

Surface Grinder Crystal Cutter

This study guide will cover the major working parts, functions, and machining techniques that can be found/used on most **Surface Grinders/Crystal Cutter**.

This study guide has been designed to directly represent the questions that will be found on the open book written assessment and as an aid for the hands-on usability assessment. Both assessments will include questions related to standard machine shop safety and APS internal user safety guidelines.

Answering the questions found at the end of the study guide will enable the user to successfully pass the hands-on usability and open book written assessments. Study guide practice test and answers can be found at the end of the guide.

Precision Surface Grinder Machines

Surface grinders are used for various grinding processes including truing flat metal stock, squaring material within tenths, sharpening cutting tools and for sharpening punch and die sets or as a cut-off saw for hard material.

A surface grinder normally consists of a magnetic chuck, which resembles a table, the grinding wheel that is attached to a rotating spindle, and a few hand wheels (if manually operated). The work piece is placed on the magnetic chuck and the chuck is then activated either by a switch or lever. When the chuck is activated the part is then held firmly to the magnetic chuck.

The grinding wheel is then moved down to the top of the work piece using a hand wheel, until the grinding wheel touches the part (carefully), then you can begin moving the table side to side and front to back until the entire surface of the part is ground. If more of the surface needs to be ground, move the table so the grinding wheel is off the work piece and lower the grinding wheel about 0.0002" to 0.0004" using the tick marks on the hand wheel and begin moving the table again, this process can be repeated until the desired dimension is accomplished.

Remember to follow all safety rules for surface grinders, as these machines can be dangerous if used improperly. Eye protection is a must.

The Grinding Process

Grinding is the process of removing material by the cutting action of the countless hard and sharp abrasive particles of a revolving grinding wheel as they come in contact with the surface to be ground.

Grinding machines are made in a variety of types and sizes, depending upon the class of work for which they are to be used.

To be successful with grinding, it is necessary to understand some basic principles. Grinding uses a method of material removal called abrasion. Rather than cutting like a lathe bit, the material is slowly worn away because the abrasive is harder than the material being ground. In truth the grinding wheel acts like many thousands of very small lathe bits, each cutting off some metal.

The abrasive must also be strong enough to withstand the forces acting upon it while grinding. Usually some sort of impact shock occurs when the abrasive comes in contact with the material.

Heat while grinding is of major concern, with effects seen at every phase of the operation. Also the abrasive needs to be able to withstand high temperatures caused by the friction during the grinding. Sometimes, these high temperatures will cause damage to the bonding agents found in the wheel causing the wheel to break down. In general [coolant](#) must be directed at the grinding wheel (fig. 1), not the material being ground, as heat causes more damage to the wheel than the work piece.

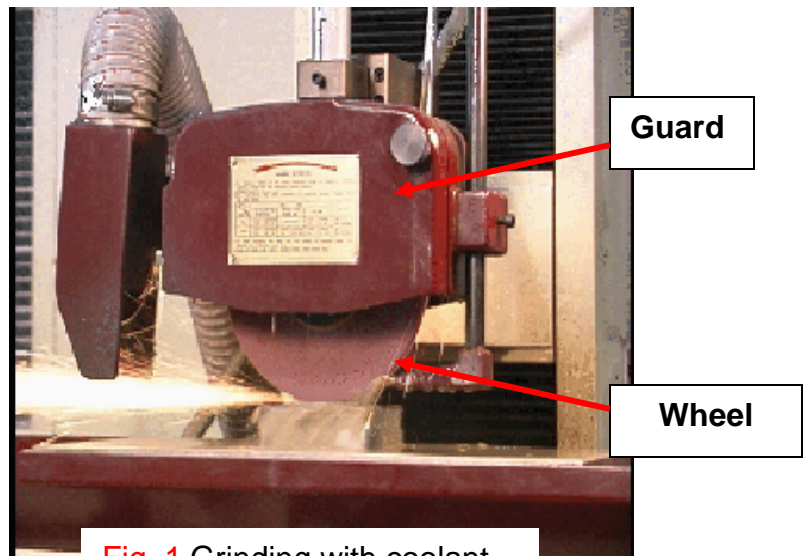


Fig. 1 Grinding with coolant

Most abrasive wheels need to be able to be resurfaced (dressed), as the old surface will become impregnated with material during the grinding operation. Dressing is accomplished by passing a diamond tipped tool laterally across the cutting surface of the wheel.

Surface grinding is probably the most fundamental of operations. Most shops have a surface grinder even if they don't have a universal cutter grinder or a cylindrical grinder.

The basic machine has a grinding wheel above the work area which can be fed downward in very small increments into a work piece which is being moved to the left and the right and in and out. This allows the wheel to contact all areas of the surface of the work piece. The grinder (fig. 2) is usually equipped with a magnetic plate used to hold the work piece. It is sometimes referred to as a magnetic chuck, although it does not look anything like a lathe chuck. The **magnetic chuck** (fig. 3) holds magnetic materials only. However steel clamps (a magnetic material) can be used to laterally clamp non-magnetic materials for surface grinding.



Fig. 2 Surface Grinder

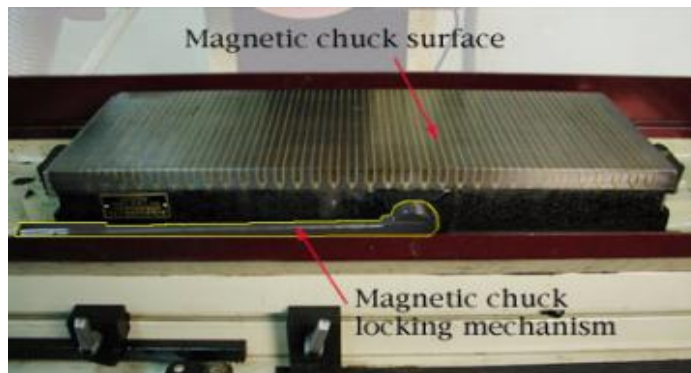


Fig. 3 Magnetic Chuck

The operator is protected against flying abrasive particles and ground material by the wheel guards, which are an integral part of a machine. Safety glasses should always be worn and face shields can be used for additional protection.

Surface grinders are used to remove surface imperfections and to work extremely hard materials. The abrasive wheels are made from an abrasive medium (usually aluminum oxide or silicon carbide) held together by a vitrified (glass) bond. The wheels are rotated at very high speeds (up to 10,000 rpm). It is important therefore that the wheels are not damaged, as fractured wheels can disintegrate and fling painful clumps of wheel in a wide area. That is why the grinders are shielded with extensive guarding.

What are some basic safety principles to know when using a surface grinder?

- Wear appropriate safety glasses. In addition, use the eye shield on the grinder, when provided.
 - Ensure that the grinder has a start/stop button within easy reach of the operator.
 - Check the grinding wheel before mounting it. Make sure it is properly maintained and in good working order.
 - Follow the manufacturer's instructions for mounting grinding wheels.
 - Keep face of the wheel evenly dressed.
 - Ensure that the wheel guard covers at least one half of the grinding wheel.
 - File off any burrs on the surface of work that is placed on the magnetic chuck.
 - Clean the magnetic chuck with a cloth and then wipe with the palm of your hand.
 - Place a piece of paper slightly larger than work piece in the centre of chuck.
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- Inspect the grinding wheels to ensure that they are not damaged
 - Ensure that all guarding is in place- Never remove guards
 - Wear safety glasses
 - Place the work piece on the magnetic chuck when grinding
 - Do not force feed the work piece into the wheel
 - Do not grind non-ferrous materials on the grinders
 - Position work on the paper and turn on the power to the magnetic chuck.
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- Check that the magnetic chuck has been turned on by trying to remove work from the chuck.
 - Check that the wheel clears the work before starting the grinder.
 - Run a new grinding wheel for about one minute before engaging the wheel into the work.
 - Stand to one side of the wheel before starting the grinder.
 - Turn off coolant before stopping the wheel to avoid creating an out-of-balance condition.
 - Keep the working surface clear of scraps, tools and materials.
 - Keep the floor around the grinder clean and free of oil and grease.

Practice Test

The following questions have been designed to directly represent the questions that will be found on the written assessment and as an aid for the hands-on usability assessment.

1. Surface grinding is probably the most fundamental of operations.
True False
2. Surface grinders are used for various grinding processes including
 - A. truing flat metal stock
 - B. squaring material within tenths
 - C. sharpening cutting tools
 - D. as a cut-off saw for hard material
 - E. All of the above
 - F. None of the above
3. If the grinder wheel is new, in the box it is not necessary to inspect it to ensure that it is not damaged before mounting.
True False
4. A surface grinder normally consists of a
 - A. magnetic chuck which resembles a table
 - B. the grinding wheel that is attached to a rotating spindle
 - C. a few hand wheels (if manually operated)
 - D. None of the above
 - E. All of the Above
5. You should always stand to one side of the wheel before starting the grinder.
True False
6. Surface grinders are normally used to
 - A. remove surface imperfections
 - B. to work extremely hard materials
 - C. Neither A or B
 - D. Both A and B

7. Failure to use eye protection in addition to the eye shield mounted on the grinder can cause serious injuries.
True False
8. All abrasive wheels should be mounted between flanges, with the exception of a few specific types of specialized wheels.
True False
9. It is OK to use an abrasive saw blade for small grinding operations.
True False
10. Never adjust the wheel guards while the grinder is running.
True False
11. Grinding is basically a machining operation that shapes or removes material by bring it into contact with a rotating abrasive wheel.
True False
12. Grinding wheels may be stored stacked upon each other to save space.
True False
13. A hand held wheel dresser is commonly used to dress a surface grinders wheel.
True False
14. Always ensure that the grinder has a start/stop button within easy reach of the operator.
True False
15. It is not a necessity to file off any burrs on the surface of work that is placed on the magnetic chuck before grinding.
True False
16. Grinding, like a milling , drilling, sawing, and turning, is a cutting operation.
True False
17. Never wear jewelry or loose clothing while operating machine.
True False
18. Maintain awareness of activity in your surrounding area at all times.
True False
19. Do not turn on a grinder if the grinder wheel looks damaged.
True False
20. You should always prop the machine shop door open upon entering the shop.
True False

Study Guide
Answer Sheet

1. True	11. True
2. E	12. False
3. False	13. False
4. E	14. True
5. True	15. False
6. D	16. True
7. True	17. True
8. True	18. True
9. False	19. True
10. True	20. True