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Design of Thermal Power Facilities

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Table of Contents

List of Tables

List of Acronyms/Abbreviations

A-USC	Advanced Ultra Super Critical
BOD	Biochemical Oxygen Demand
BOG	Boil Off Gas
COD	Chemical Oxygen Demand
COM	Coal Oil Mixture
CWM	Coal Water Mixture
CWT	Combined Water Treatment
EMS	Energy Management System
FCB	Fluidized Bed Combustion Boiler
GT	Gas Turbine
HP	High Pressure
HRSG	Heat Recovery Steam Generator
IGCC	Integrated Coal Gasification Combined Cycle
JICA	Japan International Cooperation Agency
JIS	Japan Industrial Standards
LNG	Liquefied Natural Gas
LP	Low Pressure
LPG	Liquefied Petroleum Gas
MPI	Ministry of Planning and Investment
MSP	Main Steam Pressure
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resource and Environment
NGL	Natural Gas Liquid
PC	Pre-Cast
PCB	Polychlorinated Biphenyl
QCVN	Quy Chuan Viet Nam
SCADA	Supervisory Control And Data Acquisition
TCVN	Tieu Chuan Viet Nam

PART 1. THE GENERAL

Chapter 1 Purpose

Article 1. Purpose

1. The purpose of this technical regulation is to plan, design and assess the power generation facility which is to be safely installed in an environmentally friendly location and is capable to supply stable sustained electricity by stipulating the minimum technical requirements to maintain security pursuant to the provision of "The Electricity Law: Law No.28/2004/QH11 Article-48 Clause-3" and "Detailing and guiding the implementation of a number of articles of the Electric Law: Decree No.105/2005/ND-CP Article-32 Clause-1-a".

Chapter 2 Scope of Application and Exclusion from Application

Article 2. Scope of application

1. This technical regulation shall be applied to the power station which generates electricity by utilizing thermal power and the electrical facilities, installed in the power station and important for the safe.

   This technical regulation shall be applied to the thermal power facilities which utilizes coal fuel, such as lignite, sub-bituminous coal, bituminous coal, anthracite, etc., can also utilize oil fuel, such as crude oil, naphtha, kerosene, light oil, heavy oil, residual oil, etc., and utilize gas fuel, such as natural gas, coke oven gas, blast furnace gas, converter gas, refinery gas, naphtha cracking gas, residual gas from natural gas, etc., to generate electricity by combustion. The scope of the application of fuel is pursuant to following table.

Table 1: Scope of Application of Fuel

Classification	**Type of Fuel**	
	Application of Technical Standard	**Non-application of Technical Standard**
Pulverized Coal	pulverized coal	CWM
Coal except pulverized coal	grain coal	lump coal, coke, COM
Crude Oil	crude oil, naphtha, mixed crude oil	NGL
Petroleum except crude oil	ABC heavy oil, kerosene, light oil, by-product oil, residual oil	paraffin, asphalt, orimulsion
Liquefied Gas	LNG, LPG	─
Gas	gasification gas, coke oven gas, blast furnace gas, converter gas, refinery gas, naphtha cracking gas, residual gas, natural gas	bio-gas
Others	─	Burke, coal tar, black liquor, bagasse, refuse, pitch, mineral sulfide, methanol, scrap tire, rice husk, wood scrap, poultry litter

*CWM: Coal Water Mixture *COM: Coal Oil Mixture

*NGL: Natural Gas Liquid *LNG: Liquefied Natural Gas *LPG: Liquefied Petroleum Gas

2. This technical regulation shall be applied to truck, trailer, tank truck, vehicle type mining machine. However, the provision of Road Traffic Law, Vehicle Structure Ordinance shall always be applied with the necessary changes having been carried out.

3. This technical regulation shall be applied to oil pipelines led to the outside of the power plant premises. However, the provision of Oil Pipeline Law, etc. shall always be applied with the necessary changes having been carried out.

4. This technical regulation shall be applied to LNG, LPG and gas pipeline led to the outside of the power plant premises. However, the provisions of Gas Pipeline Law, etc. shall always be applied with the necessary changes having been carried out.

Article 3. Exclusion from application

1. This technical regulation shall not be applied to the steam turbine for nuclear power plant, geothermal power plant and other steam turbine used as prime mover for compressors, etc.

2. This technical regulation shall not be applied to the boiler utilizing full steam for any other purpose but applied to the combined heat and power boiler utilizing more than half of the steam produced for generation.

3. This technical regulation shall not be applied to the internal combustion generation facilities which use a diesel engine and gas engine as the prime mover.

4. This technical regulation shall not be applied to the boiler, steam turbine, gas turbine, generator and electric facilities for ship. The provision of Shipping Law shall be applied to them.

5. This technical regulation shall not be applied to the trolley feeder, etc., such as feeder, stretching line, bracket and tensioner in the power plant premises.

6. This technical regulation shall not be applied to the transmission facility for an electric railway.

7. This technical regulation shall not be applied to a jet-engine and generator set for aviation. The provision of Aviation Law shall be applied to them. The generation facility in which the jet-engine is converted for land use or coupled with a generator and connected with the national grid shall be treated as a thermal power plant.

8. This technical regulation shall not be applied to wooden or steel poles, reinforced concrete poles, or pylons or other similar works when the main purpose is to support power wire, communication wire, and fiber optic cable which MOC have jurisdiction over.

9. This technical regulation shall not be applied to a building, foundation, bridge, electric and lightning rod facility attached to a building which MOC have jurisdiction over.

10. This technical regulation shall not be applied to the port structure itself on which Port Law is applied. However, the provision of Port Structure Law shall be applied with the necessary changes having been carried out.

11. This technical regulation shall not be applied to a ship, such as an oil tanker, LNG tanker, coal bulk carrier, etc. on which the Shipping Law is applied. The provision of Shipping Law shall be applied to them.

12. This technical regulation shall not be applied to the road in the power plant premises where Road Structure Ordinance is applied. However, the provision of Road Structure Ordinance shall be applied with the necessary changes having been carried out.

13. This technical regulation shall not be applied to thermal power facilities which utilize trash, bio-gas, industrial waste, sludge, waste tires, black liquor, forestry waste, bark, cut tree, agricultural waste, rice husks, bagasse, etc., to generate electricity by combustion heat.

14. This technical regulation shall not be applied to a power facility which is not connected with the National Power Transmission Network.

Chapter 3 Definition

Article 4. Definition of terms related to electricity business

1. In this technical regulation, the meaning of the terms related for electricity business shall be provided as follows:

   (1) *"Electricity activities or electricity business"* means the activities of organizations in the domains of electricity development planning, investment, electricity generation, electricity transmission, electric distribution, electric system regulation, electricity market transaction, electricity wholesale and retailing, specialized electricity consultancy and other relevant activities.

   (2) *"Electricity utility or electricity unit"* means the organizations or individuals who carry out activities of electricity generation, electricity transmission, electric distribution, electric system regulation, electricity market transaction, electricity wholesale and retailing, specialized electricity consultancy and other relevant activities.

   (3) *"Power plant"* means the place to generate electricity by the equipped prime mover, generator, other machines and equipment and can be composed with more than one unit.

   (4) *"Thermal power plant"* means one of the generation methods utilizing combustion by burning fuels, such as natural gas, propane gas, blast furnace gas, oil, coal, etc. and has three main styles, such as steam power plant using steam from the boiler to drive the steam turbine as an external combustion heat engine; internal combustion power plant using an internal

combustion engine, such as a gas turbine, a diesel engine and a gas engine; or a combined power plant utilizing the exhaust heat of a internal combustion engine.

(5) *"Combined cycle power plant"* means the power plant which output and efficiency are implemented by combined different heat engines, such as gas turbine with steam turbine, or diesel engine with a steam turbine.

(6) *"Unit type power plant"* means the power plant which is composed by one-boiler and one-steam turbine to be operated as a unit followed by other similar units none of which are connected.

(7) *"Private power plant"* means a power plant to supply electricity only for private demand and the power plant which buys electric power from the grid being connected.

(8) *"Commercial power plant"* means the power plant which is connected with the National Grid and sells all power to a particular large demand, power Distribution Company and to other many small consumers.

(9) *"Electric facilities"* means the facilities located within the power plant boundaries and which the electricity unit use for electricity-generating activities, such as fuel unloading facility, fuel storage facility, fuel dressing facility, boiler, steam turbine, gas turbine, generator, main transformer, dust remover, gas duct, desulfurization equipment, NOx removal equipment, chimney, etc.

(10) *"Installed Capacity"* means the nominal output authorized by MPI, MOIT, etc. in the assessment of the construction plan. As a general rule, the over-load operation shall not be allowed, even if it is possible for a short time.

Article 5. Definition of terms related to mechanical facility

1. In this technical regulation, the meanings of the terms of mechanical facilities shall be provided as follows:

(1) *"Equipment"* means the object which is organized to accomplish certain objectives, excluding land and building.

(2) *"Facility"* means the material resources that configure production activities or services, including building accessories, facilities, and machineries.

(3) *"Pipeline"* means the pipe and auxiliary equipment to transport water, steam, fuel oil, gas or liquefied gas.

(4) *"Critical speed"* means the rotation speed when the rotation frequency of bending and deflection of the rotating direction matches with the rotation frequency. It is not a problem, if the critical speed exists above the rated speed. However, one must be careful, if it is lower than the rated speed.

(5) *"Disproportionate"* means the situation in which there is a displacement between the gravity centers with the rotation center, it is called eccentricity. When rotating, it causes vibration and noise due to the centrifugal force.

(6) *"Vehicle-type mining machine"* means the exclusive vehicle which is used in a coal field or coal storage yard, such as bulldozer, grader, scraper, excavator, wheel loader and large dump truck, etc.

(7) *"Specific outdoor oil storage tank"* means a large outdoor tank which stores oil not less than 1000 m^3.

(8) *"Gas facility"* means the facility to generate gas, purify gas, transport gas, store gas, and store liquefied gas, transport liquefied gas, and evaporate gas from liquefied gas.

(9) *"Gas vaporization facility"* means the facility to vaporize the liquefied ammonia gas, liquefied nitrogen gas or liquefied natural gas, etc.

(10) *"Gas generation facility"* means the facility to generate coal gas mainly composed of hydrogen and carbon monoxide by partial oxidation, and the facility to generate hydrogen rich gas by reacting with steam to decompose at high temperatures petroleum as a raw material.

(11) *"Gas purification facility"* means the facility to remove sulfur compounds and nitrogen compounds from a blast furnace gas or an IGCC plant gas, purifying the gas from a gas generation furnace.

(12) *"Gas-holder"* means the storage tank to store gas during low demand time and discharge it at a high demand time in response to changes in demand. There are two spherical and cylindrical types.

(13) *"Liquefied gas"* means the gas which the saturation pressure is not less than 196kPa at normal operation temperature and is actually in a liquid state, or which the saturation temperature is 35 ^{0}C and below at a pressure of 196kPa and is actually in a liquid state.

(14) *"Liquefied gas storage tank"* means the storage tank to store liquefied ammonia gas, liquefied nitrogen, liquefied petroleum gas, liquefied natural gas, etc.

Article 6. Definition of terms related to electrical facility

1. In this technical regulation, the meanings of the terms of electrical facilities shall be provided as follows:

(1) *"Electric circuit"* means the place there is normally an applied voltage or current flow under the operating condition.

(2) *"Electrical equipment"* means the equipments which are power components of the electric circuit.

(3) "*Substation*" means the place to make voltage of electric power transmitted from outside premises to be transformed from high to low or the reverse by transformers and other electrical equipment, and to transmit it outside the premises.

(4) "*Switching station*" means the place to route electrical power by circuit breakers and other electrical equipment in the premises except to power plants, substations and consumers.

(5) "*Load dispatch center*" is a control unit, regulating all activities for electric power plant, planning for electrical generation, method of operation, and dispatching load to groups of electrical generation.

(6) "*Nominal voltage*" means the voltage by which a system is designated.

(7) "*Maximum voltage*" means the maximum voltage which occurs under normal operating condition in the power lines.

(8) "*Power wire*" means the conductor to transmit electric power, insulated conductor, or insulated conductor covered in a sheath to protect it.

(9) "*Contact wire*" means the electric wire to supply electricity for mobile electric equipment, such as crane and a monorail, contacting directly through a collector.

(10) "*Train line*" means the contacting wire to supply electricity power for electric locomotives, trains, and to supply electricity for in-car signaling devices, and lighting.

(11) "*Power line*" means the power wires to interconnect power plant with a substation, switching station, and to interconnect supplies of electric power to a place requiring electric power, and their supporting structures such as wooden or steel or concrete supports.

(12) "*Electric train lines*" means the train line and the supporting structure.

(13) "*National grid*" means the system of power transmission lines, transformers and auxiliaries to transmit electricity.

(14) "*National Power Transmission Network*" means the transmission network of greater than equal to 110kV voltage which is developed, installed, controlled and managed by the Government of Vietnam.

(15) "*Distribution network*" means the power wire network excluding the facility of National Power Transmission Network to supply power for an unspecified number of consumers.

(16) "*Phase modifying equipment*" means the electrical equipment to adjust the reactive power.

(17) "*Communication wire*" means the conductor for communication, insulated conductor, or insulated conductor covered sheath to protect it used in circuits at low voltage and very low current.

(18) "*Communication line*" means the communication wires and their supports.

(19) "*Optical fiber cable"* means the transmission medium to transmit light for communication with protective covers.

(20) "*Optical fiber cable line"* means the optical fiber cables and their supports, excluding what is installed indoors or on the building.

(21) "*Support"* means the wooden pole, steel pole, concrete pole, steel tower, steel structure and the like which support the power wires, the communication wires, or the optical fiber cables.

(22) "*Electrical wiring"* means the electric wires in place to consume electric power, except those in power wires in the electrical equipment and power lines.

(23) "*Power plant"* means the facility from the lead-in point of transmission line in the power plant premises, such as an insulator in which insulated wire is connected from the shackle insulators for overhead electric lines to disconnect the gas-insulated switchgear and other equipment.

Article 7. Classification of electric voltage, etc.

1. The electric voltage used in the power plant shall be classified in the following 3 classes and nominal voltages. However the nominal voltages shall not need to apply to the voltage of the generator.

   (1) Low voltage: up to 1000V

   (2) Medium voltage: exceeding 1kV and up to 35kV

   (3) High voltage: exceeding 35kV and up to 220kV

   (4) Extra high voltage: exceeding 220kV

   The said definitions are limited to this design technical regulation only.

Table 2: Classification of Electric Voltage

Class	**Three-phase four-wire or three-wire systems**	
	Nominal voltage	**Maximum voltage**
Extra High	1000 kV	1100 kV
	500 kV	550 kV
High	220 kV	245 kV
	110 kV	123 kV
Medium	35 kV	40.5 kV
	22 kV	24 kV
	15kV	17.5kV
	11 kV	12 kV
	6600 V	7200 V
	3300 V	3600 V
Low	230 / 400 V	-

Note-1: The lower value in the first column of low voltage class is voltage to neutral, and other value is voltage between phases.

Note-2: The provisions of this technical regulation shall be applied for the electrical facilities which are connected between a neutral line and another line of the medium voltage four-wire circuit limited with a neutral line as equating the operating voltage or maximum operating voltage of the electrical facilities with that of voltage between phases of a four-wire circuit.

Article 8. Classification of thermal power plant by scale

1. The rated output "P" of thermal power plant shall be classified in the following class according to the scale.

Table 3: Classification of Thermal Power Plant by Scale

Class	I	II	III	IV	V
Thermal Power Plant	P < 5MW	5MW ≤ P < 50MW	50MW ≤ P < 600MW	600MW ≤ P < 2000MW	2000MW ≤ P

Article 9. Classification of steam power plant by use conditions

1. The steam power plant shall be classified in the following class according to the terms of use.

Table 4: Classification of Steam Power Plant by Use Conditions (C1)

Class	C1					
MSP	Sub-Critical					
(MPag)	5.9	8.6	10.0	12.5	16.6	18.6
(psig)	850	1,250	1,450	1,800	2,400	2,700
Main Steam/Reheat Steam Temperature (Fahrenheit(F) /Celsius)						
～1,000	485/-	510/-				
1,000(F)			538/-	538/538		538
			538/538	538/566		
1,050(F)					566/538	
					566/566	

Table 5: Classification of Steam Power Plant by Use Conditions (C2, C3, C4)

Class	C2		C3				C4
MSP	Super Critical		Ultra Super Critical				A-USC
(MPag)	24.1		25.0	31.0			34.5
(psig)	3,500		3,625	4,500			5,000
Main Steam/Reheat Steam Temperature (Fahrenheit/Celsius)							
1,000(F)	538/538						
	538/566						
	538/552/566						
	538/593						
1,050(F)		566/593		566/566/566			
1,100(F)			600/600				
			600/610				
1,150(F)					(621/621)		
1,200(F)						(649/649)	
1,300(F)							(700/720/720)

(1) MSP : Main Steam Pressure

(2) ( ) means the plant which is not commercial at this moment but may be in the future

(3) A-USC : Advanced Ultra Super Critical

Article 10. Classification of GT combined power plant by use conditions

The gas turbine power plant and gas turbine combined cycle power plant shall be classified in the following class according to gas turbine inlet gas temperature “T”.

Table 6: Classification of GT Power Plant by Use Condition

Class	G1	G2	G3	G4	G5	G6
Gas Turbine Inlet Gas Temperature (^{0}C)	T < 1000	1000 ≤ T < 1300	1300 ≤ T < 1400	1400 ≤ T < 1500	1500 ≤ T < 1600	1600 ≤ T < 1700

Article 11. Abbreviation of power plant

The thermal power plant for electricity business use shall be called as follows considering the scale and technical innovation.

Table 7: Abbreviation of Power Plant

Abbreviation	Summary	Remarks
IV-C2	660MW Super Critical Steam Power Unit	
IV-G4	740MW 2 on 1 Gas Turbine Combined Cycle Unit	Apply G-type

Chapter 4 Security Principles

Article 12. Prevention for expansion of risk

1. The facility and system shall be designed to ensure certain safety or almost certain safety at all times in the event of a failure of components and or systems, the major principle should be to have a fail-safe design.
2. It shall be considered the following items as the fail-safe principle.
   (1) “Fault avoidance”; Parts, equipment and systems for the power plant shall be those of a high reliability and low failure.
   (2) “Fault tolerance”; Even if a failure or malfunction occurs, the function shall be maintained properly. The multiplexing and redundancy of components shall be promoted.
   (3) “Fail soft”; Even if a failure occurs, the function shall be maintained to the extent possible instead of a complete loss of function.
   (4) “Fool proof”; Even if the human operator inappropriately and accidentally acts, such systems shall not interfere with the normal behavior or produce a dangerous situation.
   (5) “Honest proof”; Even if acts which were conducted or were attempted by an operator with a purpose not inappropriate, such a system shall not cause a dangerous situation.

Article 13. Prevention of destruction due to high-temperature and high-pressure

1. The pressure vessel and piping which are used under high temperature and high pressure, such as boiler, independent super-heater, main steam piping attached to boiler, reheat steam piping, extraction piping, high pressure feed water piping, etc. shall be installed carefully to prevent harm to the human body and to prevent damage to the property due to any destruction and rupture, etc.
2. The steam turbine and gas turbine, etc. which are used under high temperature and high pressure shall be installed carefully not to harm the human body and to prevent damage to the property due to any destruction and rupture, etc.
3. The high pressure gas production and storage facility, storage vessel, pipeline, etc. shall be installed with care not to harm the human body and to prevent damage to the property due to any destruction, rupture, etc.

Article 14. Prevention of destruction due to thermal expansion

1. The pressure equipment and vessel which are used under high temperatures, such as steam turbine body, gas turbine body, boiler body, independent super-heater, shall be installed carefully to prevent harm to the human body and to prevent damage to the property due to any destruction and rupture, etc. caused by wrong measures of thermal expansion.

2. The main steam piping, reheat steam piping, extraction piping, high pressure feed water piping, high temperature duct for gas turbine, HRSG, flue gas duct, etc. which are used under high temperatures shall be carefully installed to prevent harm to the human body and to prevent damage to the property due to any destruction and rupture, etc. caused by wrong measures of thermal expansion.

3. The equipment, vessel and piping, etc. which are used under low temperatures, such as liquefied gas storage tank, liquefied gas piping shall be carefully installed to prevent harm to the human body and to reduce possible damage to the property due to any destruction and rupture, etc. caused by wrong measures of low temperature shrinkage.

Article 15. Prevention of destruction due to over-speed and imbalance

1. The rotating machine which rotates at high speeds, such as steam turbine, gas turbine, generator, pump, fan, electrical motor, etc. shall be carefully installed to prevent harm to the human body and to prevent damage to the property due to any destruction and rupture, etc. by critical-speed and or over-speed.

2. The rotating machine which rotates at high speeds, such as steam turbine, gas turbine, generator, pump, fan, electrical motor, etc. shall be carefully installed to prevent harm to the human body and to prevent damage to the property due to any destruction by the wrong type of foundation or poor balancing.

Article 16. Prevention of electric shock and fire

1. The electrical facilities shall be installed so that there is no risk of an electric shock, fire, or other damage causing harm to the human body, or damage to the other facilities.

2. The electric circuits shall be isolated from the earth. However, this shall not apply to the following:

   (1) When it is unavoidable the electric circuits to design and there is no risk of danger to consider.

   (2) There is earth grounding to avoid the risk of a fault due to accidental contact between a higher voltage circuit and a lower voltage circuit, and other necessary measures for security are taken.

3. In the case of the preceding paragraph, the insulation strength shall have no risk of a breakdown in consideration of an abnormal voltage expected during accidents except as provided in Article231 paragraph 4 and Article238 paragraph 7.

4. Insulation strength between windings in the transformers shall have no risk of a breakdown when considering the abnormal voltage expected during accidents.

5. The power wires, guy wires, ground wires, the communication wires, and the optical fiber cables used for security to the other electrical facilities shall be installed so that there is no risk of their wires braking under normal operating condition.

6. Connection of the power wire shall be accomplished so that there is no risk of an increase in electrical resistance of the power wire at the connections, or insulation degradation of the power wire except bare wires, or the breaking of the power wires under normal operating condition.

7. The electrical equipment in the power lines shall withstand the heat generated under normal operating conditions.

8. The medium, high or extra high voltage electrical equipment shall be installed so that there is no risk to people who are not fully qualified personnel employed by the power plant and who may touch or handle them.

9. The medium, high or extra high voltage switch, circuit breaker, lightning arrester and other similar equipment which can cause an arc during operation shall not be installed near a wooden wall, ceiling, or other combustible materials but installed so that there is no risk of a fire.

10. The grounding and all other appropriate measures shall be taken at the necessary points of electrical facilities so that there is no risk of any abnormal potential rise, electric shock or fire by an overvoltage on an electric circuit, a system failure causing harm to the human body or damage to the other facilities. However in the part pertaining to the electric circuits, it shall be made pursuant to the provisions of paragraph 2.

11. The grounding shall have sufficient capacity to pass the fault current into the earth safely when electrical facilities are equipped with it.

12. The fuel unloading facility, fuel transportation facility and fuel storage facility shall be installed considering the possibility of fire and explosion and all necessary precautions should be taken.

13. When storing oil, flammable gas and flammable chemicals, they shall be stored in an area where all measures are taken to prevent the danger of a fire and explosion.

Article 17. Prevention of abnormality and protective measures

1. The transformers with windings which connect the medium, high or extra high voltage electric circuit and the low voltage circuits shall be equipped with grounding at the proper points so that there is no risk of damage to the low voltage side of the electrical facilities by abnormal voltage from the medium, high or extra high voltage circuit on the low voltage circuit, electric shock or fire.

2. The medium voltage circuit whose voltage is less than 11kV that is connected to the voltage of not less than 11kV electric circuits by the transformer shall be equipped with a discharge device with grounding and must take the appropriate measures so that there is no risk of damage or electric shock or fire to the medium voltage circuit of less than 11kV of the electrical facilities by

abnormal voltage from the voltage circuit of not less than 11kV on the medium voltage circuit of less than 11kV.

3. The transformer which transforms the voltage of not less than 11kV to the low voltage directly shall not be installed except the following items:

   (1) In a case that there is no risk because measures to prevent both windings from connecting are taken.

   (2) In a case that the equipment to disconnect the electrical circuits automatically are installed when both the voltage of not less than 11kV side and the low voltage side windings contact electrically, and the appropriate measures are taken for their security.

4. The over-current circuit breaker shall be installed at the necessary point of the electrical circuits to protect the power wires and the electrical equipment from overheating and burn out due to over-current and remove the possibility of fires.

5. A ground fault circuit breaker shall be installed and other appropriate measures shall be taken in the electrical circuit so that there is no risk of damage to the power wire or the electrical equipment, electric shock or fire in the case of a ground fault in the electrical circuit. However this shall not need to be applied if there is no risk of danger by a ground fault because the electrical equipment is installed in a dry area.

Article 18. Prevention of electrical and magnetic interference

1. The electrical facilities shall be installed without any electrical and magnetic interference to other electrical facilities and functions of other facilities.

2. The power line carrier equipment shall be installed so that there is no risk which affects the continuous and serious interference to functions of the other power line carrier equipment.

Article 19. Prevention of power supply disturbance

1. The medium, high or extra high voltage electrical facilities shall be installed so that there is no risk of serious disturbance to other electric-generating activities due to their collapse.

Article 20. Prevention of public pollution

1. The thermal power plant which is established in the designated areas be set forth by air emission standard shall conform to the prescribed provision of the applicable laws and regulations and QCVN which is promulgated by MONRE (Ministry of Natural Resource and Environment) and related TCVN.

2. The thermal power plant which is established in the designated areas be set forth by the industrial effluent standard shall conform to the prescribed provision of the applicable laws and regulations and QCVN which is promulgated by MONRE (Ministry of Natural Resource and Environment) and related TCVN.

3. The thermal power plant which is established in the designated areas be set forth by noise standard shall conform to the prescribed provision of the applicable laws and regulations and QCVN which is promulgated by MONRE (Ministry of Natural Resource and Environment) and related TCVN. .
4. The thermal power plant which is established in the designated areas be set forth by vibration standard shall conform to the prescribed provision of the applicable laws and regulations and QCVN which is promulgated by MONRE (Ministry of Natural Resource and Environment) and related TCVN.
5. Should the thermal power plant have an oil storage facility, the owner must have taken the appropriate measures to prevent the local population suffering due to the discharge of oily water from the storage place into the public water system if the oil storage facility were damaged or other accidents did occur.
6. The places where transformers are connected to the electric circuits of the solidly grounded neutral system the owner should have taken the appropriate measures to prevent the insulating oil from flowing outside the premises and penetrating into the ground.
7. The thermal power plant shall not be installed on a steep slope as this is a dangerous area.
8. The electrical equipment with insulating oil which contains polychlorinated biphenyls (PCBs) shall not be installed in the electric circuits.

PART 2. PRIME MOVER

Chapter 1 Boiler, etc. and Auxiliary Facilities

Article 21. General provision

1. The boiler, independent super-heater, steam accumulator and its ancillary equipment excluding the facilities which is not belong to gas turbine, internal combustion engine, fuel cell and gas generation facility or liquefied gas facility shall be called collectively as the “boiler, etc.”
2. The boiler and its auxiliary facility is the facility to heat up the heating medium such as water by fire, combustion gas or electricity, to supply the generated steam heating up to the saturation temperature at atmospheric pressure and thereby supply steam for the steam turbine or gas turbine.
3. The independent super-heater and its auxiliary facility shall be the facility to dry up the saturated steam to super-heated steam by fire, combustion gas, high temperature gas and/or electricity from the boiler.
4. The steam accumulator and its auxiliary facility shall be the facility in which the steam is stored briefly to be supplied according to demand.

Article 22. Material for boiler, etc.

1. The material used for pressure parts of the pressure vessel and pressure piping and tube of the boiler, independent super-heater, steam accumulator and its auxiliary facilities shall have stable chemical composition and mechanical strength needed for the chemical and physical impact at the maximum operating temperatures and pressures.

Article 23. Structure of boiler, etc.

1. The structure of the boiler and its auxiliary facility pressure parts shall be safe against maximum stress which occurs under maximum operating pressure and maximum operating temperature. The stress which occurs in those parts shall not exceed the allowable stress of the material.

Article 24. Safety valve for boiler, etc.

1. The boiler and its auxiliary facility, which occasionally could experience over-pressure, shall be provided with an appropriate safety valve to relieve any over-pressure. The safety valve shall be equipped to open and prevent any over-heat of the boiler and its auxiliary facility when it is operated.

Article 25. Feed-water equipment for boiler, etc.

1. The boiler shall have the feed-water equipment needed to supply water to prevent thermal damage at maximum continuous evaporation.

2. The boiler shall have extra feed-water equipment to prevent heat damage in the case when harmful heat of boiler remains when the water level of the circulation boiler and the flow rate of the once-through boiler decreased significantly due to any abnormality of the facility even in the event of the fuel feed being turned off rapidly.

Article 26. Isolation of steam and feed-water of boiler, etc.

1. The Main Steam outlet of the boiler, except the steam outlet from the safety valve and steam outlet from the re-heater, shall have the capability to be isolated and the steam flow closed off. However, this shall not be applied to the steam outlet of the boiler which is capable to be having the steam flow isolated at the inlet of the system from any other boiler coupled with this boiler or the steam outlet of each boiler when more than two boilers generate steam together and supply to the installed steam turbines.
2. The inlet of the boiler feed-water system shall have capability to isolate the feed-water flow automatically and immediately. However, this shall not be applied to the outlet of feed-water heater and other feed-water equipment which is capable to isolate the feed-water flow automatically and immediately at the feed-water inlet of the system.

Article 27. Blow-down equipment for boiler, etc.

1. The circulation boiler shall be provided with blow-down equipment which is capable to discharge the boiler water or to adjust the water level at any time.

Article 28. Instrument equipment for boiler, etc.

1. The boiler shall be provided with instrumentation devices which will monitor the operation status and prevent damage to the facility.

Chapter 2 Steam Turbine and Auxiliary Facilities

Article 29. General provision

1. The pressure energy is converted to velocity energy when you depressurize the high temperature and pressure steam through the steam turbine. The steam turbine is the converter which is utilized to convert this velocity energy into power. The big difference in the maximum and minimum temperature in Kelvin heat-cycles will generate theoretically high heat efficiency according to the second law of thermodynamics. Practically, the higher efficiency of thermal power plants has been made possible by increasing the steam turbine inlet steam temperature.
2. At present, the practical maximum steam temperature of thermal power plants in use is about 600^0C. The further improvement of thermal efficiency of Power Plants by higher temperature steam depends on further development of high-alloy steel materials with high creep strength for the turbine and boiler and their pipe systems.

Article 30. Material for auxiliary facilities of steam turbine

1. The material used for the pressure parts of pressure vessels and pressure piping for the steam turbine and auxiliary facility shall have stable chemical composition and the mechanical strength needed to withstand the chemical and physical impact under the maximum operating temperature and pressures.

Article 31. Structure of steam turbine, etc.

1. The steam turbine shall have sufficient structural and mechanical strength to withstand the rotational speeds which occur when the emergency governor operates.
2. The steam turbine shall have sufficient structural and mechanical strength to withstand the maximum vibration that can occur at the main bearings and the rotors.
3. The bearings of the steam turbine shall be capable to support steady operational load of the steam turbine shafts during normal operation withstanding abnormal wear, deformation and over-heating shall not occur.
4. The critical speed of the coupled steam turbine rotor and any other rotor, such as the generator rotor, shall not be in the range of the minimum rotation speed that can be adjusted to the rotating speed that can be reached when the emergency governor operates. However, this shall not need to be applied when sufficient measures are taken with vibration to prevent damage in operation at critical speed.
5. The structure of the steam turbine and its auxiliary facility pressure parts shall be safe against the maximum stress which occurs under maximum operating pressure and temperature. The stress which occurs in that part shall not exceed the allowable stress of the material.

Article 32. Speed governing device for steam turbine, etc.

1. The steam turbine excluding the steam turbine which is coupled with induction generator shall be provided with a governor to adjust the steam flow automatically entering the steam turbine in order to prevent the rotation speed waving continually. In this case, the governor shall have the ability to reduce the rotation speed and reduce the rated load below the emergency governor speed.

Article 33. Emergency stop device for steam turbine, etc.

1. The steam turbine in which nominal output is not less than 400MW shall be provided with a device to detect and set off an alarm when harmful vibration occurs during operation.
2. The steam turbine shall be provided with an emergency governor or other emergency stop device which isolates steam from the boiler automatically and immediately in order to prevent the occurrence of harm due to any over-speed and any abnormal situation occurring during operation.

Article 34. Pressure relief device for steam turbine, etc.

1. The steam turbine and auxiliary facility which may have an over-pressure situation shall be provided with an appropriate pressure relief device to relieve pressure.

Article 35. Instrument equipment for steam turbine, etc.

1. The steam turbine shall be provided with an instrument device which monitors the operation status to prevent damage of the facility.

Chapter 3 Gas Turbine and Auxiliary Equipment

Article 36. General provision

1. The gas turbine compresses the air by a centrifugal or an axial compressor and feeds that air and fuel into the combustor where combustion takes place. The high-temperature combusted exhaust gas rotates the centrifugal or axial gas turbine. The shaft of the turbine is directly connected to a compressor typically and transmits power to the compressor for compression. The combustion is carried out under constant pressure and all heat energy is extracted from the combustion gas. The gas turbine, unlike a reciprocating engine, has continuous compression, combustion, expansion and exhaust processes.
2. The recent improvements in thermal efficiency of gas turbines have been made by increasing the gas turbine inlet gas temperature. Further development of this trend depends on new high-alloy steel materials with better creep strength for the turbine blades and vanes, also with improved implementation of the cooling system and heat barrier coating.

Article 37. Material for auxiliary facilities of gas turbine

1. The material used for the pressure parts of pressure vessels and piping for gas turbine and its auxiliaries, including the compressor to compress working fluid and the equipment to heat up compressed working fluid by combustion gas, shall have stable chemical composition and mechanical strength needed for the chemical and physical impact under the maximum operating temperature.

Article 38. Structure of gas turbine, etc.

1. The gas turbine shall have sufficient structural mechanical strength against the rotational speed needed when the emergency governor operates when the shut-off device works automatically due to the extreme rise in temperature of gas.
2. The bearings of the gas turbine shall be capable of supporting the shaft at the operation load of the gas turbine during normal operation and prevent abnormal wear, deformation and over-heating shall not occur.
3. The critical speed of the coupled gas turbine rotor and other rotors in the line except the gas turbine rotor if not coupled with each other in line, shall not be in the range of minimum rotation

speed which can be adjusted to the rotating speed that maybe reached when the emergency governor operates. However, this shall not need to be applied when sufficient measures have been taken to prevent harm during operation against high vibration.

4. The structure of the gas turbine and its auxiliary facility pressure parts shall be safe against the maximum stress which occurs under the maximum operating pressure and temperature. The stress which occurs at those conditions shall not exceed the allowable stress of the material.

Article 39. Speed governing device for gas turbine, etc.

1. The gas turbine excluding the gas turbine which is coupled with induction generator shall be provided with a governor to adjust energy automatically into the gas turbine in order to prevent the rotation speed and output waving continually. In this case, the governor shall have the ability to reduce the rotation speed to below the emergency speed, thereby reduce the rated load when the maximum load exceeds the rated load.

Article 40. Alarm and emergency stop device for gas turbine, etc.

1. The gas turbine shall be provided with an emergency governor or other emergency stop device which isolates energy entering into the gas turbine automatically and immediately in order to prevent the occurrence of harm due to over-speed and abnormal situation occurring during operation.

Article 41. Pressure relief device for gas turbine, etc.

1. The auxiliary facility for gas turbine that may experience over-pressure shall be provided with an appropriate pressure relief device to relieve the pressure.

Article 42. Instrument equipment for gas turbine, etc.

1. The gas turbine shall be provided with instrumentation devices which monitor the operational status to prevent damage to the facility.

PART 3. FUEL HANDLING FACILITY

Chapter 1 Coal Handling Facility

Section 1. Coal Un-loading Facility

Article 43. General provision

1. When domestic coal is applied for a coal thermal power plant, it is possible to control a minimum storage in the premises and transport directly from the coal field to the power plant by railway, conveyor and truck. However, in the case when imported coal is applied or the coal field is far from the power plant, it is necessary to transport the coal by ship. The transportation method and coal unloading facility shall be selected conforming to the type of power plant, location, level of importance, fuel property and type of boiler, etc.

Article 44. Wharf facilities

1. "*Mooring facility*"; A fender to mitigate shock to the broadside of the coal bulk carrier and a mooring arrangement to restraint movement of the ship shall be provided on the wharf.
2. "*Measure for coal spillage*"; A verge block shall be installed on the wharf to prevent coal dust falling on the wharf and mixing with rainwater and running into the sea or the river.

Article 45. Un-loader and bucket-crane

1. The coal un-loader is roughly classified into the club-bucket type and the continuous type, the continuous type un-loader is recommended for the dust splashing prevention measure. It is desirable to design a continuous type un-loader to conform similar to a bucket type in principle, although they are not a real crane. The equipment is to prevent coal falling down into the sea and to prevent coal dust splashing on the club bucket type.
2. In the case of the continuous type, the falling of coal into sea and the splashing of coal dust will be small because the club bucket type is almost enclosed, however, the boom mechanism is possible for a full range of cargo, in response to the height of the cargo, loading and scraping. The hydraulic shock absorber, "referred as float equipment", which prevents collision with a scraping bottom due to lifting by a sudden surge, shall be provided.
3. The technical regulation of the crane shall be as follow:
   (1) The break, which is capable to reduce speed and stop surely, shall be equipped on the rolling equipment.
   (2) Appropriate measures, such as the installation of the safety device on the crane to prevent over-rolling and others shall be taken.
   (3) The rope of rolling equipment shall have enough strength to bear the expected maximum load.
   (4) The crane shall have enough stability to prevent over turning.

(5) The restricted lifting load of the crane shall be indicated in the appropriate place to prevent damage to the operator and other persons who stay near there. The extreme radius of boom and restricted lifting load shall be indicated both on the crane and on the boom.

Article 46. Locomotive, wagon and track

1. The technical regulations of locomotive, wagon and track shall be stipulated as follows:

(1) The structure of track shall be pursuant as follows:

1) It shall withstand the maximum expected load; and

2) There will be no variation or interference with the safe driving of the vehicles.

(2) The orbital radius and slope of the track shall not interfere with safe running of the vehicles.

(3) The gauge shall ensure safe and stable driving of the vehicle considering the structure of the vehicle and the maximum design speed, etc.

(4) Cant shall be provided in the circular curvature taking into consideration the centrifugal force, impact of wind according to gauge, radius of curvature, etc. and thereby avoid potential risk of the vehicle over-running.

(5) Slack shall be provided in the circular curvature considering the radius of curvature, wheelbase of vehicle, etc. and thereby prevent excessive lateral pressure onto the track.

(6) A point-switch, other truck equipment, automatic alarm and sign shall be provided properly for the truck to ensure safe operation of the locomotive.

(7) The brakes shall be capable to decelerate surely or to stop the vehicle.

(8) The locomotive shall be equipped with a headlight which is capable of identifying any obstacles; the equipment will also eliminate obstacles on the surface of the rail head and provide the navigation devices and other equipment necessary for safe operation.

(9) The recovery tools for a derailed vehicle shall be equipped in the locomotive or in another appropriate place.

(10) The driver seat shall have the structure in which the driver is capable to overlook easily in the advance direction and to perform safe operations.

(11) The maximum number of vehicles coupled with locomotive shall be according to the vehicle performance, strength and situation of facilities.

(12) The electric locomotive shall be pursuant as follows:

1) An automatic circuit-breaker to cut-off fault current flowing through the circuits in high speed shall be equipped on the electric locomotive.

2) If the train line is long, a proper lightning arrester shall be equipped to prevent lightning damage.

3) The safety distance between supporting structure of train tracks and vehicles shall be ensured to prevent contact with each other.

(13) The lid and the seat can be ridden safely to prevent a fall, a chain and other equipment shall be equipped for the coach.

(14) A protective facility for the bridge across the road, railway or river shall be provided to prevent property from harm when travelling under the bridge.

Article 47. Vehicle

1. The technical regulation of the vehicle shall be as follow:

(1) The other part of ground section shall have proper gap between that and the ground to ensure safe driving.

(2) The vehicle shall have appropriate shock absorber springs or others which have sufficient capacity for the impact from the ground and thereby ensure safe driving.

(3) The vehicle shall have the necessary stability required for running under empty, loaded and other conditions.

(4) The automobile engines and power transmission equipment shall have a structure and performance to withstand the required travelling.

(5) The brakes of the vehicle shall be capable to slowdown and to stop the vehicle.

(6) The traveling gear of the vehicle shall be capable to ensure robust and safe driving.

(7) The steering equipment shall be capable to ensure robust and safe driving, and that the driver is capable to operate easily.

(8) The operating system which is necessary for driving the vehicle for instance, starter, accelerator, brake and other equipment shall be placed in the appropriate position where it can be manipulated easily by the driver and the operator has been shown how to identify them.

(9) The vehicle locking device shall be equipped for automobile engine, transmission system, travelling gear, gearbox and steering device to avoid driving by a non-nominated driver.

(10) The exhaust pipe of the internal combustion engine for the vehicle shall be arranged with no fear of harming a human being due to the exhaust gas.

2. The fuel system for the vehicle shall be as follows:

(1) The fuel tank and piping shall be robust and be equipped to avoid damage due to vibration and shock, etc.

(2) The fuel tank inlet and gas extraction pipe shall have the structure to avoid fuel leakage due to the vibration of the vehicle.

(3) The fuel tank inlet and gas extraction pipe shall not be in the opening direction of the exhaust pipe and have a safe distance from the opening of the exhaust pipe to prevent ignition of fuel due to heat from the exhaust pipe, etc.

(4) The fuel tank inlet and gas extraction pipe shall have a safe distance from exposed electrical terminals and electrical switchgear to prevent ignition of fuel due to the spark from the exhaust pipe, etc.

(5) The fuel tank inlet and gas extraction pipe shall not be opened within the cabin which has a seat and a standing area or the driving seat which is separated by a partition.

3. The electrical equipment for the vehicle shall be as follows:

(1) The electrical wiring in the vehicle shall be covered and fixed to the body.

(2) The electrical equipment in the vehicle, such as terminals, switches and other electric devices capable of causing electrical sparks shall have the appropriate measures taken to prevent a fire due to electric sparks.

(3) The battery shall be equipped to avoid damage due to moving, vibration or shock, etc. When it is installed in the cabin it shall be covered by suitable insulating material such as wooden boxes.

4. The chassis and the body for the vehicle shall be as follows:

(1) The chassis and body of the vehicle shall have sufficient strength to withstand driving.

(2) The body of the vehicle shall be securely attached to the chassis and not be able to come loose due to vibration and shock.

(3) The outline and other shape of the body o the vehicle shall not have projections and no projected rotating parts.

5. The vehicle passenger system shall have a structure which is capable to ensure a safe ride without falling or tumbling of personnel due to vibration or shock.

6. Measurement to the doorway from the driver’s room or cabin shall be taken to prevent falling while hurrying and be provided with a door that closes securely.

7. The carrier and other loading equipment of the vehicle shall have sufficient strength and structure to be capable to carry goods securely.

8. The driver seat for the vehicle shall have a view necessary for operation and the construction shall not prevent the driver from driving maneuvers or carrying goods, etc.

9. The glass used in front of the cabin shall be safety glass.

10. All vehicles shall be equipped with head lights, road lights, tail light, brake lights, reverse lights, turn signal, horn, mirror, window cleaner and other necessary equipment.

11. The installation of a solid head guard and other corrective measures shall be taken for the vehicle used in locations such as where there is the risk of falling rocks, etc.

12. The registered number in the power plant, limited carrying weight and all matters necessary for operation and management of the vehicle shall be indicated in the appropriate location.

Article 48. Vehicle type mining machines

1. The technical regulation of a vehicle type mining machine shall be as follows:

   (1) The motor, driving power transmission system, travel gear, working device, brake and steering system apparatus of the vehicle type mining machine shall be as follows:

      1) They shall have the necessary strength according to the purpose of use; and

      2) They shall not have significant damage, corrosion, deformation and wear.

   (2) An appropriate measure, such as an engine locking device, shall be installed as to prevent persons other than those related to driving of the vehicle type mining machine handling same.

   (3) The operating parts for traveling gear, working device and brake system of the vehicle type mining machine shall be equipped in an appropriate location where there is no interference with vision and where the operator finds it is easy to operate.

   (4) The vehicle type mining machine shall have all safety equipment, such as headlight, turn signal and a horn, necessary for security.

   (5) The driver seat and the assistant driver seat of the vehicle type mining machine shall have the structure needed to avoid falling down easily due to vibration and shock.

   (6) Appropriate measures shall be taken to allow the driver to have a safe ride.

   (7) The vehicle type mining machine shall have adequate vision so that a driver can safely drive and the glass used in front of the cabin shall be of a safety glass type.

   (8) The hydraulic system of the vehicle type mining machine powered by hydraulics shall be equipped with the proper safety valves needed to prevent excessive boost of oil pressure.

   (9) All necessary matters for safe operation of vehicle type mining machine, such as way of operation, maximum speed and others, shall be displayed in the correct place. However, this may not need to be applied for the areas where the operator is not likely to operate incorrectly.

Article 49. Wagon damper and truck damper

1. "*Rotary wagon damper*"; When transporting of coal from coal mines to power plant directly, the unit train should be organized to have the same format size wagons in order to efficiently unload. It is desirable to apply a rotary type coupler for the coal wagons and to install a rotary wagon damper.

2. "*Wagon station for bottom open wagon*"; When the side open or bottom open type wagon are used as the coal wagon, the way of leading to the unloading station on the elevated ground and discharge from the bottom and the way to discharge below ground into a truck hopper will be applied. In the former case, the lower place will be the coal yard as it is, in the latter case, the arrangement of coal conveyor to transport and the measures for coal dust shall be considered.

3. "*Truck dumper*"; When transporting coal by truck or trailer, the truck dumper is capable of applying direct dumping to underground. The arrangement of coal conveyor to transport from the conveyor below the hopper to coal yard directly and the measure for coal dust shall be considered.

Section 2. Coal Storage Facility

Article 50. General provision

1. When the application of domestic coal for coal-fired thermal power plants, one can control that inventory of storage in the plants, and transport directly from the coal mines to the power plant by rail, truck or conveyor. However, when use imported coal or coal mine away from the power plant, the coal to be transported by ship and should have stockpiles within power plants. Mode of transportation equipment piled, break the coal pile and coal storage must be designed in accordance with geographical location, important degree, and the fuel source and boiler types.

Article 51. Outdoor coal storage yard, stacker and re-claimer

1. "*Spontaneous combustion*"; When stocking abundant coal for a long time, it may be possible for spontaneous combustion to occur due to slow oxidation by air and the rise of coal temperature. Measurement equipment to measure coal temperature periodically shall be provided. Moreover, in the case of long term storage of coal, the stacker and re-claimer for trans-shipment of the pile shall be installed or a vehicle type mining machine for trans-shipment of the pile shall be provided.

2. "*Measure for coal dust*"; The volume of coal dust is dependent on the nature of coal and particle size distribution. In the case of outdoor coal stock method, it may change due to the weather conditions, for instance, wind velocity, water adhesion, drop height, etc. The installation of sprinkler equipment, chemical spray equipment, windbreak fence, and windbreak shall be considered.

3. A ditch shall be provided around the coal storage yard to prevent the outflow of contaminated water to the outside of the facility. An effluent treatment facility shall be provided, if required.

4. Stock capacity of the coal yard shall be enough to not affect to the operation of the power plant, especially when imported coal is used, the stock capacity of the coal yard shall be ensured sustainable operation.

5. The technical regulation of outdoor coal yard shall be as follows:

   (1) The ditch, precipitation pond and other effluent treatment facilities shall be provided.

(2) The wastewater treatment facilities shall have capacity in according to precipitation.

(3) Appropriate measures shall be taken, such as compaction, stiffening, chemical dispersion and others to prevent spontaneous combustion.

(4) The retaining facility, such as a dam or others shall be installed according to the topography and surroundings etc. and hence prevent collapse and outflow of the coal pile.

(5) The outdoor coal yard shall have a safety distance between the building and, such as a house, residence and others, or a facility which is utilized for public use, such as river, railway, national road and others.

Article 52. Indoor coal storage yard and coal storage silo

1. "*Measure for coal dust*"; The volume of dust is dependent on the nature of coal and grain distribution. In the case of an indoor stock system or coal silo system, sprinkle equipment and dust collecting equipment shall be provided.

2. "*Coal dust explosion*"; Coal dust explosion occurs when an ignition source exists in limited concentration range. The coal dust concentration in indoor coal stock yard and coal stock silo can easily rise. The structure without accumulation, and installation of sprinkler, installation of dust collector and anti-explosive structure shall be considered.

3. "*Gas explosion*"; In the case of an indoor stock yard, it is possible to generate flammable gases during the storage and handling. The ventilating fan and monitoring equipment shall be installed for CH4, CO and oxygen, etc.

Article 53. Coal discharge facility

1. "*Reliability*"; The coal discharge facility shall have a stand-by machine or other alternative method to continue discharge without any interruption of coal supply and to maintain a high reliability.

2. "*Prevention of bridging*"; The discharge facility to discharge coal by gravity shall always consider the prevention of bridging.

3. "*Emergency stop device*"; An emergency stop device for discharge facility to stop operation in an emergency shall be equipped.

Article 54. Coal conveyor, tripper and shuttle-conveyor

1. The common technical regulation for general coal handling facility shall be as follow:

(1) The necessary protection facility, such as handrail, fence, cover, safety passage and others shall be provided to secure the safety of workers.

(2) All necessary indications, such as signs shall be provided in order to alert the attention to workers of the coal handling facility.

(3) All appropriate measures shall be taken, such as the installation of a sprinkler, a dust collector and the sealing of equipment, etc. in order to prevent the splashing of dust.

(4) A fire hydrant, fire extinguisher, sand for firefighting as well as other firefighting equipment shall be supplied as needed.

(5) The appropriate measures shall be taken, such as the installation of an illumination facility to secure the necessary lightness around the work place to allow the workers to work safely.

(6) The appropriate measures, such as installation of a telephone and others, shall be taken to secure quick correspondence in an emergency.

2. The technical regulation for coal conveyor shall be as follow:

(1) The appropriate measures, for instance, the structure to prevent a fire, should be provided at the driver area and the main pulley of belt conveyor as well as other areas within the system.

(2) The appropriate measures to prevent danger of contact with the accumulated coal on the belt for trans-shipment shall be provided.

(3) The emergency stop devices and equipment shall be provided as well as against the backing other protective equipment for conveyor motor 20kW or larger.

(4) The conveyors shall be covered (except for the conveyor in the house) to prevent coal dust dispersion.

(5) The hopper of belt conveyor connection part shall have a closed structure and keep enough cross section area to prevent blockage and install a sprinkler for dust, if so required.

(6) Serial emergency switches along the belt conveyor or emergency stop switches at every important point shall be provided.

(7) The coal scale should be installed in the horizontal section, if possible.

(8) When the screen and crusher are installed at halfway on the belt conveyor, it is desirable to install it indoors where the dust collector can be equipped to prevent dust splashing and to reduce noise.

(9) An alarm device shall be provided on each belt conveyor to announce and alert the activation of the conveyor.

(10) The belt conveyor shall be capable to be activated in accordance with a sequential start and stop order.

(11) The belt conveyor shall have the structure which is capable to remove coal dust adherent on the belt surface by an attached belt cleaner or belt washing equipment.

(12) When providing sampling equipment, it shall be capable to get a sample to represent all coal property appropriately.

(13) The belt conveyor shall be provided with a foreign material remover, such as iron chip.

Section 3. Coal Dressing Facility

Article 55. General provision

1. Generally, the stoker combustion furnace system which burns lump coal in a moving bed, the fluidized combustion system which burns granular coal in a fluidized bed, the pulverized coal combustion system which burns fine powder pulverized by a coal mill and blows into the furnace with primary air are applied to the coal thermal power plant. An appropriate coal dressing facility shall be provided to suit each combustion system and type of coal property.

Article 56. Coal bunker

1. The capacity of the coal bunker is determined from the relationship between coal delivery work times. It is desirable to keep from 10 to 15 hours stock of boiler nominal fuel consumption per hour.
2. The shape of the bunker shall be taken into consideration keeping an appropriate angle which is more than a repose angle and slope and other measures to prevent blockage, moreover the material of the bunker interior surface, size and shape of discharge shall be considered.

Article 57. Coal feeder

1. The coal feeder shall be capable to adjust the amount of feed coal quickly and accurately to respond to calling demand of the boiler load.
2. The size, shape and arrangement of the connecting pipe between coal bunker and coal feeder shall be considered to avoid blockage.
3. When the coal mill is used under positive pressure, the casing of the coal feeder shall have pressure construction and have the equipment necessary to supply seal air and thereby prevent pulverized coal running back to the feeder. The connecting pipe from coal bunker to coal feeder shall have a construction which is capable to hold the appropriate height of coal seam to seal by the coal seam.
4. The electrical and instrument products used for the coal feeder shall have dust proof, explosion proof or their equivalents provided.

Article 58. Coal pulverizer

1. The coal pulverizer shall have the function to crush supplied coal fully and to separate coarse grains to get the required fine size.
2. It is desirable to use the wear-resistant material for parts of the coal pulverizer where it is adjacent to the coal.

3. The supply facility to supply hot air or gas equally and to isolate air and gas immediately and safely in an emergency shall be provided in order to dry up the supplied coal and keep the crushing effect. When flue gas is used for drying the coal, care should be taken to prevent sparks from entering.
4. The coal pulverizer shall have the system which is capable to adjust draft, pressure and the amount of air.
5. The vertical coal pulverizer shall have a structure which is capable to remove foreign objects in the coal.
6. The casing of coal pulverizer shall be pressure type and be installed with a sealing device between driving part and static part when used under positive pressure.
7. A damping system which is capable to adjust the temperature at the inlet air side of coal pulverizer, is available.
8. The foundation of coal pulverizer shall be designated without transition of excess vibration to protect surroundings for environmental protection and electric devices.
9. A thermometer and draft gauge shall be provided in order to detect burner accident and clogging of pulverized coal pipe due to other troubles.

Chapter 2 Oil Handling Facility

Section 1. Oil Unloading Facility

Article 59. General provision

1. Generally, fuel for thermal power plants that utilize petroleum-based fuels often depend on marine transportation and this is normally transported by large ocean tankers to the coastal port or big river port and then transported from the unloading port by a smaller domestic oil tanker, oil wagon, tank truck and or pipeline. An appropriate transportation method, storage method and amount of storage needed shall be selected according to the nature, location, importance, type of boiler, etc., and an appropriate oil unloading facility shall be selected to suit these, although the reserves needed will be dependent on whether it is necessary to provide storage on the premises or not.

Article 60. Oil unloading facility

1. Fenders to mitigate the impact of tankers broadside and a mooring mast to prevent movement of tankers, shall be provided on the wharf.
2. Loading arms shall be installed on the wharf to unload oil and to prevent oil spills.
3. Fence equipment and an oil neutralizer device shall be provided on the wharf as a measure to control oil spills.

4. Purging equipment for floating and submarine pipe shall be provided for unloading by the mooring system. In this case, a light, a horn and radar reflectors shall be fitted on the mooring buoys.

5. A sign “Under crude oil handling” shall be displayed on the wharf for the equipment to receive the crude oil and naphtha and earth grounding of tankers which have not greater than 10Ω resistance, shall be provided according to paragraph 1 to 4 and others.

Article 61. Oil metering facility

1. A metering facility shall be provided as close to the receiving point as possible.

2. The metering facility assumes that the tested product or inspected product is applied, however, even if the flow-meter does not normally require testing and maintenance of accuracy but shall be used periodically or as needed.

3. It is desirable to equip an integrating flow-meter, air eliminator, compensation thermometer and sampler for metering facility. In this case, it is desirable to find a detecting position for a sampler and a compensation thermometer close to the meter but after the flow-meter pipe. It is desirable that the strainer for flow-meter to be capable to be easy monitored as to it being working effectively. The air separation unit for the crude oil and naphtha shall have its air vent pipe kept at a higher location and be designed as a flare-stack.

4. It is desirable to provide the space to allow a “standard flow-meter future installation” provision on the inlet pipe where it can be used to compare flow results with the standard flow-meter for calibration purposes.

Article 62. Oil pipeline

1. Monitoring equipment used to monitor the operating condition of the pipeline, such as the valve actuation and conditions, shall be provided on the Oil Receiving pipeline.

2. A shut-off valve shall be provided in the Oil Receiving Line at a place relating to the mooring facilities of the ship and land areas close to the water’s edge. However, if the mooring facility is a mooring buoy and connects to ship directly then a blocking check valve or equivalent in lieu of the shut-off valve shall be provided for better security.

3. The opening and closing direction of shut-off valve set forth in paragraph 2 shall be able to be easily recognized at the shut-off valve locations.

4. A device which is capable to detect leakage shall be provided on the Oil Receiving pipeline by measurement of the constant oil pressure in the pipeline.

5. Oil leak detection equipment shall be provided in the vicinity of the shut-off valve unless a check valve is installed.

6. A seismic sensor shall be provided on the oil pipeline.

7. Warning equipment to detect in the event of an abnormal situation such as abnormal changes in pressure shall be provided on the Oil Receiving pipeline.

8. Reporting equipment to report emergencies shall be provided in a place around the border area and a section relating to mooring facilities and land areas on the Oil Receiving pipeline.

9. The receiving part of emergency reporting equipment shall be in a place where it is capable to take necessary measures immediately should it receive notification of an emergency.

10. A facility for reporting an emergency to the firefighting agency and marine safety agency, etc. shall be provided in the emergency reception location.

Article 63. Oil pumping facility

1. The oil pumping unit and its ancillary equipment hereinafter referred to as "pumping equipment for oil feed, etc." shall be pursuant to the following items.

   (1) The pumping equipment for oil feed, etc. shall conform to the relevant standards for having mechanical properties equivalent or higher.

   (2) The pumping equipment for oil feed, etc., if it has a dedicated machine for pumping oil feed installed in a building, the building shall be provided with an adequate open space around the pumping equipment. The pumping equipment for oil feed, etc. shall have an appropriate distance between housing, schools, hospitals and railway for security and safety.

   (3) Pumping equipment for oil feed, etc. shall be placed on a secure and solid foundation.

   (4) When installing the pumping equipment for oil feed, etc. outdoors, it shall conform to the existing and relevant standards.

2. For matters necessary for the installation of other pumps and ancillary equipment, except the pumping equipment for oil feed, they shall also conform to the relevant and existing standards.

Section 2. Oil Transportation Facility

Article 64. General provision

1. In general, fuels for thermal power plants that utilize petroleum-based fuels often depend on marine transportation, and this is normally transported by large ocean tanker to the coastal port or big river port and then transported from the unloading port by a smaller domestic oil tanker, oil wagon, tank truck and or pipeline. An appropriate transportation method, storage method and amount of storage shall be selected according to the nature, location, importance, type of boiler, etc., and an appropriate oil unloading facility shall be selected to suit these also. In the case of a domestic oil field, the pipeline shall be installed for the safety of the public's consideration.

Article 65. Material of oil pipeline

1. The material of pipe, fitting and valve hereinafter referred to as “pipeline, etc.” shall have stable chemical composition and mechanical strength suitable for the chemical and physical impact of materials under maximum operating conditions.

Article 66. Structure of oil pipeline, etc.

1. The structure of pipeline, etc. shall be secure against stress caused by the forces hereinafter referred to as “main forces, etc.” The primary force are, such as weight of oil, inside pressure of pipeline, etc., weight of other ancillary equipment, load of soil, hydraulic pressure, load of train, load of vehicle, buoyancy, and the secondary forces are, such as wind load, snow load, effect of temperature change, effect of vibration, effect of earthquake, effect of anchoring shock, effect of wave and tide, influence at the time of installation, influence from other work.
2. The pipeline, etc. shall conform to the regulation pursuant to the following items:
   (1) The circumferential and axial stress of the pipeline caused by the main load, etc. and limited to steel pipe, shall not exceed the allowable stress.
   (2) The circumferential and axial stress of the pipeline, etc. caused by internal pressure shall not exceeding 40% of the allowable yield point of the pipeline stipulated in the applicable standards. If there is no provision of a standard minimum yield point of the pipeline, the yield point shall be the one which is guaranteed by the mill sheet, etc. However, if that guaranteed yield point exceeds 0.6 of the minimum standards tensile strength value prescribed in the material of the pipeline, it shall then be the guaranteed yield point.
   (3) The composition stress caused by the Main Load, etc., which is composed of the circumferential stress, the axial stress and the perpendicular shear stress of tube in axial direction ,shall not exceeding 90% of the allowable yield point of the pipeline stipulated in the applicable standard.
   (4) Any pipeline which is installed on any bridge shall comply with safe construction against bending, stretching and vibration, etc.
   (5) The maximum thickness of the pipeline shall be calculated according to the appropriate formula, and that if that thickness does not lead to destruction when tested by the appropriate manner, then this provision can be applied.
3. The allowable stress stipulated in paragraph 2-item (1) shall be the allowable tensile strength, the allowable compression stress, the allowable shear stress and the allowable bearing stress. In this case, the allowable stress and the allowable compression stress shall be the value determined by multiplying the longitudinal joint efficiency of joint standards with the minimum yield point and divided by 2.0. If prescribed in the standard, it shall be the value which multiplying the extra coefficient factor with that value divided by 2.0. The allowable shear stress shall be the value

which multiplying 0.6 with the allowable tensile strength, and the allowable bearing stress shall be the value which multiplying 1.4 with the allowable tensile strength.

4. In addition to those prescribed in the preceding paragraph 3, the necessary matters such as the structure of pipeline, etc. shall conform to the applicable standard.

Article 67. Expansion measure for oil pipeline

1. The pipeline shall be taken measures to absorb harmful expansion at locations where hazardous expansion may occur.

Article 68. Joints of oil pipeline, etc.

1. The joint of pipeline, etc. shall be made by welding. However, if it is not possible to weld it may have a flange joint which has the necessary strength for safety.

2. In the case of the proviso of paragraph 1, it shall be possible to check the joints and take measures to prevent any oil leakage.

Article 69. Welding of oil pipeline, etc.

1. The welding of the pipeline, etc. shall be by a welding process which ensures sufficient strength for instance arc welding or similar.

2. The welding equipment and welding consumables used for welding of pipeline, etc. shall conform to the appropriate standards and have the necessary performance equivalent or better.

Article 70. Anti-corrosion coating of oil pipeline, etc.

1. The pipeline, etc. which is installed underground or on the seabed shall have measures taken to prevent surface corrosion by covering with a durable cover and having suitably large electric insulation resistance coating.

2. The pipeline, etc. which is installed on land or sea shall be applied with a corrosion protection coating to prevent external corrosion.

Article 71. Electric protection of oil pipeline, etc.

1. The pipeline, etc. which is installed underground or on the seabed shall have all cathodic protection measures necessary included.

2. If the measures set forth in paragraph 1 have been taken, then the necessary measurements for the adverse effect on adjacent structures and other buried objects shall also be taken.

Article 72. Heating and insulation for oil pipeline, etc.

1. If Trace Heating is needed for the pipeline, etc. when installed it shall not adversely affect the structure, etc. for safety and fire prevention.

Article 73. Installation site of oil pipeline

1. The pipeline shall be buried underground, however, if it is possible to establish a location other than a basement or when it is difficult to bury underground, this provision may not need to be applied.

Article 74. Underground installation of oil pipeline

1. The pipeline shall be installed pursuant to the following items when buried underground:

   (1) The pipeline shall have an appropriate horizontal distance from outside of pipeline to any building, tunnel and other structures.

   (2) The pipeline shall have a distance of 0.3m or more from outside of the pipeline to any other structures, and shall cause no trouble for the security and safety of them. However, when it is difficult to keep at least 0.3m distance and the appropriate measures for the security and safety of those structures, etc. have been taken, this provision may not need to be applied.

   (3) The distance between the outside surface of the pipeline and the ground surface shall not be less than 0.9m in forest wildness and not be less than 1.2m in other areas; however, when placed in protective structures, this provision may not need to be applied.

   (4) The pipeline shall be buried to an appropriate depth so as to ensure that no damage occurs to pipeline by freezing of the ground.

   (5) The pipeline shall be buried outside the slip surface with a sufficient safety factor when installing pipelines in the vicinity of cut slopes or any earth embankments.

   (6) When installing the pipeline in a rising section and a place where the ground conditions of support can change suddenly, a curved pipe shall be inserted and the necessary measures, such as the improvement of soil and others shall be taken.

   (7) Excavation and backfilling shall be done by a suitable method.

Article 75. Oil pipeline, etc. installation buried under road

1. The pipeline shall be installed pursuant to Article 73. as well as the following items when installing under the road:

   (1) The pipeline in principal shall be buried in a place where it has minimum affect or effect on the vehicle load.

   (2) The pipeline shall have a horizontal distance of at least 1m between the outside surface of the pipe and any boundaries.

   (3) The pipeline, “the protection works or protection structure itself when protected by the protection work or protection structure”, shall have a distance of at least 0.3m from the outside pipeline to other structures and shall cause no problem for structure security. However, when

it is difficult to keep the distance of at least 0.3m and the appropriate measures for the structure security have been taken; this provision may not need to be applied.

(4) The protection work shall be provided so as avoid damage to the pipeline from the construction work pertaining to the road, when installing the pipeline under the road in the power plant premises. However, if pipeline is placed in a protective structure, this provision may not need to be applied.

(5) When installing pipelines under the road in the power plant premise, the distance between the outside surface of pipeline “excluding that placed in the protection structure” and ground surface shall not be smaller than 1.8m and the distance between the outside surface of protection work, protection structure and ground surface shall not be smaller than 1.5m.

(6) When installing the pipeline under a paved road, it shall be buried under the roadbed, “if there is a barrier layer, under that layer”, and the distance between the bottom surface of pipeline and beneath of layer shall not be smaller than 0.5m.

(7) When burying the pipeline under the road, other than paved part, the distance between the outer surface of pipeline and ground shall not be smaller than 1.2m, “if it is protected by protection work or protection structure, not be smaller than 0.6m” and “if it is burying under the road in the urban road, not be smaller than 0.9m”.

(8) When burying the pipeline under the road where cable, water pipe, sewer pipe, gas pipe and other similar things are buried or planed to be buried, the pipeline shall not be buried on the top of them.

Article 76. Oil pipeline, etc. installation buried under rail road

1. The pipeline shall be installed pursuant to the following items and the provision of the buried pipeline shall be applied when the necessary changes have been carried out.

(1) The pipeline shall have a horizontal distance of at least 4m from the outside surface of pipeline to the orbit center and at least 1m from the outside surface of the pipeline, etc. to the land boundary of the trucks.

(2) The pipeline shall have a distance of more than 1.2m between the outside surfaces of pipe to the ground.

Article 77. Oil pipeline, etc. installation buried in the regional river conservation

1. When installing the pipeline in the river conservation area alongside rivers, the pipeline shall be kept the required distance as stated by law on the shoulder and toe of the slope or embankment for river management.

Article 78. Onshore installation oil pipeline, etc.

1. The pipeline shall be installed pursuant to the following items when installing above the ground:

   (1) The pipeline shall be installed in a manner that does not come into contact with the ground surface.

   (2) The pipeline shall be kept with a separation distance from schools, hospitals, railways and other facilities, with at least 15m width on either side.

   (3) The pipeline shall be supported by a supporting structure safely constructed with consideration for movement due to earthquake, wind pressure, land subsidence and temperature changes, etc.

   (4) The supporting structure stipulated in item- (3) shall have reinforced concrete fire resistance or better. However, if there is no fear of deformation of the supporting structures, this provision may not need to be applied.

   (5) Protection facility shall be provided if there is fear to damage to the pipeline or its support by the collision of vehicles.

   (6) The pipeline shall have the required access for the maintenance when considering against other works excluding the supporting structure of the pipeline.

Article 79. Subsea installation of oil pipeline, etc.

1. The pipeline shall be installed pursuant to the following items when installing on the seabed:

   (1) The pipeline shall be buried. However, if there is no fear of damage to the pipeline due to anchoring, etc. and other unavoidable situations, this provision may not need to be applied. Pipeline cannot cross other pipelines already bury.

   (2) In principal, the pipeline shall have a minimum horizontal distance of at least 30m from existing pipelines.

   (3) All necessary measures to avoid contact with other pipelines shall be taken, if more than two pipelines are installing together.

   (4) Protection construction shall be provided at the rising portion of pipeline. However, if it is something other than a steel pipe leading to the rise of the mooring buoy, this provision may not need to be applied.

   (5) The distance between the outer surfaces of the pipeline and seabed shall be a safe distance considering the soil quality, backfilling material and vessel traffic situation, etc. depending on the tests of anchoring. In this case, if there is planning of dredging the seabed, the seabed shall be deemed 0.6m below the planned dredged seabed level, “referring to as the seabed after the dredging has been completed in the dredging project”.

   (6) The measures to prevent a scour on the buried pipeline should be taken where necessary.

(7) The excavation and backfilling shall be done using suitable methods.

(8) If the pipeline is installed without being buried, then the pipeline shall be installed on a level seabed so as to continuously support the pipeline.

(9) Measures to prevent the pipeline floating or moving shall be taken, if there is fear of the possibility of floating or moving.

Article 80. Offshore installation of oil pipeline, etc.

1. When installing the pipeline in the sea, it shall conform with the following items:

(1) The pipeline shall be supported by a supporting structure for safe construction against earthquake, wind and wave pressure, etc.

(2) The required space between pipeline surface and sea surface shall be ensured if there is likelihood to cause problems for ship navigation.

(3) Protection facilities shall be installed if there is likelihood of damage of the pipeline and supporting structures due to ship collision, etc.

(4) The pipeline shall have the required access for maintenance between other structures excluding the supporting structure of the pipeline.

Article 81. Oil pipeline, etc. installation across the road

1. The pipeline shall be buried under the road when installing it across any road. However, when there is no other place suitable for the road over the terrain, pipeline, etc. or other special reasons and it is capable to install in the air above the road and if appropriate measures are taken for the security and safety, then this provision may not need to be applied.

2. The pipeline shall be placed in a sheath tube and other structures when it is installed across the road. However, when corrective measures are appropriate to support the rapid changing conditions, and if it does not significantly hinder the transportation of causing the work related to the implementation of pipeline, etc., this provision may not need to be applied.

3. When the pipeline is installed in the air above the road, the vertical distance between the bottom of the pipeline and other structures relating to pipeline and its ancillary with the road surface, shall be fixed at least 5 m.

Article 82. Oil pipeline, etc. installation across the rail road

1. When the pipeline is buried across the railroad, the provision of the pipeline under the railroad shall be applied with the necessary changes having been made.

Article 83. Oil pipeline, etc. installation across the river, etc.

1. When installing the pipeline across a river, etc., the pipeline shall be installed on a bridge. However, if it is not appropriate to install on a bridge it may be buried under and across the river.

2. In principal, when the buried pipeline crosses a river or waterway, it shall be installed in a sheath tube and measures shall be taken to prevent damage due to the floating of structures and ships anchoring.

3. The pipeline shall be buried at a depth which is not affected by the variations of the river bed, scouring and anchoring, etc. In the case of the proviso of paragraph 1, the distance between outside surface of pipeline with planned river bed height, “in case of the planned river bed height is higher than the maximum river bed height, it shall be the maximum river bed height”, the distance shall in principal be at least 4.0m . In the case of the pipeline crossing the waterway and being buried in the river bed, the distance shall be at least 2.5 m. In the case the pipeline crossing other small waterways, the distance shall be at least 1.2 m.

Article 84. Measure for leakage and spread of oil pipeline, etc.

1. When installing the pipeline on the river, tunnel or road, all measures necessary to prevent the spread of leaking oil shall be taken.

Article 85. Prevention of accumulation of flammable vapor from oil pipeline, etc.

1. All necessary measures shall be taken to prevent the retention of flammable vapors in the tunnel, limited to those that tunnels that people could enter.

Article 86. Installation in a place where there might be uneven settlement, etc.

1. When installing the pipeline in a location where there may be a possibility of uneven settlement and landslides, the necessary measures to avoid any damage to the pipeline, etc. due to this uneven settlement and landslide possibility shall be taken as well as a monitor fitted to detect stresses in the pipeline, etc.

Article 87. Oil pipeline connection with bridge

1. When installing the pipeline on the bridge all necessary measures shall be taken to avoid excessive stress on the pipeline.

Article 88. Non destructive test of oil pipeline, etc.

1. Welding parts of pipeline, etc. shall have radiographic examination carried out, “in cases where it is not possible to conduct radiographic examination, ultrasonic examination and magnetic practice examination or liquid penetrant examination should be applied” and those examinations need to be acceptable. In the case of only the welded parts of ground pipeline, etc. in the premises of oil terminals, this examination can be carried out by sampling not less than 20% of all weld joints.

2. Welding parts of pipeline, etc. where damage by vibration, shock and temperature, etc. is possible, shall have radiographic examination and ultrasonic examination and magnetic practice examination or liquid penetrant examination carried out and those examinations should pass this examination.

Article 89. Pressure test of oil pipeline, etc.

1. The pipeline, etc. shall have no leakage or other anomalies when tested at a pressure of at least 1.5 times the normal pressure by appropriate testing manner.

Article 90. Operation monitoring device for oil pipeline, etc.

1. The pipeline, etc. “meaning the synthesis of these valves and ancillary equipment provided for use in machines that are pumping oil transportation pipeline, etc. and their cooperation with pipeline, etc.” shall be provided with monitoring equipment to monitor the operation conditions of pumps and valves.
2. The pipeline, etc. shall be provided with a system for warning in the event of an abnormal situation such as fluctuations in pressure or flow anomalies occurring.

Article 91. Safety controller for oil pipeline, etc.

1. The safety controller features which have the following functions shall be equipped on the pipeline, etc:
   (1) A control function to operate and ensure when the control circuit oil pressure safety device, equipment to detect the leakage automatically, emergency shut-off device, seismoscope and other similar equipment are working normally.
   (2) A control function to stop the pump equipment and shut off emergency shut-off valves immediately in conjunction with any automatic or manual systems to prevent accidents in the event of any abnormal occurrence.

Article 92. Pressure relief device for oil pipeline, etc.

1. A pressure control device, hereinafter referred to as “the pressure relief device”, shall be provided to keep the internal pressure of oil pipeline, etc. at normal pressure and to prevent any pressure rise caused by hammering, etc. within 1.1 times of the normal pressure.
2. The strength and material of the pressure relief device shall be governed by the pipeline, etc.
3. The pressure relief device shall have sufficient capacity to absorb any pipeline pressure fluctuations.

Article 93. Leakage detector, etc. for oil pipeline, etc.

1. The pipeline, etc. shall be equipped with leak detection openings and leak detection equipment pursuant to the following items:
   (1) The device shall be capable of detecting flammable vapors in the check box for oil pipeline, etc.
   (2) The device shall be capable of automatically detecting oil leakage by measurement of oil flow in the pipeline, etc. or other devices having equivalent or higher performance.

(3) The device shall be capable of automatically detecting oil leakage by measurement of oil pressure in the pipeline, etc. or other devices having equivalent or higher performance.

(4) The device shall be capable of detection of oil leakage to keep oil pressure and measure pressure in the pipeline, etc. or other devices having equivalent or higher performance.

(5) The detection opening provided shall be pursuant to the provisions of the applicable standards, if the pipeline, etc. is buried in the underground.

Article 94. Emergency shut-off valve for oil pipeline, etc.

1. An emergency shut-off valve shall be provided on the pipeline, etc. at intervals of about 1km when installed in the city and where the pipeline, etc. is installed across any main river at that point.

2. The shut-off valve shall have the following functions:

   (1) A function to shut off both by remote operation and manual operation; and

   (2) A function to shut off automatically and immediately when the leakage of oil is detected by the automatic oil detector, when the acceleration of earthquake exceeding the set value is detected by the seismoscope or a strong motion is detected by the seismograph.

3. The emergency shut-off valve open and close situation shall be easily identified where it is located.

4. When providing an emergency shut-off valve in any basement, it shall be placed within a box. However, if it is provided under other than the road and/or other possible measures for inspections can be taken, this provision may not need to be applied.

5. The emergency shut-off valve shall be something that cannot be manually opened and closed by any person other than the person that is specified by the user to operate the emergency shut-off valve.

Article 95. Oil removal measure for oil pipeline, etc.

1. The measures to remove oil in the pipeline, etc. when needed shall be taken.

Article 96. Seismic sensor, etc. for oil pipeline, etc.

1. Seismoscope and seismograph shall be equipped on the pipeline, etc.

Article 97. Notification facility of oil pipeline, etc.

1. The report facility listed in following items shall be equipped on the pipeline, etc:

   (1) Emergency reporting facility; and

   (2) Reporting facility to report to the fire authority.

2. The transmitting of the emergency reporting facility shall be provided in appropriate locations and the receiving of the emergency reporting shall be provided in appropriate locations to allow an immediate response to be taken.

3. The report facility to report to the fire authority shall be a private facility and shall be provided at allocation where the receiving facility of the emergency reporting is located.

Article 98. Alarm facility of oil pipeline, etc.

1. A warning facility shall be provided for commercial oil facilities.

Article 99. Firefighting facility for oil pipeline, etc.

1. Fire extinguishing equipment shall be provided for the commercial oil facilities.

Article 100. Chemical fire engine for oil pipeline, etc.

1. Chemical fire truck, patrol cars and storage house, etc. shall be provided on the path of the pipeline, etc.

Article 101. Back-up power for oil pipeline, etc.

1. A reserve power source facility shall be provided for security.

Article 102. Grounding, etc. for safety of oil pipeline, etc.

1. A grounding system, etc. shall be provided on the pipeline, etc. for security, if required.

Article 103. Isolation of oil pipeline, etc.

1. The pipeline, etc. shall be isolated from the supporting structures and other structures, if required for safety.

2. The pipeline, etc. shall have inserted an isolation joint, if required for safety.

3. When installing the pipeline, etc. close to the ground location of the arrester, all the necessary measures for the isolation shall be taken.

Article 104. Lightning protection system for oil pipeline, etc.

1. A lightning protection system shall be provided for the ground part of commercial oil facilities. However, if it does not hinder the safety of the surrounding circumstances, this provision may not need to be applied.

Article 105. Indication, etc. for oil pipeline, etc.

1. A location marker caution sign and attention board shall be provided on the path of the pipeline, etc.

Article 106. Operation test of safety facility for oil pipeline, etc.

1. The Safety Equipment shall operate properly when tested by the appropriate method.

Article 107. Pig handling equipment for oil pipeline, etc.

1. All matters necessary for the provision of a pig handling equipment shall conform to the appropriate standards.

Section 3. Oil Storage Facility

Article 108. General provision

1. Generally, the fuel for thermal power plants that utilize petroleum-based fuels often depend on marine transportation and is transported normally by large ocean tankers to the coastal ports or big river ports and is then transported from the unloading port by small domestic oil tankers, oil wagons, tank trucks and/or pipeline. The appropriate transportation method, storage method and amount of storage shall be selected according to the nature, location, importance, type of boiler, etc., although it is capable to transport oil by pipeline continuously.

Article 109. Oil storage tank

1. The outdoor oil storage tank shall conform to the following items when installed. However, the provisions of item-(1) and (2) of this paragraph shall not need to be applied for the outdoor oil storage tank which has a capacity of not less than 1,000 m^3, hereinafter referred to as "specific outdoor oil storage tank":

   (1) The outdoor oil storage tank shall be made of the steel plate of not less than 3.2mm thickness and be airtight, shall have no leakage and other abnormalities when tested by a hydraulic test including a test performed by suitable liquid except water. The pressure vessel test shall be conducted for a period of 10 minutes at the pressure of at least 1.5 times the operation pressure. The operation pressure shall be the maximum pressure experienced under the normal operating conditions.

   (2) The outdoor oil storage tank shall be fixed on a solid foundation or ground to prevent the stress caused by inertial forces due to earthquake, wind forces concentrating to side wall or the limited place of supports. In this case, the calculation of the forces due to earthquake and wind forces shall be done in pursuant to the provision of the appropriate standard.

   (3) The outdoor oil storage tank shall have the structures which are capable to release gas or vapor from inside to outside when the pressure is abnormally raised due to an explosion in the tank.

   (4) The outdoor oil storage tank shall have an appropriate distance between itself and housing, schools, hospitals and other facilities. However, if the necessary safety measures are taken, this provision may not need to be applied.

(5) The outdoor oil storage tank shall have an appropriate distance between the boundary of the oil base premises and the side wall of tank in addition to the item-(4). However, when providing an effective fire wall built by non combustible materials and there is little danger of fire because of the location and other appropriate measures are taken, this provision may not need to be applied.

(6) The outdoor oil storage tank shall have a wide enough open space around it depending on the capacity of the tank.

(7) The outdoor oil storage tank shall have a coating applied to prevent corrosion of the outside surface.

(8) All measures necessary to prevent corrosion of the outside surface of the bottom plate shall be taken when the bottom plate of the outdoor oil storage tank is installed adjacent to the embankment.

(9) The supporting structures of the outdoor oil storage tank shall be fire-resistant using similar to reinforced concrete, the steel reinforced concrete and others equivalents.

(10) A vent pipe and safety device shall be provided for the outdoor oil storage tank.

(11) A device which is capable to automatically measure the reserve level of tank is required.

(12) A drain pipe shall be provided on a side wall for the outdoor oil storage tank. However, if it is possible to provide the drain in the tank bottom plate at the junction where the pipeline and piping are connected with the outdoor oil storage tank and this can be done without any damage due to earthquake, etc. then this is where drain should be located.

(13) All necessary measures shall be taken to avoid any damage due to earthquake to the junction where the pipeline, etc. and piping are connected with the outdoor oil storage tank.

(14) A shut-off valve which can rapidly isolate in emergencies shall be provided in the junction where the piping connects with the outdoor oil storage tank, limited to a capacity that exceeds 10,000 m^3 and above.

(15) The outdoor oil storage tank shall have an oil-proof dike around it.

(16) A bulletin board which shows posting signs and all necessary matters relating to fire-proof facilities shall be provided for the outdoor oil storage tank.

2. The specific outdoor oil storage tank which has capacity of not less than 1,000 m^3 shall conform to the following items when installed:

(1) The specific outdoor oil storage tank shall be made of steel plate which conforms to the appropriate standards; the steel plate shall have the appropriate mechanical properties be airtight, and shall have no leakage and other abnormalities when tested by a hydraulic test

including the test performed by suitable liquid except water. However, the pressure vessel may have conducted a pressure test instead of a water filling test.

(2) The specific outdoor oil storage tank shall be secure against stress caused by the main load, such as the main loads which are caused by the weight of the tank and its ancillary facility, weight of oil in the tank, inside pressure of tank, effects of temperature change, and secondary forces which are caused by, such as snow load, wind load, effect of earthquake, etc.

(3) The specific outdoor oil storage tank shall conform to the following regulations:

1) The stress caused by the main load shall be the standard yield point or not greater than 60% of 0.2% tensile strength of the material.

2) The stress caused by the composition of the main load, wind load and effect of earthquake shall be the standard yield point or not greater than 90% of 0.2% tensile strength of the material.

3) The retained horizontal strength shall not be less than the required strength to withstand the impact of an earthquake horizontal strength.

4) The thickness of the wall plate shall be calculated according to appropriate standards formula.

5) The minimum thickness of the sidewall, bottom plate and roof, the stretching length of the annular plate from the outer surface of sidewall required to be provided under the lowest sidewall of the specific outdoor oil storage tank exceeds 15mm, the minimum stretching length from the inside surface to tank center and minimum thickness shall conform to the appropriate standards.

6) The floating roof for the specific outdoor oil storage tank shall have a design that withstands any damage due to the oscillation of oil surface.

7) The structures of floating roof and bottom plate shall conform to the appropriate standards in addition to the sub-item-5).

(4) The welding procedure used for the specific outdoor oil storage tank shall conform to the appropriate standard as well as the welded part conforming to the appropriate standard of radiographic examination or vacuum test, etc.

(5) The foundation and soil of specific outdoor oil storage tank shall conform to the following regulations:

1) The foundation and soil shall be secure and firm against the stress and the transformation caused by the weight of the specific outdoor oil storage tank, its ancillary equipment and weight of stored oil, etc. In this case, the calculation formula of the foundation and soil shall conform to the appropriate standards.

2) The foundation and soil shall conform to the appropriate standards of plate loading tests and compaction tests, etc.

3. The underground tank shall conform to the following items when installed:

(1) The underground oil storage tank shall be made of steel plate of not less than 3.2mm thickness and be airtight, shall have no leakage or other abnormalities when tested under a pressure of 70kPa. However, the pressure vessel shall have a pressure test carried out for 10 minutes at a pressure of at least 1.5 times of operation pressure.

(2) The underground oil storage tank shall be secure against stress and transformation caused by the main load for example, the main load caused by the weight of tank and its ancillary facility, weight of oil in the tank, inside pressure of tank, load by soil, and the secondary forces which are caused by the effect of earthquake, etc.

(3) The stress of underground oil storage tank body caused by the main load, the composition main load and secondary load shall not exceed the allowable stress.

(4) Underground oil storage tanks shall be installed in the underground tank room.

(5) The distance between the outer wall of the underground tank and the inner wall of the tank room shall be not less than 0.1m, and dry sand shall be packed around the tank.

(6) When installing two or more underground tanks adjacent to each other, the distance between the outer surfaces of each tank shall be kept to not less than 1m.

(7) The top of the underground tank shall be not less than 0.6m below the ground surface.

(8) Piping shall be connected to the top of any underground tank.

(9) The following equipment to detect any oil leakage from the tank shall be provided on the tank or around the tank:

1) Equipment to detect oil leakage of installed pipes at four or more locations around the tank; or

2) Equipment to detect leakage of oil by monitoring the changes in the amount of oil in the underground tank at all times by monitoring the surrounding flammable gas or their equivalent.

(10) The tank room where the underground tank is to be installed shall have the necessary strength and all measures for water proofing shall be taken.

(11) The underground oil storage tank room shall be secure against stress and transformation caused by the main load, such as the main load is the combination of loads caused by the weight of tank and its ancillary facilities, the weight of oil in the tank, the inside pressure of tank, the soil load, and any secondary forces which are caused by the effect of earthquake, etc.

(12) The stress of tank room caused by the main load, the composition main load and secondary load shall not exceed the allowable stress.

(13) The following measures of water proof protection for the underground oil tank room shall be taken:

1) The underground oil tank room shall be made of a water proof concrete or material which has the equivalent or better; water proof properties and

2) Measures to avoid the entry of ground water and rain water, etc. from concrete joints and cover joints within the tank room shall be taken when the reinforced concrete is applied.

(14) A bulletin board which shows posting signs to all appropriate matters relating to the fire-proof facilities shall be provided for the underground oil storage tank.

4. When installing the indoor oil tank the following provisions shall be applied, paragraph 1 item-(1), paragraph 1 item-(5) and paragraph 1 item-(7) to paragraph 1 item-(10) shall be applied with the necessary changes having been carried out:

(1) Indoor oil tanks shall be installed in dedicated tank rooms; and

(2) When installing two or more indoor tanks adjacent to each other, the distance between the outer surfaces of each tanks shall be kept at least 0.5m; and

(3) The capacity of the indoor oil tank shall conform to the appropriate standards; and

(4) A bulletin board which shows posting signs to all appropriate matters relating to fire-proof facilities shall be provided for the indoor oil storage tank.

5. The calculation of tank capacity shall conform to the appropriate standards.

Article 110. Piping of oil storage tank

1. Piping shall be installed pursuant to the following provisions as listed when installing the pipe on the oil storage tank:

(1) Piping shall be made of steel and shall be have no leakage when it is examined by hydraulic test, including tests by non-flammable liquid other than water and non-flammable gas at least 1.5 times of the normal operation pressure, the maximum inner pressure of pipe at normal situation; and

(2) Piping which is installed on the ground shall be installed without direct contact with ground surface; and

(3) Piping which is installed on the ground shall have applied an outer coating for the prevention of corrosion; and

(4) When burying the pipe under the ground, there should be measures taken to prevent surface corrosion by the use of a protective covering coat, cathodic protection is also needed when

burying in a place where it there is a likelihood of problems caused by electrical corrosion; and

(5) When burying the piping under the ground, the joints parts , excluding welded joints , shall be inside a concrete box, etc. in order to check for leakage from those joints; and

(6) Equipment for Trace heating and keeping the piping warm shall have safety construction against fire protection.

Article 111. Changeover valve, etc. of oil storage tank

1. A switching valve and control valve, etc. for oil storage tank shall be provided pursuant to the provisions stipulated by the appropriate standards.

Article 112. Oil receiving opening of oil storage tank

1. A receiving port for the oil tank shall be provided pursuant to the provisions stipulated by appropriate standards.

Article 113. Safety measure for oil terminal

1. The oil storage base shall have provided a trench and a fence, etc. to prevent non authorized people entering into the premises without reason, and shall have indicated the commercial oil base. However, if there is no danger to the public by the surrounding situation and no entering of non-authorized people normally, this provision may not need to be applied.
2. All measures shall be taken to prevent the flow-out of oil from the oil storage base to anywhere off-premises.

Chapter 3 Gas Handling Facility

Section 1. Gas Receiving and Transportation Facility

Article 114. General provision

1. It is expected that the natural gas transported from the domestic coastal gas field, the blast furnace gas and converter gas from adjacent ironworks, the residual gas from adjacent refinery works, etc. are applied as the normal fuels for thermal power plants. This is what is utilized in the gasification process in power plant premises as well as the gas received from any underground coal gasification. A suitable unloading system shall be selected to suit the nature of the power plant, its importance, location and type of boiler.

Article 115. Classification of gas pressure for gas facilities

1. The pressure for gas facility shall be classified in 4 ranges, low pressure, middle pressure, high pressure together with very high pressure stipulated as follows.

Table 8: Classification of Gas Pressure for Gas Facilities

Class	Pressure (MPag)	Object
Very High Pressure	$7.0 \leq P$	Long range transportation from gas field by pipeline
High Pressure	$1.0 \leq P < 7.0$	Middle range transportation from gas base by pipeline
Middle Pressure	$0.2 \leq P < 1.0$	Short range transportation by pipeline
Low Pressure	$P < 0.2$	For home use

Article 116. Incoming gas pipeline

1. It is desirable to reduce bends and shorten pipeline to as short a length as possible so as to reduce any pressure drop, and also reducing bends will help to prevent the accumulation of gas in the incoming gas pipeline.
2. It is desirable that the incoming gas pipeline be buried.
3. The incoming gas pipeline shall have a slope to allow draining of any accumulation from drains, if so required.
4. Full closure devices such as water seal valves, etc. shall be provided for the incoming gas pipeline which is tapped from the main gas line; this will allow isolation of this branch for maintenance.
5. A nozzle which can be used to purge the system with steam and or nitrogen shall be provided in places where the gas is easy to accumulate.
6. Protection equipment for instance insulation to shield the pipeline from the sun where the incoming gas pipeline can be subject to direct sunlight shall be provided.
7. The Supporting System used for the incoming gas pipeline shall have the construction and materials needed to bear all loads such as are possible from mechanical, chemical and thermal impacts that can occur during the operation.
8. The incoming gas pipeline shall be connected by a gas tight thread, or welding or flange joints.
9. A water seal valve in the incoming gas pipeline shall be provided with Trace Heating to protect from freezing occurring in cold climate areas where needed. Moreover, it shall be constructed so that the effect on the water seal is visible from the outside, even if there is a sudden change of pressure inside the piping.
10. The incoming gas pipeline shall be painted in principle. In this case, the paint color shall be capable to distinguish it from other non-gas piping.
11. A discharge pipe shall be provided for the gas vent or air vent valves on the incoming gas pipeline and the discharge shall be located in a place where it is not harmful to operators.
12. A gas discharge pipe and connecting pipe for steam or nitrogen shall be provided for incoming gas pipeline.

13. The gas vent pipe prior to the boiler entry shall not be led into boiler furnace area.

14. A gas vent valve shall be provided as close as possible to the isolating equipment. Moreover, a purge valve shall be provided in front of and as close as possible to the last shutoff device, viewed from the direction of gas flow.

15. A drain system shall be provided at the bottom of incoming gas pipeline.

Article 117. Material of gas transportation facility

1. The main materials of gas pipelines which are installed in the sea or on the land and other gas pipelines shall have stable mechanical properties against chemical and physical impact that can occur under maximum and minimum operating temperatures depending on the type and scale of the facility.

Article 118. Structure, etc. of gas facility

1. Gas pipelines which are installed in the sea or on land and other pipelines shall have the appropriate structure depending on the kind and size of the facility, the load during operation, the maximum operation temperature and pressure at the minimum ambient temperature:

   (1) The part of the pipe where the gas passes through and where the inner surface is exposed to a gas pressure 0.2MPa and above.

   (2) The pipeline which is installed on the land where the gas passes through and where the inner surface is exposed to a gas pressure 0.2MPa and above.

   (3) The pipeline which is installed on the seabed where the gas passes through and where the inner surface is exposed to a gas pressure 0.2MPa and above.

   (4) The piping which is buried or where the inner surface is exposed to a gas pressure 0.2MPa and above.

2. The pressure part of gas facility where the gas passes through shall be airtight without leakage when conducting pressure tests by appropriate means. However, it does not need to be applied with regard to those items listed below:

   (1) Welded pipeline and its ancillary facility which have passed non-destructive examination; or

   (2) The high pressure pipeline which is less than 15m long and its ancillary equipment, middle pressure pipeline and its ancillary equipment which has welding joints of the same material, same dimension and same welding procedure and has passed pressure testing under at least 1.5 times the maximum operation pressure.

3. The part of gas facility where the gas passes through shall be airtight without leakage when tested by appropriate means. However, need not be applied with regard to those items listed below:

(1) That which is where the operation pressure is 0MPa or below and always be open to the atmosphere.

4. The foundation of the gas facility shall have no harmful distortion caused by uneven settlement, etc. of the pipeline.

Article 119. Welding part of gas transportation facility

1. The welding part of gas transportation facility for the pipeline installed in the sea, the pipeline installed on the land and other pipelines where the gas passes through and exceeds 0MPa shall have no harmful defects or cracks in the weld, and shall be designated with at least the strength as needed.

2. When welding the gas facility listed below, limited that the maximum operation pressure is 0.3MPa and above in case the pipeline listed in the sub-item-(2) and the weld is exposed to gas pressure , the welding procedure, etc. shall be confirmed by the appropriate mechanical testing, etc:

   (1) The pipe which the inner diameter is not less than 150mm and is listed below.

   (2) The pipeline listed below:

      1) The pipeline where the gas maximum operating pressure is high pressure; or

      2) The pipeline where the gas maximum operating pressure is middle pressure and the inner diameter is not less than 150 mm.

3. The welding parts that are stipulated in the above paragraphs and where exposed to gas pressure , shall be welded according to the appropriate weld design, kind of welding method and shape of welding part etc. and welded adequately. Moreover it shall be confirmed by appropriate examination that there is no harmful defects and adequate mechanical properties.

Article 120. Safety valve of gas transportation facility

1. An appropriate safety valve to relief pressure shall be provided for the incoming gas and transportation facility where it is possible that over-pressure may occur. In this case, such a safety valve shall be installed where it avoids interference when any gas is ejected from the safety valve during normal operation.

Article 121. Instrument device, etc. for gas transportation facility

1. Appropriate instrumentation equipment to measure or check the operation conditions shall be provided to prevent damage of incoming gas and transportation facility.

Article 122. Warning device for gas transportation facility

1. Appropriate warning devices to detect conditions that may lead to the damage of equipment for incoming gas and transportation facility shall be provided.

Article 123. Fail-safe control and interlock for gas transportation facility

1. Measures to prevent mistakes and to ensure the normal operation shall be taken for isolation of the incoming gas and transportation facility.

2. An appropriate interlock for instrument circuits shall be provided for the important part of incoming gas and transportation facility.

Article 124. Back-up power, etc. for gas transportation facility

1. Appropriate measures shall be taken to ensure that there is no loss of functionality of any part of the equipment due to power outage for safety apparatus needed to safely close the incoming gas and transportation facility.

Article 125. Measure of odor for gas transportation facility

1. The gas shall have an odor in order to sense easily its existence. However, in the case when the presence of odor can be detected, if the appropriate detector is equipped and it is possible to detect odor but the gas /air volume mixture ratio is 1/1000, this provision may not need to be applied.

Section 2. Gas Generation Facility

Article 126. General provision

1. In the future the generation of coal gasification could be applied as a means of attaining the higher efficiency coal fired thermal power plant. This Section is provided as an assumption that there may be an application for underground coal gasification, and although this type of power plant will still apply conventional steam and gas turbines. An appropriate production system, transportation system, control system and amount of production, shall be selected according to the nature, location, importance, and type of boiler, etc.

Article 127. Off Limits to gas generation and supply facility

1. Appropriate measures shall be taken so as to keep out non authorized persons with no reason to be in the premises from entering the gas generation facility.

Article 128. Security communication facility for gas generation and supply facility

1. Appropriate emergency communication equipment for gas generation facility shall be provided to ensure rapid emergency communications.

Article 129. Off-set distance for gas generation and supply facility

1. The gas generation facility shall have sufficient separation distance between the outer surface and the boundary, if the boundary border of the workplace bounds on sea, river, lakes, etc., then it shall be deemed the other side of these.

2. The gas generation facility shall have sufficient distance from outer surface to schools, hospitals, etc.

Article 130. Security compartment of gas generation and supply facility

1. The gas generation facility shall be set up with an appropriate partition for security and shall have necessary safety distance between each other to prevent any disaster depending on the system and size when gas leaks.

Article 131. Firefighting facility for gas generation and supply facility

1. An appropriate fire fighting facility for the gas generation facility shall be provided in the proper location depending on its size.

Article 132. Prevention of gas accumulation for gas generation and supply facility

1. When installing the gas generation facility indoors, its structure shall allow for no accumulation of gas should there be any gas leak.
2. A detector to detect gas leakage and alarm equipment for the gas generation facility where the gas passes through shall be provided in a suitable place where gas may be possible to accumulate in the gas manufacturing works.

Article 133. Explosion-proof structure of electric facility for gas generation and supply facility

1. Electrical equipment which is installed in the vicinity of gas work of the gas generation facility where the gas passes through shall be of the explosion-proof type depending on the conditions of place and the kind of gas.

Article 134. Distance from flammable gas facility of gas generation and supply facility

1. The gas facility of the gas generation facility where the gas passes through shall have sufficient distance from the outer surface of the works to the firefighting equipment to prevent fires due to any gas leak.

Article 135. Gas displacement of gas generation and supply facility

1. The part of gas works of the gas generation facility where the gas passes through shall have a structure that is capable to replace gas safely.
2. The appropriate measures for the vent-stack of the gas generation and supply facility shall be taken to keep from damaging its surroundings due to any gas emissions.
3. The appropriate measures for the vent-stack of the gas generation and supply facility shall be taken to keep from damaging its surroundings due to heat radiation and to be able to release gas safely.

Article 136. Material of gas generation and supply facility

1. The main materials of gas generation and supply facility shall have stable mechanical properties against any chemical or physical impacts that could occur under the maximum and minimum operating temperatures depending on the type and scale of facility.

Article 137. Structure, etc. of gas generation and supply facility

1. The gas generation facility shall have an appropriate structure depending on the kind and size of facility against the load during operation, the maximum operation temperature and pressure at the minimum ambient temperature.

2. The structure of foundation of gas works used under high pressure gas shall not cause harmful distortion due to any uneven settlement of the gas facilities.

Article 138. Welding Parts of gas generation and supply facility

1. Any welding part of the gas generation and supply facility, where the gas passes through and exceeds 0MPa shall have no harmful defects or cracks etc. in the weld, and shall be designated with at least the strength as needed.

2. When welding the gas generation facility listed as below, limited to when the maximum operation pressure is 0.3MPa and above in case the pipeline listed in the sub-item-(3)-2), and welded part where exposed to gas pressure, the welding procedure, etc. shall have its adequacy confirmed by the appropriate mechanical examination, etc.

   (1) The vessel which are listed below:

      1) Where the operating pressure of the gas is 0.2MPa and above passing through, limited to the volume 0.04 m^3 and above, the inside diameter is not less than 200mm and the length is not less than 1000mm.

   (2) The pipe which the inner diameter is not less than 150mm and is listed below:

      1) Where the gas maximum operating pressure is high pressure.

   (3) The pipeline listed below:

      1) The pipeline where the gas maximum operating pressure is high pressure; or

      2) The pipeline where the gas maximum operating pressure is middle pressure and the inner diameter is not less than 150mm.

3. The welding parts which are stipulated in above and where exposed to gas pressure shall be welded according to the appropriate weld design, kind of welding method and the shape of welding part, etc. Moreover this shall be confirmed with no harmful defect and with adequate mechanical properties by appropriate examination.

Article 139. Safety valve for gas generation and supply facility

1. An appropriate safety valve to relief pressure shall be provided for the gas generation and supply facility when the maximum pressure is high pressure class or middle pressure class and that these are likely to cause over-pressure. In this case, such a safety valve shall be installed in a manner that avoids interference by the ejected gas from the safety valve during operation.

Article 140. Instruments device, etc. for gas generation and supply facility

1. Appropriate instrumentation equipment to measure or check the operation conditions for the gas generation facility, shall be provided to prevent damage to gas generation facility.

Article 141. Alarm device for gas generation and supply facility

1. An appropriate warning device to detect conditions that may lead to the damage of equipment to gas generation facility where gas passes through shall be provided.

Article 142. Fail-safe control and interlock for gas generation and supply facility

1. All measures to prevent mistakes and to ensure the operation shall be taken for gas generation facility.
2. An appropriate interlock for instrument circuits shall be provided for the important part of gas generation facility.

Article 143. Back-up power, etc. for gas generation and supply facility

1. Appropriate measures shall be taken to ensure that there is no loss of functionality of the equipment due to power outage, etc. for the safety apparatus needed to safely stop the gas generation facility.

Article 144. Measurement of odor for gas generation and supply facility

1. The gas shall have a distinguishable odor in order for easy detection. However, when the presence of an odor can be detected, if the appropriate detector is equipped and it is possible to detect odor in the case when gas/air volume mixture ratio is 1/1000, then this provision may not need to be applied.

Article 145. Control room for gas generation and supply facility

1. The meter room installed in the gas generation facility, that is the room where control equipment to control gas generation equipment are installed intensively, shall be capable of controlling the gas safely in an emergency.

Section 3. Gas Storage Facility

Article 146. General provision

1. If it is required for some buffer for the blast furnace gas and oil refinery residue gas because there are variations in emissions. A suitable storage system, control method and storage capacity shall be selected to suit the nature of the power plant, importance, location and type of boiler.

Article 147. Material of gas storage tank

1. The main materials of gas storage tank shall have stable mechanical properties against chemical and physical impacts which may occur under the maximum and minimum operating temperatures depending on the type and scale of facility.

Article 148. Structure of gas storage tank

1. The gas storage tank shall have the appropriate structure depending on the kind and size of facility against the load during operation and the maximum operation temperature and pressure at the minimum ambient temperature.
2. Equipment for the gas storage tank to discharge any condensate liquid shall be provided due to the possibility of impairment and damage due to condensate build-up.
3. Appropriate measures for the gas storage tanks that have the ability to change volume of gas storing shall be taken so as not lose the ability to store gas due to any volume change mechanism.

Article 149. Shut-off device for gas storage tank

1. Appropriate equipment to promptly shut-off the inflow and outflow of gas shall be provided for gas feeding and discharge pipe of gas storage tank to prevent occurrence of a disaster when a gas leaks.

Article 150. Indication for gas storage tank

1. The gas storage tank shall have the ability to display any of its reserve gas for easy viewing from outside.

Article 151. Safety valves, etc. for gas storage tank

1. The gas storage tank shall be provided with more than two safety valves to prevent over-pressure.
2. The gas storage tank shall have measures taken to measure for negative pressure to prevent damage due to vacuum conditions occurring.

Article 152. Instrument device for gas storage tank

1. The gas storage tank shall be provided with instrumentation equipment to measure the operation conditions.
2. It is desirable to provide instrumentation for gas storage tank to measure the gas pressure and the temperature at the bottom of the Gas Storage Tank.

Article 153. Alarm **device for gas storage tank**

1. Warning equipment shall be provided for the gas storage tank to detect the conditions of gas and control equipments and alarms when impaired use. The situation which interferes with operation means the situation when gas pressure is raised abnormally high in principle.

Chapter 4 Liquefied Gas Handling Facility

Section 1. Liquefied Gas Unloading and Transportation Facility

Article 154. General provision

1. It is expected that imported liquefied natural gas will occupy a major part of the thermal power plant fuel in the future. A suitable unloading system shall be selected to suit the nature of the power plant, its importance, location and type of boiler.

Article 155. Classification of liquefied gas

1. Liquefied gas shall be classified into 3 types of groups.

Table 9: Classification of Liquefied Gas

Classification		Storage Specification	
LPG	Propane Rich	-42 ^{0}C at ata	0.86Mpa(abs) at 20^{0}C
	Butane Rich	-0.5 ^{0}C at ata	0.21Mpa(abs) at 20^{0}C
LNG	Methane Rich	-160 ^{0}C at ata	—

Article 156. Unloading pipeline for liquefied gas

1. The loading arms for liquefied gas shall be capable of handling according to the largest through to the smallest class of gas tankers at the loading berth.
2. The loading arms shall be capable of responding to changes in position of the manifold due to the movement of the tankers.
3. The loading arms shall have a mechanism to purge with inert gas by air purge from the beginning to end of loading and thereby to have the ability to remove all liquefied gas at the completion of loading.
4. The sliding portion of the arm shall be checked to confirm that under loading and un-loading operations there shall be no leakage and fluid temperature and pressure conditions at arm are set.
5. The loading arms shall be provided with an alarm system to sound when the arms have reached a certain limit in its operating range.
6. The loading arms shall be provided with a shut-off valve near the arm which is capable of providing isolation from the tanker. The piping which receives liquefied gas from tanker shall conform to the following conditions.
   (1) The diameter of incoming pipe of liquefied gas and the return gas pipe shall be designated to meet the required lifting rate of liquefied gas and the flow rate of return gas under the conditions of the of the tanker’s unloading pump capacity and taking into consideration any over pressures that were agreed in advance.

(2) The piping shall be arranged to avoid accumulation of liquefied gas as much as possible. However, if it is unavoidable, then measures to vent, etc. shall be taken.

(3) The piping shall be capable of always maintaining a low temperature state even when there is no liquefied gas accepted.

Article 157. Material of liquefied gas unloading and transportation facility

1. The main materials of liquefied gas unloading and transportation facilities shall have stable mechanical properties against chemical and physical impact which is possible to occur under the maximum and minimum operating temperature depending on the type and scale of the facility.

Article 158. Construction, etc. of liquefied gas unloading and transportation facility

1. The liquefied gas unloading and transportation facility shall have the appropriate structure depending on the kind and size of facility against the load during operation at the maximum operation temperature and the minimum operation pressure.

(1) The pressure part of the liquefied gas unloading and transportation facility and the part where the gas passes through shall be airtight without leakage when conducting pressure tests by appropriate means. However, this provision need not be applied with regard to those items listed below:

1) The pipeline and its ancillary facility that has passed the appropriate non-destructive test examination; or

2) The high pressure pipeline which length is less than 15m and its ancillary equipment, the middle pressure pipeline and its ancillary equipment that has passed the a pressure testing under the at least 1.5 times of the maximum operation pressure , that is of the same material, same dimension and used the same welding procedure.

3) The booster, blower, compressor, fan and pump for liquefied gas and booster supply equipment.

(2) The part of liquefied gas unloading and transportation facility where the liquefied gas passes through shall be airtight without leakage when tested by appropriate means. However, this may not need to be applied with regard to those items listed below:

1) The booster, blower, compressor, fan and pump for liquefied gas and booster supply equipment; or

2) Those which have an operational pressure of 0MPa or below and are always open to the atmosphere other than stipulated in paragraph 2.

2. The foundation for the equipment where the liquefied gas passes through shall not have any harmful distortion caused by uneven settlement, etc.

Article 159. Welding Part of liquefied gas unloading and transportation facility

1. The welding part of the liquefied gas unloading and transportation facility, where the gas passes through and operating pressure over 0MPa shall have no harmful defects or cracks in the weld, and shall be designated to have at least the strength as specified .

2. The materials of the welds of the liquefied gas unloading and transportation facility that are exposed to liquefied gas pressure , the welding procedures, etc. shall be checked to confirm their compliance by the appropriate mechanical testing, etc.

   (1) The vessel which are listed below:

      1) Where the liquefied gas operating pressure is 0.2MPa and above, limited to where the volume is not less than 0.04 m^3, the inside diameter is not less than 200mm , and the length is not less than 1000mm; or

      2) Where the liquefied gas, excluding product not less than 0.04MPa of the maximum operation pressure described in MPa and the value described in m^3.

   (2) Pipe which the inner diameter is not less than 150mm and is listed below:

      1) Pipe where the liquefied gas maximum operating pressure is high pressure; or

      2) Pipe where the liquefied gas passes through; or

      3) Pipeline where the liquefied gas maximum operating pressure is middle pressure and the inner diameter is not less than 150mm.

3. The welding part which is stipulated in each of the above items and where they are exposed to liquefied gas pressure shall be welded according to the appropriate welding design, kind of welding method and the shape of welding part etc., and welded adequately. Moreover, it shall show no harmful defect and comply to design mechanical properties when tested by appropriate testing.

Article 160. Safety valve for liquefied gas unloading and transportation facility

1. An appropriate safety valve to relief gas pressure shall be provided for the liquefied gas unloading and transportation facility where the liquefied gas maximum pressure is high or is middle pressure class, which is likely to experience an over-pressure. In this case, such a safety valve shall be installed to avoid interference during operation when gas can be ejected.

Article 161. Instruments device, etc. for liquefied gas unloading and transportation facility

1. Appropriate instrumentation equipment to measure or check the operation conditions shall be provided to prevent damage of the liquefied gas unloading and transportation facility where the gas and liquefied gas passes through and needed for gas production.

Article 162. Alarm device for liquefied gas unloading and transportation facility

1. An appropriate alarm device to detect conditions that may lead to the damage of the equipment for the liquefied gas unloading and transportation facility needed for gas production shall be provided.

Article 163. Fail-safe control and interlock for liquefied gas unloading and transportation facility

1. All measures necessary to prevent accidents and ensure operation shall be taken for fail-safe isolation of the liquefied gas unloading and transportation facility.
2. An appropriate interlock for instrument circuits shall be provided for all the important parts of the liquefied gas unloading and transportation facility.

Article 164. Back-up power, etc. for liquefied gas unloading and transportation facility

1. Appropriate measures shall be taken to ensure that there is no loss of functionality of the safety equipment due to power outage, etc. needed to safely close the liquefied gas unloading and transportation gas facility.

Section 2. Liquefied Gas storage Facility

Article 165. General provision

1. That there is a flat-bottom cylindrical tank, such as on-the-ground type, pit-in-type, outside-PC-type, and the membrane type, such as underground-type and pit-in-type, etc. for the liquefied gas storage tank. A tank system to suit size, location, generation system of thermal power plant shall be selected.

Article 166. Material of liquefied gas storage tank

1. The main materials of the liquefied gas storage tank shall have stable mechanical properties against chemical and physical impacts which are possible to occur under the maximum and minimum operating temperatures depending on the type and scale of the facility. Steel, concrete, pearlite-concrete, polyurethane foam, etc. shall be applied.

Article 167. Structure of liquefied gas storage tank

1. The pressure part of the liquefied gas storage tank shall be the part where it can be exposed to liquefied or vaporized gas pressure of 0MPa and above, excluding the membrane and seals.
2. The main part of liquefied gas storage facility shall be the body, nozzles and manhole that are exposed to liquefied or valorized gas pressures of more than 0MPa.
3. The membrane of liquefied gas storage tank shall have liquid and gas tight function, although it is not required to experience any pressure because it is made of thin metal that the gas and fluid pressure act upon in the tank.

4. The membrane of the tank shall have stable deformation behavior against the assumed load and have sufficient fatigue strength for the cycle load.
5. The cold insulation material shall have the appropriate structure when considering the properties of the used material, load acting on the tank, thermal displacement and deformation, etc.
6. The cold insulation material shall have the appropriate structure to avoid poor performance and excessive lateral pressure acting on shell plate due to temperature changes of the shell, pressure changes of the tank and earthquake, etc.
7. The cold insulation material for tank bottom shall have the structure to securely transmit the load from inner tank to the base.
8. The joints of the cold insulation material shall have measures taken to fill with sealant and hence avoid occurrence of cold-paths occurring with subsequent freezing.

Article 168. Sign for liquefied gas storage tank

1. The liquefied gas storage tank shall have a sign fitted that is easily visible when viewed from outside.

Article 169. Safety valve, etc. for liquefied gas storage tank

1. As the liquefied gas storage tank is likely to experience possible over-pressures, it shall be provided with one or more suitable safety valves to release over-pressure. In this case, such relief valves shall be installed to avoid interference from the ejected gas when safety valve operates.
2. The low temperature storage tank shall be provided more than two safety valves to allow for servicing and maintenance. Moreover, appropriate measures shall be taken to prevent destruction should vacuum conditions arise.

Article 170. Prevention vacuum in liquefied gas storage tank

1. All measures necessary to prevent vacuum conditions occurring in the liquefied gas storage tank shall be taken in order to prevent damage due to this condition.

Article 171. Instrument device for liquefied gas storage tank

1. Instrumentation measuring apparatus to monitor the operation status and prevent damage to the facility shall be provided.

Article 172. Alarm device for liquefied gas storage tank

1. An alarm device detecting any abnormal situation of the control equipment that may interfere with the operation of the liquefied gas storage tank shall be provided.

Article 173. Shut-off device of liquefied gas storage tank

1. Isolation equipment capable to shut-off rapidly the inflow and outflow of gas or liquefied gas at the main gas entry and exists of the liquefied gas storage tank when gas or liquefied gas has leaked, shall be provided.

Article 174. Heat insulation measure for liquefied gas storage tank

1. The liquefied gas storage tank and its supporting structures, except any buried part, if the liquefied storage tank is buried, shall be able to withstand any heat condition that may occur or shall be provided the appropriate cooling / heating systems.

Article 175. Dike for liquefied gas storage tank

1. Appropriate protection dikes shall be provided for the liquefied gas storage tank to prevent disaster in case of the liquefied gas leaks from tank.
2. Equipment shall not be installed inside the dikes except for those which do not interfere or prevent the spread of the liquefied gas leaks or fires inside the distance necessary for emergency work to be carried out from the outside of dikes prescribed in the paragraph 1.

Article 176. Anti-corrosion measure of liquefied gas storage tank

1. Appropriate measures shall be taken to prevent corrosion of the buried portion of the liquefied gas storage tank, if there are circumstances that are liable to cause corrosion of the installation.

Section 3. Pump, Compressor and Blower for Liquefied Gas

Article 177. General provision

1. Generally, LNG carriers have a steam turbine and generator and use C-heavy oil and LNG-BOG. The BOG will be used as the main fuel for LNG carrier without re-liquefaction and the heavy oil will be used as the supplement fuel. A-heavy oil may be used as the fuel for the generator when unloading.
2. However, BOG of LPG is prohibited to be used as the fuel for LPG carriers since it is easy to be re-liquefied as per the provisions of Intergovernmental Maritime Organization. BOG of LPG shall be provided with re-liquefaction equipment and shall not be used as fuel for LPG carriers.
3. The unloading of LNG shall be carried out and delivered by LNG pump provided in the LNG carrier. Moreover, it equalizes the pressure of the carrier and storage tank, and thus prevents air entering the discharge at the same volume of LNG gas as the revival tank to the LNG carrier by the LNG gas blower. When filling the empty LNG storage tank with air for inspection and unloading of LNG and in all cases of mixed state of gas and air, the tank shall be completely filled with the inert gas once instead of LNG gas, and then this be replacement with inert gas instead of air and discharged . It will prevent such accidents in which the explosive combustion can occur. In this case, the inert gas system shall use equipment provided on land.

Article 178. Pump for liquefied gas

1. The liquefied gas pumps shall meet the operation conditions and shall be safe enough to withstand continuous operation against the pressure, temperature and vibration caused by rotation.
2. The liquefied gas pumps shall take into consideration the heat effects of the heat generated in the pump and any external heat source.
3. Gas accumulation in the liquefied gas pumps shall be avoided as much as possible.
4. The gas pump discharge rate shall meet with the rated value and the shaft power shall be within the rated output of all motor operating conditions when operating at specified suction pressure and discharge pressure.
5. Liquefied gas pumps that are installed outside the liquefied gas storage tank shall be capable of being installed outdoors and removable protective covers shall be provided if they have moving parts exposed to outside environment.
6. Ancillary equipment and connected piping of liquefied gas pumps shall have a facility that allows easy removal for pump maintenance and checking.
7. The structure of liquefied gas pumps shall be capable to operate at the required minimum flow since the utilized fluid is easy to evaporate.

Article 179. Blower for return gas

1. The blower and its ancillary equipment shall have applied Article 178 with the necessary changes having been carried out.
2. When designing the blower system, the blower shall be capable to be controlled by a minimum flow valve, etc. and thus prevent surging and shall be capable to reduce to minimum flow rate by opening the minimum flow valve because the amount of return gas causes a decrease in the cargo tank pressure of tanker and decreases the discharge flow.
3. The blower shall be provided with an alarm system to give warning, if the blower discharge pressure is abnormally high.

Article 180. Compressor, blower

1. The structure of the compressor and the blower shall be safe enough to withstand continuous operation for the internal load due to gas pressure, etc. at operating conditions, external load due to piping and supports, etc., thermal effects, vibration by rotation and any impact loads.
2. The discharge rate of compressor and blower shall meet with the rated value and the shaft power shall be within the rated output of all motor operating conditions when operating at specified suction and discharge pressure.

3. The body of compressor and blower shall be capable to be installed outdoor and have removable protective covers provided, if they have any moving part exposed to outside environment.

4. The ancillary equipment and connecting piping of compressor and blower shall have a structure so as to be removed easily for maintenance and checking.

5. Inlet and discharge branch connections for purge gas shall be provided close to the Pump and compressor inlet and outlets in order to replace safely any remaining gas with inert gas during start-up and maintenance.

Section 4. Liquefied Gas Vaporization Facility

Article 181. General provision

1. When applying liquefied petroleum gas and liquefied natural gas as the fuel for the thermal power plant, it is necessary to provide vaporizers. Moreover, it is necessary to provide a vaporizer for de-NOx NH_3 gas for gas combined-cycle power plants, a vaporizer for N_2 gas for the coal thermal power plant, a vaporizer of CO_2, N_2 and H_2 for power plants that use H_2 gas cooling generator. A suitable vaporizing system, transportation system, control system and production capacity shall be selected to suit the nature of the power plant, importance, location and type of boiler or other facilities.

Article 182. Off limits, etc. to liquefied gas vaporization facility

1. Appropriate measures shall be taken to prevent the non-authorized public intruding into the liquefied gas vaporization facility without a proper reason.

Article 183. Security communication facility for liquefied gas vaporization facility

1. Appropriate communication equipment shall be provided in the workplace where the liquefied gas vaporization facility pipeline management is installed in order to ensure rapid communication.

Article 184. Off-set distance for liquefied gas vaporization facility

1. The liquefied storage tank, pump, vaporizer, gas compressor shall be installed to ensure sufficient distance for security.

Article 185. Security compartment for liquefied gas vaporization facility

1. The areas where installing the liquefied gas vaporization facility in the power plant premises shall be divided into a certain size by passage and these shall ensure the necessary safe distances to prevent the spread of disaster.

Article 186. Firefighting facility for liquefied gas vaporization facility

1. The equipment installed in the liquefied gas vaporization facility or which gas and liquefied gas passes through shall be provided with the appropriate firefighting equipment, depending on its size.

Article 187. Prevention of gas accumulation of liquefied gas vaporization facility

1. The room in which the liquefied gas vaporization facility is installed or which gas or liquefied gas passes through shall have a structure that avoids the accumulation of gas and liquefied gas when gas leaks.

2. Appropriate detection and alarm equipment to detect gas leakage shall be provided at locations where gas is likely to accumulate in the liquefied gas vaporization facility or where gas or liquefied gas passes through.

Article 188. Explosion-proof structure of electric facility for liquefied gas vaporization facility

1. The electrical equipment which is installed in the vicinity of gas works or liquefied gas works for the liquefied gas vaporization facility shall be of an explosion-proof type design depending on the conditions of place and the kind of gas or liquefied gas.

Article 189. Distance from flammable facility of liquefied gas vaporization facility

1. The equipment which is installed in the liquefied gas vaporization facility or which gas and liquefied gas passes through shall have ensured a sufficient distance from the outer surface of the facility to the equipment to enable the use of firefighting equipment to prevent fires due to gas or liquefied gas leaks.

Article 190. Static electricity removal for liquefied gas vaporization facility

1. All measures to eliminate static electricity caused on the liquefied gas vaporization facility or the facility where gas and liquefied gas passes through, shall be taken.

Article 191. Gas displacement of liquefied gas vaporization facility

1. The part of the liquefied gas vaporization facility where gas and liquefied gas passes through that belongs to the vaporizer, fan, pump and their ancillaries shall have a structure capable to displace gas and liquefied gas safely.

2. Appropriate measures for the vent-stack shall be taken to keep from damaging its surrounding when emitting gas.

3. The appropriate measures shall be taken to avoid damage by heat radiation generated from flare-stack and allow safe release of gas.

Article 192. Material of liquefied gas vaporization facility

1. The main material of the liquefied gas vaporization facility shall have stable mechanical properties depending on the system and size against chemical and physical impacts on the materials at maximum and minimum operation temperatures.

Article 193. Structure of liquefied gas vaporization facility

1. The vaporizer shall not have a structure which can be heated by direct fire.

2. The vaporizer shall have a structure that can absorb thermal expansion caused by the difference between the inlet and outlet temperature and thereby prevent excessive thermal stress.

3. The each heat exchanger tube of the vaporizer shall have the structure so as to have uniform distribution in liquefied gas.

4. All measures shall be taken to avoid obstruction of the passage and corrosion due to marine organisms, etc. when using sea water as a heat source for vaporizer.

5. All measures shall be taken to prevent freezing of heated portion of vaporizer that can have the structure heated by hot water.

6. All measures shall be taken to prevent leakage of liquefied gas from the vaporizer and connected piping, etc.

Article 194. Welding parts of liquefied gas vaporization facility

1. The welding part of the liquefied gas vaporization facility, where the liquefied gas passes through and where gas pressures are over 0MPa , shall show no harmful defects or cracks in the weld and shall be designated to have at least the strength as needed.

2. Any weld on the liquefied gas vaporization facility, or welds that are exposed to gas and liquefied pressures, the welding procedure, etc. shall be confirmed to be adequate by the appropriate mechanical examination, etc.

   (1) The vessels which are listed below:

      1) Where the gas operating pressure is 0.2MPa and above , limited to the volume that is not less than 0.04 m^3, the inside diameter is not less than 200mm and the length is not less than 1000mm.

      2) Where liquefied gas passes through, excluding product of 0.04MPa and above of the maximum operation pressure described in MPa and the value described in m^3.

   (2) Pipe which the inner diameter is not less than 150mm and is listed below:

      1) Pipe where the maximum operating pressure of the gas is high pressure; or

      2) Pipe where the liquefied gas passes through.

3. The welding part that is stipulated in each item above and where exposed to gas or liquefied gas pressure shall be welded according to the appropriate welding design, the kind of welding method and the shape of welding part, etc., and welded adequately. Moreover, these shall be confirmed by appropriate examination to show no harmful defect and the adequate mechanical properties.

Article 195. Safety valve for liquefied gas vaporization facility

1. One or more safety valves to relief pressure shall be provided on the gas evaporator and piping of liquefied gas vaporizer which are likely to experience some over-pressure. In this case, such

safety valves shall be installed to avoid interference with the ejected gas from the safety valve during operation.

Article 196. Instruments device, etc. for liquefied gas vaporization facility

1. The appropriate instrumentation equipment needed to measure or check the operation conditions of the liquefied gas vaporization facility shall be provided to prevent damage.

Article 197. Alarm device for liquefied gas vaporization facility

1. Appropriate warning devices shall be provided to detect conditions that may lead to the damage of equipment which has gas or liquefied gas passing through.

Article 198. Shut-off device for liquefied gas vaporization facility

1. Appropriate isolation equipment shall be provided at the inlet and outlet of vaporizer.

Article 199. Back-up power, etc. for liquefied gas vaporization facility

1. Appropriate measures shall be taken to ensure that no loss of functionality of the safety equipment due to any power outage and therefore allow the liquefied gas facility to be shut down safely.

Article 200. Odor measurement for liquefied gas vaporization facility

1. The vaporized gas shall be odorized in order to easily be detected, if leaking. However, when the presence of odor can be detected, if the appropriate detector is applied, or it is possible to detect the odor in the case when the gas/air volume mixture ratio is 1/1000, this provision may not need to be applied.

Article 201. Control room for liquefied gas vaporization facility

1. The meter room installed in the liquefied gas vaporization facility, that is the room where control equipment to gas vaporization is, shall be capable of controlling the gas safely in an emergency.

PART 4. COAL-ASH TREATMENT FACILITY

Chapter 1 Ash Collection and Transportation Facility

Article 202. General provision

1. The efficiency of the ash collecting and transportation facility does affect the wear of the boiler tubes and thereby continuous operation therefore an appropriate collecting system, transportation system, facility capacity, etc. shall be selected based upon the expected discharge volume and ash content of design coal.

Article 203. Cyclone ash collection and transportation facility

1. Cyclone ash is a fine ash and is discharged with the flue gas from the boiler furnace. It is collected at the economizer hopper, the air heater and the electric precipitator. Generally, an air or vacuum transportation system will be applied. The structure shall have no blockage or leakage and wear of transportation pipe shall be taken into consideration.

Article 204. Cinder ash collection and transportation facility

1. Cinder ash is a crude ash and is discharged with the flue gas from the boiler furnace. It is collected at the economizer hopper and air heater. Generally, an air or vacuum transportation system will be applied. The structure shall have no blockage or leakage and wear of transportation pipe shall be taken into consideration.

Article 205. Clinker ash collection and transportation facility

1. The melted clinker ash in the boiler furnace falls down into the clinker hopper which is closed, water cooled and then crushed. It will be separated from water by an extractor or be transported to an ash pond directly. An appropriate collecting system, transportation system, facility capacity, etc. and shall be selected based upon the expected discharge volume and ash content of design coal.

Chapter 2 Ash Classification and Storage Facility

Article 206. General provision

1. Coal ash and de-sulferized gypsum is produced from the coal fired power plants as a by-product. Generally, the gypsum is used as the raw material for cement and architectural material, such as plaster board. Cyclone ash which has a defined level is used as raw material for cement and civil work; however, it is not possible to use all of the ash, only about 50% can be used and the remaining ash that cannot be used in cement or civil work is used for land filling.
2. It is necessary to select the appropriate treatment method of ash in consideration of the location of the power plant, demand at site, use and location of ash disposal area, etc.

Article 207. Ash classification facility

1. It is necessary to use fly ash as cement additives, prioritize plan for dry fly ash collecting and transportation which combined fly ash quality classification processing.

Article 208. Ash storage silo

1. It is desirable to provide the ash storage supply facility to suit the requirements of site demand and the silos should reserve ash which has even quality separation.

   (1) The most efficient ash removal pattern shall be established from the electric precipitator to the raw ash powder silo.

   (2) There shall be more than two raw ash powder silos provided and separate recovery systems to suit ash quality. It should be capable to recover ash from each hopper separately, if so required.

   (3) An equalizer shall be provided for equalization of ash.

   (4) The divider shall be capable to adjust size of ash.

   (5) A plural reservoir silo shall be provided for storage separately by size and purpose of use.

Article 209. Ash discharge facility

1. The ash transport equipment from cyclone to the waste area or to consume as conveyors, ships, trucks shall be equipped with devices reduce emissions of dust, prevent to ash dust emission on the environment in the transportation, ash unloading. Overflow water, deposited water from slag yard shall be collected and processed to avoid leakage into the environment contaminating surface water and groundwater.

Chapter 3 Ash Dump

Article 210. General provision

1. It is necessary to treat the remaining unusable ash, that which is not available as raw material for cement, as industrial waste. It is necessary to select an appropriate treatment method in consideration of the location of the power plant, the demand at site, use and location of ash disposal area.

Article 211. Off-shore disposal

1. It is possible to provide an off-shore ash disposal area in the power plant and to dispose high density slurry into that location. There should be no scattering of dust considering the expected life extension of plant and land development. However, it is only possible to have this kind of ash disposal applied in coastal areas where landfill is possible.

2. The effluent from ash pond shall be used in a closed condition to prevent leakage into public water facilities.

Article 212. On-shore disposal

1. The utilization of coal ash as valuable material is the first priority of the power plant located in inland; however, it is also desirable to use any remaining ash that cannot be used in cement or civil works, as landfill material.

2. In that case where remaining ash is used as landfill then it is necessary to consider underground water system contamination, penetrating existing water systems and scattering of dust, overall it is necessary to consider the advance planning of soil cover and utilization of site.

PART 5. FEED-WATER TREATMENT FACILITY

Chapter 1 Feed-water Treatment Facility

Article 213. General provision

1. A commercial thermal power plant has a wide range of the structures, temperatures, pressures and operation modes of plant, moreover, these temperatures, pressures, and capacities have been improved together with plant efficiency improvement, such as the use of combined cycle designs. Operation modes of boilers have diversified corresponding with the greatly changing demand of power. It is necessary therefore to control water quality of the condensate-water, feed-water and boiler-water much more severely than previously because of the possibility to cause accidents which lead to plant stoppages arising from the quality of water and steam. Therefore, facilities to control the water quality, such as the feed-water, and boiler-water, shall be provided in order to prevent accidents and keep plant in best condition.

Article 214. Feed-water treatment facility

1. Nowadays it has been possible to get very pure water by the progress of de-mineralizing technology utilizing ion exchange resin; impurities in feed-water are metallic matter / “corrosive matter” which are entirely resolved from corroded material of feed-water and condensate-water. The main metallic matter is iron and copper, however, the behavior and accumulation of dissolvent in the feed-water and condensate-water systems varies between operational conditions and type of boiler.

2. It is thought that the accumulation of metallic matter increases when the heater drain water and feed-water pass through heater drain lines of LP/HP feed-water heater and the water side of LP feed-water heater regardless whether they are Sub-critical or Super-critical boilers. The part of dissolved iron and copper from low temperature parts of feed-water and condensate-water systems accumulate in HP feed-water heater, however, almost all dissolved iron and copper will be carried into boiler and adhere or accumulate on evaporator tubes, etc.

3. Therefore, it becomes one of the major objects of water quality control technology to control contamination of iron and copper, and thereby control the generation of scale and prevent corrosion due to excess dissolved oxygen. There are two major methods for feed water treatment, one is “Volatile treatment” to remove oxygen as much as possible, and the other method is “Oxygen injection method” to inject trace oxygen. The most appropriate water treatment equipment shall be equipped to suit each operation condition, operation history, type of boiler.

Chapter 2 Chemical Injection Equipment

Article 215. General provision

1. The thermal power plant shall be provided with chemical injection equipment to adjust water quality in the treatment of feed-water and boiler-water to maintain power plant in good condition.
2. The piping corrosion due to the water quality and the generation of scale are caused by the pH value, dissolved oxygen and contaminations, such as Na, Mg and Cℓ, etc. Injection equipment of ammonia and hydrazine for feed-water treatment and sodium phosphate for boiler-water shall be provided in order to maintain the quality to an appropriate level.
3. The oxygen gas injection equipment shall be provided for “CWT operation plants” in order to keep trace oxygen in condensate-water and feed-water.

Article 216. Chemical injection equipment

1. Chemicals shall be injected from the appropriate injection point to suit each type of boiler.
2. When copper alloy tube is applied for high pressure feed-water heaters, the pH value shall be controlled on the low side and hydrazine used solely for oxygen elimination and pH adjustment. When steel tube is applied, the pH value shall be controlled on the high side and ammonia used for pH adjustment and hydrazine for oxygen elimination. When “CWT operation” is applied, oxygen gas injection shall be applied instead of the hydrazine injection in order to keep trace oxygen in the condensate-water and feed-water.
3. Usually the high pressure constant injection pump for chemical injection uses a plunger type design. Chemicals shall be injected in proportion with the feed-water flow rate and condensate-water and the electric conductivity of feed-water shall be controlled to minimize the difference between setting value and measured value.
4. Ammonia water is made of ammonia gas dissolving into water automatically to suit detected tank level and electric conductivity. Moreover, it is desirable to apply an “Auto dissolving method” for hydrazine to dissolve constant undiluted solution into constant de-mineralized water.
5. The oxygen injection is usually conducted by injecting pressure reduced gas from an oxygen cylinder into condensate-water and feed-water systems. The control of oxygen injection for condensate-water shall be adjusted in proportion with flow rate of the condensate-water and the injection shall be controlled in proportion with feed-water flow rate and with concentration of dissolved oxygen.

Chapter 3 Sampling Rack and Water Quality Monitoring Instrument

Article 217. General provision

1. The sampling equipment which extract main steam, reheat steam, condensate-water, feed-water and boiler-water from everywhere in the systems and depressurize, cool down, adjust flow and supply for chemical analysis and water quality surveillance instrumentation shall be provided.

Article 218. Sampling rack and water quality monitoring instrument

1. Sampling equipment shall be the equipment which is capable to extract main steam, reheat steam, condensate-water, feed-water and boiler water from everywhere in the systems and depressurize, cool down, adjust flow and gather samples continuously.
2. The depressurizing equipment shall have an automatic depressurizing function to get stable flow corresponding with shut-down and transformation operation.
3. The electric conductivity meter, pH meter, dissolved oxygen meter shall be provided as standard for this water quality surveillance instrumentation.
4. It is desirable that the sampling equipment is automatic which samples valves and where water quality surveillance instrumentation is operated automatically corresponding with each activation mode.
5. The sampling equipment shall be clean inside and have a structure which is capable to be flushed to remove very dirty water in the system easily including depressurizing equipment.

PART 6. ENVIRONMENTAL FACILITY

Chapter 1 General Provision

Article 219. Laws and regulations related to environment

1. When constructing the thermal power plant, it shall be planned, designated pursuant to the provision of the applicable laws and regulations and QCVN which is promulgated by MONRE (Ministry of Natural Resource and Environment), and related TCVN.

Chapter 2 Facility to Prevent Air Pollution

Article 220. Emission control regulation for thermal power plants

1. When constructing a thermal power plant, a flue gas treatment facility shall be planned, designated and installed pursuant to the provision of the applicable discharge regulations which is promulgated by MONRE (Ministry of Natural Resource and Environment), and related TCVN.

Chapter 3 Missing number

Article 221. Missing number

Article 222. Discharge standard of effluent

1. When constructing a thermal power plant, a wastewater treatment facility shall be planned, designated and installed pursuant to the provision of the applicable discharge regulations which is promulgated by MONRE (Ministry of Natural Resource and Environment), and related TCVN.

Chapter 4 Facility to Prevent Noise

Article 223. Noise control regulation

1. When constructing a thermal power plant, the equipment selection, and sound-proofing and planning, design, installation of building shall be conducted pursuant to the provision of applicable discharge regulations which is promulgated by MONRE (Ministry of Natural Resource and Environment), and related TCVN.

Chapter 5 Facility to Prevent Vibration

Article 224. Vibration control regulation

1. When constructing a thermal power plant, the equipment selection, and vibration-proofing and planning, design, installation of building and foundation shall be conducted pursuant to the provision of applicable discharge regulations which is promulgated by MONRE (Ministry of Natural Resource and Environment), and related TCVN.

Chapter 6 Other Environmental Measures

Article 225. Measures for effluent

1. A sprinkler facility, such as an outdoor hydrant or sprinkler, shall be provided in the coal stock yard in order to prevent dust splashing and to extinguish fires. Moreover rainwater from the outdoor coal yard shall be treated once by the effluent treatment facility and clarified through precipitation pit to prevent outflow of any contaminations to river and or coastal area.
2. When coal ash is used as landfill material for the full controlled type ash dumping area, it is necessary to prevent leakage of any effluent containing ash and dust splashing. The slurry water and surplus water from ash pond shall be applied as a closed-cycle system and prevention of outflow of contaminations to river and or coastal area.
3. When the "seawater de-sox method" used to absorb SO_2 into the sea water that has partly utilized condenser cooling water, the effluent shall be discharged after being transformed to sulfate ion by the effluent treatment facility.

Article 226. Measures for dust from coal un-loading pier, coal yard and ash pond

1. When a truck hopper is used for unloading of coal, the vehicle which has measures taken for containing dust splashing shall be used and a car-washer and a water-wagon shall be provided.
2. When a truck is used to transport coal in the power plant premise, the vehicle that has had measures taken for containing dust splashing shall be used and a car-washer and the water-wagon shall be provided.
3. When a coal-conveyor is used to transport coal in the power plant premises, the coal-conveyor shall be installed in a conveyor gallery or shall be installed with conveyor covers to prevent dust splashing.
4. When coal ash is used as landfill material for full controlled type ash dumping area, it is necessary to prevent environmental contamination due to dust splashing by using a shield fence, sprinkler and covers, etc.
5. Coal dust contamination shall be prevented to splash by fences, sprinklers, etc. which are to be installed as required.

Article 227. Measure for thermal effluent

1. The temperature of the discharge water from the turbine condenser to the outside of the premises shall be planned to satisfy the national regulation "40^{o}C" by designing in an appropriate condenser temperature difference in order to control the environmental impact on the river and coastal eco-system as a minimum. Moreover, enough distance between intake and discharge shall be ensured and shall be planned to avoid drawing surface water to the install intake point in a deep location from the discharge point.

PART 7. WELDING

Chapter 1 Welding of Pressure Parts

Article 228. General provision

1. Recent thermal efficiency progress in thermal power plant depends on progress of attaining higher main steam temperature and the use of super alloy steel materials which have high creep strength in high temperature environments. As the result of this, it has been required to advance the technology for welding of the materials in high temperature environments like pressure vessels and piping. It is necessary to secure good properties in all pressure parts by using appropriate welding design, welding procedure, welding qualification test, welding administration and inspection.

Article 229. Pressure parts

1. Boiler parts , etc. that have pressure parts are required to have appropriate weld design and weld management shall be stipulated as below:

   (1) Boiler, independent super-heater, independent economizer, steam accumulator, steam reservoir, heat exchanger or pressure vessel that belong to the gas generation facility, liquefied gas storage facility, evaporator, gas holder; or

   (2) Pipe which the outside diameter exceeds 150mm (in case of liquefied gas, being limited only liquefied gas fuel facility)

2. The pressure which is required to have an appropriate weld design and weld management shall be stipulated as below:

   (1) Pressure vessels and water piping that have maximum operating temperature that is 100^0C or below: maximum operating pressure 1,960kPa; or

   (2) Pressure vessel and liquefied gas piping : maximum operating pressure is 0kPa; or

   (3) Other piping except item-(1) and (2): maximum operating pressure is 98kPa.

Article 230. Shape, etc. of welding parts

1. Welding parts which are called welded part and heat affected part hereinafter referred to as “welding part” shall conform to the following stipulation:

   (1) Shall not have a discontinuous and peculiar shape; and

   (2) Shall be with no fear of cracks due to welding and have confirmed there to be no harmful lack of fusion or other defects to keep solidness of welding part by non-destructive examination; and

   (3) Shall have the appropriate strength; and

(4) Shall be welded in accordance with appropriate welding procedure, etc. which have been confirmed beforehand, for instance, mechanical examination, etc.

PART 8. ELECTRICAL FACILITIES

Chapter 1 Installation of the Electrical Facilities for the Power Supply

Article 231. Prevention of electrical shock and fire

1. The power line shall be installed in accordance with installation conditions, location, and voltage so that there is no risk of electric shock or fire.
2. The power wire with insulation strength in accordance with operating voltage or the power cable shall be used for the low and medium voltage overhead power wire so that there is no risk of electric shock.
3. Power cable, with insulation strength in accordance with operating voltage, shall be used for underground power wire (the power wire which is used for underground power line) so that there is no risk of electric shock.
4. Regarding insulation resistance from a conductor to ground and between conductors in the insulation part of low voltage power lines, leakage current at the operating voltage shall not exceed the value of damage to human body.
5. The medium, high or extra high voltage electrical equipment, and bus-bars, etc. in the thermal power plant shall always have warnings to explain to visitors or guests, of the danger of touching this equipment. In addition power plant owner shall take the appropriate measures to prevent the risk that people who are not power plant personnel are not allowed to enter the premises easily.
6. Manholes and culverts used for underground power lines shall be installed so that there is no risk that people who are not the personnel in charge can enter them easily.
7. The support of the overhead power line shall be installed with the appropriate measures so that people who are not the personnel in charge can not climb up it easily and thereby cause no risk of electric shock.
8. The overhead power wire and overhead communication wire for power security shall be installed at a height that ensures there is no risk of electric shock by touching or action of induction and no risk of an obstruction to traffic.
9. Guide wires shall be installed at heights that ensure there is no risk of an obstruction to traffic.
10. The electric field intensity shall be $\leq$ 5kV/m at any point, and $\leq$ 1kV/m at 1m from the ground inside the house at any point.
11. The overhead power line whose voltage is not less than 11kV shall be installed so that there is no risk of electromagnetic induction that could cause harm to the human body through the communication line except communication equipment for power security.

12. The communication equipment for power security shall be installed so that there is no risk of electrostatic induction or electromagnetic induction from overhead power line that could cause harm to the human body.

13. The electrical equipment, etc. shall show symbols for a phase, rotating direction and the like in its prominent place to cause no risk of electric shock, fire and the like by mistake.

Article 232. Prevention of danger to other power wires, other facilities and similar

1. The power wire, communication wire for power security, and similar wire in the power line shall be installed so that there is no risk of damage to other power wires, communication wires, or similar, and there is no risk of electric shock or fire by abnormal voltage caused by contact between these wires, braking of these wires or anything similar in the case as follows:

   (1) They are too close or crossing with other power wires, communication wires, or similar.

   (2) They are installed on the same support with the other power wires, communication wires, or similar.

2. The power wire and similar wire in the power line shall be installed so that there is no risk of damage to other facilities or plant and no risk of electric shock or fire caused by contact of these wires, braking of these wires, or similar in the case as follows:

   (1) They are too close or crossing with other facilities or plant.

3. The underground power wire shall be installed so that there is no risk of damage to other power wires or similar by arc discharges during faults in the case as follows:

   (1) It is too close or crossing with other power wires, the communication wires, laying pipes, or similar.

4. The overhead power wire whose voltage is not less than 11kV and the overhead power wire whose voltage is less than 11kV shall not be installed using the same support.

5. The low voltage electrical equipment shall not be installed on supports above the power wire whose voltage is not less than 11kV.

Article 233. Prevention of danger by collapse of support of overhead power wires

1. Material and structure of the supports of the overhead power line, including the overhead power line guide wires shall be designed safely so that there is no risk of their collapse when consideration of the following:

   (1) Tension in the power wire and similar.

   (2) Wind load caused by wind speed of 40m/s

   (3) Ordinary/expected changes of weather condition, vibration, impact, and other effect by external environment on support locations.

2. The support of overhead power line whose voltage is not less than 11kV shall be installed with the safety structure so that there is no risk of a collapsing chain reaction.

Article 234. Prevention of danger by high pressure gas and similar

1. Gas insulated equipment (the electrical equipment live parts which are insulated by compressed insulation gas) and compressed air compressors that are used for switchgear or circuit breakers in the power plant shall be installed in conformity with the following items:
   (1) Material and structure of the pressure parts shall be designed to sufficiently withstand the maximum allowable working pressure safely.
   (2) The compressed air compressor air tank shall be designed to have resistance to corrosion.
   (3) When pressure rises, a function to make the pressure drop before it reaches the maximum allowable working pressure shall be incorporated.
   (4) The compressed air compressor shall have a function of automatic pressure recovery when pressure of main the air tank drops.
   (5) An early detection function of abnormal pressure shall be incorporated.
   (6) The insulation gas for gas insulation equipment shall not be combustible, corrosive or toxic.
2. The equipment to apply compressed gas pressure to cables shall be installed in conformity with the following:
   (1) Pressure parts shall sufficiently withstand the maximum allowable working pressure safely.
   (2) Pressure equipment which has an automatic compressed gas supply and a risk of a dangerous rise in pressure when a fault occurs.
      1) Material and structure shall be capable of withstanding pressure rise.
      2) A function that ensures that a pressure drop occurs before reaching the maximum allowable working pressure shall be incorporated.
   (3) The compressed gas shall not be combustible, corrosive and toxic.
3. The hydrogen-cooled generator or its hydrogen cooling system shall be installed in conformity with the following:
   (1) The structure shall have no risk of leaks of hydrogen or air mixture.
   (2) The generator and pipe, valve and other equipment for hydrogen shall have a strength that can withstand pressures caused by explosion of hydrogen at atmospheric pressure.
   (3) It shall be possible to safely stop any leaks of hydrogen or any discharge of leaked hydrogen to atmosphere when hydrogen leaks from hydrogen seals in the rotor shaft of the generator.

(4) It shall be safely possible to supply hydrogen to the generator and to discharge hydrogen to the atmosphere.

(5) A function that detects abnormal conditions in its early stages and indicates an alarm shall be incorporated.

Article 235. Prohibition of dangerous facilities

1. Switchgear, disconnecting switch, and circuit breaker with insulation oil shall not be installed on the supports of the overhead power line.

Article 236. Prevention of electrical and magnetic interference

1. The power line shall be installed so that there is no risk of electromagnetic radiation causing continuous and serious interference to the function of the radio equipment.
2. The power line shall be installed so that there is no risk of communication induction interference to the communication line.

Article 237. Prevention of power supply disturbance

1. The generator shall be equipped with a circuit breaker to disconnect it from the power line automatically in case there is a risk of serious damage or any abnormal condition which could possibly affect a serious disturbance to the power supply.
2. The transformer whose voltage is not less than 11kV shall be equipped with a circuit breaker to disconnect it from the power line automatically and have other appropriate measures taken in case there is a risk of serious damage or any abnormal condition which could possibly affect a serious disturbance to the power supply.
3. The generator, transformer, bus-bars and insulator to support the bus-bars shall be able to withstand any impulsive force due to short circuit current.
4. The generator rotor connected to the steam turbine or the gas turbine shall be able to withstand conditions when reaching the speed of rotation caused by the action of the emergency governor and the other emergency equipment.
5. The generator shall have an adequate mechanical strength to withstand maximum vibrations which can occur at the bearings or the shaft.
6. The thermal power plant shall not be installed without keeping continuous watch on its performance at same premises by personnel with the necessary operational knowledge and skill.
7. The underground power line shall be installed so that it can withstand any pressures caused by vehicles and other heavy loads, and that there is no risk that excavation work could affect it by putting up a notice that indicates that the power line is laid under the ground.

8. The underground power line where it possible to work on the interior shall have fire prevention measures incorporated.

9. The horizontal distance between the high or extra high voltage overhead power wire (limited to 220kV and over) , and any building or structure shall be kept to 3m and over to minimize any risk of serious disturbance to power supply due to collapse of the overhead power wire by a fire in the building or structure.

10. The high or extra high voltage overhead power wire (limited to 220kV and over) shall not be installed below any building, structure, road, pedestrian bridge, and other facilities

11. Power grids to connect the thermal power plant overhead power wire, or adjacent to the power grids, shall be equipped with lightning arrestor and have other appropriate measures taken to prevent destruction of the electrical facilities in the power line by any voltage surges due to lightning. However, this shall not apply to the case where there is no risk of destruction of the electrical facilities by voltage surges due to lightning.

12. Telephone equipment for the power security communications shall be installed between all places where they are required to provide mutual communications to prevent a serious disturbance to power supply and to keep security among the thermal power plants, substations, switching stations, load dispatch centers, and other places.

13. The communication wire for the power security shall be installed so that there is no risk of damage to communication functions due to any impulsive force, fire or similar.

14. The material and structure of supporting the radio communication antennas for communication equipment for power security shall be installed so that there is no risk of damage of communication function due to their collapse when taking into consideration the wind loads at a wind speed of 60m/s.

15. Storage batteries equipment shall be installed with the necessary capacity to shut down the thermal power plant safely when the site power is lost, and receive power from the grid.

Chapter 2 Electrical Facilities in Demand Site

Article 238. Prevention of electrical shock and fire, and similar

1. The electrical wiring shall be installed in accordance with the conditions of installation location and voltage so that there is no risk of electric shock or fire.

2. The moving power wire shall be connected with electrical equipment so that there is no risk of electric shock or fire caused by poor connections.

3. The moving power wire whose voltage is not less than 11kV shall not be used, notwithstanding the provision of the preceding paragraphs 1 and 2.

4. Wire (except bare wire) for the electrical wiring shall have adequate mechanical and insulation strength for use in accordance with the conditions of installation location and voltage so that there is no risk of electric shock or fire.

5. Bare wire for the electrical wiring shall not be used. However, this may not need to be applied in the case where it is installed and there is no risk of electric shock or fire of the electrical wiring with adequate mechanical strength corresponding with the conditions of the installation location and voltage taking into consideration that no insulation is used.

6. The contact wire shall not be used for the electrical wiring whose voltage is not less than 11kV.

7. Insulation resistance between power wires to and from the power wire to earth at the Demand Site low voltage power lines shall be in accordance with the following table, covering every electric circuit which can be divided by the switch or over-current circuit breaker.

Table 10: Insulation Resistance Value

Operating voltage in the low voltage electric circuit		**Insulation resistance**
Not exceeding 500V	In the case that voltage to earth（this means the voltage from the power wire to earth in the grounded electric circuit, and voltage between the power wires in the ungrounded electric circuit）	0.5MΩ and over
Over 500V		1 MΩ and over

8. The electrical equipment installed in the demand site shall be installed in conformity with the following:

   (1) Live parts are not disclosed; and

   (2) There is no generation of heat with a risk of causing harm to the human body or fire.

9. The electrostatic precipitator that uses the voltage of not less than 11kV and any electrical facilities that supply power to it shall not be installed outdoor but only inside of a building. However, this may not need to be applied in the case where it is installed and there is no risk of electric shock or fire in consideration of danger of their live parts.

Article 239. Prevention of danger to other electrical wirings, other facilities, and similar

1. The electrical wiring shall be installed so that there is no risk of electric shock or fire by an abnormal voltage caused by the contact of its wires when it is at too close or crossing with the other electrical wiring, communication wires, or similar

2. The electrical wiring shall be installed so that there is no risk of damage to the water pipes, gas pipes, or similar by an electric discharge, and no risk of electric shock or fire through these

facilities by an electric leakage or discharge when it is too close or crossing with these other facilities.

Article 240. Protection measures to abnormal condition

1. A switch shall be installed at an appropriate point in the low voltage main circuit, the low voltage electric branch circuit from the low voltage main line to the electrical equipment and other low voltage electric circuits to the electrical equipment without going through the low voltage main circuit (the low voltage main line etc.). Also an over-current circuit breaker shall be installed in the low voltage main line etc. so that there is protection to the circuits when over-current occurs. However this may not need to be applied in the case where there is no risk that over-current can occur from short circuit in the circuits.
2. The motor (except rating output up to 0.2kW) installed inside of a building shall be equipped with an over-current circuit breaker, and have other appropriate measures taken so that there is no risk of fire caused by overheating and burning due to any over-current.
3. The electrical circuit supplying power to the medium voltage moving power wire or to the medium voltage contact wire shall be equipped with an over-current circuit breaker so that there is protection to the wires when over-current occurs in the circuit.
4. The electrical circuit prescribed in the preceding paragraph shall be equipped with a ground fault circuit breaker and have appropriate measures taken so that there is no risk of electric shock or fire when a ground fault occurs in the circuit.

Article 241. Prevention of electrical and magnetic interference

1. The electrical equipment or the contact wire which are installed in the demand site shall be installed so that there is no risk that the radio wave, high frequency current, etc., affect the function of the radio equipment by continuous and serious interference or interruption.

Article 242. Installation restrictions on specific location

1. The electrical facilities installed in a place with much dust shall be installed so that there is no risk that electric shock or fire can occur due to insulation or conductivity degradation caused by dust.
2. The electrical facilities installed in the following places shall be installed so that there is no risk of explosion or fire resulting from potential sources of ignition under normal operating condition:
   (1) A place with a risk of the existence of combustible gases or flammable vapor and the existence of an ignition source that could cause an explosion; or
   (2) A place with a risk that there is an existence of dust and the existence of sources of ignition that could cause an explosion; or
   (3) A place where storage of petroleum products and other hazardous substances that could ignite easily.

3. The electrical facilities installed in a place where there is a possibility of the diffusion of corrosive gases or liquids (this means a room where there are vented storage batteries or the like) shall have preventive measures taken so that there is no risk that electric shock or fire can occur due to insulation or conductivity degradation caused by corrosive gases or liquids.
4. The electrical facilities whose voltage is not less than 11kV shall not be installed in locations described in the paragraph 1 and 2, notwithstanding the provision of the paragraph 1 and 2.
5. The contact wire shall not be installed in locations described in the paragraph 2, notwithstanding the provision of the paragraph 2.
6. The contact wire shall not be installed in locations described in the paragraph 1, notwithstanding the provision of the paragraph 1.
7. The medium voltage contact wire shall not be installed in locations described in the paragraph 3.

Article 243. Installation of special equipment

1. The electric heating device, installed in an oil pipeline etc., shall not be installed in locations described in Article 242, the paragraph 1, 2 and 3.
2. Cathodic protection system shall be installed so that there is no risk of any obstruction to other facilities due to electrolytic corrosion.

PART 9. Measurement and Protection Equipment

Chapter 1 Measurement Equipment

Article 244. General provision

1. Thermal power plants shall be equipped with measurement equipment which can monitor the operating conditions for safety of the machinery.

2. Service condition of the equipment and instruments shall be appropriately selected to meet the environment of their installation.

Article 245. Measurement equipment for boiler

1. The boiler and its auxiliary machinery shall be equipped with measurement equipment which can measure the operating conditions shown in the following table for safety of the machinery. In addition the symbol for boiler type shown in the table is as follows:

   A: Circulation boiler

   B: Once-through boiler

   C: HRSG without supplementary fuel to exhaust gas and exhaust gas re-firing

   D: Fluidized bed combustion boiler (FBC)

Table 11: Measurement Equipment for Boiler

№	Operating condition	Boiler type				Remarks
		A	B	C	D	
1	Drum water level	X	-	X	X	
2	Drum pressure	X	-	X	X	
3	Super-heater outlet steam temperature	X	X	X	X	
4	Re-heater outlet steam temperature	X	X	X	X	This is applied to boilers with re-heaters.
5	Super-heater outlet steam pressure	X	X	-	X	
6	Re-heater outlet steam pressure	X	X	-	X	This is applied to boilers with re-heaters.
7	Boiler feed-water flow or main steam flow	X	X	X	X	
8	Fuel flow or fuel consumption	X	X	-	X	
9	Fuel pressure at fuel inlet of burner	X	X	-	-	This is applied to gas or liquid fuel fired boilers.
10	Air flow	X	X	-	X	
11	Furnace draft	X	X	-	X	
12	Inlet pressure at a stop valve for starting up	-	X	-	-	This is applied to supercritical pressure boilers with a stop valve for starting up.
13	Fluidized bed temperature	-	-	-	X	Appropriate measurement point depends on a type of FBC.

№	Operating condition	Boiler type				Remarks
		A	B	C	D	
14	Fluidized bed level	-	-	-	X	This is applied to FBC when fluidized bed level can be measured.
15	Differential pressure of fluidized bed in combustion furnace	-	-	-	X	This is applied to circulation type of FBC.
16	Cyclone separator outlet gas temperature	-	-	-	X	This is applied to circulation type of FBC.
17	Temperature of fluidized bed in external heat exchanger	-	-	-	X	This is applied to circulation type of FBC with external heat exchanger.

2. The boiler shall be equipped with measurement equipment which can continuously measure and record sulfur oxide and nitrogen oxide concentrations in its exhaust gas to monitor their exhaust level provisions as required by QCVN 22/2009/BTNMT. However, this may not need to be applied to HRSG's without supplementary fuel to exhaust gas and exhaust gas re-firing.

Article 246. Measurement equipment for steam turbine

1. The steam turbine and its auxiliary machinery shall be equipped with measurement equipment which can measure operating condition shown in the following table for the safety of machinery.

Table 12: Measurement Equipment for Steam Turbine

№	Operating condition	Remarks
1	Steam turbine speed	
2	Main steam pressure	
3	Reheat steam pressure	
4	Main steam temperature	
5	Reheat steam temperature	
6	Exhaust steam pressure of turbine	
7	Lubricant oil inlet pressure at bearing	
8	Metal temperature of bearing or lubricant oil outlet temperature at bearing	
9	Governor valve position	
10	Amplitude of vibration	This is applied to steam turbines of a rated output exceeding 10000kW.
11	Condenser level	
12	Condenser vacuum	

Article 247. Measurement equipment for gas turbine

1. The gas turbine and its auxiliary machinery shall be equipped with measurement equipment which can measure operating condition shown in the following table for the safety of machinery.

Table 13: Measurement Equipment for Gas Turbine

№	Operating condition	Remarks
1	Gas turbine speed	
2	Compressor outlet pressure	
3	Lubricant oil inlet pressure at bearing	
4	Metal temperature of bearing or lubricant oil outlet temperature at bearing	
5	Amplitude of vibration	
6	Fuel flow	

2. The gas turbine shall be equipped with measurement equipment which can continuously measure and record sulfur oxide and nitrogen oxide concentrations in its exhaust gas to monitor their exhaust level in accordance to provisions required by QCVN 22/2009/BTNMT.

Article 248. Measurement equipment for generator

1. The generator and its auxiliary machinery shall be equipped with measurement equipment which can measure operating condition shown in the following table for the safety of machinery. In addition this provision shall apply to the exciter and the standby emergency generator.

Table 14: Measurement Equipment for Generator

№	Operating condition	Remarks
1	Voltage	
2	Current	
3	Power	
4	Reactive power	
5	Metal temperature of bearing or lubricant oil outlet temperature at bearing	
6	Stator temperature	
7	Amplitude of vibration	This is applied to generators driven by the turbine of a rated output exceeding 10000kW.
8	Hydrogen pressure	This is applied to hydrogen cooled generators.
9	Hydrogen temperature	This is applied to hydrogen cooled generators.

Article 249. Measurement equipment for major transformer

1. The main (step-up, generator), unit auxiliary (unit service, station auxiliary) and station start-up (service) transformers, etc., shall be equipped with measurement equipment which can measure operating conditions shown in the following table for the safety of machinery.

Table 15: Measurement Equipment for Transformers

№	Operating condition	Remarks
1	Voltage	
2	Current or power	
3	Insulating oil temperature	This is applied to transformers whose voltages are not less than 110kV.

Chapter 2 Protection Equipment

Article 250. General provision

1. Thermal power plant shall be equipped with protection equipment for the safety of machinery and operators.

Article 251. Protection for boiler

1. The boiler shall be shut down safely when abnormal condition occurs in it or its auxiliary machinery, which prevents safe operation.

2. The boiler and its auxiliary machinery shall be equipped with a protection device which can trip the boiler automatically in case of the emergency conditions shown in the following table as well as having a manual trip device. In addition, a symbol of boiler type as shown in the table means is as follows:

   A: Circulation boiler
   B: Once-through boiler
   C: Fluidized bed combustion boiler (FBC)

Table 16: Protection for Boiler

№	Emergency condition	Boiler type			Remarks
		A	B	C	
1	Loss of all forced draft fans	X	X	X	
2	Loss of all induced draft fans	X	X	X	If used
3	Flame instability	X	X	-	
4	High furnace draft	X	X	X	
5	Low furnace draft	X	X	X	If induced draft fan used
6	Very low drum water level	X	-	X	
7	Low feed-water flow or low flow of water wall (Furnace wall)	-	X	-	

3. The boiler (except HRSG without combustion) and its auxiliary machinery shall be equipped with the functions to furnace purge and fuel leak check (liquid or gas) to enable start up safely. In addition, it shall be impossible to ignite the fuel before completion of these procedures.

4. The HRSG without combustion and its auxiliary or related machinery shall be equipped with the functions to pre purge to enable start up safely.

Article 252. Protection for steam turbine

1. The steam turbine shall be shut down safely when abnormal condition occurs in it or its auxiliary machinery, which prevents safe operation.

2. The steam turbine and its auxiliary machinery shall be equipped with a protection device which can trip the steam turbine automatically in case of any emergency condition shown in the following table as well as having a manual trip device.

Table 17: Protection for Steam Turbine

№	Emergency condition	Remarks
1	Over-speed	
2	Thrust bearing wear or high thrust bearing temperature	This is applied to steam turbines of a rated output exceeding 10000kW and also gas turbines equipped with the common thrust bearing in a combined cycle plant.
3	Low condenser vacuum (high turbine exhaust pressure)	This is applied to steam turbines of a rated output exceeding 10000kW.
4	Excessive vibration	This is applied to steam turbines of a rated output exceeding 10000kW.
5	Low bearing inlet oil pressure	
6	Speed governor failure	This is applied to steam turbines equipped with an electro-hydraulic governor.
7	Generator internal failure	This is applied to generators of a rated output of not less than 10000kVA.

Article 253. Protection for gas turbine

1. The gas turbine shall be shut down safely when abnormal condition occurs in it or its auxiliary machinery, which prevents safe operation.

2. The gas turbine and its auxiliary machinery shall be equipped with a protection device which can trip the gas turbine automatically in case of any emergency condition as shown in the following table as well as having a manual trip device.

Table 18: Protection for Gas Turbine

№	Emergency condition	Remarks
1	Over-speed	
2	High gas temperature	
3	Excessive vibration	This is applied to gas turbines of a rated output exceeding 10000kW.
4	Loss of all flame	
5	Low bearing inlet oil pressure	
6	Speed governor failure	This is applied to gas turbines equipped with an electro-hydraulic governor.
7	Generator internal failure	This is applied to generators of a rated output of not less than 10000kVA.

3. The gas turbine and its auxiliary machinery shall be equipped with the function to internal purge to start up safely. In addition it shall be impossible to ignite the fuel before completion of this procedure.

Article 254. Protection for generator and major transformers

1. The generator and major transformers shall be disconnected from the electric circuit and shut down safely when abnormal condition occurs in them and their auxiliary machinery, which prevents safe operation. In addition, this provision shall apply to the exciter, the standby emergency generator, and the major transformer means main (step-up, generator), unit auxiliary (unit service, station auxiliary), station start-up (service) transformer, etc.

2. The generator, major transformers and their auxiliary machinery shall be equipped with a protection device which can disconnect and trip them from the electric circuit automatically in case of any emergency condition shown in the following table as well as having a manual trip device.

Table 19: Protection for Generator and Major Transformers

№	Emergency condition	Remarks
1	Generator internal failure	
2	Generator over-current	
3	Generator excessive vibration	This is applied to generators driven by the turbine of a rated output exceeding 10000kW.
4	Transformer over-current	This is applied to the transformers whose voltage is not less than 11kV.
5	Transformer internal failure	This is applied to transformers of a rated output of not less than 6.3MVA.

Article 255. Protection for major auxiliary machinery

1. The major auxiliary machinery which has a risk of restricting normal operation of the boiler, turbine and generator shall be shut down safely when abnormal condition occurs, which prevent safe operation. In addition, major auxiliary machinery means the motor driven feed-water pump, fuel oil pump, boiler circulating pump, forced draft fan, induced draft fan, primary air fan, coal mill (pulverizer), etc.
2. The major auxiliary machinery which has a risk of restricting normal operation of the boiler, turbine and generator shall be equipped with a protection device which can trip them safely.

Article 256. Unit interlock for power plant

1. The boiler, turbine and generator in a thermal power plant shall be equipped with a unit interlock which makes shut down of any of them from each other automatically for the safety of the facilities. In addition, the basic principles of the unit interlock are classified by the kind of power plant facilities and are shown in paragraphs 2 to 5.
2. Unit interlock of a conventional steam power plant
   (1) The steam turbine is automatically shut down immediately or on condition of the requirements in the event that any protection instrument of the boiler is activated. In addition the generator is automatically shut down after automatic shutdown of the steam turbine.
   (2) The generator is automatically shut down after automatic shutdown of the steam turbine in the event that any protection instrument of the steam turbine is activated. In addition the boiler is automatically shut down immediately or on condition of the requirements of the boiler.
   (3) The steam turbine is automatically shut down in the event that any protection instrument of the generator is activated. In addition the boiler is automatically shut down immediately or after automatic shutdown of the steam turbine.
3. Unit interlock of the gas turbine power plant
   (1) The generator is automatically shut down after automatic shutdown of the gas turbine in the event that any protection instrument of the gas turbine is activated.
   (2) The gas turbine is automatically shut down in the event that any protection instrument of the generator is activated.
4. Unit interlock of the single-shaft combined cycle power plant
   (1) The steam turbine is automatically shut down in the event that any protection instrument of the gas turbine is activated. In addition the generator is automatically shut down after automatic shutdown of the gas turbine and/or steam turbine.

(2) The gas turbine is automatically shut down in the event that any protection instrument of the steam turbine is activated. In addition the generator is automatically shut down after automatic shutdown of the gas turbine and/or steam turbine.

(3) The gas turbine and steam turbine are automatically shut down in the event that any protection instrument of the generator is activated.

(4) The gas turbine and steam turbine are automatically shut down in the event that any protection instrument of the HRSG is activated.

5. Unit interlock of the multi-shaft combined cycle power plant

(1) The gas turbine generator is automatically shut down after automatic shutdown of the gas turbine in the event that any protection instrument of the gas turbine is activated.

(2) The steam turbine generator is automatically shut down after automatic shutdown of the steam turbine in the event that any protection instrument of the steam turbine is activated.

(3) The gas turbine is automatically shut down in the event that any protection instrument of the gas turbine generator is activated.

(4) The steam turbine is automatically shut down in the event that any protection instrument of the steam turbine generator is activated.

Chapter 3 SCADA/EMS System

Article 257. General provision

1. Thermal power plant provided by article 4 of "No. 18/2010/TT-BCT : Regulating the operation of the competitive electricity generation market" shall be equipped with devices for supervisory control and data acquisition/energy management system (SCADA/EMS) and remote metering system which are provisions of article 1 of "No.26/2006/QD-TTg : Approving the roadmap and conditions for formation and development of different levels of the electricity market in Vietnam" to take part in a competitive power market.

Article 258. SCADA/EMS system

1. The devices for SCADA/EMS and remote metering system shall have the specifications that satisfy the requirements of operation of a competitive power market which is provided by article 1 of "No.26/2006/QD-TTg : Approving the roadmap and conditions for formation and development of different levels of the electricity market in Vietnam".

PART 10. SUPPLEMENTARY PROVISION

Article 259. Effect

1. This technical regulation shall take effect 15 days after the public notice as shown in gazette.
2. The minister of Industry and Trade and other officials shall endeavor to implement this technical regulation.

Article 260. Transitional measure

1. With regard to the application of this regulation, the provisions then in force shall remain applicable to the electric facilities which exist actually and have commenced installation.