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PAKISTAN STANDARD

GAS FIRED RADIANT ROOM HEATERS UNVENTED AND SEMI – VENTED TYPE



**PSQCA Complex, Standardization Wing, 1st Floor, Plot-ST-7/A, Block-3,
Scheme No.36, Gulistan-e-Jauher, Karachi.**

**PAKISTAN STANDARDS SPECIFICATION
FOR
GAS FIRED RADIANT ROOM HEATERS UNVENTED AND SEMI -VENTED TYPE
OIL & GAS BURNING APPLIANCES TECHNICAL COMMITTEE**

Chairman

1. Mr. S. Ali. H. Naqvi, Ex.General Manager,
Karachi Shipyard & Engineering Works
Banglow # C-108, Block-J,
North Nazimabad,Karachi
Cell: 0321-8739362
drjamalnaqvi@hotmail.com

Members

2. Dr. Engr. Khursheed Mahmood, Professor, Metallurgy & Material Engineering
Department
Dawood University of Egg; & Technology,
New M.A. Jinnah Road,
Karachi.
Tel: 9261261, Mobile#0300-2515030
kmahmood74@ hotmail.com
3. Engr. Muhammad Etesam Hussain Factory Manager,
M/s. Singer (Pak.) Ltd.,
Plot-39, sector 19, Korangi Industrial Area,
Karachi.
Tell: 035057437, Cell: 03312870149
4. Mr. M.S. Ansari Consultant,
Cell: 03232178789
E-mail:msansari@skenbms.com,
5. Mr. M. Shahid Zaman Coord. Engineering Support Services
Suparco, IS(III), Suparco Head Quarter,
Suparco Road,P.O.Box #8402.
Cell: 03452732629
Shahidzaman88@gmail.com
6. Muhammad Ali Shah Sr. Engineer,
M/s. Sui Southern Gas Co., Ltd.(SSGCL)
Head Office,7th Floor, Karachi
Cell: 03322185914
E-Mail: Muhammad.shah@ssgc.com.pk
7. Rehan Naeem Sr. Engineer,
M/s. Sui Southern Gas Co., Ltd.(SSGCL)
Head Office,7th Floor, Karachi
Cell: 03008437173
E-Mail: rehan.naeem@ssgc.com.pk
8. Engr. Zulfuqar A Dhakan Officer Incharge,Safety & Security
PCSIR Laboratories Complex,off University Road,
Karachi.,Cell;03333805590,E-mail:zdhakan@hotmail.com

Secretariat:

1. Syed Kaleem Ahmed Dibaji

Assistant Director
Mechanical Division
PSQCA, Karachi.

2. Fahim Bari

Assistant Director
Mechanical Division
PSQCA, Karachi.

3. Junaid Wasan

Assistant Director
Mechanical Division
PSQCA, Karachi.

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**PAKISTAN STANDARD SPECIFICATION
FOR
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UNVENTED AND SEMI – VENTED TYPE**

0. FOREWORD:

- 0.1** This Pakistan Standard has been adopted by the Authority of the Pakistan Standards & Quality Control Authority, (National Standards Body of Islamic Republic of Pakistan), after the draft prepared by the Mechanical Technical Committee (MTC-18) for “Oil & Gas Burning appliances which has been approved and endorsed by the National Standards Committee on Mechanical on 28.02.2017
- 0.1** This Standard was first formulated in 2008, in the preparation thereof, technical data of Sui Southern Gas Co. and GICP was utilized which are acknowledged with thanks.
- 0.2** Keeping in view the suggestions from the manufacturers, specialists, technologists and utilizing agencies, it has now become imperative to revise the prevailing version.
- 0.3** This revised version of PS: 3656 has been adopted after taking into consideration the views and the suggestions of manufacturers, specialists, technologists and utilizing agencies. It is hoped that user will find it well in line with the technical barriers to trade agreement (WTO/TBT).
- 0.5** This Standard is subject to periodical review in order to keep pace with develop in technology. Any suggestion to improvement will be recorded and placed before the revising committee in due course.
- 0.6** This standard is intended chiefly to cover the technical provisions related to the manufacture of gas fired radiant room heaters only

1. SCOPE

- 1.1 Un-vented and semi-vented heaters are for installation at public places, drawing rooms, dining rooms, living rooms, corridors but not in BED ROOMS. Semi-vented room heaters should be installed in a chimney opening into atmosphere or on the out wall of a room such that a part of products of combustion are vented out the atmosphere.
- 1.2. Room in which un-vented and semi-vented room heater are installed should have sufficient fresh air in take to facilitate at least 3 air changes per hour.
- 1.3. These requirements will apply in addition to all the requirements laid down in PS-4860/2008 Gas Appliances-General Requirements, unless otherwise hereinafter specified.

2. TERMINOLOGY

2.1 For the purpose of this Standard, the following definitions shall apply:-

- i) **Burner**: that part of gas equipment where air-gas mixture is formed and the flame is produced it consists of a mixing tube and burner head or pert.
- ii) **Combustion**: the rapid oxidation of flue accompanied by the production of heat, or heat and light.
- iii) **Increased Gas Pressure**: 1.5 times the Standard Supply Pressure.
- iv) **Mixing tube**: that part of the burner in which air-gas mixture is formed.
- v) **Mixing throat**: the narrow part of the venture (mixing) tube.
- vi) **Orifice**: the opening in a cap. Spud or other device whereby the flow of gas is limited and through which the gas is discharged to the burner.
- vii) **Orifice spud**: means a removable plug or cap containing an orifice and which permits adjustment of the flow of gas either by substitution of a spud with a different size orifice or by the motion of a needle with respect to it.
- viii) **Pilot**:
 - a) **Pilot**: a small flame which is utilized to ignite the gas at the main burner or burners.
 - b) **Automatic pilot**: automatic pilot device and pilot burner securely assembled in fixed relationship. Automatic pilot is some times referred to as a flame safeguard.
 - c) **Automatic pilot, complete shut-off type**: automatic pilot for shutting off automatically the gas supply to the main burner and pilot in event of pilot of gas failure and also for preventing the gas from being turned into the main burner unless the pilot is lighted. It is frequently referred to as a "100 per cent shut-off type or flame safeguard.
- ix) **Primary air**: the air introduced in to a burner and which mixes with the gas before it reaches the port or ports.
- x) **Room or Space-heater**: approved self-contained, free-standing, non-recessed, gas burning, air heating appliance intended for other than major domestic heating.
- xi) **Secondary air**: the air externally supplied to the flame at the point of combustion.
- xii) **Thermostat**: an automatic device actuated by temperature change to operate control devices on order to maintain temperature between predetermined limits.
- xiii) **Values & Cocks**: Burner Control Cock is a cock which controls the gas supply to an individual burner. It is generally built in the appliance.

In cases where it is not supplied as an integral part of the appliance (such as for aspirator burners) a taper plug brass union cock with rigid or drop fan key should be used.

- xiv) **Venting:** means the removal of combustion production products to the outer air by means of roof openings, natural draft chimneys, flue stacks, or mechanical exhaust systems.

3. CONSTRUCTION REQUIREMENTS:

3.1 The construction of the body shall be substantial to the extent that it will support without damage the following weight applied uniformly over the top:-

WEIGHT OF HEATER	LOAD
Less than 22.32 kg (50 lb)	44.64 kg (100 lb.)
22.32 kg (50 lb.) or more.	89.28 kg (200 lb)

4. PARTS & MATERIALS:

- 4.1**
 - i) The outer case shall be constructed of deep brown or mid brown stove painted sheet steel.
 - ii) The heat exchanger is aluminum coated sheet steel.
 - iii) The radiant box is stainless steel.
 - iv) The front panel are made of powder coated steel.
- 4.2.** When sheet metal is used in construction of heating surface, the thickness shall be such as to assure strength, rigidity durability, resistance to corrosion, and other physical properties equivalent to 0.762mm (0.0304") thick hot rolled sheet steel.
- 4.3.** When brick ceramic, wire screen, or other materials are used in construction of heating surfaces, the thickness should be such as to assure strength, rigidity, durability and resistance to corrosion.
- 4.4.** Baffles in flue gas passages shall be constructed or located so as to give a reasonable life.

4.5. JOINTS IN HEATING ELEMENTS:

- 4.6** Joint of metallic heating surfaces shall be either welded, brazed, threaded, lock seamed, machined and bolted, formed slip joints or of flanged construction tightly bolted together enclose gaskets.
- 4.7** A welded joint shall be interpreted as one having substantially continuous weld.
- 4.8** When heating surface is other the metal and adhesives are used in its construction, they shall be suitable to withstand the temperature required for satisfactory operation.

4.9 MAIN BURNERS:

4.10 Bodies of burners (including mixer head, mixer tubes) shall be of substantial and durable construction. They shall be constructed of materials having a melting point above 788°C (1450°F).

5. AUTOMATIC PILOTS AND PILOTS:

- 5.1 Separate pilots when provided for ignition of main burner will have a rate which shall not exceed 100 KJ/hr (2000 Btu/hr).
- 5.2 Automatic pilot when provided shall comply with reasonable concepts of safety and durability.
- 5.3 Pilot burners when provided shall be placed so that they can be easily seen, and lighted.
- 5.4 Pilot assemblies when provided shall be constructed so that it is impossible to direct the pilot flame in other than the correct direction.
- 5.5 Pilot when provided shall be supported in such a manner that their position relative to the main burner is fixed.
- 5.6 Pilot tips shall be constructed of a material that will not crack, crease, or carbonize to such an extent as to interfere with proper functioning of pilot.

6. PERFORMANCE REQUIREMENTS:

6.1 General

- 6.2 These requirements cover approval of un-vented and semi-vented room heaters for use with natural gas.

7. COMBUSTION:

- 7.1 A room heater shall produce no carbon monoxide. This requirement shall be deemed met when:
 - a) A concentration of carbon monoxide not in excess of 0.02 per cent is present in an air free sample of the products of combustion, when the heater is tested in a room, with approximately a normal oxygen supply.
 - b) A concentration of carbon monoxide not in excess of 0.05 percent produced in 28 cubic meter (1000 cubic feet) room with no air changes accruing during combustion of the amount of gas necessary to reduce oxygen contents of the room to a quantity equal to 15.1 % by volume, corrected to 15°C & 760mm (60°F & 30") Hg. Method of test shall be as follows:-

7.2 METHOD OF TEST:

- 7.3 Under (a)above, after the gas has been burning for at least 15 minutes at normal test pressure, sample of products of combustion shall be taken at flue gas outlet when the heater is operating at reduced and increased test pressure. The sample accrued shall be analyzed for carbon monoxide and carbon dioxide.

Under (b) above, the heater shall be installed in 28 cubic meter (1000 cubic feet) room construction so as to prevent infiltration of air. The heater shall be operated for 15 minutes, with the door of the room and completely ventilated. If this is not possible, then the heater shall be operated outside of the closed room for 15 minutes. Immediately after 15 minutes heating up period it shall be placed in the close room and gas ignited. The heater shall operate at increased test pressure.

A sample of room atmosphere shall be withdrawn at start of test and analyzed for carbon monoxide and oxygen sufficient samples shall be withdrawn and analyzed for oxygen during the test to permit accurate determination of the end point of the test. When percentage oxygen by volume indicates that total oxygen contained in the closed room is within $\pm 0.5\%$ of the amount contained in the room at the

Concentration of 15.1% by volume at 15°C and 760mm (60°F & 30") Hg. The test sample shall be analyzed for carbon monoxide and oxygen and increase in carbon monoxide concentration computed.

BURNER OPERATING CHARACTERISTICS:

8.1 Burners flames shall not flash back nor become permanently extinguished when subjected to a draft equivalent to a wind velocity of 4.8 km/hour (3MPH) striking the heater from front and sides.

8. PILOT OPERATING CHARACTERISTICS :

9.1 Pilot flame be adequately protected against drafts i.e. pilots should be stable against a wind of (7 MPH) 11 km/hr.

10. RADIANT EFFICIENCY

10.1 Heaters shall have a radiant efficiency of at least 35 percent.

10.2 Method of Test:

10.3 The heater shall be tested at normal test pressure and within $\pm 5\%$ of the KJ (Btu) input rating as specified by the manufacturer. The average room temperature shall be a "Comfort Zone" i.e. 21 to 24°C (70-75°F). The point representing the average temperature of the room shall be at a distance of 3 meter (10 feet) from the heater and at a height of one meter (3 feet) from the ground level.

The heater shall be turned on and allowed to operate for 15 minutes to attain its normal radiating surface. The temperature of the radiation plate shall then be measured with an optical pyrometer or any other suitable temperature measuring instrument. The temperature of the radiant plate would be taken as an average of the five temperature points which is at the discretion of the testing authority.

The radiant efficiency of the heater shall then be computed by the following formula:

$$RE = \frac{RO}{I} \times 100$$

Where RE = Radiant efficiency (%)
 I = Thermal Input / Manufacturer's rated
 Input kj/(Btu/hr)
 RO = Effective radiant output

$$= 0.173 AE \left[\left(\frac{T_1}{100} \right)^4 - \left(\frac{T_2}{100} \right)^4 \right]$$

- A = Area of radiant surface Sq.m (Sq. ft.)
E = Emissivity of the radiating material. A figure 0.85 may be taken for as emissivity factor for refractory radiant surface and 0.8 for full oxidized iron and steel surfaces.
T₁ = Temperature of Radiant Surface ‘ °k’ (R°)
T₂ = Average room temperature ‘ °k’ (R°)

11. ALLOWABLE TEMPERATURE FOR LOAD BEARING HEATING SURFACE

11.1 The temperature of the load bearing heating surfaces shall not exceed 454.4°C (850°F) unless the materials used in construction are of a special type produced to sustain higher temperature.

11.2 METHOD OF TEST

11.3 The test shall be conducted at normal test pressure. Thermocouple shall be suitably attached to load-bearing heating surfaces at probable high temperature point. At the discretion of the testing agency, other suitable temperature indicating means may be employed. The appliance shall be placed in operation and burner (s) if equipped with primary air adjustment means, adjusted to give a hard flame. When equilibrium conditions are attained, the temperature as indicated by thermocouples shall be recorded.

The burner (s) if equipped with primary air adjustment means, shall then be adjusted to give a soft flame and continued in operation until equilibrium conditions are attained. The temperatures as indicated by thermocouples shall be recorded.

The maximum rise develop on any part of load-bearing heating surface during either test conditions shall not be in excess of 454.4°C (850°F).

12. SAMPLING:

12.1 Lot – in any consignment, all the Gas fired radiant room heaters un-vented and semi vented type of the same type and manufactured from the same material under essentially similar conditions of manufacture, shall be grouped together to constitute a lot.

12.2 Sampling Plan – A sampling plan indicates the number of units of product from each lot or batch which are to be inspected (sample size or series of sample sizes) and the criteria for determining the acceptability of the lot or batch (acceptance and rejection numbers).

12.3 Inspection Level – The inspection level determines the relationship between the lot or batch sized and the sample size. Three inspection levels, I, II, and III are given in table-1 for general use. Unless otherwise specified, inspection level II will be used with an AQL of 2.5 as shown in Table-2.

12.4 Code Letters – Sample sizes are designated by code letters table No.1 shall be used to find the applicable code letter for the particular lot or batch size and the prescribed inspection level.

12.5 Obtaining Sampling Plan – The acceptable quality level (AQL) and the code letter shall be used to obtain the sampling plan from table-2.

13. MARKING:

Each appliance shall be indelibly marked with the following

- i. Manufacturer's name or trade mark (embossed)
- ii. Knob's "on" and "off" position.
- iii. Country of origin.
- iv. Gas input rating
- v. Thermal Efficiency
- vi. **PS Mark**

Brochure with instruction for use and safety shall be provided in national and English language.

NOTE – The use of PS Mark is governed by the provision of the Pakistan Standards and Quality Control Authority Ordinance Act-VI of 1996, and the rules and regulations made under the ordinance. Products bearing PS Mark are protected with the guarantee that they have been produced to comply with requirements of the relevant standard under a well defined system of inspection, testing and quality control during production. Particular governing conditions under which a license for the use of the PS Mark may be granted to manufacturers, may be obtained from the (PSQCA) Pakistan Standards and Quality Control Authority.

14. PACKING:

It shall be packed in accordance with the best prevalent trade practice or as agreed between the manufacturer and purchaser taking care of safety requirement during handling, transit and storage.

The supplier shall also supply on instruction card giving the following information.

- i) Brief instructions for installation and regulation which include piping and fitting of terminal, if any.
- ii) Instruction for the correct operation of the appliance.
- iii) Manufacturers name and address.
- iv) Guarantee period, serviced or repair, and replacement of parts.

Table I - Sample size code letters

Lot or batch size	Special inspection levels				General inspection levels		
	S-1	S-2	S-3	S-4	I	II	III
	2 to 8	A	A	A	A	A	A
9 to 15	A	A	A	A	A	B	C
16 to 25	A	A	B	B	B	C	D
26 to 50	A	B	B	C	C	D	E
51 to 90	B	B	C	C	C	E	F
91 to 150	B	B	C	D	D	F	G
151 to 280	B	C	D	E	E	G	H
281 to 500	B	C	D	E	F	H	J
501 to 1 200	C	C	E	F	G	J	K
1 201 to 3 200	C	D	E	G	H	K	L
3 201 to 10 000	C	D	F	G	J	L	M
10 001 to 35 000	C	D	F	H	K	M	N
35 001 to 150 000	D	E	G	J	L	N	P
150 001 to 500 000	D	E	G	J	M	P	Q
500 001 and over	D	E	H	K	N	Q	R

CODE
LETTERS

