COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

# Lowering Compressed Air Pressure: What Works in the Plastics Industry?

Introduction by Rod Smith, Publisher,
Compressed Air Best Practices® Magazine

For your free subscription, please visit
http://www.airbestpractices.com/magazine/subscription.

Brought to you by:

KAESER COMPRESSORS
*Built for a lifetime.™*

COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

# Compressed Air in the Plastics Industry

| Blow Molding | Typical Installed Air Compressor Capacity | Related Energy Costs | Savings Opportunity |
|---|---|---|---|
| Stretch | 2000 hp to 4000 hp | $1M to $3M | 10 to 15% |
| Injection & Extrusion | 500 hp to 600 hp | $200,000 to $750,000 | 35 to 45% |

*Smith, Rod. Extrusion Blow Molding Best Practices. (2006, June). Compressed Air Best Practices® Magazine, pg. 13. Link (PDF).

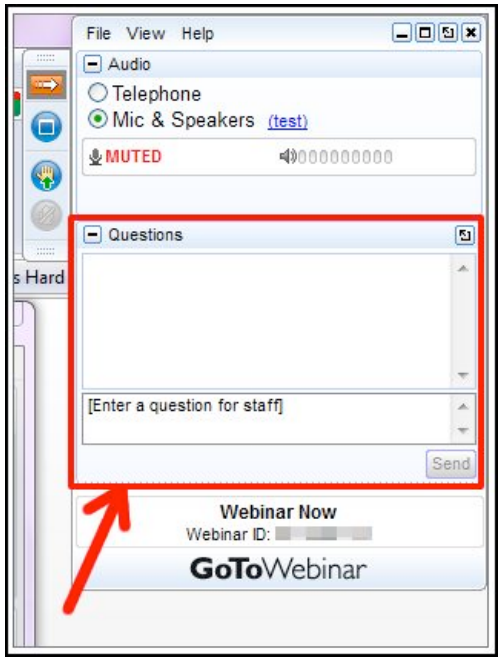
For your free subscription, please visit
http://www.airbestpractices.com/magazine/subscription.

Brought to you by:

KAESER COMPRESSORS
*Built for a lifetime.™*

COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

# Q&A Format




- Panelists will answer your questions during the Q&A session at the end of the Webinar.

- Please post your questions in the Questions Window in your GoToWebinar interface.

- Direct all questions to Clinton Shaffer, Editorial Associate at Compressed Air Best Practices® Magazine.

- Any questions that go unanswered will be addressed personally with an email after the session.

For your free subscription, please visit
http://www.airbestpractices.com/magazine/subscription.

Brought to you by:

KAESER COMPRESSORS
*Built for a lifetime.*™

COMPRESSED AIR BEST PRACTICES
airbestpractices.com

# About the Panelists

Pete Rhoten

- Served as President for at Hope Air Systems, and is currently a Senior Project Engineer at the company
- Designed compressed air systems for the plastics industry for more than 36 years
- Specializes in auditing and designing high-pressure and PET compressor systems, with a focus on energy efficiency

Stephen Horne

- U.S. Product Manager for Kaeser's blowers, boosters, and vacuum product lines
- Primary instructor in Kaeser's Factory Certified Training Program
- Served as Kaeser's in-house engineer for machine modifications and system design

For your free subscription, please visit http://www.airbestpractices.com/magazine/subscription.

Brought to you by:

KAESER COMPRESSORS
*Built for a lifetime.™*

# Plastic Industry Air Pressure (& Your) Reduction Webinar

## April 29, 2015

Hope Air Systems

# Introduction

Hope Air Systems

# Been There — Done That

Approximately 92.5% of the people on this webinar have done some sort of audit that resulted in air system changes to increase efficiency.

Hope Air Systems

Many auditors only look at the supply side, and focus on the following:

- Compressor efficiency
- Maximizing controls
- Increasing compressor room storage
- Correcting air quality
- Sometimes lowering air pressure

Hope Air Systems

Any good auditor should thoroughly look at the demand side. The low-hanging fruit for operation includes:

- Leak detection
- Re-engineering blow-off applications
- Drains replaced with 0 loss
- Pressure issues identified

Hope Air Systems

***All audits are not great audits.***

Hope Air Systems

# Process = Results

- Did the process start an initial meeting with maintenance and production department personnel to review for buy in?
- Did everyone put on the table their air issues with production and/or quality from their department?
- Were goals established before, and expanded during the audit process?
- Was the result identifiable and implementable with a realistic ROI?

Hope Air Systems

# Goal

How to take the next step on effectively continuing to reduce air system costs and maintain/improve this reduction in both operational air and high-pressure blow air — even after 1 or 2 audits.

Hope Air Systems

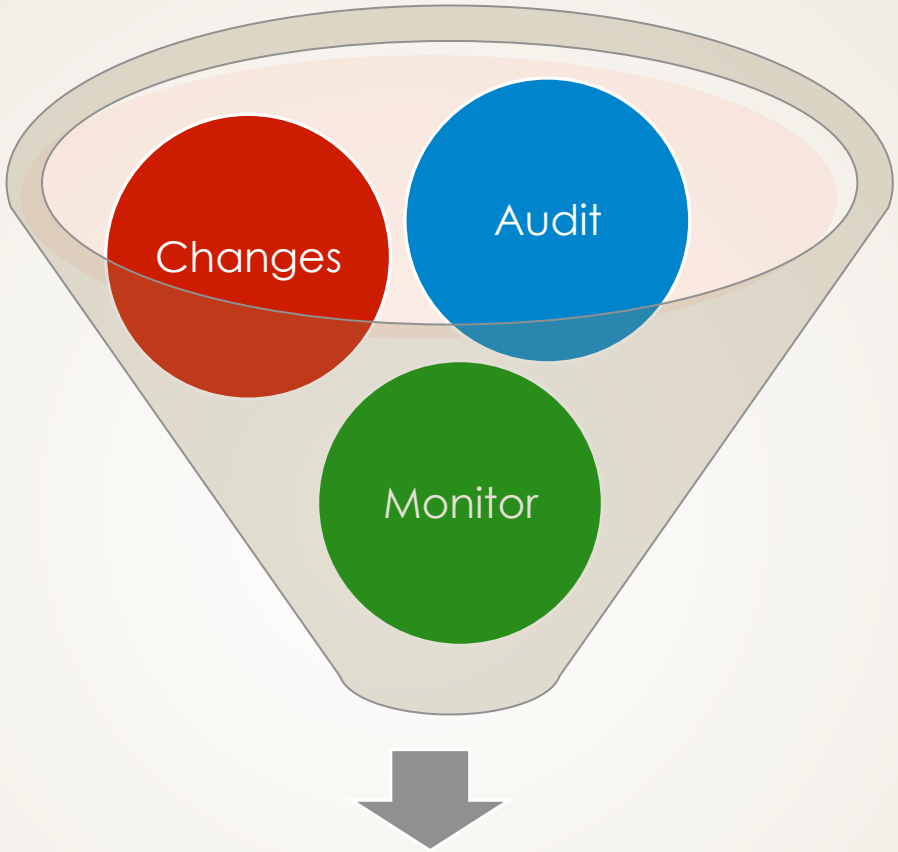
# Operation Air

Hope Air Systems

# Review Results

Review past audits to determine what recommendations were implemented and what savings were verified — did the ROI meet expectations?

Hope Air Systems




# Proof of Savings

Hope Air Systems

# Controls

- Have they been calibrated semi-annually?
- Do the compressors come on and off as originally planned?
- Monitor with a kW data logger – You really should own one if you have connected 150 hp of motors of any type of equipment.

Hope Air Systems

# Pressure

**If it has crept up from the original planned benchmark due to production issues…**

- Are you using a demand controller/ department regulation/ full flow regulators to minimize pressure in the system or beach area or on a piece of equipment to the minimum realistic level?
- Are the gauges in each department relatively new and accurate, and do you have a calibrated test gauge?
- Are the regulators lockable?
- All to be discussed in the next section.

Hope Air Systems

# Flow & Pressure Creep

- Did the audit provide a CFM and pressure study with goals?
- Do you have a flow meter and pressure monitor integrated into your building management system with thresholds?
- CDI Flowmeters: www.cdimeters.com
- Monarch Instruments Pressure Monitors: www.monarchinstrument.com/track-it.php

Hope Air Systems

# Leak Detection

- Has it been done within the last 6 months?
- Contract for it to ensure continuity.
- Each 1/16 inch leak at 110 psi passes 7 CFM or 1.6 HP based on a 100 HP compressor = $764 for 6000 per year at $.10 kW
- Multiply that by 10 weeks and it becomes real money.
- A good sonic leak detector with data logging doesn't work on the shelf =/- $4000 www.uesystems.com/applications/leak-detection

Hope Air Systems

# Blow Offs

- 1/4 inch open nozzle opening at 110 psi uses 113 CFM, equaling a 25 HP compressor, while a flow reduction nozzle will reduce it by 66% to under 40 CFM
- If you implemented flow reduction nozzles, are they still on? Are there any new blow-off applications not using nozzles? Do an audit.
- Re-evaluate if a small HP blower should be used with an air knife — more to come in the segment

Hope Air Systems

# Team Buy In

- Did production and maintenance participate with the implementation and review of the audit to own part of their responsibility?
- Example: $20,000 audit in a paper mill in Maine was never politically owned by the operational or maintenance staff and went absolutely nowhere — potential savings $300,000 plus with a 1.5 year ROI.
- Best case is to form an energy team from all departments.

Hope Air Systems

# Culture/Measurement/ Goals/Action

- Did the audit change the culture?
- Is measurement installed and monitored?
- Are the measurements compared to goals?
- Do you act on bad measurements?

Hope Air Systems

# Blow Air

Hope Air Systems

# Pressure Then & Now

- In 1979 PET blow air was 250 PSI with base cup bottles — remember?
- Mid 2000s blow air was as high as 650 PSI to maximize BPH.
- Current preform weight combined with bottle design has allowed pressure to come down to under 500 PSI.
- Each 50 PSI reduction of blow air is approximately 5-6% kW reduction.
- Go from 580 PSI to 420 PSI will save 39 kW for 7000 hours @ .10 per KW= $33,366 — again real money
- Where are you and what have you tried?

Hope Air Systems

# High Pressure Cost Culprits

- Significant pressure drops in some RSBM machines
- Internal leakage due to blow machine seals and rod wear
- Large instantaneous air demand swings (2000-3000 scfm)
- High historical pressure requirements (600+psig)
- Multiple pressure requirements in one facility for different blow machines
- Use of blow air regulated for operation air

Hope Air Systems

# Knowledge

Many auditors are not sure how to deal with PET blow air systems as they do not understand the blow unit requirements and operation.

An auditor should be able to calculate estimated blow air usage by:

- # of cavities/
- BPH/
- Pressure/
- Type of blow machine

Hope Air Systems

# HOPE AIR SYSTEMS BOTTLE BLOW CAPACITY CALCULATOR

| | | |
|---|---|---|
| CUSTOMER NAME: | Joe A. Compton | |
| PROJECT NAME: | Pressure Webinar | |
| ALTITUDE CORRECTION | ENTER | CALC'D |
| ALTITUDE (FEET): | 1000 | 1000.00 |
| ALTITUDE (METERS): | | 304.10 |
| PSIA: | | 14.170 |

Hope Air Systems

| APPLICATION REQUIREMENTS | OPT #1 | OPT #2 | OPT #3 |
|---|---|---|---|
| BLOW MACHINE MODEL | SBO6-8 | SBO6-8 | PF 24-8 |
| BOTTLE SIZE (LITERS): | 1.5 | 1.5 | 1.5 |
| NUMBER OF CAVITIES: | 8 | 8 | 8 |
| SAFETY FACTOR (PRODUCTION): | 1.1 | 1.1 | 1.1 |
| INLET PIPE VOLUME (LITERS): | 0.3 | 0.3 | 1 |
| BLOW PRESSURE (BAR): | 40 | 30 | 35 |
| PRESSURE ATMOSPHERIC: | 1 | 1 | 1 |
| CYCLE TIME (SECONDS): | 3 | 3 | 4.4 |
| SAFETY FACTOR (CYCLE TIME): | 1.1 | 1.1 | 1.1 |
| BOTTLES PER HOUR: | 9600 | 9600 | 6545 |
| CAPACITY REQUIREMENTS | | | |
| REQUIRED CAPACITY (Nl/min): | 12177 | 9207 | 7668 |
| REQUIRED CAPACITY (SCFM): | 430 | 325 | 271 |
| REQUIRED CAPACITY (l/min@ALT): | 12460 | 9421 | 7846 |
| REQUIRED CAPACITY (ACFM): | **440** | **333** | **277** |

Hope Air Systems

# Blow Machine Evaluation

- Flow meter can determine what is actually being used, which can be compared to manufacturer's data
- Recommend that an independent resource provide calculations for flow based on bottle size/number of cavities/BPH/blow pressure/ altitude
- Compare with actual usage and determine what the total plant load should be
- Can ID issues with compressor output or excessive blow machine usage

Hope Air Systems

# Blow Air Flow Monitoring

- Most high-pressure audits do not include flow monitoring, as it is perceived that it is expensive to get high-pressure flow meter installed.
- Strongly recommend flow meter for each blow machine as well as main high-pressure airline even compressor
- Minimal investment with 1.5 inch meter under $900 and a 4 inch meter under $2000 with ability to tie into building management system — www.cdimeters.com

Hope Air Systems

# Blow Air Recirculation

- Every stretch blow molder exhausts 40-50% of its blow air to atmosphere.
- In the past 5 years a number of blow machine and compressor manufacturers of been successful using this waste air.
- Can supplement high-pressure air production by recirculating back to the 2nd stage of the compressor, or
- Also can be used in operation air on the blow machine or back to the operation air system

Hope Air Systems

# Recirculation Example

- 2 ea Sidel SBO40s making 2 L and 20oz bottles
- Installed air recovery systems are taking the residual high-pressure air and regenerating about 800 cubic feet per minute to the low-pressure side
- Allows a centrifugal compressor on the low-pressure side to unload and shut down
- Can run the 2 ea Sidel SBO40s without and operational air supply
- Critical that any application be carefully engineered and have blow machine be set up for continuous production for the same bottle size
- Available for retrofit from compressor manufactures/ blow machine manufacturers/independent PET conservation control vendors

Hope Air Systems

# Motor Opportunities

Most recently a major compressor manufacturer has been installing a unique motor — MaxEff, which can:

- Reduce FLA by 15 to 30% and
- Reduce unloaded amps by 50 to 80%
- Same characteristics are evident on KVA
- kW reduction can range from 3 to 10%
- http://www.maxeffmotors.com

Hope Air Systems

# What's Next?

Hope Air Systems

# Next Step 1

Determine where you are versus your last audit — need to monitor and record — many utility companies will pay for re-monitoring if they were involved in the initial audit process

Hope Air Systems

# Next Step 2

Create or reconstitute a compressor energy conservation team utilizing employees from production/ maintenance/engineering — this is the tricky part — use an outside facilitator if necessary to kick start.

Hope Air Systems

# Next Step 3

Have an open conversation with the team members about what makes the most sense to attack based on their experience — weekly meeting — whiteboard for discussion

Hope Air Systems

# Next Step 4

- Identify areas that need attention with a checklist and desired results.
- Create budget with ROI expectations.
- Install pressure and flow monitoring equipment.
- Feed data to central point.
- Fix problem areas or create solutions for complex issues.
- Post goals and results.

Hope Air Systems

# Repeat the process each year…

Hope Air Systems

COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

# Lowering Compressed Air Pressure: What Works in the Plastics Industry?

For your free subscription, please visit
http://www.airbestpractices.com/magazine/subscription.

Brought to you by:

KAESER COMPRESSORS
*Built for a lifetime.™*

KAESER COMPRESSORS

# Compressed Air in the Plastics Industry

KAESER COMPRESSORS

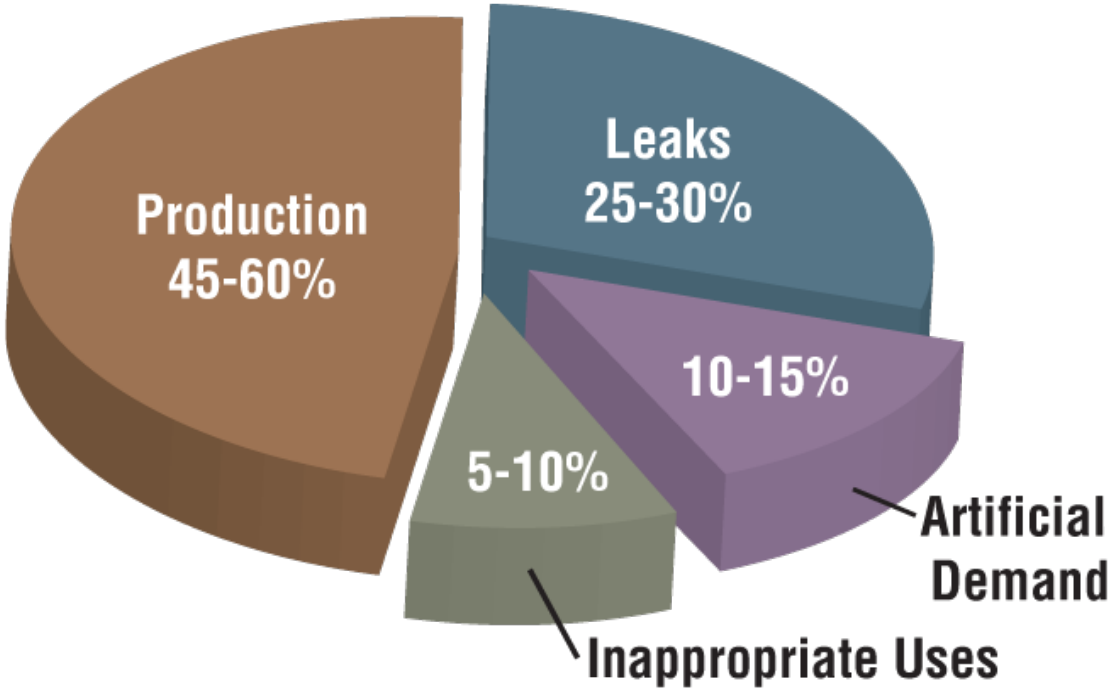
1. Effects of lowering plant pressure
2. Common low pressure applications in the plastics industry
3. Translating lower plant pressure into energy savings

Stephen Horne

Blower Product Manager

KAESER COMPRESSORS

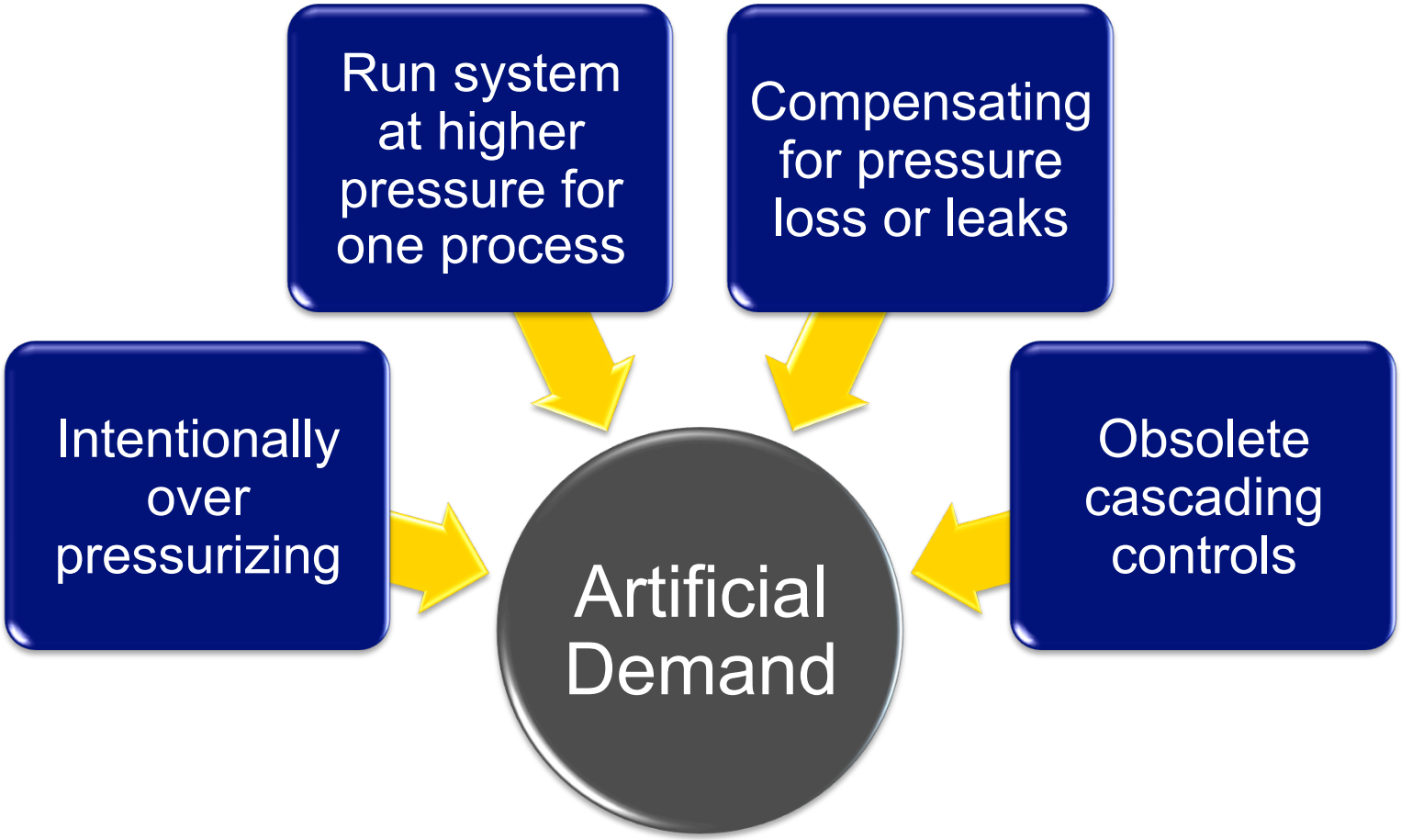
# Back to the Basics




**Artificial Demand: Operating system at higher pressure than necessary**

KAESER COMPRESSORS

# Artificial Demand



KAESER COMPRESSORS

# Back to the Basics: Why Lower Plant Pressure?

**2 psi reduction in system pressure saves 1% in compressor efficiency**

- Less Condensate in System
  - Less Wear and Tear on Filters
    - Longer Filter Life
- Lower Operating Temperature
  - Lower Lubricant Temperature
    - Longer Lubricant Life

KAESER COMPRESSORS

# How Low Can You Go?

**Lower system pressure 1 psi/week until someone complains.**

KAESER COMPRESSORS

# Look at *Why* There is a Problem

| | | |
|---|---|---|
| Intermittent demand? | → | Add a receiver tank |
| Leaks? | → | Fix them |
| Tools under supplied? | → | Add larger line |
| Equipment fighting each other? | → | Add controls |

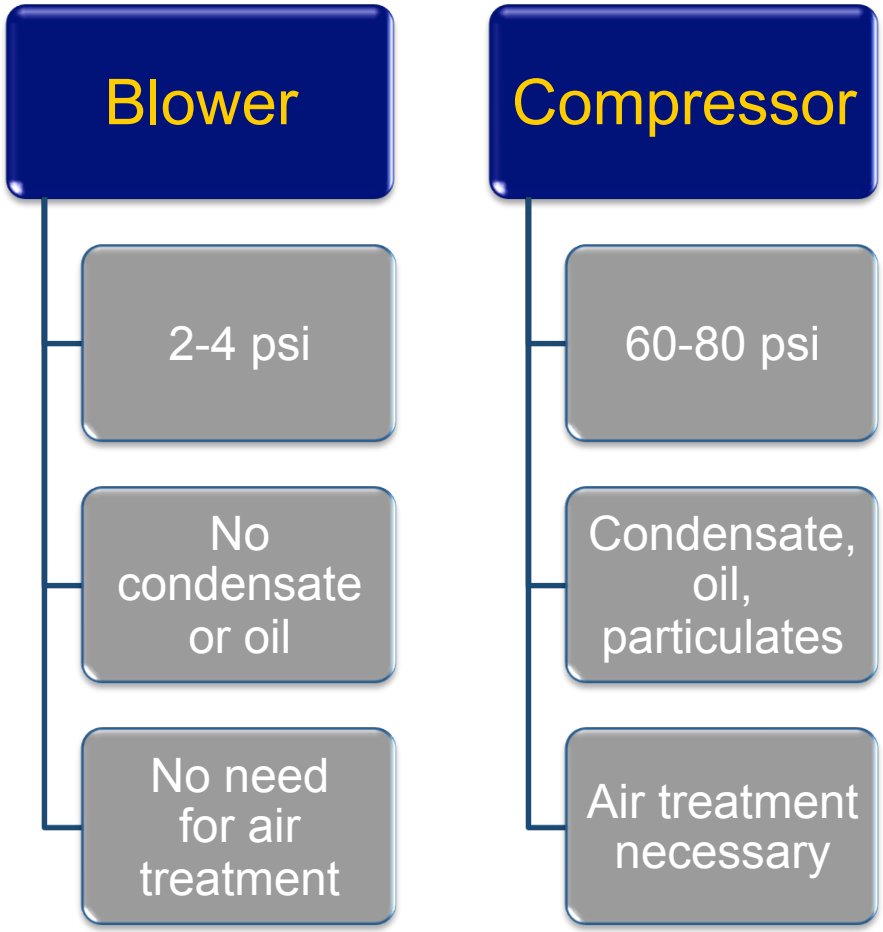
**Fix the problem instead of raising the pressure**

KAESER COMPRESSORS

# Low Pressure Applications in the Plastics Industry

KAESER COMPRESSORS

# Low Vs. High Pressure Cost Considerations:



KAESER COMPRESSORS

# Low Vs. High Pressure Cost Considerations:

| Blow off Device Type | Operating Type | Air Consumption (cfm) | Machine (hp) | Cost of Blow off Device | Annual Electrical Cost* |
|---|---|---|---|---|---|
| **Drilled Pipe** | 60 – 80 psig | 175 cfm | 40 hp compressor | $50 | $6,388 |
| **Flat Nozzles** | 60 – 80 psig | 257 cfm | 60 hp compressor | $200 | $9,742 |
| **Low Pressure Air Knife** | 2-4 psig | 345 cfm | 15 hp blower | $355 | $1,165 |
| **Amplified Air Knife** | 60-80 psig | 72 cfm | 20 hp compressor | $500 | $3,280 |

*** For a 12” bottle. Assumes 110 psig with 30% idle power. Duty cycle determined by required cfm/unit cfm. kW calculation assumes a 0.83 PF and $0.083/kWh, 8,760 annual operating hours.**

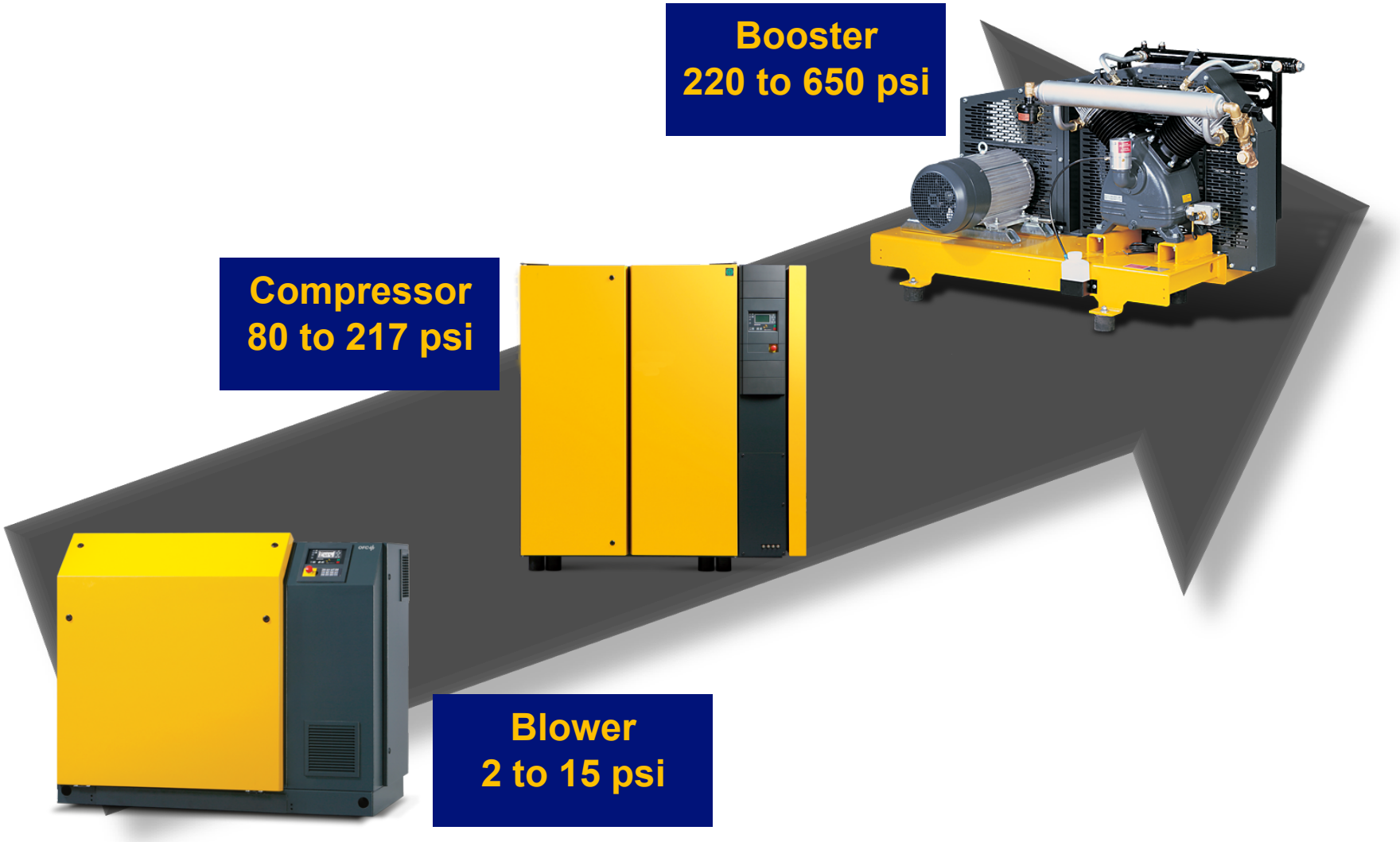
KAESER COMPRESSORS

# Which Solution is Best?

| | |
|---|---|
| **Conduct compressed air audit** | • How much does that part of the process cost? |
| **Do the math** | • Price of new equipment, operating costs, maintenance |
| **Look at ROI** | • Quick fix or long-term solution? |
| **Monitor** | • Process needs change<br>• Revisit regularly |

KAESER COMPRESSORS

# Consider Pressure Zones



KAESER COMPRESSORS

# Thank you!

Visit www.us.kaeser.com for more information.

COMPRESSED AIR BEST PRACTICES
airbestpractices.com

# Lowering Compressed Air Pressure: What Works in the Plastics Industry?

## Q&A

Please submit any questions through the Question Window on your GoToWebinar interface, directing them towards Clinton Shaffer. Our panelists will do their best to address your questions, and will follow up with you on anything that goes unanswered during this session.

**Thank you for attending!**

For your free subscription, please visit http://www.airbestpractices.com/magazine/subscription.

Brought to you by:

KAESER COMPRESSORS
*Built for a lifetime.™*