

# Energy Savings and Noise Control for Compressed Air Systems

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# Compressed Air Systems

- The use of compressed air is often a plant-wide noise issue in manufacturing plants.
- Compressed air can easily be responsible for 25-33% of a plant's noise problems.
- Compressed air noise is probably the easiest source to control.
- Plus, getting a handle on compressed air usage and noise can have significant financial and energy savings over time.

# Compressed Air Systems

Pneumatic or compressed air systems are used to:

- Operate or motivate equipment, using devices such as air cylinders, air valves, solenoids, etc.
- Air jets and nozzles, including hand-held air guns, are used to move parts/product, blow-off debris, close flaps on corrugated containers (boxes/cases), or similar service-type actions.

# Root Cause of Noise

Noise generated by compressed air is caused by:

1. Turbulence due to the mixing of gases with widely different velocities.
2. Turbulence created by compressed air blowing against objects, such as parts or sections of the machinery.
3. Mechanical impacts between driven components of the machinery.

# Compressed Air Systems

The shearing action occurring in the mixing region results in excessive noise, where the sound level is proportional to the air velocity raised to the 8<sup>th</sup> power.

$$\textit{Sound Level} \propto V^8$$

Therefore, the 1<sup>st</sup> Step toward controlling compressed air noise is to reduce the air velocity to as low as practical and maintaining that setting.

# Compressed Air Systems

The 2<sup>nd</sup> Step is to treat all open-ended discharge lines and ports, including standard air jets and nozzles with commercially-available quiet-design nozzles or pneumatic silencers.

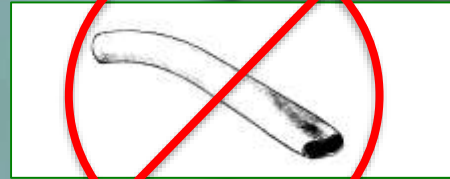
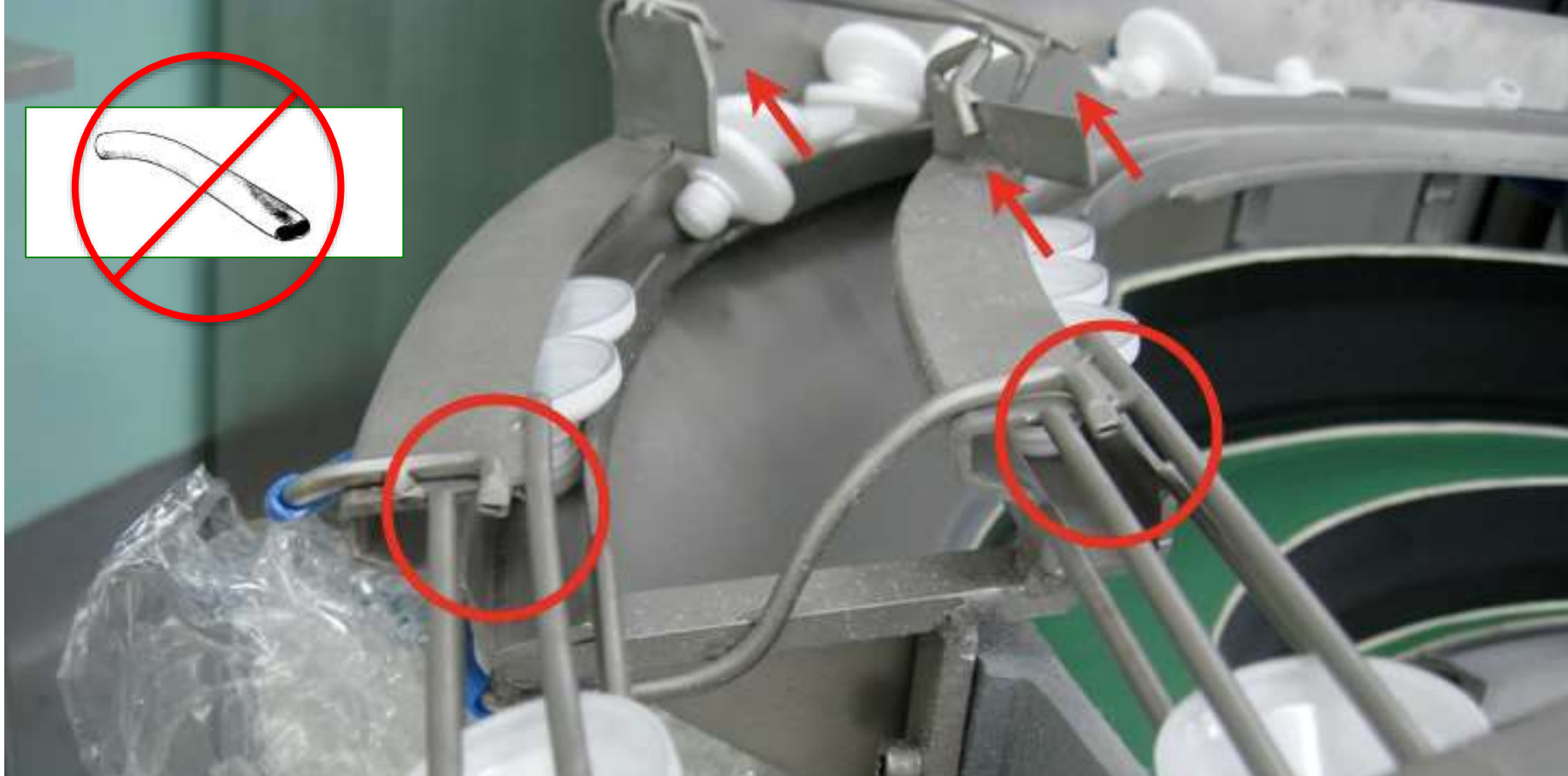
Care must be exercised to ensure the type of device used meets the service needs at the plant.

# Compressed Air Systems

There are two categories of low-noise devices:

1. Air exhaust and
2. Service-type.






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**REPLACE OPEN PIPE OF DIAMETERS:**



3 - 4 mm  
1/8"

**BENEFITS**

Reduces the noise level	14 - 18 dB(A)
Decreases air consumption	23 - 36 %
Safety nozzle	Meets OSHA standards



# Energy and Cost Savings

*And there is an energy and cost savings, too:*

- For example, blowing compressed air through a 10mm (~3/8-inch) open-ended line at a pressure of 5 bars (~70 psi) uses 185 Nm<sup>3</sup>/hr.
- At an average cost of \$0.015 (U.S. Dollars) per 1 Nm<sup>3</sup>/hr, and an estimated use time of 40%, this equates to 704 hours of consumption per year. Therefore, the annual cost for the open pipe is:
- 185 Nm<sup>3</sup>/hr x \$0.015/Nm<sup>3</sup>/hr x 704 hours = \$1954.

# Energy and Cost Savings

*And there is an energy cost savings, too:*

- Next, using a Silvent 705 quiet-design nozzle provides the same air-flow service, but only uses 95 Nm<sup>3</sup>/hr. This results in an annual cost of \$1003. Therefore, the savings is:

<u>Open Pipe</u>		<u>Quiet-design Nozzle</u>		<u>Annual Savings</u>
\$1954	—	\$1003	=	<b>\$951</b>
				<b><i>Per Nozzle!!!!</i></b>

**AND, provides 20 dBA of attenuation.**



# Cost Saving and Noise Reduction

Compare the considerable differences between open pipe and Silvent air nozzles

Pipe inside Ø		Sound level <i>dB(A)</i>	Air consumption		Replace with Silvent air nozzle	Noise level reduction		Air savings %	Annual savings USD
<i>mm</i>	<i>inch</i>		<i>Nm<sup>3</sup>/h</i>	<i>scfm</i>		<i>dB(A)</i>	%		
2	5/64"	84	8	4.7	MJ4	8	43%	50%	\$42
2.5	3/32"	87	12	7.1	MJ5	8	43%	17%	\$21
3	1/8"	90	17	10.0	MJ6	8	43%	18%	\$32
4	5/32"	95	30	17.7	512	16	67%	37%	\$116
5	3/16"	99	47	27.7	700 M	15	65%	47%	\$232
6	1/4"	102	67	39.5	920 A	21	77%	55%	\$391
7	9/32"	105	92	54.2	973	19	73%	37%	\$359
8	5/16"	108	118	69.5	404 L	24	81%	42%	\$528
10	3/8"	112	185	109.0	705	20	75%	49%	\$950
12	1/2"	116	266	156.7	707 L	22	78%	55%	\$1 542
14	9/16"	119	363	213.8	710	20	75%	40%	\$1 552
16	5/8"	122	474	279.2	412 L	34	89%	57%	\$2 851
17	11/16"	123	536	315.7	715 C	23	80%	42%	\$2 376
18	23/32"	124	599	352.8	715 L	20	75%	48%	\$3 031
20	3/4"	126	740	435.9	720	22	78%	43%	\$3 379
25	1"	131	1159	682.7	730 C	26	84%	45%	\$5 523

The table is based on 220 eight hour working days per year and a 40% degree of utilization. The cost of 1Nm<sup>3</sup> (35.3 scf) at 500 kPa (71.5 psi) is calculated at 1.5¢ (USD).

# Summary

Steps for minimizing compressed air noise:

1. Optimize air pressure setting for all pneumatic devices, document and maintain settings over time.
2. For all compressed air systems use the low-noise devices for both service and non-service type.
3. Use PLCs that integrate all digital sensors along a production line that can optimize air pressures and shut off the delivery of compressed air when the line or device is off line.