Applied Mechanics and Materials Vol. 737 (2015) pp 963-966

doi:10.4028/www.scientific.net/AMM.737.963

Research on energy efficiency status of fans in Zhejiang Province

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Keywords: Fans; Energy Efficiency; Standards.

Abstract. The fan industry has developed rapidly because of the large demand in the fields of thermal power, metallurgy and so on. There are many manufacturers in Zhejiang Province. However, energy efficiency projects are not carried out sufficiently in those factories. Compared with foreign standards on fan energy efficiency such as ANSI/AMCA 205 and ISO 12759, national standard GB 19761 still has some disparity in the scope of application, the energy efficiency classification and definition of energy efficiency. Using the experience of foreign standards and vigorously promoting the energy efficiency projects in the fan manufacturing enterprises could accelerate the development of domestic standard system on fan energy efficiency and entire fan industry.

Introduction

With the rapid development of national economy, fans has been widely used in the fields of thermal power, steel, chemical, oil refining, light textile, sewage treatment, mining, tunnel and subway, papermaking, experiment research and household appliances as well as various types of plant building. According to the statistics, the energy consumption of fans accounts for nearly 20% of the world energy consumption. In China the power consumption of fan driven system accounts for about 10.4% of the total power consumption [1]. With the intensified shortage of world energy supply and need for application of low carbon and energy-saving products, research on fan energy efficiency becomes more and more important.

There are more than 100 fan manufacturing factories with different scale in Zhejiang Province, which is one of the provinces with the most fan manufacturers. Various economic indicators rank first in China for five consecutive years. Products such as axial flow fan, centrifugal fan, air conditioning fan and cooling tower fan have strong market competitiveness. The gross annul value exceeds 5 billion Yuan and the domestic market share reaches 60%.

The motor testing lab subordinated to Zhejiang Institute of Quality Inspection Science is an IECEE-CB international mutual accreditation lab as well as the national compulsory certified product testing lab. Testing ability covers all the projects in GB 19761-2009 “Minimum allowable values of energy efficiency and energy efficiency grades for fan”, JB/T 9101-1999 “Fan rotor balance”, GB/T 1236-2000 “Industrial fans performance testing using standardized airways”, GB/T 10178-2006 “Industrial fans performance testing in situ”, GB/T 2888-2008 “Methods of noise measurement for fans blowers compressors and roots blowers”, GB/T 13470-2008 “Economical operation for the fan system”, JB/T 8689-1998 “Fan vibration detection and its limited value” and JB/T 8690-1998 “Fans noise limited value”. Some projects in GB/T 11864-2008 “Marine axial flow fans”, GB/T 11865-2008 “Marine centrifugal fans”, JB/T 10563-2006 “Technical specification for general purposes centrifugal fans”, JB/T 10562-2006 “Technical specification for general purposes

axial fans", JB/T 4358-2008 "Centrifugal fan for boiler of power station" and JB/T 4357-2008 "Centrifugal ID-fan for industry boiler" can also be conducted. The testing ability, equipments and environment occupy the province's leading level.

Energy efficiency analysis of fans in Zhejiang Province

Comparison of standards on fan energy efficiency. In the early of 2005, China has issued GB 19761 "The minimum allowable values of energy efficiency and evaluating values of energy conservation for fan" and then was amended to "Minimum allowable values o f energy efficiency and energy efficiency grades for fan" in 2009. The standard stipulates energy efficiency grades, the minimum allowable values of energy efficiency, evaluating values of energy conservation and testing methods, which is suitable for general purpose centrifugal and axial flow fan, industrial steam boiler centrifugal induced draft fan, power plant boiler induced draft fan, power plant axial flow fan and air conditioner centrifugal fan. References involved in the standard include GB/T 1236 "Industrial fans performance testing using standardized airways", GB/T 10178 "Industrial fans performance testing in situ", JB/T 4357 "Centrifugal ID-fan for industry boiler", JB/T 4358 "Centrifugal fan for boiler of power station", JB/T 4362 "Power station axial fans", JB/T 10562 "Technical specification for general purposes axial fans", JB/T 10563 "Technical specification for general purposes centrifugal fans" and so on [2].

AMCA (Air movement and control association) issued a standard AMCA 205-10 "Energy Efficiency Classification for Fans" in 2010 and revised it in 2012 with the standard number ANSI/AMCA 205-12. The standard applies only to the motor driven fans with the impeller diameter greater than or equal to 125 mm and the shaft power greater than or equal to 750 W. The calculation of energy efficiency involves the following standards: ANSI/AMCA 210 "Laboratory methods of testing fans for certified aerodynamic performance rating", ANSI/AMCA 230 "Laboratory methods of testing air circulator fans for rating and certification", AMCA 260 "Laboratory methods of testing induced flow fans for rating" and ISO 5801 "Industrial fans Performance testing using standardized airways" [3]. It could be observed that ANSI/AMCA 205 and GB 19761 are different in the scope of application. In addition, differences also exist in other aspects [4]:

(1) ANSI/AMCA 205 is not a compulsory standard, which could help consumers choose fans of different energy efficiency grades according to their needs. And GB 19761 is a compulsory standard, which is designed to eliminate low efficiency products.

(2) ANSI/AMCA 205 defines three kinds of efficiency (no motor driven fan, direct driven fan not considering driven device and fan considering driven device). However, GB 19761 only gives the calculation formula of fan efficiency and fan unit efficiency without definition of fan efficiency.

(3) ANSI/AMCA 205 uses FEG and FMEG methods for classification of efficiency. FEG method is used to evaluate the fan efficiency and FMEG is for the total efficiency evaluation of combined fan and driven device. ANSI/AMCA 205 describes 11 energy efficiency grades (from FEG50 to FEG90) using the curve method based on the fan size. GB 19761 classifies the energy efficiency of centrifugal fan, axial flow fan and air conditioning centrifugal fan according to the pressure coefficient, specific speed, machine size, efficiency and hub ratio. The method is not suitable for judgment in critical position.

ISO 12759 standard "Efficiency classification for fans" defines the efficiency classification of motor driven fans with 0.125 KW to 500 KW input power, which is applicable not only to the bare shaft fan and motor driven fan, but also to the fan in integrated products [5]. The scope of ISO 12759 is different from that of GB 19761. ISO 12759 classifies the energy efficiency grades using

the curve method and points out the installation method. However, GB 19761 adopts the data table classification method without provisions on installation. ISO 12759 takes into account the effect of rotation speed on the classification of energy efficiency grades, which is not mentioned in GB 19761. Furthermore, ISO 12759 stipulates the energy efficiency grades of bare shaft fans and motor driven fans. However, GB 19761 only gives the energy efficiency grades of bare shaft fans and air conditioning centrifugal fans [6].

As mentioned above, domestic standard of fan energy efficiency still lag behind foreign standards. Learning from the advantages of foreign standards could accelerate the development of standard system of fan energy efficiency in China [7].

Energy efficiency status in Zhejiang Province. In recent years, the energy efficiency status of fans is monitored by supervision and random inspection methods in Zhejiang Province in order to urge the manufacturing enterprises to improve their product quality. Table 1 shows the supervision and random inspection results in the last two years. It can be seen in Table 1 that the result is not ideal in the first quarter of 2013. The qualified rate of nearly 20 samples is only 33%. Lack of product name, the rotation direction of impeller and serial number are the main nonconformance. The low qualified rate is for the reason that most of the manufacturers did not carry out energy efficiency testing and filing work before that time. That's to say, the manufacturers did not pay enough attention to the energy efficiency projects.

Table 1 Supervision and random inspection results of fans

Date	Type	Samples	Qualified rate
First quarter, 2013	Special inspection of energy efficiency	nearly 20	33%
Third quarter, 2013	Regular inspection	15	100%
Third quarter, 2014	Regular inspection	2	100%
Third quarter, 2014	Flight inspection	7	100%

After publicizing the energy efficiency standards in enterprises, many of them came to our institution or other testing organizations for energy efficiency testing and filed in Chinese Energy Label Center at the same time. Energy efficiency labels were pasted on the products properly and no unqualified products were found.

Improvement measures and suggestions. The quality level of fan products is relatively stable and manufacturers pay more and more attention to the energy efficiency projects. However, the details of the standards are not understood perfectly. Although there are many fan factories in Zhejiang Province, there exist several problems such as weak technology, low innovation and high similarity of products. For that reason, technical institutions should carry out various technical assistance activities and help the manufacturers to find out the problems, develop new technology and improve product structure and technology content in order to enhance the quality and fame of the provincial fan industry. In addition, energy efficiency standards should be revised correspondingly in order to meet the requirements of advanced foreign standards.

Conclusions

Development of fan industry is closely related to many other industries. Promoting the construction of energy efficiency standard system continuously and practicing energy efficiency projects in the manufacturing enterprises energetically are critical to the development of fan industry and realization of energy saving in the whole society.

Acknowledgements

This work was financially supported by the Science and Technology Program of Zhejiang Province (2013C35077).

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