of bainite or retained austenite.

NOTE 8 Compared to dual phase steel with the same tensile strength, it shows higher elongation after fracture and work hardening index, suited for forming operations with high stretching portions.

3.13
stretcher strain marks

defects on surface of steel sheets or strips, such as slip line, orange peel, etc., detrimental to appearance, caused by aging in cold forming.

3.14
coating mass

The sum of the mass of coating on both sides.

NOTE 9 The unit is grams per square meter (g/m^2).

4 Designations, classification and symbols

4.1 Designations

4.1.1 General

The designations of the steel sheet and strip consists of five parts: application code, steel grade code (or serial number), characteristics (if any), hot-dip code (D) and coating type code. The hot-dip code (D) and the coating type code are connected by a plus sign "+".

4.1.2 Application code

The application codes are as follows.

a) DX: the first letter D represents flat steel for cold forming; If the second letter is X, it represents non-specified rolling condition of the base metal; if the second letter is C, it represents cold-rolled base metal; If the second letter is D, it represents hot-rolled base metal.

b) S: it represents structural steel.

c) HX: The first letter H represents high strength flat steel for cold forming; If the second letter is X, it represents non-specified rolling condition of the base metal; if the second letter is C, it represents cold-rolled base metal; If the second letter is D, it represents hot-rolled base metal.

4.1.3 Steel grade code (or serial number)

Steel grade codes are as follows:

a) 51 to 57: 2 digits, representing the steel grade serial number;

b) 180 to 1180: 3 to 4 digits, representing steel grade code; according to the designation, generally the minimum yield strength or minimum yield strength and minimum tensile strength in mega pascals (MPa).

4.1.4 Steel grade characteristics

The characteristics of steel grades are usually indicated by letters in 1 to 2 digits. The characteristic codes are as follows:

a) Y represents high strength interstitial free steel;

b) LA represents low alloy steel;

c) B represents bake hardening steel;

d) DP represents dual phase steel;

e) TR represents transformation induced plasticity steel;

f) CP represents complex phase steel;

g） DH represents dual phase steel with high formability；

h） G represents non-specified characteristics of steel grades.

4.1.5 Hot dip code

The hot-dip code is D.

4.1.6 Coating code

The pure zinc coating is expressed as Z，the zinc-iron alloy coating is expressed as ZF，the zinc-aluminium alloy coating is expressed as ZA，and the aluminum-zinc alloy coating is expressed as AZ.

4.2 Examples of designations

EXAMPLE 1 DC57D+ZF
flat steel for cold forming，cold-rolled base metal，with steel grade serial number 57 and hot-dip zinc-iron alloy coated product.

EXAMPLE 2 S350GD+Z
steel for structure，with specified minimum yield strength 350 MPa，non-specified characteristics，hot-dip zinc coated product.

EXAMPLE 3 HX340LAD+ZF
high strength flat steel for cold forming，non-specified rolling condition for base metal，with specified minimum yield strength 340 MPa，low alloy steel hot-dip zinc-iron alloy coated product.

EXAMPLE 4 HC330/590DPD+Z
high strength flat steel for cold forming，cold-rolled base metal，with specified minimum yield strength 330 MPa and specified minimum tensile strength 590 MPa，dual phase steel，hot-dip zinc coated product.

4.3 Designations and characteristics

4.3.1 The designations and characteristics of steel sheet and strip shall comply with Table 1.

Table 1—Designations and characteristics

Designation	Characteristics
DX51D+Z，DX51D+ZF，DX51D+ZA，DX51D+AZ	Low carbon steel
DX52D+Z，DX52D+ZF，DX52D+ZA，DX52D+AZ	
DX53D+Z，DX53D+ZF，DX53D+ZA，DX53D+AZ	Interstitial free steel
DX54D+Z，DX54D+ZF，DX54D+ZA，DX54D+AZ	
DX56D+Z，DX56D+ZF，DX56D+ZA，DX56D+AZ	
DX57D+Z，DX57D+ZF，DX57D+ZA，DX57D+AZ	

Table 1（*continued*）

Designation	Characteristics
S220GD+Z，S220GD+ZF，S220GD+ZA，S220GD+AZ	Structural steel
S250GD+Z，S250GD+ZF，S250GD+ZA，S250GD+AZ	
S280GD+Z，S280GD+ZF，S280GD+ZA，S280GD+AZ	
S300GD+Z，S300GD+ZF，S300GD+ZA，S300GD+AZ	
S320GD+Z，S320GD+ZF，S320GD+ZA，S320GD+AZ	
S350GD+Z，S350GD+ZF，S350GD+ZA，S350GD+AZ	
S390GD+Z，S390GD+ZF，S390GD+ZA，S390GD+AZ	
S420GD+Z，S420GD+ZF，S420GD+ZA，S420GD+AZ	
S450GD+Z，S450GD+ZF，S450GD+ZA，S450GD+AZ	
S550GD+Z，S550GD+ZF，S550GD+ZA，S550GD+AZ	
HX260LAD+Z，HX260LAD+ZF，HX260LAD+ZA，HX260LAD+AZ	Low alloy steel
HX300LAD+Z，HX300LAD+ZF，HX300LAD+ZA，HX300LAD+AZ	
HX340LAD+Z，HX340LAD+ZF，HX340LAD+ZA，HX340LAD+AZ	
HX380LAD+Z，HX380LAD+ZF，HX380LAD+ZA，HX380LAD+AZ	
HX420LAD+Z，HX420LAD+ZF，HX420LAD+ZA，HX420LAD+AZ	
HX460LAD+Z，HX460LAD+ZF，HX460LAD+ZA，HX460LAD+AZ	
HX500LAD+Z，HX500LAD+ZF，HX500LAD+ZA，HX500LAD+AZ	
HD550LAD+Z，HD550LAD+ZF，HD550LAD+ZA，HD550LAD+AZ	
HX180YD+Z，HX180YD+ZF，HX180YD+ZA，HX180YD+AZ	High strength interstitial free steel
HX220YD+Z，HX220YD+ZF，HX220YD+ZA，HX220YD+AZ	
HX260YD+Z，HX260YD+ZF，HX260YD+ZA，HX260YD+AZ	
HX180BD+Z，HX180BD+ZF，HX180BD+ZA，HX180BD+AZ	Bake hardening steel
HX220BD+Z，HX220BD+ZF，HX220BD+ZA，HX220BD+AZ	
HX260BD+Z，HX260BD+ZF，HX260BD+ZA，HX260BD+AZ	
HX300BD+Z，HX300BD+ZF，HX300BD+ZA，HX300BD+AZ	
HC260/450DPD+Z，HC260/450DPD+ZF，HC260/450DPD+ZA	Dual phase steel
HC290/490DPD+Z，HC290/490DPD+ZF，HC290/490DPD+ZA	
HC330/590DPD+Z，HC330/590DPD+ZF，HC330/590DPD+ZA	
HC440/780DPD+Z，HC440/780DPD+ZF，HC440/780DPD+ZA	
HC500/780DPD+Z，HC500/780DPD+ZF，HC500/780DPD+ZA	
HC590/980DPD+Z，HC590/980DPD+ZF，HC590/980DPD+ZA	
HC700/980DPD+Z，HC700/980DPD+ZF，HC700/980DPD+ZA	
HC740/1180DPD+Z，HC740/1180DPD+ZF，HC740/1180DPD+ZA	
HC820/1180DPD+Z，HC820/1180DPD+ZF，HC820/1180DPD+ZA	

Table 1（*continued*）

Designation	Characteristics
HC380/590TRD+Z，HC380/590TRD+ZF，HC380/590TRD+ZA	Transformation induced plasticity steel
HC400/690TRD+Z，HC400/690TRD+ZF，HC400/690TRD+ZA	
HC450/780TRD+Z，HC450/780TRD+ZF，HC450/780TRD+ZA	
HC350/600CPD+Z，HC350/600CPD+ZF，HC350/600CPD+ZA	Complex phase steel
HC570/780CPD+Z，HC570/780CPD+ZF，HC570/780CPD+ZA	
HC780/980CPD+Z，HC780/980CPD+ZF，HC780/980CPD+ZA	
HD660/760CPD+Z，HD660/760CPD+ZF，HD660/760CPD+ZA	
HC330/590DHD+Z，HC330/590DHD+ZF，HC330/590DHD+ZA	Dual phase steel with high formability
HC440/780DHD+Z，HC440/780DHD+ZF，HC440/780DHD+ZA	
HC550/980DHD+Z，HC550/980DHD+ZF，HC550/980DHD+ZA	
HC700/980DHD+Z，HC700/980DHD+ZF，HC700/980DHD+ZA	
NOTE For DX and HX designation series，customers can select DC，DD，HC，HD designation series as required.	

4.3.2 See Annex A for the comparison table of the designations in this standard and the foreign and domestic standards.

4.4 Surface quality classification and code

The surface quality classification and code of steel sheet and strip shall conform to Table 2.

Table 2—Classification and code of surface quality

Classification	Code
Normal surface	FA
Improved surface	FB
Advanced surface	FC

4.5 Classification and code of coating types，coating finish and surface treatment

4.5.1 The classification and code of types of coatings，coating finish and surface treatment of steel sheet and strip shall comply with Table 3.

Table 3—Classification and code of coating types，coating finish and surface treatment

Item	Classification	Code
Type of coating	zinc coating	Z
	Zinc-iron alloy coating	ZF

Table 3（*continued*）

Item	Classification		Code
Type of coating	Zinc-aluminium alloy coating		ZA
	Aluminium-zinc alloy coating		AZ
Coating finish	Zinc coating（Z）	Normal spangle	N
		Minimized spangle	M
		Few spangle	F
	Zinc-iron alloy coating（ZF）	Zinc iron alloy	R
	Zinc-aluminium alloy coating（ZA）	Normal spangle	N
	Aluminium-zinc alloy coating（AZ）	Normal spangle	N
Surface treatment	Chromic acid passivation		C
	Oiling		O
	Chromic acid passivation + oiling		CO
	Trivalent chromium passivation		C3
	Trivalent chromium passivation + oiling		CO3
	Chromium-free passivation		CN
	Chromium-free passivation + oiling		CON
	Phosphating		P
	Phosphating + oiling		PO
	Fingerprint-resistant film		AF
	Trivalent chromium fingerprint-resistant film		AF3
	Chromium-free fingerprint-resistant film		AFN
	Self-lubricating film		SL
	Trivalent chromium self-lubricating film		SL3
	Chromium-free self-lubricating film		SLN
	Untreated		U

4.5.2 For introduction and application guide of coating types，see Annex B.

5 Ordering information

5.1 Contract or order covered by this standard shall include the following information：

a） name of product（steel sheet or strip）；

b） standard number；

c） designation；

d） coating type and coating mass code；

e） dimensions and precision（including thickness，width，length，inner diameter of strips，etc.）；

f） flatness precision；

g） coating finish；

h） surface treatment；

i） surface quality；

j） mass；

k） packaging type；

l） others（e.g.，skin pass，position of the surface of better surface quality，etc.）.

5.2 If the specific requirements of dimensional and flatness precision，surface treatment type，surface quality，surface finish and packaging type are not indicated in the contract，the supplier shall supply the products with normal dimensional precision and normal flatness precision in GB/T 25052—2010，oiled surface treatment（O），normal surface quality（FA），as well as surface finish and packaging type provided by the supplier. If the inner diameter of the steel strip is not indicated in the contract，it is left to the discretion of the supplier.

6 Dimensions，shape and mass

6.1 Dimensions

6.1.1 The nominal dimensions of steel sheet and strip shall conform to Table 4. If agreed upon by the supplier and purchaser，steel sheet and strip in other dimensions can be provided. Slit strip is the strip slit from a steel strip（mother strip）. Unless otherwise specified，the steel strips include slit strips.

Table 4—Nominal dimensions

Dimensions in millimetres

Item		Nominal dimension
Nominal thickness		0.20 to 6.0
Nominal width	Steel sheet and strip	600 to 2 050
	Slit strip	＜600

Table 4 (*continued*)

Dimensions in millimetres

Item		Nominal dimension
Nominal length	Steel sheet	1 000 to 8 000
Nominal inner diameter[a]	Steel strip and slit strip	610 or 508
[a] If the purchaser has requirements for the inner diameter tolerances of coils, it shall be agreed upon by the supplier and the purchaser. If not specified, it is left to the discretion of the supplier.		

6.1.2 Nominal thickness of steel sheet and strip includes thickness of substrates and thickness of coating.

6.2 Dimensions, shape and tolerances

The dimensions, shape and tolerances of the steel sheet and strip shall conform to GB/T 25052—2010, among which the thickness tolerances of DX51D+Z, DX51D+ZF, DX51D+ZA, DX51D+AZ, S550GD+Z, S550GD+ZF, S550GD+ZA, S550GD+AZ and S550GD+AZ shall comply with Table 2 in GB/T 25052—2010, and the flatness of those shall comply with Table 9 in GB/T 25052—2010.

6.3 Mass

Steel sheets are delivered in theoretical mass or actual mass. The calculation method of theoretical mass shall comply with Annex C. Steel strips are usually delivered in actual mass.

7 Technical requirements

7.1 Chemical composition

The chemical composition (heat analysis) of steel can refer to Annex D. If the purchaser has requirements for chemical composition, it shall be agreed at the time of ordering.

7.2 Steelmaking process

Steel should be made by BOF or EAF. Unless otherwise specified, the steelmaking process shall be left to the discretion of the supplier.

7.3 Delivery condition

Steel sheet and strip are delivered in hot-dip condition or hot-dip and skin passing condition.

7.4 Mechanical properties

7.4.1 The mechanical properties of steel sheet and strip shall conform to Table 5 to Table 13. Tensile test pieces are with coating unless otherwise specified.

7.4.2 The guarantee period of mechanical properties of each designations of steel sheet and strip shall comply with Table 14. The guarantee period commence from the date on which the products are made available.

NOTE 1 Due to ageing, prolonged storage of the sheet and strip can deteriorate the mechanical properties, such as increase in yield strength and tensile strength, decrease in elongation after fracture, leading to an adverse effect on formability. Purchasers are suggested to use the products as soon as possible.

NOTE 2 Normally, the issue date in the inspection document is regarded as the date on which the products are made available.

7.4.3 When the steel sheet and strip are supplied to be specific parts, the manufacturer and the purchaser may agree upon an acceptance criterion with the range of mechanical properties meeting the processing requirements of the parts. In this case, the mechanical properties given in Table 5 to Table 13 shall not apply.

7.5 Stretcher strain mark

7.5.1 The aging period of stretcher strain marks of each designation of steel sheet and strip shall comply with Table 14. The aging period of stretcher strain marks shall be calculated from the date on which the products are made available. The supplier shall guarantee that no stretcher strain mark shall appear during the aging period.

NOTE Due to ageing, there is a tendency for stretcher strains to form again for all designations after some time, it is in the interest of the purchaser to use the products as soon as possible.

7.5.2 If there are any special requirements for stretcher strain marks, they shall be agreed at the time of ordering and indicated in the contract.

Table 5—Mechanical properties of low carbon steel and interstitial free steel

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa	Elongation after fracture[c] $A_{80\,mm}$/% No less than	Plastic strain ratio r_{90} No less than	Transverse strain hardening exponent n_{90} No less than
DX51D+Z, DX51D+ZF, DX51D+ZA, DX51D+AZ	—	270 to 500	22	—	—
DX52D+Z[f], DX52D+ZF, DX52D+ZA[f], DX52D+AZ	140 to 300	270 to 420	26	—	—

Table 5（*continued*）

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa	Elongation after fracture[c] $A_{80\ mm}$/% No less than	Plastic strain ratio r_{90} No less than	Transverse strain hardening exponent n_{90} No less than
DX53D+Z，DX53D+ZF，DX53D+ZA，DX53D+AZ	140 to 260	270 to 380	30	—	—
DX54D+Z	120 to 220	260 to 350	36	1.6	0.18
DX54D+ZF，DX54D+ZA，DX54D+AZ			34	1.4	0.18
DX56D+Z	120 to 180	260 to 350	39	1.9[d]	0.21
DX56D+ZF，DX56D+ZA，DX56D+AZ			37	1.7[d, e]	0.20[e]
DX57D+Z	120 to 170	260 to 350	41	2.1[d]	0.22
DX57D+ZF，DX57D+ZA，DX57D+AZ			39	1.9[d, e]	0.21[e]

[a] If the yield point is not pronounced，the values apply to the 0.2%-proof strength $R_{p0.2}$.

[b] P6 test piece specified in GB/T 228.1—2010 apply. The test piece is taken in the transverse direction.

[c] Decreased minimum elongation values apply for product thickness，0.5 mm $< t \leqslant$ 0.7 mm（minus 2 units），0.35 mm $< t \leqslant$ 0.5 mm（minus 4 units）and $t \leqslant$ 0.35 mm（minus 7 units）.

[d] Decreased minimum r_{90}-values apply for product thickness 1.5 mm $< t <$ 2 mm（minus 0.2），$t \geqslant$ 2 mm（minus 0.4）.

[e] Decreased minimum r_{90}-values apply for product thickness，0.5 mm $< t \leqslant$ 0.7 mm（minus 0.2），0.35 mm $< t \leqslant$ 0.5 mm（minus 0.4）and $t \leqslant$ 0.35 mm（minus 0.6）apply. Decreased minimum n_{90}-values apply for product thickness，0.5 mm $< t \leqslant$ 0.7 mm（minus 0.01），0.35 mm $< t \leqslant$ 0.5 mm（minus 0.03）and $t \leqslant$ 0.35 mm（minus 0.04）apply.

[f] The yield strength values are only applicable to skin-passed steel sheet and strip with FB，FC surface quality.

Table 6—Mechanical properties of structural steel

Designation	Upper yield strength R_{eH}[a, b]/MPa No less than	Tensile strength R_m[c]/MPa No less than	Elongation after fracture[d] $A_{80\ mm}$/% No less than
S220GD+Z，S220GD+ZF，S220GD+ZA，S220GD+AZ	220	300	20
S250GD+Z，S250GD+ZF，S250GD+ZA，S250GD+AZ	250	330	19
S280GD+Z，S280GD+ZF，S280GD+ZA，S280GD+AZ	280	360	18
S300GD+Z，S300GD+ZF，S300GD+ZA，S300GD+AZ	300	370	18
S320GD+Z，S320GD+ZF，S320GD+ZA，S320GD+AZ	320	390	17

Table 6（*continued*）

Designation	Upper yield strength R_{eH}[a, b]/MPa No less than	Tensile strength R_m[c]/MPa No less than	Elongation after fracture[d] $A_{80\ mm}$/% No less than
S350GD+Z，S350GD+ZF，S350GD+ZA，S350GD+AZ	350	420	16
S390GD+Z，S390GD+ZF，S390GD+ZA，S390GD+AZ	390	460	16
S420GD+Z，S420GD+ZF，S420GD+ZA，S420GD+AZ	420	480	15
S450GD+Z，S450GD+ZF，S450GD+ZA，S450GD+AZ	450	510	14
S550GD+Z，S550GD+ZF，S550GD+ZA，S550GD+AZ	550	560	—

[a] If the yield point is not pronounced，the values apply to the 0.2%-proof strength $R_{p0.2}$.

[b] P6 test piece specified in GB/T 228.1—2010 apply. The test piece is taken in the longitudinal direction.

[c] For all designations except S550GD+Z，S550GD+ZF，S550GD+ZA，S550GD+AZ，a range of 140 MPa can be expected for tensile strength.

[d] Decreased minimum elongation values apply for product thickness：0.5 mm $<$ $t \leqslant$ 0.7 mm（minus 2 units），0.35 mm $<$ $t \leqslant$ 0.5 mm（minus 4 units）；and $t \leqslant$ 0.35 mm（minus 7 units）.

Table 7—Mechanical properties of high strength interstitial free steel

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa	Elongation after fracture[c] $A_{80\ mm}$/% No less than	Plastic strain ratio r_{90}[d, e] No less than	Transverse strain hardening exponent n_{90}[e] No less than
HX180YD+Z	180 to 240	330 to 390	34	1.7	0.18
HX180YD+ZF，HX180YD+ZA，HX180YD+AZ			32	1.5	0.18
HX220YD+Z	220 to 280	340 to 420	32	1.5	0.17
HX220YD+ZF，HX220YD+ZA，HX220YD+AZ			30	1.3	0.17
HX260YD+Z	260 to 320	380 to 440	30	1.4	0.16
HX260YD+ZF，HX260YD+ZA，HX260YD+AZ			28	1.2	0.16

[a] If the yield point is not pronounced，the values apply to the 0.2%-proof strength $R_{p0.2}$.

[b] P6 test piece specified in GB/T 228.1—2010 apply. The test piece is taken in the transverse direction.

[c] Decreased minimum elongation values apply for product thickness，0.5 mm $<$ $t \leqslant$ 0.7 mm（minus 2 units），0.35 mm $<$ $t \leqslant$ 0.5 mm（minus 4 units）and $t \leqslant$ 0.35 mm（minus 7 units）.

[d] Decreased minimum r_{90}-values apply for product thickness，1.5 $<$ t $<$ 2 mm（minus 0.2），$t \geqslant$ 2 mm（minus 0.4）.

[e] Decreased minimum r_{90}-values apply for product thickness，0.5 mm $<$ $t \leqslant$ 0.7mm（minus 0.2），0.35 mm $<$ $t \leqslant$ 0.5 mm（minus 0.4）and $t \leqslant$ 0.35 mm（minus 0.6）. Decreased minimum n_{90}-values apply for product thickness，0.5 mm $<$ $t \leqslant$ 0.7 mm（minus 0.01），0.35 mm $<$ $t \leqslant$ 0.5 mm（minus 0.03）and $t \leqslant$ 0.35 mm（minus 0.04）.

Table 8—Mechanical properties of bake hardening steel

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa	Elongation after fracture[c] $A_{80\ mm}$/% No less than	Plastic strain ratio r_{90}[d] No less than	Transverse strain hardening exponent n_{90} No less than	Bake hardening index BH_2/MPa No less than
HX180BD+Z	180 to 240	290 to 390	34	1.5	0.16	30
HX180BD+ZF, HX180BD+ZA, HX180BD+AZ			32	1.3	0.16	30
HX220BD+Z	220 to 280	320 to 400	32	1.2	0.15	30
HX220BD+ZF, HX220BD+ZA, HX220BD+AZ			30	1.0	0.15	30
HX260BD+Z	260 to 320	360 to 440	28	—	—	30
HX260BD+ZF, HX260BD+ZA, HX260BD+AZ			26	—	—	30
HX300BD+Z	300 to 360	400 to 480	26	—	—	30
HX300BD+ZF, HX300BD+ZA, HX300BD+AZ			24	—	—	30

[a] If the yield point is not pronounced, the values apply to the 0.2%-proof strength $R_{p0.2}$.

[b] P6 test piece specified in GB/T 228.1—2010 apply. The test piece is taken in the transverse direction.

[c] Decreased minimum elongation values apply for product thickness, $0.5\ mm < t \leqslant 0.7\ mm$ (minus 2 units), $0.35\ mm < t \leqslant 0.5\ mm$ (minus 4 units) and $t \leqslant 0.35\ mm$ (minus 7 units).

[d] Decreased minimum r_{90}-values apply for product thickness, $1.5 < t < 2\ mm$ (minus 0.2), $t \geqslant 2\ mm$ (minus 0.4).

Table 9—Mechanical properties of low alloy steel

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa	Elongation after fracture[c] $A_{80\ mm}$/% No less than
HX260LAD+Z	260 to 330	350 to 430	26
HX260LAD+ZF, HX260LAD+ZA, HX260LAD+AZ			24
HX300LAD+Z	300 to 380	380 to 480	23
HX300LAD+ZF, HX300LAD+ZA, HX300LAD+AZ			21
HX340LAD+Z	340 to 420	410 to 510	21
HX340LAD+ZF, HX340LAD+ZA, HX340LAD+AZ			19

Table 9（*continued*）

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa	Elongation after fracture[c] $A_{80\ mm}$/% No less than
HX380LAD+Z	380 to 480	440 to 560	19
HX380LAD+ZF，HX380LAD+ZA，HX380LAD+AZ			17
HX420LAD+Z	420 to 520	470 to 590	17
HX420LAD+ZF，HX420LAD+ZA，HX420LAD+AZ			15
HX460LAD+Z	460 to 560	500 to 640	15
HX460LAD+ZF，HX460LAD+ZA，HX460LAD+AZ			13
HX500LAD+Z	500 to 620	530 to 690	13
HX500LAD+ZF，HX500LAD+ZA，HX500LAD+AZ			11
HD550LAD+Z	550 to 670	610 to 750	12
HD550LAD+ZF，HD550LAD+ZA，HD550LAD+AZ			10

[a] If the yield point is not pronounced，the values apply to the 0.2%-proof strength $R_{p0.2}$.

[b] P6 test piece specified in GB/T 228.1—2010 apply. The test piece is taken in the transverse direction.

[c] Decreased minimum elongation values apply for product thickness，0.5 mm $<$ $t \leqslant$ 0.7 mm（minus 2 units），0.35 mm $<$ $t \leqslant$ 0.5 mm（minus 4 units）and $t \leqslant$ 0.35 mm（minus 7 units）.

Table 10—Mechanical properties of dual phase steel

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa No less than	Elongation after fracture[c] % No less than		Longitudinal strain hardening exponent n_0 No less than	Bake hardening index BH_2/MPa No less than
			$A_{80\ mm}$	$A_{50\ mm}$		
HC260/450DPD+Z	260 to 340	450	27	—	0.16	30
HC260/450DPD+ZF，HC260/450DPD+ZA			25	—		30
HC290/490DPD+Z	290 to 380	490	23	—	0.15	30
HC290/490DPD+ZF，HC290/490DPD+ZA			21	—		30
HC330/590DPD+Z	330 to 430	590	20	—	0.14	30
HC330/590DPD+ZF，HC330/590DPD+ZA			18	—		30

Table 10（*continued*）

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa No less than	Elongation after fracture[c] % No less than		Longitudinal strain hardening exponent n_0 No less than	Bake hardening index BH_2/MPa No less than
			$A_{80\ mm}$	$A_{50\ mm}$		
HC440/780DPD+Z	440 to 550	780	14	—	—	30
HC440/780DPD+ZF，HC440/780DPD+ZA			12	—		30
HC500/780DPD+Z	500 to 650	780	10	—	—	30
HC500/780DPD+ZF，HC500/780DPD+ZA			8	—	—	30
HC590/980DPD+Z[d]	590 to 750	980	10	11	—	30
HC590/980DPD+ZF[d]，HC590/980DPD+ZA[d]			8	9	—	30
HC700/980DPD+Z[d]	700 to 900	980	8	9	—	30
HC700/980DPD+ZF[d]，HC700/980DPD+ZA[d]			6	7	—	30
HC740/1180DPD+Z[d]	740 to 980	1 180	5	6	—	30
HC740/1180DPD+ZF[d]，HC740/1180DPD+ZA[d]			3	4	—	30
HC820/1180DPD+Z[d]	820 to 1 150	1 180	5	6	—	30
HC820/1180DPD+ZF[d]，HC820/1180DPD+ZA[d]			3	4	—	30

[a] If the yield point is not pronounced，the values apply to the 0.2%-proof strength $R_{p0.2}$.

[b] P6 test piece specified in GB/T 228.1—2010 apply. The test piece is taken in the longitudinal direction.

[c] Decreased minimum elongation values apply for product thickness，0.5 mm $< t \leqslant$ 0.7 mm（minus 2 units），0.35 mm $< t \leqslant$ 0.5 mm（minus 4 units）and $t \leqslant$ 0.35 mm（minus 7 units）.

[d] Type 3 specified in ISO 6892-1：2016 can also apply. The sample shall be taken in the longitudinal direction，and the elongation after fracture $A_{50\ mm}$ apply. In case of arbitration，No. P6 in GB/T 228.1—2010 apply and the test piece shall be taken in the longitudinal direction.

Table 11— Mechanical properties of transformation induced plasticity steel

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa No less than	Elongation after fracture[c] $A_{80\ mm}$/% No less than	Longitudinal strain hardening exponent n_0 No less than	Bake hardening index BH_2/MPa No less than
HC380/590TRD+Z	380 to 480	590	25	0.20	40
HC380/590TRD+ZF，HC380/590TRD+ZA			23		40

Table 11（*continued*）

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa No less than	Elongation after fracture[c] $A_{80\,mm}$/% No less than	Longitudinal strain hardening exponent n_0 No less than	Bake hardening index BH_2/MPa No less than
HC400/690TRD+Z	400 to 520	690	23	0.19	40
HC400/690TRD+ZF，HC400/690TRD+ZA			21		40
HC450/780TRD+Z	450 to 570	780	21	0.16	40
HC450/780TRD+ZF，HC450/780TRD+ZA			19		40

[a] If the yield point is not pronounced，the values apply to the 0.2%-proof strength $R_{p0.2}$.

[b] P6 test piece specified in GB/T 228.1—2010 apply. The test piece is taken in the longitudinal direction.

[c] Decreased minimum elongation values apply for product thickness，0.5 mm $<$ $t \leqslant$ 0.7 mm（minus 2 units），0.35 mm $<$ $t \leqslant$ 0.5 mm（minus 4 units）and $t \leqslant$ 0.35 mm（minus 7 units）.

Table 12— Mechanical properties of complex phase steel

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa No less than	Elongation after fracture[c] $A_{80\,mm}$/% No less than	Bake hardening index BH_2/MPa No less than
HC350/600CPD+Z	350 to 500	600	16	30
HC350/600CPD+ZF，HC350/600CPD+ZA			14	
HC570/780CPD+Z	570 to 720	780	11	30
HC570/780CPD+ZF，HC570/780CPD+ZA			9	
HC780/980CPD+Z	780 to 950	980	7	30
HC780/980CPD+ZF，HC780/980CPD+ZA			5	
HD660/760CPD+Z	660 to 820	760	11	30
HD660/760CPD+ZF，HD660/760CPD+ZA			9	

[a] If the yield point is not pronounced，the values apply to the 0.2%-proof strength $R_{p0.2}$.

[b] P6 test piece specified in GB/T 228.1—2010 apply. The test piece is taken in the longitudinal direction.

[c] Decreased minimum elongation values apply for product thickness，0.5 mm $<$ $t \leqslant$ 0.7 mm（minus 2 units），0.35 mm $<$ $t \leqslant$ 0.5 mm（minus 4 units）and $t \leqslant$ 0.35mm（minus 7 units）.

Table 13—Mechanical properties of dual phase steel with high formability

Designation	Lower yield strength R_{eL}[a, b]/MPa	Tensile strength R_m/MPa No less than	Elongation after fracture[c] $A_{80\ mm}$/% No less than	Longitudinal strain hardening exponent n_0 No less than	Bake hardening index BH_2/MPa No less than
HC330/590DHD+Z	330 to 430	590	26	0.16	30
HC330/590DHD+ZF, HC330/590DHD+ZA			24		
HC440/780DHD+Z	440 to 550	780	18	0.13	30
HC440/780DHD+ZF, HC440/780DHD+ZA			16		
HC550/980DHD+Z	550 to 750	980	15	—	30
HC550/980DHD+ZF, HC550/980DHD+ZA			13		
HC700/980DHD+Z	700 to 900	980	13	—	30
HC700/980DHD+ZF, HC700/980DHD+ZA			11		

[a] If the yield point is not pronounced, the values apply to the 0.2%-proof strength $R_{p0.2}$.

[b] P6 test piece specified in GB/T 228.1—2010 apply. The test piece is taken in the longitudinal direction.

[c] Decreased minimum elongation values apply for product thickness, 0.5 mm $<$ $t \leqslant$ 0.7 mm (minus 2 units), 0.35 mm $<$ $t \leqslant$ 0.5 mm (minus 4 units) and $t \leqslant$ 0.35 mm (minus 7 units).

Table 14—Aging period of stretcher strain marks

Designation	Guarantee period of property	Aging period of stretcher strain marks
DX51D+Z, DX51D+ZF, DX51D+ZA, DX51D+AZ	1 month	—
DX52D+Z, DX52D+ZF, DX52D+ZA, DX52D+AZ	1 month	1 month
DX53D+Z, DX53D+ZF, DX53D+ZA, DX53D+AZ DX54D+Z, DX54D+ZF, DX54D+ZA, DX54D+AZ DX56D+Z, DX56D+ZF, DX56D+ZA, DX56D+AZ DX57D+Z, DX57D+ZF, DX57D+ZA, DX57D+AZ	6 months	6 months
HX260LAD+Z, HX260LAD+ZF, HX260LAD+ZA, HX260LAD+AZ HX300LAD+Z, HX300LAD+ZF, HX300LAD+ZA, HX300LAD+AZ HX340LAD+Z, HX340LAD+ZF, HX340LAD+ZA, HX340LAD+AZ HX380LAD+Z, HX380LAD+ZF, HX380LAD+ZA, HX380LAD+AZ HX420LAD+Z, HX420LAD+ZF, HX420LAD+ZA, HX420LAD+AZ HX460LAD+Z, HX460LAD+ZF, HX460LAD+ZA, HX460LAD+AZ HX500LAD+Z, HX500LAD+ZF, HX500LAD+ZA, HX500LAD+AZ HD550LAD+Z, HD550LAD+ZF, HD550LAD+ZA, HD550LAD+AZ	6 months	—
HX180YD+Z, HX180YD+ZF, HX180YD+ZA, HX180YD+AZ HX220YD+Z, HX220YD+ZF, HX220YD+ZA, HX220YD+AZ HX260YD+Z, HX260YD+ZF, HX260YD+ZA, HX260YD+AZ	6 months	6 months

Table 14（*continued*）

Designation	Guarantee period of property	Aging period of stretcher strain marks
HX180BD+Z，HX180BD+ZF，HX180BD+ZA，HX180BD+AZ HX220BD+Z，HX220BD+ZF，HX220BD+ZA，HX220BD+AZ HX260BD+Z，HX260BD+ZF，HX260BD+ZA，HX260BD+AZ HX300BD+Z，HX300BD+ZF，HX300BD+ZA，HX300BD+AZ	3 months	3 months[a]
[a] When the storage temperature is not below 50 ℃，the aging period of the stretcher strain marks do not apply.		

7.6 Coating adhesion

Coating adhesion shall be tested according to appropriate test methods. The test method is left to the discretion of the supplier unless otherwise specified.

7.7 Coating mass

7.7.1 The available nominal coating masses shall be in accordance with Table 15. Other coating masses can be provided if agreed upon by the supplier and purchaser.

7.7.2 The recommended nominal coating masses and corresponding coating code shall conform to Table 16. If agreed upon by the supplier and purchaser，the coating code of the total mass with same coating mass on each surface can also be expressed as the masses on each surface.

EXAMPLES hot-dip zinc coating Z250 can be expressed as Z125/125，hot-dip zinc-iron alloy coating ZF180 can be expressed as ZF90/90，hot-dip zinc-aluminium alloy coating ZA250 can be expressed as ZA125/125，hot-dip aluminum-zinc alloy coating AZ150 can be expressed as AZ75/75.

7.7.3 For same coating mass on each surface，the average value of triple spot test of coating mass shall not be less than the specified nominal coating mass；single spot test value of coating mass shall not be less than 85% of the specified nominal coating mass. The value of single-spot coating mass per side shall be not less than 34% of the specified nominal coating mass.

7.7.4 For differential coatings，the nominal coating mass and test value of coating mass shall conform to Table 17.

Table 15—Nominal coating mass

Coating form	Applicable coating finish	Nominal coating mass range for the following coating types [a]/(g/m^2)			
		Zinc coating（Z）	Zinc-iron alloy coating（ZF）	Zinc-aluminium alloy coating（ZA）	Aluminium-zinc alloy coating（AZ）
Same coating	N，M，F，R	50 to 600	60 to 180	50 to 300	60 to 200

Table 15（*continued*）

Coating form	Applicable coating finish	Nominal coating mass range for the following coating types [a]/(g/m²)			
		Zinc coating(Z)	Zinc-iron alloy coating(ZF)	Zinc-aluminium alloy coating（ZA）	Aluminium-zinc alloy coating（AZ）
Differential coating[b]	N,M,F	25 to 150（each side）	—	—	—

[a] The thickness of 50 g/m² coating（pure zinc and zinc-iron alloy）is about 7 μm，the thickness of 50 g/m² coating（zinc-aluminium alloy）is about 7.6 μm，and the thickness of 50 g/m² coating（aluminum-zinc alloy）is about 13.2 μm.

[b] For differential coatings，the ratio of the heavier coating mass to the coating mass on the other side shall not exceed 3.

Table 16—Recommended nominal coating mass and corresponding coating codes

Coating type	Coating form	Recommended nominal coating mass/(g/m²)	Coating code
Z	Same coating	60	60
		80	80
		100	100
		120	120
		150	150
		180	180
		200	200
		220	220
		250	250
		275	275
		350	350
		450	450
		600	600
ZF	Same coating	60	60
		90	90
		120	120
		140	140
ZA	Same coating	60	60
		80	80
		100	100
		120	120
		150	150
		180	180
		200	200

Table 16（*continued*）

Coating type	Coating form	Recommended nominal coating mass/(g/m²)	Coating code
ZA	Same coating	220	220
		250	250
		275	275
		300	300
AZ	Same coating	60	60
		80	80
		100	100
		120	120
		150	150
		180	180
		200	200
Z	Differential coating	30/40	30/40
		40/60	40/60
		40/100	40/100

Table 17—Nominal coating mass and test value of differential coating

Coating type	Coating form	Coating code	Nominal coating mass/(g/m²) no less than	
			Average value of triple spot test per side	Single spot test per side
Z	Differential coating	A/B[a]	A/B[a]	(0.85×A)/(0.85×B)
[a] A, B is the respective nominal coating mass(g/m²) of upper and lower surfaces (or the inner and outer surfaces) of steel sheet and strip.				

7.8 Coating finish

7.8.1 The coating finish of steel sheet and strip shall conform to Table 18.

7.8.2 For zinc coating, if a pronounced spangle is desired, this shall be indicated at the time of ordering. Products with minimized spangle or few spangle may be ordered if the normal spangle does not satisfy the surface appearance requirements of the purchaser.

Table 18—Coating finish

Coating type	Coating finish	Code	Features
Z	Normal spangle	N	The spangles are obtained when the zinc coating is left to solidify normally, visible to the unaided eye
	Minimized spangle	M	The reduced spangles are obtained by influencing the solidification process in a specific way, visible to the unaided eye
	Few spangle	F	The reduced spangles are obtained by influencing the solidification process in a specific way, not visible to the unaided eye
ZF	Zinc-iron alloy	R	The finish results from heat treatment for zinc coating. The surface usually has a matt grey appearance
ZA	Normal spangle	N	Zinc-aluminium crystals are obtained from normal solidification. The coating finish usually has a metallic lustre. Crystals of different sizes and brightness may appear depending on the manufacturing conditions. The quality of the coating is not affected by this
AZ	Normal spangle	N	Aluminium-zinc crystals are obtained from normal solidification. The coating finish usually has a metallic lustre

7.9 Surface treatment

7.9.1 Chromic acid passivation (C), trivalent chromium passivation (C3) and chromium-free passivation (CN)

The surface treatment can minimize the hazard of white rust or black rust during shipment and storage. Chromic acid passivation may cause friction black spots on the surface. When trivalent chromium passivation is applied, hexavalent chromium in passivation film which are harmful to human health shall be restricted. When chromium-free passivation is applied, the passivation film does not contain chromium or chromium ions.

7.9.2 Chromic acid passivation + oiling (CO), trivalent chromium passivation + oiling (CO3) and chromium-free passivation + oiling (CON)

This surface treatment can further minimize the hazard of white rust or black rust during shipment and storage. When trivalent chromium passivation is applied, hexavalent chromium in passivation film which are harmful to human health shall be restricted. When chromium-free passivation is applied, the passivation film does not contain chromium or chromium ions.

7.9.3 Phosphating (P) and phosphating + oiling (PO)

The surface treatment can minimize the hazard of white rust or black rust during shipment and storage, and can improve the formability of the steel sheet and strip.

7.9.4 Fingerprint-resistant film（AF），trivalent chromium fingerprint-resistant film（AF3），and chromium-free fingerprint-resistant film（AFN）

The surface treatment can minimize the hazard of white rust or black rust during shipment and storage，while the fingerprint-resistant film can improve perspiration stain resistance of the surface of electronic or electrical products. When trivalent chromium passivation is applied，hexavalent chromium in passivation film which are harmful to human health shall be restricted. When chromium-free passivation is applied，the passivation film does not contain chromium or chromium ions.

7.9.5 Self-lubricating film（SL），trivalent chromium self-lubricating film（SL3）and chromium-free self-lubricating film（SLN）

The surface treatment can minimize the hazard of white rust or black rust during shipment and storage，shows good corrosion resistance，and can better improve the formability of the steel sheet and strip. When trivalent chromium passivation is applied，hexavalent chromium in passivation film which are harmful to human health shall be restricted. When chromium-free passivation is applied，the passivation film does not contain chromium or chromium ions.

7.9.6 Oiling（O）

The surface treatment can minimize the hazard of white rust or black rust during shipment and storage，and the anti-rust oil applied is generally not used as rolling oil or stamping oil for subsequent processing.

7.9.7 Un-treated（U）

The products are only supplied without surface treatment if expressively desired by the purchaser at the time of ordering and shall be indicated in the contract. In this case，there is a greater risk of the appearance of white rust，black rust and black spots during transportation and storage. The purchasers shall be careful if require the surfaces to be un-treated.

7.10 Surface quality

7.10.1 The surface of steel sheets and strips shall be free from defects such as skipping coating，coating falling off，visible cracks，etc. that are detrimental to practical use. Tiny zinc layer cracks and white edges are permitted on the edges of untrimmed steel strips.

7.10.2 The surface quality characteristics of steel sheet and strip shall conform to Table 19.

Table 19—Surface quality

Level	Characteristics
FA	Imperfections such as minor zinc particles, marks, scratches, pits, variations in surface appearance, dark spots, stripe marks, light passivation stains and fluctuation are permitted. This surface is normally not skin-passed (polished)
FB	Small imperfections such as skin pass marks, slight scratches, minor spangles, fluctuation and light passivation stains are permitted for the better surface, while the other surface shall at least conform to surface quality FA. This surface is normally obtained by skin passing (polished)
FC	The better surface shall be further controlled for defects. The better surface shall be free from imperfections that affects a uniform high-class paint finish. The other surface shall at least conform to surface quality FB. This surface is normally obtained by skin passing(polished)

7.10.3 The steel strips are permitted to be supplied with local defects since there is no chance to detect and remove them during continuous production, provided that the total length of the defect parts shall not exceed 6% of the total length of the strip.

7.10.4 The control range and test method of surface roughness (*Ra* value) can be agreed at the time of ordering. This does not apply for the non-skin passed surface (surface quality FA).

7.11 Special requirements

On request of purchaser and agreed upon by the supplier and purchaser, the corrosion resistance of the steel sheet and strip can be evaluated. The test method and evaluation index shall be agreed at the time of ordering and indicated in the contract.

8 Test Methods

8.1 The chemical composition test of steel is generally carried out according to GB/T4336, GB/T 20123, GB/T 20125, GB/T 20126 or general chemical analysis methods. In case of arbitration, it shall be carried out according to GB/T 223.5, GB/T 223.9, GB/T 223.12, GB/T 223.14, GB/T 223.17, GB/T 223.26, GB/T 223.40, GB/T 223.59, GB/T 223.60, GB/T 223.63, GB/T 223.64, GB/T 223.78 and GB/T 20125, GB/T 20126.

8.2 The test items and test methods of each test unit of steel sheet and strip shall comply with Table 20.

8.3 The r_{90} is determined by calculation at 15% strain. When the uniform elongation is lower than 15%, the r_{90} is determined by calculation at the end of uniform elongation. n_{90}(or n_0) is determined within the strain range from 10% to 20%. If the uniform elongation is lower than 20%, the strain range from 10% to the end of uniform elongation applies.

Table 20—Test items, sampling quantity, sampling position, sampling methods and test methods of steel sheet and strip

No.	Test item	Sampling quantity	Sampling position	Sampling method	Test method
1	Chemical analysis	1 per heat	—	GB/T 20066	See 8.1
2	Tensile test	1 per test unit	—	GB/T 2975	GB/T 228.1—2010
3	r_{90} value [a]	1 per test unit	1/4 width	GB/T 2975	GB/T 5027
4	n_{90} (or n_0) value [b]	1 per test unit	1/4 width	GB/T 2975	GB/T 5028
5	Bake hardening index BH_2	1 per test unit	1/4 width	GB/T 2975	GB/T 24174
6	Coating mass[c]	3 per test unit (1 set)	As shown in Figure 1	The area of each test piece is not less than 5 000 mm^2	GB/T 1839—2008
7	Dimensions, shape	each coilor sheet	—	—	Appropriate measuring tools
8	Surface quality	each coil or sheet	—	—	Visual inspection

[a] r_{90} is the *r*-value in transverse direction.

[b] n_{90} is the *n*-value in transverse direction; n_0 is the *n*-value in longitudinal direction.

[c] Coating mass can also be tested by non-destructive testing method in Annex A of GB/T 1839—2008. In case of arbitration, it shall be tested according to the weight method of GB/T 1839—2008.

9 Inspection rules

9.1 The inspection and acceptance of steel sheet and strip shall be carried out by the supplier's quality supervision and inspection department.

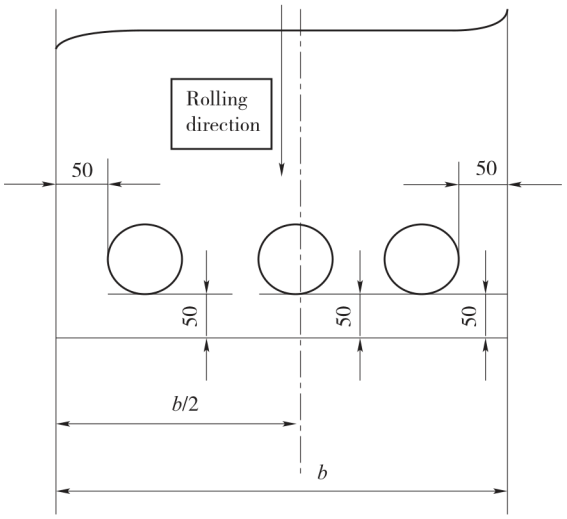
9.2 Steel sheet and strip shall be accepted in test unit. Each test unit shall consist of a maximum of 30 t steel sheets or strips of the same designation, heat, dimension, coating mass, coating finish and surface treatment. In the case of strip, a coil weighing more than 30 t shall be regarded as one test unit.

9.3 Test items, sampling quantity, sampling position and sampling methods of steel sheet and strip shall comply with Table 20.

9.4 Re-testing and acceptance rules of steel sheet and strip shall comply with GB/T 17505.

9.5 The test results of chemical compositions and mechanical properties shall be rounded in accordance with rounded value comparison method, and rules for rounding-off for numerical value shall be as specified in GB/T 8170.

in mm



Key

b Width of steel sheets or strips

Figure 1—Sampling position for coating mass test

10 Packaging，marking and quality certificate

The packaging，marking and quality certificate of steel sheet and strip shall comply with GB/T 247. If the purchaser has special requirements for packaging，it can be agreed at the time of ordering.

Annex A
（informative Annex）
Comparison of designations among this standard and domestic and foreign standards

Table A. 1 to A. 4 show the comparison of designations among this standard and domestic and foreign standards.

Table A. 1—Comparison of designations among this standard，EN 10346：2015，JIS G 3302：2012 and ASTM A653M-17

This standard	EN 10346：2015	JIS G 3302：2012	ASTM A653M-17
DX51D+Z，DX51D+ZF，DX51D+ZA，DX51D+AZ	DX51D	SGCC SGHC	CS Type C
DX52D+Z，DX52D+ZF，DX52D+ZA，DX52D+AZ	DX52D	SGCD1	CS Type A CS Type B
DX53D+Z，DX53D+ZF，DX53D+ZA，DX53D+AZ	DX53D	SGCD2	FS Type A， FS Type B
DX54D+Z，DX54D+ZF，DX54D+ZA，DX54D+AZ	DX54D	SGCD3	DDS Type C
DX56D+Z，DX56D+ZF，DX56D+ZA，DX56D+AZ	DX56D	SGCD4	DDS Type A
DX57D+Z，DX57D+ZF，DX57D+ZA，DX57D+AZ	DX57D	—	EDDS

Table A. 2—Comparison of designations among this standard，EN 10346：2015，JIS G 3302：2012，ASTM A653M-17 and AS 1397-2011

This standard	EN 10346：2015	JIS G 3302：2012	ASTM A653M-17	AS 1397—2011
S220GD+Z，S220GD+ZF，S220GD+ZA，S220GD+AZ	S220GD	—	SS 230	—
S250GD+Z，S250GD+ZF，S250GD+ZA，S250GD+AZ	S250GD	SGC340	SS 255	G250
S280GD+Z，S280GD+ZF，S280GD+ZA，S280GD+AZ	S280GD	—	SS 275	—
S300GD+Z，S300GD+ZF，S300GD+ZA，S300GD+AZ	—	SGC400	—	G300
S320GD+Z，S320GD+ZF，S320GD+ZA，S320GD+AZ	S320GD	—	—	—
S350GD+Z，S350GD+ZF，S350GD+ZA，S350GD+AZ	S350GD	SGC440	SS340 class 4	G350
S390GD+Z，S390GD+ZF，S390GD+ZA，S390GD+AZ	S390GD	SGC490	SS 380	—
S420GD+Z，S420GD+ZF，S420GD+ZA，S420GD+AZ	S420GD	—	SS 410	—

Table A. 2（*continued*）

This standard	EN 10346:2015	JIS G 3302:2012	ASTM A653M-17	AS 1397—2011
S450GD+Z, S450GD+ZF, S450GD+ZA, S450GD+AZ	S450GD	—	—	G450
S550GD+Z, S550GD+ZF, S550GD+ZA, S550GD+AZ	S550GD	SGC570	SS 550 class 2	G550

Table A. 3—Comparison of designations among this standard, EN 10346:2015 and ASTM A653M-17

This standard	EN 10346:2015	ASTM A653M-17
HX180YD+Z, HX180YD+ZF, HX180YD+ZA, HX180YD+AZ	HX180YD	SHS180
HX220YD+Z, HX220YD+ZF, HX220YD+ZA, HX220YD+AZ	HX220YD	SHS210
HX260YD+Z, HX260YD+ZF, HX260YD+ZA, HX260YD+AZ	HX260YD	SHS280
HX180BD+Z, HX180BD+ZF, HX180BD+ZA, HX180BD+AZ	HX180BD	BHS180
HX220BD+Z, HX220BD+ZF, HX220BD+ZA, HX220BD+AZ	HX220BD	BHS210
HX260BD+Z, HX260BD+ZF, HX260BD+ZA, HX260BD+AZ	HX260BD	—
HX300BD+Z, HX300BD+ZF, HX300BD+ZA, HX300BD+AZ	HX300BD	BHS300
HX260LAD+Z, HX260LAD+ZF, HX260LAD+ZA, HX260LAD+AZ	HX260LAD	HSLAS-F 275
HX300LAD+Z, HX300LAD+ZF, HX300LAD+ZA, HX300LAD+AZ	HX300LAD	—
HX340LAD+Z, HX340LAD+ZF, HX340LAD+ZA, HX340LAD+AZ	HX340LAD	HSLAS-F 340
HX380LAD+Z, HX380LAD+ZF, HX380LAD+ZA, HX380LAD+AZ	HX380LAD	HSLAS-F 380
HX420LAD+Z, HX420LAD+ZF, HX420LAD+ZA, HX420LAD+AZ	HX420LAD	HSLAS-F 410
HX460LAD+Z, HX460LAD+ZF, HX460LAD+ZA, HX460LAD+AZ	HX460LAD	—
HX500LAD+Z, HX500LAD+ZF, HX500LAD+ZA, HX500LAD+AZ	HX500LAD	HSLAS-F 480
HD550LAD+Z, HD550LAD+ZF, HD550LAD+ZA, HD550LAD+AZ	—	HSLAS-F 550

Table A. 4—Comparison of designations among this standard, EN 10346:2015 and VDA 239-100

This standard	EN 10346:2015	VDA 239-100
HC260/450DPD+Z, HC260/450DPD+ZF, HC260/450DPD+ZA	HCT450X	—
HC290/490DPD+Z, HC290/490DPD+ZF, HC290/490DPD+ZA	HCT500X	CR290Y490T-DP
HC330/590DPD+Z, HC330/590DPD+ZF, HC330/590DPD+ZA	HCT600X	CR330Y590T-DP
HC440/780DPD+Z, HC440/780DPD+ZF, HC440/780DPD+ZA	HCT780X	CR440Y780T-DP
HC500/780DPD+Z, HC500/780DPD+ZF, HC500/780DPD+ZA	—	—
HC590/980DPD+Z, HC590/980DPD+ZF, HC590/980DPD+ZA	HCT980X	CR590Y980T-DP
HC700/980DP+Z, HC700/980DP+ZF, HC700/980DP+ZA	HCT980XG	CR700Y980T-DP
HC740/1180DP+Z, HC740/1180DP+ZF, HC740/1180DP+Z	—	—

Table A.4 （*continued*）

This standard	EN 10346:2015	VDA 239-100
HC820/1180DPD+Z，HC820/1180DPD+ZF，HC820/1180DPD+ZA	—	—
HC380/590TRD+Z，HC380/590TRD+ZF，HC380/590TRD+ZA	—	—
HC400/690TRD+Z，HC400/690TRD+ZF，HC400/690TRD+ZA	HCT690T	CR400Y690T-TR
HC450/780TRD+Z，HC450/780TRD+ZF，HC450/780TRD+ZA	HCT780T	CR450Y780T-TR
HC350/600CPD+Z，HC350/600CPD+ZF，HC350/600CPD+ZA	HCT600C	—
HC570/780CPD+Z，HC570/780CPD+ZF，HC570/780CPD+ZA	HCT780C	CR570Y780T-CP
HC780/980CPD+Z，HC780/980CPD+ZF，HC780/980CPD+ZA	HCT980C	CR780Y980T-CP
HD660/760CPD+Z，HD660/760CPD+ZF，HD660/760CPD+ZA	HDT760C	HR660Y760T-CP
HC330/590DHD+Z，HC330/590DHD+ZF，HC330/590DHD+ZA	—	—
HC440/780DHD+Z，HC440/780DHD+ZF，HC440/780DHD+ZA	—	CR440Y780T-DH
HC550/980DHD+Z，HC550/980DHD+ZF，HC550/980DHD+ZA	—	—
HC700/980DHD+Z，HC700/980DHD+ZF，HC700/980DHD+ZA	—	CR700Y980T-DH

Annex B
（informative Annex）
Introduction and application guide of coating types

B.1 Coating mass，type and service life

B.1.1 In the same environment，the service life of a higher coating mass（e.g. Z275）is longer than that of a lower coating mass（e.g. Z200）for a material with the same coating type but without machining deformation. But different kinds of coatings，however，even with higher coating mass and thicker coating，the service life of one coating type may not be longer than that of other coating type. For example，Al-Zn alloy coatings（AZ）are alloy coatings that are more protective than pure zinc coatings（Z）in specific environments and applications，and therefore cannot be compared simply by coating thickness. For example，AZ150 coating used for steel structure building roofing with approximately the same thickness as Z275 coating，has a longer service life.

B.1.2 As the performance of the coating depends on the application，environment and the type of coating，when specific coating types are used in specific fields to protect specific types of steel products，the coating effect can be maximized. Some coating types，even with excellent performance in some fields，may not perform well in other fields. In addition，coating ductility may also affect coating performance.

B.2 General instructions for each type of coating

B.2.1 Zinc Coating（Z）is applicable to a variety of applications requiring enhanced corrosion resistance.

B.2.2 Zinc-iron alloy coating（ZF）is applicable to most applications where subsequent painting is applied，mainly used for body panels in automotive industry.

B.2.3 Zinc-aluminium alloy coating（ZA），with approximately the same sacrificial protection as zinc coating，are more resistant to corrosion than zinc coatings in most environments.

B.2.4 Aluminium-zinc alloy coating（AZ）shows excellent isolation protection and electrochemical protection. Compared to the above coatings，its corrosion resistance is higher in most environments and its long-term durability is also proved. The aluminium-zinc alloy coated steel sheets are widely used for roofing and walling，and can be applied directly or be used as substrates for prepainted steel sheets.

B.3 Typical application instructions for each type of coating

B.3.1 Zinc coatings（Z）are one of the most commonly used coatings in manufacturing and con-

struction industries. It is applicable to applications where steel products requires sacrificial protection from the coating to extend the life of the products or structures. Its typical applications include: building and construction components, such as steel structures (purlines and girths); steel frame decoration; rainwater pipe fittings after painting; automotive parts and body parts; pipes and sections; engineering components; household appliances (washing machine frames and panels, cookware boards, dryers, speaker supports, etc.); the industrial products (oil pumps, oil tanks, heat exchangers, ventilator housings, trapezoid sections, cable tray systems); electronic products and agricultural machinery components.

B.3.2 Zinc-iron alloy coatings (ZF) are applicable to most conditions where subsequent painting is applied and are characterized by high hardness and brittleness during the forming process and high resistance to under-film corrosion after painting. It is mainly used for exposed parts of automobiles, household appliances, etc.

B.3.3 Zinc-aluminium alloy coatings (ZA), with approximately the same sacrificial protection as zinc coatings, are more corrosion-resistant than zinc coatings in most environments. They are mainly used in applications requiring good ductility (e.g. deep-drawing parts) and environments requiring moderate corrosion resistance. Its typical applications include: building and construction components (bounding systems, roofing, partition walls, ceilings, doors, keels for residential buildings, window frames, snow shields, pinboards, spiral vessels); auto parts (motor shells, oil filters, shock absorber covers, alternator boards); household appliances (washing machine frames and panels, cookware boards, industrial drying drums, speaker supports); the industrial products (gasoline pumps, oil tanks, heat exchangers, ventilator housings, trapezoid sections, cable tray systems) and roadside guardrails.

B.3.4 The Aluminium-zinc alloy coating (AZ) shows excellent isolation protection and electrochemical protection. Compared to the above coatings, its corrosion resistance is higher in most environments and its long-term durability is also proved, which is applicable to environments requiring higher corrosion resistance. In addition, the coating shows good high temperature resistance and heat reflectivity. The coated steel sheets are widely used for roofing and walls, and can be applied directly or be used as substrates for prepainted steel sheets. Other applications of this coated steel sheets include: building and construction components (bounding systems, keels for residential buildings, roofs, walls, ceilings, doors); rainwater pipe fittings; furniture and outdoor cabinetry; unexposed automotive parts; electrical appliances (ovens, heaters); pipes and computer case, etc.

Annex C
（normative Annex）
Mass calculation method for theoretical mass

C.1 Calculation method of nominal thickness of coatings

C.1.1 The nominal thickness of coatings is calculated according to Formula（C.1）：

$$t_z = \frac{m_z}{d} \qquad (C.1)$$

where

t_z is the nominal thickness of coatings，in micrometer（μm）；

m_z is the mass of coatings for both surfaces，in grams per square meter（g/m^2）；

d is the density，in grams per cubic centimeter（g/cm^3）.

C.1.2 The density of each coating is shown in Table C.1.

Table C.1—Density of each coating

Coating types	Density d/（g/cm^3）
Zinc coating（Z）	7.1
Zinc-iron alloy coating（ZF）	7.1
Zinc-aluminium alloy coating（ZA）	6.6
Aluminium-zinc alloy coating（AZ）	3.8

C.2 Calculation method of theoretical mass of steel sheets

The mass calculation method for theoretical mass of steel sheets shall be as specified in Table C.2.

Table C.2—Mass calculation method

Calculation order	Calculation method	Rounding-off for results
Basic mass of 1 substrate/［kg/（mm•m^2）］	7.85 （mass of 1mm thickness× 1 m^2area）	—
Mass of 1 substrate /（kg/m^2）	Basic mass of 1 substrate［kg /（mm • m^2）］×（nominal thickness of order-nominal coating thickness）（mm）	Round off to 4 significant figures

Table C.2 （*continued*）

Calculation order		Calculation method	Rounding-off for results
Mass after coating /（kg/m^2）		Mass of 1 substrate（kg/m^2）+ nominal coating mass（kg/m^2）	Round off to 4 significant figures
Steel sheet	Area of 1 steel sheet /m^2	Width（mm）× length（mm）× 10^{-6}	Round off to 4 significant figures
	Mass of 1 steel sheet /kg	Mass after coating（kg/m^2）× area（m^2）	Round off to 3 significant figures
	Mass of each bundle/kg	Mass of 1 steel sheet（kg）× Number of steel sheets of the same dimension in 1 bundle	Round off to an integer value in kg
	Total mass/kg	Mass of each bundle（kg）added	Integer value in kg

Annex D
（informative annex）
Chemical composition of steels

Reference values of chemical composition（heat analysis）of steel are shown in Table D. 1 to Table D. 4.

Table D. 1—Chemical composition of steel（Heat analysis）

Designation	Chemical composition（mass fraction）/%，not greater than					
	C	Si	Mn	P	S	Ti
DX51D+Z，DX51D+ZF，DX51D+ZA，DX51D+AZ	0. 18	0. 50	1. 20	0. 12	0. 045	0. 30
DX52D+Z，DX52D+ZF，DX52D+ZA，DX52D+AZ	0. 12		0. 60	0. 10		
DX53D+Z，DX53D+ZF，DX53D+ZA，DX53D+AZ						
DX54D+Z，DX54D+ZF，DX54D+ZA，DX54D+AZ						
DX56D+Z，DX56D+ZF，DX56D+ZA，DX56D+AZ						
DX57D+Z，DX57D+ZF，DX57D+ZA，DX57D+AZ						

Table D. 2—Chemical composition of steel（Heat analysis）

Designation	Chemical composition（mass fraction）/%，not greater than				
	C	Si	Mn	P	S
S220GD+Z，S220GD+ZF，S220GD+ZA，S220GD+AZ	0. 20	0. 60	1. 70	0. 10	0. 045
S250GD+Z，S250GD+ZF，S250GD+ZA，S250GD+AZ					
S280GD+Z，S280GD+ZF，S280GD+ZA，S280GD+AZ					
S300GD+Z，S300GD+ZF，S300GD+ZA，S300GD+AZ					
S320GD+Z，S320GD+ZF，S320GD+ZA，S320GD+AZ					
S350GD+Z，S350GD+ZF，S350GD+ZA，S350GD+AZ					
S390GD+Z，S390GD+ZF，S390GD+ZA，S390GD+AZ					
S420GD+Z，S420GD+ZF，S420GD+ZA，S420GD+AZ					
S450GD+Z，S450GD+ZF，S450GD+ZA，S450GD+AZ					
S550GD+Z，S550GD+ZF，S550GD+ZA，S550GD+AZ					

Table D.3—Chemical composition of steel（Heat analysis）

Designation	Chemical composition（mass fraction）/%							
	C	Si	Mn	P	S	Ti[a]	Nb[a]	Alt
	Not greater than							Not less than
HX180YD+Z，HX180YD+ZF，HX180YD+ZA，HX180YD+AZ	0.01	0.30	0.70	0.060	0.025	0.12	0.09	0.010
HX220YD+Z，HX220YD+ZF，HX220YD+ZA，HX220YD+AZ	0.01	0.30	0.90	0.080	0.025	0.12	0.09	0.010
HX260YD+Z，HX260YD+ZF，HX260YD+ZA，HX260YD+AZ	0.01	0.30	1.60	0.10	0.025	0.12	0.09	0.010
HX180BD+Z，HX180BD+ZF，HX180BD+ZA，HX180BD+AZ	0.06	0.50	0.70	0.060	0.025	0.12	0.09	0.015
HX220BD+Z，HX220BD+ZF，HX220BD+ZA，HX220BD+AZ	0.08	0.50	0.70	0.085	0.025	0.12	0.09	0.015
HX260BD+Z，HX260BD+ZF，HX260BD+ZA，HX260BD+AZ	0.10	0.50	1.00	0.10	0.030	0.12	0.09	0.010
HX300BD+Z，HX300BD+ZF，HX300BD+ZA，HX300BD+AZ	0.11	0.50	0.80	0.12	0.025	0.12	0.09	0.010
HX260LAD+Z，HX260LAD+ZF，HX260LAD+ZA，HX260LAD+AZ	0.11	0.50	1.00	0.030	0.025	0.15	0.09	0.015
HX300LAD+Z，HX300LAD+ZF，HX300LAD+ZA，HX300LAD+AZ	0.12	0.50	1.40	0.030	0.025	0.15	0.09	0.015
HX340LAD+Z，HX340LAD+ZF，HX340LAD+ZA，HX340LAD+AZ	0.12	0.50	1.40	0.030	0.025	0.15	0.10	0.015
HX380LAD+Z，HX380LAD+ZF，HX380LAD+ZA，HX380LAD+AZ	0.12	0.50	1.50	0.030	0.025	0.15	0.10	0.015
HX420LAD+Z，HX420LAD+ZF，HX420LAD+ZA，HX420LAD+AZ	0.12	0.50	1.60	0.030	0.025	0.15	0.10	0.015
HX460LAD+Z，HX460LAD+ZF，HX460LAD+ZA，HX460LAD+AZ	0.15	0.50	1.70	0.030	0.025	0.15	0.10	0.015
HX500LAD+Z，HX500LAD+ZF，HX500LAD+ZA，HX500LAD+AZ	0.15	0.50	1.7	0.030	0.025	0.15	0.10	0.015
HD550LAD+Z，HD550LAD+ZF，HD550LAD+ZA，HD550LAD+AZ	0.15	0.50	1.7	0.030	0.025	0.15	0.10	0.015

Table D.4—Chemical composition of steel（Heat analysis）

Designation	Chemical composition（mass fraction）/%									
	C	Si	Mn	P	S	Cr+Mo	Nb+Ti	V	B	Alt
	Not greater than									
HC260/450DPD+Z，HC260/450DPD+ZF，HC260/450DPD+ZA	0.14	0.75	2.00	0.080	0.015	1.00	0.15	0.20	0.005	0.015 to 1.0
HC290/490DPD+Z，HC290/490DPD+ZF，HC290/490DPD+ZA	0.14	0.75	2.00	0.080	0.015	1.00	0.15	0.20	0.005	0.015 to 1.0
HC330/590DPD+Z，HC330/590DPD+ZF，HC330/590DPD+ZA	0.15	0.75	2.50	0.040	0.015	1.40	0.15	0.20	0.005	0.015 to 1.5
HC440/780DPD+Z，HC440/780DPD+ZF，HC440/780DPD+ZA	0.18	0.80	2.50	0.080	0.015	1.40	0.15	0.20	0.005	0.015 to 2.0
HC500/780DPD+Z，HC500/780DPD+ZF，HC500/780DPD+ZA	0.18	0.80	2.50	0.080	0.015	1.40	0.15	0.20	0.005	0.015 to 2.0
HC590/980DPD+Z，HC590/980DPD+ZF，HC590/980DPD+ZA	0.20	1.00	2.90	0.080	0.015	1.40	0.15	0.20	0.005	0.015 to 2.0
HC700/980DPD+Z，HC700/980DPD+ZF，HC700/980DPD+ZA	0.23	1.00	2.90	0.080	0.015	1.40	0.15	0.20	0.005	0.015 to 2.0
HC740/1180DPD+Z，HC740/1180DPD+ZF，HC740/1180DPD+ZA	0.23	1.00	2.90	0.050	0.010	1.00	0.15	0.20	0.005	0.015 to 1.0
HC820/1180DPD+Z，HC820/1180DPD+ZF，HC820/1180DPD+ZA	0.23	1.00	2.90	0.050	0.010	1.00	0.15	0.20	0.005	0.015 to 1.0
HC350/600CPD+Z，HC350/600CPD+ZF，HC350/600CPD+ZA	0.18	0.80	2.20	0.080	0.015	1.00	0.15	0.20	0.005	0.015 to 2.0
HC570/780CPD+Z，HC570/780CPD+ZF，HC570/780CPD+ZA	0.18	1.00	2.50	0.080	0.015	1.00	0.15	0.20	0.005	0.015 to 2.0
HC780/980CPD+Z，HC780/980CPD+ZF，HC780/980CPD+ZA	0.23	1.00	2.70	0.080	0.015	1.00	0.15	0.22	0.005	0.015 to 2.0
HD660/760CPD+Z，HD660/760CPD+ZF，HD660/760CPD+ZA	0.18	1.00	2.50	0.080	0.015	1.00	0.25	0.20	0.005	0.015 to 2.0

Table D.4 （*continued*）

Designation	Chemical composition（mass fraction）/%									
	C	Si	Mn	P	S	Cr+Mo	Nb+Ti	V	B	Alt
	Not greater than									
HC380/590TRD+Z，HC380/590TRD+ZF，HC380/590TRD+ZA	0.23	1.80	2.00	0.080	0.015	0.60	0.20	0.20	0.005	0.015 to 2.0
HC400/690TRD+Z，HC400/690TRD+ZF，HC400/690TRD+ZA	0.24	2.00	2.20	0.080	0.015	0.60	0.20	0.20	0.005	0.015 to 2.0
HC450/780TRD+Z，HC450/780TRD+ZF，HC450/780TRD+ZA	0.25	2.20	2.50	0.080	0.015	0.60	0.20	0.20	0.005	0.015 to 2.0
HC330/590DHD+Z，HC330/590DHD+ZF，HC330/590DHD+ZA	0.15	0.75	2.50	0.050	0.010	1.40	0.15	0.20	0.005	0.015 to 1.5
HC440/780DHD+Z，HC440/780DHD+ZF，HC440/780DHD+ZA	0.18	0.80	2.50	0.050	0.010	1.40	0.15	0.20	0.005	0.015 to 2.0
HC550/980DHD+Z，HC550/980DHD+ZF，HC550/980DHD+ZA	0.23	1.00	2.90	0.050	0.010	1.40	0.15	0.20	0.005	0.015 to 2.0
HC700/980DHD+Z，HC700/980DHD+ZF，HC700/980DHD+ZA	0.23	1.00	2.90	0.050	0.010	1.40	0.15	0.20	0.005	0.015 to 2.0