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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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Evaluation method of energy saving grade for gas burner

燃气燃烧器节能等级评价方法

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard was proposed by and is under the jurisdiction of the National Technical Committee on Combustion Energy Saving and Purification of Standardization Administration of China (SAC/TC 441).

The standard was issued on 14 May 2018 by the State Administration for Market Regulation and the Standardization Administration of the People's Republic of China, and has been in force since 1 December 2018.

1 Scope

China's national method for grading the energy efficiency of industrial gas burners. A burner rarely fails outright when it is wasteful; it simply draws in more air than the fuel needs, and every extra kilogram of that air is heated to flue temperature and thrown away up the stack. Excess air is therefore the honest measure of how well a burner is matched to its furnace, and this standard makes it the grading index: the burner is fired at five load points - 100, 80, 70, 50 and 30 per cent of rated load - the excess air coefficient is measured at each, and a weighted average places the product in one of five grades running from excellent to unacceptable. Weighting the part-load points is what gives the scheme its bite, because a burner spends most of its working life modulating rather than sitting at full fire, and a machine tuned only at its rating can be badly wrong everywhere else. Before it is graded at all a burner has to pass two entry conditions: a combustion efficiency of at least 99.9 per cent, or combustibles in the flue gas below 0.05 per cent, and a furnace volume heat release rate of about 1 MW per cubic metre at full load that falls in proportion as the load falls. The grading exists because a minimum requirement only clears the worst products off the market and gives a buyer no reason to look past the floor, whereas a scale gives the

buyer something to compare and the manufacturer a reason to climb - which is what energy labelling, public procurement rules and subsidy schemes then attach to. It applies to general industrial gas burners and deliberately leaves out the special types, whose combustion physics would make a single scale meaningless.

This standard specifies the energy saving grade index and the method of evaluating the energy saving grade of gas burners.

This standard applies to general industrial gas burners. It does not apply to non-oxidising burners, regenerative burners, self-preheating burners, high-velocity burners, porous media burners, domestic burners or other special burners.

2 Terms and definitions

The following terms and definitions apply to this document.

2.1 combustion efficiency - the percentage that the heat actually released by the combustion of the fuel represents of the heat that would be released by its complete combustion. NOTE: combustion efficiency is an important index for judging how completely the fuel is burnt.

2.2 excess air coefficient - the percentage relation between the mass of air actually supplied for the combustion of each kilogram of fuel and the mass of air theoretically required to burn that kilogram of fuel completely.

2.3 effective furnace volume - the geometric volume of the space within the boundaries of the furnace in which the combustion of the fuel and the effective radiative heat transfer take place.

2.4 furnace volume heat release rate - the heat released per unit of effective furnace volume in unit time; its value is the ratio of the heat input to the furnace to the effective furnace volume. NOTE: the furnace volume heat release rate is also called the furnace volume heat intensity or the furnace volume heat load.

2.5 load regulating ratio - the percentage that the mean load of the burner over a specified time represents of its rated load.

3.1 Technical requirements

3.1.1 The combustion efficiency shall be not less than 99.9 per cent, or the content of combustibles in the flue gas - the total of carbon monoxide and hydrocarbons - shall be not greater than 0.05 per cent.

3.1.2 The furnace volume heat release rate shall meet the requirements of Table 1. For a gas burner at a load ratio of 100 per cent the furnace volume heat release rate shall be 1 MW per cubic metre with a tolerance of 0.1; at the other load ratios the furnace volume heat

release rate falls in the same proportion as the load ratio.

3.2 Test method

The test shall be carried out with the kind of gas that corresponds to the gas burner, under the uniformly specified conditions of standard test environment, test furnace and test system.

3.3 Method of calculation

3.3.1 The excess air coefficients under the five operating conditions corresponding to load ratios of 100 per cent, 80 per cent, 70 per cent, 50 per cent and 30 per cent are combined by the weighted mean method, and the grade is evaluated on the mean excess air coefficient so calculated.

3.3.2 The weights of the excess air coefficient at the different load ratios shall be those of Table 2: 0.3 at a load ratio of 100 per cent, 0.3 at 80 per cent, 0.25 at 70 per cent, 0.1 at 50 per cent and 0.05 at 30 per cent.

3.3.3 The mean excess air coefficient is calculated by formula (1), $M = \sum (m(i) \times n(i))$, where M is the mean excess air coefficient, m is the excess air coefficient, n is the weight and i is the i -th load ratio.

3.4 Energy saving grades of gas burners

The energy saving grades of gas burners are divided as shown in Table 3.

Grade 1: mean excess air coefficient below 1.05 - rated excellent.

Grade 2: mean excess air coefficient from 1.05 up to but not including 1.10 - rated good.

Grade 3: mean excess air coefficient from 1.10 up to but not including 1.15 - rated fair.

Grade 4: mean excess air coefficient from 1.15 up to but not including 1.20 - rated acceptable.

Grade 5: mean excess air coefficient of 1.20 and above - rated unacceptable.