

Foreword

This code is developed by WISDRI Engineering & Research Incorporation Limited with participation of other relevant organizations according to the requirements of Document JIANBIAO [2013]No.6 issued by the Ministry of Housing and Urban-Rural Development(MOHURD)-"Notice on Printing and Distributing the Development and Revision Plan of Engineering Construction Standards and Codes in 2013".

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

This code is divided into 9 chapters. The main technical content includes: general provisions, terms, basic requirements, design of process system, equipment, technological pipeline, auxiliary facilities, test run, safety and environmental protection.

All provisions in bold type in this code are mandatory ones and must be implemented strictly.

This code is under the jurisdiction of and its mandatory provisions are interpreted by the Ministry of Housing and Urban-Rural Development of the People's Republic of China (MOHURD). China Metallurgical Construction Association is responsible for its routine management. WISDRI Engineering & Research Incorporation Limited (WISDRI for short) is responsible for explanation of the technical specifications. Any comments or suggestions during the implementation of this code should be submitted to WISDRI Engineering & Research Incorporation Limited (Address: No. 33, Daxueyuan Road, Donghu Development Zone, Wuhan, Hubei Province; Postcode: 430223; Email: 20022@wisdri.com).

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1 General provisions

1.0.1 This code is prepared to standardize the design, construction, installation, acceptance and test of the converter gas cleaning and recovery project, and to ensure safety, applicability, advanced technology, cost-effectiveness, energy-efficiency and environmental protection in the converter gas cleaning and recovery system.

1.0.2 This code is applicable to construction, expansion and renovation of the converter gas cleaning and recovery project.

1.0.3 The converter gas cleaning and recovery project shall actively employ new technologies, new processes, new equipment and new materials.

1.0.4 In addition to complying with the requirements in this code, converter gas cleaning and recovery system engineering shall also comply with the current relevant national standards.

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2 Terms

2.0.1 Calculated pressure

It is the maximum working pressure that may occur during normal operation, which is used to calculate the water seal height of the pipe or equipment, or to determine the pressure of strength test or airtight test. The maximum working pressure that the gas facility may reach during normal operation is the highest working pressure.

2.0.2 Dry de-dusting system

A gas cleaning system with water mist spray evaporation cooling and dry dedusting.

2.0.3 Wet de-dusting system

A gas cleaning system with spray water cooling and wet dedusting.

2.0.4 Evaporation cooler

A device that cools and cleans converter gas through complete evaporation of water mist, and performs rough dedusting.

2.0.5 Spray scrubber

A device that cools and saturates the converter gas through water spray cooling and performs rough dedusting.

2.0.6 Venturi tube

A device that cools or cleans converter gas in wet dedusting system, which is composed of a contraction section, a throat and an expansion section.

2.0.7 Annular gap throat

A device that performs fine dedusting through adjusting the gap of annular passage with the help of water spray device.

2.0.8 Pressure relief valve

A valve installed on dedusting equipment and pipe, which opens automatically when the defined pressure is exceeded and closes automatically after pressure relief.

2.0.9 Gas cooler

A device that directly cools down the converter gas by water spray.

2.0.10 Switch-over valve

A valve for recovery or relief of converter gas, which has two types: cup valve and 3-way valve.

2.0.11 Curtain appliance

A general term for the device(s) installed on gas pipe for reliable gas isolation, which prevents gas from leaking into the isolated area; it may be an independent or a combined device composed of a close valve or water-seal+curtain installation, etc.

2.0.12 Close valve

A general term for all kinds of valves that can open and close, but cannot cut off gas and be used as a curtain appliance alone, such as gate valve, butterfly valve, ball valve, shut-off valve and so on.

2.0.13 Curtain installation

A general term for cutoff installation, which has the function of gas cutoff, but there is a risk of gas

leakage during its cutting off and opening, or a defect in reliability of gas cutoff, thus it cannot be used alone as a curtain appliance, such as blank plate, goggle valve and water seal, etc.

2.0.14 Blank plate valve(goggle valve)

The blank plate valve(goggle valve) is glasses-like valve composed of a blank plate and a through-hole plate, etc. It includes goggle valve, gate valve, swing valve, etc. Its valve plate mechanism makes reciprocating or swinging motion for switching off or switching on.

2.0.15 V/U-shaped water seal

V or U shaped water seal formed through pipe bending for gas cutting off.

2.0.16 Water-seal drainer

Water-seal drainer can safely discharge mechanical water from the gas system while maintaining a certain water sealing level to avoid gas leaking from the system or prevent air from entering the gas system.

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3 Basic requirements

3.0.1 The outdoor equipment of the cleaning and recovery engineering should be placed in the upwind direction of minimum frequency wind direction throughout the year of main building, and maintain the fire separation from surrounding buildings/structures.

3.0.2 Facilities and buildings/structures not related to the gas cleaning system shall not be placed in the outdoor facilities area.

3.0.3 The dry dedusting system should be applied to the cleaning and recovery system.

3.0.4 The cleaning and recovery system shall be configured in conformity with the principle of "one converter—one exhaust fan—one flare stack".

3.0.5 The emission of flare stack of the cleaning and recovery system shall comply with the current national standard GB 28664 *Emission Standard of Air Pollutants for Steelmaking Industry*.

3.0.6 The calorific value of gas recovered per ton of liquid steel by the cleaning and recovery system should not be less than 586MJ.

3.0.7 Changeover valve should be provided for gas recovery and relief.

3.0.8 The fan of the cleaning and recovery system should be provided with speed control unit, and VVVF unit is preferred.

3.0.9 The construction and acceptance of the cleaning and recovery system shall comply with the current relevant standards of the nation GB 50235 *Code for Construction of Industrial Metallic Piping Engineering*, GB 50184 *Code for Acceptance of Construction Quality of Industrial Metallic Piping Engineering*, GB 50236 *Code for Construction of Field Equipment, Industrial Pipe Welding Engineering*, GB 50683 *Code for Acceptance of Field Equipment, Industrial Pipe Welding Construction Quality* and YB 4441 *Code for Construction and Acceptance of Dust Collection Project in Iron and Steel Enterprises*.

3.0.10 Pipe finish paint color shall meet the requirements of the current national standard GB 7231 *Basic Identification Colors and Code Indications and Safety Sign for Industrial Pipelines*.

4 Design of process system

4.1 General requirements

4.1.1 The cleaning and recovery system should be provided with micro differential pressure measuring device at converter mouth, and anti-clogging measures shall be taken.

4.1.2 The cleaning and recovery system shall be provided with continuous O₂ and CO₂ detector. When the O₂ content of the gas is higher than 2%, gas recovery shall be stopped.

4.1.3 The water seal of the cleaning and recovery system shall comply with the following requirements:

1 The effective height of water seal shall be at least 500mm higher than the calculated pressure value of gas pipe.

2 Heating and thermal insulation measures shall be taken for water seals placed outdoor in severe cold and cold areas.

4.1.4 Gas pipe and equipment drain pipe shall be provided with water seal.

4.1.5 The curtain appliance of gas pipe shall meet the requirements of the current professional standard AQ 2048 *Technical Code on Safety of Gas Curtain Appliance*, and shall also comply with the following requirements:

1 The parts subject to frequent maintenance shall be provided with curtain appliance.

2 Curtain appliance shall be provided between gas pipe and gas recovery header in each system.

3 Closed type blank plate valve and double gate water seal valve with water filled in valve chamber may be used as curtain appliance.

4 Open type blank plate valve should not be used alone. Instead, it shall be placed behind close valve.

4.1.6 Pressure relief device shall be installed at gas pipe and place of equipment prone to explosion.

4.1.7 Pressure relief valve should be used as pressure relief device.

4.1.8 The pressure relief opening of the pressure relief device shall not directly face door and window of building and shall be provided with warning sign.

4.1.9 Open type blank plate valve shall be installed outside of the steelmaking shop building.

4.1.10 Open type blank plate valve installed inside fan room shall be provided with ventilation facility.

4.2 Process

4.2.1 Overflow water seal or compensator shall be provided at the joint between converter waste heat boiler and the gas cleaning facility.

4.2.2 Access manhole and maintenance platform shall be provided for each layer of nozzles of the gas cleaning and cooling facility.

4.2.3 The design of fan room shall meet the following requirements:

1 The fire hazard shall be classified as category B and the fire rating shall be class 2.

2 The fan room should be provided with equipment handling and maintenance passage, which shall meet the handling requirement for biggest component.

3 The fan room shall be provided with emergency air exhaust with ventilation rate of at least 12 times/h.

4 The fan room shall be provided with fixed type CO monitoring and alarming device.

4.2.4 The design of flare stack shall comply with the following requirements:

1 The flare stack should be at least 60m high and 3m higher than surrounding buildings within 200m, with ignition device provided on the top.

2 The flare stack should be provided with a purging or ejector device, and back fire protection measures shall be taken.

3 The flare stack shall be provided with measuring hole, measuring platform and stairs, and power supply shall be provided at the measuring hole.

4.2.5 The wet dedusting system shall meet the following requirements:

1 The annular gap throat equipment should be used.

2 The three-way changeover valve shall be provided with bypass device.

3 The drainer of gas fan shall be provided separately.

4 Circulating water shall be used for dedusting and cooling.

5 The water drainage slope of horizontal pipe should not be less than 3‰, and drainer should be provided.

6 Centrifugal fan shall be used.

7 The load of equipment and pipe shall include the weight of emergency water.

8 The outlet of vent pipe and relief pipe of water seal drainer in main building shall be located outside the main building.

4.2.6 The dry dedusting system shall meet the following requirements:

1 The spray lance of evaporative cooler should be installed in the tail section of converter waste heat boiler.

2 The cup valve on the relief side shall be provided with opening adjustment function.

3 The dust conveying device shall be provided with emergency dust discharge outlet or standby dust discharge outlet.

4 U-type water seal overflow drainage should be used for gas cooler.

5 Nitrogen sealing should be provided for gas fan, electrostatic precipitator and dust conveying equipment.

6 The dust discharge outlet shall be provided with gas locking device to prevent gas from leaking.

7 Fluidizing device shall be provided for coarse dust bin and fine dust bin.

8 The air exhaust outlet of bag filter on top of coarse dust bin shall be connected to outside of building.

9 Pneumatic conveying of coarse dust should be adopted if truck transportation access is not available.

10 Manual and automatic shut-off valve shall be provided on water supply pipe of spray lance of evaporative cooler.

11 Axial fan should be used for gas fan.

4.3 Design parameters

4.3.1 Suppression combustion process shall be used for gas treatment of the cleaning and recovery

system and the combustion ratio should be 0.1.

4.3.2 The gas temperature at the exit of converter waste heat boiler shall not exceed 900°C.

4.3.3 The design gas flow rate at the annular gap throat should not be lower than 80m/s.

4.3.4 The average flow rate of spray scrubber should not exceed 6m/s.

4.3.5 The gas flow rate at inlet of elbow dehydrator should not exceed 12m/s.

4.3.6 The rated rotating speed of centrifugal fan of the wet dedusting system should not exceed 1500r/min.

4.3.7 The design temperature of gas input to gas holder shall not exceed 70°C.

4.3.8 The gas temperature at inlet of fan in dry dedusting system should not be higher than 150°C.

4.3.9 The gas temperature at inlet of electrostatic precipitator in dry dedusting system shall not be lower than the dew point. It should be higher than 80°C.

4.3.10 The flow rate of gas in electrostatic precipitator of dry dedusting system shall not exceed 1.2m/s.

4.3.11 Full pressure of the fan shall have a margin of 10%–15%, and shall comply with the current national standard GB 50019 *Design Code for Heating Ventilation and Air Conditioning of Industrial Buildings*.

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5 Equipment

5.1 General requirements

5.1.1 The equipment design and parameters of cleaning and recovery system shall be determined based on converter gas parameters through system heat balance and resistance calculation.

5.1.2 The diameters of nonstandard casing should comply with Table 5.1.2.

Table 5.1.2 Non-standard casing diameter

Nonstandard barrel diameter(mm)							
2600	2700	2800	2900	3000	3100	3200	3300
3400	3500	3600	3700	3800	3900	4000	4100
4200	4300	4400	4500	4600	4700	4800	4900
5000	5100	5200	5300	5400	5500	5600	5700
5800	5900	6000	-	-	-	-	-

Notes: 1 No limit will be applied to casing with diameter $DN\geq 6000$ and above.

2 No limit will be applied to renovation projects.

5.2 Non-standard equipment

5.2.1 Equipment design shall meet the following requirements:

1 The spray lance or nozzle in the cleaning equipment shall be reasonably arranged according to the gas flow rate distribution across the section and local dry-wet interface shall be avoided on inner wall of the equipment.

2 The casing of the cleaning equipment shall be marked with disassembly positions according to local installation conditions and actual handling conditions.

3 The cleaning equipment shall be made of materials resistant to high temperature, abrasion and corrosion.

4 Evaporative cooler shall use double-medium external mixing spray lance, and steam should be used as atomizing medium.

5 The lower dust conveying device of evaporative cooler shall be provided with emergency dust discharge outlet.

6 Dust load and dust dropping impact load shall be calculated for evaporative cooler.

7 Access door shall be provided at the bottom of elbow.

8 The gas cooler shall be provided with gas purging device, and the gas relief pipe shall be installed at the highest point.

9 Loads of dust and water accumulated at the lower part of spray scrubber caused by failure of water drainage shall be calculated.

10 Drain pipe and overflow pipe shall be provided at the lower part of spray scrubber.

11 Hollow water spray nozzle with big diameter shall be used for spray scrubber and venturi.

12 The inner wall of venturi should be smooth without pressure and temperature measuring holes provided.

5.2.2 Equipment manufacture shall meet the following requirements:

1 Materials, machining, welding, NDT and test of non-standard equipment shall comply with the current professional standard NB/T 47003.1 *Steel Welded Atmospheric Pressure Vessels*.

2 Trimming, burr and rust scale on inner wall of venturi throat shall be cleared.

3 The manhole and connecting pipe of the casing of the cleaning equipment shall be ground after welding, and their inner walls shall be smooth.

5.2.3 Equipment assembly should meet the following requirements:

1 Before casing assembling, casing plates and parts shall be examined according to design drawings with respect to the following:

1) The outline dimensions and opening size of the casing plates.

2) Specifications, dimensions and quantity of parts.

2 During casing assembly, four longitudinal assembly lines at 90° intervals and reference circle should be marked on the inner and outer walls of the casing. The verticality deviation of every 1m long casing should not be more than 1/1000, and total deviation should not be more than 10mm.

3 Allowable deviation of cleaning equipment assembly shall comply with the following requirements:

1) The allowable deviation of centerline, elevation and verticality (levelness) of nozzles at each section of the cleaning equipment shall be $\pm 1\%$ of the inside diameter of corresponding section, and shall not exceed 5mm.

2) The concentricity deviation between the counter weight of annular gap venturi and the throat shall not exceed 1mm.

3) The concentricity deviation between the venturi throat and the diffuser shall not exceed 3mm, and the levelness deviation shall not be more than 1‰.

4) The deviation of centerline, elevation and verticality between diffuser and reducer of venturi shall not exceed 5mm.

5) The allowable deviation of center elevation between equipment opening and radial connecting pipe shall be ± 5 mm. The allowable deviation of manhole shall be ± 5 mm.

4 The equipment casing assembly and welding shall meet the relevant provisions of the current national standard GB 50236 *Code for Construction of Field Equipment, Industrial Pipe Welding Engineering* in addition to the design requirements.

5 The weld quality shall meet the requirements of design drawings. When no design requirements are available, the weld quality shall conform to the relevant provisions of the current national standard GB 50236 *Code for Construction of Field Equipment, Industrial Pipe Welding Engineering*.

6 Metal-clad gasket, wound gasket or non-metal gasket should be used between equipment flanges; asbestos products must not be used. Gasket must not extend beyond the inner wall.

5.2.4 Equipment painting shall comply with the following requirements:

1 The inner and outer surfaces of equipment shall undergo derusting, the derusting class shall not be lower than St2, and antirust coating shall be applied after derusting.

2 Antirust coating and painting shall comply with the requirements of the design documents, and the technical conditions shall comply with the current national standards GB/T 8923.1, GB/T 8923.2 and GB/T 8923.3 *Preparation of Steel Substrates Before Application of Paints and Related Products-Visual Assessment of Surface Cleanliness*.

3 The weld seam of site welding shall not be painted within the range of 50mm wide, and the derusting and touch-up painting shall be carried out after successful leakage test.

4 After painting, signs, marks and numbers of the members shall be clear and complete.

5.3 General equipment

5.3.1 High temperature non-metallic compensator shall be selected in accordance with the following requirements:

1 The compensator shall be capable of absorbing the thermal displacement of waste heat boiler, evaporative cooler and spray scrubber.

2 Guide tube made of high temperature resistant stainless steel shall be provided in the compensator.

3 The compensator shall be tightly sealed without leakage.

4 In case of large size, the compensator can be made into split type and assembled on site.

5.3.2 Electrostatic precipitators shall be selected in accordance with the following requirements:

1 The bell mouth at inlet and outlet of electrostatic precipitator shall be provided with pressure relief valve.

2 The electrostatic precipitator shall be of cylindrical type and 4-electric field type.

3 The loading capacity of the casing of electrostatic precipitator shall not be less than 0.3MPa.

4 Anti-condensation thermal insulation measures shall be taken for electrostatic precipitator.

5 Electrostatic precipitator shall meet the requirements of the current professional standard JB/T 11312 *Cylindrical Electrostatic Precipitator for Converter Flue Gas Dry Cleaning*.

5.3.3 The converter gas fan shall be selected in accordance with the following requirements:

1 The capacity of the fan shall be capable of exhausting converter gas of maximum flow.

2 Fan impeller and casing shall be wear-resistant and corrosion-resistant.

3 The fan of dry dedusting system shall be capable of resisting deformation due to temperature difference, the highest temperature is 250°C, and the minimum temperature shall be determined according to the local winter ventilation temperature.

4 The fan of wet dedusting system should be provided with an impeller flushing device.

5.3.4 The changeover valve of dry dedusting system shall be selected in accordance the following requirements:

1 Cup valve should be used for the changeover valve.

2 Cup valve shall be driven by hydraulic system. The hydraulic cylinder of cup valve shall be provided with upper and lower position bidirectional buffer device. The normal opening and closing time of cup valve shall not exceed 10s.

3 Cup valve shall be provided with three operation conditions, i. e. normal relief condition, rapid relief operation and emergency relief condition.

4 Relief cup valve shall have valve position continuous adjustment function.

5 Metal hard sealing should be used for cup valve.

6 In case of emergency, the recovery cup valve shall be closed automatically and the relief cup valve shall be opened automatically.

5.3.5 The changeover valve of wet dedusting system shall be selected in accordance the following requirements:

- 1 Three-way changeover valve should be used.
 - 2 Three-way changeover valve should be driven pneumatically, and the normal opening and closing time shall not exceed 15s.
 - 3 Metal hard sealing should be used for the three-way changeover valve, and the sealing surface shall be provided with water flushing device.
- 5.3.6** The water seal check valve should be of trough rotation type.

5.4 Auxiliary equipment

5.4.1 The auxiliary equipment of the gas cleaning system shall include gas pressure relief device, negative pressure water seal drainer, positive pressure water seal drainer and pipe compensator, etc.

5.4.2 The water drainage of the gas cleaning equipment and pipe before gas fan shall be conducted through the negative pressure water seal drainer, while the water drainage of the gas cleaning equipment and pipe after gas fan shall be conducted through the positive pressure water seal drainer.

5.4.3 Besides the current national standard GB 50270 *Code for Construction and Acceptance of Conveyor Equipment Installation Engineering*, chain type dust conveyor shall be in accordance with the following requirements:

- 1 The chain type dust conveyor body shall adopt enclosed design and be filled with nitrogen for protection.
- 2 The joint between the electrostatic precipitator casing and the bottom dust conveyor shall be sealed through welding.
- 3 The tensioning device shall be installed at the tail of dust conveyor.
- 4 The drive unit at the head of dust conveyor shall be provided with overload protection, and the tail of dust conveyor shall be provided with chain break indication.
- 5 The allowable deviation of inclined angle between the center line of chain and the center line of sprocket is $\pm 3^\circ$.
- 6 The operation shall be smooth and free of noise.

5.4.4 Gas pipe compensators shall comply with the following requirements:

- 1 Metal bellows compensator shall be used.
- 2 Guide tube (draft tube) shall be provided in the compensator, and dustproof device shall be provided at the opening of guide tube.

6 Technological pipeline

6.1 General requirements

- 6.1.1** Gas pipe shall be made of carbon steel or low alloy steel. Welded pipe should be used as gas pipe.
- 6.1.2** Gas pipe shall be laid overhead instead of underground.
- 6.1.3** Gas pipe welding shall comply with the following requirements:
- 1** Butt welding should be used for gas pipe.
 - 2** Welding, flanged connection or threaded connection may be used for pipe connection with equipment and accessories. Accessories that are not frequently replaced should be welded.
 - 3** Pipe with nominal diameter not less than 800mm shall be welded on both sides, while pipe with nominal diameter less than 800mm may be welded on one side.
- 6.1.4** Bending diameter of round gas pipe should be 1.5 times pipe diameter.
- 6.1.5** The fixing points of other pipes sharing supports with gas pipe should be located at fixed support of gas pipe.
- 6.1.6** The distance from the vertical weld seam of gas pipe to the edge of pedestal shall not be less than 300mm, and the horizontal weld seam shall be located over the pedestal.
- 6.1.7** Natural compensation should be used for gas pipe. When natural compensation cannot be met the requirements, compensator shall be used.
- 6.1.8** Gas relief pipe shall be separately provided and comply with the relevant provisions of the current national standard GB 6222 *Safety Code for Gas of Industrial Enterprises*. It is not allowed to interconnect two or more gas relief pipes.
- 6.1.9** When the gas main with condensate precipitating is laid without slope, the spacing of adjacent drainers should not exceed 80m, and drainer shall be provided at the lowest point of gas pipe laid with slope.
- 6.1.10** Gas pipe with nominal diameter larger than or equal to 1400mm shall be provided with stiffeners.
- 6.1.11** Other pipe brackets laid above gas pipe shall be welded to stiffener or curved base plate.
- 6.1.12** Operating platform shall be provided for valve, access hole, sampling port, purging port and metering device, etc. of elevated gas pipe.

6.2 Pipe arrangement

- 6.2.1** Gas pipe shall not be laid above fuel and timber warehouse or on building having nothing to do with gas and shall not be laid below the power transmission line in parallel.
- 6.2.2** In case gas pipe is close to high temperature heat source or vehicle with hot objects parking under gas pipe, thermal insulation measures shall be taken for gas pipe.
- 6.2.3** Crossing between gas pipe and railway/road shall be reduced. When crossing cannot be avoided, the angle of intersection should not be less than 45°. In case of multiple pipes, they should cross railway/road in a centralized way.
- 6.2.4** When gas pipe is in parallel with other pipes, the supports should be shared. In case of support

sharing, the following rules shall be followed:

1 When gas pipe is laid on the same support or trestle stand with water pipe, thermal power pipe, fuel oil pipe and non-combustible gas pipe, the net vertical clearance should not be lower than 250mm.

2 Minimum horizontal clear distance between gas pipe and other pipes laid on the same support in parallel should meet the requirements of Table 6.2.4.

Table 6.2.4 Minimum horizontal clear distance between gas pipe and other pipes laid on the same support in parallel

Min. clear distance(mm)		Designation	Gas pipe DN(mm)		
			<300	300-600	>600
Designation		<300	100	150	150
Other pipes DN(mm)		300-600	150	150	200
		>600	150	200	300

3 Gas pipe shall be laid above when sharing supports with pipe conveying corrosive medium. For equipment prone to gas leakage, oil leakage and corrosive liquid leakage such as flange and valve, etc., protective measures shall be taken for gas pipe.

4 When gas pipe shares supports with oxygen pipe and acetylene pipe, current national standards GB 16912 *Safety Technical Regulation for Oxygen and Relative Gases Produced with Cryogenic Method* and GB 50031 *Code for Design of Acetylene Stations* shall be followed.

5 Oil pipe and oxygen pipe should be laid on different side of gas pipe.

6 The operating devices of other pipes laid along with gas pipe shall avoid positions prone to gas leakage, such as gas pipe flange, blind plate and blind plate valve, etc.

6.2.5 Minimum horizontal clear distance between elevated gas pipe and building(structure)/railway/road in case of parallel arrangement and minimum vertical clear distance between them in case of crossing arrangement shall meet the requirements of the current national standard GB 6222 *Safety Code for Gas of Industrial Enterprises*.

6.2.6 The relevant design requirements for gas pipe across river shall meet the requirements of the current national standard GB 50028 *Code for Design of City Gas Engineering*.

6.3 Process parameters of pipe

6.3.1 The calculated pressure of gas pipe shall comply with the following requirements:

1 The absolute value of maximum negative pressure generated by the fan shall be taken as the calculated pressure of gas pipe before the fan.

2 Maximum pressure at the outlet of fan shall be taken as the calculated pressure of gas pipe after the fan outlet.

6.3.2 The allowable stress of steel sheet for producing pipe, seamless steel pipe or welded pipe shall meet the requirements of current national standard GB 50316 *Design Code for Industrial Metallic Piping*.

6.3.3 The design flow rate of medium in gas pipe should not be less than 18m/s.

6.4 Auxiliary facilities of pipe

6.4.1 Gas valve shall comply with the following requirements:

1 Shut-off valve should not be used as gas valve. Metal hard sealing eccentric butterfly valve

should be used for gas valve with nominal diameter larger than or equal to $DN500$. Gate valve should be used for gas valve with nominal diameter less than $DN500$.

2 The protection level and explosion protection grade of valve shall be determined according to the characteristics of the area in which the valve is located.

3 The valve body should be made of carbon steel or alloy steel, and should be in design of weldment or casting.

4 Metallic sealing butterfly valve shall comply with the relevant provisions of the current professional standard JB/T 8527 *Metallic Sealing Butterfly Valve*. The sealing test shall comply with relevant provisions of the current national standard GB/T 13927 *Industrial Valves-Pressure Testing*, and it is deemed as qualified when class B or above is reached.

5 Blind plate valve should comply with the relevant provisions of the current national standard GB/T 24917 *Glasses Valve*. The sealing test shall comply with relevant provisions of the current national standard GB/T 13927 *Industrial Valves-Pressure Testing*, and it is deemed as qualified when zero leakage is reached.

6 For closed type blind plate valve, blowdown outlet shall be provided at the bottom, relief outlet shall be provided on the top, access hole and purging hole shall be provided in the body.

7 The specification, type and dimensions of the valve flange shall meet the requirements of the current national standard GB/T 9124 *Specification for Steel Pipe Flanges*.

8 Unidirectional sealing valve shall be installed in such a way that the pressure bearing sealing side is consistent with the pressure bearing direction during maintenance of pipe system.

9 Blind plate valves should be opened without back pressure.

10 The valve body should be marked with striking arrow indicating medium flowing direction or "high pressure side" and "low pressure side".

6.4.2 Water seal type automatic drainer shall be used for water drainage or condensate removal of gas pipe. The drainer should be of leakage protection type. The drainer arrangement shall meet the following requirements:

1 Drainer shall be separately provided on both sides of curtain appliance of the same gas pipe.

2 The drain pipes on the top of the two or more drainers shall not be interconnected.

6.4.3 The design of gas pipe compensator shall comply with the provisions of Article 6.1.7 of this code.

6.4.4 Gas pipe compensator installation shall comply with the following requirements:

1 Gas pipe compensator shall be installed in the gas flowing direction as indicated by arrow.

2 After installation and pressure test, the bolts for protecting the compensator during transportation shall be removed.

6.4.5 Manhole shall be provided at positions for maintenance and positions prone to dust deposit, and the spacing of manholes should not exceed 80m.

6.4.6 Gas pipe shall be provided with purging port and sampling pipe. Sampling pipe shall be provided before the valve of gas relief pipe, and purging port may be provided on the cover of access hole. Valve shall be provided on the connector of purging and sampling pipe.

6.4.7 Connector of steam or nitrogen pipe shall be installed on the top or side of gas pipe, and plug valve or gate valve shall be installed on the pipe connector.

6.4.8 Gas pipe shall be provided with sign indicating gas flowing direction and medium designation.

6.5 Pipe inspection and pressure test

6.5.1 Before pressure test, gas pipe shall undergo nondestructive test. Radiographic test should be used.

6.5.2 Nondestructive test of weld seam of gas pipe shall comply with design requirements. When design requirements are not available, the proportion of radiographic test shall not be less than 5%, and the weld quality shall not be lower than class III.

6.5.3 Gas pressure test shall be used for gas tightness inspection of gas pipe. Test medium shall be air or nitrogen.

6.5.4 Before the pressure test, the foreign matter and water in the gas pipe shall be removed, and the manhole or hand hole shall be closed. The valves on relief pipe, sampling pipe and purging port shall be closed. The two ends of pressure test pipe shall be sealed by blind plate.

6.5.5 Before the pressure test, the gas pipe shall not be painted and insulated.

6.5.6 Pressure test may be applied to gas pipe accessories and gas pipe together. When pressure test is applied to compensator and gas pipe together, protective measures shall be taken. When it is difficult to make pressure test for gas pipe accessories and gas pipe jointly, pressure test can be made separately according to the requirements of technical appendices.

6.5.7 Gas pipe may not be tested for strength, only tightness test is required. The test requirements shall meet the requirements of the current national standard GB 6222 *Safety Code for Gas of Industrial Enterprises*.

6.5.8 After successful pressure test, gas pipe shall be purged, and air or nitrogen should be used for purging. Gas pipe with nominal diameter larger than or equal to 600mm can be manually cleaned before purging, while gas pipe with nominal diameter less than 600mm can be directly purged.

6.6 Pipe surface treatment and coating

6.6.1 Blasting process should be used for derusting of gas pipe surface. For positions where blasting process is inappropriate, manual or power tool may be used instead. When blasting process is used for derusting, the derusting grade shall not be lower than Sa2. When manual or power tool is used for derusting, the derusting grade shall not be lower than St2.

6.6.2 The painting of gas pipe surface shall comply with the following requirements:

1 Gas pipe shall undergo anti-corrosion treatment: gas pipe painting shall be composed of primer, intermediate paint and finish paint. Single type of paint must not be used as protective coating.

2 As for anti-corrosion treatment of gas pipe, the type of paint, the course of painting and the thickness of dry film should be determined according to the parameters of gas medium and surrounding atmospheric environment, etc. The requirements for painting shall comply with the current national standard GB 50726 *Code for Anticorrosive Engineering Construction of Industrial Equipment and Pipeline* and the relevant provisions of GB 50727 *Code for Acceptance of Construction Quality of Anticorrosive Engineering of Industrial Equipment and Pipeline*.

3 For gas pipe with nominal diameter less than 800mm, anticorrosion treatment is only required for the outer wall. After the gas pipe is manufactured, primer and intermediate paint shall be applied. After the gas pipe is installed, finish paint shall be applied. For gas pipe with nominal diameter more than or equal to 800mm, anticorrosion treatment is required for both inner wall and outer wall. After the

gas pipe is manufactured, primer and intermediate paint shall be applied for the outer wall, and primer may be applied only for the inner wall. After the gas pipe is installed, finish paint shall be applied for the outer wall.

- 4 Anticorrosion painting of gas pipe shall comply with the provisions of design documents.

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7 Auxiliary facilities

7.1 General requirements

7.1.1 Auxiliary facilities shall be designed to meet the requirements of safety, reliability, stability and energy saving.

7.1.2 New electrical, instrumentation and control system should be provided according to the requirements of EIC integration. Parameter measuring and equipment monitoring should be included in the control system.

7.1.3 The control system shall make measuring, operation, monitoring, alarming and management of the parameters of process equipment in the whole system, and shall communicate with the main process system of the converter and the control system of gas holder.

7.1.4 The system should be provided with separate main control room. The main control room should be placed outside explosion hazard area and close to the load center.

7.1.5 The heating, ventilation and air conditioning design of the buildings (structures) shall meet the requirements of the current national standards GBZ 1 *Hygienic Standard for the Design of Industrial Enterprise* and GB 50019 *Design Code for Heating Ventilation and Air Conditioning of Industrial Buildings*.

7.2 Electrical and lightning protection earthing

7.2.1 The power supply of the cleaning and recovery system shall meet the requirements of the current national standard GB 50052 *Code for Design of Electric Power Supply Systems*.

7.2.2 The electrical design shall meet the requirements of the current national standards GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres* and GB 50217 *Code for Design of Cables of Electric Engineering*.

7.2.3 Process equipment should be provided with central control mode and local control mode.

7.2.4 Buildings (structures), equipment and pipes shall be provided with lightning protection facilities, and shall meet the requirements of the current national standard GB 50057 *Code for Design of Lightning Protection of Buildings*.

7.2.5 Electrical, instrumentation and automation devices, facilities, gas pipes, cables and cable trays shall be provided with anti-static and lightning protection grounding devices. The grounding shall comply with the current national standards GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres* and GB/T 50065 *Code for Design of AC Electrical Installations Earthing*.

7.2.6 Platform on each layer of the dedusting facilities shall be provided with normal lighting. In addition to the normal lighting, the control room and the power distribution room shall be provided with emergency lighting.

7.2.7 The setting of the flare stack aviation obstacle light shall meet the requirements of the current national standard GB 50034 *Standard for Lighting Design of Buildings*.

7.2.8 The electrostatic precipitator must be provided with reliable grounding device with at least two grounding points.

7.2.9 The grounding of buildings(structures) ,equipment and pipes shall meet the requirements of the current national standards GB 50057 *Code for Design of Lighting Protection of Buildings* and GB/T 50065 *Code for Design of AC Electrical Installations Earthing*.

7.3 Automatic monitoring and control

7.3.1 Automatic monitoring and control shall be in accordance with the following requirements:

1 The accuracy level of instruments shall meet the requirements of the current national standard GB/T 13283 *Accuracy Class of Measuring Instruments and Display Instruments for Industrial Process Measuring and Control*.

2 The anti-explosion,protection,safety and hygiene of the instruments shall meet the requirements of the current national standards GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres* and GB 12476 *Electrical Apparatus for Use in the Presence of Combustible Dust*.

3 The instrument air source shall comply with the relevant provisions of the current national standard GB 4830 *Industrial Process Measurement and Control Instruments-Pressure Range and Quality of Air Supply*.

7.3.2 The measuring and control items of the dry dedusting system shall meet the following requirements:

1 Micro differential pressure measuring should be provided at the mouth of converter.

2 The measuring and control items of evaporative cooler shall include inlet and outlet gas temperature measuring,pressure and flow measuring of jet cooling water,jet steam or jet nitrogen, flow adjustment of shut-off control valve and cooling water.

3 Coarse dust bin and fine dust bin shall be provided with temperature measuring and dust level or weight measuring. Pressure measuring and shut off shall be provided for nitrogen used for dust bin, and pressure adjustment may be provided.

4 The measuring and control items of electric precipitator shall include inlet and outlet fume temperature measuring, export flume flow measuring, export fume pressure measuring, insulator incubator temperature measuring and pressure relief valve opening and closing measuring.

5 Gas fan and motor shall be provided with bearing and motor winding temperature measuring, fan bearing vibration measuring and rotating speed measuring, and fume at fan inlet and outlet shall be provided with differential pressure measuring.

6 The gas before changeover valve shall be provided with CO and O₂ content measuring and the differential pressure measuring shall be provided before and after the cup valve on recovery side.

7 Ignition gas source of the flare stack shall be provided with pressure measuring, adjustment, on-off control and ignition control, and flare stack ejection nitrogen shall be provided with pressure measuring and on-off control.

8 The measuring and control items of gas cooler shall include inlet and outlet gas pressure measuring, outlet gas temperature measuring, water spray pressure, water flow measuring, water level measuring and control.

7.3.3 The measuring and control items of wet dedusting system shall meet the following requirements:

1 Micro differential pressure measuring should be provided at the mouth of converter.

2 Venturi tube shall be provided with inlet and outlet fume temperature and differential pressure

measuring.

3 The direct water supply should be provided with temperature, pressure and flow measuring.

4 The dehydrator should be provided with fume temperature, differential pressure and outlet pressure measuring.

5 Pressure and flow measuring and pressure adjustment should be provided for nitrogen and cooling water.

6 Flushing water should be provided with automatic control.

7.3.4 The control system shall comply with the following requirements:

1 The basic level control system shall be based on the integration of electrical control and instrument control. It shall meet the requirements of safety, reliability, advancedness, maintainability, expandability, compatibility and openness, etc.

2 Interface shall be reserved in the basic level control system for communication with the upper level control system.

3 At least 10% spare points shall be reserved for I/O module and channel configuration.

4 Industrial control computer should be used at the operator station of the control system.

5 Safety isolation measures shall be taken when the modules of control system are connected with field equipment in the explosion-proof area.

6 Uninterruptible power supply(UPS) shall be used for power supply of control system, of which the backup time should not be less than 30 minutes.

7.4 Fire fighting and communication

7.4.1 The fire separation distance between neighboring buildings (structures) shall meet the requirements of the current national standard GB 50016 *Code for Fire Protection Design of Buildings*.

7.4.2 Fan room and gas cleaning and recovery equipment platform shall be provided with fixed CO measuring and alarming device with on-site audible and visual alarm unit.

7.4.3 The automatic fire alarm system of electrical room, operation room and cable room shall meet the requirements of the current national standards GB 50116 *Code for Design of Automatic Fire Alarm System* and GB 50414 *Code of Design on Fire Protection and Prevention of Iron and Steel Metallurgical Enterprises*.

7.4.4 Operation room or duty room shall be provided with dial telephone, which can directly contact with the converter main control room, the gas holder operation room and the scheduling room.

7.5 Water supply and drainage

7.5.1 The design of water supply and drainage system shall meet the requirements of the current national standard GB 50721 *Code for Design of Water Supply and Drainage of Iron and Steel Enterprises*.

7.5.2 The direct water tank of dry dedusting system shall be provided with gas exhaust facility.

7.5.3 Flushing of the fan in wet dedusting system should be made by industrial water in the plant area, and the drain water should not be discharged into the direct water system.

7.5.4 The pH value of direct water supply should be 7-9, and the suspended solids should not be higher than 100mg/L.

7.6 Heating and ventilation

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

7.6.2 The fan room shall be provided with mechanical emergency ventilation system. The ventilator shall be of explosion-proof type and ventilation rate shall not be less than 12 times/h.

7.6.3 High temperature radiant heating shall not be used for fan room.

7.6.4 Electrical room and operation room should be naturally ventilated. When natural ventilation cannot meet the requirements, mechanical ventilation or air conditioning shall be used for room temperature adjustment.

7.6.5 Explosion-proof type mechanical ventilation facilities should be provided for the closed return water tank of gas cooler.

7.7 Building and structure

7.7.1 Buildings(structures)shall meet the following requirements:

1 The design of electrical room, operation room and fan room, etc. shall comply with relevant provisions of the current national standards GB 50010 *Code for Design of Concrete Structures*, GB 50017 *Code for Design of Steel Structures*, GB 50011 *Code for Seismic Design of Buildings* and GB 50191 *Code for Design of Earthquake-Resistant of Structural Constructions*.

2 The load of buildings(structures) shall meet the requirements of the current national standard GB 50009 *Load Code for the Design of Building Structures*.

3 The fire hazard classification and fire resistance rating of the buildings(structures), such as electric room and fan room, shall meet the requirements of the current national standards GB 50016 *Code for Fire Protection Design of Buildings* and GB 50414 *Code of Design on Fire Protection and Prevention of Iron and Steel Metallurgy Enterprises*.

7.7.2 The design of pipe support shall meet the requirements of the current national standard GB 50709 *Code for Design of Pipe Supports in Iron and Steel Enterprises*.

8 Test run

8.1 General requirements

8.1.1 Test includes individual test and no load combined test.

8.1.2 After the equipment and pipes are installed, the construction contractor shall submit the individual test plan, which will be executed after confirmation by the supervision company (or the employer).

8.1.3 Warning tape shall be provided in the test area.

8.1.4 The following requirements shall be met before the test:

- 1 The supply of energy media shall be secured.
- 2 Electrical and instrumentation equipment shall be capable of sending and receiving signals in a normal way.
- 3 Drive mechanism and lubricating point shall be filled with lubrication grease as required.
- 4 The safety protection devices of equipment shall comply with the design conditions and the grounding device shall be in good condition.
- 5 Pipes and equipment shall be cleaned up.

8.1.5 The cleaning and recovery system shall undergo check and maintenance after operation.

8.2 Test run

8.2.1 The test of the wet dedusting system shall meet the following requirements:

- 1 The dehydrator shall be capable of smooth water drainage, and the water drainage flume (tube) must be free from blockage and overflow.
- 2 The adjustment mechanism shall be capable of flexible running without noise, and the lifting mechanisms shall be capable of smooth lifting and lowering.
- 3 The overflow device shall be capable of even water overflow.
- 4 The water spray device shall be characterized by smooth pipe, even water flow and good water atomization.

8.2.2 The test of fan and motor shall comply with the following requirements:

- 1 Foreign matter in equipment and pipe shall be cleared.
- 2 The cooling water system and lubricating oil system shall be in normal operation.
- 3 The motor shall undergo separate no load test for at least two hours continuously, and the running direction is consistent with that of the fan.

8.2.3 The test of the gas recovery and relief equipment shall comply with the following requirements:

- 1 The valve shall be capable of flexible operation, and valve opening and closing can be completed within the defined time.
- 2 The water seal check valve shall have an overflow, which shall be adjusted to an appropriate value.
- 3 The water seal height of V type and U type water seal in the closed state shall meet the requirements.
- 4 The water seal height of drainer shall meet the requirements.

- 5 Hydraulic pipe shall undergo flushing, medium filtering and pressure test.
 - 6 The filtering accuracy of hydraulic oil shall not be lower than grade 7, and hydraulic pipe shall have no leakage at 1.5 times working pressure.
 - 7 The cup valve of dry dedusting system shall be capable of flexible switching between recovery condition and relief condition.
- 8.2.4** For test of equipment in continuous operation, the continuous test time shall not be less than two hours. For test of equipment in reciprocating operation, the reciprocating motions shall not be less than 5 times. The equipment shall be free of blockage and noise during test.
- 8.2.5** The test of evaporative cooler shall meet the following requirements:
- 1 When the spray boom sprays water, the water at the bottom of evaporative cooler shall be drained in time.
 - 2 Before the spray lance sprays nitrogen, the gas fan shall be started.
- 8.2.6** The water seal of gas cooler shall be characterized by normal water make-up and smooth water drainage.
- 8.2.7** The test of dust conveying facility shall comply with the following requirements:
- 1 The tightness of chain of dust conveying facility shall be checked, and dust conveying facility shall have no obvious scraping.
 - 2 Gate valve, double-layer flap valve and star-type dust valve shall be capable of flexible operation.
 - 3 The fluidizing device on dust silo shall be capable of normal operation.
 - 4 The pipes of pneumatic conveying system shall be smooth and free of leakage.
- 8.2.8** The test of electrostatic precipitator shall comply with the following requirements:
- 1 The cathode line and anode plate rapping device shall be free of noise during turning, and the rapping shall be normal.
 - 2 The pipe circuit of grease lubrication system shall be smooth and free of leakage.
 - 3 The valve surface of pressure relief valve shall be tightly sealed.
 - 4 High voltage power supply shall be started as per the procedures, and the voltage and current of each electric field shall be stable and normal.
- 8.2.9** The test of hydraulic system shall comply with the following requirements:
- 1 Oil level and pressure shall be normal.
 - 2 The pipes shall be free of leakage.
 - 3 The accumulator shall be capable of normal operation.
- 8.2.10** The test of flare stack shall comply with the following requirements:
- 1 The ignition control cabinet shall be capable of normal operation.
 - 2 The purging or ejector shall be capable of normal operation.
- 8.2.11** The pressure in pipe during purging shall not exceed the pipe design pressure.
- 8.2.12** After individual test of equipment is completed, the system shall undergo no load combined test.
- 8.2.13** The combined test shall comply with the following requirements:
- 1 The hydraulic, pneumatic, lubrication, water, electrical, communication, measuring instruments and appliances shall have been examined before combined test.
 - 2 The connections, curtain appliances and manholes shall be well sealed.
 - 3 After the combined test, complete combined test information shall be provided.

9 Safety and environmental protection

9.1 General requirements

9.1.1 The design of the cleaning and recovery system shall adopt new technologies, new processes, new equipment and new materials that are conducive to safety protection and environmental protection. For harmful factors such as dust, toxic gases, noise and high temperature, comprehensive control and treatment measures shall be taken.

9.1.2 Safety and environmental protection system shall be designed, constructed and commissioned in parallel with the cleaning and recovery system.

9.1.3 The location of the cleaning and recovery system shall be determined through comprehensive analysis according to the requirements of environmental protection, the danger situation of harmful factors, the overall planning as well as hydrological, geological and meteorological factors, etc.

9.2 Safety

9.2.1 Safety protection shall be in accordance with the following requirements:

1 The general layout and fire separation distance of outdoor cleaning facilities shall meet the requirements of the current national standards GB 6222 *Safety Code for Gas of Industrial Enterprises* and GB 50414 *Code for Design on Fire Protection and Prevention of Iron and Steel Metallurgy Enterprises*.

2 The area where people often stay around shall be provided with fixed CO detection and alarm device.

3 The design of the gas detection and alarm device shall meet the requirements of the current national standard GB 50493 *Specification for the Design of Combustible Gas and Toxic Gas Detection and Alarm for Petrochemical Industry*.

4 The steam or nitrogen maintenance purging pipe connected with gas pipe shall be disconnected or blocked with blind plate when not in use.

5 The pressure relief valve setting and casing grounding of electrostatic precipitator shall meet the requirements of Articles 5.3.2 and 7.2.8 of this code.

6 Nitrogen sealing of other equipment shall meet the requirements of Article 4.2.6 of this code.

9.2.2 The safety protection of fan room shall meet the following requirements:

1 The general layout of fan room shall meet the requirements of Article 3.0.2 of this code.

2 The fan room shall be provided with pressure relief facilities, which shall meet the requirements of the current national standard GB 50016 *Code for Fire Protection Design of Buildings*.

3 The selection of electrical equipment in the fan room area, cable type selection and cable laying shall meet the requirements of the current national standard GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres*.

9.2.3 Gas pipe safety protection shall be in accordance with the following requirements:

1 The gas pipe arrangement shall meet the requirements of Section 6.2 of this code.

2 The safety measures for gas pipes and auxiliary equipment shall meet the requirements of the

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

3 The water supply pipe of V-shaped water seal for gas pipe shall be provided with U-shaped water seal and check valve.

4 Warning signs shall be placed on the gas pipe at places where there may be gas leakage.

9.2.4 Platform and railing shall be provided at places where frequent manual operation is required, including manhole, valve, instrument, etc.

9.3 Environmental protection

9.3.1 Pollution control facilities for the construction project shall be designed, constructed and commissioned in parallel with the major project.

9.3.2 The project shall adhere to the principles of clean production and recovery economy. Materials and fuels with no or low harm and toxicity shall be used, and new processes, new technologies and new equipment which are feasible in technology, reasonable in economy, have no or less pollution and use no water or less water shall be used.

9.3.3 The general layout and the type selection of process equipment and auxiliary equipment shall meet the requirements of the current national standard GB 50406 *Code for Design of Environmental Protection of Iron and Steel Industry*.

9.3.4 The emission of pollutants such as particles, NO_x and SO_x, etc., in waste gas during non-recovery period shall meet the requirements of the current national standard GB 28664 *Emission Standard of Air Pollutants for Steelmaking Industry*.

9.3.5 The concentration of pollutants in the wastewater discharged from equipment and pipes of the system shall meet the requirements of the current national standard GB 13456 *Discharge Standard of Water Pollutants for Iron and Steel Industry*.

9.3.6 Noise reduction measures shall be taken for gas fan, which shall meet the requirements of the current national standard GB/T 50087 *Code for Noise Control Design of Industrial Enterprises*.

9.3.7 The ambient noise limit value at boundary of the plant shall meet the requirements of the current national standard GB 12348 *Emission Standard for Industrial Enterprises Noise at Boundary*.

9.3.8 The dust collected by the cleaning equipment shall be comprehensively utilized, and no secondary dust nuisance is allowed during transportation.

9.3.9 The storage and disposal of solid waste shall meet the requirements of the current national standard GB 18599 *Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes*.

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 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 50031 *Code for Design of Acetylene Stations*
- GB 50034 *Standard for Lighting Design of Buildings*
- GB 50052 *Code for Design of Electric Power Supply Systems*
- GB 50057 *Code for Design of Lightning Protection of Buildings*
- GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres*
- GB/T 50065 *Code for Design of AC Electrical Installations Earthing*
- GBJ 87 *Specifications for the Design of Noise Control System in Industrial Enterprises*
- GB 50116 *Code for Design of Automatic Fire Alarm System*
- GB 50217 *Code for Design of Cables of Electric Engineering*
- GB 50184 *Code for Acceptance of Construction Quality of Industrial Metallic Piping Engineering*
- GB 50235 *Code for Construction of Industrial Metallic Piping Engineering*
- GB 50236 *Code for Construction of Field Equipment, Industrial Pipe Welding Engineering*
- GB 50270 *Code for Construction and Acceptance of Conveyor Equipment Installation Engineering*
- GB 50316 *Design Code for Industrial Metallic Piping*
- GB 50406 *Code for Design of Environmental Protection of Iron and Steel Industry*
- GB 50414 *Code of Design on Fire Protection and Prevention of Iron and Steel Metallurgy Enterprises*
- GB 50493 *Specification for the Design of Combustible Gas and Toxic Gas Detection and Alarm for Petrochemical Industry*
- GB 50683 *Code for Acceptance of Field Equipment, Industrial Pipe Welding Construction Quality*
- GB 50709 *Code for Design of Pipe Supports in Iron and Steel Enterprises*
- GB 50721 *Code for Design of Water Supply and Drainage of Iron and Steel Enterprises*
- GB 50726 *Code for Anticorrosive Engineering Construction of Industrial Equipment and Pipeline*
- GB 50727 *Code for Acceptance of Construction Quality of Anticorrosive Engineering of Industrial Equipment and Pipeline*
- GBZ 1 *Hygienic Standard for the Design of Industrial Enterprises*
- GB 4830 *Industrial Process Measurement and Control Instruments-Pressure Range and Quality of Air Supply*
- GB 6222 *Safety Code for Gas of Industrial Enterprises*
- GB 7231 *Basic Identification Colors and Code Indications and Safety Sign for Industrial Pipelines*
- GB 12348 *Emission Standard for Industrial Enterprises Noise at Boundary*

GB 12476 *Electrical Apparatus for Use in the Presence of Combustible Dust*
GB 13456 *Discharge Standard of Water Pollutants for Iron and Steel Industry*
GB 16912 *Safety Technical Regulation for Oxygen and Relative Gases Produced with Cryogenic Method*
GB 18599 *Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes*
GB 28664 *Emission Standard of Air Pollutants for Steelmaking Industry*
GB/T 8923.1, GB/T 8923.2 and GB/T 8923.3 *Preparation of Steel Substrates Before Application of Paints and Related Products-Visual Assessment of Surface Cleanliness*
GB/T 9124 *Specification for Steel Pipe Flanges*
GB/T 13283 *Accuracy Class of Measuring Instruments and Display Instruments for Industrial Process Measurement and Control*
GB/T 13927 *Industrial Valves-Pressure Testing*
GB/T 24917 *Glasses Valve*
AQ 2048 *Technical Code on Safety of Gas Curtain Appliance*
YB 4441 *Code for Construction and Acceptance of Dust Collection Project in Iron and Steel Enterprises*
JB/T 8527 *Metallic Sealing Butterfly Valve*
JB/T 11312 *Cylindrical Electrostatic Precipitator for Converter Flue Gas Dry Cleaning*
NB/T 47003.1 *Steel Welded Atmospheric Pressure Vessels*