



Suggested Actions

- Inspect the entry to the compressor air intake pipe and ensure that it is free of contaminants.
- Inspect the compressed air intake filter element to ensure that it is of the appropriate type, that it is properly installed, and that it is clean.
- Check the intake filter regularly for excess pressure drop.

References

From Compressed Air Challenge® (CAC):

The Compressed Air System Best Practices Manual, Guidelines for Selecting a Compressed Air System Service Provider

From DOE's Industrial Technologies Program and CAC:

Improving Compressed Air System Performance: A Sourcebook for Industry

Training

- *Fundamentals of Compressed Air Systems* – 1 day
- *Advanced Management of Compressed Air Systems* – 2 days

Offered by the Compressed Air Challenge; for the latest course schedule and locations see www.compressedairchallenge.org

For additional information on industrial energy efficiency measures, contact the EERE Information Center at 1-877-337-3463 or visit the BestPractices Web site at www.eere.energy.gov/industry/bestpractices.

Effect of Intake on Compressor Performance

The effect of intake air on compressor performance should not be underestimated. Intake air that is contaminated or hot can impair compressor performance and result in excess energy and maintenance costs. If moisture, dust, or other contaminants are present in the intake air, such contaminants can build up on the internal components of the compressor, such as valves, impellers, rotors, and vanes. Such build-up can cause premature wear and reduce compressor capacity.

When inlet air is cooler, it is also denser. As a result, mass flow and pressure capability increase with decreasing intake air temperatures, particularly in centrifugal compressors. This mass flow increase effect is less pronounced for lubricant-injected, rotary-screw compressors because the incoming air mixes with the higher temperature lubricant. Conversely, as the temperature of intake air increases, the air density decreases and mass flow and pressure capability decrease. The resulting reduction in capacity is often addressed by operating additional compressors, thus increasing energy consumption.

To prevent adverse effects from intake air quality, it is important to ensure that the location of the entry to the inlet pipe is as free as possible from ambient contaminants, such as rain, dirt, and discharge from a cooling tower. If the air is drawn from a remote location, the inlet pipe size should be increased in accordance with the manufacturer's recommendation to prevent pressure drop and reduction of mass flow. All intake air should be adequately filtered. A pressure gauge indicating pressure drop in inches of water is essential to maintain optimum compressor performance.

When an intake air filter is located at the compressor, the ambient temperature should be kept to a minimum, to prevent reduction in mass flow. This can be accomplished by locating the inlet pipe outside the room or building. When the intake air filter is located outside the building, and particularly on a roof, ambient considerations are important, but may be less important than accessibility for maintenance in inclement or winter conditions.

How to Select an Intake Air Filter

A compressor intake air filter should be installed in, or have air brought to it from a clean, cool location. The compressor manufacturer normally supplies, or recommends, a specific grade of intake filter designed to protect the compressor. The better the filtration at the compressor inlet, the lower the maintenance at the compressor. However, the pressure drop across the intake air filter should be kept to a minimum (by size and by maintenance) to prevent a throttling effect and a reduction in compressor capacity. A pressure differential gauge is one of the best tools to monitor the condition of the inlet filter. The pressure drop across a new inlet filter should not exceed 3 pounds per square inch (psi).



Inlet Filter Replacement

As a compressor intake air filter becomes dirty, the pressure drop across it increases, reducing the pressure at the air end inlet and increasing the compression ratios. The cost of this loss of air can be much greater than the cost of a replacement inlet filter, even over a short period of time. For a 200 horsepower (hp) compressor operating two shifts, 5 days a week (4,160 hours per year) with a \$0.05/kilowatt hour (kWh) electricity rate, a dirty intake filter can decrease compressor efficiency by 1%–3%, which can translate into higher compressed air energy costs of between \$327 and \$980 per year.

About DOE's Industrial Technologies Program

The Industrial Technologies Program, through partnerships with industry, government, and non-governmental organizations, develops and delivers advanced energy efficiency, renewable energy, and pollution prevention technologies for industrial applications. The Industrial Technologies Program is part of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

The Industrial Technologies Program encourages industry-wide efforts to boost resource productivity through a strategy called Industries of the Future (IOF). IOF focuses on the following eight energy and resource intensive industries:

- Aluminum
- Forest Products
- Metal Casting
- Petroleum
- Chemicals
- Glass
- Mining
- Steel

The Industrial Technologies Program and its BestPractices activities offer a wide variety of resources to industrial partners that cover motor, steam, compressed air, and process heating systems. For example, BestPractices software can help you decide whether to replace or rewind motors (MotorMaster+), assess the efficiency of pumping systems (PSAT), compressed air systems (AirMaster+), steam systems (Steam Scoping Tool), or determine optimal insulation thickness for pipes and pressure vessels (3E Plus). Training is available to help you or your staff learn how to use these software programs and learn more about industrial systems. Workshops are held around the country on topics such as "Capturing the Value of Steam Efficiency," "Fundamentals and Advanced Management of Compressed Air Systems," and "Motor System Management." Available technical publications range from case studies and tip sheets to sourcebooks and market assessments. The Energy Matters newsletter, for example, provides timely articles and information on comprehensive energy systems for industry. You can access these resources and more by visiting the BestPractices Web site at www.eere.energy.gov/industry/bestpractices or by contacting the EERE Information Center at 877-337-3463 or via the Web at www.eere.energy.gov/informationcenter/.

BestPractices is part of the Industrial Technologies Program Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together emerging technologies and best energy-management practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices emphasizes plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small- and medium-size manufacturers.

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

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A STRONG ENERGY PORTFOLIO FOR A STRONG AMERICA

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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