

Training Objectives

After watching the video and reviewing this printed material, the viewer will gain knowledge and understanding of the various deburring processes used in industry and their application for finishing manufactured parts.

- deburring is defined and the need for various deburring processes is explained
- systems and equipment are illustrated
- mechanical, thermal, and electro-chemical processes are demonstrated

Burrs are sharp edges resulting from cutting and stamping operations. Although usually small in size, burrs can cause assembly problems, interfere with fluid flow, and are a common cause of worker injury. Burrs can also cause increased stresses and subsequent fatigue failure of the part.

Burr removal, or "deburring," is a standard practice associated with virtually every segment of the manufacturing process. The vast majority of deburring is performed using mechanical deburring processes, but thermal deburring and electro-chemical deburring processes are also used.

Mechanical Deburring Processes

Mechanical deburring encompasses many types of processes, including:

- cutting processes
- power brushing
- bonded abrasive finishing
- mass finishing
- abrasive blasting
- abrasive flow deburring

Cutting Processes

Cutting processes encompass a variety of manual and mechanized cutting tools for deburring, such as:

- drills
- reamers
- rotary and flat files
- knives and scrapers
- brushes and stones
- bonded abrasive papers, belts and wheels
- mechanical edgers
- numerically controlled machining centers with deburring tools

Cutting processes are flexible in application and require only a small capital investment. Additionally, inspection for obvious defects can occur simultaneously. However, achieving piece to piece precision and consistency can be difficult. In high production situations a variety of mechanized tools and systems can be employed which can improve consistency and dimensional accuracy.

Power Brushing

Power brushing is both a fast and relatively low cost deburring method. Brushes are made of metal filaments or wire and may also be of non-metallic or synthetic materials. Common metal filament brushes can be of hi-strength and stainless steel as well as brass, copper, nickel, and other alloys. A common synthetic brush material is nylon. Brushes come in a variety of shapes and sizes for numerous applications. Power brush aggressiveness depends on filament diameter, free length configuration, the texture, density, and bristle material type, wheel width, brush velocity, and workpiece contact.

Bonded Abrasive Finishing

Bonded abrasive finishing, also known as sanding, is found in most manufacturing facilities. Bonded abrasive products include sheets, belts, pads, disks, and wheels. The most common abrasives used include aluminum oxides, silicon carbide, or zirconia compounds. These abrasives range in size and grade from course to exceptionally fine for various applications.

Mass Finishing

Mass finishing allows for the mechanical finishing of many parts simultaneously. In addition to deburring, mass finishing may also be used to descale, brighten, and polish parts. Mass deburring is considered a 'loose-abrasive' method in which batches of parts are vibrated or tumbled in specifically designed tubs or barrels along with an abrasive media. Deburring media may be produced from organic, and preformed metallic, ceramic, or resin-bonded plastic materials. Preformed media ranges in a variety of sizes and shapes. In addition to the media, mass finishing usually employs water or other water-soluble compounds.

Vibratory finishing is the most common mass finishing method. Vibration frequency can range from 800 to 3600 vibrations per minute.

Other mass finishing processes include:

- barrel tumbling, which is a low pressure process involving the controlled sliding and rolling of the workpieces, media and compound;
- centrifugal disk and centrifugal barrel finishing, which are high-energy applications that are usually 20 to 50 times faster than vibratory finishing;
- spindle finishing, with parts mounted on a single or multi-spindle and immersed in a tub of abrasive media.

The main drawback of centrifugal disk, centrifugal barrel, and spindle finishing is that they are limited to the size and number of parts that can be finished at one time.

Abrasive Blasting

Abrasive blasting can be done either wet or dry. The stream of abrasive material, propelled by air pressure, can be focused on a specific area or applied fan-like to an entire part or part surface. Both metallic and non-metallic abrasives are used.

In wet applications the abrasive is applied as a slurry usually with water as the liquid, along with rust inhibitors if required. The process is considered a precision method in that part tolerance can be maintained.

Abrasive Flow Deburring

Abrasive flow deburring involves the extrusion of semi-solid material impregnated with abrasives through holes and openings in hydraulically clamped workpieces. Extrusion pressure can range from 100 to 3200 PSI. The most common abrasive media used is silicon carbide in a polymer carrier. Other abrasives include boron carbide, alumina, and diamond.

Thermal and Electro-Chemical Deburring

Thermal and electro-chemical deburring, although not as commonly used as the mechanical processes, are important in that they can deburr parts quickly including difficult to reach internal part surfaces.

Thermal energy deburring takes place in a chamber filled with oxygen and a combustible gas, usually natural gas. This gas is ignited producing intense heat which vaporizes the burrs and other sharp corners. A resulting oxide residue is subsequently removed using a mild acid or during any additional finishing process, such as heat treating.

In the electro-chemical deburring process burrs are dissolved by the action of a neutral-salt electrolyte flowing through the gap between the tool or cathode and the workpiece which is the anode. This is a very fast, precision process. The amount of material removed is proportional to the amount of time and levels of current applied. The dissolved metal, in the form of hydroxides, is carried away by the controlled flow of the electrolyte, which is then filtered for reuse. Electro-chemical electrodes are made of copper-tungsten. The workpiece areas not being deburred are insulated by a non-conductive material.

Review Questions

1. A process that can occur simultaneously with manual deburring is:
 - a. inspection
 - b. painting
 - c. forming
 - d. plating

2. A major problem with mechanical hand deburring is:
 - a. tool cost
 - b. worker injuries
 - c. surface blemishes
 - d. piece to piece inconsistency

3. A brushing variable in regards to deburring is:
 - a. bristle material type
 - b. free length configuration
 - c. brush velocity
 - d. all of the above

4. Mass deburring is considered a:
 - a. bonded abrasive method
 - b. loose abrasive method
 - c. free abrasive method
 - d. chemical abrasive method

5. Barrel tumbling deburring is:
 - a. followed with a secondary finishing process
 - b. a high-energy application
 - c. a low pressure process
 - d. very fast

6. A limiting factor in spindle finishing of parts is:
 - a. the size and number of parts
 - b. the speed and smoothness
 - c. the size of tub or barrel
 - d. the abrasive particle size

7. Thermal energy deburring most usually employs:
 - a. propane gas
 - b. acetylene gas
 - c. natural gas
 - d. butane gas

8. In electro-chemical deburring, the workpiece is the:
 - a. cathode
 - b. anode
 - c. insulator
 - d. resistor

Deburring Processes

Answer Key

1. a
2. d
3. d
4. b
5. c
6. a
7. c
8. b