

ENGINEERING

UPDATE

Volume 1 Issue 1

A publication for the engineering community.

September 1999

Engineering Update - the first edition

Welcome to the first edition of Greenheck's Engineering Newsletter! Our new publication is committed to providing our readers with educational, informative articles related to the HVAC industry from the leading manufacturer of air movement and control equipment worldwide - Greenheck.

Technical information

Each issue will contain technical articles that provide facts to help you in your design process. For example, a topic in this issue is AMCA Certification. What is it, why is it important and what are the benefits for you and your customers? Read on to find the answers.

A complementary article on AMCA certified dampers and the test methods used by Greenheck is also included.

Programs

Our premier issue has some straight talk about WinCAPS, Greenheck's windows-based

product selection program for engineers. You'll find out about the program and how it can make your life easier when specifying and selecting Greenheck products.

Hints and tips

And, you'll find some helpful hints and tips. This issue includes an article that will help you understand the effects of temperature and altitude on fan selection, how to apply correction factors, and how to specify fans for varying conditions.

What's New

Watch for the What's New section, a recurring column found in the back of the issue. The column will feature the latest product introductions, program enhancements and marketing support available from Greenheck.

As you can see, this is not just another newsletter. We're very sensitive to the amount of mail that crosses your desk, so we intend to have great information packed into every issue.

Our commitment

At Greenheck, we are committed to our customers. It's imperative we communicate with you and provide you with the information you need to help you do your job more effectively. Please help us communicate the right information.

Comments or suggestions

If you have comments or suggestions for articles, or know of someone who would enjoy a copy of our newsletter, please send an e-mail to our editor at cheryl.aderhold@greenheck.com

Watch for your copy of the Engineering Update newsletter quarterly. 

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Why AMCA? Because you need the performance you specify.



AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

The engineers and designers who select and specify products of all types for building projects carry a great deal of responsibility. That's why you need to specify fan, damper, and louver products that are AMCA licensed and that each individual product bear the AMCA Certified Rating Seal.

The following summarizes what you need to know about AMCA. Read on to learn more about:

- What is AMCA (What the AMCA Certified Rating Program means)
- AMCA certified rating seals
- AMCA published standards (test standards)
- Other AMCA publications
- Greenheck's commitment
- How to get what you really want

What is AMCA (What the AMCA Certified Rating Program means)

AMCA is an international, non-profit association, dedicated to the certification of performance ratings on fans, louvers, dampers and other air handling equipment.

The present AMCA membership includes the majority of the world's leading manufacturers of air movement and control equipment.

AMCA provides you with independent "third party" verification of performance ratings. In addition to verifying performance ratings, AMCA provides important application information to the fan and damper industry. (Refer to AMCA Publications listed on page 3.)

As stated by AMCA, "the associations' mission is to promote the health and growth of the air movement and control industry consistent with the interest of the public." AMCA is a valuable resource and a strong means of self-regulation for our industry. People who buy and specify fans need to be aware of the value of the AMCA seal.

AMCA Certified Rating Seals

The AMCA seal assures you that a product line has been tested to the appropriate AMCA standards in accordance with a legal license agreement and that the manufacturer's catalogued certified ratings have been submitted to the AMCA staff for approval prior to publication.

The eight certified programs covered by AMCA are as follows:

1. Air Performance
2. Sound and Air Performance
3. Air Leakage/Air Performance

4. Air Leakage
5. Water Penetration/Air Performance
6. cfm/Watt – Air Performance
7. Airflow Measurement Station – Air Performance
8. Positive Pressure Ventilators – Air Performance

For a product to be licensed to bear the AMCA seal, it must first be tested in an accredited lab (usually the manufacturer's or an independent testing facility accredited by AMCA's technical staff). To obtain a license to use the AMCA seal, each manufacturer agrees to eight major requirements:

1. Published ratings will be based on tests conforming to the appropriate AMCA standard.
2. All tests will be made in a laboratory accredited by the AMCA technical staff.
3. Test results will be submitted to the AMCA staff for checking.
4. A unit selected by the AMCA staff will be sent to the AMCA laboratory for a "Precertification Check".
5. All catalogs containing "Certified Ratings" will be submitted to the AMCA staff for approval before publication.
6. Every three years each licensed product line will be subject to



Why AMCA, continued from page 2

continuing check tests in the AMCA laboratory.

7. Licensed products will also be liable to challenge tests initiated by competing manufacturers.
8. Fees and assessments will be paid to fund the program.

And, it doesn't end there. Once licensed, a product is subject to testing at any time by a competing manufacturer who may challenge published versus actual tested performance of a product. The AMCA license will be withdrawn if the product does not continue to perform as cataloged.

AMCA Certified Ratings Program

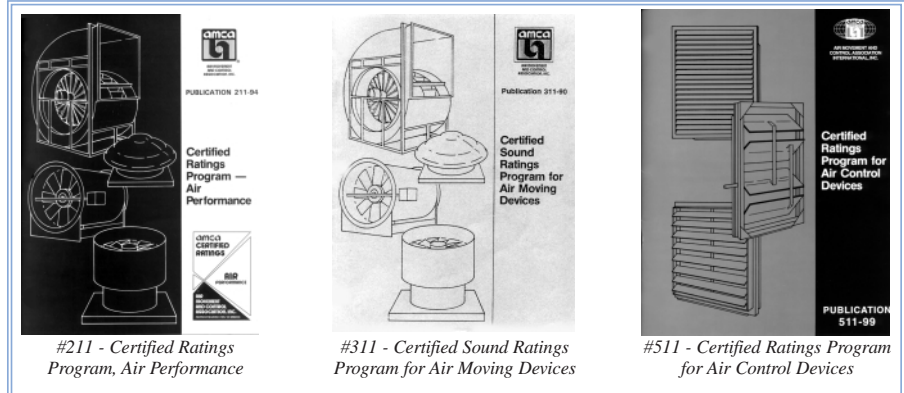
There are three AMCA rating standards that apply to air moving and control products. These are the standards under which AMCA Certified Ratings Seals are granted. Publication 211 is the testing procedure that applies to fans for air performance. Publication 311 applies to fans for sound performance. Publication 511 applies to dampers and louvers for air performance, air leakage, and water leakage.

Other AMCA Publications

For complete information on all materials, visit www.amca.org AMCA's web site. Some of the available publications include:

Publications List: Lists all available AMCA Publications and Standards along with pricing and ordering instructions.

Directory of Licensed Products, AMCA Publication 261: A listing



of all the products licensed by AMCA to bear the Certified Rating Seal. (This is only available via AMCA's web site, www.amca.org)

Fans and Systems, Publication 201: Includes information on how fans are tested in the laboratory, how performance tables and curves are developed and published, and how system connections will affect fan performance. The adverse effects of specific system connections and of other poor inlet and outlet conditions are expressed numerically in the form of "System Effect Factors".

Troubleshooting, Publication 202: Intended to help identify and correct problems with the performance and operation of the fan system after installation.

Field Performance Measurements, Publication 203: Reviews the problems of making field measurements of fan-systems and discusses in detail how to measure and calculate the actual performance of the fan and system. It discusses the accuracy that may be expected and gives examples of how to test typical fan systems and allow for the effects of the system connections on fan performance.

Methods for Calculating Fan Sound Ratings from Laboratory Test Data, Standard 301: This document establishes standard methods for calculating consistent sound ratings from laboratory test data. Data must come from AMCA 300, 320, and 330 test standards.

Application of Sone Ratings, Publication 302: Lists recommended sone level and outlines a method for determining the loudness of fans as installed taking into account room size and acoustical characteristics.

Application of Sound Power Level Ratings, Publication 303: Outlines a method for calculating and applying LwA and dBa sound ratings.

Application Manual for Air Louvers, Publication 501: Provides general information and comments on important points to consider when designing or specifying installations requiring louvers.

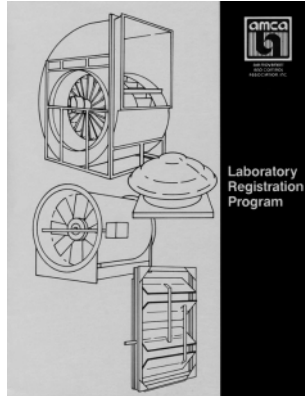
Greenheck's Commitment

Greenheck is a strong advocate of AMCA, having more testing facilities and personnel dedicated to performance testing than any of

Why AMCA, continued from page 3

our major competitors. We also have the most people of any competitor serving on AMCA committees. All of this results in the combination of more fan, damper, and louver products licensed to bear AMCA Certified Rating Seals than any of our competitors.

Greenheck has two AMCA accredited laboratories for air testing (ratings, pressure drop, leakage) of fans, dampers, and louvers plus one (one of 16 in the world) sound testing laboratory using the reverberant room method. This means that Greenheck has passed a rigid inspection by AMCA and has met all of the requirements of AMCA Publication 111 (Laboratory Accreditation Program) for facilities, personnel qualifications, and equipment calibration and maintenance. AMCA and Greenheck have conducted tests on identical pieces of equipment with test results being within one half of the CRP (certified ratings



#111 - Laboratory Registration Program

program) tolerance. In addition, our labs are accredited by Underwriters Laboratories to participate in the U.L. Client Test Data Program. (More on UL in the next issue)

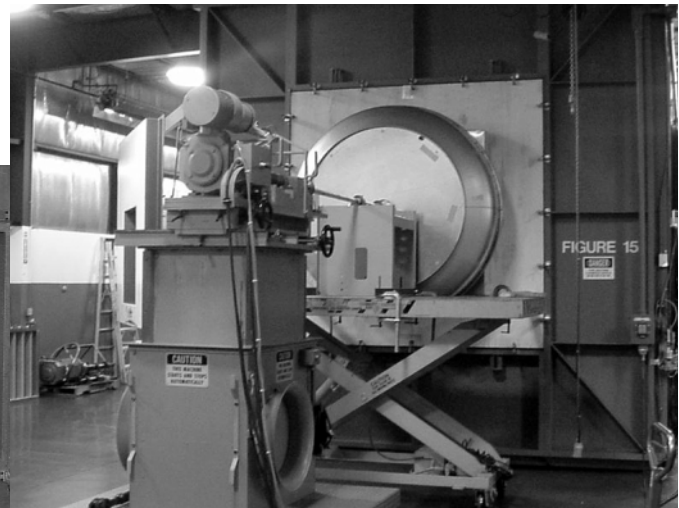
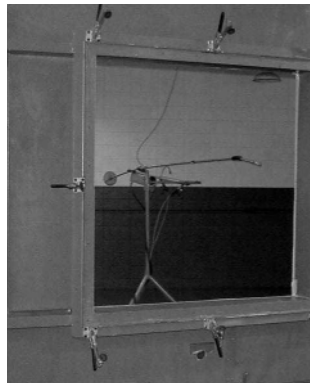
Greenheck has a few products that are not licensed to bear AMCA

Certified Rating Seals. The few Greenheck catalogs and selection programs containing performance not licensed by AMCA are completely accurate and all performance is guaranteed by Greenheck. The testing has been done in accordance with the appropriate AMCA standard in an AMCA Accredited Lab.

How to get what you really want

Using the following criteria will assure you that the product you specify will perform as expected.

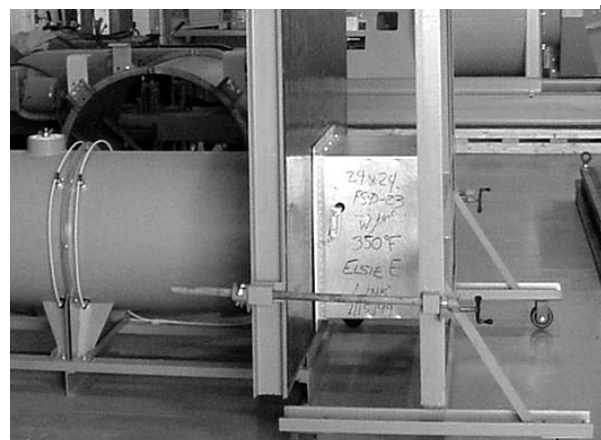
Greenheck's Sound Room



Air testing being conducted on a centrifugal roof fan



Damper being put through the test cycle on the wind drive rain tunnel



Damper Leakage Testing

Why AMCA, continued from page 4

- Identify products that are licensed to bear the AMCA Seal. The latest issue of AMCA publication 261 "Directory of Licensed Products" is your best source of current information.

Note: Listing in this directory does not imply that all of a company's products are licensed to use the AMCA Seal – only the specific products that are listed. The listing also differentiates between products licensed to bear the Air Certified Rating Seal or the Sound and Air Certified Rating Seal.

- When using manufacturers' catalogs and selection programs, make sure that the product you select shows the appropriate label and AMCA Statement. (See samples below.)

Some Pitfalls to Avoid

Some manufacturers' literature carries the statement, "Tested in accordance with AMCA

standards". This is NOT the same as "Products licensed to bear the AMCA Certified Ratings Seal".

Literature containing this notation indicates products are tested according to standards developed and published by AMCA. Such a note, however, only ensures the methods used in testing. It does not ensure that the test equipment, test laboratory, or the published data meet AMCA standards. Without a laboratory that conforms to an accepted industry-wide standard, (the AMCA testing laboratory) performance data obtained conforms only to other measurements made in that particular lab. Data may be suspect, and the product may not perform as required.

Another area where a distinction needs to be very clear is the functional difference between the AMCA Certified Ratings Seal and the member logo. There are some manufacturers who have used the

AMCA member logo in their literature where it might have been misinterpreted as licensed products. The orange and white logo shown below signifies membership in AMCA. Only the blue and yellow Certified Ratings Seals denote products that are licensed.




MEMBER

This logo only signifies membership in AMCA. When shown in catalogs, the logo does not denote products that are licensed to bear a certified rating seal.

When comparing performance of different manufacturers, only compare ratings of manufacturer products that are licensed to bear AMCA seals. Avoid comparing sound data to a manufacturer that has both the AMCA Sound and Air Seal to another with only the AMCA Air Seal. In comparing catalog performances, pay attention to statements regarding product testing, for example: inlet, outlet, or total sound, with/without ducts, with/without drive loss.

- Specify that each individual product bears the AMCA Certified Rating Seal.
- For specialized products (not AMCA licensed) specify products manufactured by the company that has the best reputation for accurate data.

Remember, you can always count on Greenheck. 



Greenheck certifies that the backward inclined and airfoil centrifugal fans shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.



Greenheck certifies that the model SMD-21 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Programs.

AMCA Licensed Dampers

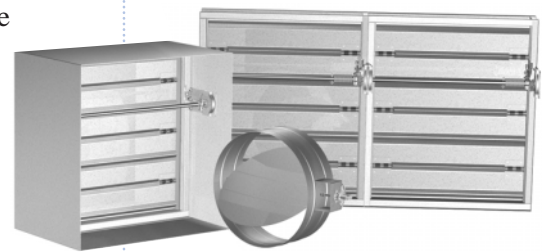
Greenheck's comprehensive line of AMCA licensed dampers lead the industry in quality and design. In addition, Greenheck's "3V" blade control dampers, smoke dampers and combination fire/smoke dampers are licensed by AMCA to bear the certified Air Performance Seal for pressure loss. The AMCA seal certifies that published pressure loss performance data for Greenheck dampers has been verified and tested in accordance with the latest edition of AMCA Standard 500-D *Laboratory Method for Testing Dampers for Rating*.

Better System Design

Engineers rarely specify or approve fan products that are not AMCA licensed. Likewise, louver products

are normally specified to be AMCA licensed for air performance and water penetration. Yet, few engineers require AMCA licensed performance data in their damper specifications.

Correctly accounting for damper pressure loss is critical to a well designed HVAC system. If the designer underestimates damper pressure loss, fans can be undersized and the system airflow will not meet specifications. To compensate for this situation the fan speed must be increased to achieve the design airflow. This requires drives to be adjusted. It may require motors to be changed out and up sized, and in worst case scenarios, may require a larger fan.



Conversely, if the designer overestimates damper pressure loss fans may be needlessly oversized. Regardless, the end result is unnecessary added cost to the system. To help assure proper system design, engineers must specify and utilize damper performance data that is licensed by AMCA and certified by the manufacturer in accordance with AMCA Standard 500-D.

No one offers more AMCA licensed dampers, and no one tests more mounting configurations or

AMCA 500-D Test Figures

Figure 5.3: A fully ducted damper. This configuration has the lowest pressure drop of the three test configurations because entrance and exit losses are minimized by straight duct runs upstream and downstream of the damper.

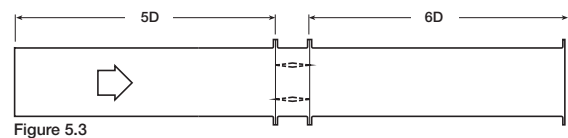


Figure 5.3

Figure 5.2: A ducted damper exhausting air into an open area. This configuration has a lower pressure drop than 5.3 because entrance losses are minimized by a straight duct run upstream of the damper.

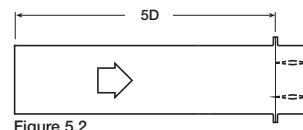


Figure 5.2

$$D = \sqrt{\frac{4(W)(H)}{3.14}}$$

Figure 5.5: A plenum mounted damper. This configuration has the highest pressure drop because of extremely high entrance and exit losses due to the sudden change of area in the system.

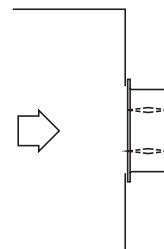


Figure 5.5

AMCA licensed dampers, continued from page 6

sizes, than Greenheck. To give designers pressure loss performance data they can count on for accurate system design Greenheck is AMCA licensed to certify pressure loss performance data for three different mounting configurations. These mounting configurations include:

- Ducted Inlet – Ducted Outlet (AMCA 500-D, Figure 5.3)
- Ducted Inlet – Free Outlet (AMCA 500-D, Figure 5.2)
- Plenum (AMCA 500-D, Figure 5.5)

The inset shows typical performance characteristics for these various mounting configurations. Note that applications with long runs of duct before and after the damper (Figure 5.3) have significantly less damper pressure loss than plenum mount (Figure 5.5) applications. For this reason, it is important to verify that damper performance data being used when designing an air distribution system is licensed by AMCA and certified by the manufacturer for the mounting configuration that most closely matches the job site situation.


Unlike fans where performance can be projected from one fan size to

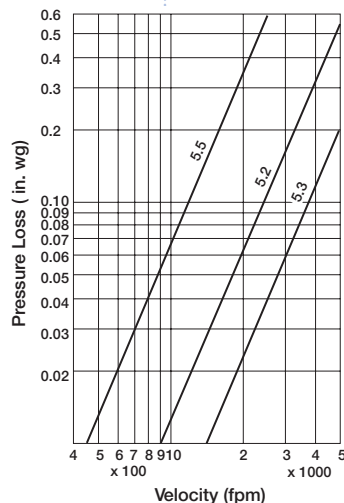
another using fan laws, no such industry accepted methods exist for predicting performance from one damper size to another. For this reason Greenheck's Certified Performance covers the full range of sizes ranging from the smallest to largest size for a given model. By having a full range of sizes certified in accordance with AMCA 500-D, the designer can utilize reliable data for the specific project application to ensure accurate system design calculations.

Why AMCA is important to you

Specifying dampers with AMCA Licensed performance data benefits

the system designer by assuring him of having complete, verifiable, and accurate pressure loss data for the basis of his system design. In addition, specifying dampers with AMCA Licensed performance data for AMCA 500-D (test figures 5.2, 5.3 and 5.5) ensures the

system designer is using performance data that most closely matches his system application. Utilizing AMCA Licensed performance data will result in a cost effective, efficient air distribution system. 



Features and benefits of Greenheck's 3V blade dampers.

Smoke Dampers:

Available in 3V blades for use in systems up to 2000 fpm and 4 in. wg or airfoil blades for use in systems up to 4000 fpm and 8 in. wg. All models have been tested and are labeled in accordance with UL 555S. The models are available in leakage class I, II, or III.

Combination Fire/Smoke Dampers:

Available in 3V blades for use in systems up to 2000 fpm and 4 in. wg or airfoil blades for use in systems up to 4000 fpm and 8 in. wg. All models have been tested and are labeled in accordance with UL 555 and UL 555S. Fire resistance ratings of either 1 ½ or 3 hours and leakage class ratings of I, II, or III.

Commercial Control Dampers:

Models are available in 3V, extruded airfoil, fabricated airfoil, and round blade designs. Galvanized, aluminum, or 304 stainless steel.

All models are available with a variety of electric two position, modulating, and pneumatic actuators.

Understanding Temperature and Altitude Corrections

The most common influences on air density are the effects of temperature other than 70°F and barometric pressures other than 29.92 caused by elevations above sea level.

Ratings found in fan performance tables and curves are based on standard air. Standard air is defined as clean, dry air with a density of .075 pounds per cubic foot, with the barometric pressure at sea level of 29.92 inches of mercury and a temperature of 70°F. Selecting a fan to operate at conditions other than standard air requires adjustment to both static pressure and brake horsepower. The volume of air will not be effected in a given system because a fan will move the same amount of air regardless of the air density. In other words, if a fan will move 3,000 cfm at 70°F it will also move 3,000 cfm at 250°F. Since 250°F air weighs only 34% of 70°F air, the fan will require less bhp but also create less pressure than specified.

When a fan is specified for given cfm and static pressure (Ps) at conditions other than standard, the correction factors (shown in table) must be applied in order to select the proper size fan, fan speed and bhp to meet the new condition.

The best way to understand how the correction factors are used is to work out several examples. Let's look at an example using a specification for a fan to operate at 600°F at sea level. This example

will clearly show that the fan must be selected to handle a much greater static pressure than specified.

Example #1: A 20" centrifugal fan (20" BISW) is required to deliver 5,000 cfm at 3.0 inches static pressure. Elevation is 0 (sea level). Temperature is 600°F.

1. Using the chart, the correction factor is 2.00.
2. Multiply the specified operating static pressure by the correction factor to determine the standard air density equivalent static pressure. (Corrected static pressure = 3.0 x 2.00 = 6". The fan must be selected for 6 in. of static pressure.)
3. Based upon our performance table for a 20" BISW fan at 5,000 cfm at 6 in wg. 2,018 frpm is needed to produce the required performance. (This now requires a Class II fan. Before the correction was made it would

have appeared to be a Class I selection.)

4. The bhp from the performance chart is 6.76.
5. What is the operating bhp at 600°F?

Since the horsepower shown in the performance chart refers to standard air density, this should be corrected to reflect actual bhp at the lighter operating air. Operating bhp = standard bhp ÷ 2.00 or 6.76 ÷ 2.00 = 3.38 bhp.

Important: We now know the operating bhp. However, what motor horsepower should be specified for this fan?

If a fan is selected to operate at high temperatures, the motor must be of sufficient horsepower to handle the increased load at any lower operating temperature where the air is denser. Assume the air entering the fan at start up is 70°F, therefore no correction should be

AIR DENSITY CORRECTION FACTORS

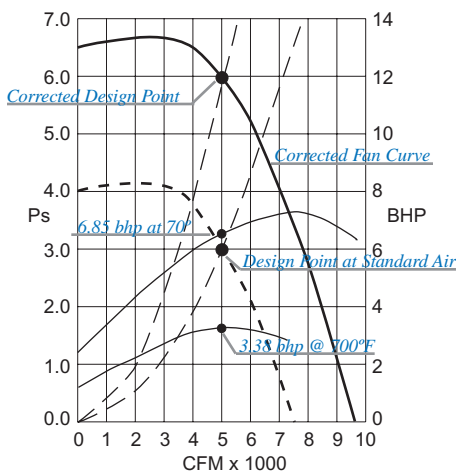
Air Temp. °F	Elevation (Feet Above Sea Level)															
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000
0	0.87	0.90	0.94	0.97	1.01	1.05	1.08	1.13	1.17	1.22	1.26	1.31	1.37	1.43	1.48	1.54
50	0.96	1.00	1.04	1.08	1.11	1.15	1.20	1.24	1.30	1.34	1.40	1.45	1.51	1.57	1.63	1.70
70	1.00	1.04	1.08	1.12	1.16	1.22	1.25	1.30	1.35	1.40	1.45	1.51	1.57	1.64	1.70	1.77
100	1.06	1.10	1.14	1.18	1.22	1.27	1.32	1.37	1.42	1.48	1.54	1.60	1.66	1.74	1.80	1.88
150	1.15	1.19	1.24	1.30	1.33	1.38	1.44	1.49	1.55	1.61	1.67	1.74	1.81	1.89	1.96	2.04
200	1.25	1.29	1.34	1.40	1.44	1.50	1.56	1.61	1.68	1.75	1.81	1.89	1.96	2.05	2.13	2.21
250	1.34	1.39	1.44	1.50	1.55	1.61	1.67	1.74	1.80	1.88	1.95	2.02	2.10	2.20	2.28	2.37
300	1.43	1.49	1.54	1.60	1.66	1.72	1.79	1.86	1.93	2.01	2.08	2.16	2.25	2.35	2.43	2.53
350	1.53	1.58	1.64	1.71	1.77	1.84	1.91	1.98	2.06	2.14	2.22	2.31	2.40	2.51	2.60	2.71
400	1.62	1.68	1.75	1.81	1.88	1.94	2.03	2.09	2.19	2.27	2.37	2.45	2.54	2.66	2.75	2.87
500	1.81	1.88	1.95	2.02	2.10	2.18	2.26	2.35	2.44	2.54	2.63	2.73	2.84	2.97	3.08	3.20
600	2.00	2.07	2.15	2.23	2.31	2.40	2.50	2.59	2.69	2.84	2.91	3.02	3.14	3.28	3.40	3.54
700	2.19	2.27	2.35	2.44	2.53	2.63	2.73	2.83	2.94	3.07	3.17	3.31	3.44	3.59	3.72	3.88
800	2.38	2.48	2.57	2.67	2.76	2.86	2.98	3.09	3.21	3.33	3.45	3.59	3.74	3.90	4.05	4.21
900	2.56	2.66	2.76	2.87	2.97	3.07	3.20	3.33	3.46	3.58	3.71	3.87	4.02	4.20	4.35	4.53
1000	2.76	2.87	2.99	3.09	3.20	3.31	3.45	3.59	3.73	3.86	4.00	4.17	4.33	4.53	4.69	4.89

Note: It's acceptable to interpolate when exact temperatures or elevations are not shown in chart.

Understanding temperature and altitude corrections, continued from page 8

made. The starting bhp remains at 6.85 and a 7 1/2 hp motor is required

Note: bhp corrections are most commonly used for altitude corrections (see next example) or when the starting and operating temperatures are the same.



Example 1: The fan curve represents the fans operation at both the corrected and specified conditions. Curves are plotted at standard air.

Example #2: A fan used at 6,000-ft. elevation to exhaust 100°F air from an attic space. A 30" roof fan (GB-300) is required to move 10,400 cfm at .25 inch static pressure.

1. Using the chart the correction factor is 1.32.
2. Multiply the specified operating static pressure by the correction factor to determine the standard air density equivalent static pressure (Corrected static pressure = .25" x 1.32 = 0.33" static pressure. The fan must be selected for .33" static pressure.)
3. Based upon our performance table for a 30" roof fan (GB-300),

698 fpm is needed to produce the required performance.

4. The bhp from the performance chart is 2.40.
5. What is the operating bhp at 6,000-ft. elevation and 100°F air?

Since the horsepower selected refers to standard air density, this should be corrected to reflect actual bhp at the lighter operating air. Operating bhp = standard bhp ÷ 1.32 or 2.40 ÷ 1.32 = 1.82 bhp.

In this example we can use the corrected bhp because the fan is located at a given elevation and will not be turned on until the attic temperature reaches 100°F. The result is a 2 hp motor can be specified in lieu of a 3 hp.

Communicate your corrections.

When a specified fan appears on the fan schedule, it's important to determine if the specifier has already made the required corrections for temperature and altitude. Avoid confusion by specifying at what temperature or altitude (or both) the static pressure was calculated.

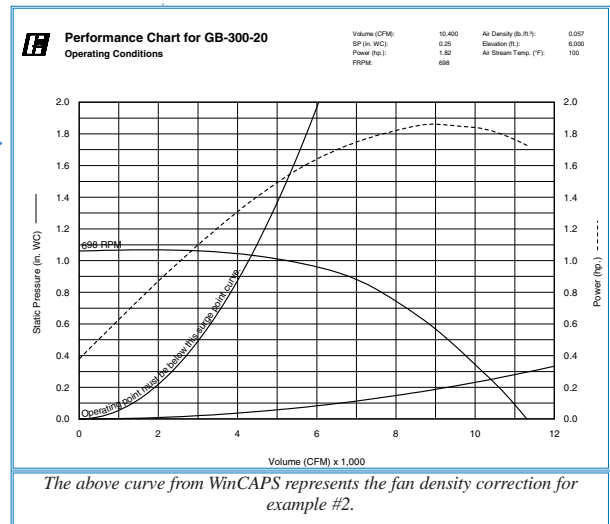
For example: 5,000 cfm at 600°F and 6 in. static pressure at 600°F (or 3" Ps. at 70°F).

Electronic fan selection programs, such as Greenheck WinCaps are


excellent tools to solve both the selection and specifying problems.

WinCaps prompts the user to enter the air stream temperature, the start up temperature, and the altitude. The fan with the corrected conditions is then automatically selected.

Using WinCaps will also guard against making selections for fan types or models that are not appropriate for the condition. This is especially important for selections at extreme temperatures that require special considerations for materials, motors, bearings, drives and speed derate factors.

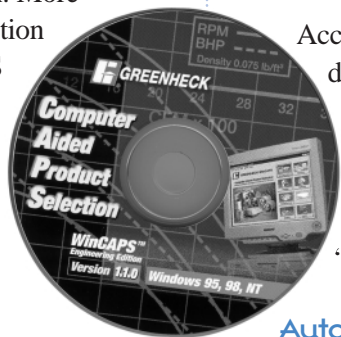


The above curve from WinCAPS represents the fan density correction for example #2.

As demonstrated in the above examples, for optimum system design and performance, it's important to understand and make the proper temperature and altitude corrections. 

WinCAPS - it's easier, faster, better

Greenheck offers a powerful productivity booster with our new Windows-based WinCAPS Engineering Edition. More than a product selection program, WinCAPS is packed with features to save you time. It's a dynamic planning tool designed for ease of use and accuracy.



Faster, easier & error-free

WinCAPS increases your productivity. Guesstimates, human error and valuable time spent on recalculations for performance variables are eliminated from the selection process. Clients will appreciate your quick response time and thorough analysis.

Following are the most significant benefits that WinCAPS provides engineers to help you quickly and accurately select and communicate air movement and equipment system applications.

Exclusive selection optimization

There's no need to predefine specific design criteria (e.g. smallest unit, smallest motor, quietest unit). All critical selection and performance criteria are automatically displayed. The selection options can be sorted by clicking on their column header. This allows the system designer to

focus on the parameters that are important to the individual product.

Model selection assistance

Accessing the model pictures, description, operating limits, and specifications before beginning the process eliminates the need to do multiple "trial" selections.

Automatic performance corrections (including options)

The effect of most critical options, like filters or inlet vanes, is automatically included in the performance calculations. This eliminates the need for pressure drop guesstimates. Additionally, performance corrections for both temperature and elevation are automatically included in the selection calculations.

Calculate using customizable units of measure

Dimensional units can be customized to meet English or metric calculation requirements. It's not necessary to calculate conversion factors. When you input your initial set-up options you can set your default requirements, or

they can be changed on a job-to-job basis.

Comprehensive selections

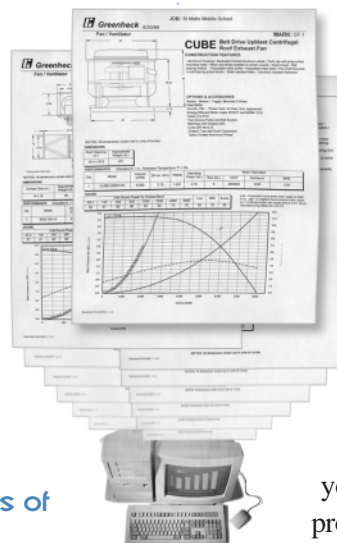
In WinCAPS, there is no behind-the-scenes, confusing selection logic that arbitrarily limits possible fan selections. It is not necessary to repeat selections or input different operating conditions to get to a specific size or model selection.

Easy information access

Once the potential selections have been displayed for a particular set of operating conditions, all remaining performance information is available immediately.

One-button detailed comparisons

Detailed fan curves for all potential fan selections can be viewed by highlighting a specific size in the drop-down box on the performance charts tab. This allows you to quickly select the proper fan based on the area of the desired fan curve.



Immediate configuration validation

Immediate validation of each configuration is displayed. If a configuration is not valid, a

WinCAPS - it's easier, faster, better, continued from page 10

message will be displayed. This eliminates any concern of specifying motors or model options and accessories that are incompatible, even for units destined for international applications.

Configuration assistance

Easy to understand drop-down lists make responses to option and accessory configurations simple and quick.

A quick wrap-up

Print out your submittals, equipment schedules and fan curves. You can e-mail your information to an associate or to your Greenheck representative.

It's easy to use

That's the word! In pre-release tests, groups of independent engineers found WinCAPS eminently



user-friendly, understandable and bug-free. On a 10 point scale, ratings averaged 8 ½ to 9, with no responses lower than 7. Your fellow engineers appreciated the program's load-and-go simplicity.

Additional programs

To get your own copy, contact us at www.greenheck.com or call your nearby Greenheck representative.

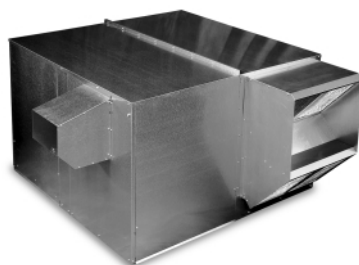


What's new at Greenheck



GK Series kitchen hoods

This new hood line incorporates high velocity cartridge filters that extract grease using centrifugal impingement technology. The new hood line provides an economical cartridge style hood that is available in both Canopy and Backshelf models. All models are constructed of 18 gauge 304 stainless steel, with a #4 finish. Straight exhaust and combination supply exhaust models are available. Supply options may include face supply, air curtain, combination face and air curtain supply or a short circuit. Each Greenheck hood is built in accordance with UL Standard 710, NFPA 96, NSF, SBCCI, BOCA, UMC and IMC.



Energy Recovery product additions

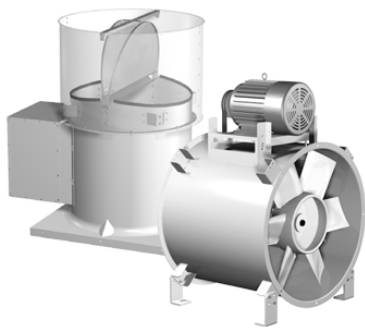
Several new options are now offered in Greenheck's Energy Recovery Ventilator product line. All sizes are now available with double wall construction, dirty filter sensor, exhaust side filters, 120 volt service receptacle, and internally mounted mesh filters. Sizes 361, 521, and 522 are also available with hinged access doors. Also, we have added more sizes of the model ERT - Energy Recovery with Cooling and Heating. The ERT-58 and ERT-64 are designed specifically to provide the best combination of performance and price in the 4,500 cfm to 6,500 cfm range.

What's new at Greenheck, continued from page 11



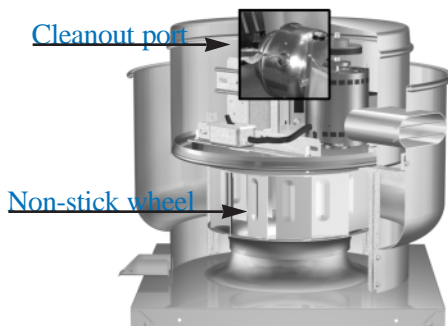
Acoustical Louvers available

Greenheck models AFJ, AFA and AFS, incorporate acoustically insulated blades to provide for sound attenuation to lower infiltrating or escaping noise. Available in 6", 8", and 12" frame depths with J, airfoil and sightproof blade styles. Standard construction material is aluminum; galvanized is available. All models are licensed to bear the AMCA seal and have been tested in accordance with ASTM test procedures to determine the Outdoor Indoor Transmission Class (OITC) and Sound Transmission Class (STC) ratings.



Two models added to tube axial line

Model TBI is a belt driven axial fan for ducted inline applications. Model TBIRU, which incorporates a curb cap, butterfly dampers and windband section, is used for roof mounted upblast installations. Both models are available with propeller diameters ranging from 24 to 54 inches and in two levels of construction to ensure the most efficient and economical unit is selected for the job. Capacities range from 4,800 to 76,000 cfm and up to 4 in. wg.



Series "C" product expansion

Greenheck's most recent addition is our CUBE-XP. This model has static pressure capabilities up to 5 in. wg, enabling you to specify the right product for the application. With the addition of the CUBE-XP, Greenheck's line of curb-mounted upblast exhaust fans offers the broadest performance range in the industry: CUBE up to 1-1/2 in. wg, CUBE-HP up to 2-1/2 in. wg, and CUBE-XP up to 5 in. wg. CUBE, CUBE-HP, and CUBE-XP are also available with Greenheck's patented clean-out port and non-stick wheel, making them not only the best performing fan in the industry but also the easiest of its type to clean and maintain.



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