

## Foreword

This code is jointly developed by WISDRI Engineering & Research Incorporation Limited and CISDI Engineering Co.,Ltd. with participation of other relevant organizations by amending the former GB 50410-2007 according to the requirements of Document JIANBIAO [2012] No.5 issued by the Ministry of Housing and Urban-Rural Development (MOHURD) – "Notice on Printing and Distributing 'the Development and Revision Plan of National Engineering Construction Standards in 2012'".

This code is finalized based on the draft for examination developed by the development team through conducting extensive investigation and research, earnestly summarizing the practical experiences and acquiring diversified comments with reference to the related advanced standards home and abroad.

This code consists of 14 chapters, covering: general provisions; terms; basic requirements; small-sized hot-rolled section steels; medium-sized hot-rolled section steels; medium-sized hot-rolled steel bars; large-sized hot-rolled section steels; large-sized hot-rolled steel bars; power supply and distribution system; electrical drive and automation system; telecommunication; utilities; architecture and structure; safety, health and environmental protection.

The main contents amended include:

1. Extension of the code application scope to "Design of section steel hot rolling mills".
2. Adjustment of size range of main hot rolled small section steel varieties.
3. Addition of the content regarding hot rolled medium-sized section steel, hot rolled medium-sized bar, hot rolled large-sized steel and hot rolled large-sized bar.
4. Addition of the content regarding power supply and distribution facilities, electrical drive and automation system, telecommunication, utilities, architecture and structure, safety, health and environmental protection.

The provision(s) printed in bold type is (are) mandatory one (ones) and must be implemented strictly.

This code is under the jurisdiction of, and interpreted by the Ministry of Housing and Urban-Rural Development for the compulsory provisions. WISDRI Engineering & Research Incorporation Limited is in charge of the explanation of technical specifications. All relevant organizations are kindly invited to contribute the comments or suggestions (if any) summarized from implementation of this code to Technical Quality Control Department of WISDRI Engineering & Research Incorporation Limited at Daxueyuan Road 33, Donghu Development Zone, Wuhan (Postcode: 430223) for reference in future revision.

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## 1 General provisions

**1.0.1** This code is developed for carrying out the relevant national laws, requirements, guidelines and polices in the construction of section steel rolling project with the purpose of achieving safe and reliable performance, environment protection and energy conservation in addition to technical advance level and cost-effectiveness.

**1.0.2** This code is applicable to the engineering design of green-field or brown-field section steel rolling mills.

**1.0.3** In addition to the requirements stipulated in this code, the design shall also comply with those stipulated in the current relevant national standards.

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## 2 Terms

### 2.0.1 hot-rolled section steels

Hot-rolled section steels generally refer to the long hot-rolled steel products of specific section and size, and they are the main steel product varieties different from steel strip and pipe.

### 2.0.2 continuous rolling mill

It features non-reversing or non-reciprocating rolling pass and stands being arranged in tandem. And the stock may be rolled in two or more rolling stands concurrently. Continuous rolling mill includes fully continuous rolling mill and end-free continuous rolling mill.

### 2.0.3 semi-continuous rolling mill

Roughing mill or breakdown mill may be reversing or reciprocating rolling mill, while the intermediate train and finishing mill train are continuous rolling mills.

### 2.0.4 rolling mills arranged in succession

Breakdown mill, intermediate mill train and finishing mill are arranged in succession, and the first two operate in reversing rolling mode.

### 2.0.5 multiple single-stand reversing mill

The entire line consists of multiple stands, and each stand performs rolling separately.

### 3 Basic requirements

**3.0.1** The design of hot-rolled section steel mills shall adopt advanced and reliable new technologies, process and equipment.

**3.0.2** Continuously cast billet shall be selected as starting material in the design of hot-rolled section steel mills, except for special steel grade.

**3.0.3** The design of hot-rolled section steel mill should adopt hot delivering and hot charging process of continuously cast billet.

**3.0.4** **The obsolete production process and equipment which are required to be eliminated by the state must not be used in the design of hot-rolled section steel mills.**

**3.0.5** The hot-rolled section steel mill shall be designed with output reaching the economic production scale and the annual working hours and load rate of rolling mills shall be determined rationally. Main techno-economic indexes of shop shall be advanced domestically and the process energy consumption shall meet the requirements specified in the current national standard GB 50632 *Code for Design of Energy Saving of Iron and Steel Industry*.

**3.0.6** The process equipment capacities of hot-rolled section steel shop shall be coordinative to each other to ensure smooth and stable production process and fulfill the production required in the product mix. The product quality shall comply with the requirements in current relevant national standards.

**3.0.7** The level of electrical drive and automation equipment of hot-rolled section steel shop shall be on par with the level of production process and the line equipment.

**3.0.8** The fire fighting design of hot-rolled section steel mill shall meet the requirements of the current national standard GB 50016 *Code for Fire Protection Design of Buildings* and the relevant requirements in GB 50414 *Standard for Fire Protection Design of Iron and Steel Metallurgy Enterprises*.

## 4 Small-sized hot-rolled section steels

### 4.1 Production scale and products

**4.1.1** The production scale of green-field small-sized hot-rolled section steel production line shall be in accordance with the following requirements:

1 For the production line mainly oriented to producing small-sized hot-rolled section steel, its designed annual output should not be less than 250,000t.

2 For the production line mainly oriented to producing alloy steel, its designed annual output should not be less than 300,000t.

3 For the production line with common quality unalloyed steel and low alloy steel as the main product grades, its designed annual output should not be less than 500,000t.

**4.1.2** The product variety should be classified in accordance with the following requirements:

1 The section steels of simple cross section, such as small-sized round steel, square steel, flat steel, hexagonal steel and octagonal steel, should be classified as the variety of small-sized bar product.

2 Ribbed bar and plain round bar should be classified as the variety of reinforced bar (rebar).

3 Small-sized section steel of complicated cross section, such as small-sized angle steel and channel steel, should be classified as the variety of small-sized section steel.

**4.1.3** The ranges of main varieties of products should be determined in accordance with the following requirements:

1 Bar products should be round steel sized  $\phi 8\text{mm}-\phi 50\text{mm}$ , or square steel, hexagonal steel and octagonal steel of corresponding cross sections, or flat steel sized  $(5-20)\text{mm} \times (30-100)\text{mm}$ ;

2 The rebar should be sized  $\phi 8\text{mm}-\phi 50\text{mm}$ ;

3 Angle steel should be sized  $2.5^{\#}-8^{\#}$ ;

4 Channel steel should be sized  $5^{\#}-10^{\#}$ .

### 4.2 Starting material

**4.2.1** The production lines shall adopt continuously cast billet as starting material, and may adopt rolled billet and forged billet for some special steel grade.

**4.2.2** The cross section of billet shall be determined in accordance with the following requirements:

1 The cross section of billet shall be selected depending on the steel grade, size and application of products.

2 The billet cross section of unalloyed steel and low alloy steel should be  $130\text{mm} \times 130\text{mm}-165\text{mm} \times 165\text{mm}$ .

3 The billet cross section of alloy steel should be  $150\text{mm} \times 150\text{mm}-200\text{mm} \times 200\text{mm}$ .

**4.2.3** The billet should be 6m-12m long.

**4.2.4** The quality of billet shall be in accordance with the following requirements:

1 The quality of continuously cast billet shall meet the requirements specified in the current professional standard YB/T 2011 *Continuous Casting Square and Rectangular Blank* and the quality of rolled billet shall meet the requirements in the current professional standard YB/T 002 *Dimension*,



*Shape, Weight and Tolerances for Hot-rolled Steel Billet.*

- 2 The quality of billet shall meet the requirements of rolling production.
- 3 Before rolling, the billet shall undergo necessary inspection and scarfing.

### **4.3 Production process**

**4.3.1** Fully continuous arrangement or end free continuous arrangement shall be selected for the rolling mill depending on the product variety, size and rolling speed. End free continuous rolling mill shall be employed if billet of large cross section is used for producing small-sized alloy steel.

**4.3.2** Rolling process shall be in accordance with the following requirements:

- 1 High pressure water descaling device shall be installed after the reheating furnace for the alloy section steel production line.
- 2 The initial rolling temperature and controlled final rolling temperature shall be preset based on steel grades to be produced.
- 3 Maximum rolling speed shall be determined based on the product variety, size and output.
- 4 The roughing and intermediate rolling mill should adopt low-tension rolling technological process; the finishing train of small-sized section steel production line and high speed bar production line should do the same, but the finishing train of other production lines should operate in tension-free rolling process.
- 5 The small-sized alloy bar production line shall be equipped with reducing & sizing block and online diameter gauge.
- 6 Flying shear shall be installed after roughing mill train, intermediate mill train, finishing mill train and reducing & sizing block respectively.
- 7 Controlled rolling and controlled cooling process should be applied.

**4.3.3** Finishing process shall be in accordance with the following requirements:

- 1 The finishing process of straight bar and rebar shall consist of the processes such as sampling, cooling, cut-to-length, inspection, short bar rejection, counting, bundling, weighing and marking, etc., and conventional cooling or slow cooling process shall be employed for the production of straight bar according to the necessity.
- 2 The finishing process of small-sized section steel shall include the processes like sampling, cooling, straightening, cut-to-length, inspection, length changing, stacking, bundling, weighing and marking.
- 3 The finishing process of bar-in-coil and rebar shall be constituted by coiling, cooling, inspection, sampling, bundling, weighing and marking, etc.
- 4 Heat treatment process shall be included in the alloy steel bar production line according to necessity.
- 5 Processes such as shot blasting, straightening, chamfering, flaw detection, inspection, bundling, weighing, marking, peeling, grinding and length changing should be designed for the alloy steel bar product production line.
- 6 Product packaging shall meet the relevant requirements in current national standard GB/T 2101 *General Requirement of Acceptance, Packaging, Marking and Certification for Section Steel.*

## 4.4 Process equipment

**4.4.1** The alloy steel production line shall adopt walking type reheating furnace, which should be selected for unalloyed steel and low alloy steel production line.

**4.4.2** The equipment in mill area shall be configured in accordance with the following requirements:

1 Rolling mill should be composed of roughing mill train, intermediate mill train and finishing mill train, and pre-finishing mill train and reducing & sizing block may be installed additionally for alloy steel production line.

2 Housingless mill should be used for roughing and intermediate mill; regarding finishing mill, cantilever stand should be adopted for the high speed bar production line and housingless mill for all of other lines.

3 The reducing & sizing mill may be of 2-roll or 3-roll design.

4 The bar mill stands should be arranged horizontal and vertical alternatively. Some convertible H/V stands may be installed according to the product variety to be produced.

5 The design of flying shear shall be selected according to the cross section of the stock and rolling speed.

6 The cooling bed shall be of walking rack design.

**4.4.3** The equipment at finishing area shall be configured in accordance with the following requirements:

1 For the cut-to-length equipment, fixed type cold shear or flying cold shear, or cold saw for the steel with special requirements may be adopted.

2 The production lines mainly producing small-sized section steel should adopt roller type straightener for online full-length straightening.

3 The alloy steel bar production line should be equipped with an off-line cross roll straightener.

4 The bar and rebar steel production line should be equipped with finished bar counter.

5 In the finishing area, finished bar weigher shall be arranged.

## 4.5 Work duty, work time and load rate

**4.5.1** Small-sized section steel workshop shall operate in a continuous work system.

**4.5.2** The specified working hours of the workshop should be designed as 7,600h/a-8,000h/a, and the rated working hours of the workshop should be 6,200h/a-7,200h/a. The lower limit is applicable for the small-sized section steel workshop producing alloy steel mainly and the upper limit for the small-sized section steel workshop producing common quality non-alloy steel and common quality low-alloy steel mainly; the section steel workshop should take the lower limit; and the rebar and bar workshop should take upper limit.

**4.5.3** The mill load rate should not be lower than 85%.

## 4.6 Shop layout

**4.6.1** The rolling workshop should be arranged adjacent to the continuous casting workshop.

**4.6.2** The process layout of the workshop shall satisfy the production process, and the process shall feature smooth flow, reasonable arrangement and convenient operation; for the workshop to be expanded in future, space provision shall be considered for future equipment and facilities.

**4.6.3** The equipment shall be of compact arrangement with sufficient space reserved for equipment

installation, operation, maintenance as well as safe evacuation.

**4.6.4** The workshop shall be provided with lifting and transportation equipment.

**4.6.5** The rail top elevation of crane in main building shall be determined considering the equipment height, convenience of equipment maintenance, stacking capacity and transportation conditions of the billets and finished products.

**4.6.6** The main electrical room should be arranged on the drive side of the rolling mill, and several electrical rooms may be arranged separately in different areas but close to the served equipment, if the production line is long or the served facilities are installed dispersedly.

**4.6.7** The roll shop shall sit close to the main rolling bay, on the operator side of the mill preferentially.

**4.6.8** The billet storage, intermediate storage and finished product storage shall be properly sized to ensure normal production. The capacity of the billet storage should meet the demand of 5d-7d production; that of intermediate storage in the finishing area 3d-4d, and that of finished product storage 7d at least.

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## 5 Medium-sized hot-rolled section steels

### 5.1 Production scale and products

**5.1.1** The green-field medium-sized section steel production line should be so designed with output not less than 500,000t/a.

**5.1.2** The product variety should include medium-sized H-beam, T-steel, I-beam, channel steel, equal angle steel, unequal angle steel, L-shape steel, U-shape steel, flat bulb steel, light rail, wheel rim steel and other profiled steels.

**5.1.3** The specification of the main product varieties should be in accordance with the following requirements:

- 1 H-beam should meet the following requirements:
  - 1) H-beam with wide flange should be sized HW100×100–HW200×200;
  - 2) H-beam with medium flange should be sized HM150×100–HM300×200;
  - 3) H-beam with narrow flange should be sized HN100×50–HN400×200;
  - 4) Thin-walled H-beam should be sized HT100×50–HT400×200.
- 2 T-section steel should meet the following requirements:
  - 1) The cut T-section steel with wide flange should range from TW50×100–TW100×200;
  - 2) The cut T-section steel with medium flange should range from TM75×100–TM150×200;
  - 3) The cut T-section steel with narrow flange should range from TN50×50–TN200×200.
- 3 I-beam should be sized 10<sup>#</sup>–36<sup>#</sup>;
- 4 Channel steel should be sized 10<sup>#</sup>–30<sup>#</sup>;
- 5 Equal angle steel should be sized 8<sup>#</sup>–16<sup>#</sup>;
- 6 Unequal angle steel should be sized 8/5<sup>#</sup>–16/9<sup>#</sup>;
- 7 L-section steel should range from L250×90–L300×120;
- 8 U-section steel should be 18UY–36U;
- 9 Flat bulb steel should be 120×6–300×13;
- 10 Light rail steel should be 12kg/m–30kg/m;
- 11 Wheel rim steel should be 5.50F–8.5B.

### 5.2 Starting material

**5.2.1** The production line shall adopt continuously cast product as starting material.

**5.2.2** The cross section of the starting materials shall be in accordance with the following requirements:

1 The cross section of starting materials shall be determined according to product variety, size and mill arrangement, etc.

2 Rectangular blank or beam blank should be selected.

**5.2.3** The length of starting materials shall be determined according to the cut-to-length of the product, and should be greater than 4m long.

**5.2.4** The quality of starting materials shall be in accordance with the following requirements:

1 The quality of continuous casting rectangular blank shall meet the relevant requirements in the

current professional standard YB/T 2011 *Continuous Casting Square and Rectangular Blank*.

- 2 The quality of starting materials should satisfy rolling production.
- 3 Necessary inspection and cleaning of starting materials shall be carried out upstream of rolling process.

### 5.3 Production process

**5.3.1** The mill arrangement shall be in accordance with the following requirements:

- 1 The mill type shall be continuous end-free mill, semi-continuous rolling mill, rolling mills arranged in succession or multiple single-stand reversing mill according to product variety, size, production scale and investment.

- 2 For the production line with the main product size close to the lower limit, continuous end-free mill should be selected.

- 3 For the production line with the main product size close to the upper limit, semi-continuous rolling mill, rolling mills arranged in succession or multiple single-stand reversing mill should be selected.

**5.3.2** The rolling process shall be in accordance with the following requirements:

- 1 A high-pressure water descaler shall be installed after the reheating furnace.

- 2 The initial rolling temperature and controlled final rolling temperature shall be preset according to different steel grades.

- 3 The maximum rolling speed shall be determined according to the product variety, size, production output and mill arrangement.

- 4 At exit of finishing mill may be installed a profile meter.

- 5 A fast cooling device may be installed after the finishing mill.

**5.3.3** The finishing process shall be in accordance with the following requirements:

- 1 Sampling, cooling, straightening, cut-to-length, inspection, length changing, automatic stacking, bundling, weighing, marking and other processes should be set up.

- 2 The adopted finishing process should include full-length cooling - full-length straightening and cut-to-length by cold saw.

- 3 Product packaging shall meet the relevant requirements in GB/T 2101 *General Requirement of Acceptance, Packaging, Marking and Certification for Section Steel*.

### 5.4 Process equipment

**5.4.1** The reheating furnace should be of walking type.

**5.4.2** Equipment in the rolling mill area shall be in accordance with the following requirements:

- 1 The composition of the rolling mill shall be determined according to the section, product variety and size of starting materials, and production output, etc.

- 2 The rolling mill should be designed with quick roll changing device.

- 3 Hot shear should be set after the roughing mill/breakdown mill, and flying shear or hot saw may be set after the finishing mill.

- 4 The cooling bed should be of walking beam type, or walking rack type or combined walking beam/chain type.

**5.4.3** Equipment in finishing area shall meet the following requirements:

- 1 Roller straightener shall be adopted.

- 2 Metal saw should be selected for cut-to-length of the bar.
- 3 Inspection and scrap rejection table should be arranged.
- 4 Automatic stacker shall be arranged.
- 5 Automatic bundling machine should be installed.
- 6 The finished product weigher shall be set up.
- 7 The collection table should be equipped with bar turning device.

### **5.5 Work duty, work time and load rate**

**5.5.1** The medium-sized section steel workshop shall adopt continuous work duty.

**5.5.2** The specified working hours of the workshop should be designed as 7,600h/a–8,000h/a, and the rated working hours of the workshop should be 6,000h/a–6,500h/a. The upper limit is applicable for the medium-sized section steel workshop producing few product varieties and the lower limit for that diversified in product varieties and in product sizes.

**5.5.3** The rolling mill load rate should not be lower than 80%.

### **5.6 Shop layout**

**5.6.1** The rolling workshop should be arranged adjacent to the continuous casting workshop.

**5.6.2** The process layout of the workshop shall meet the requirements of the production process, shall provide smooth process flow and adequate arrangement, and shall facilitate operation. For the workshops which will be developed further, space shall be reserved for future equipment and facilities.

**5.6.3** The equipment arrangement should be compact with space provision for safety walkway, equipment installation, operation and maintenance.

**5.6.4** The workshop shall be equipped with lifting and transportation equipment.

**5.6.5** The rail top elevation of the main building shall be determined taking into account the equipment height, equipment maintenance requirement, stacking capacity and transportation condition of starting materials and finished products.

**5.6.6** The main electrical room should be arranged on the drive side of the rolling mill, or several electrical rooms may be arranged in different areas near the served equipment if the production line is long or the facilities are installed dispersedly.

**5.6.7** The roll shop shall be located close to the main rolling bay, and should be positioned on the drive side of the mill.

**5.6.8** The sizes of starting material storage and finished product storage shall be adequate to satisfy normal production. Capacity of the starting material storage should be enough for 5d–7d production and that of finished products for at least 7-day production.

## 6 Medium-sized hot-rolled steel bars

### 6.1 Production scale and products

**6.1.1** The designed annual output of the new production line of medium-sized hot rolled steel bar should be at least 500,000t, and it may be appropriately reduced if it mainly produces high-alloy steel.

**6.1.2** The product variety should be section steel of simple cross section such as medium-sized round steel, square bar, flat bar, hexagonal bar, octagonal bar, square (round) billet.

**6.1.3** The size range of the main varieties of product should be in accordance with the following requirements:

- 1 The diameter of the round bar should range from  $\phi 40\text{mm}$ – $\phi 110\text{mm}$ ;
- 2 The square bar side length should range from 40mm–110mm;
- 3 The flat bar should be sized (18–60) mm $\times$ (80–150) mm;
- 4 The size of hexagonal (octagonal) bar should range from 40mm–110mm.

### 6.2 Starting material

**6.2.1** The production line shall adopt continuously cast product as starting material, or may adopt rolled billet or forged billet as starting material for some special steel grades.

**6.2.2** The cross section of starting material shall be in accordance with the following requirements:

- 1 It shall be determined according to the steel grade, size and application of the finished products.
- 2 The starting material should be square or rectangular billet.

**6.2.3** Starting material should be 6m–12m long.

**6.2.4** Starting material quality shall be in accordance with the following requirements:

1 The quality of continuously cast product shall meet the relevant requirements in current professional standard YB/T 2011 *Continuous Casting Square and Rectangular Blank* while the quality of rolled billet shall meet the relevant requirements of current professional standard YB/T 002 *Dimension, Shape, Weight and Tolerances for Hot-rolled Steel Billet*.

2 The quality of starting material shall satisfy the rolling production.

3 The necessary inspection and cleaning of starting materials shall be carried out before rolling process.

### 6.3 Production process

**6.3.1** The rolling mill should be continuous end free rolling mill.

**6.3.2** The rolling process shall be in accordance with the following requirements:

1 A high-pressure water descaler shall be installed after the reheating furnace.

2 The breakdown mill rolling temperature and controlled final rolling temperature shall be preset according to different steel grades.

3 The maximum rolling speed shall be determined depending on the product variety, size and production output.

4 Twist-free low tension rolling process shall be selected for the continuous rolling line.

- 5 Reducing/sizing block and online diameter gauge should be installed.
- 6 Flying shear shall be arranged respectively after roughing mill train, intermediate mill train, finishing mill train and reducing/sizing block.

7 Controlled rolling and controlled cooling process should be used.

**6.3.3** The finishing process shall be in accordance with the following requirements:

1 The online finishing process shall include sampling, conventional cooling or slow cooling, cutting-to-length, inspection, short bar rejecting, counting, bundling, weighing and marking.

2 The heat treatment process shall be set depending on necessity.

3 Off-line finishing process should include shot blasting, straightening, chamfering, flaw detection, inspection, bundling, weighing, marking, peeling, dressing and length changing, etc.

4 Product packaging shall meet the relevant requirements in the current national standard GB/T 2101 *General Requirement for Acceptance, Packaging, Marking and Certification of Section Steel*.

## **6.4 Process equipment**

**6.4.1** The reheating furnace should be of walking type.

**6.4.2** Equipment in the rolling mill area shall be in accordance with the following requirements:

1 The rolling mill should be composed of roughing mill train, intermediate mill train, finishing mill train and reducing/sizing mill block.

2 Roughing, intermediate and finishing mill should be of housing-less stand.

3 The reducing/sizing mill may be of 2-roll or 3-roll type.

4 The flying shear structure shall be selected according to the section size of the stock and the rolling speed.

5 The cooling bed shall be of walking rack type.

**6.4.3** The equipment in finishing area shall be in accordance with the following requirements:

1 Fixed cold shear and cold saw shall be used for cut-to-length operation.

2 High-accuracy 2-roll straightener should be arranged.

3 Surface flaw detector and internal flaw detector should be provided.

4 Other finishing equipment and heat treatment equipment shall be configured according to the relevant process.

## **6.5 Work duty, work time and load rate**

**6.5.1** The medium-sized bar workshop shall operate continuously.

**6.5.2** The specified annual working hours of the workshop should range from 7,600h/a–8,000h/a, and the rated one should be 6,200h/a–6,800h/a.

**6.5.3** The load rate of rolling mill should not be lower than 80%.

## **6.6 Shop layout**

**6.6.1** The rolling mill workshop should be arranged adjacent to the continuous casting workshop.

**6.6.2** The process layout of the workshop shall meet the requirements of the production process and shall be adequate, enabling smooth process flow and easy operation. For the workshops planned to be expanded, space provision shall be considered for future equipment and facilities.

**6.6.3** The equipment should be arranged in a compact way with space provision for safety passage,



equipment installation, operation and maintenance.

**6.6.4** The workshop shall be equipped with lifting and transportation equipment.

**6.6.5** The rail top elevation of the main building shall be determined taking into account the equipment height, equipment maintenance requirements, stacking capacity and transportation condition of starting materials and finished products.

**6.6.6** The main electrical room should be arranged on the drive side of the rolling mill, or several electrical rooms may be arranged in different areas near the served equipment if the production line is long or the facilities are installed dispersedly.

**6.6.7** The roll shop shall be located close to the main rolling bay, and should be positioned on the drive side of the mill.

**6.6.8** The area of starting material storage and finished product storage shall be adequate to satisfy normal production. The capacity of starting material storage should be enough for 5d-7d production, that of intermediate storage in finishing area should be enough for 3d-4d production, and that of finished product storage shall be enough for at least 7d production.

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## 7 Large-sized hot-rolled section steels

### 7.1 Production scale and products

**7.1.1** The designed annual output of the new large-sized hot rolled section steel production line should be at least 700, 000t, which may be cut down aptly if the line will produce products diversified in varieties and broader in size range.

**7.1.2** The product variety should include large-size H-beam, I-beam, channel steel, equal angle steel, unequal angle steel, L-shape steel, U-shape steel, bulb flat steel, steel rail, sheet pile, 310 Z-section bar, Tees, track steel and other profiled steel.

**7.1.3** The sizes of the main product varieties should be in accordance with the following requirements:

- 1 H-beam should meet the following requirements:
  - 1) The H-beam with wide flange should be sized HW250×250–HW500×500;
  - 2) The H-beam with medium flange should be sized HM300×200–HM600×300;
  - 3) The H-beam with narrow flange should be sized HN350×175–HN1000×300;
- 2 I-beam should be of steel 30#–63#;
- 3 Channel steel should be of steel 20#–40#;
- 4 Equal angle steel should be of steel 14#–25#;
- 5 Unequal angle steel should be of steel 15/9 #–20/12,5 #;
- 6 L-shape steel should be L250×90–L500×120;
- 7 U-shape steel should be sized 25U–40U;
- 8 Bulb flat steel should be sized 240×10–430×20;
- 9 Steel rail should be 38kg/m–75kg/m;
- 10 Steel sheet piles should be sized 400×85–750×225.

### 7.2 Starting material

**7.2.1** Continuously cast product shall be used as the starting material of the production line.

**7.2.2** The cross-section of the starting material shall be in accordance with the following requirements:

- 1 It shall be determined according to product variety and size, etc.
- 2 The starting material should be rectangular bloom or beam blank.

**7.2.3** The starting material should be 6m–14m long.

**7.2.4** Starting material quality shall be in accordance with the following requirements:

- 1 The quality of continuous casting rectangular billet shall meet the requirements in current professional standard YB/T 2011 *Continuous Casting Square and Rectangular Blank*.
- 2 Starting material quality shall satisfy rolling production.
- 3 Before rolling, necessary inspection and cleaning of starting materials shall be carried out.

### 7.3 Production process

**7.3.1** The rolling mill arrangement shall be in accordance with the following requirements:

- 1 Rolling mill shall be continuous end free rolling mill, semi-continuous rolling mill, rolling mills

arranged in succession or multiple single stand reversing mill, to be selected according to product variety, size, production scale and investment scale.

2 Rolling mills arranged in succession should be selected for the production line producing H-beam or rail mainly.

3 The production line mainly for producing common section steel, like channel steel and angle steel, should be configured with continuous end free rolling mill or semi-continuous rolling mill.

4 The production line for producing steel sheet pile and profiled steel mainly should adopt multiple single stand reversing mill or rolling mills arranged in succession.

**7.3.2** The rolling process shall be in accordance with the following requirements:

1 High-pressure water descaler shall be installed after the reheating furnace.

2 The initial rolling temperature and controlled final rolling temperature shall be preset according to different steel grades.

3 The maximum rolling speed shall be determined according to the product variety, size, production output and mill arrangement.

4 H-beam, I-beam and rail shall be produced by means of universal mill, steel sheet pile by universal mill or 2-roll mill; channel steel, angle steel and profiled steel by 2-roll mill, or by 2-roll mill + universal mill.

5 Profile meter may be installed at the exit of the finishing mill.

6 Quick cooling device may be arranged after the finishing mill.

**7.3.3** The finishing process shall be in accordance with the following requirements:

1 Procedures that should be arranged include sampling, cooling, straightening, cut-to-length, inspection, length changing, automatic stacking, bundling, weighing, marking, etc.

2 The finishing process should include full-length bar cooling, full-length bar straightening, and cut-to-length by cold saw.

3 The finishing process of steel rail shall include the processes such as non-destructive flaw detection, flatness inspection, gag straightening, sawing and drilling, and quenching.

4 Extra-large H-beam may be straightened by gag straightener on-line or off-line.

5 Product packaging shall meet the requirements in the current national standard GB/T 2101 *General Requirement for Acceptance, Packaging, Marking and Certification of Section Steel*.

## **7.4 Process equipment**

**7.4.1** The reheating furnace should be of walking type.

**7.4.2** Equipment in the rolling mill area shall be in accordance with the following requirements:

1 The composition of the rolling mill should be determined according to the cross section of starting material, product variety and size, and production output, etc.

2 The rolling mill should be designed with quick roll changing device.

3 Hot saw should be set after the roughing mill train/breakdown mill and the finishing mill.

4 Hot printer shall be installed before cooling bed of the rail production line.

5 The cooling bed should be of walking beam, or walking rack type, or combined walking beam + chain type.

**7.4.3** Equipment in finishing area shall meet the following requirements:

1 Roller straightener shall be used.

- 2 Jet printer may be installed after the bar straightener.
- 3 Metal saw should be selected as cold cut-to-length saw.
- 4 Inspection and scrap rejection table should be set.
- 5 Automatic stacker is the equipment that shall be arranged.
- 6 Automatic bundling machine is the equipment that should be installed.
- 7 On-line or off-line gag straightener may be equipped for the finishing process.
- 8 The finishing line for producing rail shall be configured with combined horizontal and vertical roller straightener, rail inspection center, gag straightener, sawing and drilling machine and rail quenching device, etc. The rail inspection center shall consists of surface cleaning device, sectional size inspection system, flatness measuring system, eddy current flaw detection system, ultrasonic inspection system, and defect marking device.

### **7.5 Work duty, work time and load rate**

- 7.5.1** Large-sized hot rolled section steel production workshop shall operate continuously.
- 7.5.2** The specified working hours of the workshop should be designed as 7,600h/a–8,000h/a and the rated working hour should be 6,000h/a–6,500h/a. The upper limit is applicable for the large-sized section steel workshop producing few product varieties and lower limit for that diversified in product varieties and broader in product size range.
- 7.5.3** The rolling mill load rate shall not be lower than 80%.

### **7.6 Shop layout**

- 7.6.1** The rolling workshop should be arranged adjacent to the continuous casting workshop.
- 7.6.2** The process layout of the workshop shall meet the requirements of the production process, shall provide smooth process flow and adequate arrangement, and shall allow easy operation. For the workshops which will be developed further, space shall be reserved for future equipment and facilities.
- 7.6.3** The equipment arrangement should be compact with space provision for safety passage, equipment installation, operation and maintenance.
- 7.6.4** The workshop shall be equipped with lifting and transportation equipment.
- 7.6.5** The rail top elevation of the main building shall be determined taking into account the equipment height, equipment maintenance requirements, stacking capacity and transportation condition of starting materials and finished products.
- 7.6.6** The main electrical room should be arranged on the drive side of the rolling mill, or several electrical rooms may be arranged in different areas near the served equipment if the production line is long or the facilities are installed dispersedly.
- 7.6.7** The roll shop shall be located close to the main rolling bay, and should be positioned on the operator side of the mill.
- 7.6.8** The area of starting material storage and finished product storage shall be adequate to satisfy normal production. The capacity of starting material storage should be enough for 5d–7d production, and that of finished products should be enough for at least 7 day production.

## 8 Large-sized hot-rolled steel bars

### 8.1 Production scale and products

**8.1.1** The designed annual output of the new large-sized bar production line should be at least 500,000t, but may be moderately less if the line produces high alloy steel.

**8.1.2** The product variety should include large-size round bar, square bar, and square (round) billet as well as other simple section bar.

**8.1.3** The sizes of the main product varieties should be as follows:

- 1 The diameter of the round bar should be  $\phi 80\text{mm}$ – $\phi 310\text{mm}$ ;
- 2 Side length of square bar should be 80mm–200mm.

### 8.2 Starting material

**8.2.1** Continuously cast product, steel ingot or forged blank may be used as the starting material of the production line.

**8.2.2** The cross section of starting material shall be in accordance with the following requirements:

- 1 The cross section of the starting material shall be determined according to product variety, size and application, etc.
- 2 The starting material should be rectangular billet or round billet.

**8.2.3** Starting material quality shall be in accordance with the following requirements:

- 1 The quality of continuous casting rectangular billet shall meet the requirements of the current professional standard YB/T 2011 *Continuous Casting Square and Rectangular Blank*.
- 2 Starting material quality shall satisfy production.
- 3 The necessary inspection and cleaning of starting materials shall be carried out before the rolling process.

### 8.3 Production process

**8.3.1** The rolling mill should be arranged as semi-continuous rolling mill.

**8.3.2** The rolling process shall be in accordance with the following requirements:

- 1 A high-pressure water descaler shall be installed after the reheating furnace.
- 2 The first pass rolling temperature and final controlled rolling temperature shall be preset according to different steel grades.
- 3 The maximum rolling speed shall be determined according to the product variety, size and production output.
- 4 Scarfing machine may be installed.
- 5 Before continuous rolling mill line, crop shear shall be designed.
- 6 The number of stands of continuous rolling mill line should not be less than 4.
- 7 After the continuous rolling mill line, flying shear should be installed.
- 8 The continuous rolling mill line shall be divided into two trains with flying shear arranged in between if over 8 stands are installed.

9 The continuous rolling line shall adopt twist-free low-tension rolling process.

10 After the continuous rolling train, online diameter measuring instrument should be installed.

**8.3.3** The finishing process shall be in accordance with the following requirements:

1 The online finishing process shall include pooling, hot sawing, sampling, marking, conventional cooling or slow cooling, and collection process, etc.

2 The heat treatment process shall be arranged depending on the necessity.

3 Off-line finishing process shall include shot blasting, straightening, chamfering, flaw detection, inspection, bundling, weighing, marking, peeling, dressing and length changing, etc.

4 Product packaging shall meet the requirements of the current national standard GB/T 2101 *General Requirement for Acceptance, Packaging, Marking and Certification of Section Steel*.

#### **8.4 Process equipment**

**8.4.1** Continuously cast product shall be reheated in walking type reheating furnace, while the steel ingot should be reheated in soaking furnace.

**8.4.2** Equipment in the rolling mill area shall be configured in accordance with the following requirements:

1 The rolling mill should be composed of breakdown mill and continuous rolling mill.

2 The breakdown mill shall be a reversing 2-roll mill.

3 Continuous rolling mill should be of housing-less stand design.

4 The continuous rolling mill should be equipped with quick roll changing device.

**8.4.3** Equipment configuration in finishing area shall meet the following requirements:

1 Hot saws should be selected as cut-to-length equipment.

2 Under the preconditions of fulfilling the specified sawing temperature requirement, bar of low hardness grade should be cut with metal saw, and that of high hardness grade or that having high cutting quality requirements should be cut with abrasive disc cutter.

3 Walking rack type cooling bed should be used.

4 Highly accurate 2-roll straightener and gag straightener should be arranged.

5 Surface flaw detection and internal flaw detection equipment should be installed.

6 Other finishing and heat treatment equipment shall be configured according to the relevant process requirements.

#### **8.5 Work duty, work time and load rate**

**8.5.1** The large-sized bar production workshop shall adopt continuous working system.

**8.5.2** The specified annual working hour of the workshop should be 7,600h/a–8,000h/a and the rated annual working hour should be 6,200h/a–6,800h/a.

**8.5.3** The rolling mill load rate should not be lower than 80%.

#### **8.6 Shop layout**

**8.6.1** The rolling workshop should be arranged adjacent to the continuous casting workshop.

**8.6.2** The process layout of the workshop shall meet the requirements of the production process, shall provide smooth process flow and adequate arrangement, and shall facilitate operation. For the workshops which will be developed further, space shall be reserved for future equipment and facilities.

**8.6.3** The equipment layout should be compact, but necessary space for equipment installation,

operation, maintenance and evacuation passageway shall be foreseen.

**8.6.4** The workshop shall be equipped with lifting and transportation equipment.

**8.6.5** The rail top elevation of the main building shall be determined taking into account the equipment height, equipment maintenance requirements, stacking capacity, and transportation condition of starting materials and finished products.

**8.6.6** The main electrical room should be arranged on the drive side of the rolling mill, or several electrical rooms may be arranged in different areas near the served equipment if the production line is long or the facilities are installed dispersedly.

**8.6.7** The roll shop shall be located close to the main rolling bay, and should be positioned on the operator side of the mill.

**8.6.8** The area of starting material storage, intermediate storage and finished product storage shall satisfy normal production. The capacity of starting material storage should be enough for 5d-7d production, that of intermediate storage for 3d-4d production, and that of finished products for 7 day production at least.

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## 9 Power supply and distribution system

- 9.0.1** The design of the substation shall comply with the current relevant national standards.
- 9.0.2** The design of power supply and distribution system shall satisfy the power supply requirements of loads at different levels.
- 9.0.3** The power supply voltage should be 35kV or 10kV depending on the power load.
- 9.0.4** For the power supply and distribution system, high-voltage power distribution equipment should be arranged in a centralized way and shall be arranged close to the load center.
- 9.0.5** When the power source voltage of medium-sized and large-sized section mill is 35kV, the power distribution voltage of the main drive of the mill should be 35kV, that of the auxiliary drive and other load should be 10kV; if the power source voltage is greater than 35kV, the distribution voltage for the main drive of the mill shall be determined based on the project scale and by comparing techno-economics indexes.
- 9.0.6** The main connection of the power distribution system should adopt single bus or sectionalized single bus, and power should be distributed in a radial way.
- 9.0.7** Harmonic suppression is required for the power distribution system. The harmonic current at PCC point shall comply with the relevant requirements of the current national standard GB/T 14549 *Quality of Electric Energy Supply Harmonics in Public Supply Network*, and the voltage fluctuation limit at the PCC point shall comply with the relevant requirements in current national standard GB/T 12326 *Power Quality-Voltage Fluctuation and Flicker*; reactive power compensation shall be provided to make the power factor of PCC point satisfy the requirements of the local power supply authority.
- 9.0.8** In case sectionalized single busbar is adopted for the power distribution system, all rectifier loads should be powered by the same section of busbar.
- 9.0.9** Workshop lighting and cranes should be powered by dedicated transformers.
- 9.0.10** Dry-type transformers should be selected if installed indoors.
- 9.0.11** Cables should be selected as power supply and distribution lines.
- 9.0.12** Arrangement of electrical room should be in accordance with the following requirements:
- 1** The electrical room should be located close to the load center. For production line, of which the power loads are higher and dispersed, several electrical rooms should be arranged according to the load distribution.
  - 2** Large electrical room should be designed with basement and/or cable floor.



## 10 Electrical drive and automation system

### 10.1 Electrical drive

**10.1.1** For the large motors of main drive, AC motors shall be selected. For the small- and medium-sized motors of main drive, AC motors should be used.

**10.1.2** The main drive should have AC-DC-AC speed regulation device.

**10.1.3** The drives of pumps and fan that need flow regulation should adopt AC variable frequency speed regulation system.

### 10.2 Automation instrumentation

**10.2.1** On the premise of satisfying the requirements of the production process, the instrument configuration should be determined with overall equipment level and control level of the production line taken into account. In addition to the advantages of cost efficiency, reliable performance and practical application, the selected instrument also shall be easy in maintenance and suitable for the service environment.

**10.2.2** The remote transmission signal of measuring instrument should be 4mA–20mA DC analog signal.

**10.2.3** The measuring instrument shall be selected in accordance with the following requirements:

**1** For plug-in type direct temperature measurement, resistance temperature detector (RTD) and thermocouple should be employed, where the RTD should be Pt100, and the thermocouple should be E, K, S, B type depending on the temperature range to be measured. For non-contact temperature measurement, infrared thermometers should be used.

**2** For pressure measurement of the high-pressure medium, a valve shall be installed for secondary pressure tapping.

**3** For flow measurement, such as pure gas, steam and non-conductive liquid, throttling devices should be used, and they shall comply with the current national standard GB/T 2624 *Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full*; for impurity-laden gas, special anti-blocking type throttling device should be used; for gas with greater temperature and pressure fluctuations, temperature and pressure compensation should be carried out for flow measurement; for flow measurement of high-pressure medium, throttling device should be equipped with secondary pressure tapping valve.

**4** For the flow measurement of conductive liquid medium, electromagnetic flow meter should be used. In case of insufficient the maintenance space or heavier vibration, the split type should be used. For the liquid medium containing magnetic or magnetizable substances, ultrasonic or other special flow meters should be used, other than the electromagnetic flow meter.

**5** The level should be measured by radar or other types of level meter; for the liquid medium of which the density will change significantly in normal working conditions, static pressure or differential pressure type level meter should not be adopted; for volatile liquids, ultrasonic level meter should not be used; and for medium containing magnetic or magnetizable substances, neither magnetic flap nor

magnetic float type level meter should be used for measurement.

6 The reheating furnace should be equipped with exhaust gas analysis instrument.

7 The reheating furnace area exposed to dangerous gas shall be provided with corresponding measuring instruments, and real-time alarms for the leakage detection.

8 The flap of the control valve shall be positioned at safety position in case of emergency and the safety-related control valve without bypass valve shall be provided with hand wheel.

9 Special instruments shall be set according to the process requirements. The radioactive instruments shall meet the relevant requirements in the current national standard GB 18871 *Basic Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources*.

10 Instrument shall be installed for measuring the energy media incoming to and outgoing from the rolling plant.

11 Measuring instrument should be installed for the energy media generated, consumed and recycled in the production line.

12 The energy media measuring signal of the production line should be displayed and controlled by the corresponding basic automation system.

**10.2.4** The power source of the field instrument shall meet with the following requirements:

1 The field instrument system shall be powered by 3-phase 4-wire 380V/50Hz, or single-phase 220V/50Hz alternative current or 24V direct current.

**2 Nitrogen shall neither be used as instrument air in the place where personal safety cannot be ensured, nor used in the relatively closed environment.**

**10.2.5** The installation of the field instrument shall enable easy measurement and maintenance of the instrument; the instrument transmitter and converter installed in the open air shall be protected adequately, and heat tracing is required for the field instrument and measuring pipeline installed in the area where freezing may occur.

### **10.3 Automation system**

**10.3.1** The section steel production workshop shall be designed with basic automation system (L1).

**10.3.2** The process automation system (L2) and manufacturing execution system (MES) should be provided for the section steel production workshop.

**10.3.3** The basic automation system (L1) shall be in accordance with the following requirements:

1 The electrical control and instrument control system should be of integrated design.

2 L1 system should be installed in different areas but monitored in a centralized way.

3 For the important production equipment fast process data acquisition (PDA) system should be designed.

4 The workshop should be designed with emergency stop system.

5 The emergency stop system shall be in accordance with the following requirements:

1) The coverage area of emergency stop system shall be divided according to process requirements.

2) The emergency stop system for personal safety shall be constituted by wired stop circuit triggered by the emergency stop button installed at the position convenient for the operator.

3) The emergency stop system for preventing equipment accident and production fault may be wired circuit system consisting of programmable controller or relay.

4) The emergency stop status shall be reset manually after confirmed by the operator. After reset

of emergency stop, the relevant equipment shall not be restarted automatically.

**10.3.4** Process automation system (L2) should include the functions of technological process control, production management, reporting, shift change and personnel management, roll shop management, and data communication with external systems.

**10.3.5** The design of Manufacturing Execution System (MES) shall adapt to section steel production process and in-plant enterprise management, of which the functions shall be integrated with that of enterprise resource planning system and process control system to enable data exchange.

**10.3.6** The servers, communication devices, processing equipment and storage devices of the automation system should be located in a dedicated room separately.

**10.3.7** Optical fiber cables should be used as the communication cables laid in the workshop.

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## 11 Telecommunication

### 11.1 Telephone system

**11.1.1** The arrangement of the telephone system shall satisfy the communication need for production scheduling, operation coordination and administrative management required by production process and corporate management, and shall adapt to the development plan and communication mode of the steel producer.

**11.1.2** For the enterprises which have two levels of dispatching systems a dispatching telephone switchboard should be set for the section mill plant.

**11.1.3** The dispatching telephone switchboard of the section mill plant shall be of program-controlled digital type or IP type with recording function.

**11.1.4** IP phones shall be secured with QoS.

### 11.2 Wired intercom system

**11.2.1** Small-sized section steel mills may adopt non-central-switch wired intercom system, while medium and large-sized section mill plants should adopt central-switch wired intercom system.

**11.2.2** The central-switch wired intercom system should have the functions of collective calling, group calling, and selective calling, and enable presetting of the user's calling priority.

**11.2.3** The wired intercom system should have the function of introducing in the fire alarm signal or related external emergency interlock control signal.

**11.2.4** The main operation room and the important local operation pulpit (box) shall be designed with intercom station, while the production posts in water treatment station, air compressor station and other auxiliary facilities should be designed with intercom station or one-way broadcast louder speaker.

**11.2.5** The external louder speaker or one-way broadcast louder speaker inside or outside the workshop building should be 10W–25W horn speaker selected according to the ambient noise.

**11.2.6** For signal of the wired intercom system, twisted pair shielded cable should be used and for central-switch type intercom system, the cable should be networked in a star structure.

**11.2.7** The wired intercom system should be powered in centralized way.

### 11.3 Wireless intercom system

**11.3.1** Wireless intercom should be used for communication between the workshop crane driver and the commander on the ground.

**11.3.2** For communication between equipment maintenance personnel and commissioning personnel or between such personnel and personnel in scheduling room/operation room, wireless intercom should be selected.

**11.3.3** Medium or large-sized steel workshops should be equipped with wireless intercom system consisting of base station, vehicle-mounted station and handheld station.

#### **11.4 Industrial television system**

**11.4.1** The industrial television shall be arranged as follows:

**1** For the crucial areas of the production line and the areas required to be monitored from the production and management point of view, ITV system should be installed.

**2** ITV system shall be provided for the key points of the production line which shall be monitored, but are difficult to observe directly by the operator.

**11.4.2** The video compression standard of the IP network camera, or upload network interface of the IP network video server/video encoder of the analog camera, or upload network interface of DVR shall be consistent with the video compression standard applied in the enterprise's dispatching television system.

**11.4.3** For the camera required to provide quite clear field monitoring pictures, the resolution should not be lower than D1, and the real-time transmission frame rate of the image should not be less than 25fps.

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## 12 Utilities

### 12.1 Roll shop facilities

**12.1.1** The roll shop shall be configured according to the following requirements:

1 The production tasks of the roll shop shall be determined according to the configuration and requirements of the production line, and shall include machining of groove for new roll, repairing of groove for the used roll, disassembling, cleaning, inspection and reassembly of roll, reassembling and adjustment of guide, setting of roll ring on roll and reassembling of rolls.

2 The facilities for repairing the guide, regrinding the blade edge, machining the template, regrinding and quenching the saw blade should be built commonly with other facilities, or arranged in the roll shop, or the above processing activities should be outsourced depending on the actual conditions of the plant.

3 The facilities for machining spare parts required by the routine maintenance of production equipment, and the small, medium and large sized repair facilities of the equipment should be built commonly with other facilities, or built separately; or such fabrication and repair activities may be outsourced.

**12.1.2** Equipment shall be selected as required below:

1 The specification of the roll lathe and milling machine shall be selected according to the type, specification, groove dimension, material and other parameters of the roll.

2 The quantity of roll lathes and milling machines shall be determined based on the workload, machining efficiency and workshop working system. For machining of the section mill roll, CNC heavy-duty roll lathe should be selected, other than ordinary heavy-duty lathes.

3 The roll cleaning equipment shall be selected considering the type, specification and workload of the roll and bearing.

4 Both disassembly of roll bearing and the bearing housing and cleaning of bearing and the bearing housing should be carried out in a mechanical way.

5 The machining equipment of the guide, shear blade and template shall be selected according to the material, workload and workshop working system of the work pieces.

6 For the roll on which the product trademark, specification, batch No. and other symbols shall be engraved, corresponding CNC machine tool should be arranged for automatic engraving instead of manual engraving.

7 The brazing process for machining the cold saw blades in roll shop of section mill workshop shall be provided with corresponding protection against possible high frequency radiation.

8 Oven for shrinkage fit (of roll sleeve) and vertical CNC lathe should be installed in the roll shop of large-sized section mill workshop.

**12.1.3** The equipment arrangement shall be in accordance with the following requirements:

1 The equipment in roll shop shall be so arranged as to facilitate easy work-piece transferring to the main process production equipment and to ensure smooth material flow and easy management.

2 The rail top elevation of the roll shop shall enable adequate lifting and handling of the largest

work-piece.

- 3 The roll cleaning equipment should be arranged on the side of the workshop external wall.

## **12.2 Laboratory facilities**

**12.2.1** The physical testing and chemical analysis items for the section steel shall be determined according to the product variety, specification and production equipment, and the current relevant national standards as well.

**12.2.2** The selection of the lab facilities shall be in accordance with the following requirements:

- 1 The number of machining, analyzing and property testing equipment to be installed shall be determined through calculation.

- 2 For the items which must be analyzed or tested as specified in the relevant product standard, corresponding required equipment shall be installed, and for the items used for reference only, their analysis and test tasks should be outsourced internally or externally, or only some indispensable devices should be arranged.

- 3 The equipment accuracy and capacity should be selected according to the process requirements.

**12.2.3** The arrangement of lab equipment shall be in accordance with the following requirements:

- 1 The sample processing equipment shall be installed on the first floor of the building.

- 2 In addition to satisfying the sample processing process flow, the arrangement of sample processing equipment shall be determined taking into account operation safety of the workers, convenience of sampling and sample conveying, and sufficient lighting in the processing workshop.

- 3 Enough space for maintenance and material transportation shall be reserved around the sample processing equipment.

- 4 Tensile test, impact test and upset forging test equipment shall be arranged on the same floor as that for heat treatment equipment, close to the sample processing shop as far as possible.

- 5 The heat treatment room should be arranged adjacent to the tensile test room and the hot upset forging test room.

- 6 The power distribution room and sample storage room should be arranged on the first floor of the lab.

## **12.3 Fuel gas facilities**

**12.3.1** The fuel gas facilities shall be designed in accordance with the following requirements:

- 1 The fuel shall be selected adequately considering plant-wide fuel gas balance, fuel supply condition nearby, and the process requirements of the reheating furnace and the heat treatment furnace.

- 2 The process requirements of the reheating furnace and the heat treatment furnace shall be met.

- 3 The gas pressure shall be designed as low as possible on the premises of satisfying the pressure requirements of reheating furnace and heat treatment furnace burners, pressure regulating equipment, and requirement on pipeline linear resistance loss.

- 4 The gas supply capacity shall be determined based on the maximum and minimum hourly gas consumption under normal production conditions, and shall consider the flow variation from small amount of gas consumption at beginning of startup and during maintenance to the normal gas consumption during production.

- 5 Design of the gas supply system and gas pipe network shall meet the relevant requirements in

the current national standard GB 6222 *Safety Code for Gas of Industrial Enterprises*.

6 The design of natural gas, liquefied natural gas and liquefied petroleum gas supply systems shall meet the relevant requirements in the current national standard GB 50028 *Code for Design of City Gas Engineering*.

7 The design of the producer gas supply system shall meet the relevant requirements in the current national standard GB 50195 *Design Code for Producer Gas Station*.

8 Gas leakage alarm device shall be installed inside each station in accordance with the relevant requirements in of the current national standard GB 50493 *Standard for Design of Combustible Gas and Toxic Gas Detection and Alarm for Petrochemical Industry*.

9 On the fuel pipe line of each reheating furnace and heat treatment furnace, the shut-off device for maintenance should be configured by butterfly valve + enclosed blind plate arranged near the associated furnace.

**12.3.2** The design of cutting and maintenance facilities shall be in accordance with the following requirements:

1 Workshop cutting and maintenance oxygen may be supplied from oxygen cylinder or pipeline. For the oxygen supplied via pipeline, safety valve box should be installed at the user point.

2 The design of the oxygen pipeline in the workshop shall meet the relevant requirements in the current national standard GB 16912 *Safety Technical Regulation for Oxygen and Relative Gases Produced with Cryogenic Method*.

3 The fuel gas for cutting and maintenance in the workshop may be acetylene gas, natural gas, liquefied petroleum gas supplied by the cylinders, or liquefied petroleum gas, coke oven gas, natural gas, etc. supplied via pipeline. For the gas supplied via pipeline, safety valve box should be installed at the user point.

**12.3.3** The nitrogen supply system shall meet the requirements of the production line and the purging requirement of the gas pipeline, and piped nitrogen should be used. For the liquefied nitrogen, or nitrogen supplied via bank, or the nitrogen generated via pressure swing adsorption process, nitrogen receiver should be installed to ensure safe supply of nitrogen.

**12.3.4** The accessories, such as shutoff device, pressure relief pipe, access hole and purging nozzle, shall be installed on the fuel gas pipeline before leading to the workshop.

**12.3.5** The energy metering device shall be provided for the supplied energy media.

## **12.4 Thermal power facilities**

**12.4.1** The steam source shall be in accordance with the following requirements:

1 The steam should be sourced from the evaporized cooling device of reheating furnace of the plant.

2 Demineralized water should be used for the evaporized cooling device of the reheating furnace.

3 The steam produced by the evaporized cooling device of reheating furnace should be equipped with overheating facilities.

**12.4.2** The design of compressed air shall be in accordance with the following requirements:

1 The compressed air load shall be calculated and determined according to the production process requirements for compressed air pressure, consumption and quality with the simultaneous use coefficient and the pipeline leakage coefficient taken into accounted.



2 The supply source of the compressed air shall be selected based on the overall planning of the plant.

3 In case no compressed air source available near the section steel hot rolling plant, a separate air compressor station may be installed.

4 The air compressor station should be arranged in a separate house and it shall be designed in compliance with the relevant requirements in the current national standard GB 50029 *Code for Design of Compressed Air Station*.

5 The compressed air drying device should be arranged in a centralized way. For those always operating, at least one standby device shall be provided.

## **12.5 Water supply and drainage facilities**

**12.5.1** The design of water supply and drainage facilities shall comply with the relevant requirements of the current national standard GB 50721 *Code for Design of Water Supply & Drainage of Iron and Steel Enterprises*.

**12.5.2** Water supply and drainage facilities should be set according to process requirements. For the brown-field project, the existing water supply and drainage facilities shall be fully reused.

**12.5.3** The water supply system shall be arranged according to the quality category of supply water and return water respectively, and the separate drainage systems shall be designed.

**12.5.4** Water treatment facilities for several production lines in the same workshop building should be arranged in a centralized way, and water shall be supplied respectively for different lines and systems.

**12.5.5** The water treatment station shall be designed with dosing room and operation room according to the production management requirement of the whole plant.

**12.5.6** When the water supply and drainage treatment equipment is arranged outdoors, its operation control devices, instruments, sampling devices and valves, etc. should be protected with rain-proof measures, and anti-freezing measures if required.

**12.5.7** The water treatment system shall be advanced and practical as required by the process.

**12.5.8** The design of the circulating water system shall be in accordance with the following requirements:

1 The design of the recirculating water system shall comply with the relevant requirements of the current national standard GB 50050 *Code for Design of Industrial Recirculating Cooling Water Treatment*.

2 The composition and capacity of the water supply system and water treatment facilities shall meet the requirements of the production process for water quality and water temperature.

3 The relevant parameters of the water treatment equipment and structures of the recirculating water system shall comply with the relevant requirements of the current national standard GB 50721 *Code for Design of Water Supply & Drainage of Iron and Steel Enterprises*.

**12.5.9** The recirculating water system of the reheating furnace shall be provided with emergency water supply system and shall comply with the relevant requirements of the current national standard GB 50721 *Code for Design of Water Supply & Drainage of Iron and Steel Enterprises*.

**12.5.10** The returned direct cooling water of the rolling mill shall be designed in accordance with the following requirements:

1 The scale flume, if adopted, shall be lined with wear-resistant material, and its design shall provide enough space for manual removal of the scale.

2 At the starting point, elevation change point, slope change point of the scale flume, and the flume area where scale is difficult to be removed, stationary water flushing device shall be arranged.

**12.5.11** Water supply system for the water box of the rolling line shall adapt to the change of process water consumption.

**12.5.12** Water treatment plant shall be provided with water quality analysis and measurement system and its design shall be in accordance with the following requirements:

1 The water quality monitoring project of the water treatment system shall be implemented in accordance with the relevant requirements of the current national standard GB 50050 *Code for Design of Industrial Recirculating Cooling Water Treatment*.

2 The water quality analysis data of water treatment should be transmitted to the plant wide water quality lab, or the lab of other workshops in the plant; and a water quality analysis lab shall be set up if there is no plant-wide lab or such analysis is not available in other workshops of the plant.

3 The operating parameters of the water treatment system shall be measured and system running conditions shall be controlled.

## **12.6 Heating, ventilation and air conditioning facilities**

**12.6.1** The design of heating, ventilation and air conditioning shall comply with the relevant requirements of the current national standard GB 50019 *Design Code for Heating Ventilation and Air Conditioning of Industrial Buildings*.

**12.6.2** The section steel hot rolling plant shall be provided with good natural ventilation. Auxiliary buildings should not be attached to the external walls of the main building, if possible. And the auxiliary buildings should not be built on the windward side of the dominant wind direction.

**12.6.3** The enclosure structure of the roll shop, and the building requiring heating, shall be properly heat insulated with minimum thermal resistance of the roof, external wall and gutter calculated and determined according to the temperature, humidity and meteorological conditions of the workshop to satisfy the requirements of energy saving and anti-condensation.

**12.6.4** The design of heating shall be in accordance with the following requirements:

1 The designed indoor temperature of the roll shop shall be selected according to the requirements of the process equipment, and 16°C–18°C should be taken if the process data is not available.

2 The heating medium for the roll shop and the auxiliary rooms should be 0.2MPa–0.3MPa steam or hot circulating water not lower than 95°C, and a condensate collecting device should be installed if the steam consumption of the heating system is greater than 0.6t/h.

3 The roll shop should be heated by heater fan. Warm air curtains should be provided at the doors which are opened/closed frequently. The rooms of the auxiliary system should be heated by heat radiator.

**12.6.5** Ventilation shall be designed in accordance with the following requirements:

1 In ventilation design, controlled natural ventilation should be used preferably, and mechanical ventilation or combined ventilation of natural ventilation and mechanical ventilation may be adopted if natural ventilation is not enough to ensure indoor safety, sanitation, environmental protection or production.

2 Local exhaust ventilator should be used at the spot where heat or humidity is generated locally from the production lines in the main building.

3 For the electrical room, cable room and cable tunnel without air conditioner or having no special requirements for room temperature, natural ventilation, or mechanical ventilation, or natural ventilation + mechanical ventilation may be selected. A fire damper that can automatically close, accompanied by feedback signal, shall be provided at the air inlet and outlet of the ventilation ducts for the underground cable room and cable tunnel.

4 The HV power distribution room and battery room of the power supply system shall be equipped with emergency ventilator of which the ventilation frequency shall be determined through calculation according to the process requirements, or designed as at least 12 times/h if no process data is available. The emergency ventilator shall be provided with electrical switches at indoor and outdoor spot easy for operating.

5 The underground hydraulic stations and lubrication stations, etc. shall be equipped with mechanical ventilators, and fire damper shall be arranged for the air supply and exhaust pipe at the points where they pass through the fireproof partition.

6 If the ambient temperature of an operation spot affects people's health, or the radiation intensity is greater than  $350\text{w}/\text{m}^2$ , local air supply shall be provided.

7 The fan of the ventilation system shall be interlocked with the automatic fire alarm system, and the ventilator shall be automatically shut off in case of a fire alarm.

**12.6.6** The design of air conditioning shall be in accordance with the following requirements:

1 It is required to determine the indoor calculation temperature according to the air conditioning requirements of process with personnel comfort taken into account also. The design of air conditioning system shall comply with the relevant requirements of the current national standard GB 50019 *Design Code for Heating Ventilation and Air Conditioning of Industrial Buildings*.

2 The main electrical room of the section steel hot roll mill workshop should adopt a centralized air conditioning system or discrete water-cooled air conditioning unit.

3 The air-conditioning facility shall be interlocked with the automatic fire alarm system, and it shall be automatically shut off in case of a fire alarm signal.

4 The air conditioner of the electrical room should be arranged close to the external wall and its cooling water pipe should not pass through the electrical room, instrument room and computer room while its air duct shall be heat insulated to prevent condensation. The air supply duct of the air conditioning system should not be arranged just above the electrical cabinet.

**12.6.7** The dust collector system shall be designed in compliance with the following requirements:

1 For the dust generated from the equipment such as shot blasting unit, dust collector system shall be installed with bag filter selected as air cleaning equipment.

2 At the air inlet and outlet pipes, and the exhaust chimney of the dust collector shall be installed measuring holes, of which the position shall be selected in accordance with the current national standard GB/T 16157 *The Determination of Particulates and Sampling Methods of Gaseous Pollutants Emitted from Exhaust Gas of Stationary Source*. If the height of the measuring point exceeds 3m, a working platform with ladder shall be arranged and a dedicated power supply for monitoring purpose should be provided.

## 13 Architecture and structure

### 13.1 General requirements

**13.1.1** The building and structure design shall meet the production requirements and shall comply with the relevant requirements of the current national standards.

**13.1.2** The safety class of the building and structure shall be determined in accordance with the relevant national standards, and that of the common building and structure should be class 2.

**13.1.3** The design of the building and structure shall comply with the relevant requirements of the current national standards GB 50011 *Code for Seismic Design of Buildings* and GB 50191 *Code for Seismic Design of Special Structures*, and the building and structure should adopt regular shape design.

**13.1.4** The fire protection design of buildings and structures shall comply with the relevant requirements of the current national standards GB 50016 *Code for Fire Protection Design of Buildings* and GB 50414 *Standard for Fire Protection Design of Iron and Steel Metallurgy Enterprises*.

**13.1.5** The anti-corrosion design of buildings and structures shall comply with the requirements in current national standard GB 50046 *Standard for Anticorrosion Design of Industrial Constructions* and other related standards.

**13.1.6** The waterproof requirements of underground buildings (structures) shall comply with the relevant requirements of the current national standard GB 50108 *Technical Code for Waterproofing of Underground Works*.

**13.1.7** The load of the building and structure shall be selected in compliance with the relevant requirements of the current national standard GB 50009 *Load Code for the Design of Building Structures*, and the building and structure shall be designed according to the necessary operating and maintenance load of the production process.

### 13.2 Main building

**13.2.1** The fire risk of the main building is of class D, and its fire resistance rating, combustion performance and fire resistance limit of the components shall comply with the relevant requirements of current national standard GB 50016 *Code for Fire Protection Design of Buildings*.

**13.2.2** The main building should be of steel structure fully.

**13.2.3** The maximum spacing of the main building expansion joints shall be determined according to the structure design of the main building and the relevant requirements of the current national standards GB 50010 *Code for Design of Concrete Structures* and GB 50017 *Code for Design of Steel Structures*. If required by seismic fortification, the joints should be designed as expansion joint and earthquake-proof joint based on the requirements for the earthquake-proof joint.

**13.2.4** The building foundation and superstructure of the raw material bay and the finished product bay shall be designed according to the conditions of stacking load on ground and geological conditions.

**13.2.5** The plan arrangement of main building and its structure, and internal space shall satisfy the requirements of production process and equipment maintenance.

**13.2.6** The enclosure structure of main building shall meet the requirements of production technology,

energy saving and lighting.

**13.2.7** The main building shall be designed with adequate ventilation clerestory and air inlet shutter according to the heat loss of the production line.

**13.2.8** The main building should adopt controlled roof water drainage according to the relevant requirements of the current national standard GB 50015 *Code for Design of Building Water Supply and Drainage*.

**13.2.9** The main building floor topping should be dust/sand free and wear-resistant. The bedding course, foundation and structure shall comply with the relevant requirements of the current national standard GB 50037 *Code for Design of Building Ground*.

**13.2.10** Type of main building column foundation shall be selected by comprehensively considering the influences from site engineering geology, hydrogeology, frozen soil depth, pipeline in underground channel, adjacent building (structure), and the foundation load.

**13.2.11** Small rooms inside the main building, such as hydraulic station, lubrication station, electrical room, etc. should be made of reinforced concrete or shall be of masonry structure if they have high requirements for fire protection; other small rooms inside the main building may be made of reinforced concrete masonry or steel according to requirements.

**13.2.12** Equipment foundation shall be designed according to the process layout, the load characteristics of the production line, the specified settlement and displacement requirements, and the site geological conditions, and the design shall comply with the relevant requirements in current national standard GB 50696 *Code for Design of Metallurgical Equipment Foundation in Iron and Steel Enterprises* and related standards.

## 14 Safety, health and environmental protection

### 14.1 General requirements

**14.1.1** In the engineering design of section steel hot rolling mill, the relevant national, professional and provincial laws, policies and regulations of safety and occupational health shall be implemented to ensure safety and health of employees.

**14.1.2** The site selection and general layout of the section steel hot rolling mill shall be in accordance with the following requirements:

1 The plant site shall be selected in accordance with the current relevant standards of the nation GBZ 1 *Hygienic Standards for the Design of Industrial Enterprises*, AQ 2003 *Safety Regulations for Steel Rolling* and GB 50406 *Code for Design of Environmental Protection of Iron and Steel Industry*.

2 The general layout of the plant area and arrangement of the workshop shall be designed in compliance with the requirements of current relevant standards of the nation GB 50187 *Code for Design of General Layout of Industrial Enterprises*, GB 50603 *Code for Design of General Layout and Transportation for Iron & Steel Enterprises*, GBZ 1 *Hygienic Standards for the Design of Industrial Enterprises*, AQ 2003 *Safety Regulations for Steel Rolling* and GB 50406 *Code for Design of Environmental Protection of Iron and Steel Industry*.

### 14.2 Safety

**14.2.1** The design of fire protection and explosion protection shall comply with the requirements of the current relevant standards of the nation GB 50016 *Code for Fire Protection Design of Building*, GB 50414 *Standard for Fire Protection Design of Iron and Steel Metallurgical Enterprises*, GB 6222 *Safety Code for Gas of Industrial Enterprises* and AQ 2003 *Safety Regulations for Steel Rolling*.

**14.2.2** The electrical safety design shall meet the requirements in the current relevant standards of the nation GB 50016 *Code for Fire Protection Design of Buildings*, GB 50414 *Standard for Fire Protection Design of Iron and Steel Metallurgical Enterprises*, GB 50057 *Code for Design Protection of Structures against Lightning*, GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres*, GB 50034 *Standard for Lighting Design of Buildings*, AQ 3009 *Safety Regulations for Electrical Explosion in Hazardous Locations* and AQ 2003 *Safety Regulations for Steel Rolling*.

**14.2.3** The design of gas safety shall comply with the relevant requirements of the current national standards GB 6222 *Safety Code for Gas of Industrial Enterprises* and GB 50028 *Code for Design of City Gas Engineering*.

**14.2.4** The seismic design of buildings (structures) shall comply with the relevant requirements of the current national standard GB 50011 *Code for Seismic Design of Buildings*.

**14.2.5** The walkways, stairs, platforms, protective railings, protective shields and protective covers shall be arranged in accordance with the requirements of the current relevant standards of the nation GB 4053 *Safety Requirements for Fixed Steel Ladders and Platforms* and AQ 2003 *Safety Regulations for Steel Rolling*.

**14.2.6** The setting of safety signs shall comply with the relevant requirements of the current national

standard GB 2894 *Safety Signs and Guideline for the Use*.

**14.2.7** The technical measures for the safety of transportation, handling and lifting shall comply with the relevant requirements of the current standard of the nation AQ 2003 *Safety Regulations for Steel Rolling*.

### **14.3 Health**

**14.3.1** The design of production process, workshop layout and occupational health protection measures shall comply with the relevant requirements of the current national standard GBZ/T 231 *Technical Code on Occupational Hygiene Prevention and Protection in Ferrous Metals Smelting and Rolling Industry*.

**14.3.2** The technical measures for dust prevention, toxic gas protection and asphyxiation protection shall comply with the relevant requirements of the current national standards GBZ 1 *Hygiene Standards for the Design of Industrial Enterprises* and GBZ/T 231 *Technical Code on Occupational Hygiene Prevention and Protection in Ferrous Metals Smelting and Rolling Industry*. The concentration of hazardous agents in the workplace shall comply with the relevant requirements of the current national standard GBZ 2.1 *Occupational Exposure Limits for Hazardous Agents in the Workplace-Part1: Chemical Hazardous Agents*.

**14.3.3** The protection facilities against noise, high temperature, local vibration, power frequency electric field and ionizing radiation shall be arranged in accordance with the relevant requirements of the current national standards GBZ 1 *Hygiene Standards for the Design of Industrial Enterprises*, GBZ/T 231 *Technical Code on Occupational Hygiene Prevention and Protection in Ferrous Metals Smelting and Rolling Industry* and GBZ 2.2 *Occupational Exposure Limits for Hazardous Agents in the Workplace-Part2: Physical Agents*.

**14.3.4** The design of cooling for heatstroke prevention and heating in winter shall comply with the relevant requirements of current national standards GBZ 1 *Hygienic Standards for Design of Industrial Enterprises*, GBZ/T 231 *Technical Code on Occupational Hygiene Prevention and Protection in Ferrous Metals Smelting and Rolling Industry* and GB 50019 *Design Code for Heating Ventilation and Air Conditioning of Industrial Buildings*.

**14.3.5** The auxiliary living facilities in the plant area shall be set away from the occupational hazards, such as harmful gases, radiation ray and high temperature, and the design shall comply with the relevant requirements of the current national standard GBZ 1 *Hygiene Standards for the Design of Industrial Enterprises*.

### **14.4 Environmental protection**

**14.4.1** The design for environmental protection of section steel hot rolling mills must be developed on the principle of achieving a clean production and recycling economy. Specific approaches include: prioritizing the protection, bearing in mind that "an ounce of prevention is worth a pound of cure", and attaching importance to both the prevention and the control. The environmental protection design shall provide strictly control of environment pollution and reduction of environment risks.

**14.4.2** The emission of various pollutants generated from the section steel hot rolling plant must comply with the requirements in the current national and provincial standards of emissions; for the imported section steel hot rolling mills, the pollutant emission control criteria of equipment and devices

shall not be lower than that in the current national standards. The concentration of air pollutants emitted shall meet the requirements in the relevant national standard GB 28665 *Emission Standard of Air Pollutants for Steel Rolling Industry*, and the concentration of water pollutants discharged shall meet the relevant requirements in the current national standard GB 13456 *Discharge Standard of Water Pollutants for Iron and Steel Industry*.

**14.4.3** The dust collector facilities shall be installed at the spots of the production facilities and the production line where a large amount of dusty gas (dust) is generated, and its emission control criteria shall not be lower than the requirements in the current national standards.

**14.4.4** The industrial furnace and kiln for rolling shall be fueled by gaseous fuel and other clean fuel, and should adopt regenerative combustion technology or low NO<sub>x</sub> combustion technology.

**14.4.5** Different waste water shall be collected and treated separately, and the waste water treated should be recycled, or discharged until satisfying the relevant standard.

**14.4.6** Production lines and auxiliary facilities shall be equipped with noise suppression, sound insulation, sound absorption, vibration isolation or alleviation for noise reduction depending on the noise source conditions.

**14.4.7** The treatment and disposal methods of solid waste generated from production lines and auxiliary facilities shall comply with the relevant requirements of the current national standard GB 50406 *Code for Design of Environmental Protection of Iron and Steel Industry*. Waste oil shall be recovered and recycled. If the section steel hot rolling plant is incapable of such treatment or disposal, the wastes shall be sent to the qualified unit.



## Explanation of wording in this code

1 Words used for different degrees of strictness are explained as follows in order to mark the differences in implementing the requirements of this code.

1) Words denoting a very strict or mandatory requirement:

"Must" is used for affirmation, "must not" for negation.

2) Words denoting a strict requirement under normal conditions:

"Shall" is used for affirmation, "shall not" for negation.

3) Words denoting a permission of a slight choice or an indication of the most suitable choice when conditions permit:

"Should" is used for affirmation, "should not" for negation.

4) "May" is used to express the option available, sometimes with the conditional permit.

2 "Shall comply with..." or "shall meet the requirements of..." is used in this code to indicate that it is necessary to comply with the requirements stipulated in other relative standards and codes.

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## List of quoted standards

- GB 50009 *Load Code for the Design of Building Structures*
- GB 50010 *Code for Design of Concrete Structures*
- GB 50011 *Code for Seismic Design of Buildings*
- GB 50015 *Code for Design of Building Water Supply and Drainage*
- GB 50016 *Code for Fire Protection Design of Buildings*
- GB 50017 *Code for Design of Steel Structures*
- GB 50019 *Design Code for Heating Ventilation and Air Conditioning of Industrial Buildings*
- GB 50028 *Code for Design of City Gas Engineering*
- GB 50029 *Code for Design of Compressed Air Station*
- GB 50034 *Standard for Lighting Design of Buildings*
- GB 50037 *Code for Design of Building Ground*
- GB 50046 *Standard for Anticorrosion Design of Industrial Constructions*
- GB 50050 *Code for Design of Industrial Recirculating Cooling Water Treatment*
- GB 50057 *Code for Design Protection of Structures against Lightning*
- GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres*
- GB 50108 *Technical Code for Waterproofing of Underground Works*
- GB 50187 *Code for Design of General Layout of Industrial Enterprises*
- GB 50191 *Code for Seismic Design of Special Structures*
- GB 50195 *Design Code for Producer Gas Station*
- GB 50406 *Code for Design of Environmental Protection of Iron and Steel Industry*
- GB 50414 *Standard for Fire Protection Design of Iron and Steel Metallurgy Enterprises*
- GB 50493 *Standard for Design of Combustible Gas and Toxic Gas Detection and Alarm for Petrochemical Industry*
- GB 50603 *Code for Design of General Layout and Transportation for Iron & Steel Enterprise*
- GB 50632 *Code for Design of Energy Saving of Iron and Steel Industry*
- GB 50696 *Code for Design of Metallurgical Equipment Foundation in Iron and Steel Enterprises*
- GB 50721 *Code for Design of Water Supply & Drainage of Iron and Steel Enterprises*
- GB/T 2101 *General Requirement of Acceptance, Packaging, Marking and Certification for Section Steel*
- GB/T 2624 *Measurement of Fluid Flow by Means of Pressure Differential Devices Inserted in Circular Cross-Section Conduits Running Full*
- GB 2894 *Safety Signs and Guideline for the Use*
- GB 4053 *Safety Requirements for Fixed Steel Ladders and Platforms*
- GB 6222 *Safety Code for Gas of Industrial Enterprises*
- GB/T 12326 *Power Quality—Voltage Fluctuation and Flicker*
- GB 13456 *Discharge Standard of Water Pollutants for Iron and Steel Industry*
- GB/T 14549 *Quality of Electric Energy Supply Harmonics in Public Supply Network*

GB/T 16157 *The Determination of Particulates and Sampling Methods of Gaseous Pollutants Emitted from Exhaust Gas of Stationary Source*

GB 16912 *Safety Technical Regulation for Oxygen and Relative Gases Produced with Cryogenic Method*

GB 18871 *Basic Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources*

GB 28665 *Emission Standard of Air Pollutants for Steel Rolling Industry*

GBZ 1 *Hygienic Standards for the Design of Industrial Enterprises*

GBZ 2.1 *Occupational Exposure Limits for Hazardous Agents in the Workplace—Part1: Chemical Hazardous Agents*

GBZ 2.2 *Occupational Exposure Limits for Hazardous Agents in the Workplace—Part2: Physical Agents*

GBZ/T 231 *Technical Code on Occupational Hygiene Prevention and Protection in Ferrous Metals Smelting and Rolling Industry*

AQ 2003 *Safety Regulations for Steel Rolling*

AQ 3009 *Safety Regulations for Electrical Explosion in Hazardous Locations*

YB/T 002 *Dimension, Shape, Weight and Tolerances for Hot-rolled Steel Billet*

YB/T 2011 *Continuous Casting Square and Rectangular Blank*

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