Efficiency Vermont

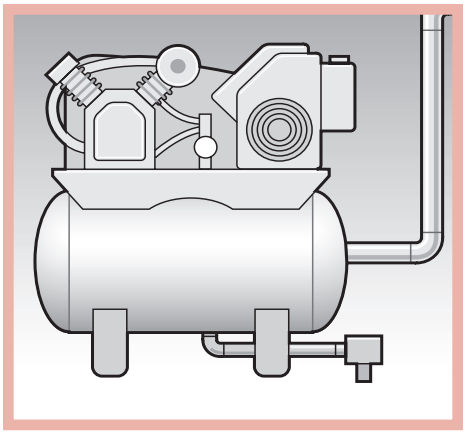
Guide to Savings

Helping Vermont businesses save energy and money

Compressed Air Systems

Efficiency Vermont

SAVE MONEY AND OPTIMIZE SYSTEM PERFORMANCE



Air compressors can account for 10% or more of the electricity use in the average industrial facility. For example, a 50-horsepower (HP) modulating compressor running 4,000 hours per year can consume almost $12,000 per year in energy. Opportunities for saving money exist in almost every compressed air system. Savings can be realized by detecting leaks, adjusting controls, and upgrading inefficient equipment, on both the supply and demand sides. In addition to saving energy and reducing energy costs, a properly working, efficient compressed air system can:

- Improve manufacturing processes, resulting in better quality control.
- Reduce plant noise thanks to less leaking air in an open blow.
- Improve overall system reliability by reducing or eliminating the need for a secondary compressor through enhanced performance and improved air usage.

Efficiency Vermont provides Vermont businesses with information and financial assistance needed to make energy-efficient choices:

- Educational brochures, technical briefs, and success stories.
- Standard rebates through an easy-to-use form.
- Information at your fingertips at **www.efficiencyvermont.com**.
- Expert technical assistance from our Customer Support team at **info@efficiencyvermont.com** or **888-921-5990**.

This guide provides detailed descriptions and valuable savings information for energy efficiency measures that can help you save energy and money.

Get Started Today

Use our **Compressed Air Systems Rebate Form** to obtain standard rebates on many of the energy-saving measures featured in this guide. Steps to cashing in on standard rebates:

1. Review the **Compressed Air Systems Rebate Form**. If you need a contractor or equipment supplier, find one at **www.efficiencyvermont.com/compressedair** or call **888-921-5990**.
2. Review the rebate and equipment options with your contractor before buying equipment.
3. Install your equipment and submit your completed rebate form to Efficiency Vermont.
4. Receive your rebate check and enjoy the lasting benefits to your business.

Custom rebates may be available for equipment not listed on our standard rebate forms. Contact Efficiency Vermont for details.

Conducting System Audits

A system audit takes a comprehensive look at the compressed air system—both supply and demand sides—to identify inefficiencies. This approach requires an experienced auditor to meter the compressors for a week or more, and conduct extensive analyses to determine the magnitude of the costs and savings of proposed improvement projects.

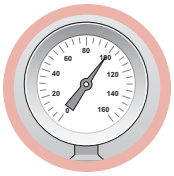
The result? A written report that will help facilities prioritize opportunities based on savings, simple payback, investment rate of return, and any other business goals or metrics critical to the facility.

- *Contact Efficiency Vermont to discuss rebates for system audits on comprehensive compressed air projects.*

Eliminating Leaks

Air leaks can significantly increase the energy demands of a compressed air system, adding up to thousands of dollars a year in excess costs. Facilities should incorporate a regular leak-detection and correction program, including:

- Listening for leaks when the facility is quiet, such as during off hours, or by using an ultrasonic leak detector.
- Estimating leaks by measuring compressed air flow or compressor power during times when no compressed air is being used in the plant, such as nights or weekends.
- Hiring a professional auditor to conduct a leak audit. They typically use an ultrasonic listening device to identify leaks and provide an estimate of the volume—and value—of the escaping air. (A leak audit can usually be completed in a day or two.)



Managing System Pressure

It's a common misconception that increasing compressor system pressure will mean more airflow and fewer problems in distribution piping. In fact, turning up the pressure can result in a reduced cubic-feet-per-minute (CFM) airflow. If you are short on air, turning up the pressure could be the wrong thing to do. Talk to an expert to determine if you are having a pressure or flow problem. Tips for managing system pressure:

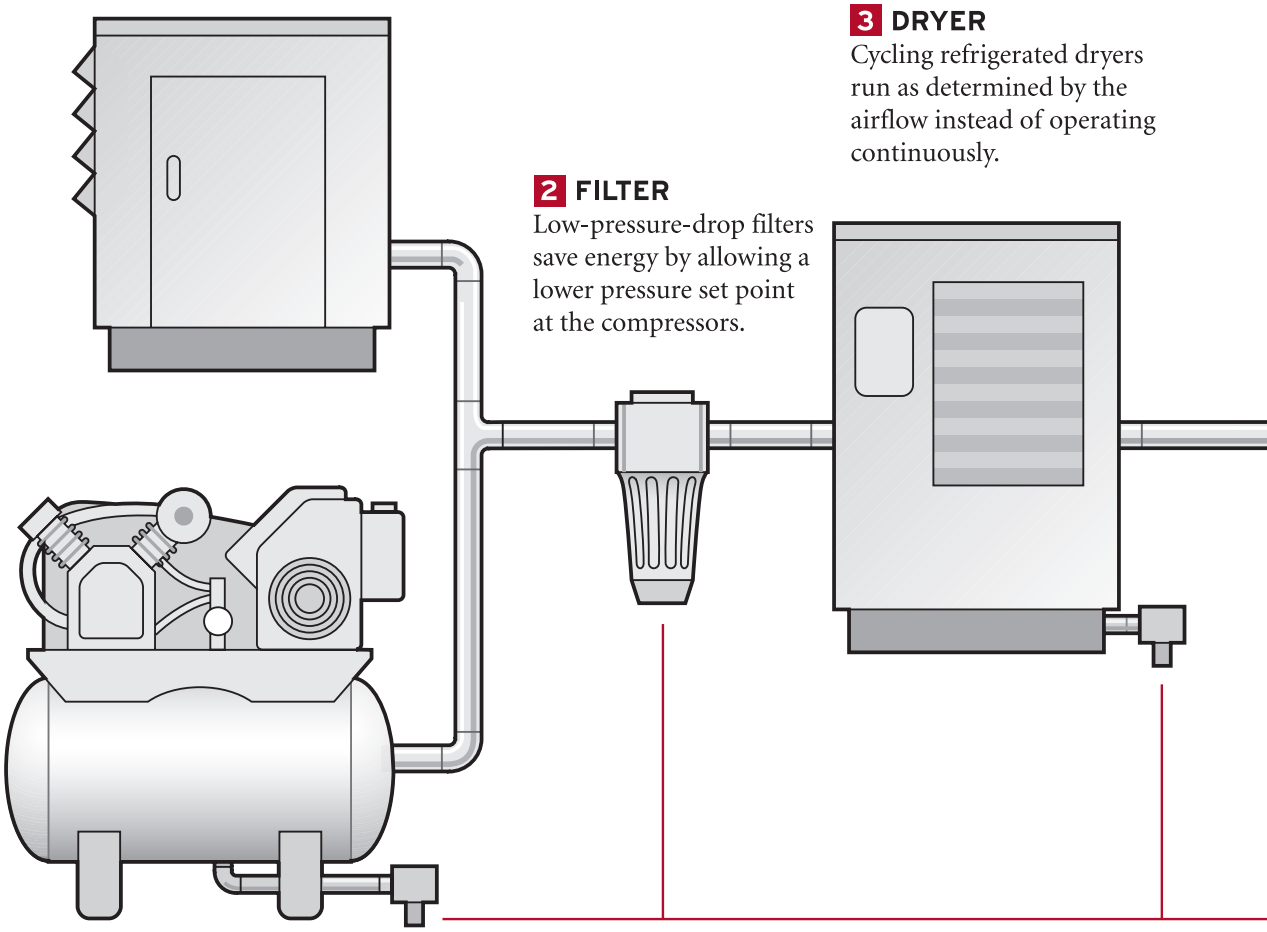
- If pressure drops and flow chokepoints occur, identify and fix their causes rather than increasing pressure or using a bigger compressor.
- By reducing pressure, you reduce the amount of air lost to leaks and from using more air than needed for other tasks; therefore reducing artificial demand.
- In general, reduce your system pressure as low as possible to maximize airflow and save energy. Turn down pressure slowly over time—one psi per day—to the lowest workable pressure that maintains plant operations.
- Other strategies to improve pressure management include minimizing sharp bends and elbows in distribution piping, using a closed-loop header layout, installing distribution piping of a sufficient diameter, installing low-pressure-drop filters (which save energy by allowing a lower pressure set point at the compressor), and maintaining filters regularly.

A TYPICAL COMPRESSED AIR SYSTEM

1 COMPRESSOR
Variable frequency drive (VFD) compressors are the most efficient option for variable loads below 90% capacity, using less energy than modulating compressors. Reciprocating compressors often come mounted on a tank (as shown on bottom).

3 DRYER
Cycling refrigerated dryers run as determined by the airflow instead of operating continuously.

2 FILTER
Low-pressure-drop filters save energy by allowing a lower pressure set point at the compressors.



TYPES OF COMPRESSED AIR SYSTEMS

- **Variable Frequency Drive (VFD) Compressors** (see page 6).
- **Load/No-Load Compressors** are usually screw type, but can also use rotary vanes. They run continuously, loading and unloading the air end to produce compressed air, or not, in response to changes in plant pressure. Unloading the compressor saves energy when no air is needed, but the unloading process results in compressed air loss. To minimize short cycling (and increase efficiency), couple the compressor with a large storage tank, or air receiver. Efficiency Vermont recommends that load/no-load compressors be combined with a storage tank that has five gallons of storage for every CFM of air produced by the compressor. Example: A 25 HP load/no-load compressor that produces 100 CFM should have a 500-gallon or larger storage tank.

SUPPLY SIDE (Compressor System)

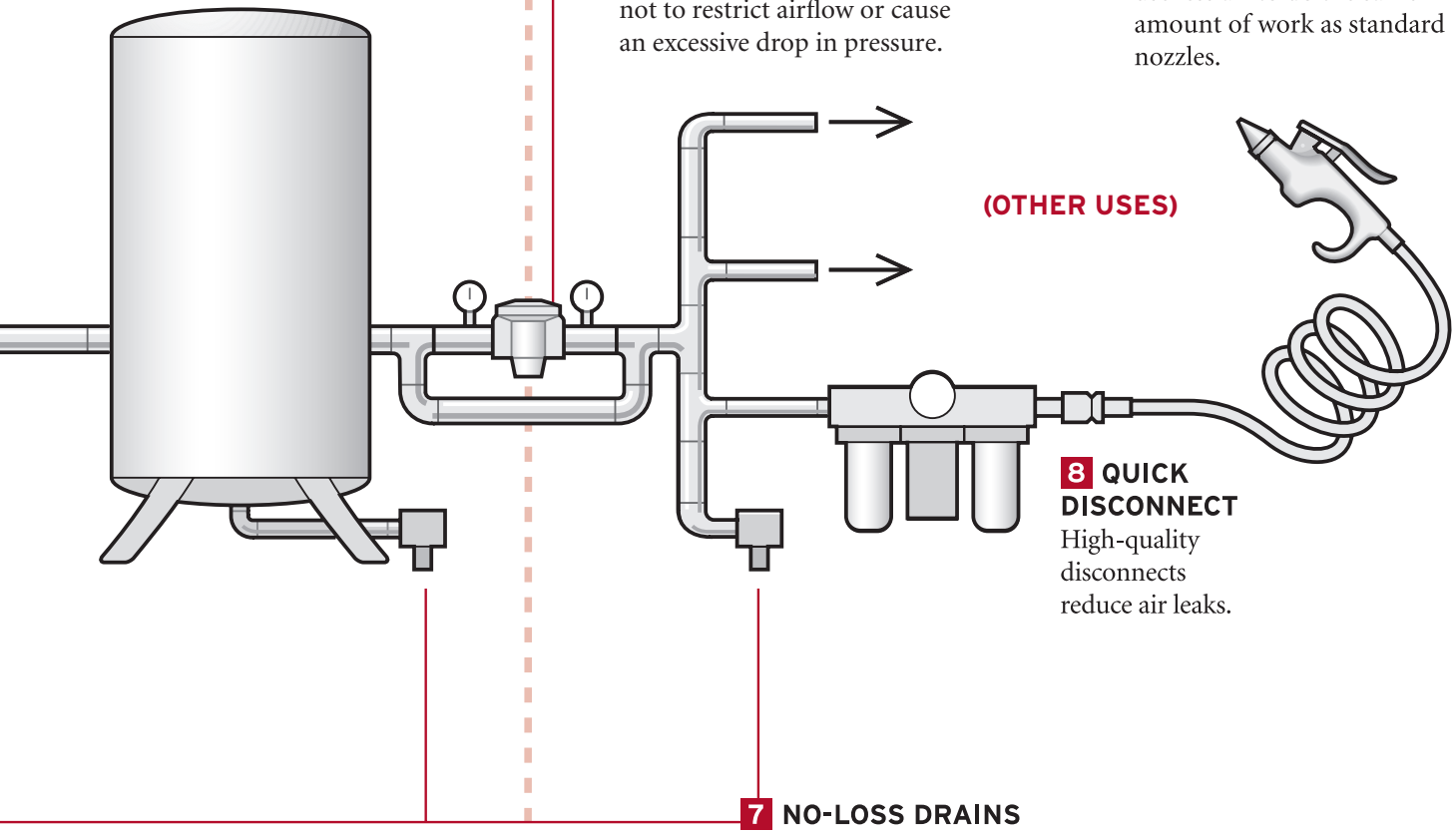
DEMAND SIDE (End Use)

4 RECEIVER/STORAGE TANK
A properly sized receiver/storage tank saves energy when coupled with a load/no-load compressor. It also enables a VFD compressor to provide more stable system pressure.

5 FLOW CONTROLLER
A flow controller stabilizes system pressure to allow for efficient compressor operation and consistent air quality while reducing artificial demand and air leakage.

6 MAIN PLANT MANIFOLD
The plant manifold and piping should be designed and sized so as not to restrict airflow or cause an excessive drop in pressure.

9 AIRHOSE & NOZZLE
Air-entraining air nozzles use less air to do the same amount of work as standard nozzles.



8 QUICK DISCONNECT
High-quality disconnects reduce air leaks.

7 NO-LOSS DRAINS
No-loss drains throughout the system allow only condensate to escape—not valuable compressed air.

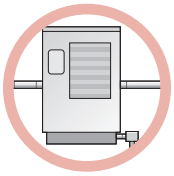
- **Multi-Compressor Systems** use a load/no-load or modulating compressor running continuously as the base load compressor; meanwhile, a VFD compressor acts as the trim compressor by speeding up and slowing down to match system demand. Care must be taken in setting up the controls to prevent compressors from working against each other.
- **On/Off Reciprocating Compressors** are most common in smaller sizes up to 10 or 20 HP. They turn on and off in response to pressure in the storage tank and are very efficient.
- **Modulating Compressors** run continuously and modulate air output in response to load, controlling the incoming air to the compressor by opening or closing a valve. Although they are the least expensive compressor to buy, they are also the least efficient to run.

EQUIPMENT SAVINGS

Variable Frequency Drive (VFD) Screw or Rotary Vane Compressors

- VFD screw or rotary vane compressors speed up and slow down in response to load. They are the best choice for efficiency when a compressed air load varies throughout the day, which is the case for most uses.
- VFDs are not a good choice for a constant load that is more than 90% of the capacity of the compressor, because the VFD never gets the opportunity to slow down the compressor, making the VFD—and the additional energy it uses—unnecessary.
- *Standard rebates are available for 10-40 HP VFD compressors. Call for custom rebates on larger VFD compressors.*

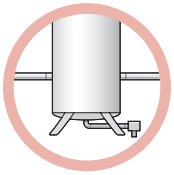
Variable Frequency Drive air compressors can reduce air compressor energy use by 10–40% compared to modulating compressors. (See chart on back page for details.)



Cycling Refrigerated Thermal Mass Dryers

- A dryer removes moisture, in the form of condensate, from the compressed air, maintaining the quality of the compressed air and helping to prevent end-use problems.
- Cycling Refrigerated Dryers: These dryers can cool compressed air so that the moisture condenses and precipitates out, and they turn on and off in response to demand rather than operating continuously, making them more efficient than standard non-cycling refrigerated dryers. Cycling refrigerated dryers reduce drying energy consumption by as much as 50% compared to non-cycling dryers.
- Desiccant Dryers: If extremely dry air is required for end use, a desiccant dryer may be needed. However, a desiccant dryer uses more energy than a refrigerated dryer and often consumes so much air that it becomes a significant air load on the system.
- *Standard rebates are available for cycling refrigerated dryers with up to 300 CFM capacity. Call for custom rebates on larger cycling dryers.*

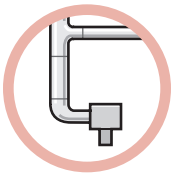
Cycling refrigerated thermal mass dryers can reduce drying energy use by 50% or more compared to non-cycling dryers.



Air Receiver Tanks for Load/No-Load Screw or Rotary Vane Compressors

- An air receiver or tank is a pressurized vessel that stores compressed air and acts as a buffer between the compressed air system's demand side (end users) and supply side (compressors). Receivers or tanks can be installed as part of a new system or retrofitted into an existing system.
- A properly sized storage tank of five gallons per CFM of airflow saves energy when coupled with a load/no-load compressor. It also enables a VFD compressor to provide more stable pressure.
- Reduce demand spikes, and pressure drops, by installing additional receivers/storage tanks close to high-volume/short-duration points of use.
- *Standard rebates on air receiver tanks are available for systems 10–40 HP. Call for custom rebates on larger systems.*

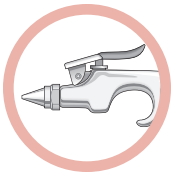
Air receiver tanks can reduce load/no-load compressed air energy by as much as 20% compared to modulating compressors or load/no-load compressors with only one gallon of storage per CFM.



No-Loss Drains

- No-loss drains allow only condensate to escape—not valuable compressed air—by opening a valve when signaled by the condensate level control. They reduce drain air losses by 100%.
- Install no-loss drains at the compressor, air dryer, filter, storage tank, and any other point in the piping where moisture might collect.
- The alternative, timed drains, waste air by operating for a fixed time, even when there is no condensate to drain (they are usually set to drain the worst-case amount of condensation).
- *Standard rebates are available for no-loss drains.*

No-loss drains can eliminate compressed air losses at the drain.



Air-Entraining Air Nozzles

- Both handheld and fixed air nozzles use compressed air for cleaning or drying; an air-entraining air nozzle uses 46% less compressed air to do the same work by grabbing or entraining surrounding atmospheric air, reducing air compressor energy use.
- *Nozzles that use less than 15 CFM at 100 psi qualify for standard rebates. Larger nozzles may be eligible for custom rebates and savings analysis. Visit www.efficiencyvermont.com/compressedair for the "Compressed Air Eligible Products List" of nozzles that qualify for rebates.*

Air-entraining air nozzles can reduce compressed air energy use by 46% compared to standard nozzles.

Compressed Air Best Practices

Appropriate Use

- Using compressed air when a task can be accomplished by other means—such as a broom, a vacuum pump, an electric motor, or a blower—results in higher electricity costs. Using compressed air to cool a bearing or an electric panel, for instance, is not cost-effective; identify and fix the underlying problem instead.

Regulated Use

- Do not use full system pressure for an end use if full system pressure is not necessary. Regulate the pressure down to minimize artificial demand and leakage rates.
- When compressed air is available at an end use continuously, even when not required, energy and money may be wasted through leaks. Isolate parts of the compressed air system with a solenoid valve to shut down air automatically when not needed.
- Turn compressors off completely when the plant does not require air, such as at night or on weekends. If a reduced amount of air is needed during these times, consider a dedicated, smaller-capacity air compressor for those tasks.

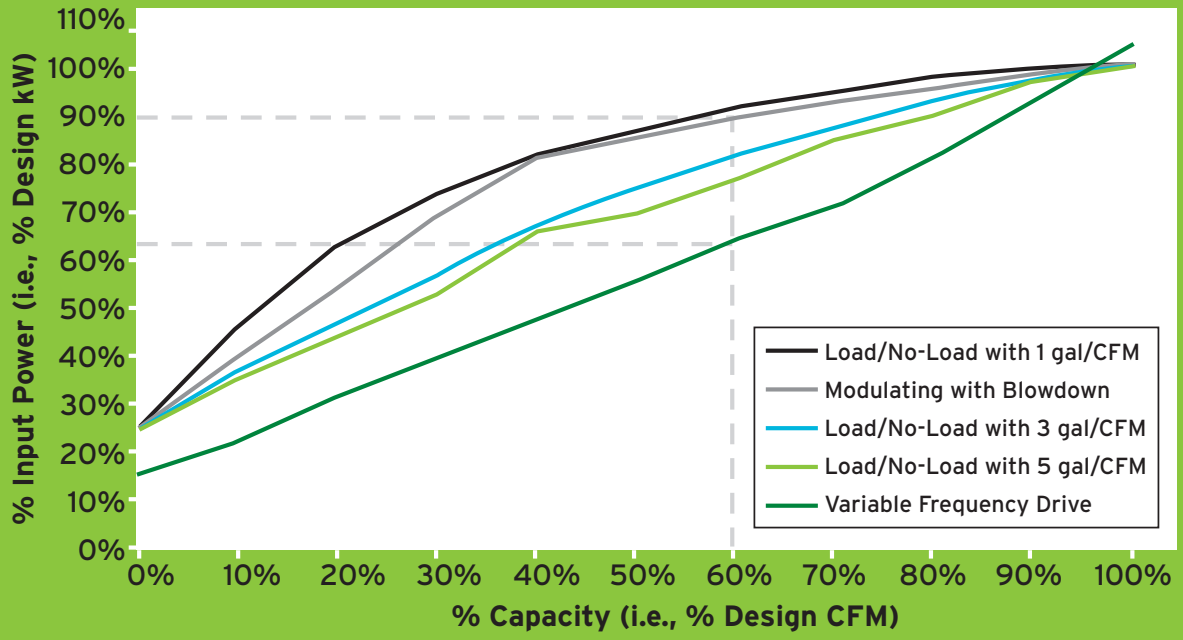
Compressor Control

- Proper control of multiple compressors on the same system is critical for efficient operation. Achieve this by using a single set of controls for all compressors (a sequencer) or by using individual compressor controls that are carefully set to maintain system-wide pressure without excess compressor cycling.

Quality Disconnects

- Reduce pressure drops and air leaks by using long-lasting, high-quality disconnects made of hardened steel or plated brass with six or more ball bearings.

INPUT POWER AT PARTIAL LOADS BY COMPRESSOR TYPE



COMPRESSOR LOADING AND ENERGY EFFICIENCY

There are many ways to control a screw compressor. This chart demonstrates that variable frequency drive (VFD) control offers the best efficiency for all variable loads below 90% of the capacity of the compressor, whereas modulating and load/no-load with little storage are the least efficient.

For example, a VFD compressor (dark green line on chart) running at 60% capacity uses only about 63% of its full load rated power. **By comparison, a modulating compressor (gray line on chart) running at 60% load uses about 90% of its full load rated power.**

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