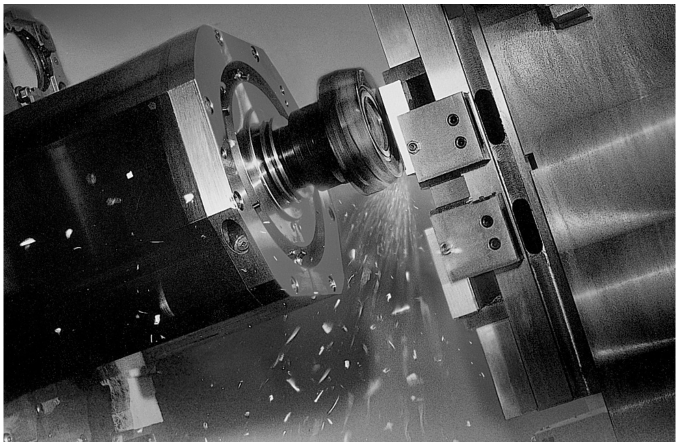

Color Transparencies (Binder/CD only)

These color transparencies are designed to help your students understand the principles and techniques of machining technology. They can be used to introduce fundamentals of operation, generate discussion on proper techniques, and facilitate and improve your presentation to the class.

Chapter 1

CT1-1. The lathe operates on the principle of the work being rotated against the edge of a cutting tool.

CT1-2. A drill press operates by rotating a cutting tool (drill) against the material with sufficient pressure to cause the tool to penetrate the material.

CT1-3. Grinding is a cutting operation, like turning, drilling, milling, or sawing. However, instead of the one, two, or multiple-edge cutting tools used in other applications, grinding employs an abrasive tool composed of thousands of cutting edges.

CT1-4. Band machining makes use of a continuous saw blade, with each tooth functioning as a precision cutting tool.

CT1-5. Milling removes material by rotating a multitoothed cutter into the work. A—With peripheral milling, the surface being machined is parallel to periphery of the cutter. B—End mills have cutting edges on the circumference and the end.

CT1-6. A broach is a multitoothed cutting tool that moves against the work. Each tooth removes only a small portion of the material being machined. The cutting operation may be on a vertical or horizontal plane.

Chapter 2

CT2-1. Chart illustrates various fire extinguisher types and fire classifications. In the small engine shop, always use an extinguisher designed for use on electrical and chemical fires.

Chapter 3

CT3-1. Many types of lines, symbols, and figures are used to give a drawing exact meaning.

CT3-2. Standard ANSI symbols are changed periodically. You must be familiar with both the old and new symbols because either may be used on the drawings. Compare these examples.

CT3-3. A great deal of information is contained in the drawing's title block. The components highlighted here are standard on most drawings.

Chapter 4

CT4-1. These are the US conventional fractional and metric graduations found on rules. Measurements are taken by counting the number of graduations.

CT4-2. How to read a Vernier micrometer caliper. Add the total reading in thousandths, then observe which of the lines on the Vernier scale coincides with a line on the thimble. In this case, it is the second line, so 0.00002 is added to the reading.

CT4-3. To read a metric micrometer, add the total reading in millimeters visible on the sleeve to the reading of hundredths of a millimeter, indicated by the graduation on the thimble. Note that the thimble reading coincides with the longitudinal line on the micrometer sleeve.

CT4-4. Reading a metric-based Vernier micrometer caliper. To the regular reading in hundredths of a millimeter (0.01), add the reading from the Vernier scale that coincides with a line on the thimble. Each line on the Vernier scale is equal to two thousandths of a millimeter (00.002 mm).

CT4-5. Reading a 25- and 50-division Vernier scale.

CT4-6. A—How to read a 25-division metric-based Vernier scale. Readings on the scale are obtained in units of two hundredths of a millimeter (0.02 mm). B—How to read a 50-division metric-based Vernier scale. Each division equals two hundredths of a millimeter (0.02 mm).

Chapter 5

CT5-1. Compare the part drawing with steps involved in laying out the job.

Chapter 6

CT6-1. How thread size is noted and what each term means.

CT6-2. Nomenclature of a fastener thread.

Chapter 7

CT7-1. Cap screws are manufactured in various types. A—Flat head. B—Hexagonal head. C—Socket head. D—Fillister head. E—Button or round head.

CT7-2. Identification marks (inch size) and class numbers (metric size) are used to indicate the relative strength of hex head cap screws. As identification marks increase in number, or class numbers become larger, increasing strength is indicated.

CT7-3. Setscrew head and point designs. A—Socket head. B—Slotted head. C, D, and E—Fluted head. F—Square head. G—Flat point. H—Oval point. I—Cone point. J—Half dog point. K—Full dog point. L—Cut point.

Chapter 8

CT8-1. A simple drill template. Identification numbers on jigs and fixtures allow these devices to be located easily when stored away between uses.

Chapter 9

CT9-1. For maximum results, coolant should flood the area being machined and cutting tool to provide the most efficient removal of the heat generated. (Kesel/JRM International, Inc.)

Chapter 10

CT10-1. A—Gun drill. The tip is shown in larger scale. The light-colored portion is tungsten carbide. The larger area does the cutting; the smaller sections act as wear surfaces. B—A taper shank twist drill with holes to direct coolant to the cutting edges. C—Three- and four-flute core drills. D—Step drill. E—Combination drill and reamer. F—Microdrills are smaller than the #80 drill (0.0135″ diameter). G—A half-round drill.

Chapter 11

CT11-1. Principles of how typical grinding machines work.

Chapter 12

CT12-1. The three principle types of cutoff saws.

CT12-2. Recommended ways to hold sharp-cornered work for cutting. A carefully planned setup will ensure that at least three teeth will be cutting, greatly extending blade life.

Chapter 13

CT13-1. Lathe measurements. A—Length of bed. B—Distance between centers. C—Diameter of work that can be turned over the ways. D— Diameter of work that can be turned over the cross-slide.

CT13-2. Cutter bit nomenclature.

Chapter 14

CT14-1. Common thread forms. A—Unified thread form, interchangeable with American National Thread. B—Sharp "V" thread form. C—Acme thread form. D—Square thread form. Note: In formulas above, N = Number of threads per inch; P = Pitch; d = depth of thread.

CT14-2. The difference between lead and pitch. A—Single thread screw, the pitch and lead are equal. B—Double thread screw, the lead is twice the pitch. C—Triple thread screw, the lead is three times the pitch.

Chapter 15

CT15-1. Centering drill. A—The drill will cut exactly on center if the hole is started with a center drill. B—Holes larger than 1/2″ (12.5 mm) in diameter require drilling of a pilot hole. C—There must be enough clearance between the back of the work and the chuck face to permit the drill to break through the work without damaging the chuck.

Chapter 16

CT16-1. This drawing shows a greatly shortened section of an internal broaching tool and a cross-section of the splines it cuts in a part. The pilot guides the cutter into a cut or hole previously made in the work. Each tooth of the broach increases slightly in size until the specified size is attained.

Chapter 17

CT17-1. A—Table movements of plain-type horizontal milling machine. B—Table movements of the universal type milling machine.

Chapter 18

CT18-1. Four of the most common methods employed to mount end mills in a vertical milling machine. A—Adapter sleeve with taper shank cutter. B—B&S taper mounted directly in the spindle. C—Spring collet with straight shank cutter. D—Adapter with setscrew on straight shank cutter.

CT18-2. Sequence for squaring work on a milling machine.

CT18-3. Nomenclature of bevel gears. The smaller gear is called the pinion.

Chapter 19

CT19-1. Three variations of the planer-type surface grinder.

CT19-2. Standard system for marking grinding wheels.

CT19-3. Standard grinding wheel shapes.

CT19-4. Cutting edges of a machine reamer.

CT19-5. A few of many abrasive belt grinding techniques.

Chapter 20

CT20-1. Blade set. A—The term "blade set" refers to side angle of the teeth. B—The different types of blade set. C—Saw blade terminology.

CT20-2. Blade guides. A—Blade guide inserts are used for light sawing. B—Roller guides are recommended for continuous high-speed cutting.

Chapter 21

CT21-1. Axes of machine tool movements. A—Vertical milling machine. B—Lathe. C—Horizontal milling machine. Spindle motion is assigned Z axis. Note how Z axis differs between machines with vertical spindle and machines with horizontal spindle.

Chapter 22

CT22-1. Basic geometric configurations of robots. All provide three articulations (specific arm movements).

Chapter 23

CT23-1. A—One type of laser inspection device. With it, tool wear can be continuously monitored. Note how laser beams can detect work that is oversize or undersize. B—Operation of the eddy current flaw detection system. Photoelectric cells turn off alarm system when the end of a test piece passes into the test coil. Any flaw would cause small current changes in the test coil.

Chapter 24

CT24-1. A spark test is sometimes employed to determine the grade of steel. Touch steel to the grinding wheel lightly, and observe the color and form of the resulting sparks.

Chapter 25

CT25-1. Before metal become incandescent (glows red), steel will pass through the colors listed on this table. Colors are also useful for tempering steel if no pyrometer is fitted to the furnace. (Bethlehem Steel Co.)

CT25-2. This diagram shows how 1/16″ steel ball penetrator is used to make a Rockwell B hardness reading. Size of the ball has been greatly exaggerated for clarity.

Chapter 26

CT26-1. A—How surface waviness is measured. Note the difference in magnitude between waviness and roughness. B—On drawings, symbols and numbers show roughness, waviness, and lay. They specify finishes required on a surface.

Chapter 27

CT27-1. A—How electrical discharge wire cutting (EDWC) works. It differs from EDM in that a fine, moving wire electrode is used for cutting instead of a solid electrode. B—This technique is ideal for CNC operations. How electrochemical machining (ECM) works.

Chapter 28

CT28-1. This aircraft part was chem-milled after it was formed. Pieces even more severely formed than this part can be chem-milled economically. (Northrop-Grumman Corp.)

Chapter 29

CT29-1. Arrows and numbers indicate sequence involved in producing bolts by chipless machining. Trace part flow through the sequence of operations.

Chapter 30

CT30-1. A well-written resume will help make a good impression on employers.

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