Abrasive (Grinding) Wheels

Introduction

Whether they are portable or fixed, grinding wheels are designed to operate at very high speeds. If a grinding wheel shatters while in use, the fragments can travel over 300 miles per hour. The potential for serious injury, material damage and other losses from these shooting fragments is great. To ensure that grinding wheels are safely used in your workplace, know the hazards and how to control them.

Hazards

Grinding wheels can pose many health and safety hazards:

Health hazards

- Breathing in dusts can cause respiratory problems.
- Contact with lubricating oils and metallic dusts can irritate the skin.
- If compressed air (used with air-powered grinders) enters the bloodstream, it can
- be deadly.
- Vibration can cause vibration-induced
- white finger.
- Noise can damage hearing and be stressful.
- Electric shock can kill.

Safety hazards

- A wheel that shatters can seriously injure the operator and those working nearby.
- Shooting fragments of a wheel can injure the eyes and face.
- Contact with a wheel can cause cuts and scrapes.
- If a portable grinder is dropped, it can injure the legs and feet.
- Sparks can cause burns.

Controls

Storage and handing

Wheels (especially vitrified or glass-based wheels) are easily damaged if they are bumped or dropped. That is why it is so important to carefully store and handle them.

- Check all wheels when they are received and before using them.
- Follow the manufacturer's instructions for storage. Figure 1, on page 2, shows how and where to store different types of wheels. Proper sorting and storage of grinding wheels will help to ensure easy access, less handling, and less chance of error.
- Store grinding wheels in an area that is dry and protected against damage from impact, solvents, high humidity, and extreme heat or cold.
- Store portable grinders on hooks or in V-shaped racks. Protect racks against damage.
- Arrange grinding wheels so that older ones will be chosen before newer ones.
- Never roll a wheel on its edge; it may absorb oil or dirt from the floor, and get damaged.

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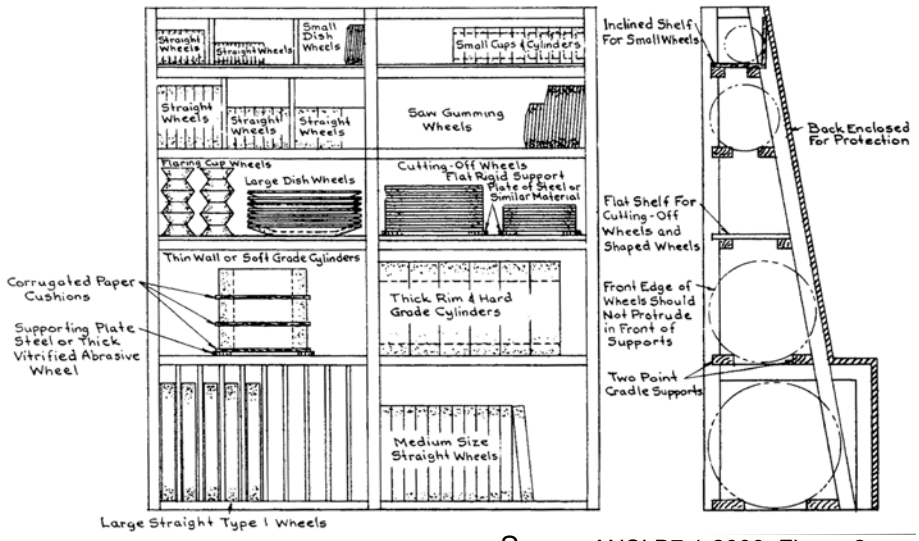
Figure 1
Proper Storage of Grinding Wheels



Source: ANSI B7.1-2000, Figure 2

Testing

Cracks in abrasive wheels are often impossible to see. Two effective methods to detect cracks are the ring test and the vibration test. Always test your wheel immediately before mounting it. Make sure that the wheel is clean and dry before you begin the test.

The Ring Test

The ring test assesses the sound coming from a grinding wheel when it is lightly tapped. An undamaged wheel sends out a clear ringing tone. Use this test on vitrified bonded wheels. Do not use it on:

- wheels that have a diameter of 10 centimetres (4 inches) or less
- plugs and cones
- mounted wheels
- segment wheels
- inserted nut and projecting stud disc wheels

Here's how the ring test works:

1. Suspend the wheel from the hole on a small pin or finger. If the wheel is too heavy, rest it on its outer edge on a clean, hard floor.
2. Tap the wheel gently with a non-metallic tool. For light wheels, use the wooden handle of a screwdriver. For heavy wheels, use a wood mallet. The best spot to tap a wheel is about 45 degrees from either side of the vertical centreline, about 2.5 to 5 centimetres (1 to 2 inches) from the outside edge. (See Figure 2 on the next page). Note: If you tap directly on the centreline, even an undamaged wheel may give off a muffled sound.
3. Listen for the sound that comes from the wheel when it is tapped. Turn the wheel 45 degrees to the right or left, and repeat the test.
4. Compare the sounds from the wheel being tested with those from other wheels of the same lot and type.
5. Set aside any wheel that has a suspiciously different ring for further testing. If you need help, call the manufacturer.

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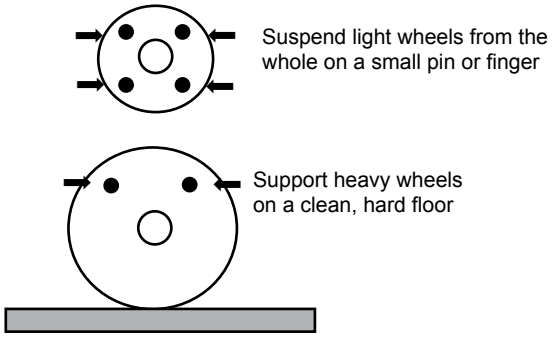
Figure 2
The Ring Test



Source: ANSI B7.1-2000, Figure 44, 45

The Vibration Test

The vibration test assesses how dry sand moves on the side of a vibrating wheel. If the wheel is in good condition, the sand will remain evenly spread out over the entire surface of the wheel. Use the vibration test on all bonded wheels. Unlike the ring test, the vibration test can be performed in noisy areas.

Here's how the vibration test works:

1. Set the abrasive wheel on its side on a test fixture.
2. Coat the wheel with a thin layer of fine, dry sand.
3. Turn on the test fixture to get the wheel to gently vibrate.
4. Watch the grains of sand as the wheel vibrates. If the sand moves away from an area of the wheel, this indicates a crack. If the sand remains evenly distributed on the wheel, the wheel in fine.
5. Repeat the above steps for the other side of the wheel.

The ring and vibration tests cannot absolutely guarantee the condition of a wheel. For this reason, all persons must stand clear when a grinding wheel is started. A defective wheel is most likely to shatter at start-up.

Mounting

- Ensure that wheels are mounted:
  - by qualified persons
  - according to the manufacturer's instructions
  - only on the machines from which they were designed
- Before mounting a wheel:
  - inspect and test it to ensure that it is safe to use
  - check that it is marked to indicate the maximum speed at which it can be used
  - turn off and lock out the machine
- When mounting a wheel, make sure that:
  - the machine spindle speed does not exceed the speed marked on the wheel
  - the wheel fits freely, but not loosely, on the spindle
- Use flanges that:
  - are equal in diameter and have equal bearing surfaces
  - are at least one-third the diameter of the wheel
  - have bearing surfaces that are true and free from burrs
  - are properly undercut (unless it is a single flange used with a threaded-hole wheel)
- Where required, use blotters that are free of creases, folds and dirt. Blotters should be just larger than the flanges.
- Tighten the clamping nuts just enough to hold the wheel firmly.
- Don't let screws for inserted nut mountings touch the abrasive part of the wheel. Use screws that are just long enough to engage a sufficient length of thread.
- Make sure that the protective hood is properly adjusted and secured, and that it encloses the wheel as closely as the work will permit.

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Mounting Grinding Wheels on Spindles

- Inspect the wheel for flaws and carry out the ring test.
- Clean the bearing surfaces of the wheel, flanges and spindles so that the clamping pressure is evenly distributed.
- Check the speed of the spindle to make sure that it is not too fast for the type and size of wheel.
- Make sure that the hole in the wheel bushing is the right size for the spindle (neither too small nor too large).
- Use flanges that are recessed and large enough to clamp the wheel well toward its outer edge.
- Use suitable blotters.
- Tighten the spindle and nuts just enough to keep the wheel from moving out of position between the flanges.
- Before turning on the power, make sure that the wheel runs true and unobstructed.
- Stand to one side of the wheel when first turning on the power.

Working Safety

Even when a grinding wheel is tested and equipped with all possible safety devices, grinding is still a hazardous activity. It is important to always follow these safe work practices:

- Wear proper eye protection.
- Wear face shield, if required.
- Wear hearing protection, if required.
- Never wear loose clothing, ties, rings or other jewellery.
- Keep long hair in a hair net.
- Stand to one side of the wheel when first turning on the power.
- Let the machine run at full speed for one minute while everyone stands clear.
- Bring the workpiece slowing and smoothly into contact with the wheel (don't bump the wheel). Bring a cold wheel a chance to warm up.
- Don't force work against the wheel so that the motor slows down excessively or stalls.
- Don't side grind on the flat side of a straight wheel; use wheels designed for this purpose.

If a wheel breaks, find out why and eliminate the causes.

- Adjust the work rest so that:
  - it has a maximum clearance of 3 millimetres (1/8 inch) from the wheel
  - it is above the horizontal centreline of the wheel
- Don't adjust the work rest while the wheel is moving.
- If a grinder appears to be defective or unsafe, tag it and report the problem immediately to your supervisor.
- Never operate a wheel at a speed above the manufacturer's recommendation.
- Dispose of damaged wheels immediately.
- Keep the work area around the machine clear.
- Use a ground fault circuit interrupter when operating an electrically-powered grinder in a damp or wet area.

Compressed Air Hazards

Air-powered grinders present additional hazards. For more information about these hazards and how to control them, refer to IAPA's guideline, "Air Powered Hand Tools".

Vibration

Equip handles of portable grinders with vibration-absorbing covers.

Maintenance

Proper maintenance of grinders and grinding wheels will help to ensure the safety and health of the persons who use or work near them. Set up a maintenance program that includes regular inspections and servicing, and record keeping.

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Inspections

Schedule regular inspections of grinders and their parts. (See the Inspection Checklist on page 7.) Operators should frequently inspect the condition of their grinders to ensure that:

- plugs and cords are free of cuts, loose or bare wires, and dirt, oil, or grease
- shells of double-insulated tools are clean and free of cracks
- there are grounding pins on the plugs of grounded tools
- the frame, motor and parts are in good condition
- guards are in place and working properly;
- switches are working properly
- wheels are in good condition (not nicked, cracked or excessively worn) and are properly dressed (see Dressing: Bench and Pedestal Grinders below)
- work rests are properly adjusted
- glass shield protectors are in good condition (not cracked or excessively scratched) and properly adjusted
- local exhaust systems are in place, properly adjusted, and working correctly

Encourage employees to report maintenance problems. An operator who identifies a defective grinder should immediately remove it from service, tag it, and report the problem to the supervisor or maintenance department.

Dressing: Bench and Pedestal Grinders

- Wear a face shield over goggles for protection against heavy particles.
- Use a dressing tool approved for the job. Don't use a lathe cutting tool.
- Inspect star dressers for loose shafts and worn discs.
- Round off the wheel edges with a hand stone before and after dressing to prevent the edges from chipping.
- Use the work rest to support and guide the tool. Use a tool holder if one is available.
- Test employees by having them perform mock lockouts. Provide refresher trainer at least quarterly.
- Always apply pressure slowly and evenly.
- Always apply diamond dressers at the centre of the wheel or slightly below the centre, never above.

Servicing

Schedule regular servicing of grinders to keep them running safely. This includes:

- cleaning the entire machine and oiling all moving parts
- testing the motor, and replacing
- defective parts
- testing for and repairing short circuits and faulty grounds

Record Keeping

Keep records of inspections, servicing, and equipment failures; these records will help you to track your maintenance activities and also identify health and safety hazards associated with the machines. Note the dates, machine(s) involved, nature of the inspection or equipment failure, what repair or maintenance work was done, and by whom.

Training

Anyone who operates or services grinders, or who supervises these tasks should be trained in the hazards of grinding wheels, safe work practices and inspection procedures.

Hazards

Review and discuss hazards during training. Employees are more likely to follow safe work practices when they understand the hazards and how these practices can protect them.

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Safe Work Procedures

Train operators in good work practices, such as:

- following manufacturer's recommendations (e.g., for spindle speeds, line pressures, wheel mounting techniques, proper use of attachments)
- pre-use checks (see Maintenance on page 4)
- tool rest adjustment (to 3 millimeters)
- start-up procedures
- housekeeping (e.g., keeping floors clear and clean; storing tools in the proper areas)
- using personal protective equipment (e.g., goggles, face shield, protective clothing)

Inspections

Train operators and maintenance people in inspection procedures, including:

- ring and vibration tests
- proper mounting
- inspection and servicing requirements

Also train the appropriate workers in the proper handling and storage of wheels.

Legislation

The following sections of the Industrial Establishments Regulation (R.R.O. 851/90) apply to grinding wheels:

- s. 24-28: machine guarding
- s. 29: requirements for mounting, operating and storing grinding wheels
- s. 30: work rests
- s. 66: compressed air
- s. 83: entanglement
- s. 139: noise

References

American National Standards Institute (ANSI) Standards

- B74.12-2001: Specifications for Size of Abrasive Grain-Grinding Wheels, Polishing and General Industrial Uses.
- B74.13-1990 (R2002): Markings for Identifying Grinding Wheels and Other Bonded Abrasives.
- B74.21-2002: Vitrified Grinding Wheels, Fatigue Proof Test Procedure
- B7.1-2000: Safety Requirements for the Use, Care and Protection of Abrasive Wheels

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Inspection Checklist

Use this sample checklist as a pre-shift check, maintenance check or department check.
Adapt it to suit your needs

	Date of Inspection											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wheel guards (position/alignment, type/strength, condition)												
Work rest (position, height)												
Ventilation/exhaust												
Procedure (testing, mounting, dressing, truing, operation)												
PPE (eye protection, hearing protection, face shield)												
Flanges (equal/correct diameter, surface condition, thickness, distortion)												
Blotters (condition, centered)												
Grinding wheel (type, condition)												
Storage and handling												
Pinch points												
Grinder speed												
Rheostat/electrical controls												
Variable pitch pulleys/gear boxes												
Portable grinders												
Grounded plugs/ double insulated cords												
Work properly secured												
Proper procedures												
Operation enclosed/isolated												
Air lines, couplings, cylinders (proper, good condition)												
Initial of person doing inspection												

Notes:

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Revised: October 2007

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