TEACH TOOLS

March 1999

#20 - Abrasive Wheel Grinder Safety

provided by:

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Abrasive Wheel Grinder Safety

Meeting Objectives –

To explain how workers can be injured when working with abrasive wheel grinders and the regulatory requirements and safety procedures that can prevent those injuries. The result should be greater attention to abrasive wheel grinder safety and fewer injuries and regulatory violations associated with this type of equipment.

Suggested Materials to Have on Hand –

- Any abrasive wheel grinders used in the facility, and
- Personal protective equipment (safety glasses or face shields, gloves, dust masks, hearing protectors).

Introduction/Overview –

One of the most common pieces of machinery found in city shops is the abrasive wheel grinder. These useful machines, used to remove metal from flat and cylindrical surfaces, are available in two types. Some are bench or pedestal grinders that stay in one place; the others are portable abrasive tools that are used for repair jobs elsewhere in the facility.

There is also more than one type of grinder design. On some, the abrasive wheels are mounted so only the exposed flat side is used for grinding. Other machines are designed so that the grinding is done on the circumference of the wheel. Some grinders also have wire brush or buffing wheel attachments.

Regular users of abrasive wheel grinders may not be aware of their hazards. You have to keep in mind that while these machines have flat surfaces, they are cutting tools. Depending on the type and use of the equipment, the wheels can revolve at an incredible 10,000 surface feet per minute—occasionally even higher. You do not want to make contact with something moving at that rate of speed!

It is clear that people do not take abrasive wheel safety seriously enough when you look at a list of most frequent safety violations. Abrasive wheel violations always rank high—right up there with hazard communication and lockout/tagout. In one recent year, 1,704 violations were found related to abrasive wheel exposure adjustments, with 1,449 of them serious violations. Also ranking high were violations related to abrasive wheel machinery work rests. With 1,113 violations—969 of them serious—that was the year's 17th most common violation.

Violations, of course, are only part of the story. What is really important is the fact that you can be seriously injured if you are not careful with these machines.

General Hazards –

Just what are the hazards of not meeting abrasive wheel safety standards? Perhaps the biggest hazard occurs when you get too close while operating or adjusting the wheel. A hand or finger that hits the moving wheel surface is in real danger of being mangled or even cut off.

Eye injuries are another serious hazard with abrasive wheel grinders. The grinding operation can loosen chips or particles that can fly into the eye. On rare occasions, excessive speed can make an abrasive wheel disintegrate, which could send pieces of metal flying through the work area—and into your eyes.

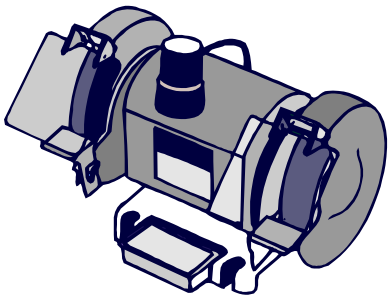
Yet another hazard is inhaling the dust and fumes generated during grinding, which can lead to respiratory diseases. An additional risk is the noise a grinding machine makes. That noise can damage your hearing if you perform these jobs for any amount of time.

Fortunately, there are ways to protect yourself from injury and illness when you work with these powerful machines.

Regulations –

The first protective step you can take is to make sure that abrasive wheel machines and their operators meet the two regulatory standards that govern their use: 29 CFR 1910.243 for portable abrasive wheels and 29 CFR 1910.215, which covers all non-portable abrasive wheel grinders.

The standard for fixed equipment is particularly detailed and even has pages of drawings and diagrams to describe:



- Design specifications for wheels and guards.
- Guarding and safe operation.
- Repairs and maintenance.
- Inspection.

You are not expected to know all of the standard's requirements, which get into such subjects as guard exposure angle dimensions for flanges. In addition, there are listed exceptions to the rules, including natural sandstone wheels; metal, wooden, or cloth paper discs with a surface abrasive layer; wheels used for internal work while within the work being ground; and mounted wheels two inches or less in diameter used in portable operations.

Many of these requirements obviously apply to the equipment itself, not to your work procedures. But the incredible level of detail gives you an idea of how much caution abrasive wheel grinders demand.

Protection Against Hazards –

The regulations also contain important protections for anyone who works with abrasive wheel grinders. The key to safety with these machines is guarding. Regulations say that, with some specified limited exceptions, both fixed and portable abrasive wheels "shall be used only on machines provided with safety guards." The safety agency defines a guard as "an enclosure designed to restrain the pieces of the grinding wheel and furnish all possible protection in the event that the wheel is broken in operation."

Most wheels are guarded with a heavy metal hood enclosure. Regulations require that guards cover the spindle end, nut and flange projections and mount in proper alignment with the wheel. The fasteners must, in most cases, be even stronger than the guard.

In addition, most abrasive wheels have to be mounted between flanges that are the same size as the wheel and not less than one-third of the wheel's diameter. The flanges distribute stresses and properly transmit the driving force. To make sure that flange pressure is distributed uniformly, regulations require blotters—compressible washers—between flanges and abrasive wheel surfaces on most equipment.

One of the riskiest parts of grinder operation occurs when you stand in front of the machine's opening. That is why regulations require an adjustable guard so you are still protected as the wheel diameter gets smaller. Though this seems like a logical form of protection, many people fail to use it.

The second most frequent abrasive wheel violation also relates to an important protection: work rests. Regulations require offhand grinding machines to have a rest that can support the piece you are working on. The rest cannot be more than one-eighth of an inch away from the wheel. Otherwise, there is a risk that the work will jam between the wheel and the rest, which could break the wheel or risk injury to the operator's hand or fingers.

You cannot use just anything for a work rest. Regulations require work rests to be rigid and provide stability. They also have to be adjustable to compensate for wheel wear. When you have to adjust the rest, make sure that the wheel is turned off. Once the adjustment is complete, be sure to clamp the rest securely.

Regulations also have other requirements designed to keep operators away from cutting edges and to prevent the machine from sending tiny metal pieces into the operators' eyes. Band type machine guards, for instance, must be made of steel plate or an equally strong material, with their ends riveted, bolted or welded together so there are no projections on the inside.

The regulations contain numerous other specifications for abrasive wheel design and guards. The regulations are hard to read, but their bottom line is very basic. The point is to ensure that operators do not come in contact with the wheels or with debris created by grinding operations.

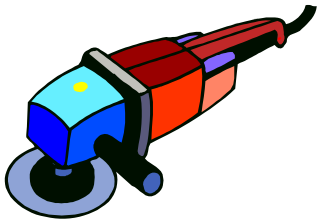
Safety Procedures –

Abrasive wheel grinder safety is not limited to machine design and setup. The regulations also try to head-off hazards with specific requirements for repair, maintenance, and inspection.

To emphasize the importance of these tasks, regulations even make the obvious into a rule. The standard says that "All flanges shall be maintained in good condition." It goes on to require that bearing surfaces be trued or refaced when they become "worn, warped, sprung, or damaged." During these operations, regulations tell us to maintain the "proper relief and rigidity" according to its diagrams.

You should also check the machine's spindle speed before mounting a wheel. This is done to ensure the machine's maximum operating speed is no higher than the speed marked on the wheel, its blotter or container. In addition, you have to inspect wheels before you mount them to make sure they have not been damaged while being moved or stored.
There is a special test you can use to make sure a wheel is not cracked. This "ring test" is very simple to perform. You gently tap a dry clean wheel with a light nonmetallic tool—perhaps a screwdriver handle for light wheels or a wooden mallet for heavier ones. The tap should produce a clear metallic "ping." If the sound is more like a dull thud, the wheel is probably cracked and should not be used.

Personal Protective Equipment –



Although we have talked almost entirely about the equipment itself, there are other safety precautions you must take in order to prevent injury with abrasive wheel grinders. One of the most important is to use assigned personal protective clothing and equipment. You will probably need:

- Safety eyeglasses with side shields or a full face shield to prevent chips or particles from getting into your eyes.
- Gloves to protect your hands from flying particles and sharp edges created during the grinding operation.
- A dust mask so you do not inhale dust or fumes that could harm your respiratory system.
- Hearing protectors to prevent hearing damage from the noise grinding creates.

Because you do not wear a full protective suit for grinding jobs, you also have to pay attention to your personal clothing. The essential rule is do not wear anything loose that could get caught in the machine. Scarves, ties, loose hair, and dangling jewelry could be dangerous. If you are wearing a long-sleeved shirt, button it at the wrist.

You also have to look out for the wheel itself. Grinding wheels are surprisingly delicate. They can easily be damaged if you handle them carelessly. It is a good idea to store new ones carefully in a dry area close to the grinding operation. When you have to carry one, do it very carefully. Take special care not to drop it or to bump it against anything.

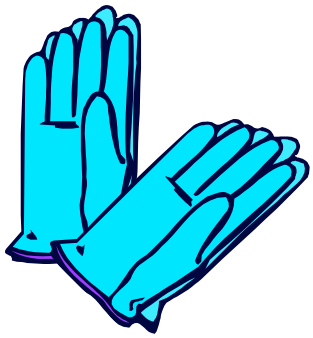
Your own work habits can also reduce the risk of accidents when you work with abrasive wheel grinders.

Before starting the grinder, make sure that:

- The work area has good lighting that does not create glare or shadows.
- The grinder itself is steady or securely mounted, with the wheel mounted securely on the machine.
- The wheel is evenly worn, without substantial nicks and scrapes or indications of cracks.
- The floor and work area are clean. Sparks could ignite debris, and water or other spills could cause electrical shock.
- The wheel is designed for the machine's size and speed.
- The power transmission motor cover is secure.
- The electrical power source is properly grounded and its cord and connections are in good condition.
- Dry grinding operations are connected to an exhaust system.
- The work rests are slightly below the wheel's center and within one-eighth inch of the wheel.
- You are standing in a balanced position to perform your work.
- You have firm control of the tool and do not have to overreach.
- You have tested the wheel with no load, while standing off to the side, to make sure it is operating safely.
- The grinder comes up to full speed before each contact with the piece you are working on.

Suggested Discussion Questions –

1. How do we use abrasive wheel grinders in this facility?
2. What are the potential hazards when you work with a grinder?
3. What is a grinder's most important protective device?
4. What role do work rests play in abrasive wheel grinder safety and how should they be positioned?
5. How do you perform a ring test on a wheel and what do you listen for?
6. What PPE should you use for grinding operations?
7. What do you want to avoid in the way you dress when you work with abrasive wheel grinders?
8. What are some things you check before you start grinding?
9. What do you look for when you inspect an abrasive wheel?
10. Are there any other questions?



Wrap Up –

Abrasive wheel grinders are great machines, but careless operation can injure your hands, fingers, eyes, and respiratory system. The fact that so many abrasive wheel grinder violations are found every year should be a warning to all of us. Remember that the most common violations—and serious hazards—are failing to properly adjust the safety guards and the work rests.

Guards block direct contact between the machine's sharp edges and your hands and fingers. The rests, when positioned properly, prevent work from getting jammed, which may either break the wheel or create a situation where your hands or fingers could get stuck and injured.

Be sure to check all the adjustments and the condition of the wheel itself before starting any job with abrasive wheel grinders. The wheels are delicate, so you have to store and handle them carefully. Before you use one, perform a ring test and listen for a clear metallic "ping" to tell you that the wheel is not cracked. If you hear a dull thud, the wheel is probably cracked, so do not use it.

Use PPE to protect your hands, eyes, ears and lungs, and do not wear anything loose or dangling that could get caught in the machine.

Like all machines, abrasive wheel grinders are as safe as the way you use them. By following the regulations, your own good sense, and keeping this equipment in good working order, you can prevent injuries.

Abrasive Wheel Grinder Safety Checklist

Be aware of abrasive wheel grinder hazards:

- ☐ Hand or finger injuries from contact with the moving wheel.
- ☐ Eye injuries from flying chips, particles or pieces of a broken wheel.
- ☐ Hearing damage from noise.
- ☐ Respiratory illness from inhaling dust and fumes created by grinding.

Before you start a grinder, check that:

- ☐ Wheel type and size are right for the job.
- ☐ Fixed grinder is securely mounted to bench.
- ☐ Portable grinder is steady.
- ☐ Grinding wheel is securely mounted on machine.
- ☐ Machine operating speed does not exceed what is marked on wheel, blotter, or container.
- ☐ Work rest is within one-eighth inch of the wheel and slightly below its center.
- ☐ Power transmission motor is securely in place.
- ☐ Grinder is connected to working exhaust system (for dry grinding).
- ☐ Electrical power source is properly grounded, with cord and connections in good condition.
- ☐ The work area contains no water or other liquid that could create electric shock potential.
- ☐ There is no debris or material in the work area that could be ignited by sparks.
- ☐ Work area lighting is adequate, without glare or shadows.
- ☐ No hair, clothes, or jewelry dangle near the machine. Button long-sleeved shirts at the wrist.
- ☐ Proper PPE is available:
  - ☐ Safety glasses with sideshields or full face shield
  - ☐ Gloves
  - ☐ Dust mask
  - ☐ Hearing protectors
- ☐ Wheel has no notable nicks, scrapes, or cracks.
- ☐ Wheel has passed “ring test” before mounting.
  - ☐ Obtain a non-metallic tester (e.g., screwdriver handle or, for heavier wheel, wooden mallet).
  - ☐ Tap gently about 45 degrees from the vertical centerline, and one or two inches from wheel’s edge.
  - ☐ Listen for clear metallic “ping”, a dull thud probably means a cracked wheel.

When you operate an abrasive wheel grinder:

- ☐ Put on PPE.
- ☐ Be sure guard aligns with wheel and covers spindle end, nut and flange projections.
- ☐ Lift wheels carefully, do not drop or bump them.
- ☐ Mount wheel or brush, replace guard, then stand to side and run machine for a minute with no load as a safety check.
- ☐ Allow grinder to come up to full speed each time before it contacts the workpiece.
- ☐ Maintain balance and firm control of tool while grinding. Do not overreach.
- ☐ Do not move or jiggle work rest while grinder is operating. Make adjustments with the power off, then clamp the rest securely.