KGS Code

KGS AB935 2018

Code for Facilities, Technology and Inspection for Manufacturing of Other Gas Burning Appliances

Deliberation/Resolution by Gas Technical Standards Committee : November 23, 2018

Approval by the Ministry of Trade, Industry & Energy : December 13, 2018

Personnel

Gas Technical Standards Committee

Chairman	Kwang-Won Lee, Professor of Hoseo University
Vice-Chairman	Seung-Hoon Nam, Principal Researcher of KRISS
Ex Officio Member	Hui-Won Lee, Manager of Energy Safety Department, Ministry of Trade, Industry & Energy
	Hae-Myeong Yang, Director of Technology and Safety, Korea Gas Safety Corporation
High-Pressure Gas	Seung-Hoon Nam, Principal Researcher of KRISS
	Beom-Seok Lee, Principal Professor of Kyung Hee University
	Dong-Myeong Ha, Professor of Semyung University
	Chang-Gi Kim, Principal Researcher of Korea Institute of Machinery and Materials
	Hyuk-Myun Kwon, Director General of Occupational Safety & Health Research Institute
	Su-Dong Byun, CEO of Q-Best
Liquefied Petroleum Gas	Doo-Seon Park, Managing Director of Daesung Industrial Gas Co., Ltd
	Hyeong-Hwan Ann, Professor of Korea National University of Transportation
	Byeong-Hak Choei, Professor of Gangneung-Wonju National University
	Seong-Min Lee, Director of KOGAS Research Institute
	Yong-Gwon Lee, Vice-President of EG CNE Co.,Ltd
	Gi-hyeon Jang, Director of Kiturmi
	Jeong-Sik Chon, Direto of E1 CO., Ltd.

History of Establishment and Revision of KGS Code	
Code Number	KGS AB935 2016
Code Title	Code for Facilities, Technology and Inspection for Manufacturing of Other Gas Burning Appliances

Date of Establishment/Revision	Description
December 31, 2008	Established (Notification of the Ministry of Knowledge Economy No. 2008-380)
May 15, 2009	Revised (Notification of the Ministry of Knowledge Economy No. 2009-193)
June 26, 2012	Revised (Notification of the Ministry of Knowledge Economy No. 2012-313)
May 20, 2013	Revised (Notification of the Ministry of Trade, Industry & Energy No. 2013-087)
November 17, 2014	Revised (Notification of the Ministry of Trade, Industry & Energy No. 2014-589)
November 4, 2015	Revised (Notification of the Ministry of Trade, Industry & Energy No. 2015-578)
January 8, 2016	Revised (Notification of the Ministry of Trade, Industry & Energy No. 2016-6)
December 13, 2018	Revised (Notification of the Ministry of Trade, Industry & Energy No. 2018-607)

Table of Contents

Code for Facilities, Technology and Inspection for Manufacturing of Other Gas Burning Appliances

1. General

1.1 Scope

1.1.1 This Code applies to facilities, technology and inspection for manufacturing of other gas burning appliances (hereinafter referred to as "gas burning appliances") of which heat input is not over 262.6 kW (200,000 kcal/h) among the gas burning appliances in conformity to the Enforcement Regulation of the Safety Control and Business of Liquefied Petroleum Gas Act (hereinafter referred to as "Enforcement Regulation"), Table 3, No. 10 and Table 7, No.4-j. <Revised on November 4, 2015>

1.1.2 The combustors excluded from the gas appliances subject to license in conformity to the Enforcement Regulation, Table 7, No.5-b are as follows:
(1) Gas torches used for welding and cutting,
(2) Drying furnace combustors used in casting sand dryers, printing ink dryers, concrete dryers, etc.,
(3) Combustors for heat treatment furnaces or heating furnaces used in metal heat treatment furnaces, glass and ceramic furnaces, atmosphere gas furnaces, etc.,
(4) Melting furnace combustors used in metal melting, glass melting, etc.,
(5) Combustors attached to gas cylinders of which internal volume is less than 100 mL, and
(6) Other combustors acknowledged by the Minister of Trade, Industry & Energy as not hindering safety control.

1.2 Validity of Code

1.2.1 This Code has passed the deliberation and resolution by the Gas Technical Standards Committee (Bill No. 2018-9, November 23, 2018) in conformity to the High Pressure Gas Safety Control Act (hereinafter referred to as "High Pressure Gas Act"), Article 33-2 in accordance with the Safety Control and Business of Liquefied Petroleum Gas Act (hereinafter referred to as "Act"), Article 45, Clause 1, has been approved by the Minister of Trade, Industry & Energy (Notification No. 2018-607 of the Ministry of Trade, Industry & Energy, December 13, 2018), and is valid and effective as the detailed standards in conformity to the Act, Article 45, Clause 1. <Revised on November 4, 2015>

1.2.2 Conformity to this Code is deemed to conform to Table 7 of the Enforcement Regulation in accordance with the Act, Article 45, Clause 4. <Revised on November 4, 2015>

1.3 Reference Codes and Standards

1.3.1 Inspection standard for new technology products

In case the Minister of Knowledge Economy acknowledges that the new manufacturing and inspection methods of gas burning appliances developed through new technology development do not meet the standard for facilities, technology and inspection in conformity to this Code in accordance with the Enforcement Regulation, Table 7, No. 5-a but do not hinder safety control, such manufacturing and inspection methods may apply only restrictively to those gas appliances. <Revised on May 15, 2009>

1.3.2 Registration standard for manufacturing of foreign products <Newly established on June 26, 2012>

The "foreign manufacturing installation standards and manufacturing technology standards" specified the Enforcement Regulation, Article 17, proviso of Clause 3 mean the detailed standards specified by the provisions of the Act, Article 45. <Revised on November 4, 2015>

1.4 Definitions

The terms used in this Code are defined as follows:

1.4.1 "Regular quality inspection" means the performance inspection performed by taking samples from products manufactured in mass production to check whether the products which are to undergo production stage inspection are the products manufactured the same as those that have undergone design stage inspection.

1.4.2 "Routine sample inspection" means the inspection performed to check on the basic product performance by taking samples from the same products manufactured in the same production lot for the products to undergo product identification inspection.

1.4.3 "Occasional quality inspection" means the inspection performed by taking samples without any advance notice from products produced in mass production in order to check whether the products which have undergone production process inspection or comprehensive process inspection are being manufactured in the same way as those that have undergone design stage inspection.

1.4.4 "Process identification audit" means the audit conducted to check on the conformity of quality system operation for the manufacturing and self-inspection processes required for manufacturing of the products which have undergone design stage inspection.

1.4.5 "Comprehensive quality control system audit" means the audit conducted to check on the conformity of quality system operation for the whole manufacturing process of gas burning appliances such as the design, manufacturing and self-inspection of the products.

1.4.6 "Type" means the unit of products distinguishable in their construction, material, capacity, performance, etc.

1.4.7 "Process inspection" means production process inspection and comprehensive process inspection.

1.5 Application of Codes and Standards

Matters necessary for the materials, construction and dimensions, performance and other technical matters of gas burning appliances not covered in this Code shall conform to relevant Korean Standards (KS).

2. Manufacturing Installation Standard

2.1 Manufacturing Facilities

A person who intends to manufacture gas burning appliances shall be furnished with the following manufacturing facilities to manufacture the gas burning appliances in accordance with this manufacturing technology standard. However, in case the licensing authority acknowledges that it is necessary for quality improvement, the facilities of specialist parts companies which are utilized for the manufacturing of the parts may be utilized or the parts manufactured with them may be used.

(1) Drilling machines, presses, tube benders and casting processing facilities,
(2) Surface treatment and painting facilities,
(3) Ultrasonic cleaning facilities (for gas burning appliance cocks and governors only), and
(4) Gas welding machines or electric welding machines and power assembly jigs and tools for gas burning appliance assembly

2.2 Inspection Facilities

2.2.1 A person who intends to manufacture gas burning appliances shall be furnished with the following inspection facilities required to check on and maintain product performance.

2.2.1.1 The kinds of inspection facilities shall suffice for self-inspection in conformity to the safety control regulation and include the followings:

2.2.1.1.1 Kinds of inspection facilities which must be furnished

(1) Dimension measuring facilities such as vernier calipers, micrometers, thread gauges, etc.

(2) Surface thermometer, and

(3) Carbon monoxide meters and carbon dioxide meters.

2.2.1.1.2 Kinds of inspection facilities which shall be furnished when required

(1) Liquefied petroleum gas or city gas immersion test facilities,

(2) Pressure-proof test facilities,

(3) Gas tightness test facilities,

(4) Safety device operating test facilities,

(5) Durability test facilities,

(6) Test gas supply facilities,

(7) Insulation resistance testers and withstand voltage testers,

(8) Heat input measuring facilities,

(9) Barometers,

(10) Voltage regulators and power consumption watt meters,

(11) Vibration testers,

(12) Thermal efficiency measuring facilities, and

(13) Other necessary inspection facilities and appliances

2.2.1.2 The capacity of inspection facilities shall match the product production capacity of the relevant manufacturing plant.

2.2.2 Notwithstanding 2.2.1, in case the test and inspection of design stage inspection items are ordered to one of the following authorized agencies to be performed or a lease contract for test and inspection facilities required for design stage inspection items is awarded to one of the following authorized agencies, the relevant test and inspection facilities among the inspection facilities in 2.2.1 shall be deemed to have been furnished.

(1) Korea Gas Safety Corporation (hereinafter referred to as "Korea Gas Safety Corporation" or "KGS") in conformity to the High Pressure Gas Act, Article 28

(2) Inspection agencies designated in accordance the High Pressure Gas Act, Article 35 (hereinafter referred to as "inspection agencies")
(3) Authorized test and inspection agencies designated in accordance the Framework Act on National Standards.

3. Manufacturing Technology Standard

3.1 Materials

The metallic materials of gas burning appliances shall be corrosion-resistant or surface-treated for corrosion resistance to secure their safety.

3.2 Construction and Dimensions

A gas burning appliance shall be of a construction and dimensions in conformity to the following standard to secure its safety, serviceability and exchangeability:

3.2.1 A gas burning appliance shall be of a construction which is not directly coupled to a gas cylinder. However, in the case of a portable gas stove for outdoor use of which maximum gas filling quantity is not over 3 kg, this provision may not apply.

3.2.2 The opening direction of the handle of the rotary cock or rotary valve for gas or water service shall be counterclockwise. However, in the case of a multi-function rotary cock of which opening direction is bidirectional, this provision may not apply.

3.2.3 A gas burning appliance provided with a pilot burner shall be of a construction in which the gas passage of the main burner is not to be opened unless the pilot burner is ignited.

3.2.4 In the case of a gas burning appliance provided with a supply fan and an exhaust fan, the supply fan shall be operated before the ignition and the gas passage shall be automatically shut off when the supply fan is stopped.

3.3. Devices

A gas burning appliance shall be provided with devices in conformity to the following standard to secure its safety and serviceability:

3.3.1 Power failure safety device

A gas burning appliance of which gas passage is opened and closed by AC power shall shut the gas passage in power outage and shall be provided with a power failure safety device which prevents the gas passage from being automatically opened or makes the pilot burner reignited when the power is on again. However, this provision may not apply for a gas burning appliance of which pilot flame is not extinguished in power outage. <Revised on May 15, 2009>

3.3.2 Head wind prevention device

A gas burning appliance fitted with an exhaust tube connector shall be provided with a device which prevents the head wind from affecting the burner.

3.3.3 Flame supervision device

A gas burning appliance shall be provided with a flame supervision device if necessary.

3.3.4 Other devices

3.3.4.1 Governor

A gas burning appliance fitted with a ceramic burner shall be provided with a governor.

3.4 Performance

A gas burning appliance shall have performances in conformity to the following standard to secure its safety and serviceability.

3.4.1 Product performance

3.4.1.1 Gas tightness performance

A gas burning appliance shall be free of any gas leakage in the gas tightness test performed at a pressure not less than 1.5 times the normal pressure. However, in the case of a part for which gas tightness test is difficult to be performed, leakage test performed in an ignited state may replace the gas tightness test.

3.4.1.2 Durability test

3.4.1.2.1 The cock and electric ignition unit shall be free of any gas leakage or abnormal performance after a 12,000-cycle cyclic test.

3.4.1.2.2 The flame supervision device and hose connector shall be free of gas leakage and maintain their performance after a 1,000-cycle cyclic test.

3.4.1.2.3 The governor shall be free of any gas leakage and the change in the regulated pressure shall not exceed [0.05P (regulated pressure before the test) + 0.03] kPa after a 30,000-cycle cyclic test.

3.4.1.3 Vibration resistance performance

A gas burning appliance shall be free of any gas leakage and pass the tests in the normal combustion state after the vibration test performed for one hour in its packed state.

3.4.1.4 Insulation resistance performance

The insulation resistance shall not be less than 1 MΩ between a live parts and dead metal parts.

3.4.1.5 Withstand voltage performance

The withstand voltage performance between a live parts and dead metal parts shall be free of any abnormality.

3.4.2 Material performance (currently not used)

3.4.3 Operating performance

3.4.3.1 Electric ignition performance

The electric ignition system of a gas burning appliance shall successfully ignite 8 times or over when it is operated 10 times and shall not consecutively fail to ignite twice.

3.4.3.2 Heat input rate performance

In case a gas burning appliance is marked with a heat input rate, the tolerance of the total heat input rate of the gas burning appliance and the heat input rate of each burner shall be within ±10% of their indicated values.

3.5 Heat Treatment

The heat treatment of gas burning appliances shall be restricted to gas burning appliances fabricated with materials requiring heat treatment and appropriate heat treatment methods shall be adopted to secure their safety.

3.6 Marking

A gas burning appliance shall be marked in accordance the following provisions so that it can be safely used.

3.6.1 Product marking

A gas burning appliance shall be attached with a nameplate and a handling method mark in a conspicuous place in an un-detachable manner, and the nameplate shall be marked with the followings:

(1) The name of combustor (other gas burning appliance)
(2) Manufacturer's type (Model No.)
(3) Gas to be burned (gas group for appliances burning city gas) and working gas pressure
(4) Heat input (gas consumption): kW (kg/h)

(5) Manufacture number (lot number) and date of manufacturing (import date for imported products) <Revised on December 13, 2018>
(6) Warranty period and service
(7) The name or abbreviation of manufacturer (name of importer for imported products)
(8) Heat efficiency (restrictive to gas burning appliances subject to heat efficiency requirement)
(9) Rated voltage (V) and power consumption (W) (restrictive to gas burning appliances using electricity)

3.6.2 Acceptance mark

A gas burning appliance shall be marked with an acceptance mark to be easily identified as a gas burning appliance which has passed the inspection in accordance with the Act, Article 39, Clause 2. <Revised on November 4, 2015>

3.6.2.1 The acceptance mark shall be as shown in Figure 3.6.2.1. <Revised on June 26, 2012>

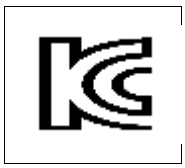


Figure 3.6.2.1 Acceptance Mark

3.6.2.1.1 The size of the acceptance mark shall be 30 mm (width) by 30 mm (height).

3.6.2.1.2 The colors of the acceptance mark shall be silver white on the background and black in letters.

3.6.2.2 In case gas burning appliances are manufactured in an integrated production process, the acceptance mark may be made in their production process.

3.6.3 Enclosure of manual

A gas burning appliance shall be provided with the handling manual (inclusive of installation method) for its safe service.

3.6.4 Marking of gas safety instructions

A gas burning appliance shall be marked with safety instructions if necessary for its safe service.

3.6.5 Attachment of piping marking and installation statement

A gas burning appliance may be attached with piping marking and installation statement if necessary for its safe service.

4. Inspection Standard

4.1 Kinds of Inspections

Gas appliance inspections shall be classified into manufacturing installation inspection and product inspection.

4.1.1 Manufacturing installation inspection

The manufacturing installation of a person who intends to manufacture gas burning appliances in accordance with the Act, Article 36, Clause 2 shall undergo manufacturing installation inspection when the installation or modification of the gas burning appliance manufacturing installation has been completed. <Revised on November 4, 2015>

4.1.2 Product inspection

A person who intends to manufacture or import gas burning appliances in accordance with the Act, Article 39, Clause 1 shall undergo the following inspections in order to check on and maintain the performance of the gas burning appliances. However, inspection of the gas appliances specified in the Enforcement Decree may be omitted in whole or in part. <Revised on November 4, 2015>

4.1.2.1 Design stage inspection

In case a product comes under one of the following cases in accordance with the Enforcement Regulation, Table 7, the product shall undergo design stage inspection. However, in case the test

report certified by Korea Gas Safety Corporation or an authorized test and inspection agency is submitted, the design stage inspection of the relevant part may be exempted.

(1) A gas appliance manufacturer manufactures a specific type of product for the first time.

(2) A gas appliance importer imports a specific type of product for the first time.

(3) The material or construction of the product of which type has undergone design stage inspection is changed and the performance of the product is changed.

(4) The product type has undergone design stage inspection but five years have elapsed from its last inspection date.

4.1.2.2 Production stage inspection

The gas burning appliances of which type has passed design stage inspection in accordance with the Reinforcement Regulation, Table 7 shall undergo production stage inspection in accordance with the following provisions. In this case, one of product identification inspection, production process inspection or comprehensive process inspection in conformity to Table 4.1.2.2 may be selected as the production stage inspection and be performed depending on self-inspection capability and quality control capability.

Table 4.1.2.2 Kinds, Units and Intervals of Production Stage Inspections

Kind of Inspection	Object	Composition Item	Inspection Unit	Interval
Product Identification Inspection	Items other than the objects of production process inspection or comprehensive process inspection	Regular quality inspection	Type	Once every 2 months
		Routine sample inspection	Type	At every application
Production Process Inspection	Items which can satisfy the conformity requirements of the quality system for manufacturing process /self-inspection process	Regular quality inspection	Type	Once every three months
		Process identification inspection	Item	Once every three months
		Occasional quality inspection	Representative type	Twice a year or more often
Comprehensive Process Inspection	Items which can satisfy the conformity requirements of the quality system for total process (design, manufacturing and self-inspection)	Comprehensive quality control system audit	Item	Once every six months
		Occasional quality inspection	Representative type	Once a year or more often

4.1.2.2.1 Product identification inspection shall be performed as follows:

(1) Product identification inspections shall be classified into regular quality inspection and routine sample inspection and each inspection shall be separately performed. In this case, the routine sample inspection is performed when the product has passed the regular quality inspection.
(2) Products of which type has passed the inspections in accordance with (1) above shall undergo regular quality inspection once every two months. However, regular quality inspection is omitted for the same type products of which manufactured or imported quantity does not exceed 20 units a month.
(3) Routine sample inspection shall be performed in accordance with (1) above for the type of products whenever application for the inspection is made.

4.1.2.2.2 Production process inspection shall be performed as follows:
(1) Production process inspections shall be classified into regular quality inspection, process identification audit and occasional quality inspection, and each inspection or audit shall be separately performed.
(2) The process identification audit of the product of which audit is applied for shall be performed when the applicant has 3-month or longer implementation experience of the quality system appropriately documented in accordance with Appendix A.
(3) Occasional quality inspection shall be performed twice a year or more often without prior notice on the product items which have undergone regular quality inspection and process identification audit.
(4) Occasional quality inspection shall be performed for one representative type of products by the same method as that of regular quality inspection.
(5) A person who has passed production process inspection may apply for product identification inspection as required.

4.1.2.2.3 Comprehensive process inspection shall be performed as follows:
(1) Comprehensive process inspections shall be classified into comprehensive quality control system audit and occasional quality inspection, and each audit or inspection shall be separately performed.
(2) The comprehensive quality control system audit of the products of which audit is applied for shall be performed when the applicant has 3-month or longer implementation experience of the quality system appropriately documented in accordance with Appendix A.

(3) Occasional quality inspection shall be performed once a year or more often without prior notice on the products which have undergone comprehensive quality control system audit.
(4) Occasional quality inspection shall be performed for one representative type of products by the same method as that of regular quality inspection.
(5) A person who has passed comprehensive process inspection may apply for product identification inspection as required.

4.2 Object Audit of Process Inspection

4.2.1 Application for audit

A gas appliance manufacturer who has 3-month or longer gas appliance manufacturing experience in accordance with Appendix A may apply for production process inspection or comprehensive process inspection.

4.2.2 Audit method

The audit shall be performed for the persons who are to undergo process inspection, who have failed process inspection or who apply for process re-inspection in accordance with 4.4.2.2.2(5).

4.2.2.1 Audit of new applicants, persons who have failed process inspection and persons who apply for re-inspection

The audit standard for process identification audit or comprehensive quality control system audit for the persons who apply for process inspection, who have failed process inspection or who apply for process re-inspection in accordance with 4.4.2.2.2(5) (hereinafter referred to as "process inspection applicants") shall conform to Appendix A.

4.2.2.2 Regular audit

In the case of process identification audit which is to be performed once every three months and comprehensive quality control system audit which is to be performed once every six months, the maintenance states of the quality system specified in Appendix A such as changes, process management, self-inspection and use of acceptance marks in the period shall be audited. The

audit for production process inspection or comprehensive process inspection shall be performed as follows:

4.2.2.2.1 Comprehensive process inspections shall be classified into comprehensive quality control system audit and occasional quality inspection, and each audit or inspection shall be separately performed.

4.2.2.2.2 The comprehensive quality control system audit of the products of which audit is applied for shall be performed when the applicant has 3-month or longer implementation experience of the quality system appropriately documented in accordance with Appendix A.

4.2.2.2.3 Occasional quality inspection shall be performed once a year or more often without prior notice on the products which have undergone comprehensive quality control system audit.

4.2.2.2.4 Occasional quality inspection shall be performed for one representative type of products by the same method as that of regular quality inspection.

4.2.2.2.5 A person who has passed comprehensive process inspection may apply for product identification inspection as required.

4.2.3 Adjudication committee

Korea Gas Safety Corporation shall establish an adjudication committee as follows to deliberate the matters related to the judgment on acceptance or rejection of the results of production process inspection and comprehensive process inspection.

4.2.3.1 The adjudication committee shall be comprised of no more than 5 members including one chairperson.

4.2.3.2 The members of the committee shall be commissioned by the president of Korea Gas Safety Corporation from among persons who have extensive knowledge and experience in gas safety or quality control and persons who can represent consumers' right to secure open and aboveboard deliberation.

4.2.3.3 Necessary matters concerning the operation of the committee shall be prescribed by the president of Korea Gas Safety Corporation.

4.3 Inspection Items

4.3.1 Manufacturing installation inspection

Inspection of a gas burning appliance manufacturing installation shall be performed on the following items in accordance with the Enforcement Regulation, Table 7 to check whether manufacturing facilities and inspection facilities are fully furnished:

(1) Whether manufacturing facilities in conformity to 2.1 are furnished, and

(2) Whether inspection facilities in conformity to 2.2 are furnished.

4.3.2 Product inspection

Inspection of gas burning appliances shall be classified into design stage inspection and production stage inspection, and each inspection shall be separately performed in accordance with the Enforcement Regulation, Table 7 to check whether the gas burning appliances are manufactured in accordance with the manufacturing standard:

4.3.2.1 Design stage inspection

The inspection items of design stage inspection to check whether the gas burning appliances conform to the manufacturing standard are as follows. However, in case the test report on a part of which performance is certified by Korea Gas Safety Corporation or an authorized test and inspection agency is submitted, the design stage inspection of that part may be exempted.

(1) Conformity of materials in accordance with 3.1

(2) Conformity of construction and dimensions in accordance with 3.2

(3) Conformity of devices in accordance with 3.3

(4) Conformity of performance in accordance with 3.4

(5) Conformity of marking in accordance with 3.6

4.3.2.2 Production stage inspection

The inspection items of production stage inspection by kinds of inspections to check whether the gas burning appliances conform to the manufacturing standard are as follows.

4.3.2.2.1 Product identification inspection

(1) Regular quality inspection

(1-1) Conformity of construction and dimensions in accordance with 3.2

(1-2) Conformity of the gas tightness performance of gas passage in accordance with 3.4.1.1

(1-3) Conformity of combustion state performance (exclusive of continuous noise and extinguishing noise) in accordance with 4.5.4

(1-4) Conformity of electric ignition performance in accordance with 3.4.3.1

(1-5) Conformity of safety device operating performance in accordance with 4.5.4

(1-6) Conformity of insulation resistance performance in accordance with 3.4.1.4

(1-7) Conformity of withstand voltage performance in accordance with 3.4.1.5

(2)Routine sample inspection

(2-1) Conformity of the gas tightness performance of gas passage in accordance with 3.4.11

(2-2) Conformity of marking in accordance with 3.6

(2-3) Conformity of combustion state performance (exclusive of CO concentration, continuous noise and extinguishing noise in windless state) in accordance with 4.5.4).

4.3.2.2.2 Production process inspection

(1)Regular quality inspection

The inspection items of regular quality inspection shall conform to 4.3.2.2.1(1).

(2)Process identification audit

The audit items of process identification audit shall conform to Table 4.3.2.2.

(3)Occasional quality inspection

The inspection items of occasional quality inspection shall conform to 4.3.2.2.1(1).

4.3.2.2.3 Comprehensive process inspection

(1) Comprehensive quality control system audit

The audit items of comprehensive quality control system audit shall conform to Table 4.3.2.2.

(2) Occasional quality inspection

The inspection items of occasional quality inspection shall conform to 4.3.2.2.1(1).

Table 4.3.2.2 Audit Items of Process Identification Audit and Comprehensive Quality Control System Audit <Revised on January 8, 2016>

Classification		Audit Item	Application	
			Process Identification Audit	Comprehensive Quality Control System Audit
General	Organization	Securement of organizations with appropriate technical and business capability	○	○
		Possession of a research or development organization to reflect the causes of potential troubles to product design		○
	Quality System	Operation of an appropriate quality system and review of operation results	○	○
	Human Resource	Maintenance of appropriate qualification for employees affecting quality	○	○
	Facilities & Equipment	Securement of facilities and equipment in conformity to product requirements and quality control	○	○
Design	Design & Development	Securement of a design and development system in conformity to product requirements		○
		Verification of product design through analysis of the effects of potential failures and assessment of reliability, and results of output supply		○
		Check on the feasibility of design and development and operation of change procedure		○
Manufacturing	Purchase	Maintenance of an appropriate management system for purchased materials	○	○
		Reflection of the evaluation of suppliers to purchase policy		○
	Production	Possession of a production process in conformity to product requirements and verification of the implementation	○	○
		Possession of acceptance criteria for process approval	○	○
		Verification of process management capability using a statistical technique		○
		Operation of control plan and guidelines for works		○
		Operation of systems for preventive and forecast maintenances and management of production tools		○
		Operation of systems for handling and storing materials and products	○	○
Self-Inspection	Inspection Method & Procedure	Maintenance of methods and procedures for inspection to secure product conformity	○	○
		Maintenance of acceptance criteria for tally data		○

		sampling at zero defect level		
		Maintenance of traceability for determination of measuring devices and guarantee of effective results, and maintenance of a procedure for record management	○	○
		Analysis of measurement system		○
		Self-inspection of the whole items of design stage inspection (once a year)	○	
		Self-inspection of the whole items of design stage inspection (twice a year)		○
	Corrective and Preventive Measures	Management of unconformity items and operation of preventive measures for recurrence prevention	○	○
	Internal Audit	Possession of capability to maintain system conformity	○	○
Obligation	Acceptance Marking	Maintenance of a written management regulation for acceptance marking	○	○
		Maintenance of a separate written regulation for manufacturing acceptance marks		○
	Training	Completion of training in quality control system	○	○
	Safety Control	Prevention of accidents due to faulty products and circulation of unconformity products	○	○
Others		Other matters related to maintenance of safety	○	○

4.4 Inspection Method

4.4.1 Manufacturing installation inspection

Manufacturing installation inspection shall be performed by checking whether manufacturing facilities and inspection facilities in conformity to 4.3.1 are fully furnished. In case all required facilities are fully furnished, the inspection shall be deemed acceptable.

4.4.2 Product inspection

4.4.2.1 Design stage inspection

Design stage inspection shall be performed in accordance with the followings to be able to clearly judge whether each inspection item conforms to the manufacturing standard:

4.4.2.1.1 The types of gas burning appliances and working pressure ranges by heat inputs shall be checked with the documents submitted by the manufacturer.

4.4.2.1.2 The corrosion resistant materials shall be checked with the documents submitted by the manufacturer.

4.4.2.1.3 Other inspection methods of design stage inspection shall conform to what the president of Korea Gas Safety Corporation specifies.

4.4.2.2 Production stage inspection

The method of production stage inspection shall conform to the followings for each inspection item to be able to clearly judge whether each item conforms to the manufacturing standard:

4.4.2.2.1 Product identification inspection

(1) Sampling

(1-1) The number of test specimens for regular quality inspection shall be two.

(1-2) The sampling standard for routine sample inspection shall be as follows:

(1-2-1) The same products manufactured in the same production unit shall form one lot.

(1-2-2) The number of test specimens to be taken from the lot formed in accordance with (1-2-1) shall conform to Table 4.4.2.2.1(1).

Table 4.4.2.2.1(1) Number of Test Specimens for Routine Sample Inspection

Number of Products Forming One Lot	10 and less	11 to 100 inclusive	101 to 300 inclusive	301 to 700 inclusive	701 to 3000 inclusive	3001 and over
Number of Test Specimens	All	10 or over	15 or over	20 or over	25 or over	1/100 of the quantity applied for inspection

(2) Judgment on acceptance or rejection

(2-1) Product identification inspection shall be performed by performing both regular quality inspection and routine sample inspection, and the products which have passed both inspections shall be deemed acceptable.

(2-2) Routine sample inspection shall be performed on sampled test specimens. All the products in the lot to which the accepted test specimens belong shall be deemed acceptable, and all the products in the lot to which the rejected test specimens belong shall be deemed rejected.

4.4.2.2.2 Process inspection

(1)Sampling

The number of test specimens for the regular quality inspection and occasional quality inspection of production process inspection and comprehensive process inspection shall be two.

(2)Judgment on acceptance or rejection

(2-1) Judgment on acceptance or rejection for process inspection applicants

Judgment on acceptance or rejection for production process inspection or comprehensive process inspection for process inspection applicants shall be made as follows. In this case, previous inspection results shall be valid until the decision of the adjudication committee meeting is made.

(2-1-1) Korea Gas Safety Corporation shall prepare the report on the results of regular quality inspection and process identification audit or comprehensive quality control system audit and submit it to the adjudication committee.

(2-1-2) The adjudication committee shall deliberate the submitted report and determine its acceptance or rejection. In this case, if it is judged that part of the quality system shall be complemented according to the deliberation results, conditional acceptance may be granted.

(2-1-3) In case a product has passed regular quality inspection by types and process identification audit for the item, the product shall be deemed to have passed production process inspection.

(2-1-4) In case a product has passed comprehensive quality control system audit, the product shall be deemed to have passed comprehensive process inspection.

(2-2) Judgment on acceptance or rejection for regular process inspection

Judgment on acceptance or rejection for the production process inspection performed once every three months and the comprehensive process inspection performed once every six months shall be made as follows:

(2-2-1) Korea Gas Safety Corporation shall perform regular quality inspection and process identification audit or comprehensive quality control system audit and determine the acceptance or rejection.

(2-2-2) In case a product has passed regular quality inspection by types and process identification audit for the item, the product shall be deemed to have passed production process inspection.

(2-2-3) In case a product has passed comprehensive quality control system audit, the product shall be deemed to have passed comprehensive process inspection.

(2-3) Judgment on acceptance or rejection for occasional quality inspection

Judgment on acceptance or rejection for occasional quality inspection shall be made by Korea Gas Safety Corporation by performing the inspection by the same method as that of regular quality inspection.

(3) Treatment of inspection results

(3-1) Treatment of inspection results for process inspection applicants

The results of the production process inspection or comprehensive process inspection for a process inspection applicant shall be treated as follows:

(3-1-1) In case the inspection results are accepted in their deliberation, Korea Gas Safety Corporation shall issue the acceptance notification to the applicant.

(3-1-2) In case the inspection results are conditionally accepted in their deliberation, the treatment shall conform to the followings:

(3-1-2-1) The applicant shall submit the complement results of the quality control system to Korea Gas Safety Corporation within one month.

(3-1-2-2) Korea Gas Safety Corporation shall review the submitted complement results, and accept the inspection results if it is confirmed that the complements have been completed.

(3-1-2-3) In case the applicant who has been conditionally accepted fails to submit the complement results within the time limit, Korea Gas Safety Corporation shall reject the inspection.

(3-1-3) In the case of rejection in deliberation, the treatment shall be made as follows:

(3-1-3-1) Korea Gas Safety Corporation shall notify the details of unconformity to the applicant and then perform product identification inspection.

(3-1-3-2) In case an applicant who has been notified of the unconformity intends to undergo production process inspection or comprehensive process inspection, the applicant may apply for production process inspection or comprehensive process inspection after three months from the date of the unconformity notification issued by Korea Gas Safety Corporation.

(3-1-3-3) An applicant who has failed comprehensive process inspection may convert the inspection to production process inspection.

(3-2) Treatment of results of regular process inspection

The results of the production process inspection performed once every three months and the comprehensive process inspection performed once every six months shall be treated as follows:

(3-2-1) In case the inspection results are accepted, Korea Gas Safety Corporation shall inform the applicant of the acceptance of production process inspection or comprehensive process inspection.

(3-2-2) In case the inspection results are rejected, Korea Gas Safety Corporation shall inform the applicant of the details of unconformity, withdraw the conformity notification and then perform product identification inspection.

(3-2-3) In case an applicant who has been notified of the unconformity intends to undergo production process inspection or comprehensive process inspection, the applicant may apply for production process inspection or comprehensive process inspection after three months from the date of the unconformity notification issued by Korea Gas Safety Corporation.

(3-3) Treatment of results of occasional quality inspection

The results of quality inspections performed occasionally shall be treated as follows:

(3-3-1) In case a manufacturer or an importer fails occasional quality inspection, Korea Gas Safety Corporation shall inform the manufacturer or importer of the details of unconformity and then perform the second occasional quality inspection.

(3-3-2) The number of test specimens for the second occasional quality inspection shall be twice the number of test specimens for the first occasional quality inspection.

(3-3-3) In case the manufacturer or importer fails the second occasional quality inspection, the products shall be rejected, product identification inspection shall be performed and collection inspection shall be performed for the relevant type.

(3-3-4) In case an applicant who has been notified of the unconformity intends to undergo production process inspection or comprehensive process inspection, the applicant may apply for production process inspection or comprehensive process inspection after three months from the date of the unconformity notification issued by Korea Gas Safety Corporation.

(4) Suspension or change of kind of inspection

In case a person who is subject to production process inspection or comprehensive process inspection in accordance with the Enforcement Regulation, Table 7, No.3 intends to suspend the production of an inspection object item for no less than six months or to change the kind of inspection, the person shall notify the matter to Korea Gas Safety Corporation and return the acceptance notification.

(5) Process re-inspection

In case a person who is subject to production process inspection or comprehensive process inspection in accordance with the Enforcement Regulation, Table 7, No.3-b and comes under one of the following cases, the person shall undergo production process inspection or comprehensive process inspection again.

(5-1) The location of the business place is changed,

(5-2) A production item is added, or

(5-3) Three years have elapsed from the acceptance date of production process inspection or comprehensive process inspection. However, in case a relevant gas appliance item is added, the period shall be the remaining period of the existing item.

4.5 Other Inspection Standards

4.5.1 Inspection of imported products

In principle, inspection of imported products shall be performed in a place where the importer wants, and the costs and expenses required for inspection such as equipment and material costs shall be borne by the applicant.

4.5.2 Partial omission of inspection

4.5.2.1 In case a person who undergoes production process inspection or comprehensive process inspection adds inspection items, part of process identification audit or comprehensive quality control system audit may be omitted.

4.5.2.2 In case a person whose quality assurance system has been certified by a certification body authorized in accordance with the Quality Management and Safety Control of Industrial Products Act applies for production process inspection or comprehensive process inspection, part of process identification audit or comprehensive quality control system audit may be omitted.

4.5.3 Disposal of rejected products (not applicable)

4.5.4 Detailed inspection standards

Other detailed matters necessary for design stage inspection and production stage inspection shall conform to what the president of Korea Gas Corporation specifies.

Appendix A General Standard for Operation of Quality Control System for Gas Appliance Manufacturing Plants

1. Introduction	
	A. This standard has been established so that gas appliance manufacturers may produce safe and reliable products through production process inspection and comprehensive process inspection in production stage inspections in accordance with the Enforcement Regulation, Table 7, No.3-b-2)-b. B. This standard consists of general, design, manufacturing, self-inspection and obligations, and is intended to be used to assess whether the quality control system of the gas appliance manufacturing plant conforms to the requirements of undergoing production process inspection or comprehensive process inspection in production stage inspections.
2. General <Revised on January 8, 2016>	
A. Organization	
(1)	The organization shall be an organization which has technical and business capability to produce products satisfactory to customers and statutory requirements.
(2)	The top management shall guarantee that processes and procedures required for quality control system have been established and are being implemented and maintained.
(3) 【Comprehensive】	Research and development organizations including the followings shall be maintained to study various failure forms which can appear in design process or after extended use and reflect them to design. (a) Person in charge of research and development and personnel (b) Appropriate facilities and equipment required for research and development
B. Quality Control	
(1)	The manufacturer shall establish, document and implement a quality control system in accordance with the requirements of this standard.
(2)	When any change in the quality control system is planned and made, the safety of the system shall be maintained and the system shall be updated through continuous improvement.
(3)	The top management shall present the evidences of development and implementation of the quality control system and continuous improvement of its effectiveness through the followings: (a) Establishment of quality policy and quality target (b) Implementation of management review (effectiveness of quality system and improvement of products)
(4) <Newly established on January 8, 2016>	Documents necessary for quality system should be managed and documented process necessary for the management of followings should be established. (a) Approval, review, renewal and re-approval of document (b) Management in identification and distribution of document (latest edition, outsourced documents) (c) Prevention on the misuse of nullified documents
C. Human Resources	
(1)	Persons affecting product quality shall be qualified on the basis of appropriate educational background, training, expertness and experiences, and the manufacturer shall implement the followings in accordance with the written procedures: (a) Decision on the qualification of personnel (b) Provision of education and training to satisfy qualification requirements and assessment of its effectiveness (c) Maintenance of the appropriate records of qualification matters

(2) 【Comprehensive】	In the case of persons in charge of design and development of products, it shall be assured that they are skillful with the tools and in the techniques to satisfy and apply the design and development requirements.
D. Facilities and Equipment	
(1) 【Interval】	Facilities, equipment and business environment required to conform to the product requirements shall be determined, secured and maintained. (a) Buildings, business places and utility (b) Process equipment (hardware and software) (c) Supporting services (transportation, communication, etc.)
(2) 【Interval】	The sites shall be maintained in a neatly arranged and clean condition to conform to the requirements of products and manufacturing process.
(3) 【Comprehensive】	Means to minimize potential hazards to employees shall be manifested in design, development and manufacturing activities.
3. Design	
A. Design and Development	
(1) 【Comprehensive】	Design and development capability shall be secured to materialize products in conformity to product requirements.
(2) 【Comprehensive】	The output of product design shall be provided in a form verifiable for the requirements, be approved before distribution, and include the followings: (a) Analysis results such as failure mode effect analysis and reliability results (b) Characteristics of the product, and specification when required (c) Measures to prevent malfunctioning of the product, if applicable (d) Definition of the product including drawings or mathematical basic data, and (e) Review results of product design.
(3) 【Comprehensive】	The output of process design shall be provided in a form verifiable for the requirements, be approved before distribution, and include the followings: (a) Drawings and specifications when required (b) Manufacturing process flow diagram and layout (c) Analysis results such as failure mode effect analysis, etc. (d) Control plan (e) Work manual (f) Acceptance criteria for process approval (g)Methods for detection of product/process unconformity and feed back
(4) 【Comprehensive】	The appropriateness of design and development shall be checked, and the records of the results of appropriateness check and all necessary measures shall be maintained.
(5) 【Comprehensive】	Changes in design and development shall be able to easily grasped and the record shall be maintained. Changes shall be reviewed, verified, checked for their appropriateness and approved before their implementation, when applicable.
4. Manufacturing	
A. Purchase	
(1) 【interval】	Inspection or other activities required to ensure that purchased materials satisfy their specified purchase requirements shall be determined and implemented.
(2)	Suppliers shall be selected on the basis of their capability to supply materials in conformity to the specified purchase requirements. The selection standard shall be established and all records related to the selection shall be maintained.
(3) 【Comprehensive】	Suppliers shall be regularly evaluated, their evaluation results shall be reflected in the purchase policy, and the management methods of suppliers shall be accordingly differentiated.
B. Production	

(1)	The manufacturer shall plan and implement production in the management conditions including the followings: (a) Use of work manuals as required (b) Use of appropriate equipment (c) Measurement (d) Application of acceptance standard for judgment of process approval
(2) 【interval】	The manufacturer shall identify the states of products in connection with the measurement requirements in manufacturing stages.
(3) 【Comprehensive】 【interval】	The manufacturer shall identify the states of products in connection with the measurement requirements and traceability in manufacturing stages.
(4) 【interval】	Work preparation shall be verified whenever the work is initially started, the material is replaced or the work is changed.
(5) 【Comprehensive】	An appropriate statistical technique for each process shall be determined before mass production and be included in the control plan. Basic concept such as distribution and process capacity shall be utilized in the overall organization.
(6) 【Comprehensive】	The manufacturer shall establish and maintain the control plan in consideration of analysis results such as failure mode effect analysis in products and manufacturing processes.
(7) 【Comprehensive】 【interval】	Written work manuals shall be prepared for all personnel affecting product quality. These manuals shall be readily available for reference on working sites.
(8) 【Comprehensive】	The manufacturer shall grasp major processes and provide resources for preservation of machines, equipment, jigs and tools, and develop an overall preventive maintenance system. The system shall include the followings: (a) Planned maintenance activities (b) Packing and preservation of equipment, tools and gauges (c) Availability of spare parts for major manufacturing equipment (d) Documentation, evaluation and improvement of maintenance activities (e) Identification specifying the states of production, repairs or disposal
5. Self-Inspection	
A. Inspection Method and Procedure	
(1) 【interval】	The manufacturer shall determine the inspections to be performed and check whether the products conform to the specified requirements. The inspections shall be performed in relevant stages of production process.
(2) 【interval】	The evidence that inspected products conform to the acceptance criteria shall be maintained. The person who approves the shipment of the products shall be specified in the record.
(3) 【Comprehensive】 【interval】	The acceptance criteria for tally data sampling shall be of zero-defect.

(4) 【interval】	Measurements shall be made in such a way as to meet the requirements, and the measurement equipment shall be as follows to assure effective results: (a) Measurement equipment shall be calibrated or verified to the measurement standards traceable to the international or national standard at specified intervals or before application. In case such standards are not available, the bases for such calibration or verification shall be recorded. (b) Identification to judge the calibrated state (c) Protection from any manipulation which may invalidate measurement results (d) Protection from damage or deterioration during handling, maintenance and safekeeping
(5) 【interval】	The records of calibration and verification results shall be maintained, and the measured values shall be used in calibrated states.
(6) 【Comprehensive】	Changes in measurement systems indicated in the various results of measurement and test shall be analyzed by statistical methods.
(7) 【interval】	The manufacturer shall inspect the whole items of design stage inspection once a year or more often and maintain the records.
(8) 【Comprehensive】 【interval】	The manufacturer shall inspect the whole items of design stage inspection twice a year or more often and maintain the records. <Revised on November 17, 2014,, January 8, 2016>>
(9) 【Comprehensive】	The manufacturer's laboratory shall be included in the quality system documentation by specifying the following technical requirements: a) Appropriateness of personnel, equipment and facilities b) Capability to accurately conduct tests in accordance with relevant specifications c) External laboratories to be authorized in accordance with KS Q ISO IEC 17025 or an equivalent standard <Revised on November 17, 2014>
B. Corrective and Preventive Measures	
(1) 【interval】	It shall be assured that unconformable products and suspicious products are identified and separately managed.
(2)	Measurements shall be taken to prevent recurrence of unconformity and the followings shall be specified in the written procedure: (a) Review of unconformity (inclusive of customer complaints) (b) Determination, implementation and recording of corrective measures
(3)	The effectiveness of quality system shall be continuously improved through the utilization of quality policy, quality target, audit results, data analyses, corrective measures, preventive measures and management review.
(4)	Preventive measures shall be taken to remove the potential causes of unconformity to prevent its recurrence.
C. Internal Audit	
(1)	The manufacturer shall conduct internal audits at planned intervals to check whether the quality system is effectively implemented and maintained.
(2)	Responsibility for and requirements of planning and implementation of audits, guarantee of the independence of audit, report of audit results and maintenance of records shall be specified in the written procedure.
6. Obligations <Revised on January 8, 2016>	
A. Acceptance Marking	

(1) 【interval】	The manufacturer shall maintain a written management regulation on acceptance marking (certificates or stamps), the record of receipt, use, safekeeping and disposal of the acceptance marks shall be immediately updated and maintained, and the management regulation shall include the followings: (a) Handling of acceptance marks (certificates or stamps) by authorized persons only (b) Use of acceptance marks subject to the approval of top management/management representative and in accordance with the planned procedure. (c) Record of the use of acceptance marks in detail (d) Establishment of a plan to prevent the misuse of acceptance marks, and (e) Safekeeping of acceptance marks to prevent their damage or robbery
(2) 【Comprehensive】 【interval】	The regulation on manufacturing of acceptance marks shall be separately documented, and all matters related to the manufacturing and change of acceptance marks shall be recorded and updated.
B. Safety Control	
(1)	For recent one year, the manufacturer shall be free from any accident due to product defects and there shall be no unconformity case in the sampling inspection undergone by the manufacturer.
(2) 【Comprehensive】	For recent three years, the manufacturer shall be free from any accident due to product defects and there shall be no unconformity case in the sampling inspection undergone by the manufacturer.
C. Others	
(1)	When any case which may cause the quality deterioration of products or serious harm to the user breaks out, the manufacturer shall take appropriate measures.
(2)	When there is any important change in the operation of the manufacturer's quality system, the manufacturer shall inform Korea Gas Safety Corporation of the change within 15 days.

[Remarks]

1. 【Comprehensive】 means that the paragraph is applicable only to the objects of comprehensive process inspection.
2. 【Interval】 means that the paragraph is applicable to the inspection to be performed according to its inspection interval.
3. Paragraphs without any mark are common provisions for process identification audit or comprehensive quality control system audit.

Appendix B General Conditions for Test of Other Gas Burning Appliances

<Newly established on May 20, 2013>

B1. Laboratory Condition

Item	Condition
Temperature in laboratory	The temperature in the laboratory shall be 20±15℃ and temperature variation during the test shall be ±5K.
Indoor atmosphere	The humidity in the laboratory shall be 65±20%.
Indoor atmosphere	Carbon dioxide shall not be over 0.2% and carbon monoxide not over 0.002% in the indoor atmosphere.
[Remarks] The temperature in the laboratory shall be measured at four points which are about 1 m from the gas burning appliance and are in front of, in the rear of and on the both sides of the gas burning appliance, while the mercury bulbs of the temperature gauges are fixed at a height almost the same as that of the top of the gas burning appliance (1.5 m if the height from the floor is over 1.5 m). The arithmetic average value of the measured temperature values shall be deemed to be the ambient temperature. However, the mercury bulbs of the temperature gauges shall not be directly affected by combustion gas or radiation heat from the gas burning appliance.	

B2. Test Gas Standard

B2.1 The volumetric ratios of test gas components shall be as shown in Table B2.1 at 15℃ and 101.3 kPa.

Table B2.1 Volumetric Composition Ratio of Test Gas

Gas Group	Type of Test Gas	Composition (vol %)						Combustibility			
		Hydrogen H_2	Methane CH_4	Propane C_3H_8	Butane C_4H_{10}	Nitrogen N_2	Air O_2;21% N_2:79%	Gross heating value MJ/m^{3}N	Specific gravity (air = 1)	Webber Index. (Wls) MJ/m^{3}N	MCP
City Gas	1	-	87.0	13.0	-	-	-	45.16 (40.90)	0.682	54.69 (49.53)	37.5
	2	23.0	68.0	11.0	-	-	-	38.07 (34.33)	0.550	51.34 (46.29)	44.1

	3	-	96.5	-	-	3.5	-	36.46 (32.82)	0.569	48.32 (43.50)	35.3
	R[b]	-	96.0	4.0	-	-	-	40.05 (36.13)	0.594	51.97 (46.89)	36.5
	S	Gas of which maximum combustion speed (MCP) is over 35.0 to 44.0 inclusive and of which WIs is over 48.80{51.50} to 53.56{56.52} MJ/m^{3}N inclusive									
Liquefied Petroleum Gas	Propane	-	-	100.0	-	-	-	95.65 (87.99)	1.550	76.83 (70.69)	41.0
	Butane	-	-	-	100.0	-	-	126.21 (116.47)	2.079	87.54 (80.78)	38.0
	S	P, B or their mixed gas									
[b] In case the WI of supply gas for quality control is within ±1% of the WI of R gas, the manufacturer may use supply gas as the test gas.											

[Remarks]

1. In case the "S" condition of city gas is within the range of the gas group [WI and combustion speed (replaced by MCP value)] and "S" is designated as test gas, supply gas in the gas group may be used.
2. The WI depending on the heating value and specific gravity of test gas (1, 2, 3 and R of city gas and P and B of liquefied petroleum gas) shall be ±1 % of a value in the above table.
3. The standard condition for the combustion and metering of test gas is 15/15℃ and 101.3 kPa and the value in ( ) is a net heating value used as a reference value.
4. The values in { } in S gas are the WI used in commercial transaction and reference values for 15/0 ℃ and 101.3 kPa.
5. MCP is calculated by the following formula:

$$\mathrm{MCP} = \frac{\Sigma(\mathrm{S_i f_i A_i i})}{\Sigma(\mathrm{f_i A_i})}(1 - \mathrm{K})$$

where,

MCP: maximum combustion speed

Si: combustion speed of combustible gas in the following table and a value indicated in the table

fi: a factor related to each combustible gas and a value indicated in the table

Ai: content of each combustible gas in gas (mol %)

K: a damping factor and a value calculated by the following formula:

$$\mathrm{K} = \frac{\Sigma \mathrm{A_i}}{\Sigma(\mathrm{a_i i A_i})}\left\{\frac{2.5\mathrm{CO_2} + \mathrm{N_2} - 3.77\mathrm{O_2}}{100 - 4.77\mathrm{O_2}} + \left[\frac{\mathrm{N_2} - 3.77\mathrm{O_2}}{100 - 4.77\mathrm{O_2}}\right]^2\right\}$$

where,

a_i: correction factor of each combustible gas and a value indicated in the table

CO_2: content of carbon dioxide in gas (mol %)

N_2: content of nitrogen in gas (mol %)

O_2: content of oxygen in gas (mol %)

B2.2 Indication Method of Test Gas Condition

The test gas condition used in this technical standard is indicated by the kind of test gas and the pressure of test gas, and the test gas condition of each item of this technical standard is indicated by "kind and symbol of test gas - pressure and symbol of test gas".

(1) In the case of liquefied petroleum gas

Kind of test gas

Symbol	Kind of test gas
P	Propane
B	Butane
S	One of propane, butane or any of their mixtures

Pressure of test gas (unit)

Symbol	Pressure of test gas (kPa)
1 (maximum pressure)	3.3
2 (standard pressure)	2.8
3 (minimum pressure)	2.3

(2) In the case of city gas

Kind of test gas

Symbol	Kind of test gas
0	Gas within the range of gas group
1	Gas prone to incomplete combustion
2	Gas prone to backfire
3	Gas to be easily extinguished by blowing
R[b]	Gas of which performance is tested
S	Gas among 1, 2, 3, or R

Pressure of test gas (unit: kPa)

Symbol	Pressure of test gas (kPa)
1 (maximum pressure)	2.5
2 (standard pressure)	2.0
3 (minimum pressure)	1.0

B2.3 Test gas condition by combustion state test items

Test Item	Test Gas Condition	
	Liquefied Petroleum Gas	City Gas
Flame propagation	P-2	S-2
Lifting	P-1	3-1
Extinguishment	P-1 & P-3	3-1 & 3-3
Flame uniformity	S-2	S-2
Backfire	P-3	2-3
Continuous noise	P-1	S-1
Extinguishing noise	P-2	S-2
CO %	B-1	1-1

Soot generation		B-1	1-1
Contact with yellow flame		B-1	R-1
Flame overflow		B-1	R-1
Flame stability of pilot burner	Extinguishment	P-1 & P-3	S-1 & S-3
	Backfire	P-3	2-3
Flame stability of burner	Extinguishment	P-1 & P-3	S-1 & S-3
	Backfire	P-3	S-3
	Flame overflow	B-1	S-1

Appendix C Test Methods of Other Gas Burning Appliances

C1. Heat Input Test (Gas Consumption Test)

Test Condition	The test gas condition shall be P-2 for liquefied petroleum gas and S-2 for city gas.
Test Method	(1) The equipment shall be installed as shown in Figure C1. (2) The equipment shall be operated at its maximum gas consumption rate with its standard gas as test gas and at the standard pressure (R-2, P-2). (3) The gas pressure of the water column gauge ③ shall be matched to the standard pressure. (4) When the gas consumption rate becomes constant, the measurement shall be started. When the difference between the values measured consecutively is not over 2%, the arithmetic average value shall be obtained. (5) The gas consumption in a dry condition at 15℃, standard gas pressure and atmospheric pressure of 101.3 kPa shall be calculated by the following formula: $$Q_c = Q \times \frac{1000}{3600} \times V \times \sqrt{\frac{101.3 + P_g}{101.3} \times \frac{P_a + P_g}{101.3} \times \frac{288}{273 + t_g} \times \frac{d}{d_r}}$$ where Q_c: gas consumption corrected to gross heat value (101.3 kPa, 15℃, dry gas) (kW) Q: gross heat value of dry standard gas at 15℃, 101.3 kPa (MJ/m^3) V: volumetric gas quantity measured through the gas meter at the humidity, temperature and pressure conditions (m^3/h) P_g: gas pressure in gas meter (kPa) P_a: atmospheric pressure at the time of test (kPa) t_g: gas temperature in the gas meter (℃) d: density of test gas d_r: density of standard gas (6) In case a wet type gas meter is used, the density of gas shall be changed from d to d_h in consideration of humidity and the value shall be corrected by the following formula: $$d_h = \frac{d(P_a + P_g - P_s) + 0.622P_s}{(P_a + P_g)}$$

where,

P_s is saturated steam pressure and is calculated as follows:

$$P_s = 10^{\alpha}\ \text{kPa}\ \left(\text{where}, \alpha = 7.203 - \frac{1735.74}{t_g + 234}\right)$$

(7) The accuracy of the measured gas consumption against the indicated gas consumption is calculated by the following formula:

$$\Delta Q_c = \frac{Q_c - Q_r}{Q_r} \times 100$$

where,

ΔQ_c: Accuracy of measured gas consumption against indicated gas consumption (%)

Q_c: measured gas consumption (kW)

Q_r: indicated gas consumption (kW)

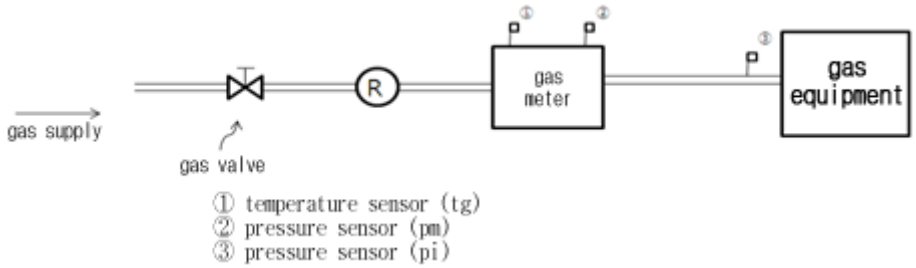
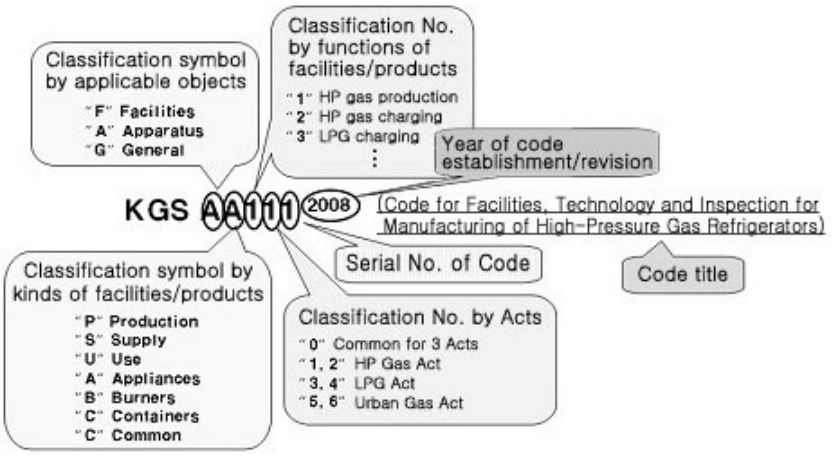


Figure C1. Gas Consumption Measurement Equipment

Symbol and Serial Number System of KGS Codes

Korea Gas Safety Codes (KGS Codes) are the codes of detailed standards for technical matters such as facilities, technology and inspection stipulated in gas-related laws and regulations and are the technical standards in gas safety areas deliberated and resolved to be adopted by the gas technical standards committee, and approved by the Ministry of Knowledge Economy.



Classification		Symbol	Facility
Apparatus **(A)**	**A**ppliances **(A)**	AA1xx	Refrigerators
		AA2xx	Piping
		AA3xx	Valves
		AA4xx	Pressure regulators
		AA5xx	Hoses
		AA6xx	Alarm & shutoff devices
		AA9xx	Other appliances
	Burners **(B)**	AB1xx	Boilers
		AB2xx	Heaters
		AB3xx	Ranges
		AB9xx	Other burners
	Containers **(C)**	AC1xx	Tanks
		AC2xx	Cylinders
		AC3xx	Cans
		AC4xx	Composite containers
		AC9xx	Other containers

Classification		Symbol	Facility
Facilities **(F)**	**P**roduction **(P)**	FP1xx	High-pressure gas manufacturing facilities
		FP2xx	High-pressure gas filling facilities
		FP3xx	LP gas filling facilities
		FP4xx	City gas wholesales manufacturing facilities
		FP5xx	City gas general manufacturing facilities
	Supply **(S)**	FS1xx	High-pressure gas sales facilities
		FS2xx	LP gas sales facilities
		FS3xx	LP gas complex supply facilities
		FS4xx	City gas wholesales supply facilities
		FS5xx	City gas general supply facilities
	Use **(U)**	FU1xx	High-pressure gas storage facilities
		FU2xx	High-pressure gas burning facilities
		FU3xx	LP gas storage facilities
		FU4xx	LP gas burning facilities
		FU5xx	City gas burning facilities
General **(G)**	**C**ommon **(C)**	GC1xx	Basic matters
		GC2xx	Common matters

KGS AB935 2018

Published by Korea Gas Safety Corporation