



# AIRMaster<sup>+</sup>

## **COMPRESSED AIR SYSTEM ASSESSMENT AND ANALYSIS SOFTWARE**

A SOFTWARE PACKAGE TO HELP YOU MAXIMIZE THE EFFICIENCY AND PERFORMANCE OF YOUR COMPRESSED AIR SYSTEM(S) THROUGH IMPROVED OPERATIONS AND MAINTENANCE (O&M) PRACTICES.

For installation instructions, see “AIRMaster<sup>+</sup> User’s *Quick Start*,” which accompanies the AIRMaster<sup>+</sup> CD. The installation instructions are also included as “Readme.txt” on the AIRMaster<sup>+</sup> CD.

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AIRMaster<sup>+</sup> operates in a graphic environment called Microsoft Windows, created by Microsoft Corporation. To run AIRMaster<sup>+</sup> under Microsoft Windows, you need to license and install Microsoft Windows.

## **ORDERING INFORMATION**

Requests for copies of this software should be directed to:

AIRMaster<sup>+</sup>

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# Contents

<b>Contents</b> .....	<b>1</b>
<b>Introducing AIRMaster<sup>+</sup></b> .....	<b>5</b>
About AIRMaster <sup>+</sup> .....	6
Features .....	7
Overview .....	8
Software and Hardware Requirements .....	9
User Support .....	10
History .....	11
Development and Acknowledgments .....	12
<b>AIRMaster<sup>+</sup> Conventions</b> .....	<b>13</b>
Toolbar Buttons .....	14
Style Conventions .....	15
Operating Tips .....	16
Data Input Form Setup window .....	17
Report Setup window .....	22
<b>AIRMaster<sup>+</sup> Navigation</b> .....	<b>25</b>
Main Menu .....	26
Menu Bar Commands .....	32
Main Menu window .....	32
<i>Inventory menu</i> .....	32
<i>System Enhancements menu</i> .....	32
<i>Calculators menu</i> .....	33
<i>Help menu</i> .....	33
Program windows .....	33
<i>File menu</i> .....	33
<i>Calculators menu</i> .....	34
<i>Help menu</i> .....	34
How to Use The Online Help .....	35
To Open the Help System .....	35
Moving Around in Help .....	35
<b>Company module</b> .....	<b>37</b>
Company window .....	38
Company report .....	44
<b>Utility module</b> .....	<b>46</b>
Utility window .....	47
Utility Rate Schedules window .....	50
Utility/Rate Schedule report .....	53
<b>Facility module</b> .....	<b>56</b>
Facility window .....	57

Facility Information tab .....	60
Compressor Summary tab .....	62
Facility report .....	64
<b>System module .....</b>	<b>66</b>
System window .....	67
System Data tab .....	71
Sequencer Data tab .....	73
Daytypes tab .....	75
End Uses tab .....	77
Air Systems report .....	79
<b>Compressor module .....</b>	<b>82</b>
Compressor Inventory window .....	83
Nameplate tab .....	89
Controls tab .....	90
Performance tab .....	92
Totals tab .....	95
Performance Profile graph .....	97
Compressor Inventory Query window .....	99
Compressor Inventory Detail window .....	103
General Data tab .....	106
Drive Motor tab .....	108
Fan Motor tab .....	110
Other Data tab .....	112
Compressor Inventory report .....	115
<b>Profile module .....</b>	<b>120</b>
System Profiles window .....	121
Data Entry tab .....	125
Profile Summary tab .....	127
Totals tab .....	129
System Order graph .....	131
System Profile Data graph .....	133
System Profile report .....	135
<b>Efficiency Measures module .....</b>	<b>138</b>
Energy Efficiency Measures window .....	140
Data Entry tab .....	144
Savings Summary tab .....	146
Reduce Air Leaks window .....	148
Improve End Use Efficiency window .....	152
Profile Draw graph .....	158
Reduce System Air Pressure window .....	161
Use Unloading Controls window .....	165
Adjust Cascading Set Points window .....	170
Use Automatic Sequencer window .....	174
General Data tab .....	178
Hourly Data tab .....	179
Reduce Run Time window .....	181
Add Primary Receiver Volume window .....	186

Performance Comparison graph.....	190
EEM Results window.....	192
Profile Summary tab .....	195
Totals tab .....	197
EEM Savings Scenario graph.....	199
Energy Efficiency Measure Parameters report.....	201
<b>Maintenance module .....</b>	<b>204</b>
Maintenance window .....	205
Maintenance History window .....	209
Maintenance report .....	213
<b>Catalog module.....</b>	<b>216</b>
Compressor Catalog window .....	217
Compressor Catalog Detail window .....	222
General Data tab .....	225
Drive Motor tab .....	227
Fan Motor tab.....	229
Other Data tab.....	231
Catalog report.....	234
<b>Life Cycle module .....</b>	<b>238</b>
Life Cycle Analysis window .....	239
Life Cycle Analysis Results window .....	245
Life Cycle Analysis report .....	248
Escalation Rates window .....	251
Escalation Rate Table report .....	255
<b>Calculators .....</b>	<b>258</b>
SCFM-ACFM Conversion Calculator window.....	259
Air Storage Capacity Calculator window.....	262
Altitude Correction and Re-rate Calculator window.....	265
Cycle Time Calculator window .....	268
Power Calculator window .....	271
<b>Data Input Forms: Inventory.....</b>	<b>274</b>
<b>Data Input Forms: System Enhancements .....</b>	<b>288</b>
<b>Artificial Demand .....</b>	<b>297</b>
<b>Pipe Size and Flow .....</b>	<b>298</b>
<b>Variable Speed Drives.....</b>	<b>299</b>
<b>Pressure/Flow Controllers.....</b>	<b>300</b>
<b>Glossary of Terms .....</b>	<b>302</b>
<b>Index .....</b>	<b>324</b>





## Chapter 1

# Introducing AIRMaster<sup>+</sup>

Welcome to AIRMaster<sup>+</sup>, a compressed air systems assessment and analysis tool.

◆ <b>About AIRMaster<sup>+</sup></b>	<b>p. 6</b>
◆ <b>Features</b>	<b>p. 7</b>
◆ <b>Overview</b>	<b>p. 8</b>
◆ <b>Software and Hardware Requirements</b>	<b>p. 9</b>
◆ <b>User Support</b>	<b>p. 10</b>
◆ <b>History</b>	<b>p. 11</b>
◆ <b>Development and Acknowledgments</b>	<b>p. 12</b>

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## About AIRMaster<sup>+</sup>

AIRMaster<sup>+</sup> is a Windows-based software tool used to analyze industrial compressed air systems. AIRMaster<sup>+</sup> is intended to enable auditors to model existing and future improved system operation, and evaluate savings from energy efficiency measures with relatively short payback periods. AIRMaster<sup>+</sup> provides a systematic approach to assessing compressed air systems, analyzing collected data, and reporting results. Users include companies or distributors of compressed air equipment, compressor system auditors, industrial plant personnel, and utility representatives.

AIRMaster<sup>+</sup> is but one tool in a large portfolio of Compressed Air Challenge offerings designed to assist the end user in improving the performance of compressed air systems. AIRMaster<sup>+</sup> allows for objective and repeatable compressed air system assessment results, and can be used to improve the performance and efficiency of operation. However, AIRMaster<sup>+</sup> is not meant to replace an experienced auditor in the evaluation of a compressed air system. AIRMaster<sup>+</sup> is intended to model airflow and associated electrical demands as seen by the supply side of the system. AIRMaster<sup>+</sup> does not model the dynamic effects of the distribution and end uses. Such issues should be addressed through consultation with an experienced auditor before implementing efficiency recommendations.

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# Features

AIRMaster<sup>+</sup> is a **stand-alone** Windows-based application that allows you to:

- manage multiple facilities and compressed air systems
- maintain two databases of air compressors (1-3500 hp): actual in-plant inventory air compressors, and generic or industry standard air compressors
- simulate existing and modified compressed air system operation
- model part load system operation for an unlimited number of interconnected rotary screw (multiple-stage lubricant-free or lubricant-injected), reciprocating and centrifugal air compressors operating simultaneously with independent control strategies and operating schedules
- enter and assign seasonal electrical utility energy and demand charge schedules
- enter 24-hour metered airflow or power data load profiles for each compressor and any number of daytypes, and then calculate electrical operating costs
- evaluate air system energy savings potential from up to eight of the following Energy Efficiency Measures, considering interactive effects of EEMs:
  - ◆ Reduce Air Leaks
  - ◆ Improve End Use Efficiency
  - ◆ Reduce System Air Pressure
  - ◆ Use Unloading Controls
  - ◆ Adjust Cascading Set Points
  - ◆ Use Automatic Sequencer
  - ◆ Reduce Run Time
  - ◆ Add Primary Receiver Volume
- manage end use loads and pressures
- calculate the following: cycle times, system air storage capacity, actual required airflow for a known airflow at standard conditions related for measured conditions, conversion from airflow values in scfm to acfm, and vice versa
- track maintenance histories of various facility, system, and compressor components
- calculate life cycle costs
- generate enhanced graphics and reports

---

## Overview

The basic steps of AIRMaster<sup>+</sup> follow the first seven modules in the order they appear on the Main Menu.

First enter information describing existing inventory and function:

1. your **Company**;
2. the **Utility** companies that provide power to your sites, and their electricity rate schedules;
3. your company **Facility**(ies) or sites;
4. compressed air **System**(s) on site;
5. air **Compressor**(s) in each system; and
6. airflow or power **Profiles** for each system.

Then define proposed system enhancements:

7. Energy **Efficiency Measures** that apply to a compressed air system. View the calculated energy, airflow, and dollar savings.

Additional features:

- Enter, sort, and view **Maintenance** records, including maintenance actions that are due or overdue.
- Use the **Catalog** of air compressors (originally generic listings) to easily view compressors that you can analyze as replacement compressors.
- Use the **Life Cycle** module to run a financial analysis for a project or equipment at any time.

---

## Software and Hardware Requirements

The AIRMaster+ program and data require a personal computer with the following minimum system configuration:

- Microsoft Windows operating system version 95 or later
- Pentium-based microprocessor (Pentium 133 minimum)
- 32 megabytes (MB) of RAM (64 MB recommended)
- CD-ROM drive
- 20 MB of free hard disk space
- VGA graphics (800x600 resolution recommended) with 256 colors or better
- Use small font settings

To change the computer's graphics setting, first open the Control Panel (see Start/Settings/Control Panel). Open the Display Options and select the Settings tab. Adjust Colors and Screen Area settings. To verify use of small fonts, click the Advanced button, select the General tab, and check Font Size. Change Font Size to Small Fonts if necessary. AIRMaster+ requires use of small fonts in order to properly display text and graphics within the software.

For installation instructions, see "AIRMaster+ Setup." This is a one-page document accompanying the AIRMaster+ CD, and is also included as "Readme.txt" on the AIRMaster+ CD.

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## User Support

**Technical assistance** for AIRMaster+ is available through the USDOE-funded Industrial Technologies Program (ITP) Information Center hotline. Call the Information Center at **1-877-337-3463** between the hours of 6 A.M. and 5 P.M. PST.

**For more information** on AIRMaster+, contact:

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Email: [airmaster@energy.wsu.edu](mailto:airmaster@energy.wsu.edu)  
URL: <http://www.energy.wsu.edu/org/airmaster>

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## History

In the fall of 1993, the Bonneville Power Administration (BPA) set out to develop a compressed air system assessment tool. Funds provided by the DOE were forwarded to Oregon State University (OSU) for the project. Greg Wheeler, director of the Industrial Assessment Center at OSU, and two graduate students (Eric Bessey and Rick McGill), took on the project.

The project purpose was to develop a software tool, AIRMaster, and a methodology for general auditors or plant personnel to evaluate compressed air system operation with simple instrumentation during a short-term assessment. They conducted field assessments to refine the methodology and assess savings potential from six common Operation and Maintenance (O&M) measures. The focus was on O&M measures because these measures typically have low capital costs, quick paybacks, and low risks.

AIRMaster was developed under the guidance of an appointed Technical Advisory Committee. The committee was comprised of professionals from compressor manufacturers, energy utilities, auditors, and energy resource centers. The software was tested by conducting assessments of compressed air systems in nine industrial facilities. Implementing AIRMaster recommendations would reduce compressed air energy use by 49.2% and yield a simple payback of 0.8 years. The first version of AIRMaster was made available in 1997.

**Washington State University Energy Program was contracted in 1999 to develop AIRMaster<sup>+</sup>, a stand-alone Windows-based enhancement of the original AIRMaster software.**

---

## Development and Acknowledgments

The U.S. Department of Energy (USDOE) Office of Industrial Technologies provided funds for the development of AIRMaster<sup>+</sup>. Appreciation is extended to Paul Scheihing and Chris Cockrill of USDOE and Mitchell Olszewski of Oak Ridge National Laboratory for supporting this work.

Many individuals contributed towards making AIRMaster<sup>+</sup> a useful industrial compressed air systems assessment tool. Comments and suggestions were made by air compressor manufacturers and distributors, compressed air system auditors, utility representatives, and representatives of industry at Compressed Air Challenge (CAC) program-hosted review and focus group meetings. AIRMaster<sup>+</sup> was beta-tested by CAC and a nationwide group of potential users.

### Principal Developers

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### Acknowledgments

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## Chapter 2

# AIRMaster+ Conventions








This chapter provides information about conventions used throughout AIRMaster+.

- ◆ **Toolbar Buttons** p. 14
- ◆ **Style Conventions** p. 15
- ◆ **Operating Tips** p. 16
- ◆ **Data Input Form Setup window** p. 17
- ◆ **Report Setup window** p. 22

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## Toolbar Buttons

The windows in AIRMaster<sup>+</sup> typically contain a button toolbar at the top. The button toolbar usually contains all the buttons listed below. (Any additional buttons on each window are described in the documentation for that window.) The toolbar buttons access the following basic functions:

	<b>Add</b>	Switch the current window into Add mode, where you can create a new record in cleared fields.
	<b>Edit</b>	Switch the current window into Edit mode, so you can make changes to the currently displayed data.
	<b>Save</b>	Save the displayed information after you have edited it.
	<b>Delete</b>	Delete the currently displayed record.
	<b>Print</b>	Open the Report Setup window to choose which report to print.
	<b>Help</b>	Display Windows-style, context-sensitive Help.
	<b>Close or Cancel</b>	In Edit or Add modes, this button appears as a Cancel button; cancel Edit or Add mode and return data to its previous values. (If any changes have been made, you must verify the Cancel command.) In View mode, this button appears as a Close button; exit the window.

The availability of toolbar buttons depends on the mode of the window. AIRMaster<sup>+</sup> windows can appear in the following modes:

**View mode:** Allows you to review information and select from enabled options. Add, Edit, Delete, Print, Help, and Close buttons are available.

**Add mode:** Allows you to add a record. Save, Help, and Cancel buttons are available.

**Edit mode:** Allows you to change information. Save, Help, and Cancel buttons are available.

---

## Style Conventions

AIRMaster+ follows all regular Windows conventions. In addition, the following style conventions are used in the AIRMaster+ program, Help system, and/or User's Manual as noted:

- In the program, a yellow field background indicates a read-only field that is never editable; a gray field background indicates a read-only field that will become editable if you enter Edit mode; and white field background indicates an editable field.
- In most windows of the program, the Windows Close button ("X" in the top right corner of each window) differs slightly from the AIRMaster+ Close button ("Close"). In Edit mode, "X" functions as "Cancel" plus "Close."
- In the User's Manual and Help, button names are **bold**.
- In the Help, links are in underlined green type.

---

## Operating Tips

When you are using AIRMaster+, remember the following:

- You can enter text in either upper or lower case.
- Some fields with drop-down lists allow you to either select from the list or type your own entry into the field; but usually you can only select from the drop-down list.
- You can drag a window to better view another window underneath; however, the top window is the active window and it must be closed to activate the window underneath. To drag a window, click on the title bar across the top of the window, hold, and drag.
- Do not divide by 100 when entering percentage values (example: 74.3% must be entered 74.3, not .743).
- Some actions may take several seconds because they invoke multiple calculations, often affecting other windows and modules.

---

# Data Input Form Setup window

**Navigation:** *System Enhancements menu / Print Data Input Forms command*

**Data Input Form Setup**

**Select Data Input Form**

- Company/Facility
- Utility Rates
- System
- End Uses
- Compressor
- Compressor Details
- Profile Order
- Profile Measurement Data
- EEM: Reduce Air Leaks
- EEM: Improve End Use Efficiency
- EEM: Reduce System Air Pressure
- EEM: Use Unloading Controls
- EEM: Adjust Cascading Set Points
- EEM: Use Automatic Sequencer
- EEM: Reduce Run Time
- EEM: Add Primary Receiver Volume

**Input Form Title Setup**

Title 1: Data Input Form

Title 2: Company/Facility

Preview Close

*Data Input Form Setup window*

## Purpose

Use the Data Input Form Setup window to select a data input form, edit the form title, then preview and print the data input form. Data input forms allow you to record the information you must gather to input into AIRMaster<sup>+</sup>.

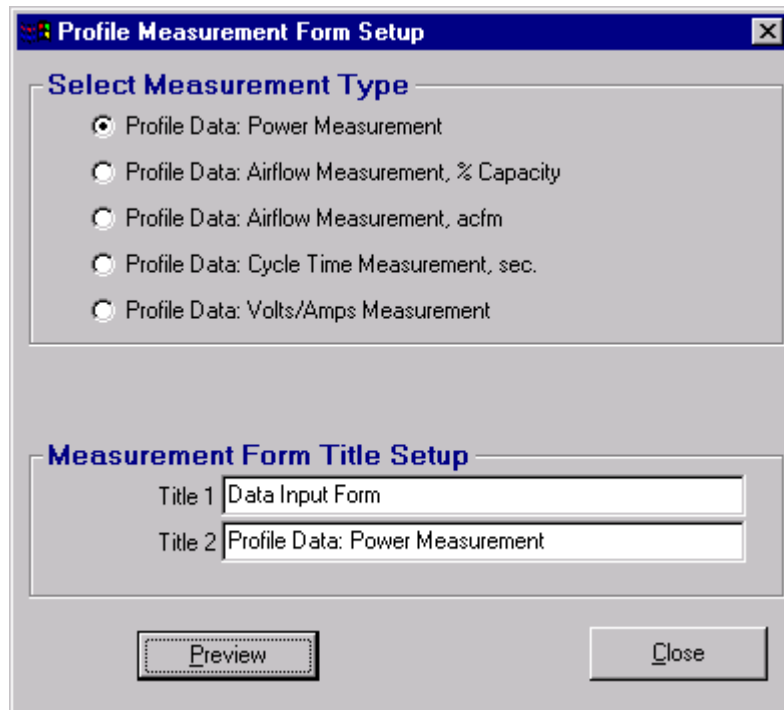
## Description

The Data Input Form Setup window contains two sections. Use the Select Data Input Form section to select the form to view or print. Use the Input Form Title Setup section to edit the title of the form.

## **Procedures for Selecting, Previewing, and Printing a Data Input Form**

### **To select and preview a data input form**

1. On the Main Menu window, System Enhancements menu, click **Print Data Input Forms** to open the Data Input Form Setup window.
2. In the Select Data Input Form section, select the form you would like to preview and/or print. If you select Profile Measurement Data, the Profile Measurement Form Setup window opens; select *one* of the five profile measurement data input forms (Power, % Capacity Airflow, acfm Airflow, Cycle Time, or Volts/Amps), depending on which profile data you measure for the System Profiles window:



The screenshot shows a dialog box titled "Profile Measurement Form Setup". It has a blue title bar with a close button (X) in the top right corner. The dialog is divided into two main sections. The first section, "Select Measurement Type", contains five radio button options: "Profile Data: Power Measurement" (which is selected), "Profile Data: Airflow Measurement, % Capacity", "Profile Data: Airflow Measurement, acfm", "Profile Data: Cycle Time Measurement, sec.", and "Profile Data: Volts/Amps Measurement". The second section, "Measurement Form Title Setup", contains two text input fields. The first field, labeled "Title 1", contains the text "Data Input Form". The second field, labeled "Title 2", contains the text "Profile Data: Power Measurement". At the bottom of the dialog, there are two buttons: "Preview" and "Close".

3. In the Input (or Measurement) Form Title Setup section, edit the two lines of the report title.
4. Click **Preview** to view the data input form on the screen:

Preview Form

Page: 1 | 100 | Print | Close

**Data Input Form** AIRMaster+

**Company/Facility**

**Company**

Name : \_\_\_\_\_ Facility 1

Industry Type : \_\_\_\_\_ Facility : \_\_\_\_\_

SIC Description : \_\_\_\_\_ Address 1 : \_\_\_\_\_

Address 1 : \_\_\_\_\_ Address 2 : \_\_\_\_\_

Address 2 : \_\_\_\_\_ City : \_\_\_\_\_

City : \_\_\_\_\_ State/Zip : \_\_\_\_\_

State/Zip : \_\_\_\_\_ Contact : \_\_\_\_\_

Contact : \_\_\_\_\_ Phone : \_\_\_\_\_

Phone : \_\_\_\_\_ Total Annual Energy Use, kWh : \_\_\_\_\_

**Facility 2**

Facility : \_\_\_\_\_

Address 1 : \_\_\_\_\_

Address 2 : \_\_\_\_\_

City : \_\_\_\_\_

State/Zip : \_\_\_\_\_

Contact : \_\_\_\_\_

Phone : \_\_\_\_\_

Total Annual Energy Use, kWh : \_\_\_\_\_

**Facility 3**

Facility : \_\_\_\_\_

Address 1 : \_\_\_\_\_

Address 2 : \_\_\_\_\_

City : \_\_\_\_\_

State/Zip : \_\_\_\_\_

Contact : \_\_\_\_\_

Phone : \_\_\_\_\_

Total Annual Energy Use, kWh : \_\_\_\_\_

Page 1/1 | Portrait | Letter, 8 1/2 x 11 in

5. Click the **Page** “arrow” buttons to browse through pages of the preview form. Click the **Zoom** buttons to zoom in or out on the form.
6. If you do not want to print the data input form, click **Close** in the preview form and **Close** in the Data Input Form Setup window.

### To print a data input form

1. Follow steps #1-5 above to select and preview a data input form.
2. Click **Print** to print the preview form.
3. Click **Close** in the preview form, and **Close** in the Data Input Form Setup window.

## Field Definitions

### *Select Data Input Form*

#### **Company/Facility**

Use this data input form to record information you will enter into the Company window and the Facility window’s Facility Information tab, Facility Data section.

Also use this form to select English or metric units and to specify the currency name and symbol that will appear on all AirMaster+ forms and reports.

**Utility Rates**

Use this data input form to record information you will enter into the Utility and Utility Rates windows.

**System**

Use this data input form to record information you will enter into the first three tabs of the System window.

**End Uses**

Use this data input form to record information you will enter into the End Uses tab of the System window.

**Compressor**

Use this data input form to record information you will enter into the first three tabs of the Compressor Inventory window.

**Compressor Details**

Use this data input form to record information you will enter into the four tabs of the Compressor Inventory Detail window.

**Profile Order**

Use this data input form to record information you will enter into the System Profiles window's Data Entry tab, regarding compressor order.

**Profile Measurement Data**

This option opens the Profile Measurement Form Setup window, where you select a profile measurement data input form, edit the form title, then preview and print the data input form. You only need to select *one* of the five profile measurement data input forms (Power, % Capacity Airflow, acfm Airflow, Cycle Time, or Volts/Amps), depending on which profile data you measure and record to enter into the System Profiles window's Data Entry tab, Profile Data section.

**EEM Reduce Air Leaks**

Use this data input form to record information you will enter into the Reduce Air Leaks window.

**EEM Improve End Use Efficiency**

Use this data input form to record information you will enter into the Improve End Use Efficiency window.

**EEM Reduce System Air Pressure**

Use this data input form to record information you will enter into the Reduce System Air Pressure window.

**EEM Use Unloading Controls**

Use this data input form to record information you will enter into the Use Unloading Controls window.

**EEM Adjust Cascading Set Points**

Use this data input form to record information you will enter into the Adjust Cascading Set Points window.

**EEM Use Automatic Sequencer**

Use this data input form to record information you will enter into both tabs of the Use Automatic Sequencer window.



**EEM Reduce Run Time**

Use this data input form to record information you will enter into the Reduce Run Time window.

**EEM Add Primary Receiver Volume**

Use this data input form to record information you will enter into the Add Primary Receiver Volume window.

***Input Form Title Setup*****Title 1**

The first line of the data input form title, as it will appear at the top of the form.

**Title 2**

The second line of the data input form title, as it will appear at the top of the form.

**Buttons**

---

**Preview**

Click to view the data input form onscreen. You can print the form from this onscreen preview.

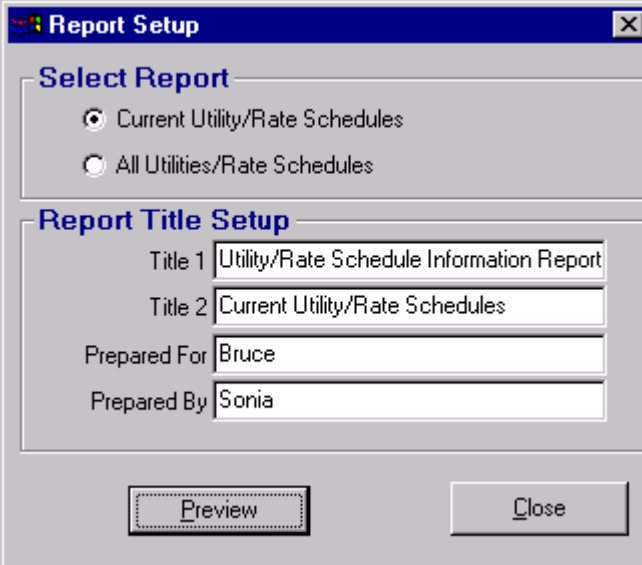
**Close**

Click to close the Data Input Form Setup window.

---

## Report Setup window

**Navigation:** *[Most windows] / Print button*



The screenshot shows a window titled "Report Setup" with a close button in the top right corner. The window is divided into two main sections. The first section, "Select Report", contains two radio buttons: "Current Utility/Rate Schedules" (which is selected) and "All Utilities/Rate Schedules". The second section, "Report Title Setup", contains four text input fields: "Title 1" with the text "Utility/Rate Schedule Information Report", "Title 2" with "Current Utility/Rate Schedules", "Prepared For" with "Bruce", and "Prepared By" with "Sonia". At the bottom of the window, there are two buttons: "Preview" and "Close".

*Report Setup window*

### Purpose

Use the Report Setup window to select a report, edit the report title, then preview and print the report. This window is accessed through the **Print** button on the toolbar of most windows. The reports available depend on the module through which the Report Setup window is accessed.

### Description

The Report Setup window contains two sections. Use the Select Report section to select a report to print from the reports available in the module. Use the Report Title Setup section to edit the title of the report, and the names of the report recipient and author.

### ***Procedures for Selecting, Previewing, and Printing a Report***

#### **To select and preview a report**

1. Report options depend on the module from which the Report Setup window is accessed. Open the Report Setup window by clicking **Print** in any window in the module of interest.
2. In the Select Report section, select the report you would like to preview and/or print. (In modules with only one available report, this section will not appear.)

3. In the Report Title Setup section, edit the two lines of the report title, and the recipient and author of the report.
4. Click **Preview** to view the Preview Report on the screen:

The screenshot shows a 'Preview Report' window with a toolbar at the top containing 'Page', '1', navigation arrows, '100', zoom icons, 'Print', and 'Close'. The report content is as follows:

Utility/Rate Schedule Information Report		AIRMaster+
For: Bruce	<b>Current Utility/Rate Schedules</b>	May 30, 2000
By: Sonia		Page 1 of 1
<b>Utility Name : ABC Light &amp; Power</b>		
Utility Code :		
Address 1 : 746 Coulomb Blvd.		
Address 2 :		
City, State, Zip : Beertown, OR 97420		
Contact : Nancy Smith		
Phone : (503) 555-8888		
commercial schedule	Season 1	Season 2
Start Month/Day	04/01	10/01
Demand Rate, \$/kW-mo	3.85	4.35
Energy   Block 1	0.03800	0.04300
Rate,   Block 2	0.03600	0.04100
\$/kWh   Block 3	0.03200	0.03900

At the bottom of the window, there is a status bar with 'Page 1/1', 'Portrait', and 'Letter, 8 1/2 x 11 in'.

5. Click the **Page** “arrow” buttons to browse through pages of the report. Click the **Zoom** buttons to zoom in or out on the report.
6. If you do not want to print the report, click **Close** in the Preview Report and **Close** in the Report Setup window.

### To print a report

1. Follow steps #1-5 above to select and preview a report.
2. Click **Print** to print the preview report.
3. Click **Close** in the Preview Report, and **Close** in the Report Setup window.

## Field Definitions

---

### *Select Report*

**[Reports]**

Select the report you would like to print, from the list of reports available in the module.

***Report Title Setup*****Title 1**

The first line of the report title, as it will appear at the top of the report.

**Title 2**

The second line of the report title, as it will appear at the top of the report.

**Prepared For**

The name of the recipient of the report, as it will appear at the top of the report.

**Prepared By**

The name of the author of the report, as it will appear at the top of the report.

**Buttons**

---

**Preview**

Click to view the report onscreen. You can print the report from this onscreen preview.

**Close**

Click to close the Report Setup window.

## Chapter 3

# AIRMaster<sup>+</sup> Navigation

This chapter provides information about navigating through the AIRMaster<sup>+</sup> program and Help system.

- ◆ **Main Menu** **p. 26**
- ◆ **AIRMaster<sup>+</sup> Modules** **p. 26**
- ◆ **Menu Bar Commands** **p. 28**
- ◆ **How To Use the Online Help** **p. 35**

---

# Main Menu

The AIRMaster<sup>+</sup> Main Menu, on the opening screen of the program, provides access to each of the program's modules. You can access each module through the menu bar (across the top of the window) or the module buttons. The status bar at the bottom of the Main Menu displays the selected company name, company database location, AIRMaster<sup>+</sup> version number, current date, and time.



## Company

Enter or view company information and company databases.

## Utility

Enter or view utility company data or rate schedules.

## Facility

Enter or view facility (site) data, facility utility rate assignment, and a summary of the air compressors on site for the selected company. Each facility may contain one or more compressed air systems.

## System

Enter or view system-level information, including design and performance parameters, automatic sequencer control pressure set points, daytypes, and end uses. Each system consists of one or more air compressors.

**Compressor**

Enter or view in-plant air compressor information, including detailed specifications, or search for inventory air compressors that meet specified criteria.

**Profile**

Enter hourly average airflow or power information and operating schedules to calculate system baseline airflow requirements and associated energy and demand costs for the selected system and daytype.

**Efficiency Measures**

Select efficiency measure(s), and apply them to a compressed air system. Proposed energy, airflow, and dollar savings may be viewed for each efficiency measure.

**Maintenance**

Enter, sort, and view maintenance records. Records contain maintenance activities, schedules, and costs.

**Catalog**

View information for generic air compressors of various ratings, or edit user-entered compressors. You can build your catalog listings by adding information to represent your inventory air compressors.

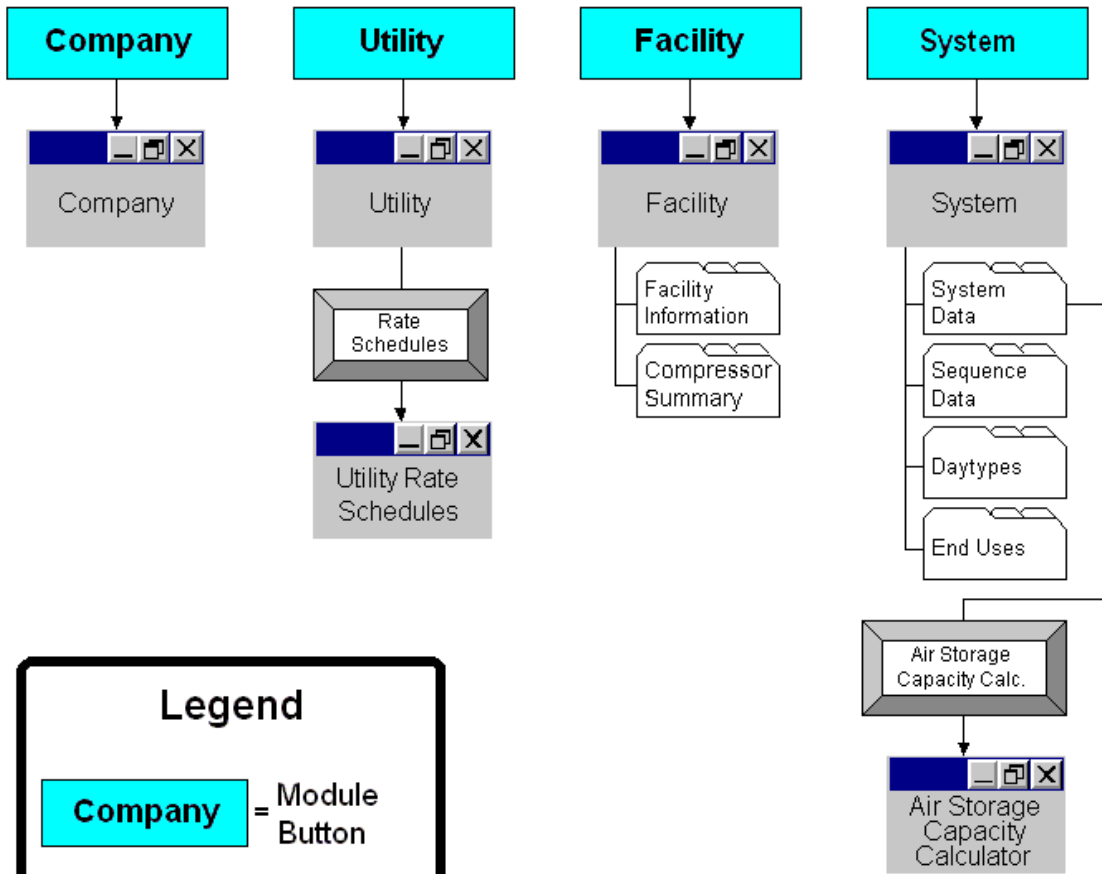
**Life Cycle**

Enter life cycle analysis setup information, and view financial calculations for a project or equipment, such as after-tax return-on-investment, net present value, and benefit-to-cost ratio.

**Print Data Input Forms**

Select a data input form, edit the form title, then preview and print the data input form. Data input forms allow you to record the information you must gather to input into AIRMaster<sup>+</sup>.

# AIRMaster+ Modules



### Legend

- Company** = Module Button
- \_ □ ×

 **Company** = Window
- Facility Information

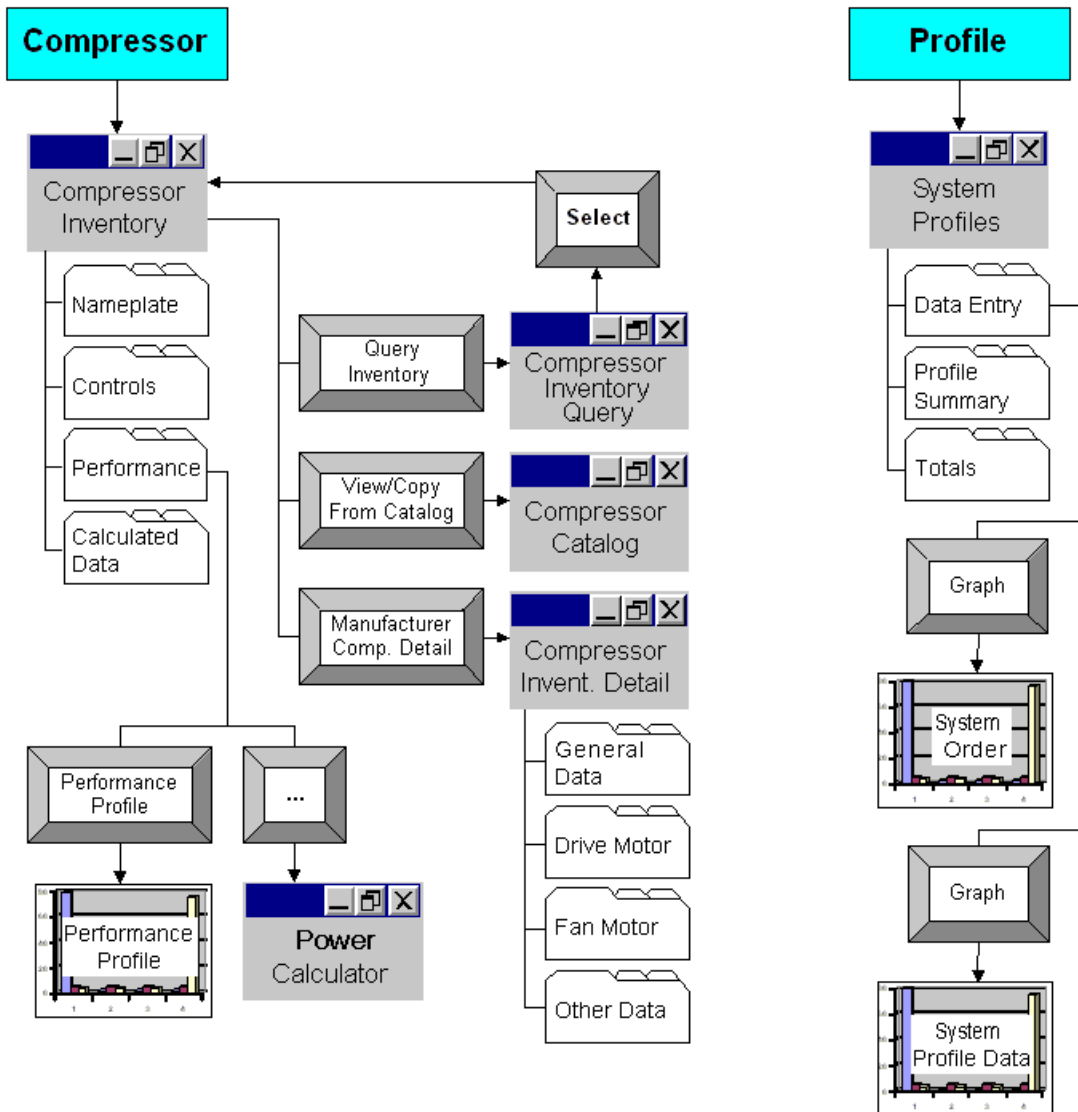
 = Window Tab
- Rate Schedules

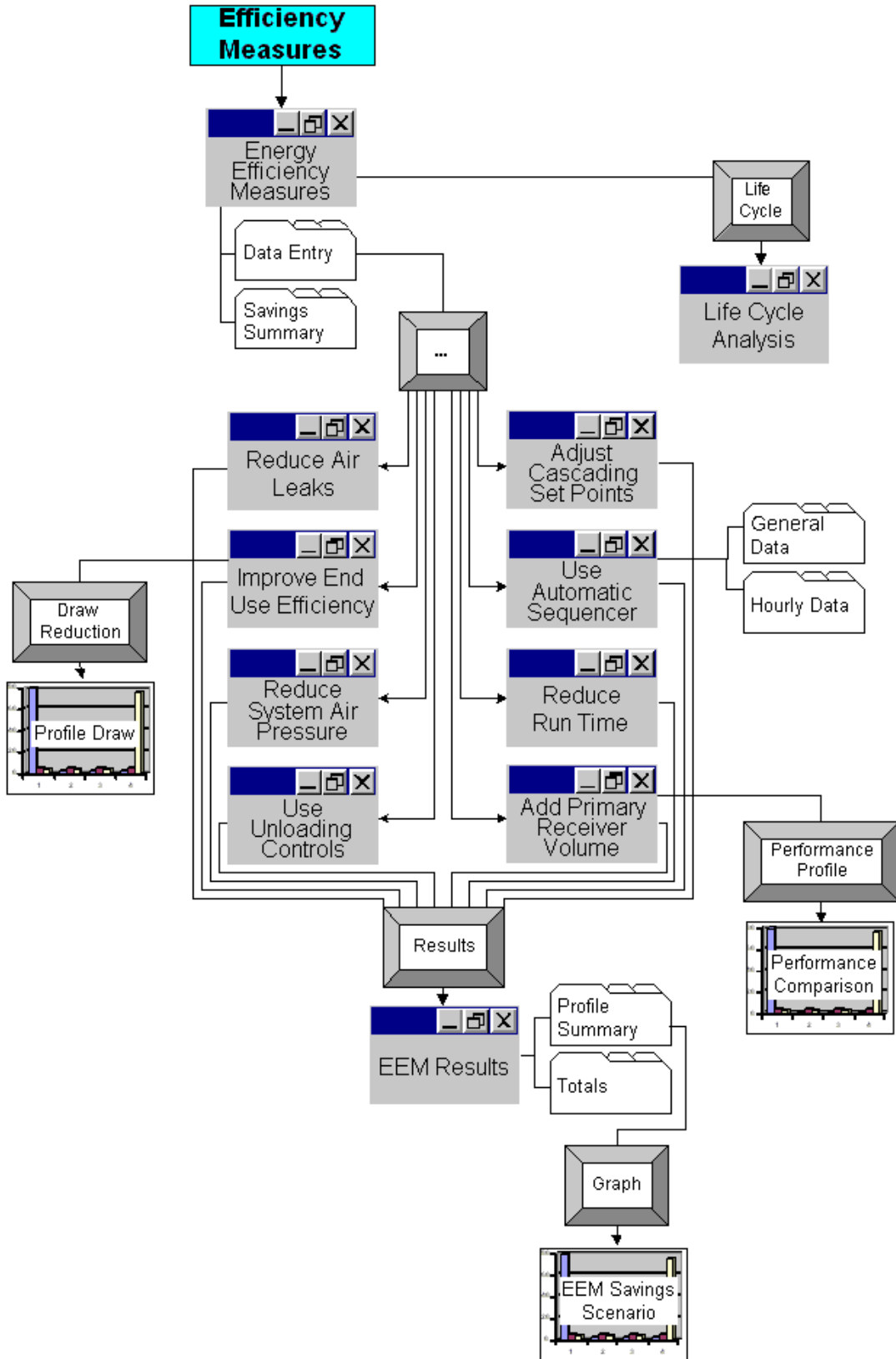
 = Button
- Performance Profile

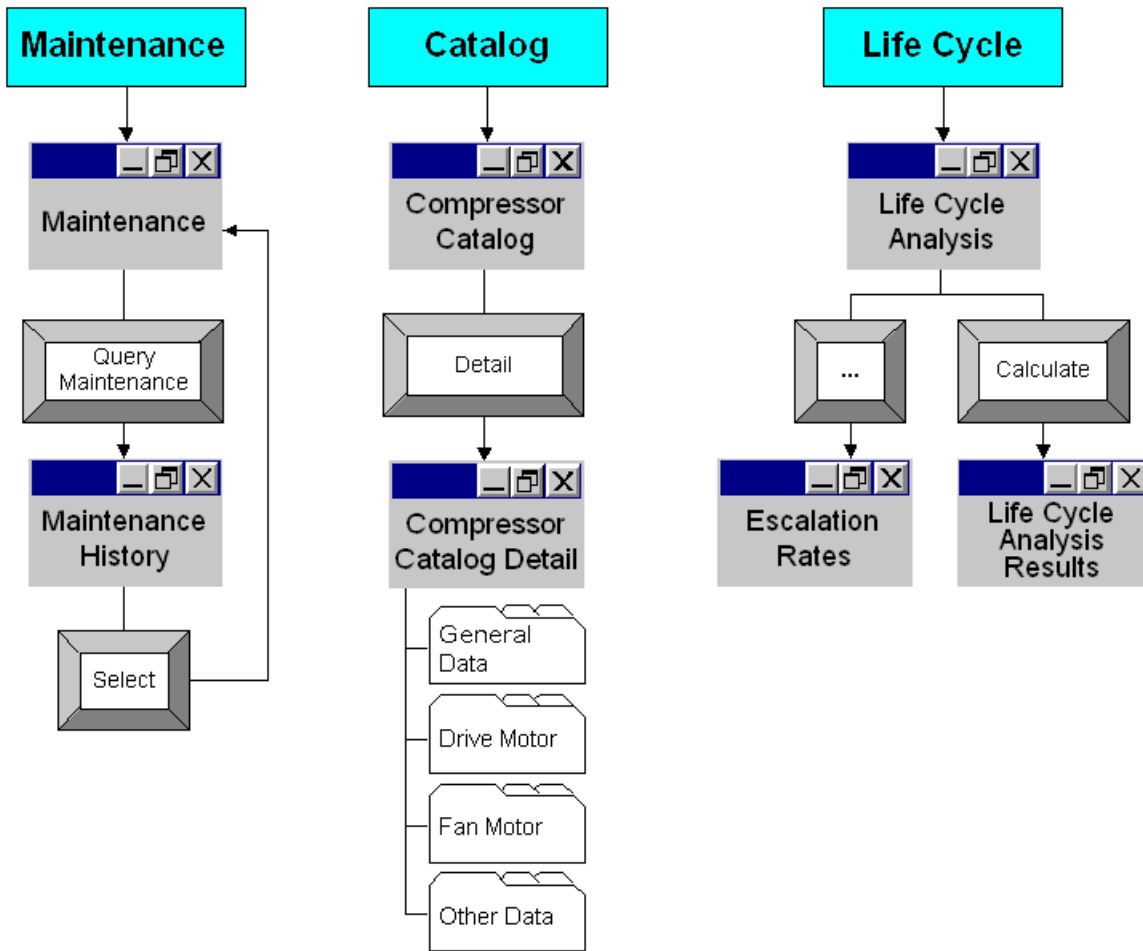
 = Graph

Note: Most windows also have a Print button that generates module-specific reports.









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## Menu Bar Commands

The Menu Bar at the top of the main menu differs from the menu bar at the top of most windows in the program. This allows you to access each module from the main menu by either key stroke or mouse click, and allows you to access “File” functions from the program windows by either key stroke or mouse click. The Calculators menu is available in the main menu window *and* program windows.

Following are the menus, commands and shortcut keys, and command results; for the *main menu window* and then the rest of the *program windows*. (Note that the single shortcut keys may be preceded by SHIFT; for example, you can open the Company Database window by pressing ALT+I, SHIFT+C.)

### Main Menu window

#### ***Inventory menu***

<b>Company Database</b> Opens Company window	(ALT+I, C)
<b>Utility Service Information</b> Opens Utility window	(ALT+I, U)
<b>Facility</b> Opens Facility window	(ALT+I, F)
<b>System</b> Opens System window	(ALT+I, S)
<b>Compressor</b> Opens Compressor Inventory window	(ALT+I, O)
<b>Profile</b> Opens System Profiles window	(ALT+I, P)
<b>Exit</b> Closes the AIRMaster <sup>+</sup> program	(ALT+I, X) or (CTRL+X)

#### ***System Enhancements menu***

<b>Efficiency Measures</b> Opens Energy Efficiency Measures window	(ALT+S, E)
<b>Maintenance</b> Opens Maintenance window	(ALT+S, M)
<b>Catalog</b> Opens Compressor Catalog window	(ALT+S, C)
<b>Life Cycle</b> Opens Life Cycle Analysis window	(ALT+S, L)

**Print Data Input Forms** (ALT+S, P)  
Opens Data Input Form Setup window

## ***Calculators menu***

**SCFM-ACFM Conversion** (ALT+C, S)  
Opens SCFM-ACFM Conversion Calculator window

**Air Storage Capacity** (ALT+C, A)  
Opens Air Storage Capacity Calculator window

**Altitude Correction** (ALT+C, L)  
Opens Altitude Correction and Re-rate Calculator window

**Cycle Time** (ALT+C, C)  
Opens Cycle Time Calculator window

## ***Help menu***

**Contents** (ALT+H, C)  
Opens AIRMaster<sup>+</sup> Help to the Contents tab (the Help system table of contents).

**Browse** (ALT+H, B)  
Opens the Help system to the first topic, “Welcome.” From there you can browse topics.

**About AIRMaster<sup>+</sup>** (ALT+H, A)  
Opens the About screen for this program, which contains general information about the program and version number.

Most windows in AIRMaster<sup>+</sup> contain a menu bar at the top left (the Compressor Inventory Query window, Maintenance History window, Compressor Catalog window, and Life Cycle windows do not). The menus, commands and shortcut keys, and command results are listed below:

## **Program windows**

### ***File menu***

**Add** (ALT+F, A) or (CTRL+A)  
Switch into Add mode, where you can create a new record in cleared fields.

**Edit** (ALT+F, E) or (CTRL+E)  
Switch the current window into Edit mode, so you can make changes to the currently displayed data.

**Save** (ALT+F, S) or (CTRL+S)  
Save the displayed information after you have edited it.

**Delete** (ALT+F, D) or (CTRL+D)  
Delete the currently displayed record.

**Print** (ALT+F, P) or (CTRL+P)  
Open the Report Setup window to choose which report to print.

**Close** (ALT+F, C) or (CTRL+X)  
Close the window.

### ***Calculators menu***

**SCFM-ACFM Conversion** (ALT+A, S)  
Opens SCFM-ACFM Conversion Calculator window

**Air Storage Capacity** (ALT+A, A)  
Opens Air Storage Capacity Calculator window

**Altitude Correction** (ALT+A, L)  
Opens Altitude Correction and Re-rate Calculator window

**Cycle Time** (ALT+A, C)  
Opens Cycle Time Calculator window

### ***Help menu***

**Contents** (ALT+H, C)  
Opens AIRMaster<sup>+</sup> Help to the Contents tab (the Help system table of contents).

**Browse** (ALT+H, B)  
Opens the Help system to the first topic, Welcome. From there you can browse topics.

**About AIRMaster<sup>+</sup>** (ALT+H, A)  
Opens the About screen for this program, which contains general information about the program and version number.

---

# How to Use The Online Help

The Help system provides introductory information about AIRMaster+, and field definitions and procedural instructions for each window and report.

## To Open the Help System

### From the menu bar:

Click the **commands on the Help menu** at the top of most windows to open the online Help system. Click the **Contents** command to open the Help system to the Contents tab (the Help system table of contents). Click the **Browse** command to open the Help system to the Welcome topic. Click the **About AIRMaster+** command to view the About screen for this program, which contains general information about the program and version number.

### From the toolbar:

Click the **Help button** in the toolbar at the top of most windows and reports. This displays the Help topic for the active window or report preview window, including links to the field definitions and procedural instructions.

### From any window or report:

You can press the **F1 key** from any place in AIRMaster+ to access Help. This displays the Help topic for the active window or report preview window, including links to the field definitions and procedural instructions.

## Moving Around in Help

Regardless of how you access Help, once you are in it you can access any Help topic in a number of ways. See your Windows documentation if you need information about Windows Help conventions.

### From the Contents tab of the Help system

Use the table of contents to view the structure of the Help system and select a topic. The table of contents for the Help system is displayed as books that contain topic pages. Double-click a book to open it, and click on a topic title to select that topic. You can display or print the selected Help topic.

### From the Index tab of the Help system

Type the first few letters of the topic you want, and select a topic from the list of Help system index entries. You can display or print the selected Help topic.

### From the Find tab of the Help system

Use the Find tab to search for a word or phrase in a Help topic instead of the topic title or topic index entries.

### From a Help topic

Click the **Help Topics** button to return to the Contents tab of the Help system. Click the **Back** button to return to the last topic that was viewed. Click the << and >> buttons to move backward or forward in the browse sequence of topics, which includes only the main conceptual topics and windows. Click on a **jump** (Help topic text in green type with a solid underline) to open the related Help topic.

Click the **Print** button at the top of any Help topic to print that topic.





## Chapter 4

# Company module

The Company module contains information about defined companies and company databases in AIRMaster<sup>+</sup>. The Company module includes the following window and report:

- ◆ **Company window**  
Select or add a company database; and add, edit, or view company information. **p. 38**
  
- ◆ **Company report**  
View and/or print company information (for each company with a database in AIRMaster<sup>+</sup>). **p. 44**

---

## Company window

**Navigation:** *Company module button*  
*or Inventory menu / Company Database command*

The screenshot shows the 'Company' window with the following details:

- Title Bar:** Company
- Menu Bar:** File, Calculators, Help
- Toolbar:** File, Edit, Delete, Print, Help, Edit Currencies, Close
- Company Selection:** Mountain Springs Brewery (dropdown), Browse button
- Form Fields:**
  - Name: Mountain Springs Brewery
  - Industry type: Manufacturing
  - SIC description: Food and Kindred Products
  - Address 1: 1040 Cascade Lane
  - Address 2: (empty)
  - City: Beertown
  - State/Zip: OR 97420
  - Contact: Bob Smith
  - Phone: (503) 555-1234
  - Currency: U.S. Dollars (\$)
- Units Section:**
  - English (selected), Metric
  - Metric Pressure Units: bar, kPa
  - Metric Airflow Units: liters/sec., cu meters/hr
- File Name:** C:\PROGRAM FILES\AIRMASTER+\AMSAMPLE.MDB

*Company window*

### Purpose

Use the Company window to select a company database, browse through existing ones, or add a new company database. You can add, edit, or view company information for the selected company.

**Note** One company database must be selected during operation of AIRMaster+. The selected company name, and database file name and location, are always displayed at the bottom of the Main Menu window.

### Description

The Company window contains two main sections; the upper section lists company databases, and the lower section displays information for the selected company. Click **Browse** to open the Select Company Database to Open window, where you can select a database from available folders.

## ***New: AirMaster+ Now Supports Metric Units***

### **Selection of Metric versus English Units**

The AirMaster+ compressed air systems assessment and energy savings analysis software tool has been modified to support metric as well as English units. Simply open your Company file, click on the **Edit** icon on the toolbar, and then click on the **Metric** button to conduct your analysis in metric units. Metric pressure selections include bars and kiloPascals (kPa) while airflows may be entered in either liters per sec (L/sec) or cubic meters per hour (m<sup>3</sup>/hour). When metric units are selected, altitudes are expressed in meters (instead of feet), receiver storage capacity in cubic meters or liters (instead of cubic feet or gallons), and temperatures in degrees Celsius (instead of degrees Fahrenheit). Click on the **Save** toolbar icon after you have made your selections. Note that the Company screen shown is set up to display pressure and air flow results in bars and m<sup>3</sup>/hour, respectively.

Users may shift between units as they desire. Data that is edited while metric units are displayed is automatically re-converted into English units if **English** is again selected at the Company screen. Unit selections are permanently saved to the Company file. Different Company files can use different sets of unit choices. Previously created Company files are compatible with this version of AirMaster+ and will open with the **English** units button pre-checked.

### **Selection of Currency Symbol**

AirMaster+ 1.20 has also been modified to allow users to make a currency selection from a **Currency** drop-down list. When a selection is made, the indicated currency symbol appears on all AirMaster+ screens and printed reports. AirMaster+ allows the user to add new currency names and symbols to the drop-down list by clicking on the **Edit Currencies** box on the toolbar.

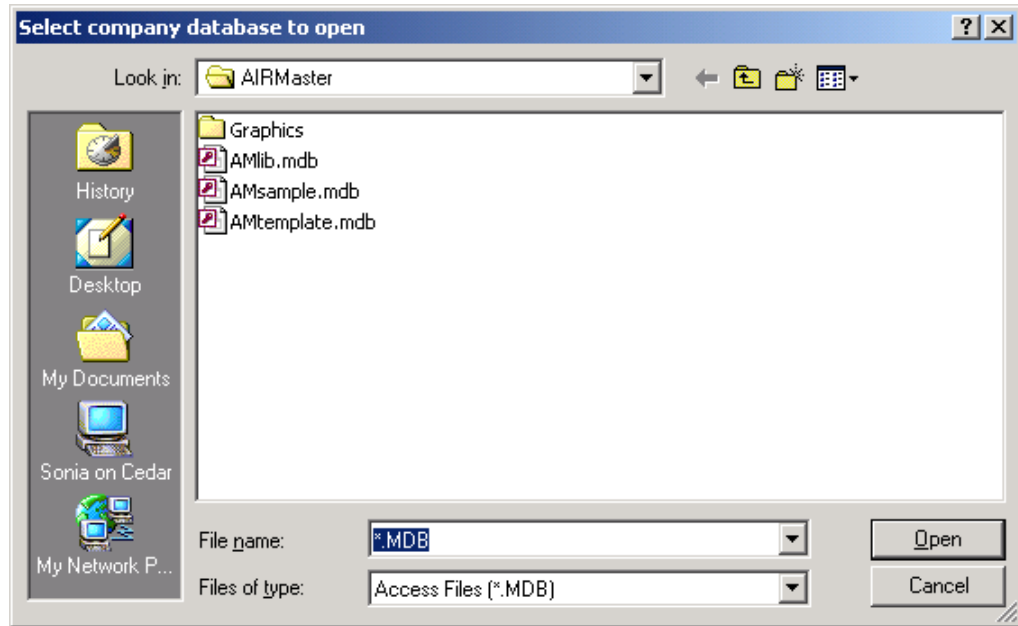
### **Regional Settings**

The Metric or International version of AirMaster+ is designed to display currency values in a format consistent with your **Control Panel: Regional and Language Options** settings. Currency conventions for thousands and decimals (space, comma, period) are consistent with the standards and formats shown for the country specified in the user's **Regional Options** drop-down list.

## ***Procedures: Selecting or Adding a Company Database, and Editing Company Information***

### **To select a company database**

1. Select from the drop-down list of companies in the Company field at the top of the window. AIRMaster+ includes a sample company, fictitious Mountain Springs Brewery.
2. If you don't see the company you want, click **Browse** to open the Select Company Database to Open window, and continue with steps #3-6.



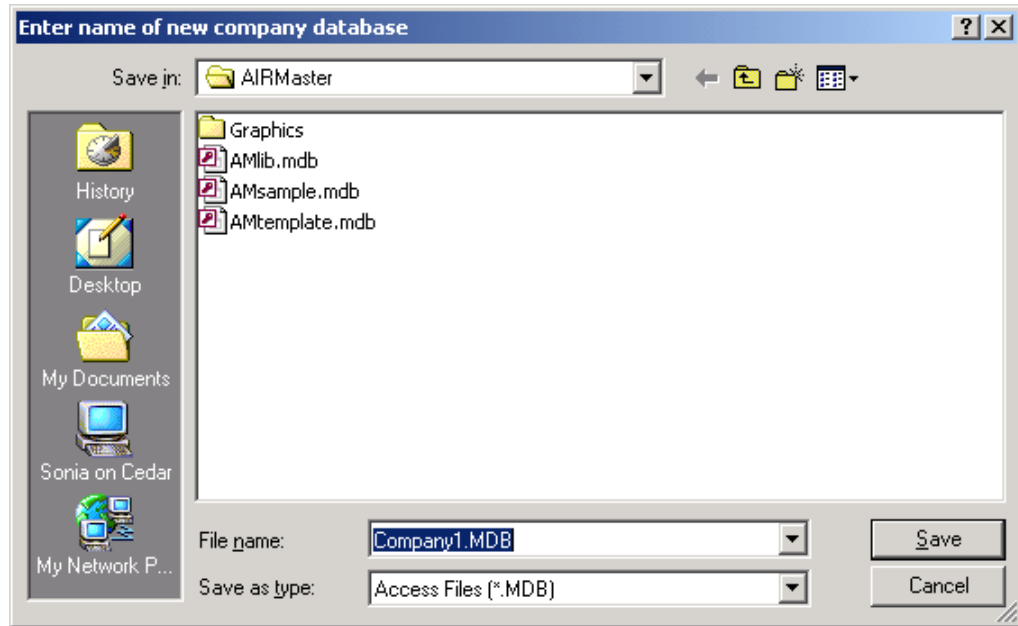
3. In the Files of Type field, select “Access Files (\*.MDB).”
4. Select the folder and database file for the desired company, using the Look In field and the list of available folders and files.

**Note** AIRMaster<sup>+</sup> uses two kinds of databases: company databases and a library database. A *company database* includes information about air compressors in the company inventory. A sample company database, “AMsample.mdb,” and the template company database, “AMtemplate.mdb,” are provided with AIRMaster<sup>+</sup>; the program can contain any number of company databases, all based on the template company database. The provided *library database* of “catalog” air compressors, “Amlib.mdb,” is shared by all company databases.

5. Make sure the File Name field displays the correct file.
6. Click **Open**. The Select Company Database to Open window will close, and the Company window will reopen with the selected company displayed.

### To add a company database

1. To enter company information for a new company database, you must first add the company database: click **Add** on the toolbar at the top of the window. The new company database is created automatically, based on the template company database. The Enter Name of New Company Database window opens:



2. In the Save In field, select a destination folder.
3. In the File Name field, enter the name of the new company database file (usually the name of the company).
4. In the Save as Type field, make sure “Access Files (\*.MDB)” is selected.
5. Click **Save**. You will return to the Company window in Add mode, and the fields will be clear and ready for data entry.

### To enter or edit company information

1. You can enter company information in Add or Edit mode. You will be in Add mode after completing the above procedures, “To add a company database.” To enter Edit mode, make sure the desired company is selected in the Company field, and click **Edit**.
2. Once in Add or Edit mode in this window, you can’t edit the Company field but you can enter information into the rest of the fields. Note that only the Name field is required.
3. When you have finished entering or editing company information, click **Save** to save the company information displayed.

### Field Definitions

---

#### Company

The name of the company for the selected company database. Select from the drop-down list, or click **Browse** to search for a company database in available folders.

#### Name

The name of the company. This is the only required field in this window.

**Industry Type**

The industry type of the company.

**SIC Description**

The Standard Industrial Classification category of the company. Available choices will be determined by the selected industry type.

**Address 1**

The first line of the street address of the company.

**Address 2**

The second line of the street address of the company.

**City**

The city of the company address.

**State**

The state of the company address.

**Zip**

The zip code of the company address.

**Contact**

The name of the company contact person.

**Phone**

The phone number of the contact person.

**File Name**

The location and name of the selected company database file.

**Edit Currencies**

Allows the user to add new currency names and symbols to the Currency list.

**Units**

Allows the user to select between using English and Metric units.

**Metric Airflow Units**

Allows the user to enter and display airflows in liters/sec or m<sup>3</sup>/hr.

**Metric Pressure Units**

Allows the user to enter and display pressure in Bars or kPa.

**Currency**

Allows for selection of a currency symbol that appears on all forms and reports.

**Buttons**

---

**Add**

Click to open the Enter Name of New Company Database window and create a new company database. You will return to the Company window in Add mode, and the fields will be clear and ready for data entry.

**Edit**

Click to enter Edit mode to make changes to the currently displayed company data.

**Save**

Once in Edit mode, click to save the company information displayed.

**Delete**

Click to delete the currently displayed company database. You will be asked whether you want to remove the selected company from the Company drop-down list, and then you will be asked whether you want to delete the company file and all its data from the hard disk as well.

**Print**

Click to open the Report Setup window, to view or print the Company report (information about each company with a database in AIRMaster<sup>+</sup>).

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Company window Help topic, which provides context-sensitive Help for this window.

**Close/Cancel**

Click to close the Company window, or cancel Edit/Add mode and reverse edits to displayed data.


**Browse**

Click to open the Select Company Database to Open window, where you can select a database from available folders.

---

# Company report

**Navigation:** *Company module button / Print button / Preview button*  
*or Inventory menu / Company Database command / Print button /*  
*Preview button*

 <b>Company Report</b>		AIRMaster+
For: Bruce		May 30, 2000
By: Sonia		Page 1 of 1
<p>Name : Mountain Springs Brewery Industry Type : Manufacturing SIC Description : Food and Kindred Products Address 1 : 1040 Cascade Lane Address 2 : City : Beertown State/Zip : OR 97420 Contact : Bob Smith Phone : (503) 555-1234</p>		

*Company report*

## **Purpose**

Use the Company report to view or print company information for each company with a database in AIRMaster<sup>+</sup>.

## **Description**

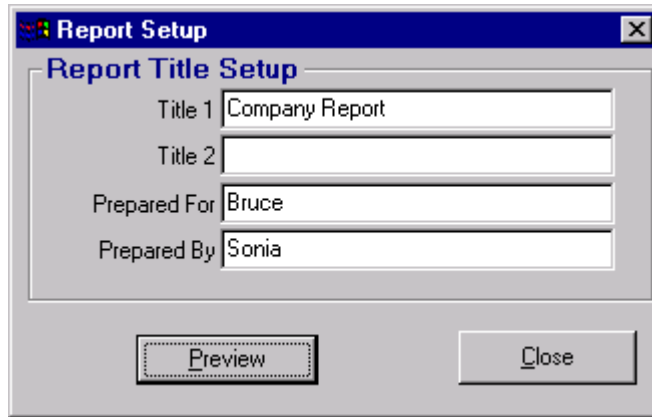
The Company report contains all the company information displayed in the fields of the Company window.

## ***Procedures for Viewing or Printing Company Information***

### **To view or print company information**

1. In the Company window, click **Print**. The Report Setup window will open:





2. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
3. Click **Preview** to view the report onscreen.
4. If you want to print the report, click **Print** at the top of the onscreen report.
5. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

## Field Definitions

---

Please refer to the field definitions for the Company window on page 41.

## Buttons (on onscreen report)

---

### Page

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

### [Zoom]

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

### Print

Click this button to print the Company report.

### Close

Click this button to close the Company onscreen report.

## Chapter 5

# Utility module

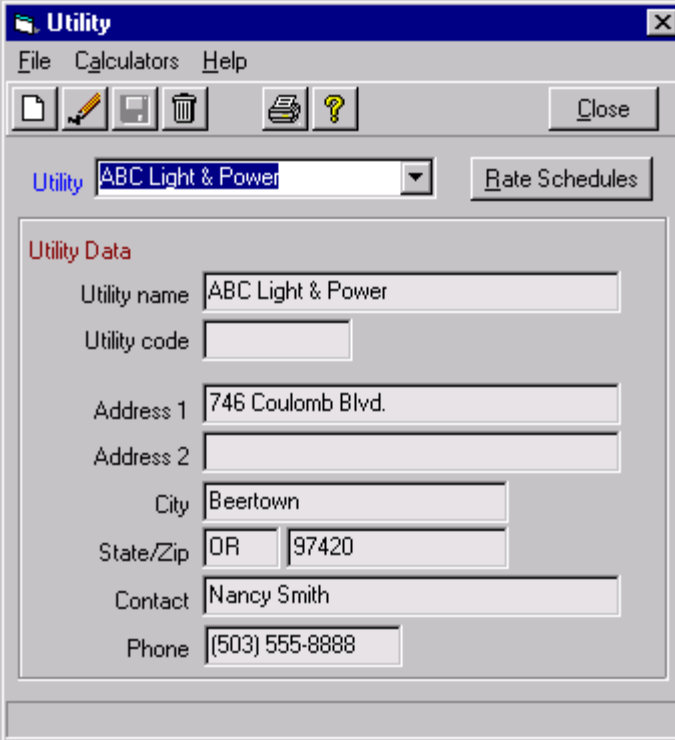
The Utility module contains information about the utility companies and rate schedules included in AIRMaster<sup>+</sup>. The Utility module includes the following windows and report:

- ◆ **Utility window**  
Add, edit, or view utility contact information. **p. 47**
  
- ◆ **Utility Rate Schedules window**  
Add, edit, or view utility rate schedule information. **p. 50**
  
- ◆ **Utility/Rate Schedule report**  
View and/or print the current utility and rate schedule,  
or all utilities and rate schedules. **p. 53**

---

# Utility window

**Navigation:** *Utility module button*  
*or Inventory menu / Utility Service Information command*



The screenshot shows a software window titled "Utility" with a menu bar containing "File", "Calculators", and "Help". Below the menu bar is a toolbar with icons for file operations and a "Close" button. The main area features a dropdown menu labeled "Utility" with "ABC Light & Power" selected, and a "Rate Schedules" button. Below this is a section titled "Utility Data" containing several input fields: "Utility name" (ABC Light & Power), "Utility code" (empty), "Address 1" (746 Coulomb Blvd.), "Address 2" (empty), "City" (Beertown), "State/Zip" (OR 97420), "Contact" (Nancy Smith), and "Phone" ((503) 555-8888).

*Utility window*

## **Purpose**

Use the Utility window to select or add a utility; and add, edit, or view the contact information for a utility.

## **Description**

The Utility window contains two main sections; the upper section lists utilities, and the lower section displays contact information for the selected utility. Click the Rate Schedules button to open the Utility Rate Schedules window, where you can enter or view rate schedule information.

## ***Procedures for Viewing, Adding, or Editing Utility Information***

### To view or add a utility

1. Select a utility from the drop-down list in the Utility field at the top of the window, and the rest of the fields display contact information for the selection. If the desired utility is not yet in AIRMaster<sup>+</sup>, see the next step.
2. If the utility is not yet in AIRMaster<sup>+</sup>, click **Add** on the toolbar at the top of the window. You are now in Add mode and all fields in the new record are cleared.

### To edit or enter utility information

1. You can enter utility information in Add or Edit mode. To edit utility information for the selected utility company, click **Edit** to enter Edit mode.
2. Once in Add or Edit mode in this window, you can't edit the Utility field but you can enter information into the rest of the fields. Note that only the Utility Name field is required.
3. When you have finished entering or editing utility information, click **Save** to save the utility information displayed.

## Field Definitions

---

### Utility

The name of the utility company. Select from the drop-down list.

### Utility Name

The name of the utility company. This is the only required field in this window.

### Utility Code

The user-entered utility company code, for your own use.

### Address 1

The first line of the street address of the utility company.

### Address 2

The second line of the street address of the utility company.

### City

The city of the utility company address.

### State/Zip

The state and zip code of the utility company address.

### Contact

The name of your utility account executive.

### Phone

The phone number of the utility company.

## Buttons

---

### Add

Click to enter Add mode, and create a new utility record in cleared fields.

**Edit**

Click to enter Edit mode to make changes to the currently displayed utility data.

**Save**

Once in Edit mode, click to save the utility information displayed.

**Delete**

Click to delete the currently displayed utility.

**Print**

Click to open the Report Setup window, to view or print the Utility/Rate Schedule report (for the *current* or *all* utilities and rates).

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Utility window Help topic, which provides context-sensitive Help for this window.

**Close/Cancel**

Click to close the Utility window, or cancel Edit/Add mode and reverse edits to displayed data.

**Rate Schedules**

Click to open the Utility Rate Schedules window to enter or view rate schedule information.

---

## Utility Rate Schedules window

**Navigation:** *Utility module button / Rate Schedules button*  
*or Inventory menu / Utility Service Information command / Rate Schedules button*

		Season 1	Season 2
Start Month/Day		04/01	10/01
Demand rate (\$/kW-Mo)		3.85	4.35
Energy Rate (\$/kWh)	Block 1	0.03800	0.04300
	Block 2	0.03600	0.04100
	Block 3	0.03200	0.03900

*Utility Rate Schedules window*

### **Purpose**

Use the Utility Rate Schedules window to add, edit, or view rate schedule information, such as rate seasons, monthly demand rates, and energy rates. You can create a catalog of industrial rate schedules, sorted by utility. Each rate schedule can accommodate two seasons, and up to three declining or escalating energy tailblocks.

### **Description**

The Utility Rate Schedules window contains two main sections; the upper section lists utilities and rate schedules, and the lower section displays rate schedule information for the selected utility rate.

## **Procedures for Viewing, Adding, or Editing a Utility Rate Schedule**

### **To view or add a utility rate schedule**

1. Select a utility and a utility rate schedule from the drop-down lists in the top of the window, and the rest of the fields display rate schedule information for the selected rate. If the desired utility is not yet in AIRMaster<sup>+</sup>, see the procedures for adding a utility on page 48. If the desired rate schedule is not yet in AIRMaster<sup>+</sup>, see the next step.
2. If the rate schedule is not yet in AIRMaster<sup>+</sup>, select the utility in the Utility field, then click **Add**. You are now in Add mode and all fields in the new record are cleared.

### **To edit or enter rate schedule information**

1. You can enter utility rate schedule information in Add or Edit mode. To edit utility rate schedule information for the selected utility rate schedule, click **Edit** to enter Edit mode.
2. Once in Add or Edit mode in this window, you can't edit the Utility or Rate Schedule fields, but you can enter rate schedule information into the rest of the fields. Enter the Start Month/Day of the two seasons (remember that the sum of Season 1 and Season 2 is an entire year). Enter the demand rate for each season. You may define up to three block usage rates for each season, corresponding to declining or escalating block prices offered by your utility. (Alternatively, you may enter an average energy rate in Block 1.) In the Facility Information tab of the Facility window, you will choose the block rate that corresponds with the level of facility energy usage in each season.
3. When you have finished entering or editing rate information, click **Save** to save the rate information displayed. If you are saving changes to a previously existing rate, the status bar at the bottom of the window will indicate that the change in the rate is affecting cost calculations elsewhere: "Updating facilities, systems, profiles, and EEM scenarios." These recalculations will take a few seconds.

---

## **Field Definitions**

### **Utility**

The name of the utility company. Select from the drop-down list.

### **Rate Schedule**

The name of the rate schedule. Select from the drop-down list.

### **Description**

The name of the selected rate schedule.

### **Start Month/Day**

The first day of Season 1 and Season 2. Utilities commonly define a summer and a winter season, with different rates in each season. To define only one season, leave the fields for Season 2 blank.

**Demand Rate, \$/kW-mo.**

The demand portion of the selected rate for each season, in dollars per kilowatt per month.

**Energy Rate, \$/kWh**

The usage rate for each season, in dollars per kilowatt-hour. You may define up to three block rates for each season. In the Facility Information tab of the Facility window, you will choose the block rate that corresponds with the level of facility energy usage in each season.

**Buttons**

---

**Add**

Click to enter Add mode, and create a new utility rate schedule in cleared fields.

**Edit**

Click to enter Edit mode to make changes to the currently displayed utility rate schedule.

**Save**

Once in Edit mode, click to save the utility rate schedule displayed.

**Delete**

Click to delete the currently displayed utility rate schedule.

**Print**

Click to open the Report Setup window, to view or print the Utility/Rate Schedule report (for the *current* or *all* utilities and rates).

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Utility Rate Schedules window Help topic, which provides context-sensitive Help for this window.

**Close/Cancel**

Click to close the Utility Rate Schedules window and return to the Utility window, or cancel Edit/Add mode and reverse edits to displayed data.



# Utility/Rate Schedule report

**Navigation:** *Utility module button / Print button / Preview button*  
*or Inventory menu / Utility Service Information command / Print button /*  
*Preview button*

Utility/Rate Schedule Information Report		AIRMaster+
Current Utility/Rate Schedules		May 30, 2000
For: Bruce		Page 1 of 1
By: Sonia		
<b>Utility Name : ABC Light &amp; Power</b> Utility Code : Address 1 : 746 Coulomb Blvd. Address 2 : City, State, Zip : Beertown, OR 97420 Contact : Nancy Smith Phone : (503) 555-8888		
commercial schedule	Season 1	Season 2
Start Month/Day	04/01	10/01
Demand Rate, \$/kW-mo	3.85	4.35
Energy   Block 1	0.03800	0.04300
Rate,   Block 2	0.03600	0.04100
\$/kWh   Block 3	0.03200	0.03900

*Utility/Rate Schedule report: Current Utility/Rate Schedules*

## Purpose

Use the Utility/Rate Schedule report to view or print the current utility and rate schedule, or all utilities and rate schedules.

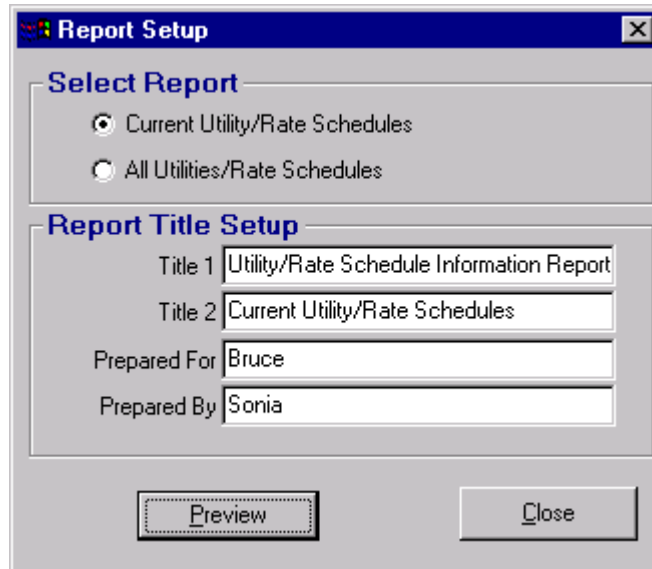
## Description

The Utility Rate/Schedule report contains two main sections for each utility rate; the upper section lists utility information, and the lower section lists rate schedule information. If the report displays all utilities and rate schedules, each utility rate record starts on a new page of the report.

## Procedures for Viewing or Printing Utility and Rate Schedule Information

### To view or print utility and rate schedule information

1. In either the Utility window or the Utility Rate Schedules window, click Print. The Report Setup window will open:



2. In the Select Report section, choose whether the report should display the current utility and all its rate schedules, or all utilities and rate schedules. The current utility is the utility that was selected in the Utility or Utility Rate Schedules window before you opened the Report Setup window.
3. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
4. Click **Preview** to view the report onscreen.
5. If you want to print the report, click **Print** at the top of the onscreen report.
6. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

---

### Field Definitions

Please refer to the field definitions for the Utility window on page 48 and the Utility Rate Schedules window on page 51.

---

### Buttons (on onscreen report)

#### Page

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

**[Zoom]**

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

**Print**

Click this button to print the Utility/Rate Schedule report.

**Close**

Click this button to close the Utility/Rate Schedule onscreen report.

## Chapter 6

# Facility module

The Facility module contains information about the facility (site) data, facility utility rate data, and a summary of the air compressors on site. The Facility module includes the following window and report:

- ◆ **Facility window**  
Add, edit, or view facility (site) data, select or view the utility rate and usage rate block for the facility, or view a summary of all air compressors on site. **p. 57**
  
- ◆ **Facility report**  
View and/or print a summary of the current facility record or all facility records. **p. 64**

# Facility window

**Navigation:** *Facility module button*  
or *Inventory menu / Facility command*

The screenshot shows a software window titled "Facility" with a menu bar (File, Calculators, Help) and a toolbar with icons for file operations and a help icon. A dropdown menu at the top shows "Facility" selected with "Brewing Facility" as the current selection. The window is divided into two main sections: "Facility Information" and "Compressor Summary (from Compressor module)".

**Facility Information**

**Facility Data**

Facility name	Brewing Facility
Address 1	1040 Cascade Lane
Address 2	
City	Beertown
State/Zip	OR 97420
Contact	Bob Smith
Phone	(503) 555-1234
Annual plant electrical use, kWh	10000000

**Utility Rate Data**

Utility: ABC Light & Power  
Rate Schedule: commercial schedule

	Season 1	Season 2
Start month/day	04/01	10/01
Demand rate (\$/kW-mo.)	3.85	4.35
Energy Rate (\$/kWh)		
Block 1	0.03800 <input type="radio"/>	0.04300 <input type="radio"/>
Block 2	0.03600 <input checked="" type="radio"/>	0.04100 <input checked="" type="radio"/>
Block 3	0.03200 <input type="radio"/>	0.03900 <input type="radio"/>

Facility window: Facility Information tab

## Purpose

The Facility window allows you to add, edit, or view facility (site) data; select or view the utility rate and usage rate block for the facility; and view a summary of all air compressors on site.

## Description

The Facility window has two tabs: the Facility Information tab and the *read-only* Compressor Summary tab. The Facility Information tab displays facility data, including utility rate schedule data for the facility. The Compressor Summary tab displays nameplate and performance data for each air compressor in the selected facility.

The information in both tabs relates to the facility selected in the Facility field at the top of the Facility window. The buttons at the top of the window apply to the selected facility, regardless of which tab is active, and you can switch between tabs in the same selected facility without losing information. The Facility field and the

buttons at the top of the window are described below, followed by a description of each tab.

### ***Procedures for Viewing, Adding, or Editing Facility Information, and Viewing Compressor Summary Information***

#### **To view or add a facility**

1. Select a facility from the drop-down list at the top of the window, and the rest of the fields display facility information for the selected facility. If the desired facility is not yet in AIRMaster<sup>+</sup>, see the next step.
2. If the facility is not yet in AIRMaster<sup>+</sup>, click **Add** to create a new record. You are now in Add mode and all fields are cleared.

#### **To edit or enter facility information**

1. You can enter facility data and select utility rate data in Add or Edit mode. To edit the facility information in this tab, click **Edit** to enter Edit mode.
2. Once in Add or Edit mode, you can't edit the Facility field. In the Facility Data section, enter or edit the facility name, address and contact information, and total energy use. In the Utility Rate Data section, select the utility and rate schedule for the facility and select the tailblock that most closely represents the facility's marginal cost for each season.
3. When you have finished editing, click **Save** to save the facility information displayed. If you are saving changes to a previously existing rate assignment, the status bar at the bottom of the window will indicate that the change is affecting cost calculations elsewhere: "Updating facilities, system, profiles, and EEM scenarios." These recalculations will take a few seconds.

#### **To view compressor summary information**

1. Select a facility from the drop-down list at the top of the window. If the desired facility is not yet in AIRMaster<sup>+</sup>, see the procedures for adding a facility on page 58.
2. The fields in the Compressor Summary tab display information about the compressors at the selected facility, including facility totals. Note that the System and Compressor fields are fixed, and you can scroll through the remaining columns. The information displayed here is entered in the Compressor and Profile modules.
3. If you want to copy the compressor summary information to a spreadsheet program, click **Copy to Clipboard**. This copies all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.

## **Field Definitions**

---

### **Facility**

The name of the facility, or site. Select from the drop-down list.

## **Buttons**

---

### **Add**

Click to enter Add mode, and create a new facility in cleared fields in the Facility Information tab.

### **Edit**

Click to enter Edit mode to make changes to the currently displayed facility in the Facility Information tab.

### **Save**

Once in Edit mode, click to save the displayed changes in the Facility Information tab.

### **Delete**

Click to delete the currently displayed facility.

### **Print**

Click to open the Report Setup window, to view or print the Facility report (a summary report for the current or all facility records).

### **Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Facility window Help topic, which provides context-sensitive Help for this window and both tabs.

### **Close/Cancel**

Click to close the Facility window, or cancel Edit/Add mode and reverse edits to displayed data.

## Facility Information tab

Use the Facility Information tab to add, edit, or view facility (site) data, such as the facility address and total energy use. You can also select or view the utility rate and usage rate block for the facility. Utility rates, with up to three energy rate blocks, are defined in the Utility Rate Schedules window. Although you can't change the definition of a rate in this tab, you can choose which utility rate is assigned to the site, and select which energy rate block is appropriate for the selected facility.

The utility rate selected here affects costs in other modules. If you change the selected utility rate or change the selected energy block rate and save the changes, note that the status bar at the bottom of this window indicates that the change in the rate is affecting calculations elsewhere: "Updating systems, profiles, and EEM scenarios." These recalculations will take a few seconds.

The left half of this tab displays facility data for the selected facility, and the right half displays utility rate data for the selected facility. See illustration of Facility Information tab on page 57.

**Procedures** Please see page 58.

### Field Definitions

---

#### *Facility Data*

##### **Facility Name**

The name of the facility (site). This is the only required field in this tab.

##### **Address 1**

The first line of the street address of the facility.

##### **Address 2**

The second line of the street address of the facility.

##### **City**

The city of the facility address.

##### **State**

The state of the facility address.

##### **Zip**

The zip code of the facility address.

##### **Contact**

The name of the facility contact person.

##### **Phone**

The phone number of the facility.

##### **Total Energy Use, kWh**

The annual energy usage of the facility, in kilowatt-hours. This will be used within the Facility Ranking report.



### ***Utility Rate Data***

#### **Utility**

The name of the utility company serving the selected facility. Select from the drop-down list.

#### **Rate Schedule**

The name of the utility rate schedule for the selected facility. Select from the drop-down list.

#### **Start Month/Day**

The first day of Season 1 and Season 2.

#### **Demand Rate, \$/kW-mo.**

The demand portion of the selected rate for each season, in dollars per kilowatt per month.

#### **Energy Rate, \$/kWh**

The energy usage rate for each season, in dollars per kilowatt-hour. For each season, there are up to three block rates from which to choose. Select the tailblock that represents your facility's marginal cost for each season.

## Compressor Summary tab

**Navigation:** *Facility module button / Compressor Summary tab*  
*or Inventory menu / Facility command / Compressor Summary tab*

System	Model	Manufacturer	Compressor Type	Compressor	Control Type
Main Air System	100 hp	<Generic>	Single stage lubricant-injected rot	Compressor 1	Inlet modu
	150 hp	<Generic>	Two stage reciprocating	Compressor 2	Load/unlc
System Totals					
Facility Totals					

Facility window: Compressor Summary tab

Use the *read-only* Compressor Summary tab to view air compressor nameplate and performance data and air compressor assignment for the selected facility. This information summarizes data entered in the Compressor and Profile modules, and reflects in-plant air compressor inventory and energy use. System totals are listed below system compressors, and facility totals are listed at the bottom of the grid. Note that the System and Model fields are fixed, and you can scroll through the remaining columns.

**Procedures** Please see page 58.

### Field Definitions

#### System

The name of the compressed air system to which the air compressor is assigned. Systems are defined in the System module.

**Model**

The model of the inventory air compressor (or the description if it's a catalog air compressor).

**Manufacturer**

The name of the air compressor manufacturer.

**Compressor Type**

The type of air compressor, such as single stage lubricant-injected rotary screw.

**Compressor**

The air compressor name.

**Control Type**

The type of control for the air compressor, such as load/unload.

**Full Load Pressure, psig**

The air compressor's rated discharge pressure, in pounds per square inch gauge.

**Rated Capacity, acfm**

The maximum operating airflow delivered by the air compressor at full load operating pressure, in actual cubic feet per minute, as specified on the air compressor nameplate. Rated capacity is subtotaled for each system and the facility.

**Horsepower Rating, hp**

The manufacturer's suggested drive motor requirement for the air compressor. The drop-down list offers hp ratings from 1-3500. Horsepower ratings are subtotaled for each system and the facility.

**Energy Use, kWh**

The annual energy usage of the air compressor, system, and facility, in kilowatt-hours.

**% Total Facility kWh Use**

The percentage of the facility kilowatt-hours energy used by the air compressor and system.

**Peak Demand, kW**

The maximum annual demand of the air compressor, system, and facility, in kilowatts.

**Annual Operating Costs, \$**

The calculated yearly cost of operating the air compressor, system, and facility, in dollars.

**Buttons**

---

**Copy to Clipboard**

Click to copy all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.

# Facility report

**Navigation:** *Facility module button / Print button / Preview button*  
 or *Inventory menu / Facility command / Print button / Preview button*

AIM		Facility Report Current Facility		AIRMaster +																															
For: Bruce By: Sonia				June 7, 2000 Page 1 of 1																															
Facility Name : Brewing Facility Address 1 : 1040 Cascade Lane Address 2 : City : Beertown State/Zip : OR 97420 Contact : Bob Smith Phone : (503) 555-1234 Annual Plant Electrical Use, kWh : 10,000,000		Utility : ABC Light & Power Rate Schedule : commercial schedule  <table border="0"> <tr> <td></td> <td>Season 1</td> <td>Season 2</td> <td></td> <td></td> </tr> <tr> <td>Start Month/Day</td> <td>04/01</td> <td>10/01</td> <td></td> <td></td> </tr> <tr> <td>Demand Rate, \$/kW-mo</td> <td>3 . 85</td> <td>4 . 35</td> <td></td> <td></td> </tr> <tr> <td>Energy   Block 1</td> <td>0 . 03800</td> <td>0 . 04300</td> <td></td> <td></td> </tr> <tr> <td>Rate,   Block 2</td> <td>0 . 03600</td> <td>X 0 . 04100</td> <td>X</td> <td></td> </tr> <tr> <td>\$/MWh   Block 3</td> <td>0 . 03200</td> <td>0 . 03900</td> <td></td> <td></td> </tr> </table> <p style="text-align: right;">X designates selected rate</p>					Season 1	Season 2			Start Month/Day	04/01	10/01			Demand Rate, \$/kW-mo	3 . 85	4 . 35			Energy   Block 1	0 . 03800	0 . 04300			Rate,   Block 2	0 . 03600	X 0 . 04100	X		\$/MWh   Block 3	0 . 03200	0 . 03900		
	Season 1	Season 2																																	
Start Month/Day	04/01	10/01																																	
Demand Rate, \$/kW-mo	3 . 85	4 . 35																																	
Energy   Block 1	0 . 03800	0 . 04300																																	
Rate,   Block 2	0 . 03600	X 0 . 04100	X																																
\$/MWh   Block 3	0 . 03200	0 . 03900																																	
<b>Compressor Summary</b>																																			
System	Model	Manufacturer	Compressor Type	Compressor	Control Type	Full Load Pressure, psig	Rated Capacity, actm	Horsepower Rating, hp	Energy Use, kWh	% Total Facility kWhUse	Peak Demand, kW	Annual Operating Costs, \$																							
Main Air System	100 hp	Generic	1 stage lub-inject rot. screw	Compressor 1	Inlet mod. w/o unloa	100.0	473.0	100	486000	4.9	90.0	0																							
	150 hp	Generic	2 stage reciprocating	Compressor 2	Load/Unload	100.0	847.0	150	325355	3.3	103.6	0																							
System Totals							1320	250	811355	8.1	182.5	38201																							
Facility Totals							1320.0	250	811355	8.1	182.5	38201																							

*Facility report: Current Facility*

## Purpose

Use the Facility report to view or print a summary of the current facility record or all facility records.

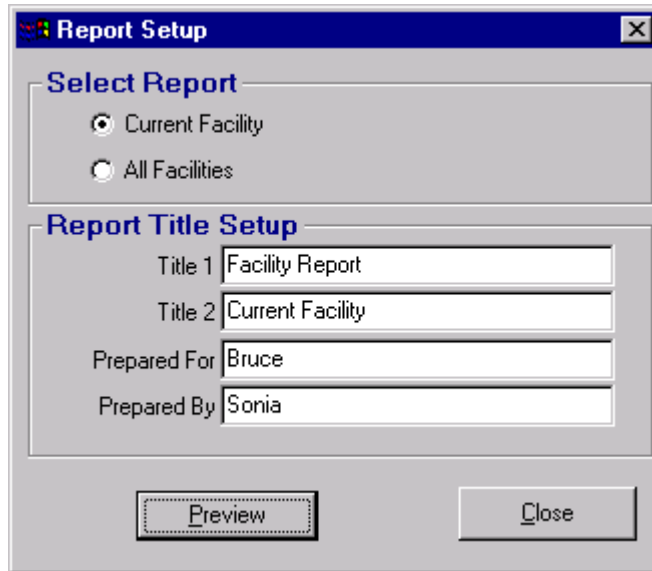
## Description

The Facility report contains two main sections for each facility record; the upper section lists facility information, and the lower section lists compressor information for that facility. If the report summarizes all facility records, each facility record (with both sections) starts on a new page of the report.

## Procedures: View or Print Facility Records

### To view or print facility records

1. In either tab of the Facility window, click **Print**. The Report Setup window will open:



2. In the Select Report section, choose whether the report should display the current facility record, or all facility records. The current facility is the facility that was selected in the Facility window before you opened the Report Setup window.
3. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
4. Click **Preview** to view the report onscreen.
5. If you want to print the report, click **Print** at the top of the onscreen report.
6. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

## Field Definitions

---

Please refer to the field definitions for the Facility window tabs on pages 60 and 62.

## Buttons (on onscreen report)

---

### Page

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

### [Zoom]

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

### Print

Click this button to print the Facility report.

### Close

Click this button to close the Facility onscreen report.

# System module

The System module contains information about the compressed air system, such as design and performance parameters, automatic sequencer control pressure set points, daytypes, and end uses. The System module includes the following window and report:

- ◆ **System window**  
Edit or view compressed air system-level information, or add a new system to AIRMaster<sup>+</sup>. **p. 67**
  
- ◆ **Air Systems report**  
View and/or print a summary of current (or all) system information, with or without end use information. **p. 79**

---

# System window

**Navigation:** *System module button*  
or *Inventory menu / System command*

The screenshot shows a software window titled "System" with a menu bar (File, Calculators, Help) and a toolbar. Below the toolbar are two dropdown menus: "Facility" set to "Brewing Facility" and "System" set to "Main Air System". The main area has four tabs: "System Data" (selected), "Sequencer Data", "Daytypes", and "End Uses". The "System Data" tab contains the following fields and controls:

System name	Main Air System	Nominal system pressure, psig	100
Contact	Bob Smith	Airflow capacity (sum of compressors), acfm	1315
Phone	(503) 555-1234	System elevation, ft.	500
Sequencer used	<input checked="" type="checkbox"/>	Air storage capacity (receivers + distribution pipe), cu. ft. *	63

Below the "Sequencer used" checkbox are two radio buttons: "Cascade" (selected) and "Target pressure". To the right of these is a button labeled "Air Storage Capacity Calculator". At the bottom of the tab, a red note reads: "\* Air storage capacity refers to unregulated (primary) storage. This field is required to run Add Receiver Volume efficiency measure."

System window: System Data tab

## Purpose

The System window allows you to edit or view compressed air system-level information, or to add new systems into AIRMaster<sup>+</sup>. Air compressors are assigned to a system in the Compressor module. All the air compressors in a compressed air system are assumed to discharge into a common header. A facility can have any number of compressed air systems, each with its own inventory of air compressors and end uses.

## Description

The System window has four tabs:

- the System Data tab, which displays compressed air system contact information and basic compressed air system statistics
- the Sequencer Data tab, which displays control pressure range information used by an automatic sequencer to operate multiple compressors. This tab does not apply if an automatic sequencer is not used (i.e. compressors use non-sequenced cascading set points).

- the Daytypes tab, which lists the different daytypes for the system, and the number of operating days of each daytype during each season. A daytype should be specified for clusters of days that feature similar operating schedules and compressed air load, such as production days, weekdays, weekends, or holidays.
- the End Uses tab, which lists end uses including air tools in a selected compressed air system. This tab displays required airflow and operating pressure, measured pressure, and calculated excess pressure.

The information in all the tabs relates to the facility and system selected in the fields at the top of the System window. The buttons at the top of the window apply to the selected system, regardless of which tab is active, and you can switch between tabs in the same selected system without losing information. The Facility and System fields and the buttons at the top of the window are described below, followed by a description of each tab.

## ***Procedures for Viewing, Adding, or Editing System Information***

### **To view or add a system**

1. Select a facility and a system from the drop-down lists at the top of the window. The system list will be limited to the systems available in the selected facility. The fields in all four tabs display information for the selected system. If the desired system is not yet in AIRMaster<sup>+</sup>, see the next step.
2. If the system is not yet in AIRMaster<sup>+</sup>, click **Add** to create a new record. You are now in Add mode and all fields are cleared or return to default values.

### **To edit or enter system information**

1. You can enter system information in Add or Edit mode. To edit the system information in all four tabs, click **Edit** to enter Edit mode.
2. Once in Add or Edit mode, you can no longer edit the Facility and System fields at the top of the window. In the System Data tab, enter or edit the system name, contact person and phone number, and mark the Sequencer Used box if the system is controlled by an automatic sequencer. If the system is sequenced, you must select whether it is cascade or target pressure sequenced. Next, enter or edit your estimate of the average system operating pressure. The Airflow Capacity field is calculated and can be ignored. Enter or edit the system elevation and system air storage capacity (including receivers and distribution pipes). If you don't know the volume of air that the system can store, click **Air Storage Capacity Calculator**, and see page 263 for Air Storage Capacity Calculator window procedures.
3. If the system is controlled by an automatic sequencer, the Sequencer Data tab is available. The appearance of this tab depends on whether the Cascade or Target Pressure type of sequencing was selected on the System Data tab.
  - If the system is cascade sequenced, enter or edit the pressures at which the compressors cut in (or load) and cut out (go offline). AIRMaster<sup>+</sup> will provide default values as more compressors are



added to the system; review these. There must be at least as many sequence positions defined as there are compressors. Compressor pressure range assignments must be in descending order, starting with lead as the highest range. Don't worry about assigning specific compressors to the sequence order positions; that is done in the Profiles module.

- If the system is target pressure sequenced, enter or edit the target pressure and variance of the automatic sequencer.
4. In the Daytypes tab, enter or edit the names of the system's operating daytypes, such as peak-season weekday or off-season weekend day. Then enter or edit the number of operating days for each daytype in each season. Total operating days may not exceed the total number of days possible for a season. These seasons are the one or two seasons defined for the rate schedule assigned to this system's facility; the rate seasons are defined in the Utility Rate Schedules window, and the rate is assigned to the facility in the Facility window. Next, enter or edit the number of months in each season in which demand charges are incurred, or in which the system is operational. The Total Annual Days and Total Down Days fields will be calculated for you.
  5. In the End Uses tab, enter or edit the end uses (usually air tools and accessories) in the compressed air system. For each end use, enter or edit its location in the system, required airflow, minimum air pressure requirement, and the measured air pressure at the end use. The difference between the required and measured pressure for each end use is calculated for you and displayed in the Excess Pressure field. The excess pressure amount indicates whether you should consider the Reduce System Air Pressure EEM (see page 161). If any end use requires airflow greater than 30% of the total airflow capacity of all the compressors, the last column is marked and a warning message appears.
  6. When you have finished entering or editing system information, click **Save** to save the system information in all tabs. If you are saving changes to a previously existing system, the status bar at the bottom of the window will indicate that the change is affecting calculations elsewhere: "Updating profiles... EEM scenarios." These recalculations will take a few seconds.

## Field Definitions

---

### Facility

The name of the facility, or site. Select from the drop-down list.

### System

The name of the compressed air system. Select from the drop-down list of systems available in the selected facility.

## Buttons

---

### Add

Click to enter Add mode, and create a new system in cleared fields.

### Edit

Click to enter Edit mode to make changes to the currently displayed system.

**Save**

Once in Edit mode, click to save the system information displayed.

**Delete**

Click to delete the currently displayed system.

**Print**

Click to open the Report Setup window, to view or print the Air Systems report (a summary of current or all system information, with or without end use information).

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the System window Help topic, which provides context-sensitive Help for this window.

**Close/Cancel**

Click to close the System window, or cancel Edit/Add mode and reverse edits to displayed data.

## System Data tab

Use the System Data tab to enter or view contact information and basic statistics for the selected compressed air system. To calculate system air storage capacity, enter Edit mode or Add mode and click **Air Storage Capacity Calculator** to open the Air Storage Capacity Calculator window. See illustration of System Data tab on page 67.

**Procedures** Please see page 68.

### Field Definitions

---

#### System Name

The name of the compressed air system. The system name can be used within the Compressor Inventory Query window as a search criterion.

#### Contact

The name of the compressed air system contact person.

#### Phone

The phone number of the contact person.

#### Sequencer Used

Mark this box if the system air compressors are controlled by an automatic sequencer. A sequencer is a device used to bring air compressors on line according to a programmed schedule. Sequencing schedules are defined in the Profile module. If this box is marked, sequencer type must be either Cascade or Target Pressure (fields to right).

#### Cascade

Choose this option if the air compressors are brought on line based upon programmed cut-in and cut-out pressures. This is only available if the Sequencer Used box is marked.

#### Target Pressure

Choose this option if the air compressors are operated to maintain the compressed air system within a defined pressure band. This is only available if the Sequencer Used box is marked.

#### Nominal System Pressure, psig

The user-assumed average compressed air system operating pressure (in pounds per square inch gauge).

#### Airflow Capacity (Sum of Compressors), acfm

The maximum airflow delivery capability of all air compressors in the system, at actual inlet and discharge conditions, in actual cubic feet per minute.

#### System Elevation, ft.

The number of feet above mean sea level at which the compressed air system is located.

#### Air Storage Capacity (receivers + distribution pipe), cu.ft.

The volume of air that the entire compressed air system can store, including receivers and distribution pipes, in cubic feet. To calculate the system air storage

capacity, open the Air Storage Capacity Calculator window by clicking **Air Storage Capacity Calculator** in the bottom right corner of this tab.

## **Buttons**

---

### **Air Storage Capacity Calculator**

In Edit or Add mode, click to open the Air Storage Capacity Calculator to calculate the system air storage capacity (this value is necessary to complete the last field in this tab).

## Sequencer Data tab

**Navigation:** *System module button / Sequencer Data tab*  
*or Inventory menu / System command / Sequencer Data tab*

Position	Full Load or Cut-In Pressure, psig	Max Full Flow or Cut-Out Pressure, psig
Lead	105.00	115.00
2	100.00	110.00
3		
4		
5		

NOTE: All pressures measured at the sequencer pressure tap.

System window: Sequencer Data tab

Use the Sequencer Data tab to enter or view operating pressure ranges for each sequence position, or target pressure and variance, for the selected system. This tab is only available if the Sequencer Used box is marked on the System Data tab, indicating that the system uses an automatic sequencer. Actual compressor sequence order assignment is entered on the Data Entry tab of the System Profiles window.

The appearance of this tab depends on whether the Cascade or Target Pressure type of sequencing is selected on the System Data tab.

**Procedures** Please see page 68.

### Field Definitions

---

*(If Cascade Sequenced System)*

**Position**

The order in which air compressors are brought on line, the first being “Lead” and the second “2.” Higher priority compressors (compressors that come on line sooner than others) have higher pressure range assignments.

**Full-Load or Cut-In Pressure, psig**

The pressure at which the air compressor comes on line or loads, in pounds per square inch gauge. The pressures should be listed in descending order. Also, the full-load or cut-in pressure must be less than the maximum full-flow or cut-out pressure for each compressor.

**Max. Full-Flow or Cut-Out Pressure, psig**

The pressure at which the air compressor cuts out or unloads, in pounds per square inch gauge. The pressures should be listed in descending order. Also, the max. full-flow or cut-out pressure must be greater than the full-load or cut-in pressure for each compressor.

***(If Target Pressure Sequenced System)*****Target Pressure, psig**

The goal pressure the sequencer has for the compressed air system, in pounds per square inch gauge.

**Variance, +/- psi**

The variance from the target pressure allowed by the sequencer for the compressed air system, in pounds per square inch.

## Daytypes tab

**Navigation:** *System module button / Daytypes tab*  
*or Inventory menu / System command / Daytypes tab*

Daytype Description	Operating Days - Season 1	Operating Days - Season 2
Production	150	100
Weekends	35	15

Season 1 demand months: 6  
Season 2 demand months: 4  
Total annual days: 300  
Total down days: 65

System window: Daytypes tab

Use the Daytypes tab to enter or view the different daytypes for the selected system, and the number of operating days and demand months for each season. A daytype is a 24-hour period representing a typical operating day, such as a peak-season weekday or an off-season weekend day. These seasons are the one or two seasons defined for the rate schedule assigned to this system's facility; the rate seasons are defined in the Utility Rate Schedules window, and the rate is assigned to the facility in the Facility window.

**Procedures** Please see page 68.

### Field Definitions

#### Daytype Description

The daytype name or description. You can describe any number of daytypes for the system.

**Operating Days-Season 1**

The number of operating days for that daytype in Season 1. You can define one or two seasons for each rate schedule in the Utility Rate Schedules window.

**Operating Days-Season 2**

The number of operating days for that daytype in Season 2. You can define one or two seasons for each rate schedule in the Utility Rate Schedules window.

**Season 1 Demand Months**

The number of months in Season 1 in which demand charges are incurred.

**Season 2 Demand Months**

The number of months in Season 2 in which demand charges are incurred.

**Total Annual Days**

The number of days each year that the compressed air system operates.

**Total Down Days**

The number of days each year that the compressed air system does not operate.



## End Uses tab

**Navigation:** *System module button / End Uses tab*  
*or Inventory menu / System command / End Uses tab*

End Use	Location	Required Airflow, acfm	Regulated?	Required Pressure, psig	Measured Pressure, psig	Excess Pressure, psi	> 30% TotCap?
bottle capper	packaging	75	<input type="checkbox"/>	80.0	105.0	25.0	<input type="checkbox"/>
bottle blowoff	packaging	20	<input type="checkbox"/>	40.0	105.0	65.0	<input type="checkbox"/>
wort transporter	brewing	125	<input type="checkbox"/>	95.0	105.0	10.0	<input type="checkbox"/>
			<input type="checkbox"/>				<input type="checkbox"/>
			<input type="checkbox"/>				<input type="checkbox"/>

NOTE: Pressures are measured at the end use point.

*System window: End Uses tab*

Use the End Uses tab to enter or view the end uses (usually air tools) in the selected compressed air system, including the required airflow, required pressure, and measured pressure for each end use. The calculated excess pressure amount indicates whether you should consider the Reduce System Air Pressure EEM.

**Procedures** Please see page 68.

### Field Definitions

#### End Use

The name of each tool or piece of equipment (including ancillary equipment) in the compressed air system.

#### Location

The location of each end use in the compressed air system.

#### Required Airflow, acfm

The airflow required by each end use, in actual cubic feet per minute.

**Regulated**

Mark this box if the end use pressure should be regulated, so that end use is removed from consideration in the Reduce System Air Pressure EEM. This means the excess pressure for that end use will not be involved in the comparison to find the smallest excess pressure, which determines the maximum possible pressure reduction in the Reduce System Air Pressure EEM.

**Required Pressure, psig**

The minimum air pressure requirement of each end use, in pounds per square inch gauge.

**Measured Pressure, psig**

The measured air pressure at each end use, in pounds per square inch gauge.

**Excess Pressure, psi**


The calculated excess pressure at each end use, in pounds per square inch. This is the difference between the previous two columns and will be zero if required pressure is not satisfied.

**>30% Tot Cap?**

This box is automatically marked if the end use has an airflow requirement greater than thirty percent of total airflow capacity of all the compressors. A warning message will also appear: "Exceeding total compressor capacity may cause serious fluctuations in pressure and flow."

# Air Systems report

**Navigation:** *System module button / Print button / Preview button*  
*or Inventory menu / System command / Print button / Preview button*

		<b>Air Systems Report</b>		AIRMaster+																													
For: Bruce By: Sonia		<b>Current System with End Uses</b>		June 7, 2000 Page 1 of 1																													
Company : Mountain Springs Brewery Facility : Brewing Facility System : Main Air System Contact Person : Bob Smith Phone Number : (503) 555-1234																																	
Systems Data																																	
Sequencing Type : Cascaded Nominal System Pressure, psig : 100 Airflow Capacity, acfm : 1315 System Elevation, ft. : 500 Air Storage Capacity, cu ft : 63.1212																																	
Sequencer Data: Cascade																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Position</th> <th style="text-align: center;">Full Load or Cut-In Pressure, psig</th> <th style="text-align: center;">Max Full Flow or Out-Out Pressure, psig</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Lead</td> <td style="text-align: center;">105.0</td> <td style="text-align: center;">115.0</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">100.0</td> <td style="text-align: center;">110.0</td> </tr> </tbody> </table>						Position	Full Load or Cut-In Pressure, psig	Max Full Flow or Out-Out Pressure, psig	Lead	105.0	115.0	2	100.0	110.0																			
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End Use Information																																	
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bottle capper	packaging	75	No	80	105	25																											
bottle blow off	packaging	20	No	40	105	65																											
wort transporter	brewing	125	No	95	105	10																											

*Air Systems report: Current System with End Uses*

## Purpose

Use the Air Systems report to view or print a summary of current (or all) system information, with or without end use information.

## Description

The Air Systems report contains up to five main sections for each system record, depending on what information is applicable: system identification and contact information at the top, then Systems Data, Sequencing Data, Daytype Information, and End Use Information. When you select the type of report in the Report Setup window, you have the option of generating the report for only the current system or all systems in the current facility, and for including or excluding the End Use Information. If the report summarizes all system records, each system record (with each appropriate section) starts on a new page of the report. Alternatively, you can generate a report of just end use data for all systems in the current facility (in this case, the different system records appear on the same page).

## Procedures for Viewing or Printing System Records

### To view or print system records

1. In any tab of the System window, click **Print**. The Report Setup window will open:

The screenshot shows a dialog box titled "Report Setup" with a close button (X) in the top right corner. The dialog is divided into two main sections. The first section, "Select Report", contains five radio button options: "Current System", "Current System with End Uses" (which is selected), "All Systems in Current Facility", "All Systems with End Uses", and "End Uses Only". The second section, "Report Title Setup", contains four text input fields: "Title 1" with the text "Air Systems Report", "Title 2" with "Current System with End Uses", "Prepared For" with "Bruce", and "Prepared By" with "Sonia". At the bottom of the dialog are two buttons: "Preview" and "Close".

2. In the Select Report section, choose which version of the report to generate. The report can include the current system or all systems in the current facility, and can include or exclude end use information. You can even generate a report of just end use data for all systems in the current facility. The current system is the system that was selected in the System window before you opened the Report Setup window.
3. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.

4. Click **Preview** to view the report onscreen.
5. If you want to print the report, click **Print** at the top of the onscreen report.
6. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

### **Field Definitions**

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Please refer to the field definitions for the System window tabs on pages 71, 73, 75, and 77.

### **Buttons (on onscreen report)**

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#### **Page**

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

#### **[Zoom]**

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

#### **Print**

Click this button to print the Air Systems report.

#### **Close**

Click this button to close the Air Systems onscreen report.

## Chapter 8

# Compressor module

The Compressor module contains information about in-plant *inventory* air compressors. The Compressor module includes the following windows and reports:

- ◆ **Compressor Inventory window**  
Edit or view inventory air compressor information, such as nameplate information, information about part load controls and cooling, inlet conditions, performance specifications, and calculated energy costs. You can also add an inventory compressor to AIRMaster<sup>+</sup>. p. 83
  
- ◆ **Performance Profile graph**  
View or print a graph of the relationship between an inventory compressor's airflow and performance. p. 97
  
- ◆ **Compressor Inventory Query window**  
Search for air compressors in your plant inventory that meet specified criteria. p. 99
  
- ◆ **Compressor Inventory Detail window**  
Edit or view inventory air compressor information that is more detailed, such as detailed specifications, drive motor and fan motor specifications, part load details, and any applicable centrifugal specifics. p. 103
  
- ◆ **Compressor Inventory report**  
View and/or print summarized or detailed information for the selected inventory compressor or all inventory compressors, or information from a query of inventory compressors.. p. 115

# Compressor Inventory window

**Navigation:** *Compressor module button*  
or *Inventory menu / Compressor command*

The screenshot shows the 'Compressor Inventory' window with the following details:

- Facility:** Brewing Facility
- Compressor:** Compressor 1
- System:** Main Air System
- Compressor Description:** 100 hp, Single Stage Rotary Screw, 475 acfm
- User-assigned ID:** AAA
- Description:** Compressor 1
- System discharge control range:** 110.0 - 116.0 psig
- In service:**
- Sequencer used:**
- Manufacturer:** Compressor Details...

The **Nameplate** tab is active, displaying the following information:

- Compressor type:** Single stage lubricant-injected rotary screw
- Manufacturer:** <Generic>
- Model:** 100 hp
- Horsepower rating:** 100
- Full load operating pressure, psig:** 100
- Rated capacity @ full load operating pressure, acfm:** 473
- Serial #:** 123-abc
- Installation date:** 01/08/1992
- Compressor location:** compressor room

Compressor Inventory window: Nameplate tab

## Purpose

The Compressor Inventory window allows you to edit or view *inventory* air compressor information, such as nameplate information, information about part load controls and cooling, inlet conditions, performance specifications, and calculated energy costs. You can also use this window to add an inventory compressor to AIRMaster<sup>+</sup>. Any number of air compressors can be assigned to each compressed air system.

**Note** AIRMaster<sup>+</sup> contains two compressor databases: the inventory database (data describing in-service and spare compressors), and the catalog database (data describing generic or sample compressors). The compressor module contains information regarding inventory compressors; for information about catalog compressors, see the Catalog module.

## Description

The Compressor Inventory window has four tabs:

- the Nameplate tab, which displays air compressor nameplate information
- the Controls tab, which displays information about part load controls and cooling
- the Performance tab, which displays inlet conditions and air compressor performance specifications
- the Totals tab, which displays calculated energy costs

The information in all four tabs relates to the compressor selected in the Compressor field at the top of the window. The buttons at the top of the window apply to the selected compressor, regardless of which tab is active, and you can switch between tabs in the same selected compressor without losing information. The fields and buttons above the tabs are described below, followed by a description of each tab.

The Compressor Inventory window also provides access to the more detailed air compressor information in the Compressor Inventory Detail window, and provides access to the search capability of the Compressor Inventory Query window.

## ***Procedures for Viewing or Editing Inventory Air Compressor Information, Adding an Inventory Air Compressor, or Copying an Inventory Air Compressor to the Catalog Database***

### **To view or edit inventory air compressor information**

1. Select the air compressor you want to view or edit, using the Facility, System, and Compressor drop-down list fields at the top of the window. Note that the list of systems will be limited to systems assigned to the selected facility, and the list of compressors will be limited to compressors assigned to the selected system. (You can also select an air compressor using the Compressor Inventory Query window; see page 99.)
2. As soon as you select a compressor, all the fields at the top of the window and in both tabs will display information for the selection. Continue to the next step only if you want to edit the selected compressor.
3. If you want to edit the selected compressor, click **Edit** to enter Edit mode. You can no longer edit the Facility, System, Compressor, System Discharge Control Range, or Sequencer Used fields at the top of the window. Edit the User-Assigned ID, compressor description, and whether the selected compressor is in service.
4. In the Nameplate tab, edit the compressor type, manufacturer, model, and drive motor rating. Edit the full load operating pressure and rated capacity at that pressure, the compressor serial number, installation date, and location.
5. In the Controls tab, select the control type of the compressor. The choices of control types in the drop-down list will be limited to control types compatible with the original compressor type and control type. In the After Cooling section, select Water-cooled or Air-cooled to describe the compressor's cooling system, and select the horsepower rating of the compressor cooling fan. In the Unloading Controls section, note that the compressor control type



influences default values and the availability of fields. If the fields are available, edit the unload point, number of unload steps, unloaded sump pressure, and whether the compressor has an automatic shutdown timer.

6. In the Performance tab, edit the inlet conditions: average temperature and atmospheric pressure. The layout of the Performance Points section depends on the control type of the compressor. Edit the available discharge pressure, airflow, and power fields. If you are unable to obtain certain airflow or power data, select the default performance value for an average compressor by clicking the “Dflt” box. If you need the Power Calculator to multiply amps by volts to obtain a power value, click the “...” button (you must be in Edit mode). Note that if you edit the performance points so that the motor load exceeds the service factor, a warning message will appear; to adjust the service factor, follow the procedures for editing inventory compressor details on page 104.
7. Since the Totals tab is display only, you are finished editing fields in this window. If you want to copy the Totals tab information to a spreadsheet program, click **Copy to Clipboard**. This copies all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.
8. Click **Manufacturer Compressor Details** to open the Compressor Inventory Detail window for the same compressor, and edit the more detailed compressor information in all tabs. (See page 104 for editing procedures in the Compressor Inventory Detail window.) When you are finished reviewing compressor details, click **Close** to return to the Compressor Inventory window.
9. Click **Save** to save the inventory air compressor information in all tabs in both the Compressor Inventory Detail and Compressor Inventory windows. The status bar at the bottom of the window will indicate that the change is affecting calculations elsewhere; these recalculations will take a few seconds.

### To add an inventory air compressor

You can add any number of air compressors to each compressed air system.

1. To enter a new compressor into the inventory database, it is important to have valid and complete data. Therefore, AIRMaster<sup>+</sup> is set up for you to copy a generic compressor from the catalog database into the inventory database and then edit values to closely match the actual in-plant compressor. First decide whether you would like the catalog compressor to become an *additional* inventory compressor (see step #2), or to *replace* the selected inventory compressor (see step #3).
2. To add a new inventory compressor, click **Add**. The Compressor Catalog window opens. Select a compressor that closely matches the in-plant compressor you want to add: select the compressor type, control type, and motor rating desired; enter capacity and full load pressure if known; click **Search** to generate a list of catalog compressors that match your criteria; select a compressor on the list; and click **Select**. The Compressor Inventory window reopens, with the selected catalog compressor information displayed. See step #4.
3. To replace the selected inventory compressor with a new compressor, click **Copy From Catalog**. The Compressor Catalog window opens, with the same compressor type, control type, and horsepower rating that were selected in the

Compressor Inventory window (limited editing will still be possible). Select a compressor that closely matches the in-plant compressor you want to add: select the compressor type, control type, and motor rating desired; enter capacity and full load pressure if known; click **Search** to generate a list of catalog compressors that match your criteria; select a compressor on the list; and click **Select**. The Compressor Inventory window reopens, with the selected catalog compressor data replacing the previous inventory compressor data.

4. Click **Edit** to modify values in the Compressor Inventory window. You may choose to use the catalog values, but actual data should be used for better accuracy. Data can come from the compressor's nameplate or operator's manual. It is important to review values in the Controls tab and Performance tab. See steps #4-6 in the above procedures, "To view or edit inventory air compressor information." Note that you will not be able to edit the Compressor Type field from a centrifugal type to a non-centrifugal type, and vice versa. Also, control type choices are limited by the selected catalog compressor control type.
5. Click **Manufacturer Compressor Details** to open the Compressor Inventory Detail window for the same compressor, and edit the more detailed compressor information in all tabs. (See page 104 for editing procedures in the Compressor Inventory Detail window.) When you are finished reviewing compressor details, click **Close** to return to the Compressor Inventory window.
6. When you have finished entering and editing the new inventory compressor information in the Compressor Inventory and Compressor Inventory Detail windows, click **Save** to save the information in all tabs. The status bar at the bottom of the window will indicate that the change is affecting calculations elsewhere; these recalculations will take a few seconds.

### **To copy an inventory air compressor to Catalog**

If the company has several similar or identical compressors in various systems or facilities, it is useful to copy the completed inventory air compressor record to the catalog database. By keeping a copy of the compressor information in the catalog database, it is easy to later copy it back into a particular system using the Compressor Inventory window. (Alternatively, you can enter a compressor directly into the catalog database using the Compressor Catalog Detail window; see page 223 for procedures.)

1. Select the desired inventory air compressor in the Compressor Inventory window. Make sure all the compressor values are satisfactory.
2. Click **Copy to Catalog**. The inventory air compressor information has been copied to the catalog database.

---

## **Field Definitions**

### **Facility**

The name of the facility, or site. Select from the drop-down list.

**System**

The name of the system. Select from the drop-down list of systems available in the selected facility.

**Compressor**

The name of the in-plant air compressor. Select from the drop-down list of compressors assigned to the selected system. A summary of the selected compressor's horsepower rating, compressor type, and full load or cut-in pressure appears in red type below this field.

**User-Assigned ID**

The user-assigned air compressor ID code, which can be used as a search parameter.

**Description**

The user-assigned name for the air compressor, such as Main Compressor.

**System Discharge Control Range**

The operating pressure range for the compressed air system, in pounds per square inch gauge.

**In Service**

Mark this box if the air compressor currently has in-service status. If this box is not marked, the compressor won't appear in the Profile or Efficiency Measures modules.

**Sequencer Used**

This box is marked if a programmed automatic sequencer brings the air compressor on line. This display-only field indicates whether "Sequencer Used" is marked on the System window, System Data tab.

**Buttons**

---

**Add**

Click to enter Add mode, automatically opening the Compressor Catalog window where you select a compressor that closely matches the inventory compressor you wish to add, then return to the Compressor Inventory window with the catalog compressor information.

**Edit**

Click to enter Edit mode to make changes to the inventory air compressor information currently displayed.

**Save**

Once in Edit mode, click to save the inventory air compressor information displayed.

**Delete**

Click to delete the currently displayed inventory air compressor.

**Print**

Click to open the Report Setup window, to view or print the Compressor Inventory report.

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Compressor Inventory window Help topic, which provides context-sensitive Help for this window.

**Query Inventory**

Click to open the Compressor Inventory Query window, where you can search for compressors in inventory that meet specified criteria.

**Copy From Catalog**

Click to enter Add mode, automatically opening the Compressor Catalog window where you select a compressor that closely matches the inventory compressor you wish to add, then return to the Compressor Inventory window with the catalog compressor information. This button functions like the **Add** button except that the selected inventory compressor information is overwritten, rather than just creating a new inventory compressor.

**Copy To Catalog**

Click to copy the selected inventory air compressor to the compressor catalog database. This is useful if the same company has several of the same compressors in various systems or facilities; by keeping a copy of the compressor information in the catalog database, it is easy to later copy it back into a particular system using the Compressor Inventory window.

**Close/Cancel**

Click to close the Compressor Inventory window, or to cancel Edit/Add mode and reverse edits to displayed data.

**Manufacturer Compressor Details**

Click to open the Compressor Inventory Detail window, where you can view more detailed information about an inventory air compressor.

## Nameplate tab

Use the Nameplate tab to edit or view information from the nameplate of the selected inventory air compressor, including compressor type, model, full-load pressure and capacity. See illustration of Nameplate tab on page 83.

**Procedures** Please see page 84.

## Field Definitions

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### Compressor Type

The type of air compressor, such as single stage lubricant-injected rotary screw. Note that if you have added a catalog compressor to the inventory database, you will not be able to edit from a centrifugal type to a non-centrifugal type, and vice versa.

### Manufacturer

The name of the air compressor manufacturer.

### Model

The model of the inventory air compressor (or the description if it's a catalog air compressor).

### Horsepower Rating

The manufacturer's suggested drive motor requirement for the air compressor. The drop-down list offers hp ratings from 1-3500.

### Full-Load Operating Pressure, psig

The air compressor's rated discharge pressure, in pounds per square inch gauge.

### Rated Capacity @ Full-Load Operating Pressure, acfm

The maximum operating airflow delivered by the air compressor at full load operating pressure, in actual cubic feet per minute, as specified on the air compressor nameplate.

### Serial #

The serial number of the air compressor.

### Installation Date

The date that the company installed the air compressor in the current compressed air system.

### Compressor Location

The location of the air compressor on the site, such as Compressor Room A.

## Controls tab

**Navigation:** *Compressor module button / Controls tab*  
*or Inventory menu / Compressor command / Controls tab*

*Compressor Inventory window: Controls tab*

Use the Controls tab to edit or view information about part load controls and cooling for the selected inventory air compressor. The available control types will be limited to those compatible with the original compressor type and control type.

The left half of the tab displays cooling data, and the right half of the tab displays unloading control information. The type of control selected will influence the default values and the availability of the Unloading Controls section.

**Procedures** Please see page 84.

### Field Definitions

#### Control Type

The type of control for the selected compressor, such as load/unload. The choices of control types in the drop-down list will be limited to control types compatible

with the original compressor type and control type. The control type selected here will, in turn, affect the default values and the availability of Unloading Controls information.

### ***After Cooling***

#### **Water-cooled**

Select this option if the air compressor uses a water-based cooling system.

#### **Air-cooled**

Select this option if the air compressor uses an air-based cooling system.

#### **Fan Motor Rating, hp**

The horsepower rating of the air compressor cooling fan. The drop-down list offers hp ratings from 1-20.

### ***Unloading Controls***

#### **Unload Point, %C**

The airflow at which the air compressor unloads, expressed as a percentage of air compressor rated full-flow capacity.

#### **# Unload Steps**

The number of steps in the load control strategy.

#### **Unloaded Sump Pressure, psig**

The residual pressure in the lubricant sump when the air compressor is completely unloaded (expressed in pounds per square inch gauge).

#### **Automatic Shutdown Timer**

Mark this box if the air compressor has a device that turns off the air compressor after it has operated at no load for a specified length of time.

## Performance tab

**Navigation:** *Compressor module button / Performance tab*  
*or Inventory menu / Compressor command / Performance tab*

**Compressor Inventory**

File Calculators Help

Query Inventory View Catalog Copy To Catalog Close

Facility: **Brewing Facility** Compressor: **Compressor 1**

System: **Main Air System** **100 hp, Single Stage Rotary Screw, 475 acfm**

User-assigned ID: **AAA** System discharge control range: **110.0 - 116.0 psig** Manufacturer Compressor Details...

Description: **Compressor 1** In service:  Sequencer used:

**Performance** (selected tab)

**Inlet Conditions**

Avg. temperature, °F: **85**

Atmos. pressure, psia: **14.4**

**Performance Points (actual, not rated)**

Load	Discharge Pressure (psig)	Airflow (acfm)	Power (kW)
Full load	110.0	475	90.0
No load (modulated)	116.0	0	60.0

Pressures are referenced from the compressor discharge. Performance Profile...

*Compressor Inventory window: Performance tab*

Use the Performance tab to edit or view inlet conditions and performance specifications for the selected inventory air compressor. The type of compressor control selected will influence the layout of the Performance Points section.

Actual measured data should be used whenever possible. However, measurement of electrical power and airflow isn't always possible due to plant operation and equipment availability. If performance point data cannot be measured, use AIRMaster+ defaults for airflow and power. AIRMaster+ will adjust catalog values based on entered compressor inlet temperature and pressure. Values will then be corrected for actual discharge pressure data, which may differ from rated values. All subsequent profile calculations will be based upon the corrected performance points.

**Procedures** Please see page 84.



## Field Definitions

---

### *Inlet Conditions*

#### **Average Temperature, °F**

The average temperature at the air compressor inlet, in degrees Fahrenheit.

#### **Atmospheric Pressure, psia**

The average barometric pressure at the location of the air compressor inlet, in pounds per square inch absolute. A default value based on elevation is calculated.

### *Unloading Blowdown Time*

This section only appears for a lubricant-injected rotary screw compressor with unloading controls.

#### **For Lubricant-Injected Rotary Screws, sec.**

The number of seconds required for the compressor to completely unload or to reach its fully unloaded power.

### *Performance Points*

Compressors with different control types are measured with different sets of performance specifications, so the appearance of this section depends on the compressor control type. Note that if you edit the performance points so that the motor load exceeds the service factor, a warning message will appear.

#### **Performance Points**

The point at which air compressor performance was measured, such as full load or maximum pressure full flow. Up to five performance points may be listed, depending on the type of compressor and control type.

#### **Discharge Pressure, psig**

The discharge pressure measured under the air compressor's rated or specified performance conditions, in pounds per square inch gauge.

#### **Airflow: Dflit?**

Mark this box to use default airflow performance values for an industry average, or generic, air compressor. If this box is marked, the "Airflow: acfm" field will not be available.

#### **Airflow: acfm**

The maximum airflow delivery capability for the air compressor at actual inlet conditions and discharge pressure, in actual cubic feet per minute.

#### **Power: Dflit?**

Mark this box to use default power performance values for a generic air compressor. If this box is marked, the "Power: kW" field will not be available.

#### **Power: kW**

The power used by the air compressor, measured at the air compressor's rated performance conditions, in kilowatts. Click the "..." button following this field to open the Power Calculator window.

## Buttons

---

“...”

Click to open the Power Calculator window (see page 271), where you can multiply amps by volts to obtain a power value. This button is available in Edit or Add mode, when the “Power, kW” field is available.

### **Performance Profile**

Click to open the Performance Profile graph window, which displays a graph of how the selected compressor’s performance is affected by airflow.

## Totals tab

**Navigation:** *Compressor module button / Totals tab*  
*or Inventory menu / Compressor command / Totals tab*

Daytype	Total OpHrs	Avg Airflow, acfm	Avg Airflow, %Cs	Peak Demand, kW	Load Factor, %	Annual Energy, kWh	Annual Energy Cost, \$
Production	6,000	333	70.0	90.0	90.0	486,000	18,468
Weekends	0	0	0.0	0.0	0.0	0	0
<b>Compressor Totals</b>	<b>6,000</b>	<b>333</b>	<b>70.0</b>	<b>90.0</b>	<b>90.0</b>	<b>486,000</b>	<b>18,468</b>

*Compressor Inventory window: Totals tab*

Use the *display-only* Totals tab to view calculated energy costs for the selected inventory air compressor, subtotaled for each daytype. The values used for these calculations are entered in the Data Entry tab of the System Profiles window. (Although profile data is entered after compressor data, these calculations for the compressors require profile information.)

**Procedures** Please see page 84.

### Field Definitions

#### Daytype

The type of typical operating day, such as Normal Production or Weekends. Daytypes are defined in the Daytypes tab of the System window.

**Total OpHrs**

The annual total operating hours for the air compressor for each daytype.

**Avg Airflow, acfm**

The average airflow delivered by the air compressor, in actual cubic feet per minute, for each daytype and the average operating day.

**Avg Airflow, %Cs**

The average airflow provided by an air compressor, measured as a percentage of the maximum airflow (capacity of the compressed air system), for each daytype and the average operating day.

**Peak Demand, kW**

The maximum demand of the air compressor during each daytype and all days, in kilowatts.

**Load Factor, %**

The average air compressor drive motor load divided by the nameplate full-load rating, expressed as a percentage, for each daytype and the average operating day.

**Annual Energy, kWh**

The air compressor's yearly energy use, subtotaled for each daytype, in kilowatt-hours.

**Annual Energy Cost, \$**

The cost of the air compressor's yearly kilowatt-hours of energy use, subtotaled for each daytype.

**Buttons**

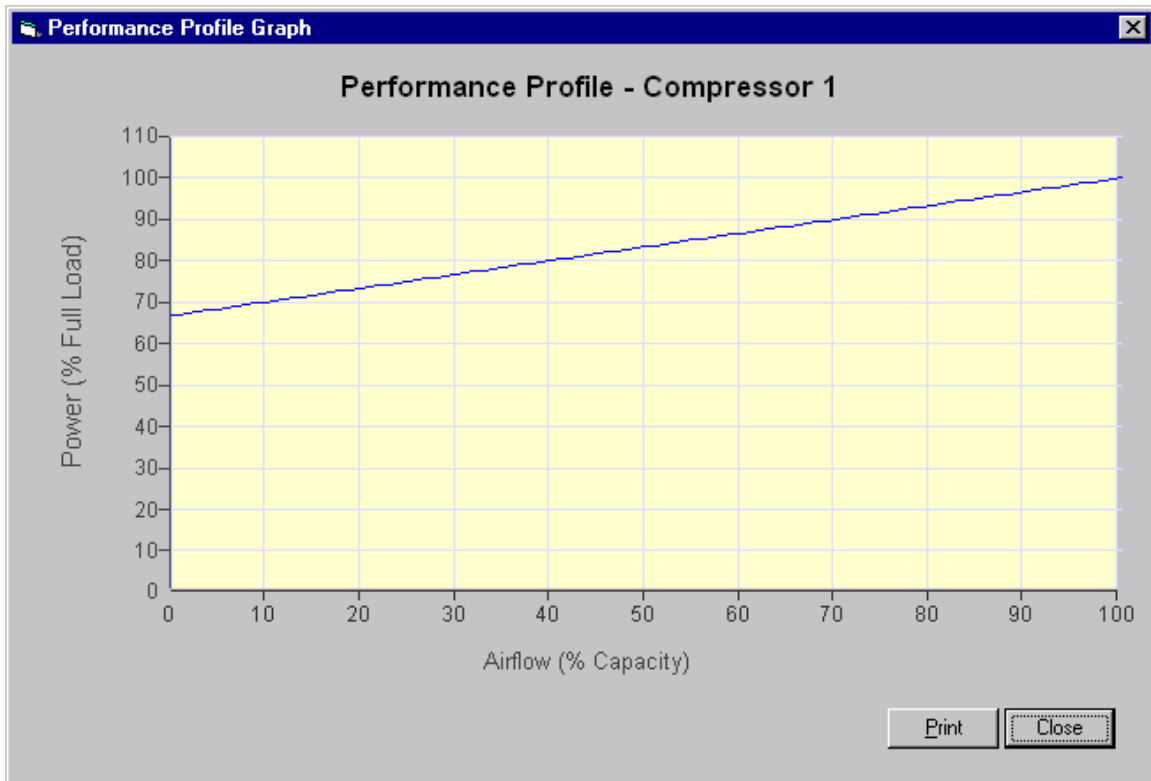
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**Copy to Clipboard**

Click to copy all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.

# Performance Profile graph

**Navigation:** *Compressor module button / Performance tab / Performance Profile button*  
or *Inventory menu / Compressor command / Performance tab / Performance Profile button*



*Performance Profile graph*

## **Purpose**

Use the Performance Profile graph to see how an inventory compressor's performance is affected by airflow. You can also print this graph.

## **Description**

The Performance Profile graph displays power (as a percentage of full load power) along the y-axis, and airflow (as a percentage of capacity) along the x-axis. This graph is accessed via the Performance Profile button on the Performance tab of the Compressor Inventory window. The Performance Profile graph represents the compressor selected in the Compressor Inventory window.

## ***Procedures for Viewing or Printing a Performance Profile Graph***

### **To view or print a performance profile graph**

1. In the Compressor Inventory window, select the desired inventory compressor.
2. Open the Performance tab.
3. Click **Performance Profile**. The Performance Profile graph opens.
4. Click **Print** if you would like to print the Performance Profile graph.
5. When you are done viewing the Performance Profile graph, click **Close** to return to the Compressor Inventory window.

### **Field Definitions**

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#### **Power (% Full Load)**

Electrical power for the selected inventory compressor, expressed as a percentage of the maximum power delivered by that compressor at full load.

#### **Airflow (% Capacity)**

Airflow for the selected inventory compressor, expressed as a percentage of the maximum airflow deliverable by that compressor.

### **Buttons**

---

#### **Print**

Click to print the Performance Profile graph.

#### **Close**

Click to close the Performance Profile graph and return to the Compressor Inventory window.

# Compressor Inventory Query window

**Navigation:** *Compressor module button / Query Inventory button*  
*or Inventory menu / Compressor command / Query Inventory button*

Description	User-Assigned ID	Facility	System	Compressor Type	Manufacturer
Compressor 1	AAA	Brewing Facility	Main Air System	Single stage lubricant-injected r	<Generic>
Compressor 2	BBB	Brewing Facility	Main Air System	Two stage reciprocating	<Generic>

*Compressor Inventory Query window*

## Purpose

The Compressor Inventory Query window allows you to search for compressors in the AIRMaster+ inventory database that meet specified criteria. These compressors can be sorted and listed by compressor type, control type, manufacturer, horsepower rating, capacity, discharge pressure, or by facility. Access this window from the Compressor Inventory window, run a search, select a compressor, and return to the Compressor Inventory window to view more information about that compressor.

## Description

The Compressor Inventory Query window contains two main sections; the upper section displays the criteria for your search, and the lower section lists the inventory air compressors that meet that criteria.

## ***Procedures for Searching Inventory Air Compressors***

### **To search inventory air compressors**

1. If you would like to limit the query, select or enter search criteria at the top of the window. Note that your options in the Control Type field are limited by the selection of compressor type.
2. When you have finished selecting or entering search criteria, click **Search**. Search results are displayed in the bottom half of the window.
3. If you would like to run another query, you can either edit the displayed Search Criteria and click **Search** again, or click **Clear** to clear the Search Criteria before selecting new information and clicking **Search**. Remember that edited Search Criteria fields will not cause the Search Results list to be updated until you click **Search**.
4. If you want to view information for an inventory air compressor in the Search Results list, select that compressor and click **Select**. The Compressor Inventory window opens, displaying information for the selected compressor.
5. When you have finished running queries, click **Close** to close the Compressor Inventory Query window.

### **Field Definitions**

---

#### ***Search Criteria***

##### **Compressor Type**

The type of air compressor, such as single stage lubricant-injected rotary screw.

##### **Control Type**

The type of control for the air compressor, such as load/unload. The list of available control types is limited by the selection of compressor type.

##### **Manufacturer**

The name of the air compressor manufacturer.

##### **Horsepower Rating**

The manufacturer's suggested drive motor requirement for the air compressor. The drop-down list offers hp ratings from 1-3500.

##### **Desired Capacity, acfm $\pm$ %**

The desired capacity of the air compressor, in actual cubic feet per minute, with an allowable variance as a percentage.

##### **Desired Full Load Pressure, psig $\pm$ %**

The desired discharge pressure, as specified on the nameplate of the air compressor, in pounds per square inch gauge, with an allowable variance as a percentage.

##### **Facility**

The facility, or site, to which the air compressor is assigned. "All Facilities" is a choice.

##### **Description**

The user-assigned name for the air compressor, such as Main Compressor.



## ***Search Results***

### **Description**

The user-assigned name for the air compressor, such as Main Compressor.

### **User-Assigned ID**

The user-assigned air compressor ID code.

### **Facility**

The facility, or site, to which the air compressor is assigned.

### **System**

The name of the compressed air system to which the air compressor is assigned.

### **Compressor Type**

The type of air compressor, such as single stage lubricant-injected rotary screw.

### **Manufacturer**

The name of the air compressor manufacturer.

### **Model**

The model of the inventory air compressor (or the description if it's a catalog air compressor).

### **Horsepower Rating**

The manufacturer's suggested drive motor requirement for the air compressor.

### **Control Type**

The type of control for the air compressor, such as load/unload.

### **Rated Capacity, acfm**

The maximum operating airflow delivered by the air compressor at full load operating pressure, in actual cubic feet per minute, as specified on the air compressor nameplate.

### **Full Load Pressure, psig**

The rated discharge pressure, as specified on the nameplate of the air compressor, in pounds per square inch gauge.

### **Max. Pressure, psig**

The maximum pressure attainable at full flow (measured in pounds per square inch gauge); usually the unload pressure setting for load/unload control or the maximum pressure attainable before capacity control begins. May require additional power.

## **Buttons**

---

### **Select**

Click to view additional information for the inventory air compressor that is selected in the Search Results list. The Compressor Inventory window opens.

### **Search**

Click to run a query based on the displayed search criteria.

### **Clear**

Click to clear the Search Criteria fields for a new search.

**Print**

Click to open the Report Setup window, to view or print the Compressor Inventory report.

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Compressor Inventory Query window Help topic, which provides context-sensitive Help for this window.

**Close**

Click to close the Compressor Inventory Query window.

# Compressor Inventory Detail window

**Navigation:** *Compressor module button / Manufacturer Compressor Details button*  
or *Inventory menu / Compressor command / Manufacturer Compressor Details button*

The screenshot shows a software window titled "Compressor Inventory Detail" with a menu bar (File, Calculators, Help) and a Close button. The window is divided into four tabs: General Data, Drive Motor, Fan Motor, and Other Data. The General Data tab is active and contains the following fields:

Field	Value
Compressor type	Single stage lubricant-injected rotary screw
Manufacturer	<Generic>
Model	100 hp
Control type	Inlet modulation without unloading
Horsepower rating	100
Full load shaft power, BHP	105.0
Rated capacity @ full load operating pressure, acfm	473
Full load operating pressure, psig	100.0
Max. full flow operating pressure, psig	110.0
Total package power input at rated conditions, kW	85.4
Specific package power input at rated conditions, kW/100 acfm	18.1

*Compressor Inventory Detail window: General Data tab*

## Purpose

The Compressor Inventory Detail window allows you to edit or view detailed information about the inventory air compressor selected in the Compressor Inventory window. If the Compressor Inventory window was in Add or Edit mode, then you can edit the fields in this window. Otherwise, this window is display only.

## Description

The Compressor Inventory Detail window has four tabs:

- the General Data tab, which displays detailed specifications about the air compressor
- the Drive Motor tab, which displays specifications for the air compressor's drive motor
- the Fan Motor tab, which displays specifications for the air compressor's fan motor
- the Other Data tab, which displays part load details and any applicable centrifugal specifics for the air compressor

## ***Procedures for Viewing or Editing Inventory Compressor Details***

### **To view inventory compressor details**

1. Select the compressor of interest at the top of the Compressor Inventory window and click **Manufacturer Compressor Details** to open the Compressor Inventory Detail window.
2. The fields in all four tabs of the Compressor Inventory Details window display information for the compressor selected in the Compressor Inventory window.

### **To edit inventory compressor details**

1. To edit fields in the Compressor Inventory Detail window, the Compressor Inventory window must be in Add or Edit mode (see procedures on page 84) before you access the Compressor Inventory Detail window. Make sure the compressor of interest is selected at the top of the Compressor Inventory window, then click **Manufacturer Compressor Details** to open the Compressor Inventory Detail window.
2. The fields in all four tabs of the Compressor Inventory Details window display information for the compressor selected in the Compressor Inventory window. You can edit every field in the four tabs except Compressor Type. Note that drive motor and fan motor performance values are usually stamped on the motor's nameplate. See the field definitions for the fields in each tab; some fields will not be applicable for certain compressor types or control types.

**Note** Most manufacturers design their compressor to operate between 105-110% of drive motor nameplate horsepower at rated full load conditions. Increasing discharge pressure beyond the rated value may bring the motor load dangerously close to, or even exceed, the service factor. To avoid approaching the actual service factor of the motor, adjust the service factor value on the Drive Motor tab so the motor overload warning will display at a lower load. For example, if the service factor was changed from 1.15 to 1.05, AIRMaster<sup>+</sup> will now warn the user when a performance point value has exceeded 105% of nameplate full load, thus providing a greater margin of safety.

3. When you have finished editing the fields in each tab, click **Close** to return to the Compressor Inventory window. Review the fields in the Compressor Inventory window tabs, and edit if necessary. Click **Save** to save the compressor information in all tabs of both the Compressor Inventory and Compressor Inventory Detail windows, or **Cancel** to cancel edits in both windows.

## **Buttons**

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### **Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Compressor Inventory Detail window Help topic, which provides context-sensitive Help for this window.

### **Close**

Click to close the Compressor Inventory Detail window, and return to the Compressor Inventory window, where you can cancel edits made in this window.

## General Data tab

Use the General Data tab to edit or view detailed specifications about the selected air compressor in inventory, including the type of air compressor, rated capacity, operating pressure, and specific package power input. See illustration of General Data tab on page 103.

**Procedures** Please see page 104.

## Field Definitions

---

### Compressor Type

The type of air compressor, such as single stage lubricant-injected rotary screw.

### Manufacturer

The name of the air compressor manufacturer.

### Model

The model of the inventory air compressor (or the description if it's a catalog air compressor).

### Control Type

The type of control for the air compressor, such as load/unload.

### Horsepower Rating

The manufacturer's suggested drive motor requirement for the air compressor. The drop-down list offers hp ratings from 1-3500.

### Full-Load Shaft Power, BHP

The power requirements at the air compressor shaft when operating at full speed with a fully open inlet and discharge delivering maximum airflow (measured in brake horsepower).

### Rated Capacity @ Full-Load Operating Pressure, acfm

The maximum operating airflow at inlet conditions, measured at the discharge terminal point of the air compressor package, in actual cubic feet per minute. For rotary screw air compressors, measured in accordance with CAGI/PNEUROPP/PNZCPTCZ Test Code.

### Full-Load Operating Pressure, psig

The operating pressure at which rated capacity is measured, in pounds per square inch gauge.

### Max. Full-Flow Operating Pressure, psig

The maximum pressure attainable at full flow (measured in pounds per square inch gauge); usually the unload pressure setting for load/unload control or the maximum pressure attainable before capacity control begins. May require additional power.

### Total Package Power Input at Rated Conditions, kW

The total electrical power (in kilowatts) input to an air compressor under rated conditions, including drive motor, cooling fan, auxiliary motors, and controls.

**Specific Package Power Input at Rated Conditions, kW/ 100 acfm**

A measure of air compressor efficiency in the form of power required to deliver a fixed airflow at rated capacity and full-load operating pressure (expressed as kilowatts per 100 times actual cubic feet per minute).

## Drive Motor tab

**Navigation:** *Compressor module button / Manufacturer Compressor Details button / Drive Motor tab or Inventory menu / Compressor command / Manufacturer Compressor Details button / Drive Motor tab*

The screenshot shows a software window titled "Compressor Inventory Detail" with a menu bar (File, Calculators, Help) and a Close button. The "Drive Motor" tab is selected, showing various input fields for motor specifications. The fields are organized into two main sections: General Data and Full Load specifications.

Field	Value
Manufacturer	[Dropdown]
Model	[Text]
Serial #	[Text]
Frame size	[Text]
Motor type	[Dropdown]
Motor rating, hp	100
Synchronous speed, rpm	1800
Enclosure type	[Dropdown]
Full Load Amps	119.0
Full Load Speed, rpm	[Text]
Full Load Power factor, %	87.0
Full Load Efficiency, %	91.7
Voltage rating	230/460
Wired-for voltage	460
Service factor	1.15
Insulation class	[Dropdown]
Rewound	<input type="checkbox"/>

*Compressor Inventory Detail window: Drive Motor tab*

Use the Drive Motor tab to edit or view detailed specifications about the drive motor for the selected air compressor in inventory. Drive motor performance values are usually stamped on the motor's nameplate.

There is a separate section of the tab for Full Load specifications.

**Procedures** Please see page 104.

### Field Definitions

#### **Manufacturer**

The name of the drive motor manufacturer.

#### **Model**

The model of the air compressor's drive motor.

#### **Serial #**

The serial number of the air compressor's drive motor.



**Frame Size**

The frame size for the drive motor.

**Motor Type**

The type of drive motor, such as NEMA Design B.

**Motor Rating, hp**

The horsepower rating of the air compressor's drive motor. The drop-down list offers hp ratings from 1-3500.

**Synchronous Speed, rpm**

The motor's synchronous or no-load speed, in revolutions per minute. The drop-down list offers these options: 900,1200,1800, or 3600 rpm.

**Enclosure Type**

The type of enclosure for the drive motor. The drop-down list offers these options: open dripproof (ODP), totally enclosed fan-cooled (TEFC), totally enclosed non-ventilated (TENV), or totally enclosed blower-cooled (TEBC).

**Voltage Rating**

The voltage rating of the drive motor. The drop-down list offers several options.

**Wired-For Voltage**

The actual motor operating voltage.

**Service Factor**

The service factor of the drive motor, such as 1.15.

**Insulation Class**

The insulation class for the motor's windings. The drop-down list offers B, F, or H.

**Rewound**

Mark this box if the drive motor has previously been rewound.

***Full Load*****Amps**

The required current for the drive motor at full load, measured in amperes.

**Speed, rpm**

The rotational speed of the drive motor at full load, in revolutions per minute.

**Power Factor, %**

The power factor of the drive motor at full load, expressed as a percentage.

**Efficiency, %**

The efficiency of the drive motor at full load, expressed as a percentage.

## Fan Motor tab

**Navigation:** *Compressor module button / Manufacturer Compressor Details button / Fan Motor tab or Inventory menu / Compressor command / Manufacturer Compressor Details button / Fan Motor tab*

The screenshot shows a software window titled "Compressor Inventory Detail" with a menu bar (File, Calculators, Help) and a Close button. The window is divided into four tabs: General Data, Drive Motor, Fan Motor (selected), and Other Data. The Fan Motor tab contains several input fields and a "Full Load" section. The "Full Load" section includes a "Clear" button and fields for Amps, Speed, rpm, Power factor, %, and Efficiency, %. Other fields include Manufacturer (dropdown), Model, Serial #, Frame size, Motor type (dropdown), Motor rating, hp (dropdown), Synchronous speed, rpm (dropdown), Enclosure type (dropdown), Voltage rating (dropdown), Wired-for voltage (dropdown), Service factor, Insulation class (dropdown), and Rewound (checkbox).

*Compressor Inventory Detail window: Fan Motor tab*

Use the Fan Motor tab to edit or view detailed specifications about the fan motor for the selected air compressor in inventory. Fan motor performance values are usually stamped on the motor's nameplate.

There is a separate section of the tab for Full Load specifications.

**Procedures** Please see page 104.

### Field Definitions

---

#### **Manufacturer**

The name of the fan motor manufacturer.

#### **Model**

The model of the air compressor's fan motor.

#### **Serial #**

The serial number of the air compressor's fan motor.

**Frame Size**

The frame size for the fan motor.

**Motor Type**

The type of fan motor, such as NEMA Design B.

**Motor Rating, hp**

The horsepower rating of the air compressor's fan motor. The drop-down list offers hp ratings from 1-3500.

**Synchronous Speed, rpm**

The motor's synchronous or no-load speed, in revolutions per minute. The drop-down list offers these options: 900,1200,1800, or 3600 rpm.

**Enclosure Type**

The type of enclosure for the fan motor. The drop-down list offers these options: open dripproof (ODP), totally enclosed fan-cooled (TEFC), totally enclosed non-ventilated (TENV), or totally enclosed blower-cooled (TEBC).

**Voltage Rating**

The voltage rating of the fan motor. The drop-down list offers several options.

**Wired-For Voltage**

The actual motor operating voltage.

**Service Factor**

The service factor of the fan motor, such as 1.15.

**Insulation Class**

The insulation class for the motor's windings. The drop-down list offers B, F, or H.

**Rewound**

Mark this box if the fan motor has previously been rewound.

***Full Load*****Amps**

The required current for the fan motor at full load, measured in amperes.

**Speed, rpm**

The rotational speed of the fan motor at full load, in revolutions per minute.

**Power Factor, %**

The power factor of the fan motor at full load, expressed as a percentage.

**Efficiency, %**

The efficiency of the fan motor at full load, expressed as a percentage.

**Buttons**

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**Clear**

Click to remove all entries from the Fan Motor tab.

## Other Data tab

**Navigation:** Compressor module button / Manufacturer Compressor Details button / Other Data tab  
or Inventory menu / Compressor command / Manufacturer Compressor Details button / Other Data tab

The screenshot shows a software window titled "Compressor Inventory Detail : Edit". The window has a menu bar with "File", "Calculators", and "Help". Below the menu bar is a toolbar with a question mark icon and a "Close" button. The main area is divided into four tabs: "General Data", "Drive Motor", "Fan Motor", and "Other Data". The "Other Data" tab is selected and contains two sections: "Part Load Details" and "Centrifugal Specifics".

Section	Parameter	Value
Part Load Details	Proportional modulating pressure range, psi	6.0
	# unload steps	2
	Minimum unloaded sump pressure, psig	15.0
	Blowdown time, seconds	40
	Unload point, % of compressor capacity	50
	Fully modulated power (theoretical), % of full load power	65.0
	Fully unloaded power, % of full load power	18.0
Other Data	Design inlet temp, °F	68
	Design inlet pressure, psia	14.5
	<b>Centrifugal Specifics</b>	
	Surge airflow @ design conditions, acfm	N/A
	Max. full load (surge) pressure, psig	N/A
	Capacity @ max. full load pressure, acfm	N/A
Min. full load (stonewall) pressure, psig	N/A	
Capacity @ min. full load pressure, acfm	N/A	

Compressor Inventory Detail window: Other Data tab

Use the Other Data tab to edit or view part load details and any applicable centrifugal specifics for the selected air compressor in inventory. This window contains two sections: Part Load Details are on the left, and Centrifugal Specifics are on the right.

**Procedures** Please see page 104.

### Field Definitions

---

#### *Part Load Details*

##### **Proportional Modulating Pressure Range, psi**

The difference between the full-load and no-load discharge pressures (in pounds per square inch), if the air compressor has modulation controls.

### **# Unload Steps**

The number of steps in the load control strategy, or the number of discrete operating points at which the compressor can operate if it is a reciprocating compressor.

### **Minimum Unloaded Sump Pressure, psig**

The minimum achievable sump pressure upon unloading (in pounds per square inch gauge), if it is a lubricant injected rotary screw air compressor. (It may take from 15 seconds to two minutes to complete blowdown depending upon orifice size and sump volume.)

### **Blowdown Time, seconds**

The number of seconds required for a compressor to completely unload or to reach its fully unloaded power, or the number of seconds required for the sump pressure to decrease from the cut-out (unloading) pressure to the minimum unloaded sump pressure. Only applicable to lubricant-injected rotary screw compressors with load/unload controls.

### **Unload Point, % of Compressor Capacity**

The airflow at which the air compressor unloads, expressed as a percentage of air compressor rated full-flow capacity.

### **Fully Modulated Power (Theoretical), % of Full-Load Power**

The power draw when the air compressor is fully modulated and delivering no air (expressed as a percentage of full-load power), if it is a lubricant injected air compressor with modulation controls.

### **Fully Unloaded Power, % of Full-Load Power**

The power required when the lubricant-injected rotary screw air compressor is unloaded and completely blown down, expressed as a percentage of the full-load power.

## ***Centrifugal Specifics***

### **Design Inlet Temp, °F**

The inlet temperature for which the air compressor is designed, in degrees Fahrenheit.

### **Design Inlet Pressure, psia**

The inlet pressure for which the air compressor is designed (in pounds per square inch absolute), which is also the design pressure under which the air compressor is rated.

### **Surge Airflow @ Design Conditions, acfm**

The airflow below which air compressor operation is unstable at design conditions, measured in actual cubic feet per minute.

### **Max. Full-Load (Surge) Pressure, psig**

The maximum achievable pressure above which air compressor operation becomes unstable at design conditions, in pounds per square inch gauge.

### **Capacity @ Max. Full-Load Pressure, acfm**

The airflow at the maximum full-load (surge) discharge pressure, in actual cubic feet per minute.

**Min. Full-Load (Stonewall) Pressure, psig**


The minimum pressure below which airflow is choked, in pounds per square inch gauge. (Decreasing pressure further will result in no increase in airflow, at design conditions.)

**Capacity @ Min. Full-Load Pressure, acfm**

The airflow at the minimum full-load (stonewall) discharge pressure, in actual cubic feet per minute.

# Compressor Inventory report

**Navigation:** *Compressor module button / Print button / Preview button*  
*or Inventory menu / Compressor command / Print button / Preview button*  
*or Compressor module button / Query Inventory button / Print button / Preview button*  
*or Inventory menu / Compressor command / Query Inventory button / Print button / Preview button*

 <b>Compressor Inventory Report</b>		AIRMaster+
<b>Current Compressor Detail</b>		May 30, 2000
For: Bruce By: Sonia		Page 1 of 1
Facility: Brewing Facility System: Main Air System Compressor: Compressor 1 User-assigned ID: AAA	System Discharge Control Range: 110.0 - 116.0 psig Service Status: In Service Sequencing: Sequencer Not Used	
<b>General Data</b> Compressortype: Single stage lubricant-injected rotary screw Manufacturer: Generic Model: 100 hp Control type: Inlet modulation without unloading Horsepower Rating: 100	Full load shaft power, BHP: 105.0 Rated capacity,* acfm: 473 Full load operating pressure, psig: 100.0 Max. full flow operating pressure, psig: 110.0 Total package power input,** kW: 85.4 Specific package power input,** kW/100 acfm: 18.1	
* - at full load operating pressure.    ** - at rated conditions.		
<b>Drive Motor</b> Manufacturer: Model: Serial #: Frame size: Motor type: Motor rating, hp: 100 Synchronous speed, rpm: 1800 Enclosure type: Rewound: No	Amps*: 119 Full load speed,* rpm: 0 Power factor,* %: 87 Efficiency,* %: 91.7 Voltage rating: 230/460 Wired-for voltage: 460 Service factor: 1.15 Insulation class:	
* - at full load operating conditions.		
<b>Other Data</b>	<b>Part Load Details</b>	<b>Centrifugal Specifics</b>
Proportional modulating pressure range, psi: 6.0 # unload steps: 2 Minimum unloaded sump pressure, psig: 15.0 Blowdown time, sec.: 40 Unload point, % of comp. capacity: 50 Fully modulated power (theoretical), % of full load power: 65.0 Fully unloaded power, % of full load power: 18.0	Design inlet temp., °F: 68 Design inlet pressure, psia: 14.5 Surge airflow @ design conditions, acfm: N/A Max. full load (surge) pressure, psig: N/A Capacity @ max. full load pressure, acfm: N/A Min. full load (stonewall) pressure, psig: N/A Capacity @ min. full load pressure, acfm: N/A	

Compressor Inventory report: Current Compressor Detail

## Purpose

Use the Compressor Inventory report to view or print summarized or detailed information for the selected inventory compressor or all inventory compressors, or information from a query of inventory compressors.

## Description

The Compressor Inventory reports contain information from the Compressor Inventory and Compressor Inventory Detail windows, or information from the Compressor Inventory Query window. Report type options for the Compressor Inventory report depend upon how the Report Setup window is accessed.

When accessed from Compressor Inventory window, you select from the following types of reports in the Report Setup window: Current Compressor Summary, Current Compressor Detail, All Compressors Summary, or All Compressors Detail. The Summary reports list information from the Compressor Inventory window and tabs, while the Detail reports lists information from the top of the Compressor Inventory window plus the tabs of the Compressor Inventory Detail window. The first two reports contain information for the selected inventory compressor, and the last two reports contain information for all inventory compressors.

When accessed from the Compressor Inventory Query window, the only report type available is List Compressor Summary, which provides information from the Compressor Inventory Query window.

## ***Procedures for Viewing or Printing Inventory Compressor Information or Inventory Compressor Query Information***

### To view or print inventory compressor information

1. In the Compressor Inventory window, click **Print**. The Report Setup window will open:

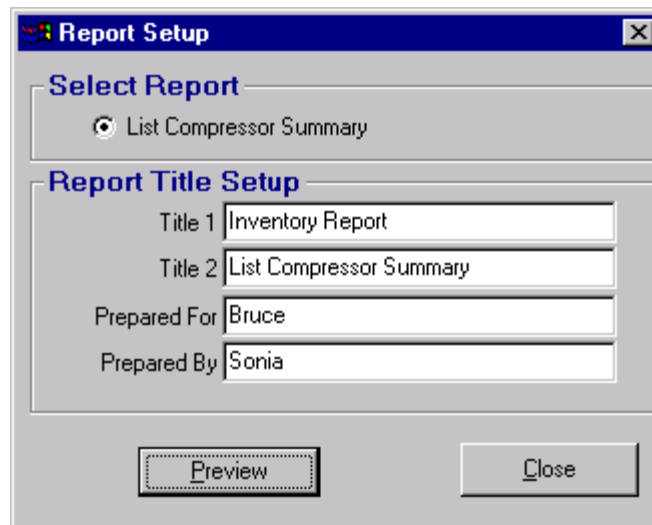
The screenshot shows a 'Report Setup' dialog box. It has a title bar with the text 'Report Setup' and a close button. The dialog is divided into two main sections. The first section, 'Select Report', contains four radio button options: 'Current Compressor Summary', 'Current Compressor Detail' (which is selected), 'All Compressors Summary', and 'All Compressors Detail'. The second section, 'Report Title Setup', contains four text input fields: 'Title 1' with the text 'Compressor Inventory Report', 'Title 2' with the text 'Current Compressor Detail', 'Prepared For' with the text 'Bruce', and 'Prepared By' with the text 'Sonia'. At the bottom of the dialog are two buttons: 'Preview' and 'Close'.



2. In the Select Report section, choose which version of the report to generate:
  - The Current Compressor Summary displays information from the Compressor Inventory window and tabs, for the currently selected inventory compressor.
  - The Current Compressor Detail displays information from the top of the Compressor Inventory window plus the tabs of the Compressor Inventory Detail window, for the currently selected inventory compressor.
  - The All Compressors Summary report displays information from the Compressor Inventory window and tabs, for all inventory compressors.
  - The All Compressors Detail report displays information from the top of the Compressor Inventory window plus the tabs of the Compressor Inventory Detail window, for all inventory compressors.
3. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
4. Click **Preview** to view the report onscreen.
5. If you want to print the report, click **Print** at the top of the onscreen report.
6. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

### To view or print inventory compressor query information

1. In the Compressor Inventory Query window, click Print. The Report Setup window will open:



2. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
3. Click Preview to view the report onscreen.
4. If you want to print the report, click Print at the top of the onscreen report.

5. When you have finished viewing and/or printing the report, click Close to close the onscreen report and Close to close the Report Setup window.

## **Field Definitions**

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Please refer to the field definitions for the Compressor Inventory window and tabs on page 83, the Compressor Inventory Detail window tabs on page 103, and the Compressor Inventory Query window on page 99.

## **Buttons (on onscreen report)**

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### **Page**

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

### **[Zoom]**

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

### **Print**

Click this button to print the Compressor Inventory report.

### **Close**

Click this button to close the Compressor Inventory onscreen report.



## Chapter 9

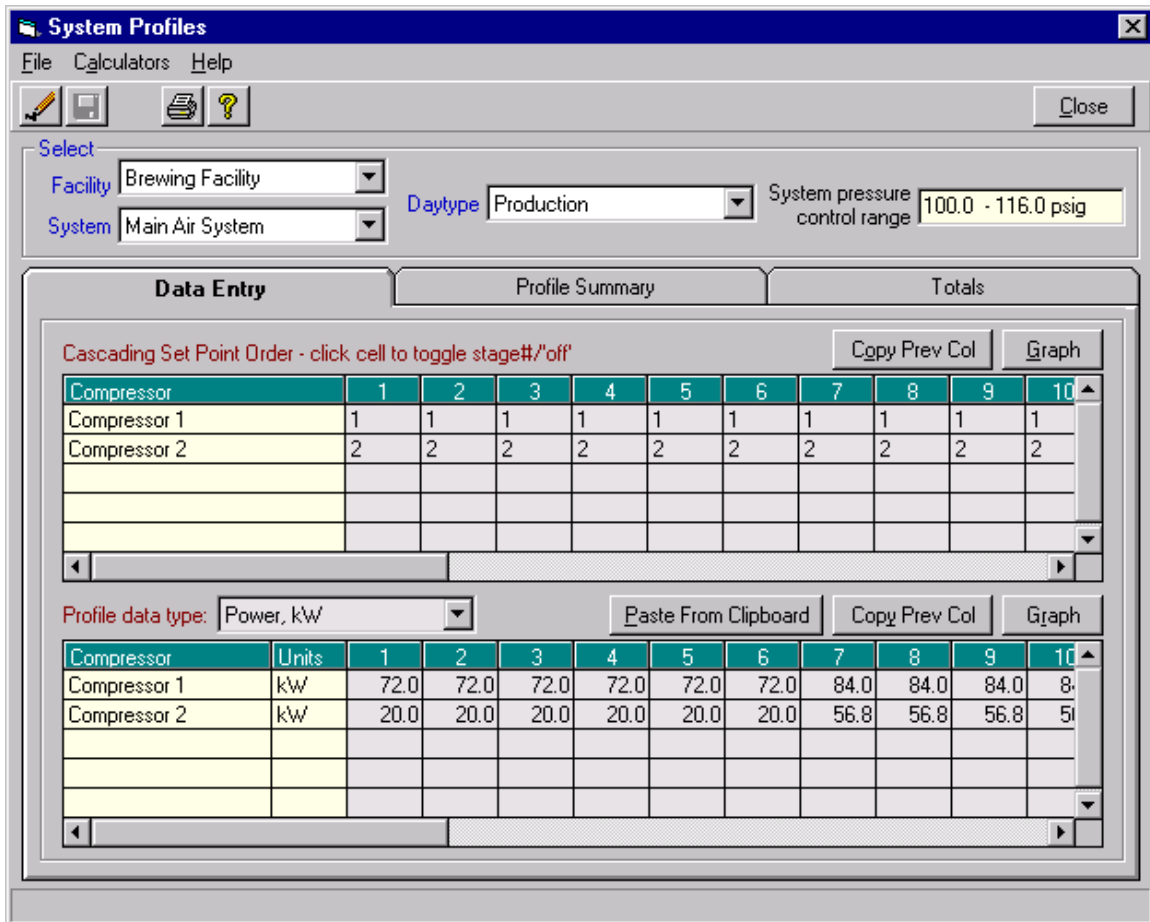
# Profile module

The Profile module contains hourly airflow delivery and load information for each air compressor in a system, for each daytype. The Profile module includes the following windows and report:

- ◆ **System Profiles window**  
Edit or view hourly profile data and air compressor sequencing or non-sequenced cascading set point order, and view the airflow delivery and load of each air compressor and the total system. **p. 121**
  
- ◆ **System Order graph**  
View and/or print a graphic representation of the hourly sequencing or cascading set point order for a system during one daytype. **p. 131**
  
- ◆ **System Profile Data graph**  
View and/or print an hourly airflow or load profile during a specified daytype. **p. 133**
  
- ◆ **System Profile report**  
View and/or print the power and airflow profiles for each compressor in a system, for the current daytype or all daytypes. **p. 135**

# System Profiles window

**Navigation:** *Profile module button*  
 or *Inventory menu / Profile command*



*System Profiles window: Data Entry tab*

## Purpose

The System Profiles window allows you to edit or view hourly profile data and compressor sequencing or cascading set point order, and view the airflow delivery and load of each air compressor and the total system. The average profile data (airflow or power draw) that you enter for each compressor and daytype is obtained through data logging or metering. A typical metering effort might extend for one week to capture operation over all expected daytypes.

AIRMaster<sup>+</sup> uses the hourly estimated or metered data and air compressor performance information to determine the airflow delivery and load of each air compressor. If measured airflow values are supplied, AIRMaster<sup>+</sup> determines the hourly average power supplied to each air compressor, and vice versa. The individual air compressor contributions are summed to provide the total system hourly airflow and load requirements.

## Description

The System Profiles window has three tabs:

- the Data Entry tab, where you enter hourly sequencing or cascading set point order, and airflow or load profile data
- the Profile Summary tab, which displays airflow and load requirements for each air compressor and the total compressed air system, and sequencing or cascade set point order
- the Totals tab, which displays the system airflow and load requirements by daytype, and the annual system energy and demand costs

The Facility, System, Daytype, and System Pressure Control Range fields and the buttons at the top of the window are described below, followed by a description of each tab.

## ***Procedures for Viewing or Editing Profile Data***

### **To view system profile data**

1. Select a facility, system, and daytype from the drop-down lists at the top of the window. Note that the list of systems will be limited to systems assigned to the selected facility, and the list of daytypes will be limited to the daytypes for the selected system.
2. View profile data for the selected system in all three tabs. (Profile data consists of sequencing or cascading set point order, and airflow or load profile data.) The hourly profile data entered into AIRMaster<sup>+</sup> are displayed in the Data Entry tab. All the compressor and system air flow and load requirements are displayed in the Profile Summary tab. System airflow and load requirements and costs subtotaled by daytype are displayed in the Totals tab.
3. If you want to view the System Order graph or System Profile Data graph, click the upper or lower **Graph** button on the Data Entry tab.
4. If you want to copy the Profile Summary or Totals tab information to a spreadsheet program, click **Copy to Clipboard**. This copies all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.
5. When you finish viewing profile data in the tabs, click **Close** to close the System Profiles window.

### **To edit system profile data**

Profile data consists of sequencing or cascading set point order, and airflow or load profile data for one system during one daytype. Both sets of hourly data are entered and edited in the Data Entry tab.

1. Select a facility, system, and daytype from the drop-down lists at the top of the window. Note that the list of systems will be limited to systems assigned to the selected facility, and the list of daytypes will be limited to the daytypes for the selected system.

2. Click **Edit** to enter Edit mode. You can now edit data in the Data Entry tab, but not the fields above the tab.
3. In the Data Entry tab, the top grid will be titled either Sequencing Order or Cascading Set Point Order, depending on whether the selected system is sequenced or uses cascading set points. In both cases, the grid displays the order in which available air compressors are brought on line to meet existing loads, with a “1” indicating a “lead” air compressor. If the system is sequenced, see step #4. If the system is not sequenced, see step #5.
4. If the system is sequenced, then in the top grid choose a sequence order number or “off” for each compressor hour in the grid. Turning a compressor off for a specified hour will affect the sequencing order numbers for the other compressors in that hour. Repeat the entering or editing process for each daytype for the system. To enter columns of duplicate data, click **Copy Previous Col** above the Sequencing Order grid. If you want to see a graphical representation of the sequencing order, click **Graph** above the Sequencing Order grid and see page 131. When you have finished entering sequencing order data, see step #5.
5. If the system is not sequenced, it uses cascading set points and operates solely on the performance points of each compressor. The Cascading Set Point Order grid is initially loaded with the cascading set point order according to full load pressures (the highest full load is lead and so on). In the Cascading Set Point Order grid, you can only toggle between the established compressor hour cascading set point order number and “off.” (Toggle between your options by clicking on a cell, or pressing the spacebar when the cell is selected.) Turning a compressor off for a specified hour will affect the cascading set point order numbers for the other compressors in that hour. Repeat the editing process for each daytype for the system. To enter columns of duplicate data, click **Copy Previous Col** above the Cascading Set Point Order grid. If you want to see a graphical representation of the cascading set point order, click **Graph** above the Cascading Set Point Order grid and see page 131.
6. In the lower grid of the Data Entry tab, the profile data you enter can be either airflow or load data, whichever you prefer to estimate or meter. Use the Profile Data Type drop-down list to select the units of measurement for your hourly compressor data: power (kW), airflow (% capacity), airflow (acfm), cycle time (on and off), or volts and amperes. Enter the profile data for each compressor and hour, and repeat the process for each daytype of the system. To enter data copied from a spreadsheet, select the first desired cell and click **Paste From Clipboard**; AIRMaster<sup>+</sup> will enter the absolute value of a negative number, and if the profile data type is a percentage, will limit values to 100. To enter columns of duplicate data, click **Copy Previous Col** above the Profile Data grid. If any profile data cells are red (which indicates inadequate airflow -- less than the required amount for that hour), you must edit profile data values to resolve the problem. If the motor load exceeds the service factor, a warning message will appear.

Note that if the sequence or cascading set point order is “off” for a compressor hour, the profile data for that compressor hour will be zero and not editable. If you change the sequencing or cascading set point order to “off” and then turn the compressor hour back on again, the old profile data for that compressor hour will reappear. Also note that once you have entered values in the lower grid, switching to a different unit of measurement will remove these values; to recover them, cancel your editing.

7. Click **Save** to save the system profile data in the Data Entry tab.

## Field Definitions

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### Facility

The name of the facility, or site. Select from the drop-down list.

### System

The name of the compressed air system. Select from the drop-down list of systems available in the selected facility.

### Daytype

The name of the daytype. Select from the drop-down list of daytypes for the selected system.

### System Pressure Control Range

The operating pressure range for the system, in pounds per square inch gauge. This field is display only.

## Buttons

---

### Edit

Click to enter Edit mode to make changes to the currently displayed system profile information.

### Save

Once in Edit mode, click to save the system profile information displayed.

### Print

Click to open the Report Setup window, to view or print the System Profile report (the power and airflow profiles for each compressor in the system, for the current daytype or all daytypes).

### Help

Click to open the AIRMaster<sup>+</sup> Help system to the System Profiles window Help topic, which provides context-sensitive Help for this window.

### Close/Cancel

Click to close the System Profiles window, or cancel Edit mode and reverse edits to displayed data.



## Data Entry tab

Use the Data Entry tab to enter or edit hourly sequencing or cascading set point order, and hourly airflow or load profiles, for each system compressor during each daytype. Sequencing or cascading set point information will be used to calculate airflow requirements for each air compressor and the total compressed air system in the Profile Summary tab.

The Data Entry tab contains a Cascading Set Point Order or Sequencing Order grid in the top half of the tab, and a Profile Data grid in the bottom half of the tab. The sequencing or cascading set point order indicates the order in which available compressors are brought on line to meet existing loads, with “1” describing a “lead” air compressor. The hourly profile data can be entered in kW, % capacity, acfm, cycle time, or volts and amperes. Red cells in the Profile Data grid indicate that airflow is less than the required amount for that hour. If the motor load exceeds the service factor, a warning message will appear. This tab offers access to graphs of sequencing (or cascading set point) order, and graphs of profile data.

See illustration of Data Entry tab on page 121.

**Procedures** Please see page 122.

## Field Definitions

---

### *Sequencing Order -or- Cascading Set Point Order*

#### **Compressor**

The names of all air compressors assigned to the selected compressed air system. Sequencing or cascading set point information should be entered for each air compressor.

#### **[Hours]**

The sequencing or cascading set point order number for each air compressor, for every hour of the selected daytype. In a sequenced system, you can choose between any sequence order number and “off.” In a non-sequenced cascading set point system, you can only toggle between the established compressor hour cascading set point number and “off.”

### *Profile Data*

#### **Profile Data Type**

Use the drop-down list to choose the units of measurement for the profile values.

#### **Compressor**

The names of all air compressors assigned to the selected compressed air system. Data should be entered for each air compressor.

#### **Units**

The units selected in the drop-down list above: kW, % capacity, acfm, on/off, or volts and amperes.

**[Hours]**

The airflow or power draw data for each air compressor, for every hour of the selected daytype. This field will display zero and not be editable if the compressor was turned off for this hour in the grid above.

**Buttons**

---

***Sequencing Order -or- Cascading Set Point Order*****Copy Prev Col**

Click to enter a column of data identical to the previous column.

**Graph**

Click to open the System Order graph, which displays hourly sequencing or cascading set point information for the whole system or an individual compressor.

***Profile Data*****Paste From Clipboard**

To enter profile data copied from a spreadsheet, select the first desired cell in the lower grid and click this button; AIRMaster<sup>+</sup> will enter the absolute value of a negative number, and if the profile data type is a percentage, will limit values to 100.

**Copy Prev Col**

Click to enter a column of data identical to the previous column.

**Graph**

Click to open the System Profile Data graph, which displays hourly airflow, power, or capacity for the whole system or an individual compressor.

## Profile Summary tab

**Navigation:** *Profile module button / Profile Summary tab*  
*or Inventory menu / Profile command / Profile Summary tab*

The screenshot shows the 'System Profiles' window with the 'Profile Summary' tab selected. The window title is 'System Profiles' and it has a menu bar with 'File', 'Calculators', and 'Help'. Below the menu bar are icons for edit, save, print, and help, and a 'Close' button. The 'Select' section contains dropdown menus for 'Facility' (Brewing Facility) and 'System' (Main Air System), a 'Daytype' dropdown (Production), and a 'System pressure control range' text box (100.0 - 116.0 psig). The main area is a table with columns for days 1 through 11 and rows for Compressor 1, Compressor 2, and Totals. The table is divided into 'Data Entry' and 'Totals' sections. The 'Profile Summary' tab is active. The table data is as follows:

Compressor	1	2	3	4	5	6	7	8	9	10	11
<b>Compressor 1</b>											
Meas Power, kW	72.0	72.0	72.0	72.0	72.0	72.0	84.0	84.0	84.0	84.0	84.0
Calc Airflow, acfm	190	190	190	190	190	190	380	380	380	380	380
Calc %Capacity	40.0	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0	80.0	80.0
Cascade #	1	1	1	1	1	1	1	1	1	1	1
<b>Compressor 2</b>											
Meas Power, kW	20.0	20.0	20.0	20.0	20.0	20.0	56.8	56.8	56.8	56.8	56.8
Calc Airflow, acfm	0	0	0	0	0	0	277	277	277	277	277
Calc %Capacity	0.0	0.0	0.0	0.0	0.0	0.0	33.0	33.0	33.0	33.0	33.0
Cascade #	2	2	2	2	2	2	2	2	2	2	2
<b>Totals</b>											
Total Power, kW	92.0	92.0	92.0	92.0	92.0	92.0	140.8	140.8	140.8	140.8	140.8
Total Airflow, acfm	190	190	190	190	190	190	657	657	657	657	657
% System Capacity	14.4	14.4	14.4	14.4	14.4	14.4	50.0	50.0	50.0	50.0	50.0

At the bottom right of the table area are buttons for 'Copy To Clipboard' and 'Graph'.

*System Profiles window: Profile Summary tab*

Use the *display-only* Profile Summary tab to view airflow and load requirements for each air compressor and the total compressed air system. The profile data type entered in the Data Entry tab is titled “Measured,” and the other data types “Calculated.” This tab also displays the sequencing or cascading set point order entered in the Data Entry tab. The airflow and load requirements are calculated from the hourly average airflow or power draw data entered in the Data Entry tab. If the motor load exceeds the service factor, a warning message will appear here.

**Procedures** Please see page 122.

## Field Definitions

---

### **Compressor**

The names of all air compressors assigned to the selected compressed air system, and the airflow and power measurement fields for each air compressor.

### **[Hours]**

The airflow requirements for each air compressor and the total compressed air system, for every hour of the selected daytype.

### **[Calc or Meas] Power, kW**

The calculated or entered power used by the air compressor, for each operating hour of the selected daytype, in kilowatts.

### **[Calc or Meas] Airflow, acfm**

The calculated or entered airflow for each air compressor, for each operating hour of the selected daytype, in actual cubic feet per minute.

### **[Calc or Meas] % Capacity**

The calculated or entered percent of capacity used by each air compressor for the selected daytype. The % capacity is the airflow delivered by the air compressor divided by its maximum airflow, multiplied by 100.

### **Cascade # or Sequence #**

The order in which air compressors are brought on line to meet load requirements for each hour of the selected daytype (as entered in the Data Entry tab).

### **Total Power, kW**

The total power in kilowatts used by all air compressors (and their auxiliaries) assigned to the compressed air system.

### **Total Airflow, acfm**

The total airflow provided by all air compressors assigned to the compressed air system in actual cubic feet per minute, for each hour of the selected daytype.

### **% System Capacity**

The percent of system capacity used by each compressor for each hour during the selected daytype.

## Buttons

---

### **Copy to Clipboard**

Click to copy all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.

### **Graph**

Click to open the System Profile Data graph, which graphs an hourly airflow or load profile for a specified daytype.

## Totals tab

**Navigation:** *Profile module button / Totals tab*  
*or Inventory menu / Profile command / Totals tab*

The screenshot shows the 'System Profiles' window with the 'Totals' tab selected. The 'System Summary' table is as follows:

Daytype	Total OpHrs	Avg Airflow, acfm	Avg Airflow, %Cs.	Peak Demand, kW	Load Factor, %	Annual Energy, kWh	Annual Energy Cost, \$
Production	6,000	538	40.9	182.5	58.9	769,905	29,256
Weekends	400	630	47.9	103.6	47.5	41,450	1,554
System Totals	6,400	561	42.7	182.5	56.0	811,355	30,811

Below the table, the following cost values are displayed:

- Total demand cost, \$: \$ 7390
- Total operating costs, \$: \$ 38201

*System Profiles window: Totals tab*

Use the *display-only* Totals tab to view the system airflow and load requirements and costs, subtotaled by daytype, and the system annual demand cost and total annual cost.

**Procedures** Please see page 122.

### Field Definitions

#### Daytype

The daytypes (types of typical operating day) for which compressed air system summary calculations are made. Each daytype of the system is included.

**Total OpHrs**

The total annual operating hours for the compressed air system, subtotaled for each daytype.

**Avg Airflow, acfm**

The average airflow delivered by the compressed air system, in actual cubic feet per minute, for each daytype and the average operating day.

**Avg Airflow, %Cs**

The average system airflow requirements, for each daytype and the average operating day, expressed as a percentage of system capacity.

**Peak Demand, kW**

The maximum demand for the compressed air system during each daytype, in kilowatts.

**Load Factor, %**

The average air compressor drive motor load divided by the nameplate full-load rating, expressed as a percentage (for each daytype and the average day).

**Annual Energy, kWh**

The compressed air system's yearly energy use, subtotaled for each daytype, in kilowatt-hours.

**Annual Energy Cost, \$**

The compressed air system's total annual cost for kilowatt-hours, subtotaled for each daytype, in dollars.

**Total Demand Cost, \$**

The compressed air system's total annual demand cost, in dollars.

**Total Cost, \$**

The compressed air system's total annual operating cost (for energy and demand), in dollars.

**Buttons**

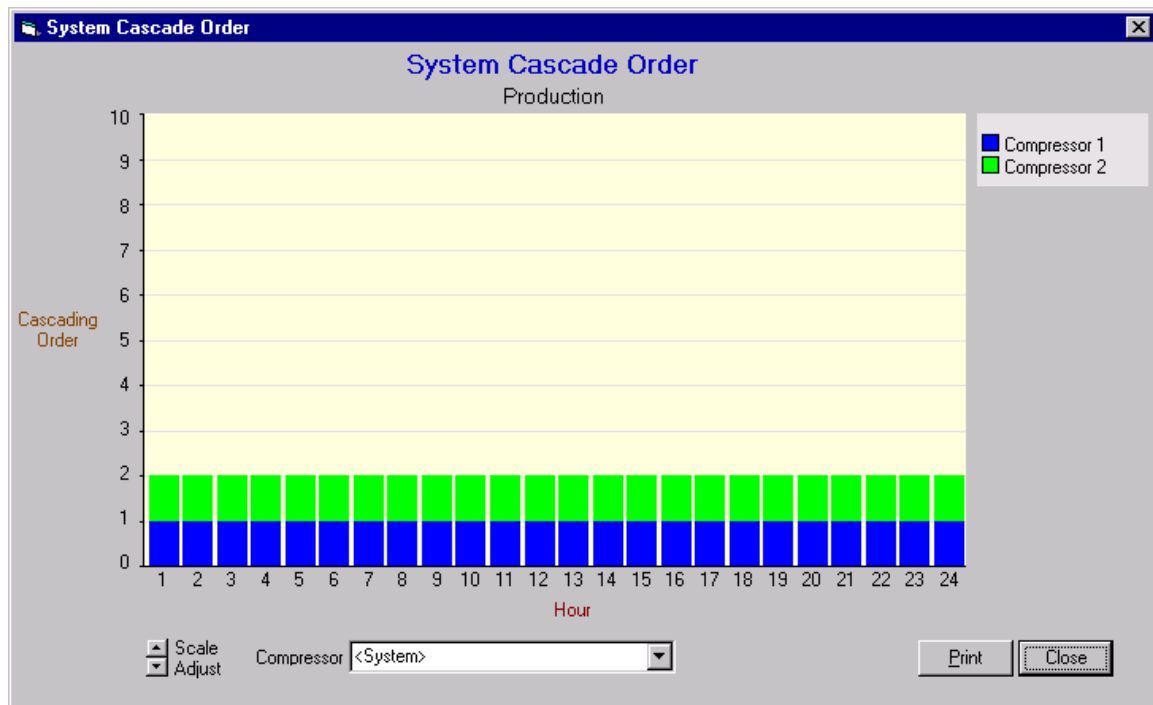
---

**Copy to Clipboard**

Click to copy all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.

# System Order graph

**Navigation:** *Profile module button / Data Entry tab / upper Graph button*  
or *Inventory menu / Profile command / Data Entry tab / upper Graph button*



*System Order graph*

## Purpose

Use the System Order graph to view or print a graphic representation of the hourly sequencing or cascading set point order for a system during one daytype. This graph displays the hours that a single air compressor or all air compressors are brought on line to meet existing loads.

## Description

The System Order graph can be either the System Sequence Order graph, or the System Cascade Order graph, depending on whether the selected system has an automatic sequencer. This graph is accessed via the upper Graph button on the System Profiles window, Data Entry tab. This graph represents a specific daytype, which is listed at the top of the graph and is determined by the selected daytype in the Data Entry tab.

The System Order graph displays compressor order on the y-axis and the hours of the selected daytype along the x-axis. You can select whether this graph displays hourly information for a single compressor or all compressors. The y-axis scale is adjustable.

## **Procedures for Viewing or Printing a System Order Graph**

### **To view or print a system order graph**

1. In the System Profiles window, select the desired system and daytype.
2. In the Data Entry tab, click the upper Graph button.
3. The System Order graph opens. The title of this graph depends on whether the selected system uses an automatic sequencer. A sequenced system produces a System Sequence Order graph, and a system with cascading set points produces a System Cascade Order graph.
4. Use the Compressor field to select whether the graph displays information for a single air compressor or all air compressors.
5. Click **Print** if you would like to print the System Order graph.
6. When you are done viewing the System Order graph, click **Close** to return to the System Profiles window.

### **Field Definitions**

---

#### **Sequence Order —or— Cascading Order**

The order in which available compressors are brought on line to meet existing loads, with “1” describing a “lead” air compressor. Note that this ordering system is limited when only a single compressor is selected in the Compressor field.

#### **Hour**

The hour of the selected daytype.

#### **Compressor**

The system compressors (one or all) represented in the graph.

### **Buttons**

---

#### **Scale Adjust**

Click the arrows to increase or decrease the range of order numbers displayed on the vertical axis.

#### **Print**

Click to print the System Order graph .

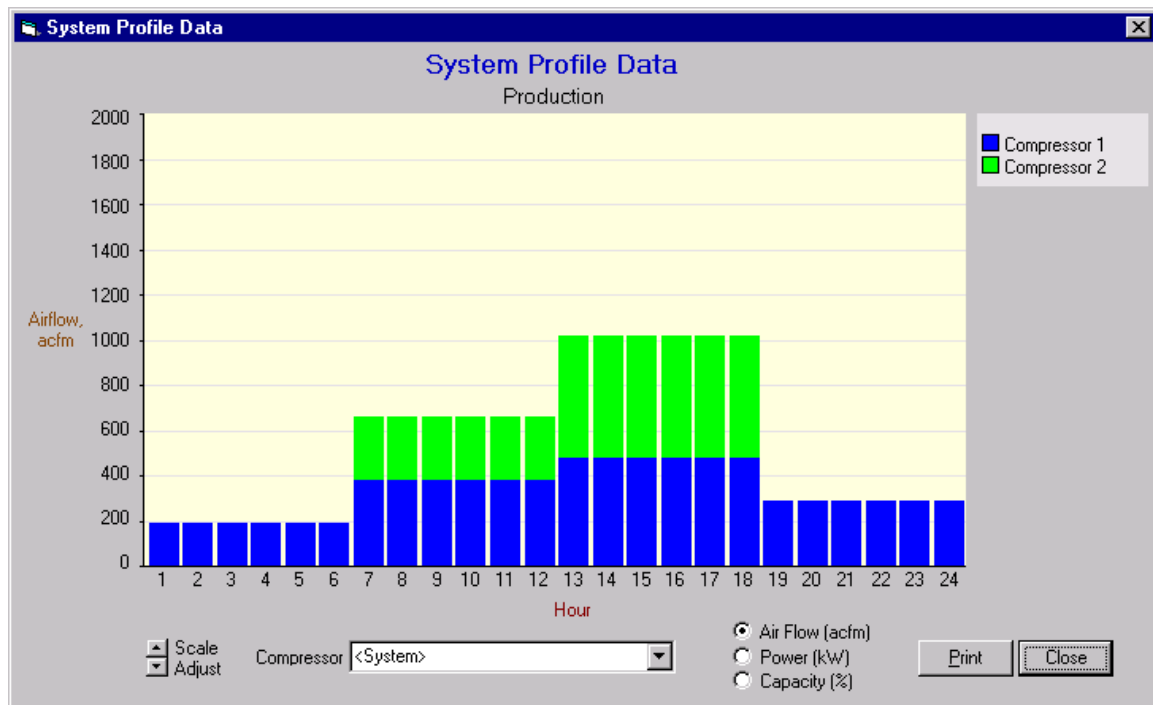
#### **Close**

Click to close the System Order graph and return to the System Profiles window.



# System Profile Data graph

**Navigation:** *Profile module button / Data Entry tab / lower Graph button*  
*or Inventory menu / Profile command / Data Entry tab / lower Graph button*



*System Profile Data graph*

## Purpose

Use the System Profile Data graph to view or print an hourly airflow or load profile during a specified daytype. This graph can display hourly airflow, power, or capacity profile data for the selected compressor or an entire system.

## Description

The System Profile Data graph is accessed via the lower **Graph** button on the System Profiles window, Data Entry tab. This graph represents a specific daytype, which is listed at the top of the graph and is determined by the selected daytype in the Data Entry tab. The System Profile Data graph displays airflow, power, or capacity on the y-axis, and the hours of the selected daytype along the x-axis. The y-axis scale is adjustable. You can select whether this graph displays hourly information for a single compressor or all compressors.

The data for the hourly profiles is from the Profile Summary tab of the System Profiles window. One of the sets of profile data (airflow, power, or capacity) is entered into AIRMaster<sup>+</sup> and the other two sets are calculated by the program.

## **Procedures for Viewing or Printing a System Profile Data Graph**

### **To view or print a system profile data graph**

1. In the System Profiles window, select the desired system and daytype.
2. In the Data Entry tab, click the lower Graph button.
3. The System Profile Data graph opens.
4. Use the Compressor field to select whether the graph displays information for a single air compressor or all air compressors in the system.
5. Select which kind of profile data you want the graph to display: Airflow (acfm), Power (kW), or Capacity (%).
6. Click **Print** if you would like to print the System Profile Data graph.
7. When you are done viewing the System Profile Data graph, click **Close** to return to the System Profiles window.

### **Field Definitions**

---

#### **Airflow, acfm —or— Power, kW —or— Capacity, %**

The measured or calculated profile data.

#### **Hour**

The hour of the selected daytype.

#### **Compressor**

The system compressors (one or all) represented in the graph.

#### **[Profile Data]**

Select the type of profile data you want the graph to display. AIRMaster<sup>+</sup> calculates remaining profile data from the set of hourly data that was measured and entered into the Data Entry tab of the System Profiles window.

### **Buttons**

---

#### **Scale Adjust**

Click the arrows to increase or decrease the range of profile data amounts displayed on the vertical axis.

#### **Print**


Click to print the System Profile Data graph.

#### **Close**

Click to close the System Profile Data graph and return to the System Profiles window.

# System Profile report

Navigation: *Profile module button / Print button / Preview button*  
 or *Inventory menu / Profile command / Print button / Preview button*

		System Profile Report																				AIRMaster +			
For: Bruce By: Sonia		Current Daytype Profile																				June 7, 2000 Page 1 of 2			
Facility : Brewing Facility System : Main Air System System Pressure Control Range : 100.0 - 116.0 psig Daytype : Production																									
<b>Data Entry</b>																									
<i>Cascading Order</i>																									
Compressor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Compressor 1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Compressor 2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
<i>Profile Data Type: Power, kW</i>																									
Compressor	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Compressor 1	kW	72.0	72.0	72.0	72.0	72.0	72.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	90.0	90.0	90.0	90.0	90.0	90.0	78.0	78.0	78.0	78.0	78.0
Compressor 2	kW	20.0	20.0	20.0	20.0	20.0	20.0	56.8	56.8	56.8	56.8	56.8	56.8	56.8	92.5	92.5	92.5	92.5	92.5	92.5	20.0	20.0	20.0	20.0	20.0
<b>Profile Summary</b>																									
Compressor 1		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Meas Power, kW		72	72	72	72	72	72	84	84	84	84	84	84	90	90	90	90	90	90	90	78	78	78	78	78
Calc Airflow, actm		190	190	190	190	190	190	380	380	380	380	380	380	475	475	475	475	475	475	475	285	285	285	285	285
Calc % Capacity		40	40	40	40	40	40	80	80	80	80	80	80	100	100	100	100	100	100	100	60	60	60	60	60
Cascade #		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Compressor 2		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Meas Power, kW		20	20	20	20	20	20	57	57	57	57	57	57	92	92	92	92	92	92	92	20	20	20	20	20
Calc Airflow, actm		0	0	0	0	0	0	277	277	277	277	277	277	546	546	546	546	546	546	546	0	0	0	0	0
Calc % Capacity		0	0	0	0	0	0	33	33	33	33	33	33	65	65	65	65	65	65	65	0	0	0	0	0
Cascade #		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Totals		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Total Power, kW		92	92	92	92	92	92	141	141	141	141	141	141	182	182	182	182	182	182	182	98	98	98	98	98
Total Airflow, actm		190	190	190	190	190	190	657	657	657	657	657	657	1021	1021	1021	1021	1021	1021	1021	285	285	285	285	285
% System Capacity		14	14	14	14	14	14	50	50	50	50	50	50	78	78	78	78	78	78	78	22	22	22	22	22
<b>System Profile Totals</b>																									
	Daytype	Total Operating Hrs	Avg. Airflow, actm	Avg. Airflow, % System Capacity	Peak Demand, kW	Load Factor, %	Annual Energy, kWh	Annual Energy Cost, \$																	
	Production	6000	538	40.9	182	59	769,905	29,256																	

System Profile report: Current Daytype Profile

## Purpose

Use the System Profile report to view or print the power and airflow profiles for each compressor in a system, and the hourly sequencing or cascading set point order, for the current daytype or all daytypes.

## Description

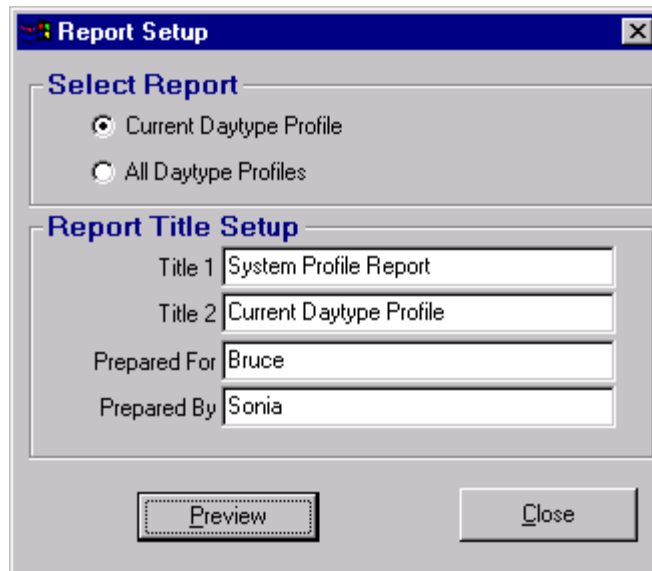
The System Profile report contains three main sections for each system profile: Data Entry, Profile Summary, and System Profile Totals. These sections and the fields within them contain information from the corresponding three tabs of the System Profiles window.

When you select the type of report in the Report Setup window, you have the option of generating the report for only the current daytype or all daytypes. (The current daytype is the daytype selected in the System Profiles window.)

## Procedures for Viewing or Printing System Profile Data

### To view or print system profile data

1. In any tab of the System window, click **Print**. The Report Setup window will open:



2. In the Select Report section, choose which version of the report to generate. The report can include the current daytype or all daytypes. The current daytype is the daytype that was selected in the System Profiles window before you opened the Report Setup window.
3. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
4. Click **Preview** to view the report onscreen.
5. If you want to print the report, click **Print** at the top of the onscreen report.
6. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

## **Field Definitions**

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Please refer to the field definitions for the System Profiles window following page 121.

## **Buttons (on onscreen report)**

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### **Page**

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

### **[Zoom]**

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

### **Print**

Click this button to print the System Profile report.

### **Close**

Click this button to close the System Profile onscreen report.

# Efficiency Measures module

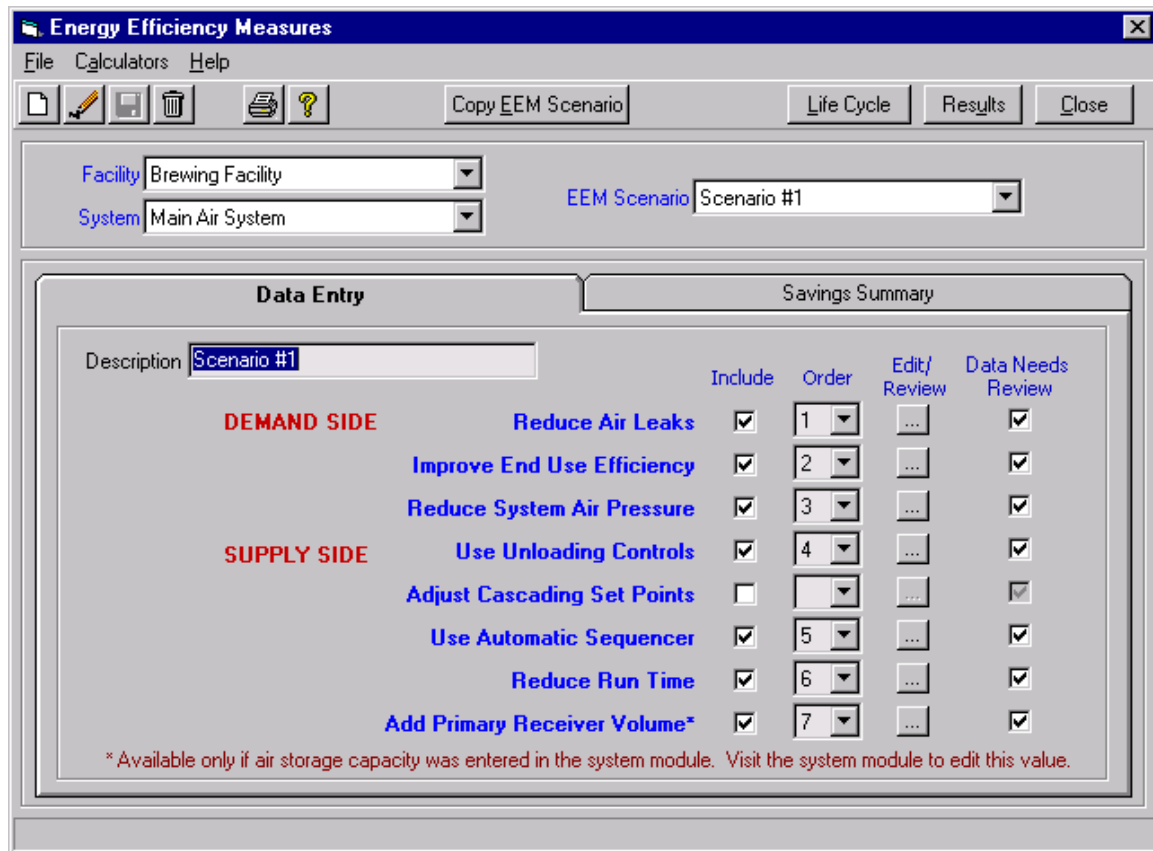
The Efficiency Measures module contains information about the efficiency measures included in system conservation scenarios. The Efficiency Measures module includes the following windows and reports:

- ◆ **Energy Efficiency Measures window**  
Select, order, and apply the energy efficiency measures (EEMs) in a conservation scenario, and access individual EEM windows. You can also edit and analyze conservation scenarios. p. 140
  
- ◆ **EEM: Reduce Air Leaks window**  
Enter compressor contributions to feed leaks, calculate your leak load, and propose a leak reduction amount. p. 148
  
- ◆ **EEM: Improve End Use Efficiency window**  
Enter fixed or variable airflow reduction amounts measured at the point of end use. p. 152
  
- ◆ **Profile Draw graph**  
Graphically enter a variable airflow reduction profile. p. 158
  
- ◆ **EEM: Reduce System Air Pressure window**  
Specify a constant reduction in operating pressure. p. 161
  
- ◆ **EEM: Use Unloading Controls window**  
Enter changes in compressor unloading controls within a system. p. 165
  
- ◆ **EEM: Adjust Cascading Set Points window**  
Enter pressure set points that determine the order in which a system's compressors are brought on-line to meet hourly average load requirements. p. 170

- ◆ **EEM: Use Automatic Sequencer window**  
 Add an automatic sequencer to a system, or adjust the existing hourly sequencing or an air system's compressors. **p. 174**
- ◆ **EEM: Reduce Run Time window**  
 Turn off selected air compressors during selected hours. **p. 181**
- ◆ **EEM: Add Primary Receiver Volume window**  
 Specify an increase in system storage capacity. **p. 186**
- ◆ **EEM Results window**  
 View the calculated results of any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs. **p. 192**
- ◆ **EEM Savings Scenario graph**  
 View a graphical representation of hourly airflow, power, or capacity before or after the selected EEM is implemented. **p. 199**
- ◆ **Energy Efficiency Measure Parameters report**  
 View and/or print a conservation scenario savings summary, efficiency measure parameters, or EEM or scenario results. **p. 201**

# Energy Efficiency Measures window

**Navigation:** *Efficiency Measures module button*  
or *System Enhancements menu / Efficiency Measures command*



Energy Efficiency Measures window: Data Entry tab

## Purpose

The Energy Efficiency Measures window allows you to create a conservation scenario (select, order, and apply the energy efficiency measures, or EEMs, in the scenario), and edit or analyze conservation scenarios. Use the Energy Efficiency Measures window to access individual EEM windows, the EEM Results window, or the Life Cycle Analysis window.

**Note** An Energy Efficiency Measure (EEM) is a specific change to a compressed air system that results in improved efficiency and other systems benefits as well (for example, increased equipment life, reliability, and increased airflow). Some EEMs refer to specific daytypes or compressors. AIRMaster<sup>+</sup> allows the user to determine the energy and dollar savings from applying up to eight different EEMs in any conservation scenario.

EEM order affects savings in subsequent steps, so you may want to study the effects of implementing a measure after an analysis is complete. For example, the ability to shut off an air compressor may depend on whether air leaks are reduced enough.



Reducing leaks further or reducing compressed air system pressure may allow new air loads to be added or even eliminate the need for a new air compressor. To study the effects of EEM order, you can either save different scenarios with different EEM orders, or print the Savings Summary for a scenario before editing EEM order in that scenario.

## **Description**

The Energy Efficiency Measures window has two tabs: the Data Entry tab and the Savings Summary tab. The Data Entry tab displays energy efficiency measure (EEM) selections and order for the scenario, and is where you access a separate editing window for each applied EEM. The Savings Summary tab displays a summary of the savings from all of the EEMs in the scenario.

The information in both tabs relates to the facility, system, and scenario selected in the top of the Energy Efficiency Measures window. The buttons at the top of the window also apply to the selected facility, system, and scenario, regardless of which tab is active, and you can switch between tabs without losing information. The Facility, System, and Scenario fields and the buttons at the top of the window are described below, followed by a description of each tab.

## ***Procedures for Viewing a Conservation Scenario and Scenario Results, and Editing or Adding a Conservation Scenario***

### **To view a conservation scenario and scenario results**

1. Select the conservation scenario you want to view, using the Facility, System, and EEM Scenario drop-down list fields at the top of the window. Note that the list of systems will be limited to systems assigned to the selected facility, and the list of scenarios will be limited to previously created scenarios assigned to the selected system.
2. As soon as you select a scenario, all the fields in both tabs will display information for the selection. To view the information for individual energy efficiency measures (EEMs) in the scenario, click the **Edit/Review** button in the Data Entry tab for that EEM. To see the results of implementing an individual EEM, see page 192. Continue to step #3 if you want to view scenario results.
3. Open the Savings Summary tab to view scenario results. These are the results of implementing all the combined EEMs in the conservation scenario.
4. If you want to copy the savings summary information to a spreadsheet program, click **Copy to Clipboard**. This copies all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.
5. Click **Close** to close the Energy Efficiency Measures window.

### **To edit or add a conservation scenario**

1. If you want to edit a conservation scenario, select the EEM scenario (follow step #1 in the procedures above) and click **Edit**. If you want to create a new conservation scenario, click **Add**. If you want to create a copy of a scenario

so that editing doesn't affect the original scenario, click **Copy EEM Scenario** and the copy will be selected automatically.

2. Now that you are in Edit or Add mode, you can edit the fields in the Data Entry tab. You can edit the default description name of the scenario, select which energy efficiency measures (EEMs) should be included in the scenario, and define the order of selected EEMs. (Note that the Adjust Cascading Set Points EEM must precede the Use Automatic Sequencer EEM.)
3. To edit the specific information for each selected EEM, click the "..." (or **Edit/Review**) button to the right of each selected EEM to open the appropriate EEM window.
4. Edit the proposed parameters for each applied EEM (see individual EEM window procedures). Click **Close** in each EEM window to return to the Energy Efficiency Measures window.
5. When you finish editing the EEMs, return to the Energy Efficiency Measures window and click **Save**. This saves all the information for this scenario, including the information in each EEM window.
6. EEM order affects savings in subsequent steps, but the overall net savings for all EEMs in a scenario will be the same regardless of order. You may want to experiment with EEM order to change which EEMs create the greatest savings, or to see how a change in order will increase the savings from a particular EEM. To study the effects of EEM order, you can either save different scenarios with different EEM orders, or print the Savings Summary for a scenario before editing EEM order in that scenario.
7. When you finish editing and/or adding conservation scenarios, click **Close** to close the Energy Efficiency Measures window.

## Field Definitions

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### Facility

The name of the facility, or site, where the conservation scenario is applied. Select from the drop-down list.

### System

The name of the system where the conservation scenario is applied. Select from the drop-down list of systems available in the selected facility.

### EEM Scenario

The name of the selected conservation scenario. Select from the drop-down list of scenarios created for the selected system, or add a new scenario.

## Buttons

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### Add

Click to enter Add mode, and select and order energy efficiency measures (EEMs) for a new scenario in cleared fields.

### Edit

Click to enter Edit mode to make changes to the currently displayed conservation scenario, including the EEMs.

**Save**

Once in Edit mode, click to save the displayed conservation scenario and all the included EEMs.

**Delete**

Click to delete the currently displayed conservation scenario and all its EEMs.

**Print**

Click to open the Report Setup window, to view or print the EEM Parameters report.

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Energy Efficiency Measures window Help topic, which provides context-sensitive Help for this window.

**Copy EEM Scenario**

Click to create a copy of the selected scenario, so that editing does not affect the original scenario. The copy will automatically be selected.

**Life Cycle**

Click to open the Life Cycle Analysis window, which allows you to conduct a life cycle cost analysis to ascertain the cost-effectiveness of a package of EEMs or any project.

**Results**

Click to open the EEM Results window, which displays the calculated results of any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs.

**Close/Cancel**

Click to close the Energy Efficiency Measures window, or cancel Edit/Add mode and reverse edits to the displayed conservation scenario and its included EEMs.

## Data Entry tab

The Data Entry tab allows you to select energy efficiency measures (EEMs) for the specified conservation scenario, and state the order in which the EEMs are to be analyzed.

You may select any number of available demand side (system-oriented) EEMs and/or supply side (compressor-oriented) EEMs. The ability to analyze some EEMs depends on your air compressors. For example, check with your manufacturer to be sure that unloading controls are available if you would like to analyze the Use Unloading Controls EEM.

EEMs are analyzed in the order you specify. Interactive effects are considered when determining energy and dollar savings. Each EEM uses a set of initial operating conditions, such as system airflow profiles, operating schedules, and control strategies, obtained from the previous EEM. Varying the inputs for one measure automatically changes the energy savings for subsequent measures. EEM order affects savings calculations in subsequent steps, but the overall net savings for all EEMs in a scenario will be the same regardless of order.

See illustration of Data Entry tab on page 140.

**Procedures** Please see page 141.

## Field Definitions

---

### Description

The user-assigned name for the selected conservation scenario, as it will later appear in the list of available scenarios above. You can edit the default name.

### Include

Mark this box if you want to select the energy efficiency measure (EEM) for the conservation scenario. You will need to specify the parameters for the EEM (see Edit button). You may apply any combination of supply-side and demand-side EEMs in a conservation scenario.

### Order

The order in which you would like the EEMs evaluated. Start with “1” and don’t skip numbers. (Note that the Adjust Cascading Set Points EEM must precede the Use Automatic Sequencer EEM.)

### Data Needs Review

This box is automatically marked when an EEM is selected for a scenario, and is marked any time there is a change to data that affects this EEM. The mark is removed after the edit window for that EEM has been accessed.

## Buttons

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### Edit/Review

Click this button to open another window, specific to the type of EEM, where you can enter a set of proposed operating conditions for that applied EEM. For example, if you have decided to apply the “Reduce Air Leaks” EEM, click the top button in the Edit column to access the Reduce Air Leaks window, where you

can specify operating conditions for the Reduce Air Leaks EEM in that conservation scenario.

## Savings Summary tab

**Navigation:** *Efficiency Measures module button / Savings Summary tab*  
 or *System Enhancements menu / Efficiency Measures command / Savings Summary tab*

*Energy Efficiency Measures window: Savings Summary tab*

Use the Savings Summary tab to view a summary of the energy savings, demand reduction, and dollar savings from each energy efficiency measure (EEM) for the selected conservation scenario after EEM parameters have been entered. Savings are determined by examining the difference between initial and proposed operating conditions. All savings are incremental.

**Note** Energy efficiency measure (EEM) order affects savings calculations in subsequent steps, but the overall net savings for all EEMs in a scenario will be the same regardless of order. To study the effects of EEM order, you can either save different scenarios with different EEM orders, or print the Savings Summary version of the EEM Parameters report for a scenario before editing EEM order in that scenario.

**Procedures** Please see page 141.

## Field Definitions

---

### **Description**

The user-assigned title (or the default title) of each energy efficiency measure (EEM) applied in the selected conservation scenario.

### **Energy, kWh**

The calculated annual energy savings from implementation of each EEM, in kilowatt-hours.

### **Energy, \$**

The calculated annual energy conservation benefits from implementation of each EEM, in dollars.

### **Energy Use, %**

The calculated percentage reduction in compressed air system energy use due to the implementation of each EEM.

### **Peak Demand, kW**

The calculated demand reduction, in kilowatts, for each analyzed EEM.

### **Demand, \$**

The calculated annual demand reduction benefits for each analyzed EEM, in dollars.

### **Installed Cost, \$**

The user-entered equipment and installation costs for each EEM, in dollars.

### **Cost Savings, \$**

The calculated total utility cost savings (in dollars) due to implementing each EEM.

### **Simple Payback, years**

The calculated simple payback on the investment in each EEM, in years.

### **Totals**

The calculated total demand reduction, costs, and energy and dollar savings, and the simple payback on investment in the package of EEMs analyzed.

## Buttons

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### **Copy to Clipboard**

Click to copy all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.

# Reduce Air Leaks window

**Navigation:** *Efficiency Measures module button / Reduce Air Leaks Edit-Review button*  
or *System Enhancements menu / Efficiency Measures command / Reduce Air Leaks Edit-Review button*

Compressor	Units	Airflow, %C
Compressor 1	%Cap	40.0
Compressor 2	%Cap	0.0

Peak system requirement + leaks	Airflow, acfm	% Cs.
	1021	77.6
Leaks	190	14.4
Peak system requirement	831	63.2

Lowest hourly system airflow, acfm (according to entered profile values) 190

Reduce leaks by 95 acfm 50.0 %

*Reduce Air Leaks window*

## Purpose

Use the Reduce Air Leaks window to add, edit, or view a Reduce Air Leaks EEM (energy efficiency measure) for the proposed scenario. Enter compressor contributions to feed leaks, calculate your leak load (in acfm and percentage of system total), and propose a leak reduction amount. Determine leak loads by examining air compressor operations when air-using equipment is turned off.

This EEM assumes that you have a constant leak load for the compressed air system. That is, when all air-using equipment is turned off, the airflow to support leaks remains constant over the annual operating schedule. This EEM does not consider different leak loads that would occur if portions of the compressed air system were valved off during different shifts or seasons.

## Description

The Reduce Air Leaks window contains three main sections: general EEM information at the top, then the Compressor Operations to Feed Leaks section and the Leak Airflow Values section. Click **Results** to open the EEM Results window,



which displays the hourly power, airflow, and sequence order for the system after this EEM is implemented.

## ***Procedures for Viewing, Editing, or Adding a Reduce Air Leaks EEM***

### **To view a Reduce Air Leaks EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to view.
2. In the Data Entry tab of the Energy Efficiency Measures window, click the **Edit/Review** button in the Reduce Air Leaks row. (The Reduce Air Leaks EEM must be included in the selected scenario.) The Reduce Air Leaks window opens, with the facility and system of the selected scenario displayed at the top of the window.
3. The Reduce Air Leaks window displays the lowest hourly system airflow, peak system required flow, and the airflow required to sustain leaks; calculated from entered compressor operations to feed leaks (in kW, % Capacity, acfm, cycle time, or volts and amps). It also displays the percentage of proposed leak reduction as acfm and as a percentage of system total.
4. If you want to see the results of this Reduce Air Leaks EEM, click **Results** to open the EEM Results window.
5. When you finish viewing the EEM information in the Reduce Air Leaks window, click **Close** to return to the Energy Efficiency Measures window.

### **To edit or add a Reduce Air Leaks EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to edit.
2. Click **Edit** to enter Edit mode.
3. In the Data Entry tab of the Energy Efficiency Measures window, see if the **Include** box in the Reduce Air Leaks row has been marked. If a Reduce Air Leaks EEM is not yet included in the scenario, mark the **Include** box to add the EEM.
4. Click the **Edit/Review** button in the Reduce Air Leaks row to open the Reduce Air Leaks window.
5. In the Reduce Air Leaks window, edit the title or default title of this Reduce Air Leaks EEM in the Description field, and the cost of this EEM in the Measure Cost field.
6. In the Measured Data field, select the units you use to measure compressor operations to feed leaks.
7. In the Compressor Operations to Feed Leaks section, enter values for compressor operations to feed leaks, measured as either kW average power, direct airflow values as a percentage of air compressor capacity, airflow in acfm, load/unload cycle times, or measured current and voltage. (AIRMaster<sup>+</sup> will convert power to corresponding airflow values.) Enter values for the minimum number of compressors required to run to feed leaks, so air

compressors turned off when leak load measurements are made should be left blank.

8. After you have entered compressor operations to feed leaks, click in another cell and the Lowest Hourly System Airflow, Peak System Requirement + Leaks (from the System Profiles window), Leaks, and Peak System Requirement values are calculated. The Reduce Leaks By row is also recalculated, if it already contained values.
9. In the Reduce Leaks By row, edit the amount by which you expect leakage loads to decrease due to undertaking leakage elimination and repair actions, in acfm or as a percentage of leak load total (you may overwrite the default of 50%). Then click in the other Reduce Leaks By field to view new calculation results there.
10. When you finish editing the EEM information in the Reduce Air Leaks window, click **Save** in the Reduce Air Leaks window or the Energy Efficiency Measures window to save the edited or additional Reduce Air Leaks EEM in the scenario. Click **Close** to return to the Energy Efficiency Measures window.

## Field Definitions

---

### Facility

The name of the facility, or site, where this EEM and the entire scenario is applied.

### System

The name of the system where this EEM and the entire scenario is applied.

### Description

The title for this Reduce Air Leaks EEM. You can edit the default title.

### Measured Data

The unit of measurement (select kW power, % capacity airflow, acfm airflow, cycle time, or volts and amps) for the values you will enter in the Compressor Operations to Feed Leaks section.

### Measure Cost, \$

All costs associated with implementing this EEM, in dollars. Implementation cost varies depending on the number and type of leaks to be fixed, cost of rebuild kits, and hourly labor costs.

## *Compressor Operations to Feed Leaks*

### Compressor

A list of all air compressors assigned to the selected compressed air system. You may enter leak load information for any number of the air compressors turned on during measurements.

### Units

The units selected (above, in the Measured Data field) for the entry of measured data.

**[Selected Units]**

The values for compressor operations to feed leaks, in the units of measurement selected in the Measured Data field.

**Maximum Possible Leak Airflow, acfm (Minimum System Flow)**

The minimum system airflow, as entered in the System Profiles window (this may include some end uses in addition to leaks), in actual cubic feet per minute.

***Leak Airflow Values*****Peak System Requirement + Leaks**

The peak system airflow requirement (including leakage loads), in actual cubic feet per minute and as a percentage of system capacity. This airflow amount is entered or calculated in the System Profiles window.

**Leaks**

The amount of airflow devoted to leakage loads, in actual cubic feet per minute and as a percentage of system capacity. This airflow amount is calculated from the total compressor operations to feed leaks entered in the section to the left.

**Peak System Requirement**

The peak system airflow requirement (with leakage loads removed), in actual cubic feet per minute and as a percentage of system capacity. This airflow amount is calculated from the previous two fields.

**Reduce Leaks by**

The amount by which you expect leakage loads to decrease due to undertaking leakage elimination and repair actions, in actual cubic feet per minute and as a percentage of the leak load total.

**Buttons**

---

**Edit**

Click to enter Edit mode to make changes to the currently displayed conservation scenario, including the EEMs.

**Save**

Once in Edit mode, click to save the displayed conservation scenario and all the included EEMs.

**Print**

Click to open the Report Setup window, to view or print the EEM Parameters report.

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Reduce Air Leaks window Help topic, which provides context-sensitive Help for this window.

**Results**

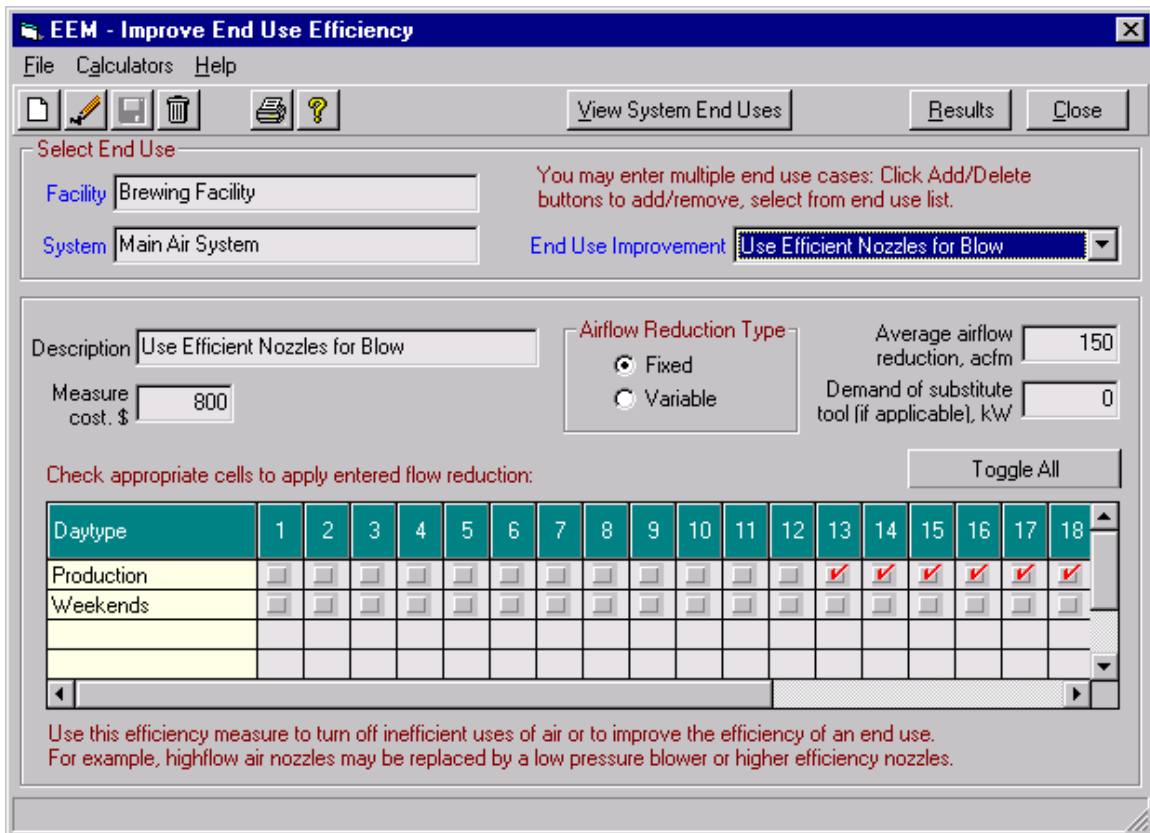
Click to open the EEM Results window, which displays the calculated results of this or any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs.

**Close**

Click to close the Reduce Air Leaks window, and return to the Energy Efficiency Measures window, where you can cancel edits made in this and other EEM windows.

# Improve End Use Efficiency window

**Navigation:** *Efficiency Measures module button / Improve End Use Efficiency Edit-Review button*  
 or *System Enhancements menu / Efficiency Measures command / Improve End Use Efficiency Edit-Review button*



**EEM - Improve End Use Efficiency**

File Calculators Help

View System End Uses Results Close

Select End Use

Facility: Brewing Facility

System: Main Air System

End Use Improvement: Use Efficient Nozzles for Blow

Description: Use Efficient Nozzles for Blow

Measure cost. \$: 800

Airflow Reduction Type:

- Fixed
- Variable

Average airflow reduction, acfm: 150

Demand of substitute tool (if applicable), kW: 0

Toggle All

Daytype	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Weekends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Use this efficiency measure to turn off inefficient uses of air or to improve the efficiency of an end use. For example, highflow air nozzles may be replaced by a low pressure blower or higher efficiency nozzles.

Improve End Use Efficiency window

## Purpose

Use the Improve End Use Efficiency window to add, edit, or view an Improve End Use Efficiency EEM (energy efficiency measure) for the proposed scenario. A variety of conservation measures result in airflow reductions at the point of end use, and you can enter multiple and concurrent end use improvements in one EEM. Use this window to enter the system airflow reduction amounts for each hour of each daytype, for each end use improvement. The airflow reductions can be fixed or variable. AIRMaster<sup>+</sup> will use the entered airflow reduction data to calculate energy savings through modified air compressor operating schedules that meet the new system airflow requirements. Proposed system airflow profiles are apportioned among available air compressors based on daytype operating schedules and air compressor control strategies.

Some possible end use conservation measures for this EEM are: eliminating open blowing, spargers, or aspirators; adding efficient nozzles; turning off a piece of

equipment; replacing a Venturi vacuum generator with a vacuum pump; replacing a pneumatic tool with an electric tool; and using a blower rather than high pressure air.

### Description

The Improve End Use Efficiency window contains three main sections: the upper section displays the selected end use improvement, the middle section displays general information for the improvement, and the lower section displays the airflow reduction grid for the selected end use improvement. Click **Results** to open the EEM Results window, which displays the hourly power, airflow, and sequence order for the system after this end use improvement is implemented.

### Procedures for Viewing, Editing, or Adding an Improve End Use Efficiency EEM

#### To view an Improve End Use Efficiency EEM

1. In the Energy Efficiency Measures window, select the conservation scenario you want to view.
2. In the Data Entry tab of the Energy Efficiency Measures window, click the **Edit/Review** button in the Improve End Use Efficiency row. (The Improve End Use Efficiency EEM must be included in the selected scenario.) The Improve End Use Efficiency window opens. The facility and compressed air system of the selected scenario are displayed at the top of the window.
3. You may enter any number of end use improvements for the selected system. The Improve End Use Efficiency window displays information for the improvement selected in the End Use Improvement field. This information includes the end use improvement name, cost of implementation, airflow reduction type, kW demand of any substitute end use tool, and hourly airflow reduction data for each daytype. To view information for a different improvement, select it from the drop-down list of end use improvements defined for this EEM.
4. If you would like to view all the end uses for the selected system, click **View System End Uses**. The System End Uses window appears:

End Use	Location	Required Airflow, acfm	Regulated?	Required Pressure, psig	Measured Pressure, psig	Excess Pressure, psi	> 30% TotCap?
bottle capper	packaging	75	<input type="checkbox"/>	80.0	105.0	25.0	<input type="checkbox"/>
bottle blowoff	packaging	20	<input type="checkbox"/>	40.0	105.0	65.0	<input type="checkbox"/>
wort transporter	brewing	125	<input type="checkbox"/>	95.0	105.0	10.0	<input type="checkbox"/>
			<input type="checkbox"/>				<input type="checkbox"/>
			<input type="checkbox"/>				<input type="checkbox"/>

NOTE: Pressures are measured at the end use point.

Close

If any end use requires airflow greater than 30% of the total airflow capacity of all the compressors, the last column is automatically marked and a warning message appears.

5. If you want to see the results of an Improve End Use Efficiency EEM (including all the end use improvements), click **Results** to open the EEM Results window.
6. When you finish viewing the EEM information in the Improve End Use Efficiency window, click **Close** to return to the Energy Efficiency Measures window.

### To edit or add an Improve End Use Efficiency EEM

1. In the Energy Efficiency Measures window, select the conservation scenario you want to edit.
2. Click **Edit** to enter Edit mode.
3. In the Data Entry tab of the Energy Efficiency Measures window, see if the **Include** box in the Improve End Use Efficiency row has been marked. If an Improve End Use Efficiency EEM is not yet included in the scenario, mark the **Include** box to add the EEM.
4. Click the **Edit/Review** button in the Improve End Use Efficiency row to open the Improve End Use Efficiency window.
5. If you want to edit an existing end use improvement defined for this EEM, select the improvement you want to edit, using the End Use Improvement field. The drop-down list in this field displays all the end use improvements defined for this EEM. If you want to create a new end use improvement for this EEM, click **Add** (any number of end use improvements, concurrent or not, can be included in this EEM). The first time you open this EEM window, a default end use improvement titled “Improve End Use Efficiency #1” is selected. If you want to delete an end use improvement from this EEM, select that improvement and click **Delete**; then see step #11.
6. In the Description field, edit the title or default title of the selected end use improvement.
7. In the Measure Cost field, edit the implementation cost of the selected end use improvement.
8. In the Airflow Reduction Type field, edit the choice of airflow reduction type resulting from the selected end use improvement: fixed or variable. If the improvement creates a fixed airflow reduction, edit the Average Airflow Reduction field. If the end use improvement involves the addition of an electric tool to the system, edit the Demand of Substitute Tool field.
9. The appearance and procedures for the Airflow Reduction grid depend on which airflow reduction type is selected for the end use improvement:
  - If a *fixed* airflow reduction is selected, toggle the hours cells to mark the operating hours over which the airflow reduction occurs in each daytype. You can also click **Toggle All** to mark or unmark all hours of all daytypes, instantly assigning or removing the fixed airflow reduction from every possible hour.
  - If a *variable* airflow reduction occurs, enter the airflow reductions that will occur in each hour of each daytype. Alternatively, you can click

**Draw Reduction** and graphically enter a variable airflow reduction profile for each operating daytype.

Regardless of airflow reduction type, hourly grid cells will be unavailable (gray) during times in the daytype when the system is turned off; there is no available flow and can be no end use improvement applied during those hours.

10. Repeat steps # 5-9 to edit or add additional end use improvements to this EEM.
11. If you would like to view all the end uses for the selected system, click **View System End Uses**. The System End Uses window appears.
12. AIRMaster<sup>+</sup> will use the end use improvements data to calculate energy savings through modified air compressor operating schedules that meet the new system airflow requirements. Proposed system airflow profiles are apportioned among available air compressors based on daytype operating schedules and air compressor control strategies. Click **Results** to view, in the EEM Results window, the results of the (combined) end use improvement(s) in this EEM.
13. When you finish editing the EEM information in the Improve End Use Efficiency window, click **Save** in this window or the Energy Efficiency Measures window to save the edited or additional Improve End Use Efficiency EEM in the scenario. Click **Close** to return to the Energy Efficiency Measures window.

## Field Definitions

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### *Select End Use*

#### **Facility**

The name of the facility, or site, where this EEM and the entire scenario is applied.

#### **System**

The name of the system where this EEM and the entire scenario is applied.

#### **End Use Improvement**

The name of the end use improvement described in the rest of the window. You can include any number of end use improvements in one Improve End Use Efficiency EEM.

### *End Use Improvement Information*

#### **Description**

The title for this end use improvement. You can edit the default title.

#### **Measure Cost, \$**

All costs associated with implementing this end use improvement, in dollars.

#### **Airflow Reduction Type**

Select whether the end use improvement creates a fixed or a variable airflow reduction. Your selection will affect the availability of the Average Airflow Reduction field, and the appearance of the Airflow Reduction Grid.

### **Average Airflow Reduction, acfm**

The average magnitude (in actual cubic feet per minute) of the airflow reduction created by the selected end use improvement. This field is only available if the end use improvement creates a *fixed* airflow reduction.

### **Demand of Substitute Tool (if Applicable), kW**

The demand of the substitute tool (in kilowatts), if your end use improvement involves substituting an electric tool for a pneumatic tool. The calculated energy savings are the air compressor-related savings less the energy required to operate the electric air tool.

### ***Airflow Reduction Grid***

The appearance of this grid depends on whether the end use improvement creates a fixed or variable airflow reduction. For a *fixed* airflow reduction, the grid will contain boxes where you mark which hours the fixed airflow reduction occurs in each daytype. For a *variable* airflow reduction, the grid will contain cells where you enter specific reduction amounts (in acfm) for each hour of each daytype. Alternatively, you can click **Draw Reduction** and graphically enter a variable airflow reduction profile for each operating daytype.

### **Daytype**

A list of all daytypes designated for the selected system. The rest of the grid shows airflow reduction information for each applicable daytype.

### **[Hours]**

Airflow reduction information for each hour of each daytype, for the selected end use improvement. Hours that are unavailable (gray) in Edit mode indicate times during the daytype when the system is turned off; there is no available flow and can be no end use improvement during those hours.

## **Buttons**

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### **Add**

Click to enter Add mode, and create a new end use improvement for this EEM. There is no limit to the number of end use improvements possible in an Improve End Use Efficiency EEM.

### **Edit**

Click to enter Edit mode to make changes to the currently displayed conservation scenario, including the EEMs.

### **Save**

Once in Edit mode, click to save the displayed conservation scenario and all the included EEMs.

### **Delete**

Click to delete the currently displayed end use improvement from the Improve End Use Efficiency EEM.

### **Print**

Click to open the Report Setup window, to view or print the EEM Parameters report.

### **Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Improve End Use Efficiency window Help topic, which provides context-sensitive Help for this window.



**View System End Uses**

Click to open the System End Uses window, where you can view all the end uses for the selected system.

**Results**

Click to open the EEM Results window, which displays the calculated results of this or any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs.

**Close**

Click to close the Improve End Use Efficiency window, and return to the Energy Efficiency Measures window, where you can cancel edits made in this and other EEM windows.

**Toggle All**

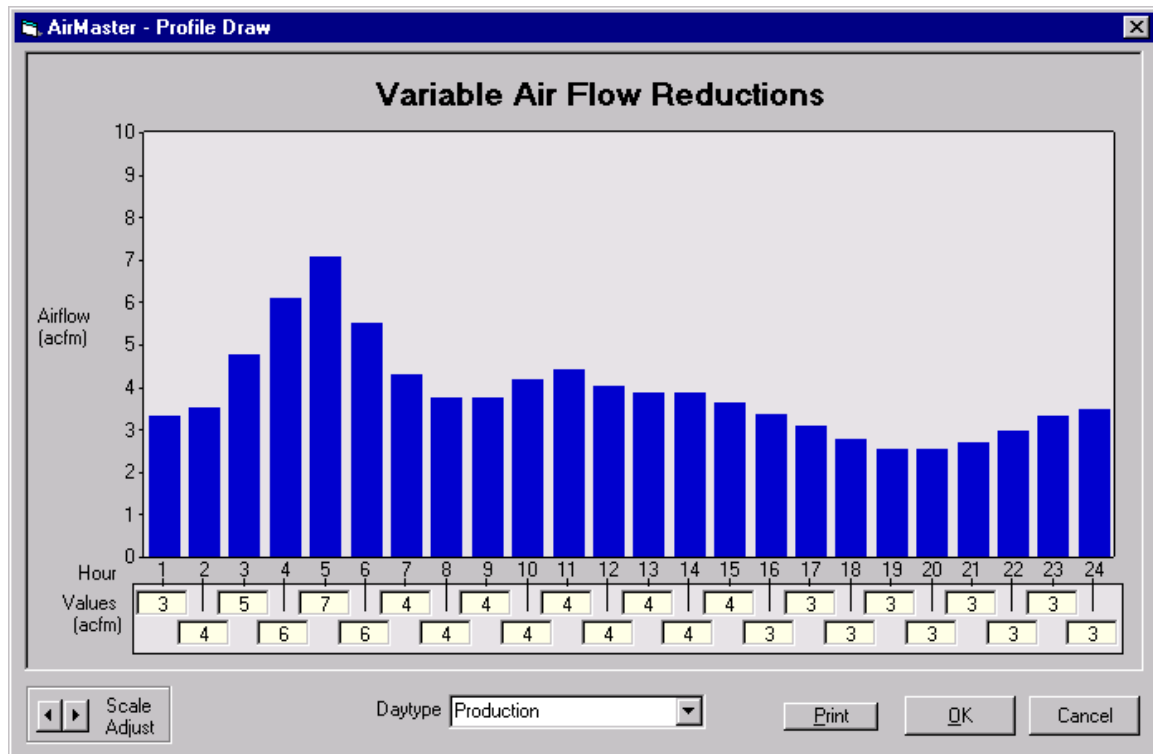
Click to mark or unmark all hours of all daytypes in the Airflow Reduction Grid, instantly assigning or removing the fixed airflow reduction from every possible hour. This button only appears for a fixed airflow reduction.

**Draw Reduction**

Click to open the Profile Draw graph, to graphically enter a variable airflow reduction profile that defines the effects of an end use improvement for an operating daytype. This button only appears for a variable airflow reduction.

# Profile Draw graph

**Navigation:** *Efficiency Measures module button / Improve End Use Efficiency Edit-Review button / Draw Reduction button*  
or *System Enhancements menu / Efficiency Measures command / Improve End Use Efficiency Edit-Review button / Draw Reduction button*



Profile Draw graph

## Purpose

Use the Profile Draw graph to enter, view, or print a graphic profile for a variable airflow reduction. The variable airflow reduction represents a specified daytype and defines the effects of an end use improvement in an Improve End Use Efficiency EEM (energy efficiency measure). You can either draw the profile, or enter hourly airflow values.

## Description

The Profile Draw graph displays airflow (in actual cubic feet per minute) along the y-axis and hours (24 total) along the x-axis. This graph also shows hourly airflow reduction values in boxes along the x-axis. You can adjust the y-axis scale. The displayed graph represents the system daytype selected in the Daytype field.

## ***Procedures for Viewing, Editing, or Adding a Graphic Airflow Reduction Profile***

### **To view or print a graphic airflow reduction profile**

1. In the Improve End Use Efficiency window, select the desired end use improvement. This improvement must create a variable type of airflow reduction.
2. Click **Draw Reduction**. The Profile Draw graph opens.
3. The Profile Draw graph displays airflow reduction information graphically and numerically. Use the Daytype field to select different daytype graphs for viewing.
4. If you want to print this graph, click **Print**.
5. When you are done viewing the Profile Draw graph, click **OK** to return to the Improve End Use Efficiency window, leaving the airflow reduction information unchanged.

### **To edit a graphic airflow reduction profile or add an airflow reduction profile graphically**

1. Follow steps #1-3 above to open the Profile Draw graph for the airflow reduction profile of the selected end use improvement and daytype.
2. You can edit or add the airflow reduction profile graphically or numerically. To draw the profile, click and drag across the graph. If you want to redraw it, just drag again. To add the profile numerically, enter hourly airflow values (in acfm) in the boxes at the bottom of the graph. You may use any combination of graphical and numeric data entry to create or edit a profile.
3. If you want to save the displayed profile, click **OK**. If you want to delete the displayed profile, click **Cancel**. The Profile Draw graph closes and the Improve End Use Efficiency window reopens.

## **Field Definitions**

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### **Airflow, acfm**

The airflow reduction amounts, in actual cubic feet per minute.

### **Hour**

The hour of the selected daytype.

### **Values, acfm**

The hourly airflow reduction values displayed in the bar graph above.

### **Daytype**

The system daytype represented by the airflow reduction graph.

## **Buttons**

---

### **Scale Adjust**

Click the arrows to increase or decrease the range of airflow amounts displayed on the vertical axis.

### **Print**

Click to print the Profile Draw graph.

### **OK**

Click to save the profile entered and return to the Improve End Use Efficiency window.

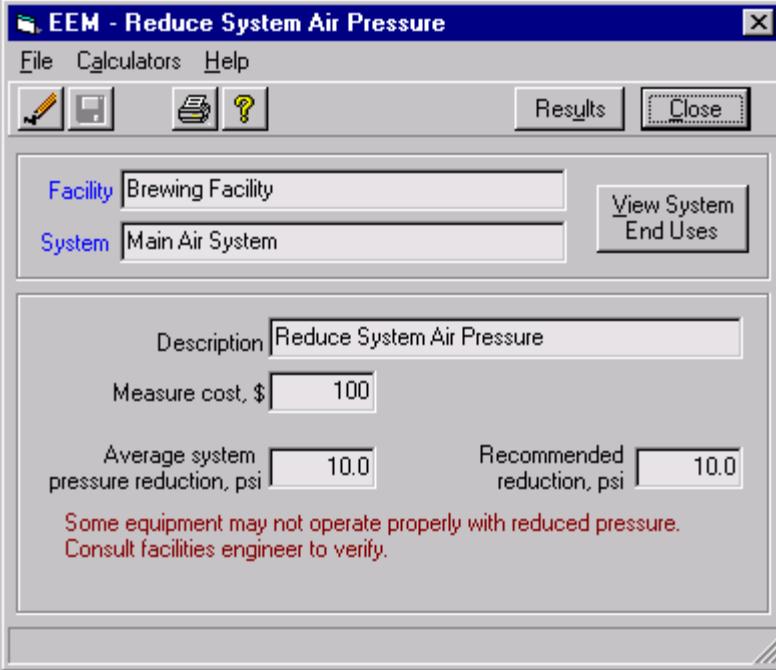
### **Cancel**

Click to close the Profile Draw graph and return to the Improve End Use Efficiency window, without saving the displayed airflow reduction profile.

---

## Reduce System Air Pressure window

**Navigation:** *Efficiency Measures module button / Reduce System Air Pressure Edit-Review button*  
or *System Enhancements menu / Efficiency Measures command / Reduce System Air Pressure Edit-Review button*



*Reduce System Air Pressure window*

### Purpose

Use the Reduce System Air Pressure window to add, edit, or view a Reduce System Air Pressure EEM (energy efficiency measure) for the proposed scenario. A Reduce System Air Pressure EEM specifies a constant reduction in operating pressure at the system level.

You may reduce the average compressed air system pressure by reducing the full-load discharge pressures of all air compressors by a specified amount. The pressure reduction may be due to segregation or elimination of high pressure equipment, or reduction of pressure drops caused by pipe re-sizing or looping the in-plant distribution system. AIRMaster<sup>+</sup> modifies the system airflow and power profiles to reflect operation at a lower pressure. Less compressed air is needed for end uses and leaks when pressure is reduced. Daytype operating schedules are unchanged.

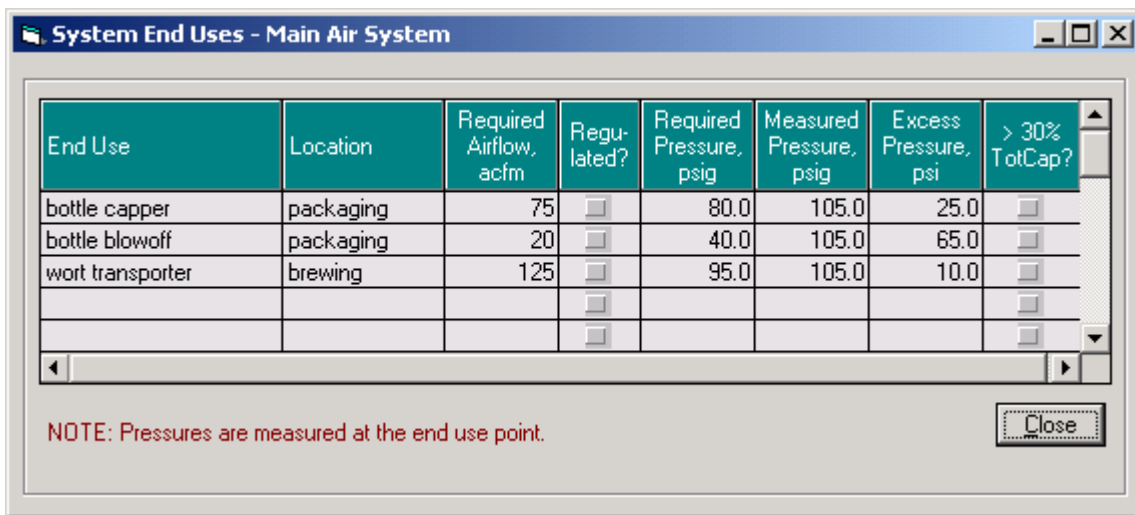
### Description

The Reduce System Air Pressure window contains two main sections; the upper section displays the facility and system of the scenario, and the lower section displays information about the system air pressure reduction.

## Procedures for Viewing, Editing, or Adding a Reduce System Air Pressure EEM

### To view a Reduce System Air Pressure EEM

1. In the Energy Efficiency Measures window, select the conservation scenario you want to view.
2. In the Data Entry tab of the Energy Efficiency Measures window, click the **Edit/Review** button in the Reduce System Air Pressure row. (The Reduce System Air Pressure EEM must be included in the selected scenario.) The Reduce System Air Pressure window opens.
3. The Reduce System Air Pressure window displays the facility and system of the scenario, the title and cost of this EEM, the proposed pressure reduction, and the recommended reduction.
4. If you would like to view all the end uses for the selected system, click **View System End Uses**. The System End Uses window appears:



End Use	Location	Required Airflow, acfm	Regulated?	Required Pressure, psig	Measured Pressure, psig	Excess Pressure, psi	> 30% TotCap?
bottle capper	packaging	75	<input type="checkbox"/>	80.0	105.0	25.0	<input type="checkbox"/>
bottle blowoff	packaging	20	<input type="checkbox"/>	40.0	105.0	65.0	<input type="checkbox"/>
wort transporter	brewing	125	<input type="checkbox"/>	95.0	105.0	10.0	<input type="checkbox"/>
			<input type="checkbox"/>				<input type="checkbox"/>
			<input type="checkbox"/>				<input type="checkbox"/>

NOTE: Pressures are measured at the end use point.

Close

If any end use requires airflow greater than 30% of the total airflow capacity of all the compressors, the last column is automatically marked and a warning message appears.

5. If you want to see the results of this Reduce System Air Pressure EEM, click **Results** to open the EEM Results window.
6. When you finish viewing the EEM information in the Reduce System Air Pressure window, click **Close** to return to the Energy Efficiency Measures window.

### To edit or add a Reduce System Air Pressure EEM

1. In the Energy Efficiency Measures window, select the conservation scenario you want to edit.
2. Click **Edit** to enter Edit mode.
3. In the Data Entry tab of the Energy Efficiency Measures window, see if the **Include** box in the Reduce System Air Pressure row has been marked. If a

Reduce System Air Pressure EEM is not yet included in the scenario, mark the **Include** box to add the EEM.

4. Click the **Edit/Review** button in the Reduce System Air Pressure row to open the Reduce System Air Pressure window.
5. In the Reduce System Air Pressure window, edit the title or default title of this Reduce System Air Pressure EEM in the Description field, and the cost of this EEM in the Measure Cost field.
6. In the Average System Pressure Reduction field, edit or enter the amount of the proposed system air pressure reduction, in pounds per square inch. You may reduce the average compressed air system pressure by reducing the full-load discharge pressures of all air compressors by a specified amount. You can reduce pressure by segregating or eliminating high pressure equipment or reducing pressure drops (by resizing pipes or looping the in-plant distribution system). The amount you enter in the Average System Pressure Reduction field cannot be greater than the displayed Recommended Reduction amount.
7. If you would like to view all the end uses for the selected system, click **View System End Uses**. The System End Uses window appears.
8. When you finish editing the EEM information in the Reduce System Air Pressure window, click **Save** in this window or the Energy Efficiency Measures window to save the edited or additional Reduce System Air Pressure EEM in the scenario. Click **Close** to return to the Energy Efficiency Measures window.

## Field Definitions

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### Facility

The name of the facility, or site, where this EEM and the entire scenario is applied.

### System

The name of the system where this EEM and the entire scenario is applied.

### Description

The title for this Reduce System Air Pressure EEM. You can edit the default title.

### Measure Cost, \$

All costs associated with implementing this EEM, in dollars. Usually this is the labor cost to adjust existing controls, but there could be other costs. For example, you may need to install larger diameter distribution pipe.

### Average System Pressure Reduction, psi

The average amount that the compressed air system pressure is reduced, in pounds per square inch.

### Recommended Reduction, psi

The maximum amount that the compressed air system pressure can be reduced. This is the difference between the minimum required airflow and the available airflow; the Average System Pressure Reduction amount cannot exceed this amount. This field is display only.

## **Buttons**

---

### **Edit**

Click to enter Edit mode to make changes to the currently displayed conservation scenario, including the EEMs.

### **Save**

Once in Edit mode, click to save the displayed conservation scenario and all the included EEMs.

### **Print**

Click to open the Report Setup window, to view or print the EEM Parameters report.

### **Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Reduce System Air Pressure window Help topic, which provides context-sensitive Help for this window.

### **Results**

Click to open the EEM Results window, which displays the calculated results of this or any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs.

### **Close**

Click to close the Reduce System Air Pressure window, and return to the Energy Efficiency Measures window, where you can cancel edits made in this and other EEM windows.

### **View System End Uses**

Click to open the System End Uses window, where you can view all the end uses for the selected system.



# Use Unloading Controls window

**Navigation:** *Efficiency Measures module button / Use Unloading Controls Edit-Review button*  
 or *System Enhancements menu / Efficiency Measures command / Use Unloading Controls Edit-Review button*

Facility:   
 System:   
 Description:   
 Measure cost, \$:   
 Compressor:   
 Existing  
 Proposed  
 Restore  
 Compressor has unloading controls  
 Proposed  
 Control type:   
 Performance Profile  
 Unload pt, %C:   
 Automatic shutdown timer:   
 Pressures are referenced from the compressor discharge or sequencer pressure tap.

Performance Points	Discharge Pressure psig	Airflow Dflt? acfm	Power Dflt? kW
Full load (cut-in)	<input type="text" value="100.0"/>	<input type="checkbox"/> <input type="text" value="479"/>	<input type="checkbox"/> <input type="text" value="85.4"/>
Max full flow (mod begins)	<input type="text" value="107.0"/>	<input checked="" type="checkbox"/> <input type="text" value="476"/>	<input checked="" type="checkbox"/> <input type="text" value="88.6"/>
Unload point (cut-out)	<input type="text" value="108.2"/>	<input checked="" type="checkbox"/> <input type="text" value="383"/>	<input type="checkbox"/> <input type="text" value="82.7"/>
No load (unloaded)	<input type="text" value="15.0"/>	<input checked="" type="checkbox"/> <input type="text" value="0"/>	<input checked="" type="checkbox"/> <input type="text" value="16.1"/>

Use Unloading Controls window

## Purpose

The Use Unloading Controls window allows you to add, edit, or view a Use Unloading Controls EEM (energy efficiency measure) for the proposed scenario. Use this window to enter EEM parameters for changes in compressor(s) unloading controls within a system. You can add unloading controls to selected air compressors and/or adjust or modify existing control set points. You can also add an automatic shutdown timer. Consult air compressor manufacturers for unloading control availability for your air compressor models or for instructions on how to adjust existing controls. AIRMaster<sup>+</sup> apportions system airflow profiles among the air compressors based on air compressor operating schedules and proposed air compressor controls.

## Description

The Use Unloading Controls window contains four main sections: Facility and System, Data View, general information, and control information. The information displayed in the control information section refers to existing or proposed compressor data, depending on the selection in Data View. The control type of each compressor will influence the layout and your ability to edit the Performance Points grid.

Click **Performance Profile** to view the Performance Comparison graph (a profile of power according to airflow) before and after unloading control modifications. Click **Results** to open the EEM Results window, which displays the hourly power, airflow, and sequence order for the system after this EEM is implemented.

## ***Procedures for Viewing, Editing, or Adding a Use Unloading Controls EEM***

### **To view a Use Unloading Controls EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to view.
2. In the Data Entry tab of the Energy Efficiency Measures window, click the **Edit/Review** button in the Use Unloading Controls row. (The Use Unloading Controls EEM must be included in the selected scenario.) The Use Unloading Controls window opens.
3. The Use Unloading Controls window displays the facility and system of the scenario, the title and cost of this EEM, and existing or proposed control information for the selected compressor.
4. Choose whether you want to view existing or proposed control information, and make a selection in the Data View section.
5. If you would like to view existing or proposed data for a different compressor in the system, make a new selection in the Compressor field.
6. If you want to see the results of this Use Unloading Controls EEM, click **Results** to open the EEM Results window.
7. When you finish viewing the EEM information in the Use Unloading Controls window, click **Close** to return to the Energy Efficiency Measures window.

### **To edit or add a Use Unloading Controls EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to edit.
2. Click **Edit** to enter Edit mode.
3. In the Data Entry tab of the Energy Efficiency Measures window, see if the **Include** box in the Use Unloading Controls row has been marked. If a Use Unloading Controls EEM is not yet included in the scenario, mark the **Include** box to add the EEM.

4. Click the **Edit/Review** button in the Use Unloading Controls row to open the Use Unloading Controls window.
5. In the Use Unloading Controls window, select Proposed in the Data View field. This allows you to edit available control information fields. You cannot edit existing values. If you want to change proposed control information to existing control information, click **Restore**.
6. Edit the title or default title of this Use Unloading Controls EEM in the Description field, and the cost of this EEM in the Measure Cost field.
7. In the Compressor field, select the compressor for which you would like to edit control information. (All the compressors in the system are available in the drop-down list.) The Control Information section displays information for the selected compressor. The default proposed data is the existing data.
8. In the Control Type field, you may select a different control type for the compressor. The drop-down list of available control types is limited by the type of compressor and existing control type; you can add unloading controls, but not remove them.
9. In the Unload Point field, you may edit the airflow at which the compressor unloads, expressed as a percentage of air compressor rated full-flow capacity.
10. In the Automatic Shutdown Timer field, you may add or remove an automatic shutdown timer for the compressor.
11. Compressors with different control types are measured with different sets of performance specifications, so the appearance of the performance points grid depends on the compressor control type. Modify the available control set points (many performance points will not be available for editing because of control type limitations). Note that if you edit the performance points so that the motor load exceeds the service factor, a warning message will appear.
12. Click **Performance Profile** to view the profile before and after unloading control modifications.
13. When you finish editing the EEM information in the Use Unloading Controls window, click **Save** in the Use Unloading Controls window or the Energy Efficiency Measures window to save the edited or additional Use Unloading Controls EEM in the scenario. Click **Close** to return to the Energy Efficiency Measures window.

## Field Definitions

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### **Facility**

The name of the facility, or site, where this EEM and the entire scenario is applied.

### **System**

The name of the system where this EEM and the entire scenario is applied.

### ***Data View***

#### **Data View**

A description of the values displayed in the Control Information section; the original control parameters, or those proposed in this EEM.

## ***General Information***

### **Description**

The title for this Use Unloading Controls EEM. You can edit the default title.

### **Compressor**

Select the compressor on which you want to change unloading controls. The drop-down list includes the names of all air compressors assigned to the selected compressed air system.

### **Measure Cost, \$**

All costs associated with implementing this EEM, such as equipment, servicing, and installation, in dollars. Include an estimate of any labor costs.

### **Compressor Has Unloading Controls**

This box is marked automatically to indicate that the specified compressor has existing unloading controls. This field is display only.

## ***Control Information***

Compressors with different control types are measured with different sets of performance specifications, so the appearance of the performance points grid depends on the compressor control type. Note that if you edit the performance points so that the motor load exceeds the service factor, a warning message will appear.

### **Control Type**

The type of unloading controls to be installed. You can propose a change from a compressor type without unloading controls to one with unloading controls.

### **Unload Point, %C**

The airflow at which the air compressor unloads, expressed as a percentage of air compressor rated full-flow capacity.

### **Automatic Shutdown Timer**

Mark this box to indicate that the air compressor controls will include an automatic shutdown timer.

### **Performance Points**

The point at which air compressor performance was measured, such as full load or maximum pressure full flow. Up to five performance points may be listed, depending on the control type.

### **Discharge Pressure, psig**

The discharge pressure measured under the air compressor's rated or specified performance conditions, in pounds per square inch gauge.

### **Airflow: Dflt?**

Mark this box to use default airflow performance values for an industry average, or generic, air compressor. If this box is marked, the "Airflow: acfm" field will not be available.

### **Airflow: acfm**

The maximum airflow delivery capability for the air compressor at actual inlet conditions and discharge pressure, in actual cubic feet per minute. This field is not available if the default airflow performance value is selected.

### **Power: Dflt?**

Mark this box to use default power performance values for a generic air compressor. If this box is marked, the "Power: kW" field will not be available.

**Power: kW**

The power used by the air compressor, measured at the air compressor's rated performance conditions, in kilowatts. This field is not available if the default power performance value is selected. Click the "...” button following this field to open the Power Calculator window.

**Buttons**

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**Edit**

Click to enter Edit mode to make changes to the currently displayed conservation scenario, including the EEMs.

**Save**

Once in Edit mode, click to save the displayed conservation scenario and all the included EEMs.

**Print**

Click to open the Report Setup window, to view or print the EEM Parameters report.

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Use Unloading Controls window Help topic, which provides context-sensitive Help for this window.

**Results**

Click to open the EEM Results window, which displays the calculated results of this or any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs.

**Close**

Click to close the Use Unloading Controls window, and return to the Energy Efficiency Measures window, where you can cancel edits made in this and other EEM windows.

**Restore**

Click to delete proposed values in the Control Information section and replace them with Existing Values.

**Performance Profile**

Click to open the Performance Comparison graph, where you can view the compressor profile (power according to airflow) before and after unloading control modifications.

**"..."**

Click to open the Power Calculator window (see page 271), where you can multiply amps by volts to obtain a power value.

# Adjust Cascading Set Points window

**Navigation:** *Efficiency Measures module button / Adjust Cascading Set Points Edit-Review button*  
or *System Enhancements menu / Efficiency Measures command / Adjust Cascading Set Points Edit-Review button*

Position	Compressor	Control Type	Full Load or Cut-In Pressure, psig	Max Full Flow or Cut-Out Pressure, psig
Lead	Compressor 1	Inlet modulation with unloading	95.0	105.0
2	Compressor 2	Load/unload	90.0	100.0
3				
4				

*Adjust Cascading Set Points window*

## Purpose

Use the Adjust Cascading Set Points window to add, edit, or view an Adjust Cascading Set Points EEM (energy efficiency measure) for the proposed scenario. Enter pressure set points (or cut-in and cut-out pressures) that determine the order in which a system's compressors are brought on-line to meet hourly average load requirements. Consult your air compressor's manual or a qualified technician on how to adjust pressure switch set points. AIRMaster<sup>+</sup> apportions airflow profiles among the air compressors in accordance with the new cascading set point order. The annual energy use is recalculated and the energy and dollar savings associated with this EEM determined.

An example of this EEM: a compressed air system with a base-loaded rotary screw air compressor and a partly loaded centrifugal air compressor would probably benefit by adjusting cascading set points to make the centrifugal air compressor the lead and the rotary screw air compressor the lag unit.

**Note** You cannot apply this EEM to a sequenced system; in fact, this EEM will not be available if the system was initially defined to include a sequencer.

Because you can add a sequencer to a system after initial system definition, this EEM must precede the Use Automatic Sequencer EEM in the EEM order.

## **Description**

The Adjust Cascading Set Points window contains four main sections: Facility and System, Data View, EEM Description and Measure Cost, and the set point grid. The displayed set point information is existing or proposed data, depending on the selection in Data View. Depending on the control type of each compressor, some Cut-Out Pressure fields may not be available for editing.

## ***Procedures for Viewing, Editing, or Adding an Adjust Cascading Set Points EEM***

### **To view an Adjust Cascading Set Points EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to view.
2. In the Data Entry tab of the Energy Efficiency Measures window, click the **Edit/Review** button in the Adjust Cascading Set Points row. (The Adjust Cascading Set Points EEM must be included in the selected scenario.) The Adjust Cascading Set Points window opens.
3. The Adjust Cascading Set Points window displays the facility and system of the scenario, the title and cost of this EEM, and existing or proposed set point information for each compressor.
4. Choose whether you want to view existing or proposed set point information, and make a selection in the Data View section.
5. If you want to see the results of this Adjust Cascading Set Points EEM, click **Results** to open the EEM Results window.
6. When you finish viewing the EEM information in the Adjust Cascading Set Points window, click **Close** to return to the Energy Efficiency Measures window.

### **To edit or add an Adjust Cascading Set Points EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to edit.
2. Click **Edit** to enter Edit mode.
3. In the Data Entry tab of the Energy Efficiency Measures window, see if the **Include** box in the Adjust Cascading Set Points row has been marked. If an Adjust Cascading Set Points EEM is not yet included in the scenario, mark the **Include** box to add the EEM. If the **Include** box is not available, the system for the conservation scenario was initially defined to include a sequencer, and this EEM cannot be applied to the system.
4. Click the **Edit/Review** button in the Adjust Cascading Set Points row to open the Adjust Cascading Set Points window.

5. In the Adjust Cascading Set Points window, select Proposed in the Data View field. This allows you to edit available fields in the set point grid. You cannot edit existing values. If you want to change proposed set point information to existing set point information, click **Restore**.
6. Edit the title or default title of this Adjust Cascading Set Points EEM in the Description field, and the cost of this EEM in the Measure Cost field.
7. In the set point grid, all the compressors in the system and their control types are displayed. In the cut-in and cut-out pressure fields, the default proposed data is the existing data; edit available cells in those fields. (Some cut-out pressure fields may not be available for editing because of compressor control type limitations.) The pressure set points that you enter for each compressor will determine the order in which the system's compressors are brought on-line to meet hourly average load requirements.
8. When you finish editing the EEM information in the Adjust Cascading Set Points window, click **Save** in this window or the Energy Efficiency Measures window to save the edited or additional Adjust Cascading Set Points EEM in the scenario. Click **Close** to return to the Energy Efficiency Measures window.

## Field Definitions

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### Facility

The name of the facility, or site, where this EEM and the entire scenario is applied.

### System

The name of the system where this EEM and the entire scenario is applied.

### *Data View*

#### Data View

A description of the values displayed in the set point grid; the original pressure set points, or those proposed in this EEM.

### *General Information*

#### Description

The title for this Adjust Cascading Set Points EEM. You can edit the default title.

#### Measure Cost, \$

All costs associated with implementing this EEM, in dollars. Generally, implementation cost is only the labor time required to adjust existing controls. Cost could go up if a manufacturer's service technician has to visit the plant.

### *Set Point Grid (Existing or Proposed)*

#### Position

The order in which air compressors will be brought on line to meet air load requirements.

#### Compressor

The names of all air compressor assigned to the selected compressed air system. This field is display only.



**Control Type**

The type of control for the air compressor, such as inlet modulation with unloading. The control type limits the availability of the Cut-out Pressure field for editing. This field is display only.

**Full Load or Cut-In Pressure, psig**

The pressure at which the air compressor comes on line or loads, in pounds per square inch gauge. At this point the compressor may reload or turn on, and is delivering full flow. The pressures should be listed in descending order, and each cut-in pressure must be less than the corresponding cut-out pressure.

**Max Full Flow or Cut-Out Pressure, psig**

The pressure at which the air compressor cuts out or unloads, in pounds per square inch gauge. May require additional power. At this point, the compressor may unload, be fully modulated, or turn off. The pressures should be listed in descending order, and each cut-out pressure must be greater than the corresponding cut-in pressure.

**Buttons**

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**Edit**

Click to enter Edit mode to make changes to the currently displayed conservation scenario, including the EEMs.

**Save**

Once in Edit mode, click to save the displayed conservation scenario and all the included EEMs.

**Print**

Click to open the Report Setup window, to view or print the EEM Parameters report.

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Adjust Cascading Set Points window Help topic, which provides context-sensitive Help for this window.

**Results**

Click to open the EEM Results window, which displays the calculated results of this or any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs.

**Close**

Click to close the Adjust Cascading Set Points window, and return to the Energy Efficiency Measures window, where you can cancel edits made in this and other EEM windows.

**Restore**

Click to delete proposed values in the set point grid and replace them with Existing values.

# Use Automatic Sequencer window

**Navigation:** *Efficiency Measures module button / Use Automatic Sequencer Edit-Review button*  
or *System Enhancements menu / Efficiency Measures command / Use Automatic Sequencer Edit-Review button*

The screenshot shows a software window titled "EEM - Use Automatic Sequencer". The window has a menu bar with "File", "Calculators", and "Help". Below the menu bar is a toolbar with icons for edit, save, print, and help. On the right side of the toolbar are "Results" and "Close" buttons. The main area is divided into two tabs: "General Data" (selected) and "Hourly Data". In the "General Data" tab, there are two main sections: "Measure Description" and "Proposed Sequencing Options". The "Measure Description" section has a "Description" field containing "Use Automatic Sequencer" and a "Measure cost, \$" field containing "8000". The "Proposed Sequencing Options" section has two radio buttons: "Cascade" (unselected) and "Target pressure" (selected). To the right of these radio buttons are two input fields: "Target pressure" with a value of "90" and units "psig", and "Variance (+/-)" with a value of "2" and units "psi". A "Restore" button is located to the right of the "Data View" section. The "Data View" section has two radio buttons: "Existing" (unselected) and "Proposed" (selected). At the bottom of the "Proposed Sequencing Options" section, there is a red note: "NOTE: All pressures measured at the sequencer pressure tap."

*Use Automatic Sequencer window: General Data tab*

## Purpose

The Use Automatic Sequencer window allows you to add, edit, or view a Use Automatic Sequencer EEM (energy efficiency measure) for the proposed scenario. Use this window to enter the parameters for an additional automatic sequencer or an adjustment to the existing hourly sequencing of an air system's compressors.

Once changes are proposed, the system airflow profiles are recalculated to reflect the new pressure ranges. AIRMaster<sup>™</sup> will apportion system airflow profiles among available air compressors with respect to the new sequence order and recalculate compressed air system power profiles, annual energy use, and operating costs.

**Note** This EEM cannot precede the Adjust Cascading Set Points EEM in the EEM order for a scenario.

## Description

The Use Automatic Sequencer window has two tabs: the General Data tab and the Hourly Data tab. The General Data tab displays the EEM description, cost, whether the system has a cascade or target pressure type of sequencing, and the pressure

range(s). The Hourly Data tab displays the hourly sequencing order for each compressor during each daytype.

The information in both tabs applies to the facility and system for the scenario, and the data type, displayed at the top of the window. The buttons at the top of the window also apply to both tabs, regardless of which is open, and you can switch between tabs without losing information. The Facility, System, and Data View fields and the buttons at the top of the window are described below, followed by a description of each tab.

## ***Procedures for Viewing, Editing, or Adding a Use Automatic Sequencer EEM***

### **To view a Use Automatic Sequencer EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to view.
2. In the Data Entry tab of the Energy Efficiency Measures window, click the **Edit/Review** button in the Use Automatic Sequencer row. (The Use Automatic Sequencer EEM must be included in the selected scenario.) The Use Automatic Sequencer window opens.
3. The Use Automatic Sequencer window displays the facility and system of the scenario at the top of the window, the measure description and existing or proposed sequencing options on the General Data tab, and existing or proposed sequencing data on the Hourly Data tab.
4. Choose whether you want to view existing or proposed sequencing information, and make a selection in the Data View section at the top of the window. Your selection here determines which information is displayed in both tabs.
5. In the Hourly Data tab, select different daytypes to view existing or proposed sequencing data for different operating daytypes.
6. If you want to see the results of this Use Automatic Sequencer EEM, click **Results** to open the EEM Results window.
7. When you finish viewing the EEM information in the Use Automatic Sequencer window, click **Close** to return to the Energy Efficiency Measures window.

### **To edit or add a Use Automatic Sequencer EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to edit.
2. Click **Edit** to enter Edit mode.
3. In the Data Entry tab of the Energy Efficiency Measures window, see if the **Include** box in the Use Automatic Sequencer row has been marked. If a Use Automatic Sequencer EEM is not yet included in the scenario, mark the **Include** box to add the EEM.
4. Click the **Edit/Review** button in the Use Automatic Sequencer row to open the Use Automatic Sequencer window.

5. In the Use Automatic Sequencer window, select Proposed in the Data View field. This allows you to edit available fields in the Proposed Sequencing Options and Proposed Sequencing Data sections. You cannot edit existing sequencing information. If you want to change proposed sequencing information to existing sequencing information, click **Restore**.
6. In the General Data tab, Measure Description section, edit the title or default title of this Use Automatic Sequencer EEM in the Description field, and the cost of this EEM in the Measure Cost field.
7. In the Proposed Sequencing Options section, select whether the compressed air system will have a cascade or target pressure type of sequencing. Your selection will affect the appearance of the grid in this section. Enter or edit the pressure range for the selected option (if Cascade, you will edit the Full Load or Cut-in Pressure and the Max Full Flow or Cut-out Pressure fields for each compressor; if Target Pressure, you will edit the Target Pressure and Variance fields for the system). Whether the system has a cascade or target pressure type of sequencing, the default proposed data is the existing data. The sequencing information that you enter for the compressors or system will determine the order in which the system's compressors are brought on-line to meet hourly average load requirements.
8. When you finish editing fields in the General Data tab, open the Hourly Data tab and select a daytype.
9. In the Hourly Data tab, you may add (but not remove) a shutdown timer for each compressor. If an automatic shutdown timer is on a compressor during one daytype, it is on during all daytypes; it will be automatically marked for the other daytypes.
10. For the selected daytype, use the grid to specify the new sequence order for each compressor for each hour of that daytype. Click in each cell to display a drop-down list that includes available sequence order numbers and "off." You can turn an air compressor off during desired hours if it is a spare or does not have an automatic shutdown timer to turn it off when not needed. Use the displayed airflow capacity of each compressor and the displayed hourly airflow requirement to determine the smallest compressor(s) necessary to meet required airflow each hour. To enter columns of duplicate data, click **Copy Previous Col**. You can turn an air compressor on if the desired compressor hour on the grid is available; if an hour of compressor cells is unavailable, the system has been defined as "off" for that hour in the Profile module. To make those compressor hours available, define at least one compressor as "on" in that hour in the Data Entry tab of the System Profiles window.
11. If any Available Airflow or Required Airflow cells are red, that indicates that compressor sequencing provides insufficient airflow for that hour. If that is the case, edit the sequence order in the grid to remedy the insufficient airflow.
12. Repeat steps #10-11 for each daytype.
13. When you finish editing the EEM information in both tabs of the Use Automatic Sequencer window, click **Save** in this window or the Energy Efficiency Measures window to save the edited or additional Use Automatic Sequencer EEM in the scenario. Click **Close** to return to the Energy Efficiency Measures window.

## Field Definitions

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### Facility

The name of the facility, or site, where this EEM and the entire scenario is applied.

### System

The name of the system where this EEM and the entire scenario is applied.

### Data View

A description of the information displayed in both tabs; the original sequencing information, or sequencing proposed in this EEM. The selection here affects the titles and contents of the Existing or Proposed Sequencing Options and Sequencing Data sections.

## Buttons

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### Edit

Click to enter Edit mode to make changes to the currently displayed conservation scenario, including the EEMs.

### Save

Once in Edit mode, click to save the displayed conservation scenario and all the included EEMs.

### Print

Click to open the Report Setup window, to view or print the EEM Parameters report.

### Help

Click to open the AIRMaster<sup>+</sup> Help system to the Use Automatic Sequencer window Help topic, which provides context-sensitive Help for this window.

### Results

Click to open the EEM Results window, which displays the calculated results of this or any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs.

### Close

Click to close the Use Automatic Sequencer window, and return to the Energy Efficiency Measures window, where you can cancel edits made in this and other EEM windows.

### Restore

Click to delete information in the Proposed Sequencing Options and Proposed Sequencing Data sections and replace it with Existing information.

## General Data tab

The General Data tab allows you to enter the energy efficiency measure (EEM) description and cost, select whether the compressed air system's proposed sequencing is cascade or target pressure, and enter the pressure range for the selected option. This tab is divided into two sections: Measure Description and Existing (or Proposed) Sequencing Options. The appearance of the grid in the Existing (or Proposed) Sequencing Options section is determined by the selection of a Cascade or Target Pressure type of sequencing.

See illustration of General Data tab on page 174.

**Procedures** Please see page 175.

## Field Definitions

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### *Measure Description*

#### **Description**

The title for this Use Automatic Sequencer EEM. You can edit the default title.

#### **Measure Cost, \$**

All costs associated with implementing this EEM, in dollars, including labor costs.

### *(Existing or Proposed) Sequencing Options*

#### **None, Cascade, or Target Pressure**

Select a sequence type to indicate whether your proposed compressed air system has a cascade or target pressure type of sequencing. If Existing Sequencing Options are displayed, "None" is an option; this will make the sequencing data grid in this section unavailable.

#### **(If Cascade) Position**

The position of the compressor in sequence order of 1 through 20.

#### **(If Cascade) Full Load or Cut-in Pressure, psig**

The pressure at which the air compressor cuts in or loads, in pounds per square inch gauge.

#### **(If Cascade) Max. Full Flow or Cut-out Pressure, psig**

The pressure at which the air compressor cuts out or unloads, in pounds per square inch gauge.

#### **(If Target) Target Pressure, psig**

The median of the target pressure band for the compressed air system, defined in pounds per square inch gauge.

#### **(If Target) Variance, +/- psi**

The variance from the median allowed in the target pressure band for the compressed air system, defined in pounds per square inch.

## Hourly Data tab

**Navigation:** *Efficiency Measures module button / Use Automatic Sequencer Edit-Review button / Hourly Data tab*  
 or *System Enhancements menu / Efficiency Measures command / Use Automatic Sequencer Edit-Review button / Hourly Data tab*

The screenshot shows the 'EEM - Use Automatic Sequencer' window. The 'Hourly Data' tab is selected, displaying 'Proposed Sequencing Data' for the 'Production' daytype. The table below shows the sequencing order for two compressors over a 9-hour period. Compressor 1 has a capacity of 475 acfm and a shutdown timer (checked), while Compressor 2 has a capacity of 840 acfm and a shutdown timer (checked). The 'Available Airflow' is constant at 1325 acfm, while the 'Required Airflow' varies by hour (83 acfm for hours 1-6, 492 acfm for hours 7-9). Power requirements are 44 kW for hours 1-6 and 78 kW for hours 7-9.

Compressor	Airflow Capacity acfm	Shut down Timer	1	2	3	4	5	6	7	8	9
Compressor 1	475	<input checked="" type="checkbox"/>	1	1	1	1	1	1	2	2	2
Compressor 2	840	<input checked="" type="checkbox"/>	2	2	2	2	2	2	1	1	1
Available Airflow, acfm			1325	1325	1325	1325	1325	1325	1325	1325	1325
Required Airflow, acfm			83	83	83	83	83	83	492	492	492
Power, kW			44	44	44	44	44	44	78	78	78

*Use Automatic Sequencer window: Hourly Data tab*

The Hourly Data tab allows you to specify the proposed sequence order of each air compressor for each hour of each daytype, and whether each compressor has a shutdown timer. You can turn an air compressor off during desired hours if it is a spare or does not have an automatic shutdown timer. You can also turn an air compressor on if the desired compressor hour on the grid is available. This tab contains a field for selecting the daytype described in the table, and a table of hourly sequencing data for each compressor. Use the displayed airflow capacity of each compressor and the displayed hourly airflow requirement to determine the smallest compressor(s) necessary to meet required airflow each hour.

**Procedures** Please see page 175.

### Field Definitions

#### Daytype

Select a daytype for which to display hourly sequencing order.

***(Existing or Proposed) Sequencing Data***

**Compressor**

The names of all air compressors assigned to the selected compressed air system. This field is display only.

**Airflow Capacity, acfm**

The contribution of each air compressor to the system's airflow requirements, in actual cubic feet per minute. This field is display only.

**Shutdown Timer**

Mark this box if the air compressor controls include an automatic shutdown timer.

**[Hours]**

The sequence order for each compressor for each hour of the selected daytype.

**Available Airflow, acfm**

The total compressed air system airflow capacity, in actual cubic feet per minute. This field is display only.

**Required Airflow, acfm**

The compressed air system's hourly airflow requirement, in actual cubic feet per minute. This field is display only.

**Power, kW**

The power, in kilowatts, consumed in each hour by the compressors. This field is display only.

**Buttons**

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**Copy Prev Col**

Click to enter a column of data identical to the previous column.



# Reduce Run Time window

**Navigation:** *Efficiency Measures module button / Reduce Run Time Edit-Review button*  
 or *System Enhancements menu / Efficiency Measures command / Reduce Run Time Edit-Review button*

Compressor	Airflow Cap., acfm	1	2	3	4	5	6	7	8	9
Compressor 1	479	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Compressor 2	846	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Available Airflow, acfm		0	0	0	0	0	0	1325	1325	1325
Required Airflow, acfm		83	83	83	83	83	83	492	492	492

Reduce Run Time window

## Purpose

Use the Reduce Run Time window to add, edit, or view a Reduce Run Time EEM (energy efficiency measure) for the proposed scenario. Use this window to enter EEM information for manually turning off selected air compressors at selected times. This means taking a compressor offline so that it is no longer available for service. Compressors marked “on” in the Existing Run Time Data grid may not be running but are still available if needed; a Reduce Run Time EEM proposes manually switching the compressor off or unplugging it. You can also use this window to enter information for manually turning on an air compressor if the desired hour on the grid is available.

Use the displayed airflow capacity of each compressor and the displayed hourly airflow requirement only as guidelines to determine the smallest compressor(s) necessary to meet required airflow each hour. An air compressor may not be needed because it is merely supplying an avoidable load (leaks) as opposed to a useful load.

Note that sequencers, automatic shutdown timers, or other controls cannot distinguish between a useless load and a useful or required load.

Once changes are proposed, AIRMaster<sup>+</sup> will determine energy savings by recalculating compressed air system power profiles after reapportioning the modified system airflow profile among the available air compressors. Daytype operating schedules and control strategies are appropriately taken into account. Also, the leak load will be reduced to zero when all air compressors are turned off.

## **Description**

The Reduce Run Time window has four sections: Facility and System, Data View, Measure Description, and Existing or Proposed Run Time Data. The facility and system of the selected conservation scenario are displayed at the top of the window. The selection made in the Data View selection determines whether the Run Time Data grid displays existing or proposed data. The Measure Description section displays the EEM description and cost. The Existing or Proposed Run Time Data section displays the hourly “on” or “off” status for each compressor during each daytype.

## ***Procedures for Viewing, Editing, or Adding a Reduce Run Time EEM***

### **To view a Reduce Run Time EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to view.
2. In the Data Entry tab of the Energy Efficiency Measures window, click the **Edit/Review** button in the Reduce Run Time row. (The Reduce Run Time EEM must be included in the selected scenario.) The Reduce Run Time window opens.
3. The Reduce Run Time window displays the facility and system of the scenario at the top of the window, the measure description and cost, and existing or proposed run time data for each daytype.
4. Choose whether you want to view existing or proposed run time information, and make a selection in the Data View section at the top of the window. Your selection here determines which information is displayed in the grid.
5. Select different daytypes to view existing or proposed run time data for different operating daytypes.
6. If you want to see the results of this Reduce Run Time EEM, click **Results** to open the EEM Results window.
7. When you finish viewing the EEM information in the Reduce Run Time window, click **Close** to return to the Energy Efficiency Measures window.

### **To edit or add a Reduce Run Time EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to edit.
2. Click **Edit** to enter Edit mode.

3. In the Data Entry tab of the Energy Efficiency Measures window, see if the **Include** box in the Reduce Run Time row has been marked. If a Reduce Run Time EEM is not yet included in the scenario, mark the **Include** box to add the EEM.
4. Click the **Edit/Review** button in the Reduce Run Time row to open the Reduce Run Time window.
5. In the Reduce Run Time window, select Proposed in the Data View field. This allows you to edit available fields in the Proposed Run Time Data grid. You cannot edit existing run time data. If you want to change proposed run time data to existing run time data, click **Restore**.
6. In the Measure Description section, edit the title or default title of this Reduce Run Time EEM in the Description field, and the cost of this EEM in the Measure Cost field.
7. In the Proposed Run Time Data section, select a daytype and use the grid to specify the new run time data for each compressor for each hour of that daytype. Click in a cell to switch that compressor “on” or “off” during that hour. Use the displayed airflow capacity of each compressor and the displayed hourly airflow requirement to determine the smallest compressor(s) necessary to meet required airflow each hour, but remember that sequencers, automatic shutdown timers, or other controls cannot distinguish between a useless (leak) load and a useful or required load. Determine the times when air compressors are supplying leaks, and only leaks. For example, an air compressor may be left on overnight feeding leaks. In this case, the air compressor should be turned off even though the entries on the Required Flow row will indicate that the system airflow requirements are not being met. You might turn off an air compressor during certain hours because it is a spare or does not have an automatic shutdown timer.  
  
You can turn an air compressor on if the desired compressor hour on the grid is available; if an hour of compressor cells is unavailable, the system has been defined as “off” for that hour in the Profile module. To make those compressor hours available, define at least one compressor as “on” in that hour in the Data Entry tab of the System Profiles window.
8. If any Available Airflow or Required Airflow cells are red, that indicates that compressor run time provides insufficient airflow for that hour. If that is truly the case, edit the run time data in the grid to remedy the insufficient airflow.
9. Repeat steps #7-8 for each daytype.
10. When you finish editing the EEM information in the Reduce Run Time window, click **Save** in the Reduce Run Time window or the Energy Efficiency Measures window to save the edited or additional Reduce Run Time EEM in the scenario. Click **Close** to return to the Energy Efficiency Measures window.

## Field Definitions

---

### Facility

The name of the facility, or site, where this EEM and the entire scenario is applied.

**System**

The name of the system where this EEM and the entire scenario is applied.

***Data View*****Data View**

A description of the information displayed in the Run Time Data grid; the previously existing air compressor run time schedules, or the modified (proposed) air compressor run time schedules. The selection here affects the title and contents of the Existing or Proposed Run Time Data section.

***Measure Description*****Description**

The title for this Reduce Run Time EEM. You can edit the default title.

**Measure Cost, \$**

All costs associated with implementing this EEM, in dollars.

***(Existing or Proposed) Run Time Data*****Daytype**

Select a daytype for which to display hourly run time data.

**Compressor**

The names of all air compressors assigned to the selected compressed air system. This field is display only.

**Airflow Cap., acfm**

The contribution of each air compressor to the system's airflow requirements, in actual cubic feet per minute. This field is display only.

**[Hours]**

A mark in a compressor-hour box indicates that the compressor is "on," or available for service, during that hour.

**Available Airflow, acfm**

The total compressed air system airflow capacity, in actual cubic feet per minute. This field is display only.

**Required Airflow, acfm**

The compressed air system's hourly airflow requirement, in actual cubic feet per minute. This field is display only.

**Buttons**

---

**Edit**

Click to enter Edit mode to make changes to the currently displayed conservation scenario, including the EEMs.

**Save**

Once in Edit mode, click to save the displayed conservation scenario and all the included EEMs.

**Print**

Click to open the Report Setup window, to view or print the EEM Parameters report.

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Reduce Run Time window Help topic, which provides context-sensitive Help for this window.

**Results**

Click to open the EEM Results window, which displays the calculated results of this or any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs.

**Close**

Click to close the Reduce Run Time window, and return to the Energy Efficiency Measures window, where you can cancel edits made in this and other EEM windows.

**Restore**

Click to delete information in the Proposed Run Time Data section and replace it with Existing information.

---

## Add Primary Receiver Volume window

**Navigation:** *Efficiency Measures module button / Add Primary Receiver Volume Edit-Review button*  
or *System Enhancements menu / Efficiency Measures command / Add Primary Receiver Volume Edit-Review button*

Measure cost, \$	cubic ft.	gallons
3500	63.1	472
	200.5	1500
	263.6	1972

*Add Primary Receiver Volume window*

### Purpose

Use the Add Primary Receiver Volume window to add, edit, or view an Add Primary Receiver Volume EEM (energy efficiency measure) for the proposed scenario. Specify an increase in system storage capacity, which may be accomplished by installing additional receiver volume.

Locating additional or designated receiver volume near large intermittent loads allows the system to meet load requirements without drawing down the system pressure. The additional volume also conserves energy by lengthening the compressor cycle time so that complete blowdown is achieved and the full benefits of load/unload controls are realized. Analyze your compressed air system capacity requirements to determine how much, if possible, you should increase receiver capacity. Once this EEM is applied, AIRMaster<sup>+</sup> modifies the system airflow and power profiles to reflect operation with increased storage capacity.

**Note** To open this window, there must be a specified system volume in the System window.

## Description

The Add Primary Receiver Volume window contains two main sections; the upper section lists the facility and system of the selected scenario, and the lower section displays the EEM description and cost, the existing and proposed system air storage capacity, and the proposed increase in system volume. Click **Performance Profile** to view the Performance Comparison graph (a compressor profile of power according to airflow) before and after receiver volume modifications. Click **Results** to open the EEM Results window, which displays the hourly power, airflow, and sequence order for the system after this EEM is implemented.

## ***Procedures for Viewing, Editing, or Adding an Add Primary Receiver Volume EEM***

### **To view an Add Primary Receiver Volume EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to view.
2. In the Data Entry tab of the Energy Efficiency Measures window, click the **Edit/Review** button in the Add Primary Receiver Volume row. (The Add Primary Receiver Volume EEM must be included in the selected scenario.) The Add Primary Receiver Volume window opens.
3. The Add Primary Receiver Volume window displays the facility and system of the selected scenario, the title and cost of this EEM, the system air storage capacity before and after implementing the EEM, and the amount of the proposed system volume increase.
4. If you want to see the results of this Add Primary Receiver Volume EEM, click **Results** to open the EEM Results window.
5. When you finish viewing the EEM information in the Add Primary Receiver Volume window, click **Close** to return to the Energy Efficiency Measures window.

### **To edit or add an Add Primary Receiver Volume EEM**

1. In the Energy Efficiency Measures window, select the conservation scenario you want to edit.
2. Click **Edit** to enter Edit mode.
3. In the Data Entry tab of the Energy Efficiency Measures window, see if the **Include** box in the Add Primary Receiver Volume row has been marked. If an Add Primary Receiver Volume EEM is not yet included in the scenario, mark the **Include** box to add the EEM.
4. Click the **Edit/Review** button in the Add Primary Receiver Volume row to open the Add Primary Receiver Volume window.
5. In the Add Primary Receiver Volume window, edit the title or default title of this EEM in the Description field, and the cost of this EEM in the Measure Cost field.
6. Enter the amount of the proposed system volume increase, in cubic feet or gallons, in the Increased Volume field. Click in any other field, and the other

Increased Volume measurement, and both the Proposed Air Storage Capacity measurements, are calculated.

7. Repeat step #6 if you want to view additional Increased Volume and Proposed Air Storage Capacity measurement calculations.
8. When you finish editing the EEM information in the Add Primary Receiver Volume window, click **Save** in this window or the Energy Efficiency Measures window to save the edited or additional Add Primary Receiver Volume EEM in the scenario. Click **Close** to return to the Energy Efficiency Measures window.

## Field Definitions

---

### Facility

The name of the facility, or site, where this EEM and the entire scenario is applied.

### System

The name of the system where this EEM and the entire scenario is applied.

### Description

The title for this Add Primary Receiver Volume EEM. You can edit the default title.

### Measure Cost, \$

All costs associated with implementing this EEM, in dollars.

### Existing Air Storage Capacity

The volume of air that the compressed air system can store before the EEM is implemented, including receivers and distribution pipes, in cubic feet and gallons. This value is determined by the System Air Storage Capacity value in the System Data tab of the System window.

### Increased Volume

The amount that the compressed air system volume is increased by the proposed changes, in cubic feet and gallons.

### Proposed Air Storage Capacity

The volume of air that the compressed air system can store after the EEM is implemented, including receivers and distribution pipes, in cubic feet and gallons. This amount is the sum of the previous two fields.

## Buttons

---

### Edit

Click to enter Edit mode to make changes to the currently displayed conservation scenario, including the EEMs.

### Save

Once in Edit mode, click to save the displayed conservation scenario and all the included EEMs.



**Print**

Click to open the Report Setup window, to view or print the EEM Parameters report.

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Add Primary Receiver Volume window Help topic, which provides context-sensitive Help for this window.

**Results**

Click to open the EEM Results window, which displays the calculated results of this or any EEM, including hourly power, airflow, and sequence order; and system airflow, load requirements, and costs.

**Close**

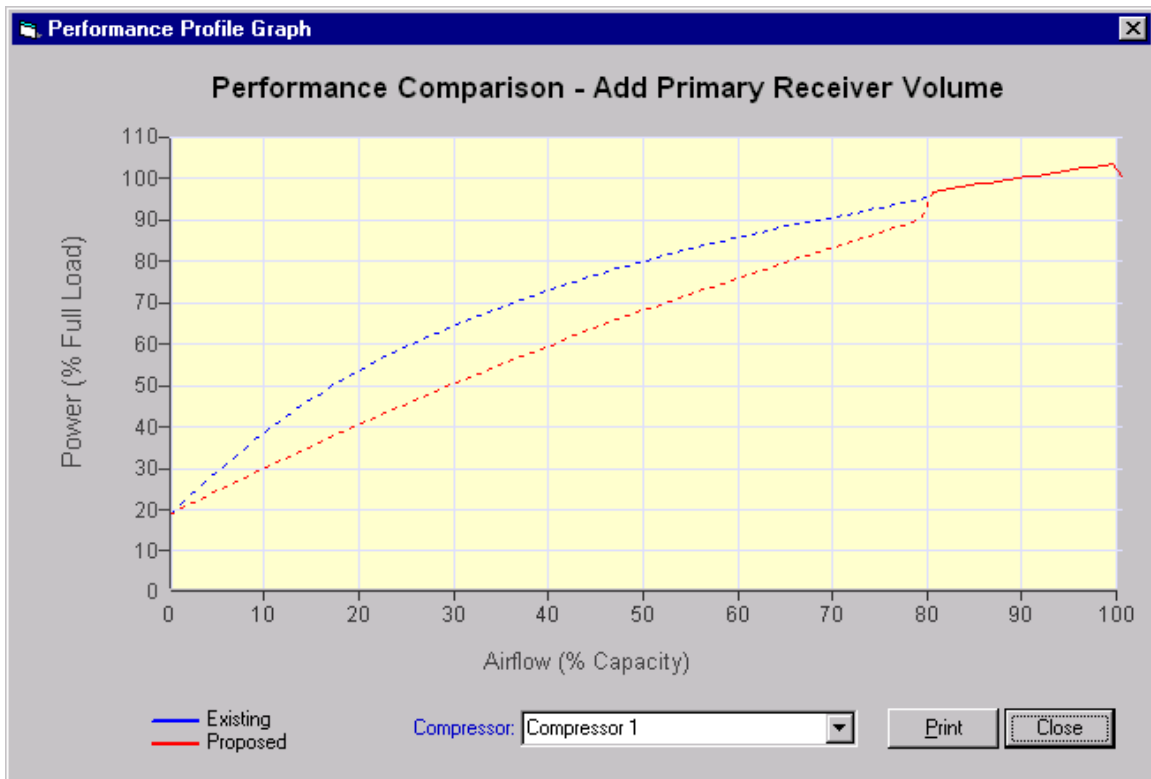
Click to close the Add Primary Receiver Volume window, and return to the Energy Efficiency Measures window, where you can cancel edits made in this and other EEM windows.

**Performance Profile**

Click to open the Performance Comparison graph, where you can view the compressor profile (power according to airflow) before and after receiver volume modifications.

# Performance Comparison graph

**Navigation:** *Efficiency Measures module button / Add Primary Receiver Volume Edit-Review button / Performance Profile*  
or *System Enhancements menu / Efficiency Measures command / Add Primary Receiver Volume Edit-Review button / Performance Profile*



*Performance Comparison graph*

## Purpose

Use the Performance Comparison graph to see how a compressor's profile (of power according to airflow) is affected by receiver volume modification. You can also print this graph.

## Description

The Performance Comparison graph displays power (as a percentage of full load power) along the y-axis, and airflow (as a percentage of capacity) along the x-axis. The "existing" and "proposed" data displayed in this graph demonstrate the effect of the Add Primary Receiver Volume EEM. This graph is accessed via the Performance Profile button on the Add Primary Receiver Volume window. You can portray any single compressor from the system that was selected in the Add Primary Receiver Volume EEM window.

## ***Procedures for Viewing or Printing a Performance Comparison Graph***

### **To view or print a performance comparison graph**

1. In the Add Primary Receiver Volume window, click **Performance Profile**. The Performance Comparison graph opens.
2. In the Compressor field, select which compressor you would like displayed in the Performance Comparison graph.
3. Click **Print** if you would like to print the Performance Comparison graph.
4. When you are done viewing the Performance Comparison graph, click **Close** to return to the Add Primary Receiver Volume window.

### **Field Definitions**

---

#### **Power (% Full Load)**

Electrical power for the selected compressor, expressed as a percentage of the maximum power delivered by that compressor at full load.

#### **Airflow (% Capacity)**

Airflow for the selected compressor, expressed as a percentage of the maximum airflow deliverable by that compressor.

#### **Compressor**

The system compressor represented in the graph.

### **Buttons**

---

#### **Print**

Click to print the Performance Comparison graph.

#### **Close**

Click to close the Performance Comparison graph and return to the Add Primary Receiver Volume window.

# EEM Results window

**Navigation:** *Efficiency Measures module button / Results button*  
 or *System Enhancements menu / Efficiency Measures command / Results button*

The screenshot shows the 'EEM Results' window with the 'Profile Summary' tab selected. The window title is 'EEM Results'. It has a 'Close' button and a 'Help' icon. The 'EEM Scenario' is 'Scenario #1' and the 'EEM' is 'Add Receiver Volume'. The 'Daytype' is 'Production'. The table shows data for Compressor 1 and Compressor 2 across 11 days. Total Power is 107.5 kW and Total Airflow is 87 acfm. A red cell in the Total Airflow row indicates inadequate capacity.

Compressor	1	2	3	4	5	6	7	8	9	10	11
<b>Compressor 1</b>											
Calc Power, kW	0.0	0.0	0.0	0.0	0.0	0.0	82.9	82.9	82.9	82.9	82.9
Calc Airflow, acfm	0	0	0	0	0	0	479	479	479	479	479
Calc %Capacity	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0
Cascade #	0	0	0	0	0	0	1	1	1	1	1
<b>Compressor 2</b>											
Calc Power, kW	0.0	0.0	0.0	0.0	0.0	0.0	24.5	24.5	24.5	24.5	24.5
Calc Airflow, acfm	0	0	0	0	0	0	37	37	37	37	37
Calc %Capacity	0.0	0.0	0.0	0.0	0.0	0.0	4.3	4.3	4.3	4.3	4.3
Cascade #	0	0	0	0	0	0	2	2	2	2	2
<b>Total Power, kW</b>	0.0	0.0	0.0	0.0	0.0	0.0	107.5	107.5	107.5	107.5	107.5
<b>Total Airflow, acfm</b>	87	87	87	87	87	87	515	515	515	515	515
<b>% System Capacity</b>	0.0	0.0	0.0	0.0	0.0	0.0	38.9	38.9	38.9	38.9	38.9

Red cells indicate inadequate capacity available to meet required airflow. System pressure may drop to an unacceptable level resulting in improper equipment operation.

Buttons: Copy To Clipboard, Graph

EEM Results window: Profile Summary tab

## Purpose

The EEM Results window allows you to view the calculated results of any one energy efficiency measure (EEM), or the system baseline before any EEM is implemented.

**Note** To view the results of implementing *all* the combined EEMs in the conservation scenario, see the Energy Efficiency Measures window, Savings Summary tab.

## Description

The EEM Results window (Energy Efficiency Measure Results window) is accessed from the Energy Efficiency Measures window or from any of the EEM windows. Regardless of how it is accessed, this window retains the same layout and options. The EEM Results window has two tabs: the Profile Summary tab and the Totals tab. The Profile Summary tab displays the hourly power, airflow, capacity, and sequence

or cascade set point order for each compressor and the system, for the selected daytype. The Totals tab displays the system airflow and load requirements and costs, subtotaled by daytype, and the system annual demand cost and total annual cost.

The information in both tabs relates to the scenario and EEM (or the system baseline) selected in the fields at the top of the EEM Results window. The EEM Scenario and EEM fields at the top of the window are described below, followed by a description of each tab.

## ***Procedures for Viewing the System Baseline or Results of an EEM***

### **To view the system baseline or results of an EEM**

1. In the Energy Efficiency Measures window or any EEM (energy efficiency measure) window, make sure the selected scenario is the scenario containing the EEM or system baseline you want to view.
2. In the Energy Efficiency Measures window or an EEM window, click **Results**. The EEM Results window opens.
3. The two tabs of the EEM Results window display results for the EEM selected at the top of the window. The EEM drop-down list contains System Baseline and all EEMs applied in the scenario; make a selection. (If you accessed the EEM Results window from the Energy Efficiency Measures window, the default EEM selected is actually the System Baseline, or the system parameters before any EEM is applied. If you accessed the EEM Results window from an EEM window, the default EEM selected is the EEM of the previous window.)
4. In the Daytype field at the top of the Profile Summary tab, select the daytype for which you would like to view profile summary information. Profile Summary information includes the hourly power, airflow, capacity, and sequence or cascade set point order for each compressor and the system.
5. In the Totals tab, view the system airflow and load requirements and costs, subtotaled by daytype, and the system annual demand cost and total annual cost.
6. If you want to copy the profile summary or totals information to a spreadsheet program, click **Copy to Clipboard** in either tab. This copies all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.
7. If you want to view the EEM Savings Scenario graph, click **Graph**. This graph displays hourly airflow, power, or capacity before and after the selected EEM is implemented. If you selected “System Baseline” in the Profile Summary tab, the graph will compare baseline data to the data resulting from all EEMs in the complete scenario. This allows you to edit an individual EEM, then view the resulting changes for the entire scenario.
8. When you finish viewing EEM Results information, click **Close** to close the EEM Results window.

## **Field Definitions**

---

### **EEM Scenario**

The name of the energy efficiency measure (EEM) conservation scenario described by the displayed information in both tabs.

### **EEM**

The name of the energy efficiency measure, or the system baseline, described in both tabs. Select from the drop-down list of efficiency measures applied in the selected scenario.

## **Buttons**

---

### **Print**

Click to open the Report Setup window, to view or print the EEM Parameters report.

### **Help**

Click to open the AIRMaster<sup>+</sup> Help system to the EEM Results window Help topic, which provides context-sensitive Help for this window.

### **Close**

Click to close the EEM Results window.

## Profile Summary tab

Use the *display only* Profile Summary tab to view the hourly power, airflow, capacity, and sequence or cascade set point order for each compressor and the system, for the selected daytype. The information displayed in this tab is for the system baseline or the result of the single energy efficiency measure (EEM) selected in the EEM field at the top of the window. For the system baseline, the profile data type entered in the Data Entry tab of the System Profiles window is titled “Measured,” and the other data types “Calculated”; for EEMs, all profile data types are calculated. Note that a red cell in the Total Airflow or % System Capacity rows indicates inadequate capacity is available to meet required airflow for that hour.

Click **Graph** to open the EEM Savings Scenario graph, which graphs hourly airflow, power, or capacity before and after the selected EEM is implemented.

See illustration of Profile Summary tab on page 192.

**Procedures** Please see page 193.

---

## Field Definitions

### Daytype

The daytype described by information in this tab. Select from the drop-down list of daytypes defined for the system in the selected scenario.

### Compressor

The names of all air compressors assigned to the compressed air system in the selected scenario, and the airflow and power measurement fields for each air compressor.

### [Hours]

The airflow and load requirements for each air compressor and the total compressed air system, for every hour of the selected daytype.

### [Calc or Meas] Power, kW

The calculated or entered power used by the air compressor, for each operating hour of the selected daytype, in kilowatts.

### [Calc or Meas] Airflow, acfm

The calculated or entered airflow for each air compressor, for each operating hour of the selected daytype, in actual cubic feet per minute.

### [Calc or Meas] % Capacity

The calculated or entered percent of capacity used by each air compressor for each operating hour of the selected daytype. The % capacity is the airflow delivered by the air compressor divided by its maximum airflow, multiplied by 100.

### Cascade # or Sequence #

The order in which air compressors are brought on line to meet load requirements for each hour of the selected daytype.

**Total Power, kW**

The total power in kilowatts used by all air compressors (and their auxiliaries) assigned to the compressed air system, for each hour of the selected daytype.

**Total Airflow, acfm**

The total airflow provided by all air compressors assigned to the compressed air system, for each hour of the selected daytype, in actual cubic feet per minute.

**% System Capacity**

The percent of system capacity used by each compressor for each hour during the selected daytype.

**Buttons**

---

**Copy to Clipboard**

Click to copy all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.

**Graph**

Click to open the EEM Savings Scenario graph, which graphs hourly airflow, power, or capacity before and after the selected energy efficiency measure (EEM) is implemented. If you selected "System Baseline" in the Profile Summary tab, the graph will compare baseline data to the data resulting from all EEMs in the complete scenario. This allows you to edit an individual EEM, then view the resulting changes for the entire scenario.



## Totals tab

**Navigation:** *Efficiency Measures module button / Results button / Totals tab*  
or *System Enhancements menu / Efficiency Measures command / Results button / Totals tab*

The screenshot shows the 'EEM Results' window with the 'Totals' tab selected. The window title is 'EEM Results'. Below the title bar, there are icons for printing and help, and a 'Close' button. The 'EEM Scenario' is set to 'Scenario #1' and the 'EEM' dropdown is set to 'Add Receiver Volume'. The 'Totals' tab is active, showing a 'System Summary' table and cost calculations.

Daytype	Total OpHrs	Avg Airflow, acfm	Avg Airflow, %Cs	Peak Demand, kW	Load Factor, %	Annual Energy, kWh	Annual Energy Cost, \$
Production	4,500	445	33.6	100.6	36.8	340,758	12,949
Weekends	400	468	35.3	75.5	36.7	30,215	1,133
System Totals	4,900	452	34.1	100.6	36.7	370,974	14,082

Copy To Clipboard

Total demand cost, \$ \$ 4073

Total operating costs, \$ \$ 18154

*EEM Results window: Totals tab*

Use the *display only* Totals tab to view the system airflow and load requirements and costs, subtotaled by daytype, and the system annual demand cost and total annual cost. The information displayed in this tab is for the system baseline or the result of the single energy efficiency measure (EEM) selected in the EEM field at the top of the window.

**Procedures** Please see page 193.

### Field Definitions

#### Daytype

The daytypes (types of typical operating day) for which compressed air system summary calculations are made. Each daytype of the system is included.

**Total OpHrs**

The total annual operating hours for the compressed air system, subtotaled for each daytype.

**Avg Airflow, acfm**

The average airflow delivered by the compressed air system, in actual cubic feet per minute, for each daytype and the average operating day.

**Avg Airflow, %Cs**

The average system airflow requirements, for each daytype and the average operating day, expressed as a percentage of system capacity.

**Peak Demand, kW**

The maximum demand for the compressed air system during each daytype, in kilowatts.

**Load Factor, %**

The average air compressor drive motor load divided by the nameplate full-load rating, expressed as a percentage (for each daytype and the average day).

**Annual Energy, kWh**

The compressed air system's yearly energy use, subtotaled for each daytype, in kilowatt-hours.

**Annual Energy Cost, \$**

The compressed air system's total annual cost for kilowatt-hours, subtotaled for each daytype, in dollars.

**Total Demand Cost, \$**

The compressed air system's total annual demand cost, in dollars.

**Total Cost, \$**

The compressed air system's total annual operating cost (for energy and demand), in dollars.

**Buttons**

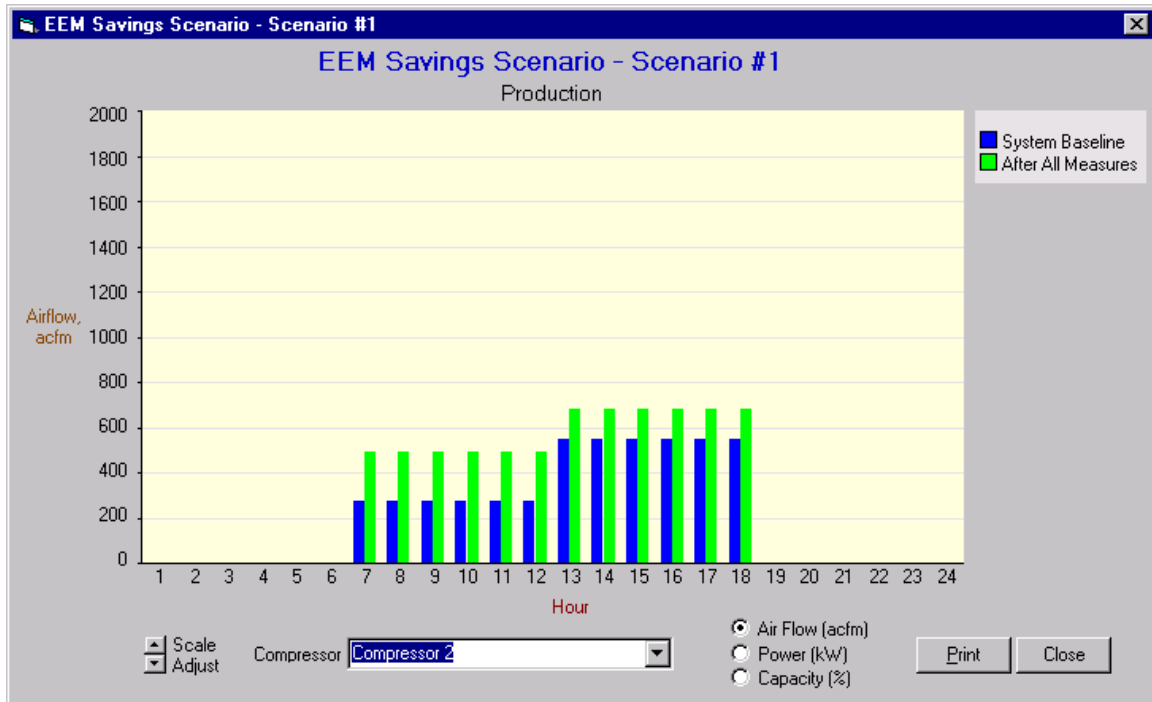
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**Copy to Clipboard**

Click to copy all information on the grid to the Windows clipboard. A dialog box informs you that the clipboard contents may be pasted into a spreadsheet program.

# EEM Savings Scenario graph

**Navigation:** *Efficiency Measures module button / Results button / Profile Summary tab / Graph button*  
or *System Enhancements menu / Efficiency Measures command / Results button / Profile Summary tab / Graph button*



*EEM Savings Scenario graph*

## Purpose

Use the EEM Savings Scenario graph to view or print hourly airflow, power, or capacity before and after the selected energy efficiency measure (EEM) or entire scenario is implemented. Depending on whether you selected “System Baseline” or a specific EEM in the Profile Summary tab of the EEM Results window, the graph will compare baseline data to the data resulting from all EEMs in the complete scenario, or compare data before and after a specific EEM is implemented. This allows you to edit an individual EEM, then view the resulting changes for the entire scenario.

## Description

The EEM Savings Scenario graph displays airflow, power, or capacity along the y-axis, and hours (24 total) along the x-axis. You can adjust the y-axis scale. The displayed graph represents the system daytype selected in the Profile Summary tab of the EEM Results window. The selected scenario, daytype, and EEM are listed in the title of the graph.

## **Procedures for Viewing or Printing an EEM Savings Scenario graph**

### **To view or print an EEM savings scenario graph**

1. In the EEM Results window, select the desired scenario and EEM.
2. Open the Profile Summary tab. Select the desired daytype.
3. Click Graph. The EEM Savings Scenario graph opens.
4. The EEM Savings Scenario graph displays hourly airflow or power profiles before and after one or all EEMs are applied. Use the Compressor field to select whether the information will represent one or all compressors in the system.
5. Click **Print** if you want to print the EEM Savings Scenario graph.
6. When you are done viewing the EEM Savings Scenario graph, click **Close** to return to the EEM Results window.

### **Field Definitions**

---

#### **Airflow, acfm —or— Power, kW —or— Capacity, %**

The measured or calculated profile data.

#### **Hour**

The hour of the selected daytype.

#### **Compressor**

The system compressors (one or all) represented in the graph.

#### **[Profile Data]**

Select the type of profile data you want the graph to display.

### **Buttons**

---

#### **Scale Adjust**

Click the arrows to increase or decrease the range of profile data amounts displayed on the vertical axis.

#### **Print**


Click to print the EEM Savings Scenario graph .

#### **Close**

Click to close the EEM Savings Scenario graph and return to the EEM Results window.

# Energy Efficiency Measure Parameters report

Navigation: *Efficiency Measures module button / Print button / Preview button*  
 or *System Enhancements menu / Efficiency Measures command / Print button / Preview button*

 <b>Energy Efficiency Measure Parameters Report</b>		AIR Master +					
For: Bruce By: Sonia		June 7, 2000 Page 1 of 2					
<b>Results</b>							
<b>Profile Summary</b> EBM Scenario : Scenario #1 EBM : System Baseline							
Daytype: Production							
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24						
<b>Compressor 1</b>							
Meas Power, kW	72.0 72.0 72.0 72.0 72.0 72.0 84.0 84.0 84.0 84.0 84.0 84.0 90.0 90.0 90.0 90.0 90.0 90.0 78.0 78.0 78.0 78.0 78.0 78.0						
Calc Airflow, acfm	190 190 190 190 190 190 380 380 380 380 380 380 475 475 475 475 475 475 285 285 285 285 285 285						
Calc % Capacity	40.0 40.0 40.0 40.0 40.0 40.0 80.0 80.0 80.0 80.0 80.0 80.0 100.0 100.0 100.0 100.0 100.0 100.0 60.0 60.0 60.0 60.0 60.0 60.0						
Cascade #	1 1						
<b>Compressor 2</b>							
Meas Power, kW	20.0 20.0 20.0 20.0 20.0 20.0 56.8 56.8 56.8 56.8 56.8 56.8 92.5 92.5 92.5 92.5 92.5 92.5 20.0 20.0 20.0 20.0 20.0 20.0						
Calc Airflow, acfm	0 0 0 0 0 0 277 277 277 277 277 277 546 546 546 546 546 546 0 0 0 0 0 0						
Calc % Capacity	0.0 0.0 0.0 0.0 0.0 0.0 33.0 33.0 33.0 33.0 33.0 33.0 65.0 65.0 65.0 65.0 65.0 65.0 0.0 0.0 0.0 0.0 0.0 0.0						
Cascade #	2 2						
Total Power, kW	92.0 92.0 92.0 92.0 92.0 92.0 140.8 140.8 140.8 140.8 140.8 140.8 182.5 182.5 182.5 182.5 182.5 182.5 98.0 98.0 98.0 98.0 98.0 98.0						
Total Airflow, acfm	190 190 190 190 190 190 857 857 857 857 857 857 1021 1021 1021 1021 1021 1021 285 285 285 285 285 285						
% System Capacity	14.4 14.4 14.4 14.4 14.4 14.4 50.0 50.0 50.0 50.0 50.0 50.0 77.6 77.6 77.6 77.6 77.6 77.6 21.7 21.7 21.7 21.7 21.7 21.7						
<b>Daytype: Weekends</b>							
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24						
<b>Compressor 1</b>							
Meas Power, kW	0.0 0.0						
Calc Airflow, acfm	0 0						
Calc % Capacity	0.0 0.0						
Cascade #	0 0						
<b>Compressor 2</b>							
Meas Power, kW	0.0 0.0 0.0 0.0 0.0 0.0 103.6 103.6 103.6 103.6 103.6 103.6 103.6 103.6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0						
Calc Airflow, acfm	0 0 0 0 0 0 630 630 630 630 630 630 630 630 0 0 0 0 0 0 0 0 0 0						
Calc % Capacity	0.0 0.0 0.0 0.0 0.0 0.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 75.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0						
Cascade #	0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0						
Total Power, kW	0.0 0.0 0.0 0.0 0.0 0.0 103.6 103.6 103.6 103.6 103.6 103.6 103.6 103.6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0						
Total Airflow, acfm	0 0 0 0 0 0 630 630 630 630 630 630 630 630 0 0 0 0 0 0 0 0 0 0						
% System Capacity	0.0 0.0 0.0 0.0 0.0 0.0 47.9 47.9 47.9 47.9 47.9 47.9 47.9 47.9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0						
<b>Totals</b>							
Daytype	Total Op Hrs	Avg Airflow, acfm	Avg Airflow, % Cs.	Peak Demand, kW	Load Factor, %	Annual Energy, kWh	Annual Energy Cost, \$
Production	8,000	538	40.9	182.5	58.9	769,905	29,256
Weekends	400	630	47.9	103.6	47.5	41,480	1,554
System Totals	8,400	581	42.7	182.5	56.0	811,355	30,811
Total Demand Cost : \$7,390 Total Operating Costs : \$38,201							

Energy Efficiency Measure Parameters report: Results

## Purpose

Use the Energy Efficiency Measure Parameters report to view or print a conservation scenario savings summary, efficiency measure parameters, or EEM or scenario results.

## Description

This report contains information from the Energy Efficiency Measures window Savings Summary tab, one or all the applicable EEM windows, or the EEM Results window. When you select the type of report in the Report Setup window, you have the option of generating a Savings Summary report, a specific EEM report, a Results report, or All EEM Parameters Reports. (All eleven report types are available from any window in the Efficiency Measures module, but the Results report content depends upon your EEM selection in the originating window.)

## Procedures for Viewing or Printing Energy Efficiency Measure Information

### To view or print EEM information

1. In any window within the Efficiency Measures module, click **Print**. The Report Setup window will open:

**Report Setup**

**Select Report**

- Savings Summary
- Reduce Air Leaks
- Improve End Use Efficiency
- Reduce System Air Pressure
- Use Unloading Controls
- Adjust Cascading Set Points
- Use Automatic Sequencer
- Reduce Run Time
- Add Primary Receiver Volume
- Results
- All EEM Parameters Reports

**Report Title Setup**

Title 1: Energy Efficiency Measure Parameters Report

Title 2: Results

Prepared For: Bruce

Prepared By: Sonia

Preview Close

2. In the Select Report section, choose which version of the report to generate. You have the option of generating a Savings Summary report, a specific EEM report, a Results report, or All EEM Parameters Reports:
  - The Savings Summary report displays information from the Energy Efficiency Measures window, Savings Summary tab, for the selected scenario.
  - The individual EEM reports (eight possible) display all information for that EEM in the selected scenario.

- The Results report displays information from the EEM Results window for the selected scenario or a specific EEM within that scenario. (If you clicked **Print** in the Energy Efficiency Measures window, this report displays System Baseline information. If you clicked **Print** in an EEM, this report displays information for that EEM. If you clicked **Print** in the EEM Results window, this report displays either System Baseline or specific EEM information, depending on what was selected in the EEM Results window.)
  - All EEM Parameters Reports displays information from the Energy Efficiency Measures window, Savings Summary tab, for the selected scenario; plus all the information for each applicable EEM in the scenario.
3. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
  4. Click **Preview** to view the report onscreen.
  5. If you want to print the report, click **Print** at the top of the onscreen report.
  6. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

## Field Definitions

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Please refer to the field definitions for the Energy Efficiency Measures window Savings Summary tab on page 146, each of the individual EEM windows (pages 148 to 186), and the field definitions for the EEM Results window on page 192.

## Buttons (on onscreen report)

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### Page

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

### [Zoom]

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

### Print

Click this button to print the Energy Efficiency Measure Parameters report.

### Close

Click this button to close the Energy Efficiency Measure Parameters onscreen report.

## Chapter 11

# Maintenance module

The Maintenance module contains maintenance records for a facility, system, or compressor. The Maintenance module includes the following windows and report:

- ◆ **Maintenance window**  
Add, edit, or view maintenance records. **p. 205**
  
- ◆ **Maintenance History window**  
Query and view previously created maintenance records. **p. 209**
  
- ◆ **Maintenance report**  
View and/or print detailed or summarized maintenance information, for the current maintenance record or all in a query list. **p. 213**



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# Maintenance window

**Navigation:** *Maintenance module button*  
*or System Enhancements menu / Maintenance command*

The screenshot shows a software window titled "Maintenance" with a menu bar (File, Calculators, Help) and a toolbar with icons for file operations and a "Query Maintenance" button. The main area contains several input fields and a text area:

- Facility: Brewing Facility
- Compressor: -All-
- System: Main Air System
- Previous Actions: Oil Leaks - 01/01/00
- System component: Safety
- Cost, \$: 0
- Action: High pressure relief valves
- Maintenance date: 01/01/2000
- Description: Oil Leaks
- Next maintenance date: 01/08/2000
- Notes: Clean up oil and check for leaks on screw compressor.

*Maintenance window*

## Purpose

Use the Maintenance window to add, edit, or view maintenance records. Maintenance records become part of the maintenance log, and can be queried and viewed later in the Maintenance History window. You can use maintenance records to track both completed and pending actions, their associated costs, and their categorization within system components.

## Description

The Maintenance window contains two main sections; the upper section allows you to select an action to view or edit, and the lower section displays the maintenance record for the selected action.

## ***Procedures for Adding, Editing, or Viewing a Maintenance Record***

### **To view or add a maintenance record**

1. Select the facility to which the maintenance record applies, using the Facility drop-down list at the top of the window.
2. If the maintenance record applies to a specific compressed air system, select the system at the top of the window. The System options will be limited by your selection of facility.
3. If the maintenance record applies to a specific air compressor, select the compressor at the top of the window. The Compressor options will be limited by your selection of system.
4. The Previous Actions drop-down list will display the action and date from each maintenance record logged for the selected facility, system, or compressor. To view a record, select from the drop-down list of actions. Maintenance record information for the selected action will be displayed in this window.
5. If the desired maintenance action record is not yet in AIRMaster<sup>+</sup>, click **Add** to create a new record. You are now in Add mode and all fields are cleared (or return to default selections).

### **To edit or enter a maintenance record**

1. You can enter maintenance record information in Add mode or Edit mode. To edit maintenance record information for the selected record, click **Edit** to enter Edit mode.
2. Once in Add mode or Edit mode, you can no longer change the Facility, System, Compressor, or Previous Actions fields at the top of the window. The rest of the fields are available for edit; note that the System Component, Action, Description, and Maintenance Date fields are required in a maintenance record.
3. In the System Component field, select the system component that best describes the general area to which the maintenance pertains.
4. In the Action field, select the action that best describes the maintenance activity. Your choices in this drop-down list will be limited by your selection of system component. If none of the choices fit, select "other."
5. Enter your own description of the maintenance action in the Description field.
6. If you want to enter the cost of the maintenance action, enter it in the Cost field. The default value is \$0.
7. In the Maintenance Date field, enter the date that the maintenance action was completed. (There is a default date.)
8. If you want to enter the next scheduled date for the maintenance action, enter it in the Next Maintenance Date field. This information can be used later in the Maintenance History window to query for maintenance actions that are due in a certain time frame.
9. If you want to enter additional information about the maintenance action, use the Notes field. This field may be used to display the dates on which frequently recurring inspections or actions were, or should be, taken.

10. When you have finished entering or editing maintenance record information, click **Save** to save the displayed record (or **Cancel** to cancel your edits). Click **Close** to close the Maintenance window.

## Field Definitions

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### Facility

The name of the facility, or site, where the maintenance occurs. Select from the drop-down list.

### System

The name of the compressed air system where the maintenance occurs. Select from the drop-down list of systems available in the selected facility.

### Compressor

The name of the air compressor where the maintenance occurs. Select from the drop-down list of compressors assigned to the selected facility.

### Previous Actions

The action and date from each of the maintenance records logged for the selected facility, system, or compressor. Select from the drop-down list of actions.

### System Component

The general area to which the maintenance pertains, such as controls. The default system component is “compressor.”

### Action

The title of the maintenance work. The drop-down list of options depends upon the System Component selected. (Required field.) If you select the Action “other,” you can describe the action in the next field.

### Description

The user-assigned name of the maintenance action. (Required field.)

### Cost, \$

The cost of the maintenance action, in dollars. The default value is zero.

### Maintenance Date

The date that the maintenance action was completed. There is a default date.

### Next Maintenance Date

The date that the maintenance action will be due next. You can later create lists of pending or overdue maintenance actions by querying for a certain “next maintenance date” range in the Maintenance History window.

### Notes

Additional information about the maintenance action. For maintenance activities with frequent recurrence intervals, this field can be used to display the dates on which inspections or actions were taken.

## **Buttons**

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### **Add**

Click to enter Add mode, and create a new maintenance record in cleared fields.

### **Edit**

Click to enter Edit mode to make changes to the currently displayed maintenance record.

### **Save**

Once in Edit mode, click to save the maintenance record information displayed.

### **Delete**

Click to delete the currently displayed maintenance record.

### **Print**

Click to open the Report Setup window, to view or print the Maintenance report. This button is disabled if no maintenance actions are defined at the facility level (and System is “All”), or if none are defined at the System level (and Compressor is “All”).

### **Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Maintenance window Help topic, which provides context-sensitive Help for this window.

### **Query Maintenance**

Click to open the Maintenance History window, which allows you to query previously created maintenance records.

### **[Browse Buttons]**

Click to select the previous or next record in the Maintenance History query list. (These buttons are only available if you clicked **Select** to access the Maintenance window from the Maintenance History window.)

### **Close/Cancel**

Click to close the Maintenance window, or cancel Edit/Add mode and reverse edits to displayed data.

# Maintenance History window

**Navigation:** *Maintenance module button / Query Maintenance button*  
or *System Enhancements menu / Maintenance command / Query Maintenance button*

Date	Description	Action	System Component	Costs, \$	Next Date
01/01/00	Oil Leaks	High pressure relief valves	Safety	0	01/08/00
01/01/00	Change Compressor Lubrican	Compressor oil, filters, separators	Compressor	200	07/01/00
04/01/00	Check Unloader Valves	Reciprocating compressor valves	Compressor	0	09/29/00
TOTAL				200	

*Maintenance History window*

## Purpose

Use the Maintenance History window to query and view previously created maintenance records for a facility, compressed air system, or air compressor. You can select a maintenance record from the list of query results and view or edit record details in the Maintenance window.

## Description

The Maintenance History window contains two main sections; the upper section displays the criteria for your search, and the lower section lists the maintenance records that meet that criteria. This window allows you to access the Maintenance window to view or edit details for a record in your search results.

## ***Procedures for Searching Maintenance Records***

### **To search maintenance records**

1. In the fields above the grid, you will select criteria that limit the query. All these fields default to create the most comprehensive search possible.
2. If you want to limit the search to a single compressed air system, select a system. Your options in the System field are limited to those in the selected facility.
3. If you want to limit the search to a single air compressor, select a compressor. Your options in the Compressor field are limited to those in the selected system.
4. If you want to limit the search to a specific maintenance system component, select a system component (accessories, air distribution system, air compressor, controls, end uses, or safety).
5. If you want to limit the search to a specific action, select an action. Your options in the Action field are limited by your selection in the System Component field. If you select the action "Other," the search results list will include the unique descriptions entered in the Maintenance window.
6. If you want to limit the search to maintenance actions completed during a specific time period, use the spin boxes to select From and To dates in the Maintenance Date fields.
7. If you want to query for a list of pending maintenance actions that are due or will be due, use the spin boxes to select From and To dates in the Next Maintenance Date fields.
8. When you have finished selecting search criteria, click **Search**. A list of maintenance actions that match the selected criteria are displayed in the bottom half of the window. (Although the query is run every time a search criterion is edited, **Search** refreshes the query.)
9. If you would like to run another query, you can either edit the displayed search criteria (optionally clicking **Search** again), or click **Clear** to clear all search criteria fields before making new selections (and clicking **Search**).
10. If you want to view or edit a more detailed presentation of a maintenance record from the list of search results, select that record (click on that row in the search results grid) and click **Select**. The Maintenance window opens, displaying information for the selection.
11. When you have finished running queries, click **Cancel** to close the Maintenance History window and return to the Maintenance window.

### **Field Definitions**

---

#### ***Search Criteria***

##### **Facility**

The name of the facility, or site, where the maintenance occurs. Select from the drop-down list.

**System**

The name of the compressed air system where the maintenance occurs. Select from the drop-down list of systems available in the selected facility.

**Compressor**

The name of the air compressor where the maintenance occurs. Select from the drop-down list of compressors assigned to the selected facility.

**System Component**

The general area to which the maintenance pertains, such as controls.

**Action**

The title of the maintenance work. The drop-down list of options depends upon the System Component selected. If you select the Action "other," the Search Results list will include the unique descriptions entered in the Maintenance window.

**Maintenance Date**

The range of dates during which the maintenance action was done. Select dates using the "From" and "To" date spin boxes. This field is optional; if no date is entered, the query will find all dates.

**Next Maintenance Date**

The range of dates during which the same maintenance action is next due. Select dates using the "From" and "To" date spin boxes. You can use this field to query for a list of maintenance actions that need to be done. This field is optional; if no date is entered, the query will find all dates.

***Search Results Grid*****Date**

The date that each maintenance action was done.

**Description**

The user-assigned name of each maintenance action.

**Action**

The title of each piece of maintenance work.

**System Component**

The general area to which each maintenance pertains, such as controls.

**Cost, \$**

The cost of each maintenance action, in dollars (and the total cost of all maintenance actions).

**Next Date**

The date that each maintenance action is next due.

**Buttons**

---

**Search**

Click to run a query based on the entries in the Search Criteria fields.

**Select**

Click to open the Maintenance window to view or edit record details for the record selected in the Search Results list of the Maintenance History window.

**Clear**

Click to clear all the fields in the window (most of the Search Criteria fields return to a default selection).

**Print**

Click to open the Report Setup window, to view or print the Maintenance report.

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Maintenance History window Help topic, which provides context-sensitive Help for this window.

**Cancel**

Click to close the Maintenance History window and return to the Maintenance window.





## Purpose

Use the Maintenance report to view or print detailed or summarized maintenance information for the current maintenance record or all in a query list. The query list may contain maintenance records for a selected facility, system, compressor; or maintenance actions completed or due within a specified time frame.

## Description

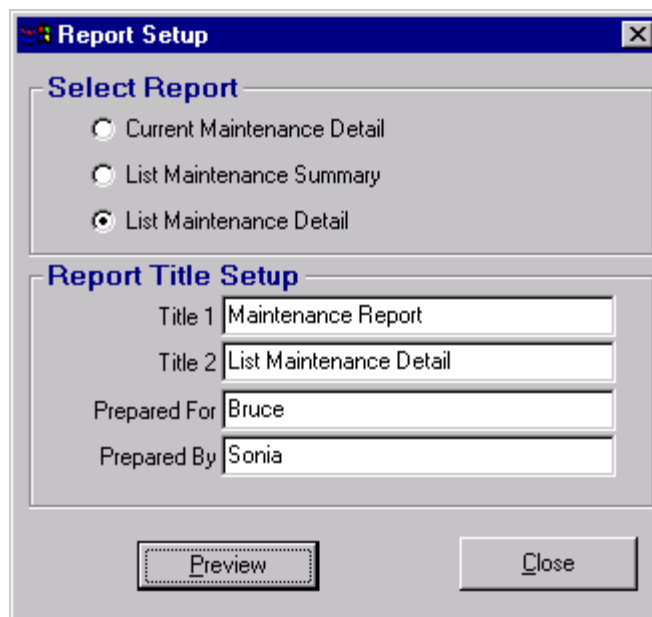
This report contains information queried in the Maintenance History window, and information entered in the Maintenance window. When you select the type of report in the Report Setup window, you have the option of generating the following reports:

- The Current Maintenance Detail report (accessible from the Maintenance and Maintenance History windows) displays all information for the record selected in the Maintenance History window or Maintenance window.
- The List Maintenance Summary report (accessible from the Maintenance History window only) displays all information for each record in the query results list in the Maintenance History window.
- The List Maintenance Detail report (accessible from the Maintenance History window only) displays search criteria and search results information for each record in the query results list in the Maintenance History window.

## ***Procedures for Viewing or Printing Maintenance Information***

### **To view or print maintenance information**

1. In the Maintenance window or Maintenance History window, click **Print**. Note that **Print** in the Maintenance window is disabled if no maintenance actions are defined at the facility level (System is “All”), or if none are defined at the System level (Compressor is “All”). The Report Setup window will open:



The screenshot shows a 'Report Setup' dialog box. It has a title bar with the text 'Report Setup' and a close button (X). The dialog is divided into two main sections. The first section, 'Select Report', contains three radio buttons: 'Current Maintenance Detail' (unselected), 'List Maintenance Summary' (unselected), and 'List Maintenance Detail' (selected). The second section, 'Report Title Setup', contains four text input fields: 'Title 1' with the value 'Maintenance Report', 'Title 2' with the value 'List Maintenance Detail', 'Prepared For' with the value 'Bruce', and 'Prepared By' with the value 'Sonia'. At the bottom of the dialog, there are two buttons: 'Preview' and 'Close'.

2. In the Select Report section, choose which version of the report to generate. You can generate a Current Maintenance Detail report, a List Maintenance Summary report, or a List Maintenance Detail report:
  - The Current Maintenance Detail report (accessible from the Maintenance and Maintenance History windows) displays all information for the record selected in the Maintenance window or Maintenance History window.
  - The List Maintenance Summary report (accessible from the Maintenance and Maintenance History windows) displays all information for each record in the query results list in the Maintenance History window.
  - The List Maintenance Detail report (accessible from the Maintenance History window only) displays summarized information for each record in the query results list in the Maintenance History window.
3. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
4. Click **Preview** to view the report onscreen.
5. If you want to print the report, click **Print** at the top of the onscreen report.
6. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

## Field Definitions

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Please refer to the field definitions for the Maintenance window following page 205 and the Maintenance History window following page 209.

## Buttons (on onscreen report)

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### Page

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

### [Zoom]

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

### Print

Click this button to print the Maintenance report.

### Close

Click this button to close the Maintenance onscreen report.

## Chapter 12

# Catalog module

The Catalog module contains information about *generic* or sample compressors. You can copy catalog compressors to inventory. You may want to add in-plant inventory compressors to the catalog module if you'll need to add them to the compressor module several times. The Catalog module includes the following windows and report:

- ◆ **Compressor Catalog window**  
Search for air compressors in the catalog that meet specified criteria. **p. 217**
  
- ◆ **Compressor Catalog Detail window**  
Add, edit, or view detailed information about an air compressor (usually generic) in the catalog. **p. 222**
  
- ◆ **Catalog report**  
View and/or print detailed or summarized information for the selected compressor or all in a query list. **p. 234**

# Compressor Catalog window

**Navigation:** *Catalog module button*  
or *System Enhancements menu / Catalog command*

The screenshot shows the 'Compressor Catalog' window. At the top, there are buttons for 'Search', 'Clear', 'Add Copy', and 'Click Search to update list'. Below these are search criteria fields: 'Compressor type', 'Control type', and 'Manufacturer', all set to '-All-'. There are also fields for 'Horsepower rating' (set to '-All-'), 'Desired capacity, acfm' (with a +/- % field), and 'Desired full load pressure, psig' (with a +/- % field). A 'User-created only' checkbox is present. Below the search criteria is a 'Click Search to update list...' button and a 'Compressor Details' button. The main area contains a table with the following columns: 'Compressor Type', 'Manufacturer', 'Model', 'Horsepower Rating', and 'Control Type'. The table is currently empty.

Compressor Type	Manufacturer	Model	Horsepower Rating	Control Type

*Compressor Catalog window*

## Purpose

The Compressor Catalog window allows you to search for sample compressors in the AIRMaster<sup>+</sup> catalog database that meet certain performance specifications, and add a copy of a catalog compressor to the catalog. The catalog compressors can be sorted and listed by compressor type, manufacturer, control type, horsepower rating, capacity, or full load pressure.

**Note** AIRMaster<sup>+</sup> contains two compressor databases: the catalog database (data describing generic or sample compressors), and the inventory database (data describing in-service and spare compressors). The Catalog module contains information regarding generic compressors, and any inventory compressors you've added to the catalog. The generic compressors in the catalog include typical performance information for multi-stage lubricant-injected rotary screw and reciprocating compressors in the 5hp to 600hp range, plus lubricant-free compressors and a centrifugal compressor. For information about inventory compressors, see the Compressor module.

## Description

The Compressor Catalog window contains two main sections; the upper section displays the criteria for your search, and the lower section lists the catalog air compressors that meet that criteria. This window also allows you access to details about a specific compressor in your search results, in the Compressor Catalog Detail window.

## ***Procedures for Searching or Adding Catalog Air Compressors***

### **To search catalog air compressors**

1. In the Search Criteria section, you will select criteria that limit the query. None of the search criteria must be defined in order to run a query; note that the default for most of the search criteria fields is the most comprehensive search possible. If you want to limit the search to a single type of air compressor, select a compressor type. Otherwise, the field's default selection is "All."
2. If you want to limit the search to compressors with a specific control type, select a control type. Otherwise, the field's default selection is "All." The drop-down list of control types is determined by the selection of compressor type.
3. If you want to limit the search to compressors made by a single manufacturer, select a manufacturer.
4. If you want to limit the search to compressors with a specific horsepower rating, select a horsepower rating. Otherwise, the field's default selection is "All."
5. If you want to limit the search to compressors with capacities in a defined range, enter the desired capacity and allowable percentage variance.
6. If you want to limit the search to compressors with full load pressures within a defined range, enter the desired full load pressure and allowable percentage variance.
7. If you want to limit the search to air compressors that were added to the catalog from inventory, mark the User-Created Only box.
8. When you have finished selecting or entering search criteria, click **Search** to run a query that updates the list of search results. A list of catalog compressors that match the search criteria are displayed in the bottom half of the window.
9. If you would like to run another query, you may click **Clear** to clear the Search Criteria. Edit the Search Criteria, then click **Search** again. Remember that edited Search Criteria fields will not cause the Search Results list to be updated until you click **Search**; until then, there will be a note at the top of the window, "Click Search to update list."
10. If you want to view or edit a more detailed presentation of a catalog compressor from the Search Results list, select that compressor and click **Manufacturer Compressor Details**. The Compressor Catalog Detail window opens, displaying information for the selection.

11. When you have finished running queries, click **Close** to close the Compressor Catalog window.

### **To add a catalog air compressor**

1. There are two ways to enter an air compressor into the catalog: add a copy of a catalog compressor (which you can edit), or use the Compressor Inventory window to copy an inventory compressor to the catalog. Procedures for the latter are on page 86.
2. In the Catalog window, choose a compressor that best matches the one being added. Match compressor type, control type, and horsepower rating as close as possible. Manufacturer can be left as "All." Leave desired capacity and full load discharge pressure blank. After choosing appropriate search criteria, click **Search**.
3. Highlight the compressor that most closely matches the rated pressure of the compressor to be added and click **Add Copy** to display the Compressor Catalog Details screen.
4. Review the information in the General Data tab. Maximum full flow operating pressure must be equal or greater than full load operating pressure. All fields are required except total and specific package power data, however these are convenient for efficiency comparison among other compressors.
5. Select the Drive Motor tab, review the information and change as necessary. Required fields include: motor rating, full load amps, power factor, efficiency, voltage rating, wired-for voltage, and service factor.
6. Select the Fan Motor tab, review the information and change as necessary. Required fields include: motor rating, full load amps, power factor, efficiency, voltage rating, wired-for voltage, and service factor.
7. Select the Other Data tab, review the information and change as necessary. (Unless specified "N/A", all fields are required.) Many times data is not readily available for a specific manufacturer's compressor. AIRMaster+ defaults should be used for unavailable data. Other data, such as the "proportional modulating pressure range" (PMPR) and "fully modulated power (theoretical), % of full-load power" (%Pfm) may have to be calculated based on provided information. See the glossary for calculations for these two terms.
8. Click **Save** and the new compressor will be added to the catalog.

## **Field Definitions**

---

### ***Search Criteria***

#### **Compressor Type**

The type of air compressor, such as single stage lubricant-injected rotary screw.

#### **Manufacturer**

The name of the air compressor manufacturer.

#### **Control Type**

The type of control for the air compressor, such as load/unload. The list of available control types is limited by the selection of compressor type.

#### **Horsepower Rating**

The manufacturer's suggested drive motor requirement for the air compressor. The drop-down list offers hp ratings from 1-3500.

**Desired Capacity, acfm ±%**

The desired capacity of the air compressor, in actual cubic feet per minute, with an allowable variance as a percentage.

**Desired Full Load Pressure, psig ±%**

The desired discharge pressure, in pounds per square inch gauge, with an allowable variance as a percentage.

**User-created Only**

Mark this box to limit the query to air compressors that were added to the catalog from inventory.

***Search Results*****Compressor Type**

The type of air compressor, such as single stage lubricant-injected rotary screw.

**Manufacturer**

The name of the air compressor manufacturer.

**Model**

The description of the catalog air compressor (or the model if it's an inventory air compressor).

**Horsepower Rating**

The manufacturer's suggested drive motor requirement for the air compressor.

**Control Type**

The type of control for the air compressor, such as load/unload.

**Rated Capacity, acfm**

The maximum operating airflow delivered by the air compressor at full load operating pressure, in actual cubic feet per minute.

**Full Load Pressure, psig**

The rated discharge pressure, in pounds per square inch gauge.

**Max. Pressure, psig**

The maximum pressure attainable at full flow (measured in pounds per square inch gauge); usually the unload pressure setting for load/unload control or the maximum pressure attainable before capacity control begins. May require additional power.

**Buttons**

---

**Search**

Click to run a query based on the displayed search criteria.

**Select**

This button only appears when the Compressor Catalog window is accessed from the Compressor Inventory window to add a catalog compressor to inventory. Click to add the selected compressor to inventory.

**Clear**

Click to clear the Search Criteria fields for a new search (most of the search criteria fields return to a default selection).



**Add Copy**

Click to add a copy of the selected catalog compressor to the catalog. The Compressor Catalog Detail window opens. This copy can be edited or deleted.

**Print**

Click to open the Report Setup window, to view or print the Catalog report (detailed or summarized information for the selected compressor or all in a query list).

**Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Compressor Catalog window Help topic, which provides context-sensitive Help for this window.

**Close**

Click to close the Compressor Catalog window.

**Compressor Details**

Click to view details for the catalog air compressor that is selected in the Search Results list. The Compressor Catalog Detail window opens.

# Compressor Catalog Detail window

**Navigation:** *Catalog module button / Compressor Details button*  
or *System Enhancements menu / Catalog command / Compressor Details button*

The screenshot shows a software window titled "Compressor Catalog Detail" with a menu bar (File, Calculators, Help) and a toolbar (Add Copy, navigation arrows, Close). The window has four tabs: "General Data" (selected), "Drive Motor", "Fan Motor", and "Other Data". The "General Data" tab contains the following fields:

Compressor type	Single stage lubricant-injected rotary screw	Full load shaft power, BHP	5.3
Manufacturer	<Generic>	Rated capacity @ full load operating pressure, acfm	18
Model	5 hp	Full load operating pressure, psig	100.0
Control type	Inlet modulation without unloading	Max. full flow operating pressure, psig	110.0
Horsepower rating	5	Total package power input at rated conditions, kW	4.6
<input type="checkbox"/> User created		Specific package power input at rated conditions, kW/100 acfm	25.9

*Compressor Catalog Detail window: General Data tab*

## Purpose

The Compressor Catalog Detail window allows you to add, edit, or view detailed information about the catalog air compressor(s) selected in the Compressor Catalog window. Use this window to view details about generic or sample compressors, or to add a generic or inventory compressor to the catalog database. It is useful to add or copy an inventory compressor into the catalog database if that compressor is duplicated in inventory; once a compressor is in the catalog database, you can easily copy it into inventory any number of times.

**Note** The generic compressors originally included in the catalog database cannot be edited or deleted, but *copies* can be. Compressors added to the AIRMaster<sup>+</sup> catalog by the user *can* be edited or deleted.

## Description

The Compressor Catalog Detail window has four tabs:

- the General Data tab, which displays detailed specifications for the air compressor

- the Drive Motor tab, which displays specifications for the air compressor's drive motor
- the Fan Motor tab, which displays specifications for the air compressor's fan motor
- the Other Data tab, which displays part load details and any applicable centrifugal specifics for the air compressor

## ***Procedures for Viewing, Editing, or Adding Catalog Compressor Details***

### **To view catalog compressor details**

1. Select the compressor of interest in the Search Results section of the Compressor Catalog window and click **Compressor Details** to open the Compressor Catalog Detail window.
2. The fields in all four tabs of the Compressor Catalog Detail window display information for the compressor selected in the Compressor Catalog window.

### **To edit catalog compressor details**

1. Make sure the displayed compressor details are for the compressor of interest (see procedures above, "To view catalog compressor details"). Note that the generic compressors included in the *original* catalog database cannot be edited, but copies can be.
2. To edit fields in the Compressor Catalog Detail window, you must be in Add mode (see next set of procedures, "To add a catalog compressor") or Edit mode (continue to step #3).
3. Click **Edit** to enter Edit mode. You can edit every field in all four tabs, except User Created in the General Data tab. See the field definitions for the fields in each tab, and note that some fields in the Other Data tab will not be applicable for certain compressor types or control types. If you are entering an actual inventory compressor, note that drive motor and fan motor performance values are usually stamped on the motor's nameplate.
4. When you have finished editing the fields in each tab, click **Save** to save the compressor information in all four tabs of the Compressor Catalog Detail window.
5. Click **Close** to close the Compressor Catalog Detail window and return to the Compressor Catalog window.

### **To add a catalog compressor**

See the procedures for adding catalog compressors on page 219.

## **Buttons**

---

### **Edit**

Click to enter Edit mode to make changes to the catalog compressor details displayed in all four tabs.

### **Save**

Once in Edit mode, click to save the catalog compressor information in all four tabs.

### **Delete**

Click to delete the currently displayed catalog compressor details from all four tabs.

### **Print**

Click to open the Report Setup window, to view or print the Catalog report (detailed or summarized information for the selected compressor or all in a query list).

### **Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Compressor Catalog Detail window Help topic, which provides context-sensitive Help for this window.

### **Add Copy**

Click to add a copy of the selected catalog compressor to the catalog. This copy can be edited or deleted.

### **[Browse Buttons]**

Click to browse backward or forward through the Search Results compressors in the Compressor Catalog window. The tabs in this window will display detailed information for the compressor selected in the Compressor Catalog window.

### **Close/Cancel**

Click to close the Compressor Catalog Detail window, and return to the Compressor Catalog window; or to cancel Edit/Add mode and reverse edits to the displayed data in all four tabs.

## General Data tab

Use the General Data tab to add, edit, or view detailed specifications about the selected catalog air compressor, including the type of air compressor, rated capacity, operating pressure, and specific package power input. See illustration of General Data tab on page 222.

**Procedures** Please see page 223.

### Field Definitions

---

#### **Compressor Type**

The type of air compressor, such as single stage lubricant-injected rotary screw.

#### **Manufacturer**

The name of the air compressor manufacturer.

#### **Model**

The description of the catalog air compressor, or the model if it's an inventory compressor.

#### **Control Type**

The type of control for the air compressor, such as load/unload.

#### **Horsepower Rating**

The manufacturer's suggested drive motor requirement for the air compressor. The drop-down list offers hp ratings from 1-3500.

#### **User Created**

This box is automatically marked if the compressor was entered into the catalog database, or copied from inventory to catalog, by the user. This field is display only.

#### **Full-Load Shaft Power, BHP**

The power requirements at the air compressor shaft when operating at full speed with a fully open inlet and discharge delivering maximum airflow (measured in brake horsepower).

#### **Rated Capacity @ Full-Load Operating Pressure, acfm**

The maximum operating airflow at inlet conditions, measured at the discharge terminal point of the air compressor package, in actual cubic feet per minute. For rotary screw air compressors, measured in accordance with CAGI/PNEUROP/PNZCPTCZ Test Code.

#### **Full-Load Operating Pressure, psig**

The operating pressure at which rated capacity is measured, in pounds per square inch gauge.

#### **Max. Full-Flow Operating Pressure, psig**

The maximum pressure attainable at full flow (measured in pounds per square inch gauge); usually the unload pressure setting for load/unload control or the maximum pressure attainable before capacity control begins. May require additional power.

**Total Package Power Input at Rated Conditions, kW**

The total electrical power (in kilowatts) input to an air compressor under rated conditions, including drive motor, cooling fan, auxiliary motors, and controls.

**Specific Package Power Input at Rated Conditions, kW/100 acfm**

A measure of air compressor efficiency in the form of power required to deliver a fixed airflow at rated capacity and full-load operating pressure (expressed as kilowatts per 100 actual cubic feet per minute).

## Drive Motor tab

**Navigation:** *Catalog module button / Detail button / Drive Motor tab*  
*or System Enhancements menu / Catalog command / Detail button / Drive Motor tab*

The screenshot shows a software window titled "Compressor Catalog Detail" with a menu bar (File, Calculators, Help) and a toolbar (New, Edit, Save, Delete, Print, Help, Add Copy, Navigation, Close). The "Drive Motor" tab is selected, showing fields for Manufacturer, Model, Serial #, Frame size, Motor type, Motor rating (5 hp), Synchronous speed (1800 rpm), Enclosure type, Voltage rating (230/460), Wired-for voltage (460), Service factor (1.15), Insulation class, and a Rewound checkbox. A "Full Load" section contains Amps (7.5), Speed (1740 rpm), Power factor (82.0%), and Efficiency (85.0%).

*Compressor Catalog Detail window: Drive Motor tab*

Use the Drive Motor tab to add, edit, or view detailed specifications about the drive motor for the selected catalog compressor. There is a separate section of the tab for Full Load specifications.

**Procedures** Please see page 223.

### Field Definitions

---

#### **Manufacturer**

The name of the drive motor manufacturer.

#### **Model**

The model of the air compressor's drive motor.

#### **Serial #**

The serial number of the air compressor's drive motor.

**Frame Size**

The frame size for the drive motor.

**Motor Type**

The type of drive motor, such as NEMA Design B.

**Motor Rating, hp**

The horsepower rating of the air compressor's drive motor. The drop-down list offers hp ratings from 1-3500.

**Synchronous Speed, rpm**

The motor's synchronous or no-load speed, in revolutions per minute. The drop-down list offers these options: 900, 1200, 1800, or 3600 rpm.

**Enclosure Type**

The type of enclosure for the drive motor. The drop-down list offers these options: open dripproof (ODP), totally enclosed fan-cooled (TEFC), totally enclosed non-ventilated (TENV), or totally enclosed blower-cooled (TEBC).

**Voltage Rating**

The voltage rating of the drive motor. The drop-down list offers several options.

**Wired-For Voltage**

The actual motor operating voltage.

**Service Factor**

The service factor of the drive motor, for example 1.15.

**Insulation Class**

The insulation class for the motor's windings. The drop-down list offers B, F, or H.

**Rewound**

Mark this box if the drive motor has previously been rewound.

***Full Load*****Amps**

The required current for the drive motor at full load, measured in amperes.

**Speed, rpm**

The rotational speed of the drive motor at full load, in revolutions per minute.

**Power Factor, %**

The power factor of the drive motor at full load, expressed as a percentage.

**Efficiency, %**

The efficiency of the drive motor at full load, expressed as a percentage.



## Fan Motor tab

**Navigation:** *Catalog module button / Detail button / Fan Motor tab*  
*or System Enhancements menu / Catalog command / Detail button / Fan Motor tab*

The screenshot shows a software window titled "Compressor Catalog Detail" with a menu bar (File, Calculators, Help) and a toolbar (File, Edit, Print, Add Copy, Navigation, Close). The window is divided into four tabs: "General Data", "Drive Motor", "Fan Motor" (selected), and "Other Data". The "Fan Motor" tab contains several input fields and a "Full Load" section. The "Full Load" section includes a "Clear" button and fields for Amps, Speed, rpm, Power factor, %, and Efficiency, %. Other fields include Manufacturer (dropdown), Model, Serial #, Frame size, Motor type (dropdown), Voltage rating (dropdown), Motor rating, hp (dropdown), Wired-for voltage (dropdown), Synchronous speed, rpm (dropdown), Service factor, Enclosure type (dropdown), Insulation class (dropdown), and a Rewound checkbox.

*Compressor Catalog Detail window: Fan Motor tab*

Use the Fan Motor tab to add, edit, or view detailed specifications about the fan motor for the selected catalog compressor. There is a separate section of the tab for Full Load specifications.

**Procedures** Please see page 223.

### Field Definitions

---

**Manufacturer**

The name of the fan motor manufacturer.

**Model**

The model of the air compressor's fan motor.

**Serial #**

The serial number of the air compressor's fan motor.

**Frame Size**

The frame size for the fan motor.

**Motor Type**

The type of fan motor, such as NEMA Design B.

**Motor Rating, hp**

The horsepower rating of the air compressor's fan motor. The drop-down list offers hp ratings from 1-3500.

**Synchronous Speed, rpm**

The motor's synchronous or no-load speed, in revolutions per minute. The drop-down list offers these options: 900, 1200, 1800, or 3600 rpm.

**Enclosure Type**

The type of enclosure for the fan motor. The drop-down list offers these options: open dripproof (ODP), totally enclosed fan-cooled (TEFC), totally enclosed non-ventilated (TENV), or totally enclosed blower-cooled (TEBC).

**Voltage Rating**

The voltage rating of the fan motor. The drop-down list offers several options.

**Wired-For Voltage**

The actual motor operating voltage.

**Service Factor**

The service factor of the fan motor, for example 1.15.

**Insulation Class**

The insulation class for the motor's windings. The drop-down list offers B, F, or H.

**Rewound**

Mark this box if the fan motor has previously been rewound.

***Full Load*****Amps**

The required current for the fan motor at full load, measured in amperes.

**Speed, rpm**

The rotational speed of the fan motor at full load, in revolutions per minute.

**Power Factor, %**

The power factor of the fan motor at full load, expressed as a percentage.

**Efficiency, %**

The efficiency of the fan motor at full load, expressed as a percentage.

**Buttons**

---

**Clear**

Click to remove all entries from the Fan Motor tab.

## Other Data tab

**Navigation:** *Catalog module button / Detail button / Other Data tab*  
*or System Enhancements menu / Catalog command / Detail button / Other Data tab*

*Compressor Catalog Detail window: Other Data tab*

Use the Other Data tab to add, edit, or view part load details and any applicable centrifugal specifics for the selected catalog air compressor. This window contains two sections: Part Load Details are on the left, and Centrifugal Specifics are on the right.

**Procedures** Please see page 223.

### Field Definitions

---

#### *Part Load Details*

##### **Proportional Modulating Pressure Range, psi**

The difference between the full-load and no-load discharge pressures (in pounds per square inch), if the air compressor has modulation controls.

### **# Unload Steps**

The number of discrete points at which the compressor can operate; for example, a load/unload rotary screw compressor has two unload steps, and a multi-step reciprocating compressor may have three or five.

### **Minimum Unloaded Sump Pressure, psig**

The minimum achievable sump pressure upon unloading (in pounds per square inch gauge), if it is a lubricant injected rotary screw air compressor. (It may take from 15 seconds to two minutes to complete blowdown depending upon orifice size and sump volume.)

### **Blowdown Time, seconds**

The number of seconds required for a compressor to completely unload or to reach its fully unloaded power, or the number of seconds required for the sump pressure to decrease from the cut-out (unloading) pressure to the minimum unloaded sump pressure. Only applicable to lubricant-injected rotary screw compressors with load/unload controls.

### **Unload Point, % of Compressor Capacity**

The airflow at which the air compressor unloads, expressed as a percentage of air compressor rated full-flow capacity.

### **Fully Modulated Power (Theoretical), % of Full-Load Power**

The power draw when the air compressor is fully modulated and delivering no air (expressed as a percentage of full-load power), if it is a lubricant injected air compressor with modulation controls.

### **Fully Unloaded Power, % of Full-Load Power**

The power required when the lubricant-injected rotary screw air compressor is unloaded and completely blown down, expressed as a percentage of the full-load power.

## ***Centrifugal Specifics***

### **Design Inlet Temp, °F**

The inlet temperature for which the air compressor is designed, in degrees Fahrenheit.

### **Design Inlet Pressure, psia**

The inlet pressure for which the air compressor is designed (in pounds per square inch absolute), which is also the design pressure under which the air compressor is rated.

### **Surge Airflow @ Design Conditions, acfm**

The airflow below which air compressor operation is unstable at design conditions, measured in actual cubic feet per minute.

### **Max. Full-Load (Surge) Pressure, psig**

The maximum achievable pressure above which air compressor operation becomes unstable at design conditions, in pounds per square inch gauge.

### **Capacity @ Max. Full-Load Pressure, acfm**

The airflow at the maximum full-load (surge) discharge pressure, in actual cubic feet per minute.

**Min. Full-Load (Stonewall) Pressure, psig**

The minimum pressure below which airflow is choked, in pounds per square inch gauge. (Decreasing pressure further will result in no increase in airflow, at design conditions.)

**Capacity @ Min. Full-Load Pressure, acfm**

The airflow at the minimum full-load (stonewall) discharge pressure, in actual cubic feet per minute.

# Catalog report

**Navigation:** *Catalog module button / Print button / Preview button*  
 or *System Enhancements menu / Catalog command / Print button /*  
*Preview button*

Catalog Report		AIRMaster+
Current Compressor Catalog Detail		May 31, 2000
For: Bruce By: Sonia		Page 1 of 1
<b>General Data</b>		
Compressor type : Single stage lubricant-injected rotary screw	Full load shaft power, BHP :	5.3
Manufacturer : Generic	Rated capacity,* acfm :	18
Model : 5 hp	Full load operating pressure, psig :	100.0
Control type : Inlet modulation without unloading	Max. full flow operating pressure, psig :	110.0
Horsepower Rating : 5	Total package power input,** kW :	4.6
	Specific package power input,** kW/100 acfm :	25.9
	* - at full load operating pressure. ** - at rated conditions.	
<b>Drive Motor</b>		
Manufacturer :	Amps* :	7.5
Model :	Full load speed,* rpm :	1740
Serial # :	Power factor,* % :	82
Frame size :	Efficiency,* % :	85
Motor type :	Voltage rating :	230/460
Motor rating, hp : 5	Wired-for voltage :	460
Synchronous speed, rpm : 1800	Service factor :	1.15
Enclosure type :	Insulation class :	
Rebuild : No	* - at full load operating conditions.	
<b>Fan Motor</b>		
Manufacturer :	Amps* :	0
Model :	Full load speed,* rpm :	0
Serial # :	Power factor,* % :	0
Frame size :	Efficiency,* % :	0
Motor type :	Voltage rating :	
Motor rating, hp : 0	Wired-for voltage :	0
Synchronous speed, rpm : 0	Service factor :	0
Enclosure type :	Insulation class :	
Rebuild : No	* - at full load operating conditions.	
<b>Other Data</b>		
<b>Part Load Details</b>		<b>Centrifugal Specifics</b>
Proportional modulating pressure range, psi : 5.0	# unload steps : 2	Design inlet temp., °F : 68
Minimum unloaded sump pressure, psig : 15.0	Blowdown time, sec. : 40	Design inlet pressure, psia : 14.5
Unload point, % of comp. capacity : 50	Fully modulated power (theoretical), % of full load power : 65.0	Surge airflow @ design conditions, acfm : N/A
Fully unloaded power, % of full load power : 50.0		Max. full load (surge) pressure, psig : N/A
		Capacity @ max. full load pressure, acfm : N/A
		Min. full load (stonewall) pressure, psig : N/A
		Capacity @ min. full load pressure, acfm : N/A

Catalog report: Current Compressor Catalog Detail

## Purpose

Use the Catalog report to view or print detailed or summarized information for the selected catalog compressor or all catalog compressors in a query list.

## Description

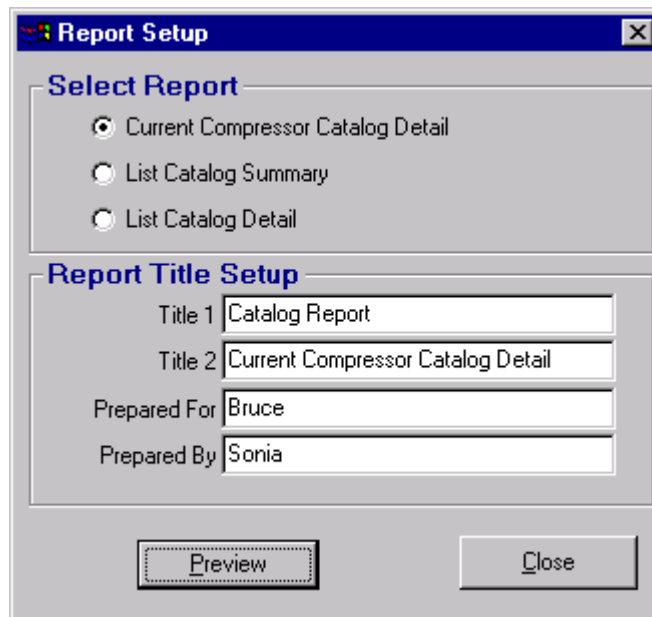
The Catalog report contains information about compressors queried in the Compressor Catalog window, or information from the Compressor Catalog Detail window.

When you select the type of report in the Report Setup window, you have the option of generating a Current Compressor Catalog Detail report, List Catalog Summary report, or a List Catalog Detail report. The Detail reports list information from the fields in the Compressor Catalog Detail window, and the Summary report lists information from the fields in the Compressor Catalog window.

## Procedures for Viewing or Printing Catalog Compressor Information

### To view or print catalog compressor information

1. In the Compressor Catalog or Compressor Catalog Detail window, click Print. (If you are accessing the report from the Compressor Catalog window, make sure you have clicked Search to update the query list.) The Report Setup window will open:



2. In the Select Report section, choose which version of the report to generate. (When accessed from the Compressor Catalog Detail window, only the first option is available.) You can generate a Current Compressor Catalog Detail report, a List Catalog Summary report, or a List Catalog Detail report:
  - The Current Compressor Catalog Detail report displays information from the Compressor Catalog Detail window for the selected compressor.
  - The List Catalog Summary report displays information from the Compressor Catalog window for each compressor in the query list. In the List Catalog Summary report, each compressor record starts on a new page of the report.

- The List Catalog Detail report displays information from the Compressor Catalog Detail window for each compressor in the Compressor Catalog window query list.
3. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
  4. Click Preview to view the report onscreen.
  5. If you want to print the report, click Print at the top of the onscreen report.
  6. When you have finished viewing and/or printing the report, click Close to close the onscreen report and Close to close the Report Setup window.

## **Field Definitions**

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Please refer to the field definitions for the Compressor Catalog window following page 217 and the Compressor Catalog Detail window following page 222.

## **Buttons (on onscreen report)**

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### **Page**

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

### **[Zoom]**

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

### **Print**

Click this button to print the Catalog report.

### **Close**

Click this button to close the Catalog onscreen report.





## Chapter 13

# Life Cycle module

The Life Cycle module allows you to conduct a life cycle economic analysis to ascertain the cost-effectiveness of a project, piece of equipment, an energy efficiency measure (EEM), or package of EEMs. The Life Cycle module includes the following windows and reports:

- ◆ **Life Cycle Analysis window**  
Enter life cycle analysis information for the project or equipment, such as the depreciation method, costs, escalation rates, electricity usage, financing terms, and project life parameters. **p. 239**
  
- ◆ **Life Cycle Analysis Results window**  
View the results from the life cycle cost analysis: a summary of calculated economic cost-effectiveness results, and yearly revenue and cost cash flows. **p. 245**
  
- ◆ **Life Cycle Analysis report**  
View and/or print the life cycle analysis inputs and results. **p. 248**
  
- ◆ **Escalation Rates window**  
Add, edit, or view escalation rate tables for use in the Life Cycle Analysis window. **p. 251**
  
- ◆ **Escalation Rate Table report**  
View and/or print the yearly rates of an escalation rate table. **p. 255**

# Life Cycle Analysis window

**Navigation:** *Life Cycle module button*  
or *System Enhancements menu / Life Cycle command*

The screenshot shows the 'Life Cycle Analysis' window with the following sections and data:

- Project/Corporate:** Radio buttons for 'Project' and 'Corporate' (selected).
- Depreciation Method:** Straight-line (dropdown).
- Buttons:** Calculate, ? (help), Close.
- Costs:**
  - Capital costs, \$: 14800
  - Installation costs, \$: 0
  - Interest during construction, \$: 0
  - Annual O&M cost, \$: 0
  - Annual fuel cost, \$: 0
  - Fuel cost escalation rate table: Rate #1 (dropdown)
- Default Escalation Rates:**
  - 5.0 % (for Capital costs)
  - 0.0 % (for Annual O&M cost)
  - 3.0 % (for Annual fuel cost)
- Financing:**
  - Date of loan, yr: 2005
  - Loan life, yrs: 5
  - Loan interest rate, %: 8.0
  - Discount rate, %: 3.0
  - Property tax rate, %: 0.0
  - Corporate tax rate, %: 0.0
  - State income tax rate, %: 0.0
- Electricity Use and Cost:**
  - Project annual energy savings, kWh: 365561
  - Average energy cost, \$/kWh: 0.037985
  - Energy cost escalation rate table: \*Use Default Rate (dropdown)
  - Project demand reduction, kW: 66.3
  - Average demand cost, \$/kW: 3.38
  - Demand cost escalation rate table: \*Use Default Rate (dropdown)
  - Peak demand months: 12
- Default Escalation Rates:**
  - 5.0 % (for Average energy cost)
  - 5.0 % (for Average demand cost)
- Project Life:**
  - Base Year: 1999
  - First year of operation: 2000
  - Life expectancy, yrs: 15
  - Depreciation life, yrs: 5
  - Salvage value, \$: 0
  - Junk value, \$: 0

*Life Cycle Analysis window*

## Purpose

Use the Life Cycle Analysis window to enter information for the financial calculations of Life Cycle Cost Analysis (LCCA). LCCA is an economic decision-making tool for choosing between alternatives (equipment, projects, or EEMs) that are intended to serve the same purpose. Life cycle analysis information for the project or equipment includes the depreciation method, total installed cost, electricity usage, escalation rates, financing, and project life parameters.

The LCCA adjusts base-year costs for price changes over the study period (including depreciation through a selected method, and interest), and calculates over a designated study period all costs and energy conservation benefits related to the owning and operating of a compressed air system or any project. You can designate the fixed default escalation rate for capital costs, annual O&M costs, annual fuel costs, the average (electrical) energy cost, and the average (electrical) demand cost. You may also enter, save, and recall sets of variable price indices or annual

escalation rates (escalation rate tables) for the fuel cost, energy cost, and demand cost in an LCCA.

## **Description**

The Life Cycle Analysis window is accessible from the Energy Efficiency Measures window or from the main menu. When this window is accessed from the Energy Efficiency Measures window, many parameters are loaded automatically into the Life Cycle Analysis window: the total energy efficiency measure (EEM) purchase and installation costs, annual energy and demand costs and savings, peak demand months, and utility rate information. You may modify these values.

The Life Cycle Analysis window contains four main sections; Costs, Electricity Use and Cost, Financing, and Project Life. Click **Calculate** to display the calculated results of the LCCA in the Life Cycle Analysis Results window.

## ***Procedures for Entering Life Cycle Information***

### **To enter life cycle information**

1. Access the Life Cycle Analysis window via **Life Cycle** on the Energy Efficiency Measures window, or through the Life Cycle module button on the Main Menu window. When Life Cycle is accessed from the Energy Efficiency Measures window, many parameters are loaded automatically into the Life Cycle Analysis window: the total energy efficiency measure (EEM) purchase and installation costs, annual energy and demand costs and savings, peak demand months, and utility rate information. You will still be able to edit these values. Many of the input parameters, such as loan date, interest rate, discount rate, and corporate and state tax rates, will contain default values from previous analyses. Other variables are reset to zero.
2. Select the analysis level for the life cycle analysis: Project or Corporate. This choice will affect the calculation of after-tax benefits. If the analysis is run at the project level, depreciation credits that are not needed to reduce or eliminate tax liability for project-related savings or revenues are lost rather than carried forward.
3. Select the depreciation method for the life cycle analysis: Double-Declining Balance, Sum of Years Digits, or Straight Line. See the Depreciation Method field definition for further information.
4. Enter or edit life cycle information into the fields in all four sections of the window: Costs, Electricity Use and Cost, Financing, and Project Life. You can edit any field. See the field definitions for further information about each field. To add, edit, or view escalation rate tables, click “...” and see the procedures for the Escalation Rates window on page 252.
5. When you have finished entering information into all the fields in the Life Cycle Analysis window, click **Calculate** to display the calculated results of the LCCA in the Life Cycle Analysis Results window.
6. From the Life Cycle Analysis Results window, you can return to the Life Cycle Analysis window to view or edit life cycle parameters and rerun the LCCA calculations. Multiple LCCA's are not saved, so when you enter a new set of life cycle parameters, old parameters are lost.
7. Click **Close** to close the Life Cycle Analysis window.

## Field Definitions

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### **Project**

Select this option to perform the life cycle analysis at the project level. This choice will affect the calculation of after-tax benefits. Depreciation credits that are not needed to reduce or eliminate tax liability for project-related savings or revenues are lost. They are not carried forward.

### **Corporate**

Select this option to perform the life cycle analysis at the corporate level. This choice will affect the calculation of after-tax benefits. Depreciation credits that are not needed to reduce or eliminate tax liability for project-related savings or revenues are multiplied by the composite federal and state tax rate and counted as a benefit (as they may be used to reduce the overall corporate tax liability).

### **Depreciation Method**

Select a depreciation method for the life cycle analysis from the drop-down list: Double-Declining Balance, Sum of Years Digits, or Straight Line. The **Double-Declining Balance** method is an accelerated depreciation method in which the book value of an asset (measured cost less depreciation to date) can be depreciated at double the straight-line rate. Double-declining balance depreciation charges cease when the book value equals the estimated salvage value. AIRMaster<sup>+</sup> automatically switches from double-declining balance to straight-line depreciation when the straight line depreciation method results in larger charges and a more rapid reduction in the book value of an asset. The **Sum of Years Digits** method results in a more rapid depreciation than the straight line method during the early years of the asset life with necessarily smaller charges as the asset nears the end of its depreciation period, or estimated life. The annual depreciation charge is computed as the remaining useful depreciation life at the beginning of the year, divided by the sum of the year's digits for the total depreciation life, with this ratio multiplied by the total amount to be depreciated (total installed cost less salvage value). The **Straight Line** method creates a constant annual depreciation charge equal to the total installed cost less salvage value, divided by the depreciation life in years.

### *Costs*

#### **Capital Costs, \$**

The total costs for purchasing equipment necessary to improve compressed air system performance, in base-year dollars. When the Life Cycle Analysis window is accessed from the Energy Efficiency Measures window, this data is loaded automatically; you can still edit the data. In the field to the right, enter a fixed default escalation rate (the average annual rate at which capital costs are expected to change over the study period), as a percentage.

#### **Installation Costs, \$**

The costs associated with installation of energy efficiency measures (EEMs), conducting leak surveys, or other systems improvements, in dollars. When the Life Cycle Analysis window is accessed from the Energy Efficiency Measures window, this data is loaded automatically; you can still edit the data.

#### **Interest During Construction, \$**

The dollar amount needed to meet debt service requirements incurred between the loan date and year of commercial operation, expressed in base-year dollars.

This field is used for large revenue-generating projects with multi-year duration for planning and construction.

**Annual O&M Cost, \$**

The yearly operating, maintenance, and repair expenses, in dollars. Only costs that vary for the baseline and energy-efficient alternatives need to be considered. In the field to the right, enter a fixed default escalation rate (the average annual rate at which O&M costs are expected to change over the study period).

**Annual Fuel Cost, \$**

The yearly cost for fossil fuel such as oil or natural gas, in base-year dollars. Note: This value is generally set equal to “0”; however, for some conservation actions fossil fuel related costs are incurred. One example is the replacement of an electric motor with a natural gas-fired engine driven pipeline air compressor. The field to the right is the fixed default escalation rate (the average annual rate at which fuel costs are expected to change over the study period), which is only available if “Use Default Rate” is selected in the Fuel Cost Escalation Rate Table field below.

**Fuel Cost Escalation Rate Table**

Select a previously created fuel cost escalation rate table from the drop-down list, or click “...” to add or edit a file of variable price indices or annual escalation rates. If you choose to use a fixed annual fuel cost escalation rate over the period of your analysis, select “Use Default Rate” and the default escalation rate from the Annual Fuel Cost field will be used.

***Electricity Use and Cost***

**Project Annual Energy Savings, kWh**

The total quantity of energy conserved or produced annually by the package of EEMs, energy conservation alternatives under consideration, or other project, in kilowatt-hours. When the Life Cycle Analysis window is accessed from the Energy Efficiency Measures window, this data is loaded automatically; you can still edit the data.

**Average Energy Cost, \$/kWh**

The seasonally averaged marginal cost of electrical energy conserved, in dollars per kilowatt-hour. When the Life Cycle Analysis window is accessed from the Energy Efficiency Measures window, this data is loaded automatically; you can still edit the data. The field to the right is the fixed default escalation rate (the average annual rate at which energy costs are expected to change over the study period), which is only available if “Use Default Rate” is selected in the Energy Cost Escalation Rate Table field below.

**Energy Cost Escalation Rate Table**

Select a previously created energy cost escalation rate table from the drop-down list, or click “...” to add or edit a file of variable price indices or annual escalation rates. If you choose to use a fixed average energy cost escalation rate over the period of your analysis, select “Use Default Rate” and the default escalation rate from the Average Energy Cost field will be used.

**Project Demand Reduction, kW**

The demand reduction, in kilowatts, achieved by the package of EEMs or other project. When the Life Cycle Analysis window is accessed from the Energy Efficiency Measures window, this data is loaded automatically; you can still edit the data.

**Average Demand Cost, \$/kW**

The seasonally averaged marginal electrical demand charge, in dollars per kilowatt. When the Life Cycle Analysis window is accessed from the Energy Efficiency Measures window, this data is loaded automatically; you can still edit the data. The field to the right is the fixed default escalation rate (the average annual rate at which demand costs are expected to change over the study period), which is only available if “Use Default Rate” is selected in the Demand Cost Escalation Rate Table field below.

**Demand Cost Escalation Rate Table**

Select a previously created demand cost escalation rate table from the drop-down list, or click “...” to add or edit a file of variable price indices or annual escalation rates. If you choose to use a fixed average demand cost escalation rate over the period of your analysis, select “Use Default Rate” and the default escalation rate from the Average Demand Cost field will be used.

**Peak Demand Months**

The number of months per year that the compressed air system operates during the peak demand period of the facility. When the Life Cycle Analysis window is accessed from the Energy Efficiency Measures window, this data is loaded automatically; you can still edit the data.

***Financing*****Date of Loan, yr.**

The loan origination year. The loan year must occur after or coincident with the base year and prior to or coincident with project startup or first year of operation.

**Loan Life, yr.**

The number of years over which the loan will be repaid. Typically the loan is repaid before the expected end of life for the compressed air system improvements. A loan life of “0” indicates that the project is funded through cash reserves (existing maintenance or capital equipment budgets).

**Loan Interest Rate, %**

The annual interest rate of the loan in nominal or market terms, as a percentage.

**Discount Rate, %**

The time value of money, as a percentage. For public organizations, this may be equivalent to the bond rate or loan interest rate. For private industry, the discount rate is the hurdle rate or minimum attractive rate of return on investment.

**Property Tax Rate, %**

The uniform annual tax levied on property, equal to the tax rate times the total project installed cost, as a percentage. The property tax commences upon project startup and continues until the end of project life. Set this and all tax rates to “0” to complete a “before-tax” analysis.

**Corporate Tax Rate, %**

The federal income tax rate applied to the last dollar of income to the investor, as a percentage. Set this and all tax rates to “0” to complete a “before-tax” analysis.

**State Income Tax Rate, %**

The state income tax rate applied to the last dollar of income to the investor, as a percentage. State taxes are allowable itemized deductions when determining federal tax liability. Set this and all tax rates to “0” to complete a “before-tax” analysis.

## ***Project Life***

### **Base Year**

The year in which the analysis begins. All benefits and costs are discounted back to the base-year date and are expressed in base-year dollars. All EEM or project cost data must be entered in base-year dollars.

### **First Year of Operation**

The year in which the project commences operation or is put into service.

### **Life Expectancy, yr.**

The expected or useful life of the compressed air system or other improvement, in years.

### **Depreciation Life, yr.**

The number of years over which the compressed air system or conservation improvement will be depreciated. The depreciation period cannot extend beyond the useful operating life of the project.

### **Salvage Value, \$**

The salvage value in base-year dollars. The salvage value is deducted from the initial asset cost before calculating depreciation.

### **Junk Value, \$**

The dollar value of existing equipment that may be sold for its junk value rather than retained as a spare. The sales price is considered as a benefit that occurs in the first year of project operation.

## **Buttons**

---

### **Calculate**

Click to display the calculated results of the LCCA in the Life Cycle Analysis Results window.

### **Help**

Click to open the AIRMaster<sup>+</sup> Help system to the Life Cycle Analysis window Help topic, which provides context-sensitive Help for this window.

### **Close**

Click to close the Life Cycle Analysis window.

### **“...”**

Click to open the Escalation Rates window, where you can add, edit, or view escalation rate tables.



# Life Cycle Analysis Results window

**Navigation:** *Life Cycle module button / Calculate button*  
 or *System Enhancements menu / Life Cycle command / Calculate button*

The screenshot shows a software window titled "Life Cycle Analysis Results". It contains several input fields for parameters and a table of results.

Input fields:

- Loan Amount, \$: 19,833
- Capital recovery factor: 0.25
- Annual loan payment, \$: 4,967
- After tax net present value, \$: 271,886
- After tax return on investment, %: (empty)
- Benefit-to-cost ratio (before tax): 15.27
- Benefit-to-cost ratio (after tax): 15.27
- Levelized cost of conserved energy, mills/kWh: 4.5

Table of Results:

Year	Project Revenues, Nominal \$	Loan Pmt + Op Costs, Nominal \$	Depreciation, Nominal \$	After Tax Benefits, Nominal \$	After Tax Benefits, BY \$	Cumulative After Tax Benefits, BY	Conserved Energy Cost, Nominal \$
2000	17,401	0	3,967	17,401	16,895	16,895	0
2001	18,271	0	3,967	18,271	17,223	34,117	0
2002	19,185	0	3,967	19,185	17,557	51,674	0
2003	20,144	0	3,967	20,144	17,898	69,572	0
2004	21,152	0	3,967	21,152	18,245	87,818	0
2005	22,209	0	0	22,209	18,600	106,417	0
2006	23,320	4,967	0	18,352	14,922	121,339	14
2007	24,486	4,967	0	19,518	15,408	136,747	14
2008	25,710	4,967	0	20,742	15,897	152,645	14
2009	26,995	4,967	0	22,028	16,391	169,035	14
2010	28,345	4,967	0	23,378	16,889	185,924	14
2011	29,762	0	0	29,762	20,875	206,799	0

*Life Cycle Analysis Results window*

## Purpose

Use the Life Cycle Analysis Results window to view the results from the life cycle calculations, as a summary of cost-effectiveness results and a grid of yearly cash flows.

## Description

The Life Cycle Analysis Results window contains two main sections. The upper section summarizes calculated economic cost-effectiveness results, including the Net Present Value (NPV), After-Tax Return on Investment (ROI), and Benefit-to-Cost Ratio. The lower section displays yearly revenue and cost cash flows in nominal and base year or discounted dollars.

## ***Procedures for Running a Life Cycle Cost Analysis***

### **To run a life cycle cost analysis**

1. Enter life cycle information into the Life Cycle Analysis window (see steps #1-5 of the procedures on page 240).
2. When you have finished entering information into all the fields in the Life Cycle Analysis window, click **Calculate** to display the calculated results of the LCCA in the Life Cycle Analysis Results window.
3. If you would like to view or print all the LCCA inputs and results, click **Print** in the Life Cycle Analysis Results window to access the Life Cycle Analysis report.
4. From the Life Cycle Analysis Results window, you can return to the Life Cycle Analysis window to view or edit life cycle parameters and rerun the LCCA calculations. Multiple LCCA's are not saved, so when you enter a new set of life cycle parameters, old parameters are lost.
5. Click **Close** to close the Life Cycle Analysis window.

---

### **Field Definitions**

#### ***Summary of Results***

##### **Loan Amount, \$**

The amount of the loan for the equipment or project, in dollars.

##### **Capital Recovery Factor**

The loan repayment factor for the equipment or project.

##### **Annual Loan Payment, \$**

The dollar amount paid on the loan each year.

##### **After Tax Net Present Value, \$**

The net present dollar value of the equipment or project after taxes are considered. The net present value is the present worth of all project benefits less the present worth of all project costs.

##### **After Tax Return on Investment, %**

The after-tax return on investment for your proposed energy conservation project. The ROI is the discount rate that yields an after-tax net present value of zero.

##### **Benefit-to-Cost Ratio (Before Tax)**

The present worth of all project revenues or benefits divided by the present worth of all project costs, before taxes are considered. A value of one or higher indicates that the project is cost-effective.

##### **Benefit-to-Cost Ratio (After Tax)**

The present worth of all project revenues or benefits divided by the present worth of all project costs, after taxes are considered. A value of one or higher indicates that the project is cost-effective.

##### **Levelized Cost of Conserved Energy, mills/kWh**

The cost of energy conservation measures, levelized over the life span of the equipment or project. Measured in tenths of a penny per kilowatt-hour.

## ***Cash Flow Analysis Grid***

### **Year**

The year for the calculated data in the following analysis fields.

### **Project Revenues, Nominal \$**

The value of the conservation project energy savings by year, taking all escalation rates into account.

### **Loan Pmt + Op Costs, Nominal \$**

The annual loan payment plus operating and maintenance costs associated with the conservation project.

### **Depreciation, Nominal \$**

The annual depreciation for the project, taking into account the selected Depreciation Method, Capital Cost, Depreciation Cost, and Salvage Value.

### **After Tax Benefits, Nominal \$**

The project revenues less costs, by operating year.

### **After Tax Benefits, BY\$**

The project benefits after they have been discounted to base year (BY) dollars using the selected Discount Rate.

### **Cumulative After Tax Benefits, BY\$**

The cumulative benefits or savings due to continued operation of the conservation project, expressed in discounted or base year dollars.

### **Conserved Energy Cost, Nominal \$**

The conserved energy cost of the conservation project.

## **Buttons**

---

### **Print**


Click to open the Report Setup window, to view or print the Life Cycle Analysis report, which displays the life cycle analysis inputs and results.

### **Close**

Click to close the Life Cycle Analysis Results window.

# Life Cycle Analysis report

**Navigation:** *Life Cycle module button / Calc button / Print button / Preview button*  
 or *System Enhancements menu / Life Cycle command / Calc button / Print button / Preview button*

 <b>Life Cycle Analysis Report</b>		AIRMaster+					
For: Bruce By: Sonia		May 31, 2000 Page 1 of 1					
<b>INPUTS</b>							
<b>COSTS (Corporate analysis)</b>		<b>FINANCING</b>					
Capital cost: \$1000 Capital escalation rate: 5.0 % Installation cost: \$0 Interest during construction: \$0 Annual O&M cost: \$0 O&M escalation rate: 0.0 % Annual fuel cost: \$0 Fuel escalation rate: Rate #1	Date of loan: 2005 Loan life: 5 years Loan interest rate: 8.0 % Discount rate: 3.0 % Property tax rate: 0.0 % Corporate tax rate: 0.0 % State income tax rate: 0.0 %						
<b>ELECTRICITY USE AND COST</b>		<b>PROJECT LIFE</b>					
Project annual energy savings: 3000 kWh Average energy cost: 0.05000 \$/kWh Electric cost escalation rate: 5.0 % Project demand reduction: 5.00 MW Average demand cost: 5.00 \$/kW-mo Demand cost escalation rate: 5.0 % Peak demand months: 12 months	Base year: 1999 First year of operation: 2000 Life expectancy: 15 years Depreciation life: 5 years Salvage value: \$0 Junk value: \$0 Depreciation method: Straight-line						
<b>RESULTS</b>							
Loan Amount: \$1340 Capital recovery factor: 0.25 Annual loan payment: \$336 After tax net present value: \$66.13		After tax return on investment: -1000.0 % Benefit-to-cost ratio, before tax: 6.14 Benefit-to-cost ratio, after tax: 6.14 Levelized cost of course net energy: 37.0 mills/kWh					
Year	Project Revenues, Nominal \$	Loan Pmt, + Op Costs, Nominal \$	Depreciation, Nominal \$	After-Tax Benefits, Nominal \$	After-Tax Benefits, Base Year \$	Cumulative After-Tax Benefits, Base Year \$	Course Net Energy Cost, Nominal \$
2000	473	0	268	473	459	459	0
2001	496	0	268	496	468	926	0
2002	521	0	268	521	477	1,403	0
2003	547	0	268	547	486	1,889	0
2004	574	0	268	574	495	2,385	0
2005	603	0	0	603	505	2,890	0
2006	633	336	0	298	242	3,131	112
2007	665	336	0	329	250	3,391	112
2008	698	336	0	362	278	3,669	112
2009	733	336	0	397	296	3,965	112
2010	770	336	0	434	314	4,278	112
2011	808	0	0	808	567	4,845	0
2012	849	0	0	849	578	5,423	0
2013	891	0	0	891	589	6,012	0
2014	936	0	0	936	600	6,613	0

*Life Cycle Analysis report*

## Purpose

Use the Life Cycle Analysis report to view or print the life cycle analysis inputs and results all at once.

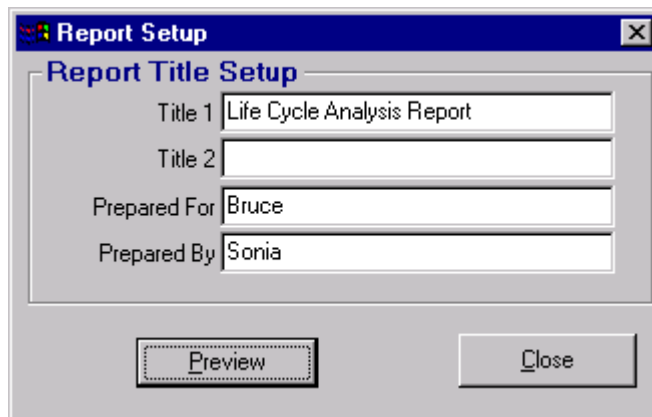
## Description

The Life Cycle Analysis report contains two sections: Inputs and Results. The Inputs section contains life cycle information input in the Life Cycle Analysis window, displayed in four sections that correspond to the division of the Life Cycle Analysis window. The Results section contains the resulting life cycle calculated information, as it is displayed in the Life Cycle Analysis Results window: a summary of cost-effectiveness results and a grid of yearly cash flows.

## Procedures for Viewing or Printing Life Cycle Analysis Information

### To view or print life cycle analysis information

1. In the Life Cycle Analysis Results window, click **Print**. The Report Setup window will open:



2. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
3. Click **Preview** to view the report onscreen.
4. If you want to print the report, click **Print** at the top of the onscreen report.
5. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

## Field Definitions

Please refer to the field definitions for the Life Cycle Analysis window following page 239 and the Life Cycle Analysis Results window following page 245.

## **Buttons (on onscreen report)**

---

### **Page**

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

### **[Zoom]**

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

### **Print**

Click this button to print the Life Cycle Analysis report.

### **Close**

Click this button to close the Life Cycle Analysis onscreen report.

# Escalation Rates window

**Navigation:** *Life Cycle module button / “...” button*  
*or System Enhancements menu / Life Cycle command / “...” button*

Year	Rate, %	Year	Rate, %	Year	Rate, %	Year	Rate, %	Year	Rate, %
2000	2.000	2010	3.000	2020	3.000	2030	3.000	2040	3.000
2001	3.000	2011	3.000	2021	3.000	2031	3.000	2041	3.000
2002	3.000	2012	3.000	2022	3.000	2032	3.000	2042	3.000
2003	3.000	2013	3.000	2023	3.000	2033	3.000	2043	3.000
2004	3.000	2014	3.000	2024	3.000	2034	3.000	2044	3.000
2005	3.000	2015	3.000	2025	3.000	2035	3.000	2045	3.000
2006	3.000	2016	3.000	2026	3.000	2036	3.000	2046	3.000
2007	3.000	2017	3.000	2027	3.000	2037	3.000	2047	3.000
2008	3.000	2018	3.000	2028	3.000	2038	3.000	2048	3.000
2009	3.000	2019	3.000	2029	3.000	2039	3.000	2049	3.000

*Escalation Rates window*

## Purpose

Use the Escalation Rates window to add, edit, or view escalation rate tables for use in the Life Cycle Analysis window. These tables of variable annual fuel, energy, or demand price escalation rates can be applied to the annual fuel cost, average energy cost, and average demand cost in the Life Cycle Analysis window.

## Description

The Escalation Rates window contains three main sections; the top section specifies a rate table, the middle section displays general rate table information, and the bottom section displays the table of yearly rates. Click **Fill Default** to change all “zero” values in the rate table to the default rate.

## ***Procedures for Viewing, Editing, or Adding an Escalation Rate Table***

### **To view an escalation rate table**

1. Access the Escalation Rates Table window from the Life Cycle Analysis window. Specifically, click “...” after the Fuel Cost Escalation Rate Table field, the Energy Cost Escalation Rate Table field, or the Demand Cost Escalation Rate Table field.
2. The Escalation Rates window opens, displaying the escalation type and rate table that were selected in the Life Cycle Analysis field from which this window was accessed.
3. You can select a different escalation type: fuel cost, energy cost, or demand cost.
4. You can select a different rate table, as well. Only rate tables for the selected escalation type are available. The option “Default Rate Selected” indicates that the default rate will be applied as the average annual rate of cost change instead of using an escalation rate table with yearly rates.
5. The rest of the fields in the Escalation Rates window display information for the selected escalation rate table. When you finish viewing the escalation rate table information, click **Close** to close the Escalation Rates window and return to the Life Cycle Analysis window.

### **To edit or add an escalation rate table**

1. If you want to edit an escalation rate table, select the rate table (see steps #1-3 in the previous procedures), and click **Edit** in the Escalation Rates window. If you want to add an escalation rate table, access the Escalation Rates window (see step #1 in the previous procedures), and click **Add**.
2. Once in Edit or Add mode, you can no longer change the Escalation Type or Rate Table fields at the top of the window. The rest of the fields are available for you to edit or add information.
3. The Default Rate field displays the same value as the Default Escalation Rate field for the appropriate escalation type on the Life Cycle Analysis window. This is the annual rate that will replace “zero” values in the rate table if you click **Fill Default**. You may edit or enter the default rate. (The value will also change in the Life Cycle Analysis window.)
4. Edit or enter the name of the escalation rate table in the Description field.
5. Edit or enter the first year that the escalation rate table is applied. The table will cover up to fifty years.
6. Edit or enter the average annual rate at which costs are expected to change over each year in the rate table. Note that when you save this data, rates will be defined to three decimal places. At any time, you can click **Fill Default** to change “zero” values in the rate table to the default rate.
7. When you finish editing or entering escalation rate table information, click **Save** to save the displayed information.



8. Click **Close** to close the Escalation Rates window and return to the Life Cycle Analysis window. The edited or added escalation rate table will now appear in the drop-down list of rate table options for the appropriate escalation type.

## Field Definitions

---

### Escalation Type

The type of escalation rate table: fuel cost, energy cost, or demand cost.

### Rate Table

The name of the rate table. Your choices are limited by the escalation type chosen in the previous field. The option “Default Rate Selected” indicates that the default rate will be applied as the average annual rate of cost change instead of using an escalation rate table with yearly rates.

### Default Rate, %

The annual rate that will replace “zero” values in the rate table if you click **Fill Default**. This field displays the same value as the Default Escalation Rate field for the appropriate escalation type on the Life Cycle Analysis window.

### Description

The name of the selected escalation rate table.

### First Year

The first year that the escalation rate table is applied.

### [Year]

The year of the study period for each annual rate percentage.

### [Rate, %]

The average annual rate at which costs are expected to change over each year, defined to three decimal places.

## Buttons

---

### Add

Click to enter Add mode, and create a new escalation rate table in cleared fields.

### Edit

Click to enter Edit mode to make changes to the currently displayed escalation rate table.

### Save

Once in Edit mode, click to save the escalation rate table displayed.

### Delete

Click to delete the currently displayed escalation rate table.

### Print

Click to open the Report Setup window, to view or print the Escalation Rate Table report for the selected table.

### Help

Click to open the AIRMaster<sup>+</sup> Help system to the Escalation Rates window Help topic, which provides context-sensitive Help for this window.

**Close/Cancel**

Click to close the Escalation Rates window, or cancel Edit/Add mode and reverse edits to displayed data.


**Fill Default**

Click to change all “zero” values in the rate table to the default rate.

---

# Escalation Rate Table report

**Navigation:** *Life Cycle module button / “...” button / Print button / Preview button*  
*or System Enhancements menu / Life Cycle command / Print button / Preview button*

 <b>Escalation Rate Table Report</b> <span style="float: right;">AIRMaster+</span>									
For: Bruce					May 31, 2000				
By: Sonia					Page 1 of 1				
Description : Rate #1 Escalation Type : Fuel Cost									
Year	Rate, %	Year	Rate, %	Year	Rate, %	Year	Rate, %	Year	Rate, %
2000	2.0	2010	3.0	2020	3.0	2030	3.0	2040	3.0
2001	3.0	2011	3.0	2021	3.0	2031	3.0	2041	3.0
2002	3.0	2012	3.0	2022	3.0	2032	3.0	2042	3.0
2003	3.0	2013	3.0	2023	3.0	2033	3.0	2043	3.0
2004	3.0	2014	3.0	2024	3.0	2034	3.0	2044	3.0
2005	3.0	2015	3.0	2025	3.0	2035	3.0	2045	3.0
2006	3.0	2016	3.0	2026	3.0	2036	3.0	2046	3.0
2007	3.0	2017	3.0	2027	3.0	2037	3.0	2047	3.0
2008	3.0	2018	3.0	2028	3.0	2038	3.0	2048	3.0
2009	3.0	2019	3.0	2029	3.0	2039	3.0	2049	3.0

*Escalation Rate Table report*

## Purpose

Use the Escalation Rate Table report to view or print the yearly escalation rates in an escalation rate table. Escalation rate tables are applied to fuel, energy, or demand costs in the Life Cycle Analysis window.

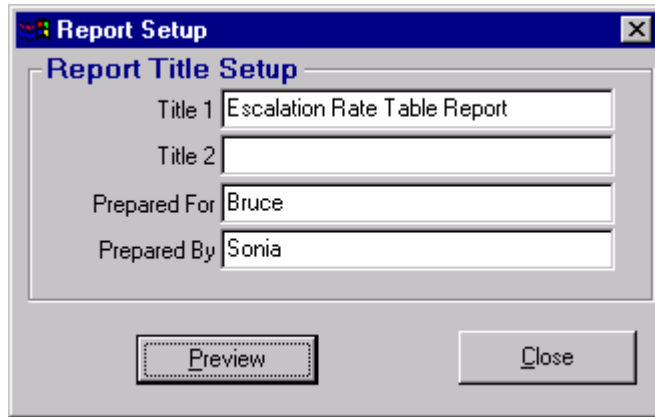
## Description

The Escalation Rate Table report contains information entered in the Escalation Rates window. The default title of the report will reflect the escalation type (fuel, energy, or demand).

## ***Procedures for Viewing or Printing Escalation Rate Table Information***

### **To view or print escalation rate table information**

1. In the Escalation Rates window, click **Print**. The Report Setup window will open:



2. In the Report Title Setup section, edit or enter the two lines of the report title, and the names of the report recipient and author.
3. Click **Preview** to view the report onscreen.
4. If you want to print the report, click **Print** at the top of the onscreen report.
5. When you have finished viewing and/or printing the report, click **Close** to close the onscreen report and **Close** to close the Report Setup window.

## Field Definitions

---

Please refer to the field definitions for the Escalation Rates window following page 251.

## Buttons (on onscreen report)

---

### Page

The page number for the currently displayed page of the report. Click the arrows next to this field to view other pages of the report.

### [Zoom]

Click these buttons to zoom in or out on the report. The selected magnification level is displayed to the left of the **Zoom** buttons.

### Print

Click this button to print the Escalation Rate Table report.

### Close

Click this button to close the Escalation Rate Table onscreen report.



## Chapter 14

# Calculators

The Calculators allow you to make conversions or calculations that provide values used in various AIRMaster<sup>+</sup> windows. The Calculator windows include:

- ◆ **SCFM-ACFM Conversion Calculator window**  
Convert compressor or system airflow requirements between actual and standard conditions. **p. 259**
  
- ◆ **Air Storage Capacity Calculator window**  
Calculate system air storage capacity using data from a pump-up/drain-down test. **p. 262**
  
- ◆ **Altitude Correction and Re-rate Calculator window**  
Calculate the actual required airflow (rerated for altitude) of a positive displacement compressor. **p. 265**
  
- ◆ **Cycle Time Calculator window**  
Calculate the cycle time of an unloading compressor. **p. 268**
  
- ◆ **Power Calculator window**  
Calculate power from amps and volts. **p. 271**

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# SCFM-ACFM Conversion Calculator window

**Navigation:** *Calculators menu / SCFM-ACFM Conversion command*

The screenshot shows a software window titled "SCFM - ACFM Conversion Calculator". It is divided into three main sections:

- Actual Conditions:** Includes input fields for Elevation (ft.), Atmospheric pressure (psi), Ambient temperature (°F), and Relative humidity (%).
- Standard Conditions Method:** Includes radio buttons for ASME and CAGI/ISO Pneurop, and corresponding input fields for pressure (psi), temperature (°F), and relative humidity (%).
- Results:** Includes two input fields for "Required airflow" in acfm and scfm, and a note: "(Enter: acfm to calculate scfm OR scfm to calculate acfm)".

At the bottom of the window are "Calculate" and "Close" buttons.

*SCFM-ACFM Conversion Calculator window*

## Purpose

Use the SCFM-ACFM Conversion Calculator window to convert compressor or system airflow requirements between actual and standard conditions. You can enter actual conditions and actual output to determine standard output ratings, or you can enter your actual conditions and standard output to determine actual output.

## Description

The SCFM-ACFM Conversion Calculator window contains three main sections: Actual Conditions, Standard Conditions Method, and Results. The Actual Conditions section displays the elevation and actual air conditions of the air compressor or compressed air system. The Standard Conditions Method section shows the standard air conditions, under ASME or CAGI definitions, for the conversion calculation. The Results section displays the air compressor or compressed air system average airflow requirements at inlet conditions, in acfm and scfm.

## ***Procedures for Converting Airflow Between Actual and Standard Conditions***

### **To convert airflow between actual and standard conditions**

1. In the Actual Conditions section, enter the actual conditions at the air compressor or compressed air system: elevation, air pressure, air temperature, and humidity.
2. In the Standard Conditions Method section, select whether the standard conditions for the conversion will use ASME or CAGI definitions. The selected set of definitions will be displayed in the Standard Conditions Method section.
3. In the Results section, enter actual airflow output or standard airflow output for the air compressor or compressed air system.
4. Click on the other required airflow field to display the calculated conversion results.
5. If you want to run another calculation, you can either repeat steps #3-4 or repeat steps #1-4.
6. When you finish running calculations, click **Close** to close the SCFM-ACFM Conversion Calculator window.

## **Field Definitions**

---

### ***Actual Conditions***

#### **Elevation, ft.**

The number of feet above mean sea level at which the air compressor or compressed air system is located. The default value is zero feet, or sea level.

#### **Atmospheric Pressure, psia**

The average barometric pressure at the location of the air compressor or system, in pounds per square inch absolute. A default value based on elevation is calculated.

#### **Ambient Temperature, °F**

The temperature adjacent to the air compressor or system inlet, in degrees Fahrenheit.

#### **Relative Humidity, %**

The average vapor pressure (at the location of the air compressor or system) divided by the vapor pressure under saturated conditions, expressed as a percentage.

### ***Standard Conditions***

#### **Standard Conditions Method**

Select whether the standard air conditions will use CAGI or ASME definitions. CAGI air conditions assume: 14.5 psia (1 bar), 68°F (20°C), and dry (0% relative humidity). ASME air conditions assume: 14.7 psia (1 bar), 68°F (20°C), and 36% relative humidity.



**Atmospheric Pressure, psia**

The rated atmospheric pressure conditions under the selected CAGI or ASME definitions, in pounds per square inch absolute.

**Ambient Temperature, °F**

The rated ambient temperature conditions under the selected CAGI or ASME definitions, in degrees Fahrenheit.

**Relative Humidity, %**

The rated humidity conditions under the selected CAGI or ASME definitions, expressed as a percentage.

***Results*****Required Airflow**

The air compressor or compressed air system average airflow requirements at inlet conditions, rated in actual cubic feet per minute and standard cubic feet per minute. Enter actual or standard airflow, and the other airflow rating will be calculated using the values entered in the actual conditions section. Click either field to make that field the origination of the conversion.

**Buttons**

---

**Close**

Click to close the SCFM-ACFM Conversion Calculator window.

---

## Air Storage Capacity Calculator window

**Navigation:** *System module button / Air Storage Capacity Calculator button  
or Calculators menu / Air Storage Capacity command*

Measured Test Conditions	
Elevation, ft.	0
Atmospheric pressure, psia	14.69
Compressor capacity, acfm	0
Full load or cut-in pressure, psig	100
Unload or cut-out pressure, psig	110
Pump-up time, sec.	0
Drain-down time, sec.	0

Results	
Air storage capacity (receivers + distribution pipe), cu. ft.	0

*Air Storage Capacity Calculator window*

### Purpose

Use the Air Storage Capacity Calculator window to calculate system air storage capacity (including air receivers and distribution pipe) using data from a pump-up/drain-down test. Only one or two compressors are used in this test; there is no limitation on the type of compressor(s) used.

**Note** If the pump-up/drain-down test is performed with two compressors, one should be running at full load so that its contribution to the system is constant. Enter test data only for the lag compressor (the compressor operating at full load to pump up the system and turned off or unloaded to drain down the system). This compressor may be allowed to load and then unload, but not allowed to throttle.

### Description

The Air Storage Capacity Calculator window contains two main sections; the Measured Test Conditions section displays test data, and the Results section displays calculator results. This calculator will display default values (with elevation and atmospheric pressure) from the System Data tab, if opened from there, and the result from this calculator can be transferred to the System Data tab.

## ***Procedures for Calculating System Volume***

### **To calculate system volume**

1. Open this window either from the **Air Storage Capacity Calculator** button on the System Data tab of the System window (you must be in Edit mode), or through the Calculators menu on the menu bar.
2. Before entering values in this window, you must perform a pump-up/drain-down test, using one or two compressors (compressors can be any type); if the pump-up/drain-down test is performed with two compressors, one should be running at full load so that its contribution to the system is constant. The values you enter in this window should be for the lag compressor (the compressor operating at full load to pump up the system and turned off or unloaded to drain down the system). This compressor may be allowed to load and then unload, but not allowed to throttle.
3. In the Air Storage Capacity Calculator window, enter the elevation of the compressed air system.
4. When you click on the Atmospheric Pressure field, it will display a default value based on the the elevation entered. Edit this value if it is not the atmospheric pressure at the elevation of the compressed air system during the test.
5. In the Compressor Capacity field, enter the maximum airflow delivered by the (lag) air compressor used for the pump-up/drain-down test.
6. In the Cut-in Pressure and Cut-out Pressure fields, enter the minimum and maximum system pressures of the compressor during the test. These could be the cut-in and cut-out pressures for the lag compressor.
7. In the Pump-up and Drain-down Time fields, enter the number of seconds it takes for the air compressor(s) to increase the system pressure from minimum to maximum pressure, and then back to minimum when the (lag) air compressor is unloaded or turned off.
8. Click in any field, and the Air Storage Capacity field displays the calculated system air storage capacity, including air receivers and distribution pipe.
9. If you want to recalculate the system air storage capacity, edit any of the Measured Test Conditions fields and click another field to display the new calculated results.
10. When you finish running calculations, decide whether you want to transfer the calculated system air storage capacity value to the System Data tab of the System window (only possible if this calculator was accessed from there). Click **Apply** to make this transfer and close the calculator, **Cancel** or **Close** to simply close the calculator.

### **Field Definitions**

---

#### ***Measured Test Conditions***

**Elevation, ft.**

The number of feet above mean sea level at which the compressed air system is located. The default value is 0.

**Atmospheric Pressure, psia**

The average barometric pressure at the location of the compressed air system during the test, in pounds per square inch absolute. A default value based on elevation is calculated.

**Compressor Capacity, acfm**

The maximum airflow delivered by the (lag) air compressor used for the pump-up/drain-down test, in actual cubic feet per minute.

**Full Load or Cut-in Pressure, psig**

The minimum pressure of the compressor during the pump-up test, in pounds per square inch gauge. This could be the cut-in pressure for the lag compressor during this test. The default value is 100.

**Unload or Cut-out Pressure, psig**

The maximum pressure of the compressor during the pump-up test, in pounds per square inch gauge. This could be the cut-out pressure for the lag compressor during this test. The default value is 110.

**Pump-up Time, sec.**

The number of seconds it takes for the air compressor(s) to increase the compressed air system pressure from the minimum to the maximum. The default value is 0.

**Drain-down Time, sec.**

The number of seconds it takes for the compressed air system to fall from the maximum to the minimum system pressure when the (lag) air compressor is unloaded or turned off. The default value is 0.

***Results*****Air Storage Capacity, cu. ft.**

The compressed air system volume calculated from the above fields. The compressed air system volume is the total volume of air that the entire compressed air system can store, including receivers and distribution pipes, in cubic feet.

**Buttons**

---

**Close/Cancel**

Click to close the Air Storage Capacity Calculator window. This button is **Cancel** only if this calculator is accessed from the button on the System Data tab of the System window; click to return to the System window without applying the calculated result.

**Apply**

This button only appears if this calculator is accessed from the button on the System Data tab of the System window. Click to apply the calculated volume to the System Data tab.

# Altitude Correction and Re-rate Calculator window

Navigation: *Calculators menu / Altitude Correction command*

**Altitude Correction and Re-rate Calculator**

**Actual Conditions**

Elevation, ft.

Required flow at standard conditions, scfm

System pressure, psig

Atmospheric pressure, psia

Ambient temperature, °F

Relative humidity, %

**Standard Conditions Method**

ASME  CAGI

psia

°F

%

**Results**

Actual required airflow, acfm

Acfm compressor capacity deration, %

Actual required airflow, acfm - rerated for altitude

**Note: This calculator is for positive displacement compressors only.**

*Altitude Correction and Re-rate Calculator window*

## Purpose

Use the Altitude Correction and Re-rate Calculator window to calculate the actual required airflow (rerated for altitude) of a positive displacement compressor.

## Description

The Altitude Correction and Re-rate Calculator window contains three main sections: Actual Conditions, Standard Conditions Method, and Results. The Actual Conditions section displays the elevation, known airflow at standard conditions, and operating pressure of the system, and actual air conditions of the air compressor. The Standard Conditions Method section displays standard air conditions, under ASME or CAGI definitions. The Results section displays the actual required airflow for the positive displacement compressor; the compressor capacity deration percentage; and the compressor's actual required airflow, rerated for altitude.

## ***Procedures for Calculating Actual Airflow for a Positive Displacement Compressor***

### **To calculate actual airflow for a positive displacement compressor**

1. In the Actual Conditions section, enter the system elevation, known system airflow at standard conditions, system operating pressure, and actual air conditions of the air compressor.
2. In the Standard Conditions Method section, select whether the standard conditions for the scfm-acfm conversion calculation will use ASME or CAGI definitions. The selected set of definitions will be displayed in the Standard Conditions Method section.
3. Click in any field in the Results section, and the calculation results are displayed.
4. If you want to run another calculation, repeat steps #1-3.
5. When you finish running calculations, click **Close** to close the Altitude Correction and Re-rate Calculator window.

### **Field Definitions**

---

#### ***Actual Conditions***

##### **Elevation, ft.**

The number of feet above mean sea level at which the compressed air system is located. The default value is zero feet, or sea level.

##### **Required Airflow at Standard Conditions, scfm**

The compressed air system average airflow requirements rated at standard conditions, in standard cubic feet per minute. The default value is 0.

##### **Operating Pressure, psig**

The average system operating pressure, in pounds per square inch gauge. The default value is 100.

##### **Atmospheric Pressure, psia**

The average barometric pressure at the location of the air compressor inlet, in pounds per square inch absolute. A default value based on elevation is calculated.

##### **Ambient Temperature, °F**

The temperature adjacent to the air compressor inlet, in degrees Fahrenheit.

##### **Relative Humidity, %**

The relative humidity at the location of the air compressor, expressed as a percentage.

#### ***Standard Conditions Method***

##### **Standard Conditions Method**

Select whether the standard air conditions will use ASME or CAGI definitions. ASME air conditions assume: 14.7 psia (1 bar), 68°F (20°C), and 36% relative humidity. CAGI air conditions assume: 14.5 psia (1 bar), 68°F (20°C), and dry (0% relative humidity).

**Atmospheric Pressure, psia**

The rated atmospheric pressure conditions under the selected CAGI or ASME definitions, in pounds per square inch absolute.

**Ambient Temperature, °F**

The rated ambient temperature conditions under the selected CAGI or ASME definitions, in degrees Fahrenheit.

**Relative Humidity, %**

The rated humidity conditions under the selected CAGI or ASME definitions, expressed as a percentage.

***Results*****Actual Required Airflow, acfm**

The calculated required airflow for the compressor, converted from standard conditions to actual conditions.

**Acfm Compressor Capacity Deration, %**

The calculated volumetric efficiency deration by which the compressor capacity (in acfm) should be adjusted to account for the effects of elevation.

**Actual Required Airflow, acfm – Re-rated for Altitude**

The required capacity of a positive displacement compressor re-rated for altitude. This value is equal to the actual required airflow divided by the acfm compressor capacity deration factor.

**Buttons**

---

**Close**

Click to close the Altitude Correction and Re-rate Calculator window.

---

## Cycle Time Calculator window

**Navigation:** *Calculator menu / Cycle Time command*

Actual Conditions	
Elevation, ft.	<input type="text"/>
Atmospheric pressure, psia	<input type="text" value="14.69"/>
Compressor capacity, acfm	<input type="text" value="0"/>
System airflow requirement, acfm	<input type="text" value="0"/>
System volume, cu. ft.	<input type="text" value="0"/>
Full load or cut-in pressure, psig	<input type="text" value="100"/>
Unload or cut-out pressure, psig	<input type="text" value="110"/>

Results	
Pump-up time, sec.	<input type="text" value="0"/>
Drain-down time, sec.	<input type="text" value="0"/>
Total cycle time, sec.	<input type="text" value="0"/>

Close

*Cycle Time Calculator window*

### Purpose

Use the Cycle Time Calculator window to determine the cycle time of a compressor equipped with unloading controls. The cycle time of a compressor is the amount of time it takes for that compressor to pump up and drain down the system (alone, or with a second compressor running at full load so that its contribution to the system is constant).

### Description

The Cycle Time Calculator window contains two main sections; the Actual Conditions section displays data entry fields, and the Results section displays the calculated results.



## ***Procedures for Calculating Cycle Time***

### **To calculate the cycle time of an unloading compressor**

1. In the Elevation field, enter the elevation of the air compressor.
2. When you click on the Atmospheric Pressure field, it will display a default value based on the elevation entered. Edit this value if it is not the atmospheric pressure at the elevation of the air compressor.
3. In the Compressor Capacity field, enter the compressor capacity at rated speed and under rated pressure conditions.
4. In the System Airflow Requirement field, enter the average airflow requirement of the compressed air system.
5. In the System Volume field, enter the system air storage volume, including air receivers and distribution pipe. You may need to use the Air Storage Capacity Calculator window to calculate this value.
6. In the Cut-in and Cut-out Pressure fields, enter the pressures at which the compressor reloads and unloads.
7. Click in any field, and the Results section displays calculated results.
8. If you want to run another calculation, edit any of the first seven fields and then click another field to display the new results.
9. When you finish running calculations, click **Close** to close the Cycle Time Calculator window.

## **Field Definitions**

---

### ***Actual Conditions***

#### **Elevation, ft.**

The number of feet above mean sea level at which the air compressor is located. The default value is 0 feet, or sea level.

#### **Atmospheric Pressure, psia**

The average barometric pressure at the location of the air compressor inlet, in pounds per square inch absolute. A default value based on elevation is calculated.

#### **Compressor Capacity, acfm**

The quantity of air actually compressed from inlet conditions and delivered to the discharge system at rated speed and under rated pressure conditions, measured in actual cubic feet per minute.

#### **System Airflow Requirement, acfm**

The compressed air system average airflow requirement, rated at inlet conditions, in actual cubic feet per minute.

#### **System Volume, cu. ft.**

The system air storage capacity in cubic feet (all air storage volume, including receivers and distribution pipe).

**Full Load or Cut-in Pressure, psig**

The pressure at which the air compressor reloads, in pounds per square inch gauge. The default value is 100.

**Unload or Cut-out Pressure, psig**

The pressure at which the air compressor unloads, in pounds per square inch gauge. The default value is 110.

***Results*****Pump-up Time, sec.**

The number of seconds it takes for the air compressor to raise compressed air system pressure from the minimum to the maximum. The default value is 0.

**Drain-down Time, sec.**

The number of seconds it takes for the compressed air system to go from the maximum to the minimum pressure when the air compressor is unloaded or turned off. The default value is 0.

**Total Cycle Time, sec.**

The sum of the system pump-up and drain-down times, which is the total cycle time for the air compressor.

**Buttons**

---

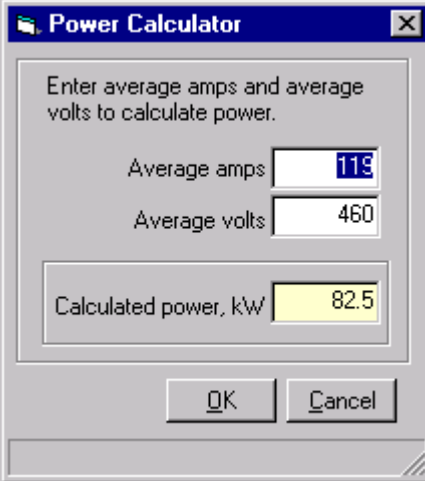
**Close**

Click to close the Cycle Time Calculator window.

---

## Power Calculator window

**Navigation:** *Compressor module button / Performance tab / “...” button  
or Inventory menu / Compressor command / Performance tab / “...”  
button*



Enter average amps and average volts to calculate power.

Average amps

Average volts

Calculated power, kW

*Power Calculator window*

### Purpose

Use the Power Calculator window to calculate power (kW) from current (amps) and potential (volts). This calculated power is compressor power at a specific performance point, displayed in the Compressor Inventory window, Performance tab.

### Description

The Power Calculator window contains three fields: Average Amps, Average Volts, and Calculated Power. The calculated power can be automatically copied to the Power field of origin in the Performance tab of the Compressor Inventory window.

### **Procedures for Calculating Power**

#### **To calculate power**

1. In the Compressor Inventory window, Performance tab, find the Performance Points grid. In Edit mode, click “...” next to a Power field in a specific “performance point” row to open the Power Calculator window.
2. In the Power Calculator window, enter the average required current for the compressor at the specified performance point, measured in amperes.
3. Enter the average electric potential for the compressor at the specified performance point, in volts.
4. Click in another field, and the calculated power in kilowatts appears.

5. If you want to run another power calculation, repeat steps #2-4.
6. If you want to close the Power Calculator window and automatically copy the calculated power to the Power field in the “performance point” row of origin in the Performance tab, click **OK**. If you want to close the Power Calculator window without copying the calculated power to the Performance tab, click **Cancel**.
7. You are returned to the Performance tab of the Compressor Inventory window.

## **Field Definitions**

---

### **Average Amps**

The average required current for the compressor at the specified performance point, measured in amperes.

### **Average Volts**

The average electric potential for the compressor at the specified performance point, in volts.

### **Calculated Power, kW**

The result of average amps multiplied by average volts: power in kilowatts. This is the power of the compressor at the specified performance point.

## **Buttons**

---

### **OK**

Click to close the Power Calculator window, and return to the Performance tab of the Compressor Inventory window. The calculated power is automatically copied into the Power field next to the button that accessed the Power Calculator window.

### **Cancel**

Click to close the Power Calculator window, and return to the Performance tab of the Compressor Inventory window. The calculated power is not copied to the Performance tab.



## Appendix A

# Data Input Forms: Inventory

Use the following forms to record *existing* compressed air system information required for AIRMaster<sup>+</sup>. Access the Data Input Forms on the Main Menu window via the Print Data Input Forms module button or via the System Enhancements menu. You can preview or print any of the following Data Input Forms:

◆ <b>Company/Facility</b>	<b>p. 274</b>
◆ <b>Utility Rates</b>	<b>p. 275</b>
◆ <b>System</b>	<b>p. 276</b>
◆ <b>End Uses</b>	<b>p. 277</b>
◆ <b>Compressor</b>	<b>p. 278</b>
◆ <b>Compressor Details</b>	<b>p. 279</b>
◆ <b>Profile Order</b>	<b>p. 280</b>
◆ <b>Profile Data</b> (Power, % Capacity Airflow, acfm Airflow, Cycle Time, or Volts/Amps)	<b>p. 281</b>



## Data Input Form Company/Facility

AIRMaster+

### Company

Name : \_\_\_\_\_ **Facility 1**  
Industry Type : \_\_\_\_\_ Facility : \_\_\_\_\_  
SIC Description : \_\_\_\_\_ Address 1 : \_\_\_\_\_  
Address 1 : \_\_\_\_\_ Address 2 : \_\_\_\_\_  
Address 2 : \_\_\_\_\_ City : \_\_\_\_\_  
City : \_\_\_\_\_ State/Zip : \_\_\_\_\_  
State/Zip : \_\_\_\_\_ Contact : \_\_\_\_\_  
Contact : \_\_\_\_\_ Phone : \_\_\_\_\_  
Phone : \_\_\_\_\_ Total Annual Energy Use, kWh : \_\_\_\_\_

### Facility 2

Facility : \_\_\_\_\_  
Address 1 : \_\_\_\_\_  
Address 2 : \_\_\_\_\_  
City : \_\_\_\_\_  
State/Zip : \_\_\_\_\_  
Contact : \_\_\_\_\_  
Phone : \_\_\_\_\_  
Total Annual Energy Use, kWh : \_\_\_\_\_

### Facility 3

Facility : \_\_\_\_\_  
Address 1 : \_\_\_\_\_  
Address 2 : \_\_\_\_\_  
City : \_\_\_\_\_  
State/Zip : \_\_\_\_\_  
Contact : \_\_\_\_\_  
Phone : \_\_\_\_\_  
Total Annual Energy Use, kWh : \_\_\_\_\_



## Data Input Form Utility Rates

AIRMaster+

**Utility Name :** \_\_\_\_\_  
Utility Code : \_\_\_\_\_  
Address 1 : \_\_\_\_\_  
Address 2 : \_\_\_\_\_  
City, State, Zip : \_\_\_\_\_  
Contact : \_\_\_\_\_  
Phone : \_\_\_\_\_

Rate Schedule: _____	Season 1	Season 2
Start Month/Day	_____	_____
Dem and Rate, \$/kW-mo	_____	_____
Energy Rate, \$/kWh: Block 1	_____	_____
Block 2	_____	_____
Block 3	_____	_____

Rate Schedule: _____	Season 1	Season 2
Start Month/Day	_____	_____
Dem and Rate, \$/kW-mo	_____	_____
Energy Rate, \$/kWh: Block 1	_____	_____
Block 2	_____	_____
Block 3	_____	_____

Rate Schedule: _____	Season 1	Season 2
Start Month/Day	_____	_____
Dem and Rate, \$/kW-mo	_____	_____
Energy Rate, \$/kWh: Block 1	_____	_____
Block 2	_____	_____
Block 3	_____	_____

Rate Schedule: _____	Season 1	Season 2
Start Month/Day	_____	_____
Dem and Rate, \$/kW-mo	_____	_____
Energy Rate, \$/kWh: Block 1	_____	_____
Block 2	_____	_____
Block 3	_____	_____





## Data Input Form System

AIRMaster+

Company: \_\_\_\_\_  
 Facility: \_\_\_\_\_  
 System: \_\_\_\_\_  
 Contact Person: \_\_\_\_\_  
 Phone Number: \_\_\_\_\_

### System Data

Nominal System Pressure, psig: \_\_\_\_\_  
 Airflow Capacity, acfm: \_\_\_\_\_  
 System Elevation, ft.: \_\_\_\_\_  
 System Air Storage Capacity, cu ft: \_\_\_\_\_

### Sequencer Data

Cascade Sequencing Data

Target Sequencing Data

Position	Full Load or Cut-In Pressure, psi g	Max Full Flow or Cut-Out Pressure, psig
Lead		
2		
3		
4		
5		

Target Pressure, psig: \_\_\_\_\_

Variance (+/-), psi: \_\_\_\_\_

### Daytype Information

Daytype Description	Operating Days Season 1	Operating Days Season 2
1		
2		
3		
4		
5		

Season 1 Demand Months: \_\_\_\_\_

Season 2 Demand Months: \_\_\_\_\_



### Data Input Form End Uses

AIRMaster+

#	End Use	Location	Regulated, Y/N	Required Airflow, acfm	Required Pressure, psig	Measured Pressure, psig
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						



## Data Input Form Compressor

AIRMaster+

Facility : \_\_\_\_\_ User-Assigned ID : \_\_\_\_\_  
 System : \_\_\_\_\_ In Service, Y/N : \_\_\_\_\_  
 Compressor : \_\_\_\_\_ Sequencer Used, Y/N : \_\_\_\_\_

### Nameplate Information

Compressor type : \_\_\_\_\_  
 Manufacturer : \_\_\_\_\_  
 Model : \_\_\_\_\_  
 Horsepower rating : \_\_\_\_\_  
 Full load operating pressure, psig : \_\_\_\_\_  
 Rated capacity @ full load operating pressure, acfm : \_\_\_\_\_  
 Serial # : \_\_\_\_\_  
 Installation date : \_\_\_\_\_  
 Compressor location : \_\_\_\_\_

### Control Information

Control type : \_\_\_\_\_

*Unloading Controls*

Unload point, %Capacity : \_\_\_\_\_

# of unload steps : \_\_\_\_\_

*After Cooling info*

Cooling type : \_\_\_\_\_ Unloaded sump pressure, psig : \_\_\_\_\_  
 Fan motor rating, HP : \_\_\_\_\_ Automatic shutdown timer, Y/N : \_\_\_\_\_

### Compressor Performance

Performance Points	Discharge Pressure, psig	Airflow, acfm	Power, kW
Full Load			
Max full flow			
Unload Point or surge point for centrifugal			
No load (fully modulated or unloaded)			

*Inlet Conditions*

Avg. temperature, °F : \_\_\_\_\_  
 Atmos. pressure, psia : \_\_\_\_\_  
 Blowdown time, sec. : \_\_\_\_\_



## Data Input Form Compressor Details

AIRMaster+

### General Data

Compressor Name : \_\_\_\_\_ Full load shaft power, BHP : \_\_\_\_\_  
 Compressor type : \_\_\_\_\_ Rated capacity @ full load operating pressure, acfm : \_\_\_\_\_  
 Manufacturer : \_\_\_\_\_ Full load operating pressure, psig : \_\_\_\_\_  
 Model : \_\_\_\_\_ Max. full flow operating pressure, psig : \_\_\_\_\_  
 Control type : \_\_\_\_\_ Total package power input at rated conditions, kW : \_\_\_\_\_  
 Specific package power input at rated conditions, kW/100acfm : \_\_\_\_\_

### Drive Motor Details

Manufacturer : \_\_\_\_\_ Speed,\* rpm : \_\_\_\_\_  
 Model : \_\_\_\_\_ Power factor,\* % : \_\_\_\_\_  
 Serial no. : \_\_\_\_\_ Efficiency,\* % : \_\_\_\_\_  
 Frame size : \_\_\_\_\_ Voltage rating : \_\_\_\_\_  
 Motor type : \_\_\_\_\_ Wired-for voltage : \_\_\_\_\_  
 Motor rating, hp : \_\_\_\_\_ Service factor : \_\_\_\_\_  
 Synchronous speed, rpm : \_\_\_\_\_ Insulation class : \_\_\_\_\_  
 Enclosure type : \_\_\_\_\_ Rewound, Y/N : \_\_\_\_\_  
 Amps\* : \_\_\_\_\_ \* - at full load operating conditions.

### Fan Motor Details

Manufacturer : \_\_\_\_\_ Speed,\* rpm : \_\_\_\_\_  
 Model : \_\_\_\_\_ Power factor,\* % : \_\_\_\_\_  
 Serial no. : \_\_\_\_\_ Efficiency,\* % : \_\_\_\_\_  
 Frame size : \_\_\_\_\_ Voltage rating : \_\_\_\_\_  
 Motor type : \_\_\_\_\_ Wired-for voltage : \_\_\_\_\_  
 Motor rating, hp : \_\_\_\_\_ Service factor : \_\_\_\_\_  
 Synchronous speed, rpm : \_\_\_\_\_ Insulation class : \_\_\_\_\_  
 Enclosure type : \_\_\_\_\_ Rewound, Y/N : \_\_\_\_\_  
 Amps\* : \_\_\_\_\_ \* - at full load operating conditions.

### Performance Details

<i>Part Load Details</i>	<i>Centrifugal Specifics</i>
Proportional modulating pressure range, psi : _____	Design inlet temp., °F : _____
# unload steps : _____	Design inlet pressure, psia : _____
Minimum unloaded sump pressure, psig : _____	Surge airflow @ design conditions, acfm : _____
Blowdown time, sec. : _____	Max. full load (surge) pressure, psig : _____
Unload point (% of comp. Capacity) : _____	Capacity @ max. full load pressure, acfm : _____
Fully modulated power, theoretical (% of full load power) : _____	Min. full load (stonewall) pressure, psig : _____
Fully unloaded power (% of full load power) : _____	Capacity @ min. full load pressure, acfm : _____



## Data Input Form Profile Order

AIRMaster+

Facility : \_\_\_\_\_  
 System : \_\_\_\_\_  
 Daytype : \_\_\_\_\_

### Sequencing or Cascading Set Point Order

Compressor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Compressor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

For each hour, enter cascading set point order for modulating-only compressors, or sequence order for compressors with unloading controls or which are controlled by an automatic sequencer. Start by entering a 1 in the lead compressor position and continue consecutively. Enter zeros for compressors turned off during applicable hours.



### Data Input Form

AIRMaster+

### Profile Data: Power Measurement

Facility : \_\_\_\_\_  
 System : \_\_\_\_\_  
 Daytype : \_\_\_\_\_

### Profile Data Measurements

Compressor	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	kW																								
2	kW																								
3	kW																								
4	kW																								
5	kW																								



### Data Input Form

AIRMaster+

#### Profile Data: Airflow Measurement, %Capacity

Facility : \_\_\_\_\_  
 System : \_\_\_\_\_  
 Daytype : \_\_\_\_\_

#### Profile Data Measurements

Compressor	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	%Cap																								
2	%Cap																								
3	%Cap																								
4	%Cap																								
5	%Cap																								



### Data Input Form

AIRMaster+

#### Profile Data: Airflow Measurement, acfm

Facility : \_\_\_\_\_

System : \_\_\_\_\_

Daytype : \_\_\_\_\_

#### Profile Data Measurements

Compressor	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	acfm																									
2	acfm																									
3	acfm																									
4	acfm																									
5	acfm																									





### Data Input Form

AIRMaster+

#### Profile Data: Cycle Time Measurement, sec.

Facility : \_\_\_\_\_

System : \_\_\_\_\_

Daytype : \_\_\_\_\_

#### Profile Data Measurements

Compressor	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	On																								
	Off																								
2	On																								
	Off																								
3	On																								
	Off																								
4	On																								
	Off																								
5	On																								
	Off																								



### Data Input Form

AIRMaster+

### Profile Data: Volts/Amps Measurement

Facility : \_\_\_\_\_

System : \_\_\_\_\_

Daytype : \_\_\_\_\_

### Profile Data Measurements

Compressor	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Volts																								
	Amps																								
2	Volts																								
	Amps																								
3	Volts																								
	Amps																								
4	Volts																								
	Amps																								
5	Volts																								
	Amps																								



## Appendix B

# Data Input Forms: System Enhancements

Use the following forms to record *proposed* energy efficiency measure information for AIRMaster<sup>+</sup>. Access the Data Input Forms on the Main Menu window; open the System Enhancements menu and click Print Data Input Forms. You can preview or print any of the following Data Input Forms:

- ◆ **EEM Reduce Air Leaks** p. 288
- ◆ **EEM Improve End Use Efficiency** p. 289
- ◆ **EEM Reduce System Air Pressure** p. 290
- ◆ **EEM Use Unloading Controls** p. 291
- ◆ **EEM Adjust Cascading Set Points** p. 292
- ◆ **EEM Use Automatic Sequencer** p. 293
- ◆ **EEM Reduce Run Time** p. 294
- ◆ **EEM Add Primary Receiver Volume** p. 295



### Data Input Form

AIRMaster+

### EEM: Reduce Air Leaks

Facility : \_\_\_\_\_  
 System : \_\_\_\_\_  
 Description : \_\_\_\_\_  
 Measure cost, \$ : \_\_\_\_\_

#### Compressor Operations to Feed Leaks

Compressor	Power, kW	Airflow, % Cap.	Airflow, acfm	Volts	Amps	Cycle Time On, sec.	Cycle Time Off, sec.

Make one measurement for each compressor: either Power; Airflow, % Cap; Airflow, acfm; Voltage and Amperage; or Cycle Time On/Off.

#### Leak Airflow Values

	Airflow, acfm	% Leak Load Total
Reduce leaks by		

Choose one method of describing leak reduction: either Airflow, acfm; or % Leak Load Total.



## Data Input Form

AIRMaster+

### EEM: Improve End Use Efficiency

Facility : \_\_\_\_\_

System : \_\_\_\_\_

Description : \_\_\_\_\_

Measure cost, \$ : \_\_\_\_\_

Airflow Reduction Type, Fixed/Variable : \_\_\_\_\_

Average Airflow Reduction, acfm : \_\_\_\_\_

Demand of Substitute Tool, kW : \_\_\_\_\_

Daytype	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

For fixed airflow reductions, mark hours in use. For variable airflow reductions, enter hourly reduction.



## Data Input Form

AIRMaster+

### EEM: Reduce System Air Pressure

Facility : \_\_\_\_\_  
System : \_\_\_\_\_  
Description : \_\_\_\_\_  
Measure cost, \$ : \_\_\_\_\_  
Average system pressure reduction, psi : \_\_\_\_\_  
Recommended reduction, psi : \_\_\_\_\_



## Data Input Form

AIRMaster+

### EEM: Use Unloading Controls

Facility : \_\_\_\_\_  
 System : \_\_\_\_\_  
 Description : \_\_\_\_\_  
 Measure cost, \$ : \_\_\_\_\_

#### Proposed Compressor Operations

Compressor Name : \_\_\_\_\_  
 Has Unloading Controls, Y/N : \_\_\_\_\_  
 Shutdown Timer, Y/N : \_\_\_\_\_  
 Control Type : \_\_\_\_\_  
 Unload Point, %C : \_\_\_\_\_

Performance Point	Discharge Pressure, psig	Airflow, acfm	Power, kW
Full Load			
Max Full Flow			
Unload Point (or surge point for centrifugal)			
No Load (fully modulated or unloaded)			

Compressor Name : \_\_\_\_\_  
 Has Unloading Controls, Y/N : \_\_\_\_\_  
 Shutdown Timer, Y/N : \_\_\_\_\_  
 Control Type : \_\_\_\_\_  
 Unload Point, %C : \_\_\_\_\_

Performance Point	Discharge Pressure, psig	Airflow, acfm	Power, kW
Full Load			
Max Full Flow			
Unload Point (or surge point for centrifugal)			
No Load (fully modulated or unloaded)			

Compressor Name : \_\_\_\_\_  
 Has Unloading Controls, Y/N : \_\_\_\_\_  
 Shutdown Timer, Y/N : \_\_\_\_\_  
 Control Type : \_\_\_\_\_  
 Unload Point, %C : \_\_\_\_\_

Performance Point	Discharge Pressure, psig	Airflow, acfm	Power, kW
Full Load			
Max Full Flow			
Unload Point (or surge point for centrifugal)			
No Load (fully modulated or unloaded)			





### Data Input Form

AIRMaster+

### EEM: Adjust Cascading Set Points

Facility : \_\_\_\_\_  
System : \_\_\_\_\_  
Description : \_\_\_\_\_  
Measure cost, \$ : \_\_\_\_\_

#### Proposed Pressure Set Points

Position	Compressor	Cut-In Pressure, psig	Cut-Out Pressure, psig
Lead			
2			
3			
4			
5			



### Data Input Form

AIRMaster+

### EEM: Use Automatic Sequencer

Facility : \_\_\_\_\_  
 System : \_\_\_\_\_  
 Description : \_\_\_\_\_  
 Measure cost, \$ : \_\_\_\_\_

#### Proposed Sequencing Options

Cascading Sequencing Data

Target Sequencing Data

Position	Full Load or Cut-In Pressure, psig	Max. Full Flow or Cut-Out Pressure, psig
Lead		
2		
3		
4		

Target Pressure, psig : \_\_\_\_\_  
 Variance (+/-), psi : \_\_\_\_\_

#### Proposed Sequencing Data

Daytype \_\_\_\_\_

Compressor	Shut down Timer, Y/N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Daytype \_\_\_\_\_

Compressor	Shut down Timer, Y/N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24



### Data Input Form

AIRMas ter +

### EEM: Reduce Run Time

Facility : \_\_\_\_\_  
 System : \_\_\_\_\_  
 Description : \_\_\_\_\_  
 Measure cost, \$ : \_\_\_\_\_

#### Proposed Run Time Data

Daytype \_\_\_\_\_

Compressor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	

Daytype \_\_\_\_\_

Compressor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	

Daytype \_\_\_\_\_

Compressor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	



### Data Input Form

AIRMaster+

### EEM: Add Primary Receiver Volume

Facility : \_\_\_\_\_  
System : \_\_\_\_\_  
Description : \_\_\_\_\_  
Measure cost, \$ : \_\_\_\_\_

\_\_\_\_\_ cubic ft.      gallons  
Increased volume      \_\_\_\_\_

Enter one value: either cubic ft., or gallons.

## Appendix C

# Artificial Demand

Artificial demand is defined as the excess air required by a system's unregulated uses because the system is being operated at a pressure in excess of production's true requirements. Higher operating pressures affect unregulated end uses and leaks, so take care not to calculate artificial demand based on total system demand.

AIRMaster<sup>+</sup> accounts for artificial demand by correcting system airflow requirements for system pressure adjustments. For example, if system pressure is lowered in the Reduce System Air Pressure EEM, AIRMaster<sup>+</sup> will adjust hourly airflow requirements accordingly. Similar adjustments in artificial demand are calculated in the Use Unloading Controls, Adjust Cascading Set Points, and Use Automatic Sequencer EEMs. Airflow adjustments are made as follows:

$$Q_c = Q_e \times (P_p + 14.7\text{psia}) / (P_e + 14.7\text{psia})$$

where:

$Q_c$  = corrected air flow requirement, in acfm

$Q_e$  = existing air flow requirement, in acfm

$P_p$  = proposed average system pressure, in psi gauge

$P_e$  = existing average system pressure, in psi gauge

Suppose system pressure of an airflow requirement of 100 acfm rated at 100 psig is lowered to an average pressure of 90 psig. Artificial demand would be lowered, resulting in a new airflow requirement of 91.3 acfm. Not only will compressor power decrease, but airflow needs will be less as a result of lowering the system pressure. It is important to note that AIRMaster<sup>+</sup> assumes that all end uses are unregulated, and therefore corrects total system airflow requirements for each hour.<sup>1</sup>

<sup>1</sup> Compressed Air Challenge, Advanced Management of Compressed Air Systems, July 2000.

## Appendix D

# Pipe Size and Flow

Pressure drop through piping is caused by the friction of the air mass flowing on the side walls of the pipe.

- Pressure drop is a function of the volume or quantity of air flow.
- *The larger diameter the pipe, the smaller the pressure drop.*
- *The longer the pipe, the greater the pressure drop.*
- *Other important factors include:*
  - *Initial air pressure*
  - *The type of pipe*
  - *The number of valves, couplings, and bends in the system*

Air pressure loss due to friction is usually expressed in psi per feet of pipe with a given inlet pressure.

Loss of air pressure due to friction, as a function of cfm, pipe inside diameter, pipe length, and initial pressure can be found in the [Compressed Air and Gas Institute Handbook](#). An example is shown below. Figures show pressure drop in psi.

cfm free air	cfm @ 100 psig	2" ID velocity-fps/ press drop-psi	3" ID velocity-fps/ press drop-psi	4" ID velocity-fps/ press drop-psi
500	64.08	48.9/19.2	21.7/2.34	12.2/1.09
600	76.89	58.7/27.6	26.1/3.36	14.6/1.56
700	89.74	68.5/37.7	30.4/4.55	17.1/2.13

$$V = \text{cfm} \times 14.7 / [60 \times a \times (p_2 + 14.7)]$$

where: cfm is cubic feet per minute of free air

a = cross-sectional area of pipe bore - sq. ft.

p<sub>2</sub> = gauge pressure in pipe

Pressure drop - psi for 1000-ft of pipe; 100 psig initial pressure.

Losses are proportional to pipe length.

Pressure drop increases as the square of the rate of flow. Doubling the flow rate means four times the pressure drop through the same piping. When the compressor discharge pressure falls due to increasing demand, another compressor will be required to come on line. Initially the pressure at the point(s) of use will increase but as the rate of demand increases, so also will the pressure drop in the piping system. Running another compressor, or adding a pressure/flow controller, will not cure an inadequately sized distribution piping system.<sup>2</sup>

<sup>2</sup> Compressed Air Challenge, [Advanced Management of Compressed Air Systems](#), July 2000.

## Appendix E

# Variable Speed Drives

Historically, the use of variable speed drives (VSDs) for industrial air compressors has been rare. One of the primary reasons was that the high initial cost of a VSD could not justify the efficiency gain over other control schemes. Cost is no longer a major issue, as VSDs have decreased in price. VSDs may gain acceptance in compressor applications as they become more reliable and more efficient at full load.

Variable speed control is gaining acceptance for rotary screw compressors. In a positive displacement rotary screw compressor, the displacement is directly proportional to the rotational speed of the input shaft of the air end. However, it is important to note that with constant discharge pressure, if efficiency remained constant over the speed range, the input torque requirement would also remain constant, unlike the requirement of dynamic compressors, fans or pumps. Hence, outlet capacity and horsepower would be completely proportional. The actual efficiency also may fall at lower speeds, requiring an increase in torque.

However, in a rotary screw compressor, there is an optimum rotor tip speed corresponding to the maximum efficiency. If the full capacity speed is above the optimum speed, full load efficiency will suffer and required horsepower will increase, but efficiency at lower capacities will benefit. If the full capacity speed is optimum, then the efficiency at reduced speeds and capacities will suffer and torque will rise.

Electric motors and controllers currently are available to satisfy these needs, but their efficiency and power factor at reduced speeds must be taken into consideration. These include variable frequency AC motor controls or switched reluctance DC motor controls that have their own efficiency versus speed characteristics. Some variable speed drive controls can regulate the outlet capacity from 15 percent to 100 percent, and provide a “soft” start. This allows the compressor to operate below 15 percent capacity in a stop/start mode, avoiding unloaded power consumption. Variable speed drive controls can produce a very stable pressure band (+/-1.5 psi), and the power factor is usually improved when compared to other conventional solutions.

Steam turbines and engines also are variable speed drivers, but rarely are used to power industrial air compressors.

Compressors that are originally designed to use variable speed control typically benefit more from this control method than those that are retrofit.<sup>3</sup>

<sup>3</sup> Compressed Air Challenge, Advanced Management of Compressed Air Systems, July 2000.

## Appendix F

# Pressure/Flow Controllers

Flow controllers are optional system pressure controls used in conjunction with individual compressor or system controls. A flow controller does not directly control a compressor and is generally not included as a part of a compressor package. A flow controller is a device that serves to separate the supply side of a compressor system from the demand side. This may require compressors to be operated at an elevated pressure and therefore, increased horsepower, while pressure on the demand side can be reduced to a stable level to minimize actual compressed air consumption.

Storage, sized to meet anticipated fluctuations in demand, is an essential part of the control strategy. Higher pressure supply air enters the primary storage tanks from the air compressors and is available to reliably meet fluctuation in demand at a constant lower pressure level.

A well designed and managed system needs to include some or all of the following: overall control strategy, demand control, good signal locations, compressor controls, and storage. The goal is to deliver compressed air at the lowest stable pressure to the main plant distribution system, and to support transient events as much as possible with stored higher pressure compressed air. Primary storage replacement should utilize the minimum compressor horsepower to restore the primary pressure to the required level.

Each compressed air system differs in supply, distribution and demand aspects that require proper evaluation of the benefits to the system of a flow/pressure controller. Additional primary and/or secondary air receivers may also address intermittent loads, which can affect system pressure and reliability, and may allow operating the compressor at the lowest possible discharge pressure and input power. The following should be considered:

- The primary function of a pressure/flow controller in a compressed air system is to stabilize pressure in the system.
- As demand changes in a compressed air system, so too will pressure.
- In a facility that is supplied by one air compressor, the change in pressure will occur relative to the control bandwidth of that air compressor. For example, if a single rotary screw air compressor with modulation control is the compressor in use, the compressor will progressively open its inlet to supply an increase in compressed air consumption. This modulation control, typically having a span of 3-10 psi, will deliver the least amount of air at the highest pressure and the most amount of air at the lowest pressure in its span.



- This 3-10 psi swing in system pressure may be undesirable to some facilities, especially those facilities that require very stable pressure for their instrumentation and processes.
- In a system that is supplied by more than one compressor, the various control bandwidths will overlap and cascade, and can magnify the variance in pressure.
- Pressure/flow controllers can stabilize plant pressure within tighter tolerances than compressor controls can. Typically, the set point pressure is held within  $\pm 1\%$  and the pressure delivered to the plant will not change regardless of the number of compressors that are on-line.
- Pressure/flow controllers require some knowledge of the system into which they are installed.
- Simply counting the total capacity of air compressors will not ensure a successful installation.
- Pressure/flow controllers respond very quickly to demand events in a compressed air system. That is why they are able to keep pressure stable.
- Some demand events can be larger in their *rate of flow* than all of the compressor capacities combined.
- Some demand events can change demand too rapidly for standard controls to react.
- These end-uses must be taken into consideration when sizing a pressure/flow controller or variations in pressure will still occur because of the inability to respond to system demand events.
- Some demand events are best serviced from local storage to isolate their influence from the system.
- Most events can be supplied from central storage located upstream of the pressure/flow controller faster than compressor controls can respond, and often will avoid the need to start a compressor if the storage is sized properly and the compressor controls are set up correctly.
- Pressure/flow controllers will not resolve a problem of inadequately sized piping, although distribution piping is rarely a significant cause of pressure problems in a compressed air system.<sup>4</sup>

<sup>4</sup> Compressed Air Challenge, Advanced Management of Compressed Air Systems, July 2000.

# Glossary of Terms

## **%C**

Abbreviation for “percentage of compressor capacity”; airflow for a single compressor expressed as a percentage of the maximum airflow deliverable by that compressor.

## **%C<sub>s</sub>**

Abbreviation for “percentage of system capacity”; airflow of the compressed air system expressed as a percentage of the maximum airflow deliverable by that compressed air system.

## **%P**

Abbreviation for “percentage of full load power”; electrical power for a single compressor expressed as a percentage of the maximum power delivered by that compressor at full load.

## **%P<sub>s</sub>**

Abbreviation for “percentage of system full load power”; electrical power of the compressed air system expressed as a percentage of the maximum power delivered by that system at full load.

## **acfm**

Actual cubic feet per minute. This is the amount of air at atmospheric conditions that actually leaves the compressor discharge.

## **action**

See “maintenance action”

## **actual conditions**

Measured air conditions (air pressure, temperature, and humidity) at the air compressor inlet or discharge, as opposed to standard conditions.

## **adjust cascading set points**

See “cascading set points”

## **after-cooling**

The cooling system for an air compressor: air-cooled or water-cooled.

**air storage capacity**

The volume of air that the compressed air system can store, including receivers and distribution pipes.

**air-cooled**

One of two types of cooling systems (after-cooling) for air compressors.

**airflow**

Air delivered by compressors or used by devices.

**airflow capacity**

The maximum airflow delivery capability of an air compressor at rated inlet and discharge conditions.

**airflow control strategy**

How airflow delivered by a compressor is controlled or modulated. Strategies include: modulation, flow/no flow, and low-unload.

**airflow profile**

Airflow distribution over a specified period of time.

**airflow reduction**

In AIRMaster<sup>+</sup>, a specific decrease in airflow at the point of end use, caused by an end use improvement like adding an efficient nozzle. The two types of airflow reductions are fixed and variable.

**airflow requirement**

See “required airflow”

**ambient temperature**

The air temperature adjacent to the air compressor inlet.

**ampere**

The unit of measurement for electrical current, or how much electricity flows through a conductor. Calculated by dividing watts by volts. Ampere is abbreviated A or amp(s).

**annual operating schedule**

A set of daytypes with each daytype having a number of annual operating days assigned to it.

**artificial demand**

See Appendix C, “Artificial Demand”

**ASME**

American Society of Mechanical Engineers.

**atmospheric pressure**

In AIRMaster<sup>+</sup>, the average barometric pressure at the location of the air compressor inlet.

**automatic sequencer**

A device used to bring air compressors on line according to a programmed schedule. Different than an automatic shutdown timer.

**automatic shutdown timer**

A device that turns off a compressor after it has operated at no load for a specified length of time. This is different than on-off control, which turns off an air compressor when the full load discharge pressure is reached.

**available airflow**

The total compressed air system airflow capacity.

**avg airflow**

The average airflow provided by or required of an air compressor or compressed air system. May be measured as a percentage of system capacity (%Cs) or in actual cubic feet per minute (acfm).

**base year**

In a project analysis, the year in which the analysis begins.

**baseline**

Compressor or system conditions before changes are made.

**benefit-to-cost ratio**

The present worth of all project revenues or benefits divided by the present worth of all project costs.

**blowdown time**

The number of seconds required for a compressor to completely unload or to reach its fully unloaded power, or the number of seconds required for the sump pressure to decrease from the cut-out (unloading) pressure to the minimum unloaded sump pressure. This only applies to lubricant-injected rotary screw compressors with load/unload controls. Distinct from “drain-down time.”

**CAGI**

Compressed Air and Gas Institute.

**capacity**

Maximum, or full load, airflow delivered by a compressor.

**capacity at maximum full-load (surge) pressure**

Full load airflow for a centrifugal compressor when operating the compressor at its maximum stable discharge pressure.

**capacity at minimum full-load (stonewall) pressure**

Maximum airflow delivery capability of a centrifugal compressor. Reduction of discharge pressure will not increase airflow since the air has reached sonic speed.

**cascade**

One of two types of sequencing; the system has an automatic sequencer and the compressors are brought on line based upon programmed cut-in and cut-out pressures. Distinct from “cascading set points.”

**cascading set points**

The cut-in and cut-out pressures ( $P_{max}$  and  $P_{min}$  settings or pressure ranges) that determine the order in which compressors are brought on line, in a system with modulating-only compressors or compressors that are not controlled by an automatic sequencer. Once cascading set point order is established, it remains constant throughout the operating schedule. Distinct from “cascaded” or “cascading,” which refer to a sequenced system.

**centrifugal**

See “multiple stage centrifugal”

**compressor capacity deration**

The calculated volumetric efficiency deration by which the compressor capacity should be adjusted to account for the effects of elevation.

**compressor performance profile**

A graph that displays how power is related to airflow for a single air compressor. Created using performance point power measurements and control strategy.

**compressor type**

A general description of the air compressor. The compressor type options in AIRMaster<sup>+</sup> are: single stage lubricant-injected rotary screw, two stage lubricant-injected rotary screw, two stage lubricant-free rotary screw, single stage reciprocating, two stage reciprocating, and centrifugal.

**control range**

The operating pressure range for the air compressor, determined by the unloading controls.

**control type**

A general description of the air compressor's unloading controls. The control type options in AIRMaster<sup>+</sup> are: inlet modulation without unloading, inlet modulation with unloading, variable displacement with unloading, load/unload, multi-step unloading, on/off, inlet butterfly modulation with blowoff, inlet butterfly modulation with unloading, inlet guide vane modulation with blowoff, inlet guide vane modulation with unloading, and proprietary. Each type of compressor can only have certain types of unloading controls.

**cut-in pressure**

The pressure at which the air compressor begins to deliver air; at this point, the compressor may reload or turn on, and is delivering full flow.

**cut-out pressure**

The pressure at which the air compressor no longer delivers air; at this point, the compressor may unload, be fully modulated, or turn off.

**cycle**

The following sequence of steps at which a compressor with unloading controls operates: 1) fully loaded, 2) modulating, 3) unloading, 4) unloaded idle, 5) reloading. Eliminate step 2 for compressors that do not modulate before unloading.

**cycle losses**

The energy lost during each compressor cycle due to air lost during sump and oil separator blow down and recovery; only applies to compressors with unloading or on-off controls. Cycle losses typically only apply to lubricant-injected rotary screw compressors (either single or two stage).

**cycle time**

The time it takes for a compressor to complete one cycle of reload, full load delivery, modulation, and unload.

**daytype**

A 24 hour period representing a typical operating day, such as a peak-season weekday or off-season weekend day.

**daytype operating schedule**

A 24 hour profile indicating which compressors are on and how they are sequenced or use cascading set points.

**demand**

The level at which electricity is delivered to users at a given point in time, usually expressed in kilowatts or megawatts. This instantaneous draw of power is usually measured as the maximum (peak) amount of power used during a specified period of time (15-minute, half-hour, hour, day, or month) during the month (or year). Demand may also be referred to as load.

**demand months**

Months in which demand charges are incurred.

**demand savings**

Difference between existing and proposed peak power requirements.

**deration**

A factor used to adjust the capacity of a positive displacement compressor operating at an elevation higher than rated.

**design inlet pressure**

The inlet pressure for which the air compressor is designed, which is also the design pressure under which the air compressor is rated.

**design inlet temperature**

The inlet temperature for which the air compressor is designed, which is also the design temperature under which the air compressor is rated.

**discharge pressure**

See “full load discharge pressure”

**drain-down time**

The number of seconds it takes the compressed air *system* to decrease from the maximum to the minimum pressure when the air compressor(s) is *unloaded or turned off*. Distinct from “blowdown time.”

**EEM**

Abbreviation for energy efficiency measure. A specific change to a compressed air system that results in improved efficiency and other systems benefits as well (for example, increased equipment life, reliability, and increased airflow). The eight EEMs that can be applied in AIRMaster<sup>+</sup> are: Reduce Air Leaks, Improve End Use Efficiency, Reduce System Air Pressure, Use Unloading Controls, Adjust Cascading Set Points, Use Automatic Sequencer, Reduce Run Time, and Add Primary Receiver Volume.

**EEM scenario**

See “scenario”

**efficiency**

The mechanical efficiency of a motor, defined as ideal kW divided by actual kW to drive the motor.

**enclosure type**

In AIRMaster<sup>+</sup>, the type of enclosure around an air compressor’s drive motor or fan motor. The four enclosure types are open dripproof (ODP), totally enclosed fan-

cooled (TEFC), totally enclosed non-ventilated (TENV), and totally enclosed blower-cooled (TEBC).

**end use**

A tool or piece of equipment (including ancillary equipment and tasks) that can use compressed air. Even a desiccant (air dryer), which treats the air, would be an end use.

**end use improvement**

A conservation measure that causes an airflow reduction (a specific decrease in airflow at the point of end use).

**energy**

In AIRMaster<sup>+</sup>, electricity or electricity usage. Usually measured in kilowatt-hours.

**energy use**

In AIRMaster<sup>+</sup>, electricity usage measured in kilowatt-hours.

**escalation rate table**

In AIRMaster<sup>+</sup>, a table of yearly escalation rates that operates as a series of estimated inflation rates for fuel, energy, or demand prices in a life cycle cost analysis.

**facility**

In AIRMaster<sup>+</sup>, a company site that has one or more compressed air systems. Each system consists of one or more air compressors.

**fixed airflow reduction**

A constant decrease in airflow at the point of end use, caused by an end use improvement, applied during specified hours and daytypes. May be due to the removal of a piece of equipment using a fixed amount of airflow, such as a blow down nozzle that used 50 acfm of compressed air.

**flow/no flow**

A method of controlling airflow delivery by causing the compressor to operate at full load or no load, which includes load-unload and on-off. Also included is multi-step control, which isn't actually a flow/no flow control strategy, but can be modeled as such. With multi-step, the compressor operates at full load, no load, and one or more intermediate points. Multi-step is found only on reciprocating compressors.

**frame size**

The frame size for an air compressor's drive motor or fan motor.

**full load (performance point)**

The operating pressure point of a compressor where capacity flow is delivered. The compressor will reload or turn on at this point, or the modulation device is wide open.



**full load discharge pressure**

The discharge pressure for which a compressor's capacity is measured.

**full load operating pressure**

See "full load pressure"

**full load or cut-in pressure**

The pressure at which the air compressor begins to deliver air; at this point, the compressor may reload or turn on, and is delivering full flow. Distinct from full load discharge pressure.

**full load power**

Power required when a compressor is at capacity (maximum airflow) and full load pressure; it is the maximum power experienced by the compressor. Full load discharge pressure must be achieved before full load power can be measured.

**full load pressure**

The rated discharge pressure, or operating pressure at which the air compressor's rated capacity is measured, as specified on the nameplate of the air compressor. Same as "full load operating pressure."

**full load shaft power**

Power required at the air compressor shaft when operating at full speed with a fully open inlet and discharge delivering maximum airflow.

**fully modulated power, % of full load power**

The power required when the air compressor is fully modulated and delivering no air (expressed as a percentage of full-load power), if it is a lubricant-injected air compressor with modulation controls.

Often, a manufacturer will provide the unload point's pressure and percent full load power, but not exactly the value needed for the fully modulated power, % of full load power (%Pfm). For example, a compressor may unload at 60% of capacity and use 88% of full load power. The required value may be calculated as follows:

$$\%P_{fm} = (\%P_{ul} - (\%C_{ul})^n) / (1 - (\%C_{ul})^n)$$

where: %Pfm = fully modulated power, % full load power  
 %Pul = power at the unload point, % full load power  
 %Cul = unload point, %capacity  
 n = 1 if modulating compressor, 2 if variable displacement

For a modulating compressor that unloads at 60% of capacity and uses 88% of full load power, %Pfm is calculated as follows:

$$\%P_{fm} = (0.88 - (0.60)^1) / (1 - (0.60)^1) = 70\%$$

**fully unloaded power, % of full load power**

The power required when the lubricant-injected rotary screw air compressor is unloaded and completely blown down, expressed as a percentage of full-load power.

**horsepower rating**

The manufacturer's suggested drive motor requirement for the air compressor. Distinct from "motor rating."

**in service**

Description for an air compressor that is used on a regular basis, as opposed to an air compressor that is in storage. Air compressors with in-service status appear in the Profile and Efficiency Measures modules of AIRMaster<sup>+</sup>.

**inlet**

The part of the air compressor which draws in air from the atmosphere.

**inlet butterfly modulation with blowoff**

An air compressor control type. A part load control used by centrifugal compressors. As airflow requirements decrease, an inlet butterfly throttle closes to reduce airflow through the compressor. This continues until the compressor reaches a point of airflow instability (surge) at which time a portion of the discharge air is allowed to blow off to the atmosphere or is routed back to the inlet of the compressor.

**inlet butterfly modulation with unloading**

An air compressor control type. A part load control used by centrifugal compressors. As airflow requirements decrease, an inlet butterfly throttle closes to reduce airflow through the compressor. This continues until the compressor reaches a point of airflow instability (surge) at which the compressor is unloaded. When system pressure has reached a specified minimum, the compressor reloads.

**inlet guide vane modulation with blowoff**

An air compressor control type. A part load control used by centrifugal compressors. As airflow requirements decrease, a set of inlet guide vanes close to reduce airflow through the compressor. This continues until the compressor reaches a point of airflow instability (surge) at which time a portion of the discharge air is allowed to blow off to the atmosphere or routed back to the inlet of the compressor.

**inlet guide vane modulation with unloading**

An air compressor control type. A part load control used by centrifugal compressors. As airflow requirements decrease, a set of inlet guide vanes close to reduce airflow through the compressor. This continues until the compressor reaches a point of airflow instability (surge) at which time the compressor is unloaded. When system pressure has reached a specified minimum, the compressor reloads.

**inlet modulation with unloading**

An air compressor control type. A method of reducing airflow delivery by restricting inlet air to the compressor to a specified minimum at which time the compressor is

unloaded. During the unloaded period, the compressor idles and delivers no air until system pressure reaches a specified minimum when the compressor reloads.

### **inlet modulation without unloading**

An air compressor control type. A method of reducing airflow delivery by creating a partial vacuum at the compressor inlet. This may be achieved by closing a butterfly-style throttle or a slide valve.

### **insulation class**

The insulation class for the motor's windings: B, F, or H.

### **integral pressure gauge**

A pressure gauge that is part of a piece of equipment.

### **kilowatt**

Unit of power (energy demand), abbreviated kW.

### **Kilowatt-hour**

Unit of energy usage, abbreviated kWh. One kilowatt of electricity supplied for one hour. The most commonly used unit of measure for electricity usage, measuring the amount of electricity consumed over time.

### **kW**

Unit of power (energy demand); abbreviation for kilowatt(s).

### **kWh**

Unit of energy usage; abbreviation for kilowatt-hour(s). One kilowatt of electricity supplied for one hour. The most commonly used unit of measure for electricity usage, measuring the amount of electricity consumed over time.

### **leak**

A loss of compressed air through either the distribution system or an end use, caused by a worn, damaged, defective, or improperly operated or installed part. Leaks are unintended losses of compressed air to ambient conditions and do not benefit production or plant operation.

### **leak airflow**

Airflow used to support plant air leaks.

### **leak airflow as a percentage of peak plant airflow**

Leak airflow divided by peak plant airflow, expressed as a percentage of system capacity.

### **load**

Electrical demand. See "demand"

**load factor**

The average air compressor drive motor load divided by the nameplate full-load rating.

**load time**

Time period from when a compressor loads until it unloads.

**load/unload**

An air compressor control type. A method of controlling average airflow delivery by allowing the motor to run continuously, but unloading the compressor when a predetermined pressure is reached. The compressor reloads at a predetermined lower discharge pressure. This control type is also known as constant speed or constant run control.

**low-unload**

A method of controlling airflow delivery by combining modulation and flow/no flow strategies. Applies to rotary screw type compressors.

**maintenance action**

Specific work that has been or will be done to a facility, compressed air system, or air compressor, and is entered into AIRMaster<sup>+</sup> as a maintenance record.

**maintenance date**

The date that the maintenance action was completed.

**maximum discharge pressure**

Equal to no load discharge pressure for modulating-only compressors, or equal to pressure at which compressor unloads or turns off if equipped with unloading or on-off control.

**maximum full flow operating pressure**

See “maximum full flow or cut-out pressure”

**maximum full flow or cut-out pressure**

The maximum pressure attainable at full flow; usually the unload pressure setting for load/unload control or the maximum pressure attainable before capacity control begins.

**maximum full flow (performance point)**

An operating pressure point where the compressor will begin to modulate, unload, or turn off. The compressor may require more power than full load at this point.

**maximum full load (surge) pressure**

The maximum achievable pressure above which air compressor operation becomes unstable at design conditions.

**maximum pressure**

See “maximum full flow or cut-out pressure”

**measure cost**

All costs associated with implementing an EEM (energy efficiency measure).

**minimum discharge pressure**

Equal to full load discharge pressure for modulating-only compressors, or equal to pressure at which compressor reloads or turns on if equipped with unloading or on-off control.

**minimum full load (stonewall) pressure**

The minimum pressure below which airflow is choked in the air compressor. Decreasing pressure further will result in no increase in airflow, at design conditions.

**minimum unloaded sump pressure**

The minimum achievable sump pressure upon unloading, if it is a lubricant-injected rotary screw air compressor.

**modulation**

A method of reducing airflow delivery by causing the compressor to operate at part load. Common methods of modulation include: throttle, turn or spiral valve, or poppet valves.

**modulation-only**

Refers to a compressor with modulation control, and no unloading controls.

**motor rating**

The horsepower rating of an air compressor’s drive motor or fan motor. Distinct from “horsepower rating.”

**motor type**

The type of drive motor or fan motor in an air compressor. AIRMaster<sup>+</sup> includes seven motor type options: NEMA Design B, High-Starting Torque (NEMA Design C), Oil Well Pumpers (NEMA Design D), IEC (Metric), NEMA Design A, Two-Speed/Variable Torque, and Two-Speed/Constant Torque.

**multi-step unloading**

An air compressor control type. A variable displacement method of part load control used by reciprocating compressors. Variable displacement is achieved by unloading one or more cylinders as dictated by pressure point settings.

**multiple stage centrifugal**

A dynamic type of air compressor which raises pressure by imparting velocity energy and converting it to pressure energy. These may be two or more stage with intercooling between stages.

**Next maintenance date**

The date that the maintenance action will be due next.

**no load, fully modulated or unloaded (performance point)**

An operating pressure point where the compressor delivers no air to the system. The compressor may be fully modulated, unloaded, or off.

**no load discharge pressure**

Minimum discharge pressure when a compressor is on but delivering no air. This is equal to Pmax for modulating-only compressors.

**no load power (modulated)**

Power measured when a compressor is fully modulated and delivering no air.

**no load power (unloaded)**

Power measured when a compressor is unloaded and completely blown down. For compressors with on-off control, this value is zero.

**nominal system pressure**

The user-assumed average compressed air system operating pressure.

**O&M**

Abbreviation for Operations and Maintenance.

**ODP**

Abbreviation for “open dripproof”; a type of enclosure for an air compressor’s drive motor or fan motor.

**on-off (on/off)**

See “start/stop”

**operating days**

Days of compressed air system operation.

**operating point**

A load at which an air compressor operates to meet a requirement. An operating point has measurable power and an associated airflow.

**operating pressure**

Average system pressure.

**Pmax**

Maximum discharge pressure.

**Pmin**

Minimum discharge pressure.

**PR**

Abbreviation for pressure range.

**peak demand**

The maximum demand of an air compressor or compressed air system.

**peak demand months**

The number of months per year that the compressed air system operates during the peak demand period of the facility.

**peak plant airflow**

Peak system airflow minus leak airflow, expressed as a percentage of system capacity.

**peak system requirement**

The maximum hourly airflow requirement.

**percentage of compressor capacity (%C)**

Airflow for a single compressor expressed as a percentage of the maximum airflow deliverable by that compressor.

**percentage of full load power (%P)**

Electrical power for a single compressor expressed as a percentage of the maximum power delivered by that compressor at full load.

**percentage of system capacity (%C<sub>s</sub>)**

Airflow of the compressed air system expressed as a percentage of the maximum airflow deliverable by that compressed air system.

**percentage of system full load power (%P<sub>s</sub>)**

Electrical power of the compressed air system expressed as a percentage of the maximum power delivered by that system at full load.

**performance point**

A compressor operating condition where airflow and power performance is measured. Performance points include: full load, maximum full flow, unload point (or surge point for centrifugal), and no load (fully modulated or unloaded). Depending on compressor control type, measurements at some or all of these points are necessary to construct the compressor's performance profile.

**performance profile**

A graph illustrating how power is related to airflow. This is created using necessary performance points and the control strategy.

**pipe size and flow**

See Appendix D, "Pipe Size and Flow"

**planned leak**

An inefficient use of air that may be eliminated and its function be substituted with more efficient means. A planned leak may be eliminated altogether. A process that uses compressed air, but can be accomplished more efficiently by another energy source. Planned leaks are typically inefficient, wasteful uses of compressed air, but unlike standard leaks they are intended and are used for a purpose. Examples include cooling and cleaning work in process, work areas, or employees with compressed air; using inefficient nozzles; or deliberately keeping drain traps open.

**poppet valves**

A collection of valves used to modulate airflow of a rotary screw compressor. As air requirements decrease, the poppet valves open, allowing intake air to escape to atmospheric pressure through ports in the compression chamber walls, shortening the effective rotor length. The volumetric compression ratio and airflow are reduced.

**power**

Electrical power, either measured directly or calculated from current, voltage, phase factor, and power factor. Calculated power is based on:

$$\text{power} = \text{current} \times \text{voltage} \times \phi \times \text{power factor.}$$

where:

$$\text{current} = \text{current: amps}$$

$$\text{voltage} = \text{voltage: volts}$$

$$\phi = \text{phase factor: 1 for single phase, } \sqrt{3} \text{ for three phase power}$$

$$\text{power factor} = \text{cosine of the phase shift between current and voltage: \%}$$

**power factor**

The ratio of power actually consumed by the air compressor to the total apparent power supplied, usually expressed as a percentage.



**power profile**

Power distribution over a specified period of time.

**pressure**

Air pressure.

**pressure/flow controllers**

See Appendix F, “Pressure/Flow Controllers”

**pressure range**

Difference between Pmin and Pmax of a given air compressor.

**proportional modulating pressure range**

For compressors with modulation controls, it is the difference between full load and no load discharge pressures. This value is equal to the pressure range for modulating-only compressors.

Often, a manufacturer will provide the unload point’s pressure and percent full load power, but not exactly the value needed for PMPR. For example, a compressor may unload at 60% of capacity at 10 psi above the maximum full load pressure. The required value may be calculated as follows:

$$\text{PMPR} = (\text{MFFP} - \text{UP}) / (1 - \% \text{Cul})$$

where: PMPR = proportional modulating pressure range, psi  
 MFFP = maximum full flow pressure, psig  
 UP = unload point pressure, psig  
 %Cul = unload point, %capacity

For a 100 psig rated modulating compressor that unloads at 60% of capacity at 110 psig, PMPR is calculated as follows:

$$\text{PMPR} = (110 - 100) / (1 - 0.60) = 25 \text{ psi}$$

**proprietary**

An air compressor control type. A part load control which combines inlet modulation with load/unload controls. The inlet throttle closes to a specified amount at which time the compressor unloads. The compressor then operates in load/unload mode until airflow requirements increase past the unload point. The compressor then returns to modulation mode.

**psia**

A unit of measurement of absolute pressure; pounds per square inch absolute.

**psig**

A unit of measurement for pressure referenced to atmospheric pressure; pounds per square inch gauge.

**pump-up time**

The amount of time required for the air compressor(s) to increase compressed air system pressure from the minimum to the maximum.

**rated capacity**

See “rated capacity at full-load operating pressure”

**rated capacity at full-load operating pressure**

The maximum operating airflow delivered by the air compressor at full load operating pressure, as specified on the air compressor nameplate. For rotary screw compressors, measured in accordance with CAGI/ PNEUROP/PNZCPTCZ Test Code.

**relative humidity**

The average atmospheric vapor pressure at the location of the air compressor or system, divided by the atmospheric vapor pressure under saturated conditions.

**required airflow**

The airflow needed by an end use.

**reration**

A method of rerating a compressor’s capacity or the airflow requirement of an end use when operating outside of rated conditions.

**reserve air margin**

A percentage of system airflow capacity which is available in the event of an unexpected air requirement (surge). It is an extra, or safety, quantity that is not intended for use during normal plant operation. A common amount used in industry is 20% of system capacity, but may vary.

**scenario**

In AIRMaster<sup>+</sup>, an EEM conservation scenario. A proposed group of ordered energy efficiency measures applied to a compressed air system.

**scfm**

Standard cubic feet per minute. This is airflow rated at standard conditions. Standard conditions under ASME definitions are 14.7 psia, 68°F, and 36% relative humidity. Standard conditions under CAGI definitions are 14.5 psia, 68°F, and 0% relative humidity.

**sequence order**

The order in which compressors are brought “on line” (either compressor turns on or reloads to deliver air) according to a programmed automatic sequencer. For compressed air systems with modulating-only compressors or compressors that are not controlled by an automatic sequencer, see “cascading set point.”

**sequenced**

A description for a compressed air system that is controlled by an automatic sequencer. There are two types of sequenced systems: cascade, and target pressure.

**serial #**

A unique identifying number stamped on each manufactured air compressor, drive motor, and fan motor.

**service factor**

A measurement of the efficiency of an air compressor, drive motor, or fan motor. The factor or rated capacity at which a compressor can be run continuously without sustaining any damage.

**SIC**

Abbreviation for Standard Industrial Classification, a standardized set of categories for types of businesses.

**Single stage lubricant-injected rotary screw**

A type of air compressor. A positive displacement compressor that uses two intermeshing rotors in a stator housing with an inlet port at one end and a discharge port at the other. Lubricant is injected into the compression chamber during compression to lubricate the intermeshing rotors and bearings, remove heat of compression, and seal the clearances between the meshing rotors and between rotors and the stator.

**single stage reciprocating**

A type of air compressor. A positive displacement compression where air is taken into a cylinder through the inlet, compressed by a moving piston, then discharged through the discharge port. The compressor may be single or double acting.

**specific package power input at rated conditions**

A measure of air compressor efficiency: power required to deliver a fixed airflow at rated capacity and full-load operating pressure.

**speed**

In AIRMaster<sup>+</sup>, the rotational speed of the air compressor's drive motor or fan motor at full load.

**spiral valve**

A device used to modulate airflow of a rotary screw compressor. As air requirements decrease the turn valve rotates, allowing intake air to escape to atmospheric pressure through ports in the compression chamber walls, shortening the effective rotor length. The volumetric compression ratio and airflow are reduced. This is the same as a *turn valve*.

**standard conditions**

A definition of standard air conditions (air pressure, temperature, and humidity), as defined by either the Compressed Air and Gas Institute (CAGI) or the American Society of Mechanical Engineers (ASME) standard conditions method.

**start/stop**

An air compressor control type. A control method where the motor driving the compressor is turned on and off in response to a pressure signal.

**surge airflow at design conditions**

The airflow below which air compressor operation is unstable at design conditions.

**synchronous speed**

The air compressor drive motor or fan motor's synchronous or no-load speed.

**system**

In AIRMaster<sup>+</sup>, a compressed air system comprised of one or more air compressors.

**system air storage capacity**

See "air storage capacity." Distinct from "system capacity."

**system airflow requirement**

See "airflow requirement"

**system capacity**

Maximum airflow available to the entire compressed air system—the sum of all available compressors. Distinct from "system air storage capacity."

**system component**

In AIRMaster<sup>+</sup>, the general area to which a maintenance action pertains. The system components are: Accessories, Air Distribution System, Compressor, Controls, End Uses, and Safety.

**system pressure control range**

The operating pressure range for the compressed air system, determined by the unloading controls.

**system volume**

See "air storage capacity." Distinct from "system capacity."

**target pressure**

One of two types of sequencing; the system has an automatic sequencer that operates the compressors to maintain the compressed air system within a defined pressure

band. Also, the median of the target pressure band for a compressed air system operated with this type of sequencing.

**TEBC**

Abbreviation for “totally enclosed blower-cooled”; a type of enclosure for an air compressor’s drive motor or fan motor.

**TEFC**

Abbreviation for “totally enclosed fan-cooled”; a type of enclosure for an air compressor’s drive motor or fan motor.

**TENV**

Abbreviation for “totally enclosed non-ventilated”; a type of enclosure for an air compressor’s drive motor or fan motor.

**throttle**

A device used to modulate airflow of a rotary screw or reciprocating compressor. Airflow is reduced by creating a partial vacuum at the compressor inlet by closing a butterfly or slide valve.

**total airflow**

The total air delivered by all air compressors assigned to the compressed air system.

**total annual days**

The number of days each year that the compressed air system operates.

**total down days**

The number of days each year that the compressed air system does not operate.

**total package power input at rated conditions**

The total electrical power input to an air compressor under rated conditions, including drive motor, cooling fan, auxiliary motors, and controls.

**turn valve**

See spiral valve.

**two stage lubricant-free rotary screw**

A type of air compressor. A positive displacement compressor similar to the two stage lubricant-injected except that instead of using lubricant, water is used or the chambers are dry. In the case of dry chambers, tighter tolerances between rotors and stator are used. Heat of compression is removed between first and second stages.

**two stage lubricant-injected rotary screw**

A type of air compressor. A positive displacement compressor similar to the single stage lubricant-injected rotary screw compressor except it uses two sets of inter-

meshing rotors instead of one. Partial compression takes place in the first stage. Heat of compression is removed before entering the second stage where the air is compressed to its final discharge pressure.

### **two stage reciprocating**

A type of air compressor. A positive displacement compressor similar to a single stage reciprocating compressor except that compression takes place in two stages. Air is initially compressed to an intermediate pressure. Heat of compression is removed, then in a second compression the air is compressed to its final discharge pressure.

### **unload point**

Airflow at which the air compressor unloads.

### **unload point (performance point)**

The operating pressure point where a compressor unloads. For centrifugal compressors, this is the surge point. This value can range from 0 to 100 percent of capacity.

### **unload power**

Compressor power at the unload point.

### **unload steps**

Steps in the load control strategy, or discrete points at which the compressor can operate.

### **unloaded sump pressure**

The residual pressure in the lubricant sump when the air compressor is completely unloaded.

### **unloading controls**

Controls that allow a compressor to operate at no load with a substantially lower discharge pressure. Unloading controls are found on load-unload, on-off, low-unload, and multi-step airflow control strategies. Unloading controls may be a subset of part-load controls.

### **usage**

The amount of energy used over time, or power multiplied by time. Electricity usage is usually measured in kilowatt-hours. The difference between usage and demand is that demand is the maximum usage measured during a specified period of time.

### **User-assigned ID**

The user-assigned air compressor ID code.

### **utility code**

The user-assigned utility company code.

**variable airflow reduction**

A variable decrease in airflow at the point of end use, caused by an end use improvement. The airflow reduction amounts must be defined for each hour and daytype.

**variable displacement with unloading**

An air compressor control type. A method of reducing airflow delivery by progressively reducing the compressor displacement without reducing inlet pressure. This may be achieved by turn, spiral, or poppet valves. Once the displacement reaches a specified minimum, the compressor will unload. Reloading occurs when system pressure reaches a set minimum.

**variable speed drives**

See Appendix E, “Variable Speed Drives”

**volt**

The unit of measurement for electric potential, or electric force, which is the condition that causes electric energy to flow. A volt is the amount of force required to drive a steady current of one ampere through a resistance of one ohm. One thousand volts (V) equal one kilovolt (kV).

**voltage rating**

The voltage rating of the drive motor or fan motor. See “volt”

**water-cooled**

One of two types of cooling systems (after-cooling) for air compressors.

**wired-for voltage**

The actual motor operating voltage.

# Index

- Actual and standard conditions
  - to convert airflow between, 259
- Add Primary Receiver Volume EEM
  - to add, 186
  - to edit, 186
  - to view, 186
- Add Primary Receiver Volume window, 185
- Adjust Cascading Set Points EEM
  - to add, 170
  - to edit, 170
  - to view, 170
- Adjust Cascading Set Points window, 169
- Air Storage Capacity Calculator window, 261
- Air Systems report, 78
- Airflow reduction profile
  - to add graphically, 158
- AIRMaster<sup>+</sup>
  - about, 6
  - features, 7
  - history, 11
  - introducing, 5
  - overview, 8
- Altitude Correction and Re-rate Calculator window, 264
- artificial demand, 296
- Calculators
  - windows, 257
- Catalog
  - module windows and reports, 215
- Catalog air compressors
  - to add, 218
  - to search, 217
- Catalog compressor details
  - to edit, 222
  - to view, 222
- Catalog compressor information
  - to print, 234
  - to view, 234
- Catalog report, 233
- Company
  - module windows and reports, 37
- Company database
  - to add, 40
  - to select, 39
- Company information
  - to edit, 40
  - to enter, 40
  - to print, 43
  - to view, 43
- Company report, 43
- Company window, 38
- Compressor
  - module windows and reports, 81
- Compressor Catalog Detail
  - Drive Motor tab, 226
  - Fan Motor tab, 228
  - General Data tab, 224
  - Other Data tab, 230
- Compressor Catalog Detail window, 221
- Compressor Catalog window, 216
- Compressor Inventory
  - Controls tab, 89
  - Nameplate tab, 88
  - Performance tab, 91
  - Totals tab, 94
- Compressor Inventory Detail
  - Drive Motor tab, 107
  - Fan Motor tab, 109
  - General Data tab, 105
  - Other Data tab, 111
- Compressor Inventory Detail window, 102
- Compressor Inventory Query window, 98
- Compressor Inventory report, 114
- Compressor Inventory window, 82
- Compressor summary information
  - to view, 57
- Compressor Summary tab, 61
- Conservation scenario
  - to add, 140
  - to edit, 140
  - to view, 140
- Conservation scenario results
  - to view, 140
- Controls tab, 89
- Cycle time
  - to calculate, 268
- Cycle Time Calculator window, 267
- Data Entry tab, 124, 143
- Data input form
  - to preview, 18
  - to select, 18
- Data Input Form Setup window, 17
- Data Input Forms
  - Inventory, 273



- System Enhancements, 287
- Daytypes tab, 74
- Drive Motor tab, 107, 226
- EEM information
  - to print, 201
  - to view, 201
- EEM Results
  - Profile Summary tab, 194
  - to view, 192
  - Totals tab, 196
- EEM Results window, 191
- EEM savings scenario graph
  - to print, 199
  - to view, 199
- EEM Savings Scenario graph, 198
- Efficiency Measures
  - Data Entry tab, 143
  - module windows and reports, 137
  - Savings Summary tab, 145
- End Uses tab, 76
- Energy Efficiency Measure Parameters report, 200
- Energy Efficiency Measures window, 139
- Escalation rate table
  - to add, 251
  - to edit, 251
  - to view, 251
- Escalation rate table information
  - to print, 254
  - to view, 254
- Escalation Rate Table report, 254
- Escalation Rates window, 250
- Facility
  - Compressor Summary tab, 61
  - Facility Information tab, 59
  - module windows and reports, 55
  - to add, 57
- Facility information
  - to edit, 57
  - to enter, 57
  - to view, 57
- Facility Information tab, 59
- Facility records
  - to print, 63
  - to view, 63
- Facility report, 63
- Facility window, 56
- Fan Motor tab, 109, 228
- General Data tab, 105, 177, 224
- Graphic airflow reduction profile
  - to edit, 158
  - to print, 158
  - to view, 158
- Graphs
  - EEM Savings Scenario, 198
  - Performance Comparison, 189
- Performance Profile, 96
- Profile Draw, 157
- System Order, 130
- System Profile Data, 132
- Hourly Data tab, 178
- Improve End Use Efficiency EEM
  - to add, 153
  - to edit, 153
  - to view, 152
- Improve End Use Efficiency window, 151
- Inventory air compressor
  - to add, 84
  - to copy to Catalog, 85
- Inventory air compressor information
  - to edit, 83
  - to view, 83
- Inventory air compressors
  - to search, 99
- Inventory compressor details
  - to edit, 103
  - to view, 103
- Inventory compressor information
  - to print, 115
  - to view, 115
- Inventory compressor query information
  - to print, 116
  - to view, 116
- LCCA
  - to enter information for, 239
  - to run, 245
- Life Cycle
  - module windows and reports, 237
- Life cycle analysis information
  - to print, 248
  - to view, 248
- Life Cycle Analysis report, 247
- Life Cycle Analysis Results window, 244
- Life Cycle Analysis window, 238
- Life cycle cost analysis
  - to run, 245
- Life cycle information
  - to enter, 239
- Maintenance
  - module windows and reports, 203
- Maintenance History window, 208
- Maintenance information
  - to print, 213
  - to view, 213
- Maintenance record
  - to add, 205
  - to edit, 205
  - to enter, 205
  - to view, 205
- Maintenance records
  - to search, 209
- Maintenance report, 212

Maintenance window, 204  
 Nameplate tab, 88  
 Other Data tab, 111, 230  
 Performance comparison graph  
   to print, 190  
   to view, 190  
 Performance Comparison graph, 189  
 Performance profile graph  
   to print, 97  
   to view, 97  
 Performance Profile graph, 96  
 Performance tab, 91  
 pipe size and flow, 297  
 Positive displacement compressor  
   to calculate actual airflow of, 265  
 Power  
   to calculate, 270  
 Power Calculator window, 270  
 pressure/flow controllers, 299  
 Procedures  
   to add a company database, 40  
   to add a conservation scenario, 140  
   to add a facility, 57  
   to add a maintenance record, 205  
   to add a Reduce Air Leaks EEM, 148  
   to add a Reduce Run Time EEM, 181  
   to add a Reduce System Air Pressure EEM,  
     161  
   to add a system, 67  
   to add a Use Automatic Sequencer EEM, 174  
   to add a Use Unloading Controls EEM, 165  
   to add a utility, 47  
   to add a utility rate schedule, 50  
   to add an Add Primary Receiver Volume  
     EEM, 186  
   to add an Adjust Cascading Set Points EEM,  
     170  
   to add an escalation rate table, 251  
   to add an Improve End Use Efficiency EEM,  
     153  
   to add an inventory air compressor, 84  
   to add catalog air compressors, 218  
   to calculate actual airflow for a positive  
     displacement compressor, 265  
   to calculate cycle time for an unloading  
     compressor, 268  
   to calculate power, 270  
   to calculate system volume, 262  
   to convert airflow between actual and standard  
     conditions, 259  
   to copy an inventory air compressor to  
     Catalog, 85  
   to edit a conservation scenario, 140  
   to edit a graphic airflow reduction profile, 158  
   to edit a maintenance record, 205  
   to edit a Reduce Air Leaks EEM, 148  
   to edit a Reduce Run Time EEM, 181  
   to edit a Reduce System Air Pressure EEM,  
     161  
   to edit a Use Automatic Sequencer EEM, 174  
   to edit a Use Unloading Controls EEM, 165  
   to edit an Add Primary Receiver Volume  
     EEM, 186  
   to edit an Adjust Cascading Set Points EEM,  
     170  
   to edit an escalation rate table, 251  
   to edit an Improve End Use Efficiency EEM,  
     153  
   to edit catalog compressor details, 222  
   to edit company information, 40  
   to edit facility information, 57  
   to edit inventory air compressor information,  
     83  
   to edit inventory compressor details, 103  
   to edit system information, 67  
   to edit system profile data, 121  
   to edit utility information, 47  
   to edit utility rate schedule information, 50  
   to enter a maintenance record, 205  
   to enter company information, 40  
   to enter facility information, 57  
   to enter utility information, 47  
   to enter utility rate schedule information, 50  
   to graphically add an airflow reduction profile,  
     158  
   to preview a data input form, 18  
   to preview a report, 22  
   to print a graphic airflow reduction profile,  
     158  
   to print a performance comparison graph, 190  
   to print a performance profile graph, 97  
   to print a report, 19, 23  
   to print a system order graph, 131  
   to print a system profile data graph, 133  
   to print an EEM savings scenario graph, 199  
   to print catalog compressor information, 234  
   to print company information, 43  
   to print EEM information, 201  
   to print escalation rate table information, 254  
   to print facility records, 63  
   to print inventory compressor information,  
     115  
   to print inventory compressor query  
     information, 116  
   to print life cycle analysis information, 248  
   to print maintenance information, 213  
   to print system profile data, 135  
   to print system records, 79  
   to print utility and rate schedule information,  
     53  
   to run a LCCA, 245  
   to run a life cycle cost analysis, 245

- to search catalog air compressors, 217
- to search inventory air compressors, 99
- to search maintenance records, 209
- to select a company database, 39
- to select a data input form, 18
- to select a report, 22
- to view a conservation scenario, 140
- to view a graphic airflow reduction profile, 158
- to view a maintenance record, 205
- to view a performance comparison graph, 190
- to view a performance profile graph, 97
- to view a Reduce Air Leaks EEM, 148
- to view a Reduce Run Time EEM, 181
- to view a Reduce System Air Pressure EEM, 161
- to view a system order graph, 131
- to view a system profile data graph, 133
- to view a Use Automatic Sequencer EEM, 174
- to view a Use Unloading Controls EEM, 165
- to view a utility, 47
- to view a utility rate schedule, 50
- to view an Add Primary Receiver Volume EEM, 186
- to view an Adjust Cascading Set Points EEM, 170
- to view an EEM savings scenario graph, 199
- to view an escalation rate table, 251
- to view an Improve End Use Efficiency EEM, 152
- to view catalog compressor details, 222
- to view catalog compressor information, 234
- to view company information, 43
- to view compressor summary information, 57
- to view conservation scenario results, 140
- to view EEM information, 201
- to view EEM Results, 192
- to view escalation rate table information, 254
- to view facility information, 57
- to view facility records, 63
- to view inventory air compressor information, 83
- to view inventory compressor details, 103
- to view inventory compressor information, 115
- to view inventory compressor query information, 116
- to view life cycle analysis information, 248
- to view maintenance information, 213
- to view system information, 67
- to view system profile data, 121, 135
- to view system records, 79
- to view the system baseline, 192
- to view utility and rate schedule information, 53

Profile

- module windows and reports, 119
- Profile Draw graph, 157
- Profile Summary tab, 126, 194
- Reduce Air Leaks EEM
  - to add, 148
  - to edit, 148
  - to view, 148
- Reduce Air Leaks window, 147
- Reduce Run Time EEM
  - to add, 181
  - to edit, 181
  - to view, 181
- Reduce Run Time window, 180
- Reduce System Air Pressure EEM
  - to add, 161
  - to edit, 161
  - to view, 161
- Reduce System Air Pressure window, 160
- Report
  - to preview, 22
  - to print, 19, 23
  - to select, 22
- Report Setup window, 22
- Reports
  - Air Systems, 78
  - Catalog, 233
  - Company, 43
  - Compressor Inventory, 114
  - Escalation Rate Table, 254
  - Facility, 63
  - Life Cycle Analysis, 247
  - Maintenance, 212
  - System Profile, 134
  - Utility/Rate Schedule, 52
- Savings Summary tab, 145
- SCFM-ACFM Conversion Calculator window, 258
- Sequencer Data tab, 72
- shortcut keys, 32
- System
  - Daytypes tab, 74
  - End Uses tab, 76
  - module windows and reports, 65
  - Sequencer Data tab, 72
  - System Data tab, 70
    - to add, 67
- System baseline
  - to view, 192
- System Data tab, 70
- System information
  - to edit, 67
  - to view, 67
- System order graph
  - to print, 131
  - to view, 131
- System Order graph, 130

System profile data  
   to edit, 121  
   to print, 135  
   to view, 135  
   to view, 121  
 System profile data graph  
   to print, 133  
   to view, 133  
 System Profile Data graph, 132  
 System Profile report, 134  
 System Profiles  
   Data Entry tab, 124  
   Profile Summary tab, 126  
   Totals tab, 128  
 System Profiles window, 120  
 System records  
   to print, 79  
   to view, 79  
 System volume  
   to calculate, 262  
 System window, 66  
 Totals tab, 94, 128, 196  
 Use Automatic Sequencer  
   General Data tab, 177  
   Hourly Data tab, 178  
 Use Automatic Sequencer EEM  
   to add, 174  
   to edit, 174  
   to view, 174  
 Use Automatic Sequencer window, 173  
 Use Unloading Controls EEM  
   to add, 165  
   to edit, 165  
   to view, 165  
 Use Unloading Controls window, 164  
 Utility  
   module windows and reports, 45  
   to add, 47  
   to view, 47  
 Utility and rate schedule information  
   to print, 53  
   to view, 53  
 Utility information  
   to edit, 47  
   to enter, 47  
 Utility rate schedule  
   to add, 50  
   to view, 50  
 Utility rate schedule information  
   to edit, 50  
   to enter, 50  
 Utility Rate Schedules window, 49  
 Utility window, 46  
 Utility/Rate Schedule report, 52  
 variable speed drives, 298  
 Windows  
   Add Primary Receiver Volume, 185  
   Adjust Cascading Set Points, 169  
   Air Storage Capacity Calculator, 261  
   Altitude Correction and Re-rate Calculator, 264  
   Company, 38  
   Compressor Catalog, 216  
   Compressor Catalog Detail – Drive Motor, 226  
   Compressor Catalog Detail – Fan Motor, 228  
   Compressor Catalog Detail – General Data tab, 221  
   Compressor Catalog Detail – Other Data, 230  
   Compressor Inventory – Controls, 89  
   Compressor Inventory – Nameplate tab, 82  
   Compressor Inventory – Performance, 91  
   Compressor Inventory – Totals, 94  
   Compressor Inventory Detail – Drive Motor, 107  
   Compressor Inventory Detail – Fan Motor, 109  
   Compressor Inventory Detail – General Data tab, 102  
   Compressor Inventory Detail – Other Data, 111  
   Compressor Inventory Query, 98  
   Cycle Time Calculator, 267  
   Data Input Form Setup, 17  
   EEM Results – Profile Summary tab, 191  
   EEM Results – Totals, 196  
   Energy Efficiency Measures – Data Entry tab, 139  
   Energy Efficiency Measures – Savings Summary, 145  
   Escalation Rates, 250  
   Facility – Compressor Summary tab, 61  
   Facility – Facility Information tab, 56  
   Improve End Use Efficiency, 151  
   Life Cycle Analysis, 238  
   Life Cycle Analysis Results, 244  
   Maintenance, 204  
   Maintenance History, 208  
   Power Calculator, 270  
   Reduce Air Leaks, 147  
   Reduce Run Time, 180  
   Reduce System Air Pressure, 160  
   Report Setup, 22  
   SCFM-ACFM Conversion Calculator, 258  
   System – Daytypes, 74  
   System – End Uses, 76  
   System – Sequencer Data, 72  
   System – System Data tab, 66  
   System Profiles – Data Entry tab, 120  
   System Profiles – Profile Summary, 126  
   System Profiles – Totals, 128

Use Automatic Sequencer – General Data tab,  
*173*  
Use Automatic Sequencer – Hourly Data, *178*

Use Unloading Controls, *164*  
Utility, *46*  
Utility Rate Schedules, *49*