Blower Testing Standard

ET11SCE5020 Report

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Executive Summary

There are industry recognized testing standards for pumps, lighting, and compressed air systems that enable us to identify and differentiate energy efficient products from others. However, Southern California Edison (SCE) identified that there was no industry recognized test standard for electric blowers. This Technology Development Support (TDS) project, as a part of the SCE Emerging Technology (ET) program, focuses on developing a performance test standard for commercial and industrial electric blowers recognizing a significant energy saving opportunity in California.

According to the Pacific Gas and Electric Company’s 2006 study (PG&E 2006 Study), blowers and fans consume approximately 1,300 gigawatt-hours (GWh) per year in SCE’s service area alone. Blowers and fans are the fourth largest electric energy consumption components among industrial customers, and yet design engineers, customers, and utilities with energy efficiency programs are not able to identify energy efficient blowers in the marketplace. SCE, therefore, has been working with other utilities through the Consortium of Energy Efficiency (CEE) to encourage the Compressed Air and Gas Institute (CAGI) and the American Society of Mechanical Engineers (ASME) to develop blower test standards. After working with various professional organizations for over three years, there is now a blower test standard, which is Annex G to the existing ISO 5389 by CAGI. ASME expects to have the Performance Test Code 13 standard completed in 2013.

These test standards provide a level playing field among blower manufacturers for testing and comparing their blower performance to others without facing ambiguities of testing variables, conditions, or even qualification of certified laboratories, as the new standards clearly define them.

When blower manufactures test their blowers according to these test standards, design engineers, customers, and utilities with energy efficiency programs are able to identify high performance blowers easily - above the industry average. This brings an opportunity to develop additional energy efficiency programs that promote higher efficiency blowers for commercial and industrial applications. This is similar to incentivizing a customer who had a choice of purchasing a standard motor vs. a highly efficient motor in the past.

To create a successful program for high efficiency electric blowers, SCE recommends the following:

- Conduct laboratory assessments, according to these test standards, to determine blower performance efficiency levels at various load conditions and determine the average performance.
- Continue to work with CAGI and ASME to update test standards as new technologies become available.
- Continue to seek CAGI support to develop a blower database that allows design engineers, customers, and utilities to compare and find a high efficiency blower among various manufacturers’ that meets or exceeds the design requirements.
- Demand high efficiency blowers from manufacturers.

Educate design engineers, commercial and industrial facility engineers, customers, and energy advisors about the way of identifying high efficient blowers.
# Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>CAGI</td>
<td>Compressed Air and Gas Institute</td>
</tr>
<tr>
<td>CEE</td>
<td>Consortium of Energy Efficiency</td>
</tr>
<tr>
<td>DES</td>
<td>Design and Engineering Services</td>
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<tr>
<td>GWh</td>
<td>Giga Watt hour</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>PG&amp;E</td>
<td>Pacific Gas and Electric</td>
</tr>
<tr>
<td>PTC</td>
<td>Performance Test Code</td>
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<tr>
<td>SCE</td>
<td>Southern California Edison</td>
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INTRODUCTION

As a part of the Emerging Technology (ET) Program, the Technology Development and Support project focuses on targeted opportunities to support and identify energy efficiency products in development or in the market. Developing a test standard by a professional organization allows utilities to examine and identify energy efficiency products (e.g., above average performance) in the market fairly. Furthermore, it removes ambiguities of test variables, test conditions, or even qualifications of certified laboratories conducting performance testing. For example, when reading the nametag of a motor, design engineers, developers, etc., are able to identify its efficiency and are able to compare it to others. Therefore, a test standard provides a level playing field for differentiating products’ performances when appropriately and consistently being used by manufacturers.

When a certain device is widely used among customers (i.e., opportunity to affect larger energy savings), the EEP can reach out to those customers informing them of more energy efficient devices, and encourage customers to buy/use them. The industrial blower is certainly a device that is being widely used among commercial and industrial customers. By using the testing standard, the EEP is able to identify more energy-efficient blowers on the market.

BACKGROUND

According to the Pacific Gas and Electric Company’s 2006 study (PG&E 2006 study), blowers and fans consume approximately 1,300 gigawatt-hours (GWh) per year in Southern California Edison’s (SCE’s) service territory alone. Blowers and fans represent the fourth largest electric energy consumption components among industrial customers. However, unlike pumps, lighting, or compressed air systems, there are no industry-recognized efficiency-testing standards or technical resources for promoting best practices. See Table 1.

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TABLE 1. SCE’S BLOWER MARKET SIZE AND AVAILABILITY OF TECHNICAL RESOURCES

<table>
<thead>
<tr>
<th>Component (Industrial Sector)</th>
<th>SCE Market Size(^3) (GWh/year)</th>
<th>Efficiency Test Standard</th>
<th>Resources for Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pump</td>
<td>2,400</td>
<td>Hydraulic Institute</td>
<td>Yes</td>
</tr>
<tr>
<td>2. Lighting</td>
<td>1,600</td>
<td>International Organization for Standards, Energy Star</td>
<td>Yes</td>
</tr>
<tr>
<td>3. Compressor</td>
<td>1,400</td>
<td>International Organization for Standards, CAGI</td>
<td>Yes</td>
</tr>
<tr>
<td>4. Blower/Fan</td>
<td>1,300</td>
<td>None</td>
<td>None or Limited</td>
</tr>
</tbody>
</table>

SCE has been working with other utilities through the Consortium of Energy Efficiency (CEE) to encourage the Compressed Air and Gas Institute (CAGI) and the American Society of Mechanical Engineers (ASME) to develop blower test standards. SCE and CEE identified CAGI and ASME to be the best professional organizations that could develop such standards for the following reasons:

- They are well-established professional and standard developing organizations in the U.S., and recognized internationally. For example, the International Organization for Standardization (ISO) has adopted many CAGI standards. ASME is also recognized worldwide, and has more than 600 technical standards used in over 100 countries.

- Many blower and compressed air system manufacturers follow their standards.

- They can provide unbiased authority on technical, educational, promotional, and other matters that affect the industry. This aspect is particularly important for addressing inappropriate usage of compressed air and promotes energy efficient blowers where applicable.

- They both have specialized technical committees (e.g., experts in the area) who follow their existing developing/reviewing/commenting/voting processes for developing well-represented standards.

\(^3\) Derived from Pacific Gas and Electric Company’s “California Industrial Existing Construction Energy Efficiency Potential Study,” 2006, p. 3-4 and 3-5
OBJECTIVES

The main objective of both CAGI and ASME blower test standards is to evaluate the performance of electric blowers under the same test conditions. These standards relate the volume flow rate to the specific energy consumption at a stated set of operating conditions, (e.g., outlet operating pressures and temperatures).

These standards also allow us to compare the actual performance to the performance data sheets provided by the manufacturers. For example, CAGI requires the following test conditions:

- Absolute air pressure 100 kilo-Pascal
- Air temperature 20 degree Celsius,
- Relative humidity 0%

In addition, it requires the following variables to be measured in accordance to ISO 5167, for airflow measurement, and EN60051, a European standard for electrical measuring instruments and requirements:

- Compressor rotational speed
- Inlet air temperature
- Inlet air pressure
- Inlet air humidity
- Outlet air pressure
- Blower package power input
- Volume flow rate at the outlet of the package

CAGI also specifies 4% as the tolerance value for three major output variables (discharge pressure, volume flow rate, and total energy required at the discharge pressure and volume flow rate). All blower products that do not meet the tolerance value cannot use the CAGI standard as the basis of certifying their performance levels or producing datasheets.
STANDARD DEVELOPMENT APPROACH

SCE recognized the need of having a blower test standard and shared its findings with CEE staff members in 2008. There was awareness in the blower industry that a new test standard was needed for packaged turbo blowers (an emerging product), too. As a result, CEE invited CAGI, and some blower manufacturers, and the author of this report to the CEE Industry Partners’ Meeting in September 2009. An SCE presentation urged blower manufacturers to provide blower datasheets to electric utility companies that have energy efficiency programs. The datasheets will be used to implement energy efficient electric blower programs. Consecutively, SCE presented market assessment and field assessment results to CAGI, ASME, and other utilities through various conferences, and meetings (e.g., ET Summit 2010, CEE Industry Partners’ Meeting in 2010 and 2011 and various CEE committee meetings, including the Industry Planning Committee of CEE). With support of CEE’s utility members, CAGI formed a working group to develop a blower standard in 2010. A few months later, ASME formed a working group to develop its own blower test standard.
CAGI AND ASME BLOWER TEST STANDARDS – SIMILARITIES AND DIFFERENCES

CAGI developed the blower test standard Annex G to include in the existing ISO 5389 standard while ASME is in the final phase of developing their Performance Test Code (PTC) 13; ASME expects to release the PTC 13 in 2013. CAGI and ASME blower test standards are the same from a perspective of measuring the blower’s performance (output pressure, airflow rate) with respect to required electric energy at a specified test condition and with respect to a specified tolerance level.

CAGI and ASME, however, have taken different approaches in developing their standards. The ISO 5389 addresses performance testing on turbo-compressors of all types, and does not apply to fans or high-vacuum pumps. CAGI wanted to start with one specific blower that has the biggest energy saving market potential (i.e., turbo blowers in wastewater treatment facilities), and later apply similar approaches to developing other types of blowers; see attached standard. ASME, on the other hand, is taking a comprehensive approach by addressing all types of packaged blowers at the same time. It also wants to provide a way of evaluating the lifecycle cost of blowers as well.
RECOMMENDATIONS

CAGI’s and ASME’s blower test standards are the first step in creating an effective energy efficiency program for electric blowers. It virtually eliminates the need of verifying blowers’ performance when blower manufacturers test their blowers according to these test standards. That is, reliance on the manufacturers’ datasheets to determine their efficiency levels will be sufficient. Therefore, in the near future, design engineers, customers, and utilities with energy efficiency programs will be able to identify high performance blowers easily (e.g., above the industry average) by comparing manufacturers’ datasheets. Furthermore, a designer can choose a higher efficiency blower when a pressure level and an airflow rate are specified. The primary benefit of having the performance test standard is the ability to specify energy efficiencies into the design specifications. This energy efficiency specification practice can make blower manufacturers and end users more conscious about energy efficiency and economic values. This creates an opportunity to develop additional energy efficiency programs that promote higher efficiency blowers for various commercial and industrial applications. This is similar to incentivizing a customer who had a choice of purchasing a standard motor vs. a highly efficient motor offered in the past. For a successful program creation for high efficiency electric blowers, SCE recommends the following:

- Conduct laboratory assessments, according to these test standards, to determine blower performance efficiency levels at various load conditions and determine the average performance.
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Appendix


CAGI BL 5389
Final V3 6-17-13.