Compressed Air

Description
Students will be introduced to the potential hazards of working with compressed air and how to appreciate the benefits of air-operated tools. Students will also be shown the safe and proper operation of air tools.

Lesson Outcomes
The student will be able to:

• Recognize and understand the dangers and the safe use of compressed air
• Recognize the benefits of using compressed air tools over electrical or hand tools
• Describe the operation and use of several commonly used air-operated hand tools
• Connect and disconnect a variety of air tools to an air supply
• Describe the correct procedure to maintain air tools connectors and the air supply

Assumptions

• Students have little or no previous knowledge or skill in the use of compressed air tools.
• The teacher has previously used air tools and has a good working knowledge of air-operated tools.

Estimated Time
Sixty minutes if the lesson is divided into three 20-minute sessions consisting of (1) explanation, (2) demonstration and (3) student practice time

Recommended Number of Students
20, based on the BC Technology Educators’ Best Practice Guide, preferably working in pairs (will depend on the availability of equipment)

Facilities
Any shop facility with compressed available
Tools

- Sufficient air hoses with connectors for each pair of students if possible. If not, then stations can be made with a short length of hose and a connector installed. This will allow students to practise connecting and disconnecting different air tools despite them not being connected to an air supply.
- As many different types of air tools as can be located to demonstrate their use and purpose to the students.
- An “air gun” (impact wrench), air drill, air/die grinder, air hammer/chisel and a “blow gun” should be the minimum set of tools available for demonstration. Additional tools would be an asset.

![Figure 1—Impact wrench](image1)

![Figure 2—Die grinder](image2)
Figure 3—Air drill

Figure 4—Air ratchet

Figure 5—Tire inflator
Figure 6—Air cutter

Figure 7—Air blow gun

Figure 8—Air chisel
Materials

- “Cleaning with Compressed Air” handout for each student, listing the dangers of using high-pressure air (see “Resources” section).
- Safety glasses
- Sufficient air hoses with connectors for each pair of students if possible. If not, then stations can be made with a short length of hose with a “female” connector installed for students to practise connecting and disconnecting different air tools.
- A sufficient amount and variety of air tools (listed in the “Tools” section) and attachments for students to be able to learn all types of tools and how they connect and operate.

Resources

“Cleaning with Compressed Air.” Canadian Centre for Occupational Health and Safety
www.ccohs.ca/oshanswers/safety_haz/compressed_air.html
Demonstration

1. Begin with an explanation of how air is delivered to the shop. Show the students the location of the air supply (compressor).

![Air compressor](image)

*Figure 9—Air compressor*

2. Ensure access is possible for all students, or have a portable unit available for the demonstration. Show the start-up procedure as explained in the owner's manual and follow up with the scheduled maintenance described in the same manual. This will include checking the air filter, crankcase and oil level and also draining the tank daily to ensure that no condensation has built up inside the air tank, which could otherwise lead to rusting.

3. Describe and demonstrate the connection of air fittings. Describe the relationship and how to identify “male” and “female” connectors. Demonstrate how to recognize faulty air hoses and connectors by showing poorly installed connectors, and cut or leaking hoses and fittings.
Activity

1. Start with an explanation of the types of air fittings attached to an air hose. Describe and explain the use of “male” and “female” terminology in relation to shop tools and equipment.

![Figure 10—Female coupler](image)

![Figure 11—Male coupler](image)

2. Have students obtain safety glasses and demonstrate the need for glasses when connecting and disconnecting an air line to its supply connector, especially at eye level.

3. Hand out a copy of “Cleaning with Compressed Air” to each student and have them read along while explaining the dangers of high-pressure compressed air. An open discussion should be prompted to raise any additional questions that may promote safety awareness among all students. Lead a discussion on where air tools should be used (e.g., where there is no available electrical power or in an explosive environment).

4. Have students work in pairs to connect and disconnect tools and fittings to an “uncharged” air line to learn the process.

5. Demonstrate and then have students operate the forward and reverse function of tools such as air drills, impact wrenches and ratchets.

6. Have students work in pairs to connect and disconnect several air tools to a “live” air supply line and become comfortable with the tools’ operation.

7. Show the students how to coil the air hose in the correct manner by making as long a loop as is practical to hang on a hook on the wall. To help the hose coil properly, demonstrate how to “rotate” the hose away from you to form the coil, in much the same way as a rope is coiled. Have the students try doing the coil with the hose connected to the air supply and again when it’s not connected, to see how much easier it is when it’s disconnected.

8. Explain the need for safety glasses or shields when using a blow gun and undamaged cutter wheels, and explain the need for guards on air/die grinders.
Cleaning with Compressed Air

Is it a good idea to use compressed air to blow dirt off clothing or work surfaces?
Is cleaning with compressed air allowed by law?
What are the hazards of using compressed air?
What should I use instead of compressed air for cleaning purposes?
Where compressed air is allowed for cleaning, how can I do it safely?

Is it a good idea to use compressed air to blow dirt off clothing or work surfaces?
No. Although many people know using compressed air to clean debris or clothes can be hazardous, it is still used because of old habits and the easy availability of compressed air in many workplaces. However, cleaning objects, machinery, bench tops, clothing and other things with compressed air is dangerous. Injuries can be caused by the air jet and by particles made airborne (re-enter the air).

Is cleaning with compressed air allowed by law?
In many Canadian jurisdictions, cleaning with compressed air is not allowed by law. Alberta, Newfoundland, Prince Edward Island, Quebec and Saskatchewan specifically mention that compressed air shall not be used to clean clothes, or in other situations cleaning a person, machinery, work benches, etc. Reference to cleaning may also be included with specific mention to it being prohibited when there is a risk to the worker being injured (federal regulations, Ontario, British Columbia, North West Territories, Nunavut and the Yukon).

In some cases, other legislation may apply. For example, cleaning with compressed air is prohibited in Manitoba and Ontario when working with asbestos.

Always check with your jurisdiction for more information.

What are the hazards of using compressed air?
First, compressed air is extremely forceful. Depending on its pressure, compressed air can dislodge particles. These particles are a danger since they can enter your eyes or abrade skin. The possible damage would depend on the size, weight, shape, composition and speed of the particles. There have also been reports of hearing damage caused by the pressure of compressed air and by its sound.

Second, compressed air itself is also a serious hazard. On rare occasions, some of the compressed air can enter the blood stream through a break in the skin or through a body opening. An air bubble in the blood stream is known medically as an embolism, a dangerous medical condition in which a blood vessel is blocked, in this case, by an air bubble. An embolism of an artery can cause coma, paralysis or death depending upon its size, duration and location.
While air embolisms are usually associated with incorrect diving procedures, they are possible with compressed air due to high pressures. While this seems improbable, the consequences of even a small quantity of air or other gas in the blood can quickly be fatal.

In addition, using air to clean forces the dirt and dust particles into the air, making these contaminants airborne and creating a respiratory hazard.

Unfortunately, horseplay has been a cause of some serious workplace accidents caused by individuals not aware of the hazards of compressed air, or proper work procedures.

**What should I use instead of compressed air for cleaning purposes?**
Use wet sweeping techniques, sweeping compounds, or vacuum cleaners equipped with special filters or other devices to prevent dust from being recirculated into the air.

**Where compressed air is allowed for cleaning, how can I do it safely?**
A “quiet” nozzle (i.e. one with low noise emission) should be selected.

The nozzle pressure must remain below 10 psi (69 or 70 kPa) and personal protection equipment (PPE) must be worn to protect the worker’s body, especially the eyes, against particles and dust under pressure.

**Note:** Air pressure is legislated by New Brunswick (69 kPa), Yukon (69 kPa/10 psi) and where permitted under federal (69 kPa/10 psi), British Columbia (70 kPa/10 psig), North West Territories and Nunavut (68.9 kPa/10 P.S.I.) legislation.

The Nova Scotia regulation states:

101. (2) Where compressed air is used to clean a surface or person, an employer shall ensure that the device that is used to deliver the air is

(a) commercially manufactured and approved in the manufacturer’s specifications for the purpose of cleaning a surface or person with compressed air; or

(b) certified by an engineer as adequate for the purpose of cleaning a surface or person with compressed air.

**Occupational Safety General Regulations N.S. Reg. 44/99 Section 101**

Ontario does not specify a pressure limit but does state:

66. A compressed air or other compressed gas blowing device shall not be used for blowing dust or other substances,

(a) from clothing worn by a worker except where the device limits increase in pressure when the nozzle is blocked; or

(b) in such a manner as to endanger the safety of any worker.

**Industrial Establishments R.R.O. 1990, Reg. 851**
In addition, air guns should also be used with some local exhaust ventilation or facilities to control the generation of airborne particulates. When compressed air cleaning is unavoidable, hazards can be reduced by making adjustments to the air gun such as:

- chip guards or curtains that can deflect flying dust or debris,
- extension tubes that provide the worker a safer working distance, or
- air guns equipped with injection exhausts and particle collection bags.
Cleaning with Compressed Air Quiz

Instructions: Read the “Cleaning with Compressed Air” handout and answer the following questions.

1. Explain how compressed air is produced and delivered to shop outlets.
   
   Answer will vary depending on facility.

2. List two important safety rules to remember when using compressed air tools.
   
   Always wear eye protection.
   Never blow air at exposed skin.

3. Give two examples of when air-operated tools are more suitable than electrical tools.
   
   A flammable environment
   Main power is not yet installed to a new building.

4. Why should an air compressor storage tank be drained daily?
   
   To stop the inside of the tank from rusting from condensation.

5. If compressed air MUST be used to blow off machinery, what is the maximum pressure?
   
   10 pounds per square inch (PSI).