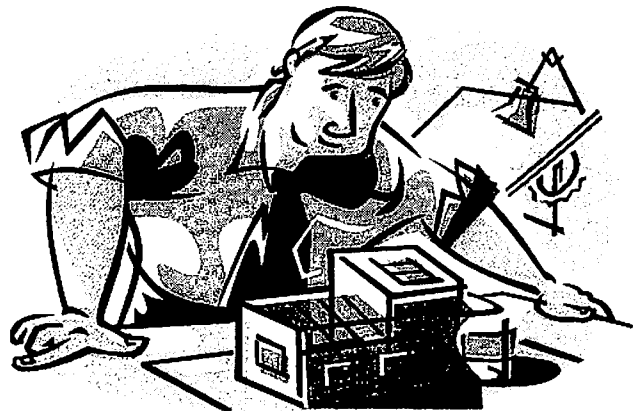
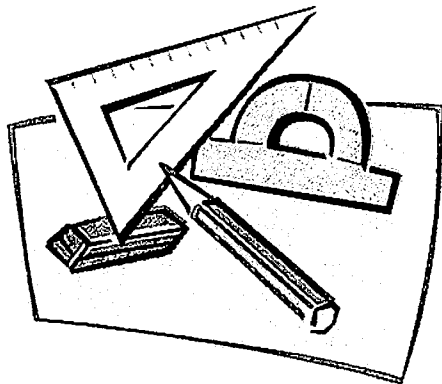
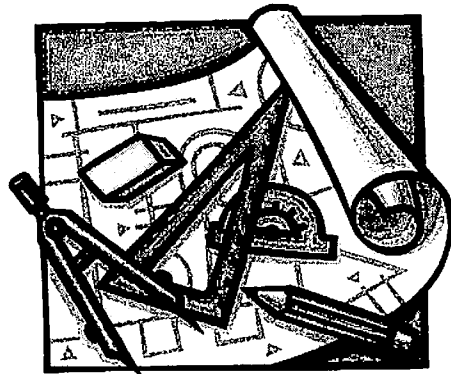
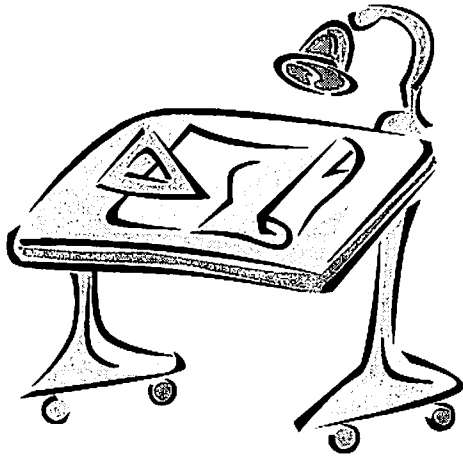


Lewis & Clark Career Center

Curriculum Guide

Design Drafting



**Curriculum Guide
For
Design Drafting / CAD**

Course Rationale, Course Description, Units of Study

Competencies

Crosswalk to Show Me Standards

Articulation Agreements

Employer Survey / Advisory Board Minutes

Instructional Methods

Integrated Lesson Sample

Work Experience Program

SkillsUSA Officers

Teacher Certification

School and Program Policies and Procedures

Inventory

Program Enrollment Data

Placement Data

Program Evaluation

Program Brochures/Enrollment Packet

Miscellaneous

DESIGN DRAFTING TECHNOLOGY/CAD

1 or 2 year program; 3 units of credit per year

Drafting and Design Technology is a one or two year course designed for students intending to enter drafting or the engineering fields. The program is structured so that upon completion, the student will be qualified to enter a wide variety of engineering graphic areas or architectural areas at entry level. The student may also continue post-high school training in drafting if desired.

In one year, the program concentrates on general drafting skills with an emphasis on mechanical drafting areas including welding, sheet metal, gearing, castings, power transfer, and introduction to Computer Aided Drafting (CAD) and Solid-works.

The second year encompasses architectural and 3-D modeling areas such as architectural history, styles, design, electrical, plumbing, HVAC, structural details and codes.

It is recommended that students have two units of mathematics with average or better grades. Algebra and Geometry would be helpful, but good basic math skills are essential.

LEWIS & CLARK CAREER CENTER

DESIGN DRAFTING/CAD UNITS OF STUDY

- Drafting Room Procedures
- Tools and Equipment
- Basic Drawing Skills
- Orthographic Projections: Multiviews
- Auxiliary Views
- Descriptive Geometry/Revolutions
- Sectional Views/Conventions
- Pictorial Drawings
- Dimensioning and Tolerancing as Applied to Specific Drafting Fields
- Applied Mathematical Skills
- Basic CAD Skills
- Advanced CAD Skills
- Solidworks
- Introduction to Production Manufacturing Drawing
- Introduction to Architectural Drawings
- Introduction to Residential and Commercial Wiring Drawings
- Introduction to Electronic Drawings
- Introduction to Pipe/Plumbing Drawings
- Introduction to Civil/GIS (Geographic Information System) Drawings
- Employability Skills
- SkillsUSA
- **Articulated with: Linn State Technical College
St. Charles Community College**

Lewis & Clark Career Center
Design Drafting/CAD

Grading Breakdown

Lab Assignments	50%
Tests	25%
Employability	25%



P.B. Tiller
Instructor



LEWIS & CLARK

CAREER CENTER

STUDENT: _____

ID NO: _____

Design Drafting Competencies

Rating Scale: 3 Mastered
 2 Requires Supervision
 1 Not Mastered
 N No Exposure

3	2	1	N	A. DRAFTING ROOM PROCEDURES
				1. Apply safety policies and procedures (NSS 2.2.2)
				2. Identify drafting terminology
				3. Identify American National Standards Institute, Inc. (ANSI) and International Standards Organization (ISO) stand
				4. Identify drafting occupation and related fields
				5. Apply record- keeping procedures (filing and record retrieval)
				6. Identify and apply ergonomic considerations

3	2	1	N	B. TOOLS AND EQUIPMENT
				1. Select proper drawing instruments and equipment to complement the drafting media (e.g., Mylar, vellum) (NSS 1.1.
				2. Demonstrate proper use, care and adjustment of drawing instruments and equipment and computer equipment (NSS 2.1
				3. Produce copies (e.g., stick- on decals, sepia and blueline copies) (NSS 1.1.8
				4. Operate and adjust input devices (e.g., mouse, keyboard, digitizer, scanner) (NSS 2.1.2)
				5. Operate and adjust output devices (e.g., printers, plotters, data transfer) (NSS 2.1.3, 2.1.7)
				6. Identify and use data storage, retrieval and back-up systems (NSS 2.1.4, 2.3.2., 2.3.3, 2.3.5, 2.3.8)
				7. Identify operating systems and procedures (NSS 2.3.1, 2.3.4, 2.3.7)

3	2	1	N	C. BASIC DRAWING SKILLS
				1. Lay out drawing
				2. Construct borders and information blocks (NSS 1.1.5)
				3. Construct freehand sketches (NSS 1.1.9)
				4. Read and transfer measurements (English and metric) (NSS 1.1.2., 1.1.6)
				5. Letter freehand (letter and numerals)
				6. Demonstrate techniques in line constructions (e.g. weights, types and uniformity) (NSS 1.1.4)
				7. Construct a reproducible drawing with mechanical pencils
				8. Construct a reproducible drawing with technical ink pens
				9. Perform basic geometric construction (e.g., line dividing, angles, tangents, polygons, arcs)
				10. Identify and use various annotation methods (NSS 1.1.3)

3	2	1	N	E. Orthographic Drawings
				1. Identify use and application of orthographic drawing (3 rd angle)
				2. Identify 1 st and 3 rd angle projection drawings
				3. Interpret an orthographic projection (3 rd angle)
				4. Sketch multiview drawing (3 rd angle) (NSS 1.1.3)
				5. Prepare orthographic drawing (3 rd angle)

3	2	1	N	F. Auxiliary Views
				1. Identify use and application of auxiliary views
				2. Construct primary auxiliary views
				3. Construct secondary auxiliary views

3	2	1	N	I. Descriptive Geometry/Revolutions
				1. Perform graphic solutions of points, lines and planes
				2. Solve true length of lines, bearing, and slope of lines
				3. Perform graphic solutions of solids
				4. Perform graphic solutions of intersections (e.g., lines, planes, and solids)
				5. Construct drawing using the revolution method

3	2	1	N	G. SECTIONAL VIEWS / CONVENTIONS
				1. Identify and draw standard sectional views
				2. Identify the symbols used to represent different materials
				3. Identify and use cutting planes
				4. Identify and use conventional breaks
				5. Identify use and applications of sectional views

3	2	1	N	J. PICTORIAL DRAWINGS
				1. Identify use and application of pictorial drawings (NSS 1.3.1 – 1.3.3)
				2. Sketch pictorial drawings (NSS 1.1.9)
				3. Construct axonometric, oblique and perspective drawings (NSS 1.3.2)

3	2	1	N	H. DIENSIONING AND TOLERANCING AS APPLIED TO SPECIFIC DRAFTING FIELDS
				1. Construct the lines used to dimension drawings (NSS 1.4.2)
				2. Identify and apply dimensioning practices (NSS 1.4.3 – 1.4.6, 1.4.8, 1.4.9)
				3. Identify and apply tolerancing (NSS 1.4.10)
				4. Identify and apply geometric dimensioning and tolerancing techniques (NSS 1.4.10)
				5. Dimension drawing using ANSI and ISO standards (NSS 1.4.7, 1.1.6)

3	2	1	N	S. APPLIED MATHEMATICAL SKILLS
				1. Apply basic mathematics principles (NSS 1.1.2, M1, M2, M13)
				2. Apply basic geometric principles (NSS M5- M8)
				3. Apply basic trigonometric principles (NSS M12)
				4. Solve problems using formulas (NSS M9- M11)

3	2	1	N	U. BASIC CAD SKILLS
				1. Create new 2-D drawing (NSS 3.1.1, 3.1.3)
				2. Perform drawing setup to applicable standards (e.g., settings, layers, line types and widths) (NSS 3.1.2, 3.3.1)
				3. Identify and use view and display commands (e.g., zoom, pan, viewpoints, rotation, shading) (NSS 3.1.5, 3.3.3, 3)
				4. Use query commands to extract drawings data (e.g., entity characteristics, distance, area, status) (NSS 3.4)
				5. Edit, copy and manipulate drawing entities (e.g., properties, stretch, trimming, scaling) (NSS 3.2.1, 3.2.2, 3.3)
				U. Basic Cad Skills cont'd
				6. Save, retrieve and manage drawings (NSS 3.3.9)
				7. Dimension drawings (NSS 3.5)

				8. Set and change dimensioning variables (NSS 3.5)
				9. Enter and edit text (NSS 3.1.4)
				10. Plot drawings too proper scale (NSS 3.3.6)
				11. Identify backup and archival methods
				12. Create, edit and retrieve comment/symbol libraries (e.g., groups block, symbol, third-party libraries) (NSS)
				13. Identify and apply layering techniques (NSS 3.3.7)
				14. Identify methods of sharing drawings (e.g., team projects)

3	2	1	N	V. ADVANCED CAD SKILLS
				1. Create 3-D drawing using extrusions and wireframes (NSS 3.1.7, 3.1.10,3.1.11, 4.1.1)
				2. Create surface and solid models (NSS 3.1.7, 3.1.11, 4.1.1-4.1.5)
				3. Create joined and offset surface (NSS 3.1.8, 3.1.10, 4.1.7)
				4. Edit solids, curves and surface (NSS 4.1.6, 4.1.7- 4.1.9, 4.2.1- 4.2.6)
				5. Create 2-D geometric from 3-D models (NNS 3.1.9)
				6. Import and export various file formats (e.g., DXF, IGES, raster) (NSS 2.3.6, 4.5.2)
				7. Extract geometric and attribute data (e.g., database and component information) (NSS 4.3.2, 4.4.1- 4.4.3)
				8. Perform customization to improve productivity (NSS 4.5.1)
				9. Install and configure software
				10. Install and configure hardware
				11. Extract surface and mass properties (e.g., area, perimeter, moments, of inertia, centurions) (NSS 4.4.4, 4.4.5)
				12. Develop geometry using parametric programs (NSS 4.5.4)

3	2	1	N	O. INTRODUCTION TO PRODUCTION MANUFACTURING DRAWING
				1. Identify use and applications of threads and fasteners (e.g., bolts, pins, keys)
				2. Identify manufacturing processes (e.g., machine processes, metal forming, CNC)
				3. Produce detail drawings applying standards machine fits, finishes and tolerances
				4. Produce machine assembly drawing
				5. Apply standards fits, finishes and tolerances to machine drawing
				6. Develop a parts list
				7. Produce drawings for welded component parts
				8. Produce drawings for metal bending and fabricating
				9. Produce drawings for non- steel materials
				10. Produce drawings for CAD.CAM applications
				11. Produce drawings for cams
				12. Produce drawings for gears

3	2	1	N	K INTRODUCTION TO ARCHITECTURAL DRAWING
				1. Construct architectural symbols (NSS 1.1.7)
				2. Identify architectural design and planning principles
				3. Identify basic construction terminology and materials
				4. Produce site plan
				5. Identify applicable building codes
				6. Prepare a schedule using a freehand architectural style lettering (NSS 1.1.3)
				7. Measures, sketch and draft an as built floor plan (NSS 1.1.2, 1.1.9)
				K. Introduction to Architectural Drawings con't
				8. Produce typical wall and building sections sections with necessary details
				9. Produce floor plans
				10. Produce elevation drawings

3	2	1	N	W. INTRODUCTION TO RESIDENTIAL AND COMMERCIAL WIRING DRAWING
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				1. Identify electrical symbols (NSS 1.1.7)
				2. Identify applicable codes (e.g., IEC, NEC and IEEE)
				3. Produce wiring schematics

3	2	1	N	X. INTRODUCTION TO ELECTRONIC DRAWINGS
				1. Identify electronic symbols (NSS 1.1.7)
				2. Produce electronic electrical schematics and diagrams

3	2	1	N	M. INTRODUCTION TO PIPE/PLUMBING DRAWINGS
				1. Identify piping symbols, fitting, fixtures and valves (NSS 1.1.7)
				2. Identify applications codes
				3. Identify principles of pneumatics and hydraulics
				4. Produce orthographic drawings
				5. Produce isometric drawings

3	2	1	N	N. INTRODUCTION TO STRUCTURAL STEEL DRAWING
				1. Identify structural steel shape
				2. Identify applicable codes (OSHA, AWS, SJI, and BOCA)
				3. Identify and apply welding symbols (NSS 1.1.7)
				4. Identify open- web joist types and applications
				5. Produce a steel framing plan drawing
				6. Produce a detail and assembly drawing (including beam connections) with bill of materials
				7. Sketch complex connections (NSS 1.1.9)

3	2	1	N	Y. INTRODUCTION TO CIVIL/GIS (GEOGRAPHIC INFORMATION SYSTEM) DRAWING
				1. Identify symbols (NSS 1.1.7)
				2. Identify uses of GIS and GPS (global positioning system)
				3. Produce a contour plan
				4. Produce a profile drawing
				5. Produce a land survey plot from written description

3	2	1	N	Q. INTRODUCTION TO SHEET METAL/HVAC DRAWINGS
				1. Identify applicable codes (e.g., ASHRAE)
				2. Produce representative sheet metal drawings
				3. Identify sheet metal layout procedures
				4. Identify HVSC symbols (NSS 1.1.7)
				5. Produce sheet metal drawings for CAD/CAM applications
				6. Prepare HVAC ductwork plan

3	2	1	N	T. LEADERSHIP COMPETENCIES
				1. Demonstrate an understanding of VICA, its structure and actives
				2. Demonstrate an understanding of one's personal values
				3. Perform tasks related to effective personal management
				4. Demonstrate interpersonal skills
				5. Demonstrate etiquette and courtesy
				6. Demonstrate effectiveness in oral and written communications
				7. Develop and maintain a code of professional ethics
				8. Maintain a good professional appearance
				9. Perform basic tasks related a securing and terminating employment
				10. Perform basic parliamentary procedures in a group meeting

* Highlighted items indicate essential skills.

**PROGRAM ARTICULATION AGREEMENT
FOR
THE TECHNICAL CAREER PATHWAYS PROGRAM
*Lewis and Clark Vocational School***

All credit is awarded on the basis that students have successfully completed the prerequisites for each course. Students are to provide competencies of their vocational technical program as well of letters of recommendation to accompany their petition for credit. All credit which is to be awarded is subject to: possessing the required number of competencies; receiving favorable letters of recommendations (to include comments about work ethic, attendance, interpersonal communication, appearance, motivation, industriousness; passing a written and performance examination covering the competencies which are part of the Ranken Technical College course.

The first term or semester of technical courses listed below will be articulated based upon successful completion of a 2 year program at a vocational technical school, favorable letters of recommendation (to cover our work ethic component), possessing the required number of competencies and a proficiency test (written and performance) given by Ranken Technical College with a grade of "B" or higher: The written test for all eligible programs* must be completed successfully before the performance testing will be administered.

<u>Lewis & Clark Program Title</u>	<u>Ranken Course Title</u>	<u>Credit Hours</u>
Design Drafting/CAD	1st semester, Architectural Technology	14
Auto Collision Repair	1st term, Automotive Collision Repair	10
Auto Service Technology	1st term, Automotive Maintenance Technology	10
Building Trades	1st term, Carpentry and Building Construction	10
Electrical Trades	1st term, Industrial Electricity/Electronics Technology	10
Electronics	1st term, Electronics Engineering Technology	10
Heating, Ventilation, and Air Conditioning (HVAC)	1st semester, Refrigeration/Air Conditioning/Heating	15
Computer Information Systems	1st term Computer Networking Technology	10

*Some technical programs may be excluded from the articulation agreement.

Kenneth C. Cobb
Signature
Voc Director
Title
11-2-98
Date

Debra R. McPeak
Signature
Dean
Title

Debra R. McPeak, Ph.D, Dean of Enrollment Services
Ranken Technical College



COPY

Effective Date: FA/94

Articulation Agreement
Between
Lewis & Clark Area Vocational/Technical School
East Central College

Drafting and Design

East Central College has agreed to grant college credit to students completing the Drafting & Design program at Lewis & Clark Area Vocational/Technical School for the following courses:

<u>Course No.</u>	<u>Course Title</u>	<u>Credit Hours</u>
DF 1013	Engineering Drawing	3
DF 1023	Descriptive Geometry	3
DF 1043	Technical Computations I	3
DF 1063/1072	Machine Drawing	5
DF 1055	Materials & Processes	5
DF 2143	Intro CAD Applications I	3
DF 2073/2083	Architectural Drawing	<u>5</u>
	Total	27

The following criteria must be met in order for students to receive the credits:

1. Students must supply the college with an official transcript from Lewis & Clark AVTS showing grades of "C" or better in the course(s) or program for which articulation credit is to be granted.
2. Students must meet the program prerequisites as established by the college and stated in the current college catalog.
3. Students must pursue an AAS degree; credit is not applicable to a one-year certificate program.
4. One semester or 15 credit hours of coursework must be completed satisfactorily at East Central College before credit will be granted.

Drafting & Design

5. Students must maintain 90% attendance at Lewis & Clark.
6. Students must qualify and receive the Missouri Passport.

Student Tuition and Fees:

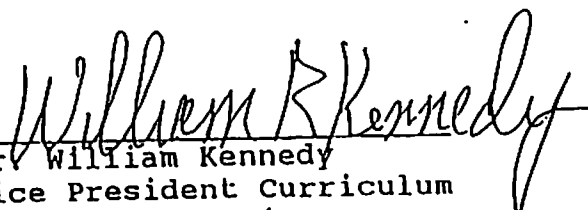
- A. Articulated courses: student tuition and fees will be waived.
- B. Non-articulated courses required for AAS degree: student will pay regular tuition and fees or qualify for grants, scholarships, and loans which satisfy the costs of instruction at the current rates for the semester.

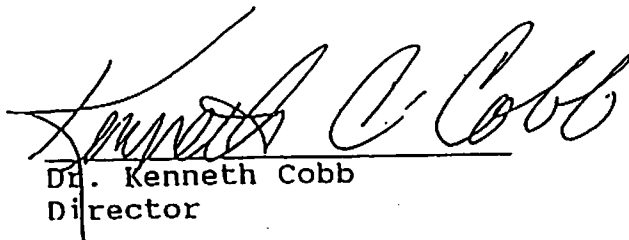
Miscellaneous:

- A. Either party may withdraw from this agreement provided written notice is tendered to the other party at least one year prior to the intended date of withdrawal. Such withdrawal must coincide with the end of the academic year.
- B. This Articulation Agreement applies to only those programs/courses outlined in the document.

East Central College

Lewis & Clark AVTS


Dr. William Kennedy
Vice President Curriculum
and Instruction


Dr. Kenneth Cobb
Director

21 Nov 94
Date

11-9-94
Date

LINN STATE

Technical College

DESIGN DRAFTING

Articulation Agreement

Between

Linn State Technical College And Hewitt & Clark Career Center

General Understanding:

Linn State Technical College seeks to expand educational opportunities to students through advanced and professional technical education. The program specifics outlined below provide a baseline of courses available for articulated credit. To allow reasonable flexibility for individual secondary school differences, changes in program specifics may be made with the mutual assent of the secondary school and LSTC prior to finalizing/signing the articulation agreement. Contact LSTC should course changes be required.

Refer to "Competency" listing LSTC program content and course descriptions (following) for clarification of articulated course learning objectives.

PROGRAM SPECIFICS:

COURSES WHICH QUALIFY FOR ARTICULATED CREDIT				
COURSE DESCRIPTION	COURSE NO.	CREDIT HOURS	SECONDARY COURSES TITLE/DESCRIPTION	COURSE NO.
Fundamentals of Drafting	DFT 150	3.0		
Industrial Graphics	DFT 151	3.0		
Fundamentals of Mechanical Applications	DFT 183	3.0		
Dimensioning & Tolerancing	DFT 151	3.0		
Industrial Design	DFT 154	3.0		
Fundamentals of CAD	DFT 184	3.0		
Elements of Civil Design	DFT 273	3.0		
CREDIT EARNED		21.0		

SIGNATURES:

LSTC agrees to grant college credit to students based on the "Goals, Guidelines, Procedures and the program specific guidelines/amendments" provided in the agreement

We have reviewed this agreement and the supporting instruments and agree to the terms of this articulation agreement

LINN STATE TECHNICAL COLLEGE AND

Hewitt & Clark Career Center
(School District)

Don Toliver Date 4-10-99
Vice President of Academic Affairs, LSTC

James C. Cobb Date 4-16-99
Director

LINN STATE

Technical College

CIVIL/CONSTRUCTION ENGINEERING MANAGEMENT TECHNOLOGY

Articulation Agreement Between Linn State Technical College And Lewis & Clark Career Center

General Understanding:

Linn State Technical College seeks to expand educational opportunities to students through advanced and professional technical education.

PROGRAM SPECIFICS:

COURSES WHICH QUALIFY FOR ARTICULATED CREDIT				
COURSE DESCRIPTION	COURSE NO.	CREDIT HOURS	SECONDARY COURSES TITLE/DESCRIPTION	COURSE NO.
Engineering Drafting/Graphics	CET 130	3.0	Design Drafting I	N/A
CREDIT EARNED		3.0		

SIGNATURES:

LSTC agrees to grant college credit to students based on the "Goals, Guidelines, Procedures and the program specific guidelines/amendments" provided in the agreement.
We have reviewed this agreement and the supporting instruments and agree to the terms of this articulation agreement.

LINN STATE TECHNICAL COLLEGE AND

ST. CHARLES R-VI
School District

Don R. Helven Date: 3/27/00
Vice President of Academic Affairs, LSTC

Kenneth C. Cook Date: 3-21-00
Secondary Director

Kevin U. Blund Date: 3/26/00
Department Chair, LSTC

Janeth Robinson, P.E. Date: 21 Mar 00
Secondary Instructor
perm. sub

**Lewis & Clark Career Center
Design Drafting/CAD
Advisory Meeting
Fall 2008**

The Following is a list of Advisory Committee members:

Megan Bogner of Kansas States Architecture Program-5th yr. student
Adam Rehagen of
Mike Quinn of QTE Technologies
David Nermann, Associate Professor & Program Coordinator for CAD/Pre-Engineering
At St. Charles Community College

Due to the full schedules and the distance of one member, information has been derived from one or more of the following methods: Personal contact, telephone conversations and e-mails.

Members were informed (though some already knew) that this past summer I had another 1st place National finisher. This is the 3rd 1st Place National finisher that my program has had in the last four years. They were also reminded that in addition to the three 1st places my program has also produced a 3rd, two 5ths and two 7th place National finishers. Members wanted to know how the members were honored. Both NAWIC and SkillsUSA provided ample compensation and praise through such things as awards, scholarships, free software, articles in newspapers and publications. There was even a plaque, free software and a week in Vegas to AutoCAD University for myself. The members wanted to know what the School and School District had done to honor the students. Sadly I had to tell them nothing had been done. I told them of how I had asked my administrator to write a letter about my students accomplishments and to place it in my personnel file at Central Office and that her response was to tell me to write my own letter. Additionally I told them of the Superintendent and Asst. Superintendents were notified of the students accomplishments and non have yet to even say good job. One member stated that this is exactly why we have the results in our public schools that we do.

All members are familiar with my classroom, equipment and the areas to which I teach. Due to the fact that this year I will be teaching Architectural applications this is the area on which I wish to concentrate on.

The first question asked was why my class was not allowed to design and draw the plans for the house that is built by the school each year. I showed them the correspondence in

which I had asked district administrators the same questions. They shook their heads in disgust.

As for any changes to the program itself they felt strongly that Rivot by AutoDesk is the way architectural software is going and that within the next 5 to 6 years that it will for the most part replace 2-D software as the industry standard. We currently use Chief Architect which in many ways is a program similar to Rivot. Though some architects are moving to Chief they felt that the program should head towards the use of Rivot. They also discussed the trend towards Sustainable and Green Architecture. It was agreed that I should start implementing this into my program over the next several years. They felt that this trend will only become stronger and within the next few years entry employees will be required to have had training in these areas.

A discussion was also held about the exit testing to begin with students at the end of the current school year. I showed them the information that I had at this point in time and showed them test information available at this time. It was decided that this issue should be addressed after the first of the year when I might have more information available.

Other than items mentioned above they felt that I was doing a good job in training students for industry ready placement.

Phil Tiller
Design Drafting/CAD Instructor

Design Problem and Project Requirements

1. Project Description

The Smith family has gone on hiking and camping vacations in New England for many years. Finally, after dreaming and saving, the Smiths found land for sale on a lake near a state park that they vacationed at and really liked. They want to build their dream house on this site but the process will take some time and the house will have to be built in phases.

The Smiths have two children, a boy who is eight and a girl, six. The Smiths want to start their dream house now so that they can enjoy it while the kids are young. The plan is to build a small, simple house that can be added on to as the children get older. The Smiths have asked you, as their architect, to help them choose the best location on the site for their house. They also want to consider their ideas for the dream house so that it will be relatively simple to add on to the house later.

The site has spectacular views into the hills across the lake and the Smiths have said they would really like to watch the sunsets from their deck. They want the house to have a feeling of being a treehouse, with spaces that flow from the outdoors into the house. The Smiths want to be able to use the house year-round, but since winters are long and cold, another part of your task is to make the house energy-efficient and well-insulated.

Here are the things the Smiths have said are important for the first part of the project. You have figured that the first phase of the house will be 3,000 square feet and the garage should be about 600 square feet.

- A bedroom for each of the children

- A shared bathroom for the kids—this bathroom also should be accessible from a hall for general use

- An open living area that includes the kitchen and space for eating and entertainment.

 - They want to include a large flat-screen TV in this space. They also want to be able to see the lake from this area.

- A large front deck, with views of the lake and storage for fishing poles, water skis and boards, lawn furniture and other outdoor games

- A bedroom for the parents with its own bathroom, maybe with its own deck

- A garage with plenty of storage space for camping equipment, cross country skis, and bikes

- A laundry room with an enclosed, private area for changing from wet or dirty outdoors clothes

- Lots of glass if it doesn't hurt the energy efficiency of the house

- Natural and environmentally friendly materials for both the inside and outside of the house

Here are some things that the Smiths know they want in the future. They want you to show possible locations for this second wish list:

- A master suite with a large bathroom with a hot tub, dressing rooms and closets. They'd like the hot tub to have a view to the lake

- Separate bedrooms, each with a bathroom, for the children

- A screened-off changing area with an outdoor shower near the beach

- A separate guest cottage with its own small kitchen and washer and dryer

- A storage building for winter storage of a power boat, Jet Skis® and kayaks

Nothing with a permanent foundation can be built within fifty feet of the beach. Local regulations call for a green space buffer of at least fifteen feet along the side property lines and a setback of twenty-five feet from the front (street) property line. The garage may be attached to the house but it should not be visible from the lake side of the house. The Smiths want to preserve as many of the existing trees as they can, along with the wooded area and stone wall near East Lake Drive.

2. Site Design

There are two versions of the Site Plan included with the Design Problem and Project Requirements. Both are .pdf files, formatted at 8.5" x 11" and at 24" x 36". The larger Site Plan is to a scale of 1" = 10'-0". Students will redraw the Site Plan at a scale of 1" = 10'-0", using their school's software or drafting by hand.

- A. Use the setbacks and restrictions on the site plan.
- B. Contour lines are shown at one-foot intervals. There is a moderate slope down from East Lake Drive into the allowable building area of the site. Care must be taken to preserve the steeper slope and brook on the west side of the property.
- C. Use the proposed driveway location as shown.
- D. The shoreline is natural.
- E. The North Arrow ↯ should appear on the site plans and floor plans and will point up with the lake to the left side of the lot (west) and the street to the right side of the lot (east).

NOTE: STUDENTS WILL USE THE SITE PLAN FOR TWO REQUIRED DRAWINGS.

3. Drawing and Submittal Requirements

- A. Submit a minimum of five (5) drawing sheets; a maximum of seven (7) drawing sheets on 24' x 36" paper.
- B. Each drawing sheet should contain:
 - 1" x 6" Title block placed in the lower right-hand corner of each sheet shall include project title, date, student code number and drawing sheet number.
 - Appropriate labels for drawings and materials
 - Required scale for each drawing on the sheet
 - Accurate and readable dimensions
 - North arrow where appropriate
 - Floor plans should be shown with the North arrow in the same direction as on the Site Plan
- C. Submit entries as Black Line photocopies of Black Line or Blue Line prints. Original computer plots may be submitted on bond paper only and in black ink only.
 - CAD only – Computer plots or prints are required. DO NOT submit CD's, diskettes, plots on vellum or color ink plots. Drawings must be plotted at the required scale. DO NOT plot "Scale to Fit" the sheet size.

- Hand Drafting only – DO NOT submit hand-drafted original drawings. All lettering is to be freehand and all drawings drawn by hand. Guidelines and straightedges for vertical strokes may be used for lettering.
- D. All submissions must comply with the requirements of the competition to be eligible for judging. Do not submit an incomplete set of drawings. All judges' decisions are final.
- E. All submitted sheets shall be stapled in the left-hand border with the Design Narrative stapled in the upper left-hand corner of Sheet A-1.
- F. The bottom portion of the signed student application forms shall be placed in a plain envelope and stapled to the back of Sheet A-1 (on the opposite side from the Design Narrative).
- G. The student's school name should not appear in the Title block or in any place visible on the drawing sheets.
- H. Drawings will not be returned to the contestant.

4. Design Narrative

- A. The Design narrative is a statement about what the student feels are the positive and appropriate elements in the design and how the design meets the project description.
- B. Be creative! This is your first impression with the judges.
- C. Narrative will be 400 to 500 words and must be typed. Please use either Times Roman or Arial fonts in 10 pt. or 12 pt.
- D. Place the student code number in the upper right-hand corner of the narrative. DO NOT put the student name or school name on the narrative.
- E. Staple the narrative to the upper left-hand corner of the drawing set.
- F. Spelling and grammar will be considered. Do not rely on your computer's spell-checker.

5. Required Drawings

- A. **DRAWING SHEET A-1: SITE PLAN WITH ROOF PLAN**
Scale: 1" = 10'- 0"

NOTE: STUDENTS WILL SHOW PHASE ONE BUILDING (S) WITH A ROOF PLAN AND PHASE TWO BUILDINGS WITH A DOTTED LINE.

1. Students must use the site plan in the competition package.
2. Show the location of Phase One house and garage on the site plan with the roof plan superimposed on the building(s). Show the proposed locations for Phase Two buildings as dotted lines.

3. Use the driveway location shown on the site plan. Show paving, walks, curbs, building setbacks, property lines, etc.
4. Show the location of the building with dimensions to the property lines. Setback requirements are shown on the site plan.
5. All students will be required to draw the site plan. No CD or diskette is provided.

B. DRAWING SHEET A-2: Site Landscape Plan
Scale: 1" = 10'-0"

1. Show trees to be removed.
2. Show trees to remain.
3. Show landscaping and plantings to be added to the site and around the house.

C. DRAWING SHEET A-3: Phase One Floor Plans
Scale: 1/4" = 1'-0"

1. SHOW TOTAL SQUARE FOOTAGE OF THE HOUSE AND TOTAL SQUARE FOOTAGE OF THE GARAGE ON THE DRAWING.
2. Show walls, windows, doors and door swings and openings along with appropriate dimensions for each. Show door and window sizes on the plan or provide a door/window schedule.
3. Show closets, cabinets, plumbing fixtures and appliances.
4. Show any changes in floor elevations, stairs and stair landings.
5. Label each room or area and indicated floor finishes for each room (wood, vinyl, ceramic tile, carpet, etc.)
6. Label floor plan levels as applicable (Basement, First Floor, Second Floor)
7. Show Section Cut marks to correspond with Drawing Sheet A-5.
8. Optional items (encouraged but not required)
 - furniture placement
 - shading of walls with accepted symbols to indicate wall construction materials

D. DRAWING SHEET A-4: Exterior Elevations
Scale: 1/4" = 1'-0"

1. Show two (2) exterior elevations; one must depict the LAKEFRONT (west) elevation of the house and one must depict the right side (south) or left side (north) of the house.
2. Label the elevations as "Lakefront Elevation," "Left Side," or "Right Side."

3. Show walls, windows, doors, roof; indicate roof slopes
4. Label all exterior finish materials (shingles, brick, stucco, siding, stone, etc.)
5. Show finish grades on each elevation.

E. DRAWING SHEET A-5: Building and Wall Section

Building Section Scale: Scale: $\frac{1}{4}'' = 1'-0''$

1. Show footings and foundation walls, exterior and interior walls, floors, windows, ceilings and roof line.
2. Label rooms where the section is cut through.
3. Label different construction materials.
4. Dimension room heights and roof overhangs.
5. Optional items (encouraged but not required)
 - interior wall elevations
 - section cut through a stairway (if applicable)

Wall Section Scale: $\frac{1}{2}'' = 1'-0''$

1. Show and label footing, foundation wall, floor slab or framing, typical exterior wall eave, roof structure and roofing materials.
2. Use break lines to shorten the wall section (if needed to fit the drawing on the 24" x 36" drawing sheet).
3. Show and label wall thickness and different construction materials (concrete, wood, insulation, sheathing, finishes, etc.).

F. DRAWING SHEETS A-6 and A-7: Optional Drawings

1. Additional two (2) elevations not shown on Sheet A-4. Follow instructions for Sheet A-4.
2. Floor Plans for Phase Two master suite and additional bedrooms (show Phase 1 in dotted lines).
3. Floor Plans and Front and Left or Right Side Elevations of Phase Two Guest Cottage. Follow instructions for Sheets A-3 and A-4.
4. Interior Elevations for Phase One kitchen and bathrooms.
5. Additional building sections
6. Electrical and lighting plan (exterior and interior) for Phase One

Resource Material

1. Energy Efficiency

The Smiths have asked for a building that is as energy-efficient as possible. Energy efficiency is just one aspect of "green" building design. Consider using "green" design as you work on your project. Here are some of its principles:

- Energy efficiency and alternative energy sources in the building's plumbing, heating/ventilation/air conditioning systems (for example, passive or active solar energy, heat pumps, appropriate building siting)
- Use of building materials with less of an environmental impact than traditional materials (for example, fiber-cement siding, recycled lumber or stone, wall-board panels using recycled material, paints and adhesives that do not give off toxic fumes)
- Consideration of transportation costs and manufacturing processes in selection of materials and suppliers

"Green" building is an extremely important element of responsible design and construction. A good starting place for your research is the website of the U.S. Green Building Council:

www.usgbc.org

2. Design Ideas

Here are some websites, books and magazines to look at as you are designing the Smiths' new home. Architect Sarah Susanka has written three books with many project photos of "not so big" houses that meet clients' needs with ingenious and beautiful ideas. These books are widely available in bookstores.

[The Not So Big House](#)

[Creating the Not So Big House](#)

[Home by Design](#)

Visit this website for more information and ideas: www.entsobighouse.com

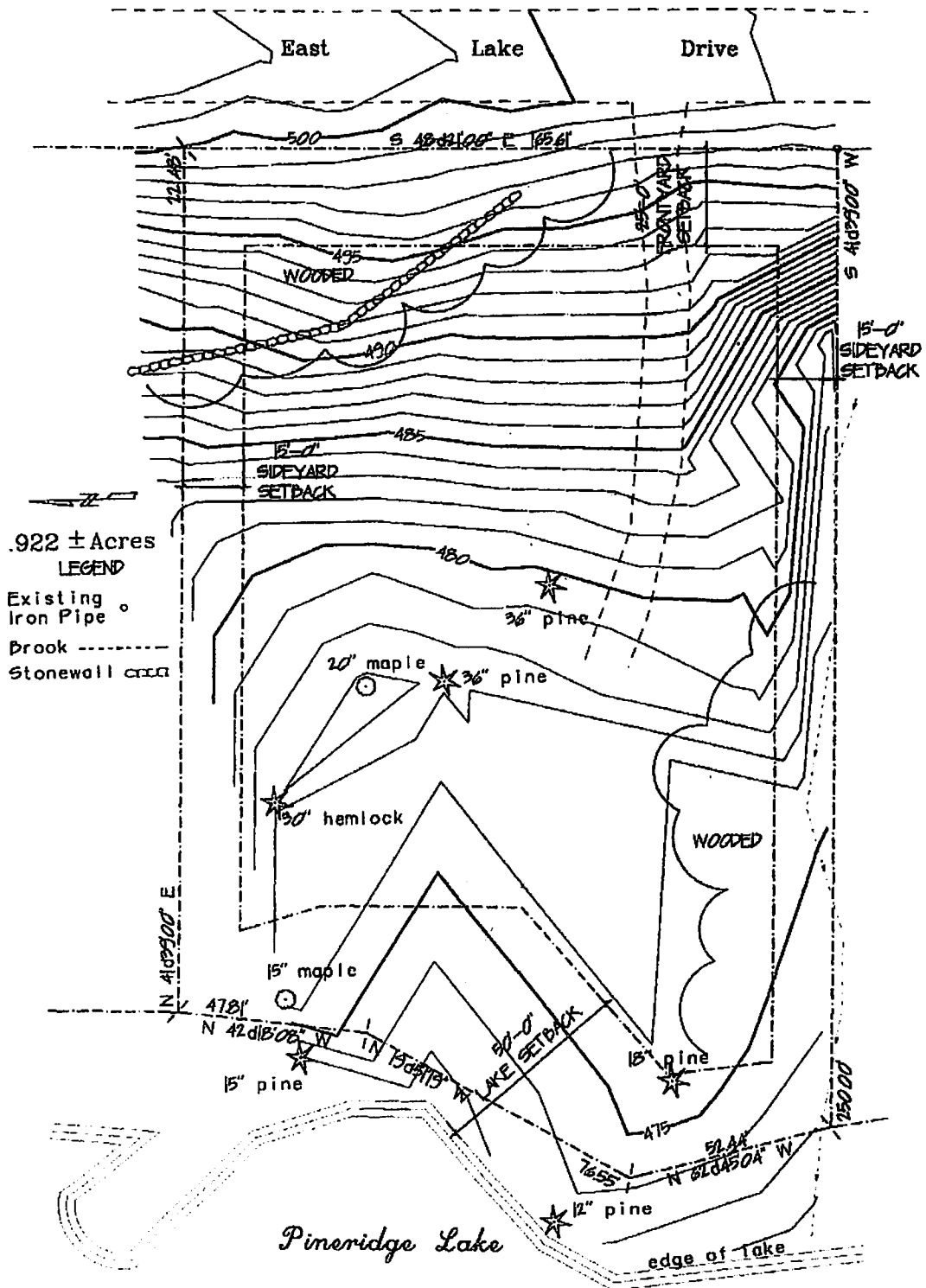
[Fine Homebuilding](#) magazine, published by Taunton Press six times a year, also has good information about custom-designed houses. It is geared for professional builders, so there is technical information about tools and construction methods. The website is:

www.tauntonpress/finehomebuilding.com

3. Field Research

- Many community organizations sponsor house tours. Attend one of these and keep a list of ideas you see that you like.
- Write down a list of questions as you begin designing. Ask a residential architect to visit your class and discuss some of these questions.
- Visit a historic or famous house that's open to the public in your area. Notice and write down what you like and don't like. Use these ideas as you design.
- What do you like/dislike about your own house? What would you change?

SITE PLAN



.922 ± Acres

LEGEND

- Existing Iron Pipe ○
- Brook - - - - -
- Stonewall

MODULE: INTRODUCTION TO PRODUCTION/MANUFACTURING DRAFTING

UNIT II: INTRODUCTION TO MACHINE DRAWINGS

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- A. Objective sheets
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- D. Lesson plans
 - 1. **Lesson 1: Layouts and Working Drawings** 49
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 - b. Transparency masters
 - TM 2.1: Engineering Change Notice
 - TM 2.2: Title Forms
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 - TM 2.4: Bill of Materials/Parts List
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 - TM 2.6: Assembly Drawing
 - c. Assignment sheets
 - AS 2.1: Draw a Design Layout
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 - AS 2.3: Draw an Assembly Drawing
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 - 2. **Lesson 2: Dimensioning and Tolerancing** 77
 - a. Information outline
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 - c. Assignment sheets
 - AS 2.6: Write Proper Dimension Notes for Standard Machine Manufactured Features

- AS 2.7: Dimension an Object Completely
- AS 2.8: Calculate and Dimension Clearance Fit Tolerances Using Standard Fit Tables
- AS 2.9: Calculate and Dimension Interference Fit Tolerances Using Standard Fit Tables
- AS 2.10: Calculate and Assign Tolerances to Mating Parts Using Standard Fit Tables

d. Answers to assignment sheets

3. **Lesson 3: Fasteners and Hardware** 121

a. Information outline

b. Transparency masters

- TM 2.11: Screw Thread Nomenclature
- TM 2.12: Screw Thread Profiles
- TM 2.13: Screw Thread Symbols
- TM 2.14: Combined Screw Thread Symbols
- TM 2.15: American National Thread Note for Holes
- TM 2.16: American National Thread Notes for Threaded Shaft
- TM 2.17: American Standard Unified Thread Notes
- TM 2.18: Removable Fasteners
- TM 2.19: Locknuts and Locking Devices
- TM 2.20: Standard Cap Screws
- TM 2.21: Machine Screws
- TM 2.22: Set Screws
- TM 2.23: Miscellaneous Bolts and Screws
- TM 2.24: Miscellaneous Bolts and Screws (continued)
- TM 2.25: Shaft Locking Hardware
- TM 2.26: Keys
- TM 2.27: Washers
- TM 2.28: Tooth Lock Washers

c. Assignment sheets

- AS 2.11: Construct Thread Symbols
- AS 2.12: Construct Bolts, Screws, and Nuts
- AS 2.13: Construct an Assembly Containing Various Fasteners
- AS 2.14: Construct Keys in Assembled Positions

d. Answers to assignment sheets

E. Unit test

F. Answers to unit test

REFERENCES

- A. 1980 Fastening and Joining Reference Issue, Machine Design. Vol. 52, #26. Penton/IPC Inc., November 13, 1980.
 - B. American National Standards Institute, 1430 Broadway, New York, NY 10018.
- 46 *Introduction to Machine Drawings*

- C. American National Standards Institute. Dimensioning and Tolerancing (ANSI Y14.5-1973). New York, NY: American Society of Mechanical Engineers, 1973.
- D. American National Standards Institute. Drawing Sheet Size and Format (ANSI Y14.1-1975). New York, NY: American Society of Mechanical Engineers, 1975.
- E. American National Standards Institute. Forgings (ANSI Y14.9-1958). New York, NY: American Society of Mechanical Engineers, 1958.
- F. Beakley, George C. and Ernest G. Chilton. Design Serving the Needs of Man. New York, NY: Macmillan Publishing Co., 1974.
- G. Brown, Walter C. Drafting for Industry. South Holland, IL: Goodheart-Willcox Co., Inc., 1974.
- H. Dent, Joseph B., et al. Fundamentals of Engineering Graphics. 51st edition, Macmillan Publishing Co., Inc., 1979.
- I. Dreyfuss, Henry. The Measure of Man: Human Factors in Design. 2nd ed. New York, NY: Whitney Library of Design, 1967.
- J. Dygdon, John Thomas and Henry Cecil Spencer. Basic Technical Drawing. New York, NY: Macmillan Publishing Co., Inc. 1968.
- K. Fasteners Standards, 5th edition. Cleveland, OH: Industrial Fasteners Institute, 1970.
- L. Foster, Lowell W. Geo-Metrics. Reading, MA: Addison-Wesley, 1974.
- M. Giesecke, Frederick E., et.al. Technical Drawing. New York, NY: Macmillan Publishing Co., Inc., 1980.
- N. Jensen, Cecil, and Jay Helsel. Engineering Drawing and Design. St. Louis, MO: Gregg Division: Gregg Division/McGraw-Hill Book Co., 1979.
- O. Jensen, Cecil and Jay Helsel. Engineering Drawing and Design. New York, NY: Gregg Division/McGraw-Hill Book Co., 1979.
- P. Levens, Alexander and William Chalk. Graphics in Engineering Design. New York, NY: John Wiley and Sons, 1980.
- Q. Parmley, Robert O. Standard Handbook of Fastening and Joining. New York, NY: McGraw-Hill Book Co., 1977.

NOTES TO THE INSTRUCTOR

- A. Suggested approaches to teaching this unit
 - 1. **Lesson 1: Layouts and Working Drawings**
 - a. Select the title block that you want the students to use in this particular class, and give instructions on filling it out.
 - b. Make appropriate changes in the student's drawing sheets.

2. Lesson 2: Dimensioning and Tolerancing

- a. Develop a display of different types of gages with corresponding parts to be measured for size and location.
- b. Have students check a group of parts for correct dimensions by using gages.
- c. Provide part drawings for students to see specified tolerances.
- d. Visit a manufacturing quality control department to see how they operate and inspect parts.

3. Lesson 3: Fasteners and Hardware

- a. Have students tour a hardware store, searching out various fasteners. A display of various fasteners in the classroom would improve learning of this unit.
- b. Have students tour a welding lab to see how parts are welded together.
- c. Assemble a display of various hardware items obtainable from a hardware store and discuss their possible uses.
- d. Have various springs for the students to see.

MODULE: INTRODUCTION TO PRODUCTION/MANUFACTURING DRAFTING

UNIT II: INTRODUCTION TO MACHINE DRAWINGS

LESSON 1: LAYOUTS AND WORKING DRAWINGS

I. Terms and definitions

- A. **Assembly drawing**--drawing showing all parts in their working position
- B. **Bill of materials/parts list**--itemized list of parts shown with an assembly drawing **NOTE:** Parts may be raw stock, purchased parts, or fasteners.
- C. **Casting drawing**--a detail drawing of a workpiece to be cast
- D. **Design layout**--accurate drawing of all parts in working positions showing clearances of moving parts, ease of assembly, and ease of serviceability
- E. **Design process**--organized method to combine scientific principles, standard parts, and resources into the solution of a problem
- F. **Detail assembly drawing**--combined detail and assembly drawing used when the details are simple enough for all parts to be shown and dimensioned clearly while shown in assembled positions

NOTE: This drawing is used on aircraft subassemblies, drawings of jigs and fixtures, and welding drawings.

- G. **Detail drawing**--drawing containing the necessary information to completely manufacture a single part of one stage of a single part
- H. **Engineering change notice (ECN)**--an approved change to a drawing caused by a change in design, tool changes, errors in design or production, and customer changes (TM 2.1)

NOTE: ECN's are reflected in the revision record on the drawing.

- I. **Forging drawing**--a detail drawing of a workpiece to be forged in dies
- J. **Revision form**--area to show all information related to a drawing revision
- K. **Revision**--change made on a drawing

NOTE: This change may be due to drafting error, design change or error, production change or error, or customer change or error.

- L. **Title form**--standardized place to show all information not shown with notes and dimensions on the drawing
- M. **Title**--name of the object or project

NOTE: The title is the second most important size of lettering on the drawing.

N. **Zoning**—equal intervals along the margins labeled with numbers along the horizontal margin and with letters along the vertical margin for locating an area on a drawing

II. Information on a title form (TM 2.2)

NOTE: The following information is generally found in a title form as a title block or title strip.

A. Standard information

1. Name of the object represented
2. Name and address of the industry
3. Name and address of the client, if any
4. Number of drawings which may include sheet letter size
5. Revision letter
6. Signature of drafter with date of completion
7. Signature of checker with date of completion
8. Signature of designer, engineer, or other official and date approved
9. Predominate scale of drawing
10. Sheet number for multiple sheets

B. Additional information

1. Tolerances
2. Material
3. Heat treatment
4. Quantity
5. Finish
6. Hardness
7. Weight
8. Superseding note
9. Company logos
10. Other peculiarities of the product

III. Information on a revision block (TM 2.3)

- A. Letter or number of change(s)

- B. Description of correction or change
- C. Person making change
- D. Person checking change
- E. Date of change
- F. Zone for location of change

IV. Information on a bill of materials/parts list (TM 2.4)

A. Standard information

- 1. Item number referring to assembly drawing

NOTE: Item numbers are sometimes referred to as dash numbers.

- 2. Part name
- 3. Number required
- 4. Material from which part is made

B. Additional information

- 1. Stock number
 - 2. Description or nomenclature
 - 3. Address of vender
 - 4. Unit of measure
- NOTE: These units include grams, pieces, feet, pounds, or gallons.**
- 5. Group subassembly where used
 - 6. Approval
 - 7. Release date
 - 8. Originator
 - 9. Revision
 - 10. Stock size
 - 11. Pattern number
 - 12. Weight

V. Standard parts of a detail drawing (TM 2.5)

A. Shape description

NOTE: This includes multiview, auxiliary, sections, and/or pictorials.

B. Dimensions

NOTE: These include size, location, and tolerances.

C. Notes

NOTE: These may be general or specific.

VI. Parts of an assembly drawing and functions (TM 2.6)

A. Views--show relationship of parts

NOTE: Views do not show the shapes of individual parts but just how they fit together.

B. Sections--show the inside function or construction of the parts

C. Hidden lines--shown only to promote clearness; unnecessary when several sections are used

NOTE: Hidden lines may not be necessary and in some cases would only confuse the reading of the drawing.

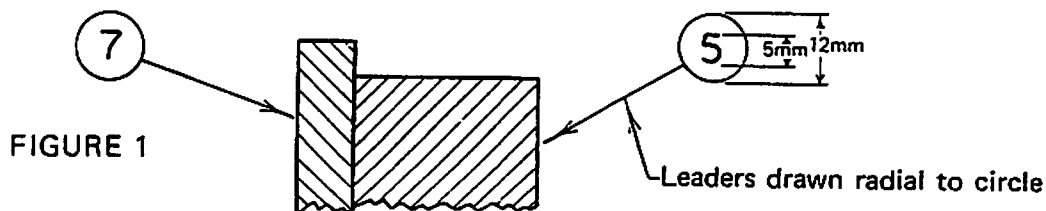
D. Dimensions--show maximum or minimum sizes or locations of machine parts after assembly and overall size

NOTE: Only certain dimensions and notes are given on an assembly drawing.

E. Parts identification numbers--allow for quick identification of physical shape and guide reader to the parts list (Figure 1)

NOTE: An identification number should be 5mm high in a 12mm circle. The circle is connected to the part with an arrowhead, dot, or S.

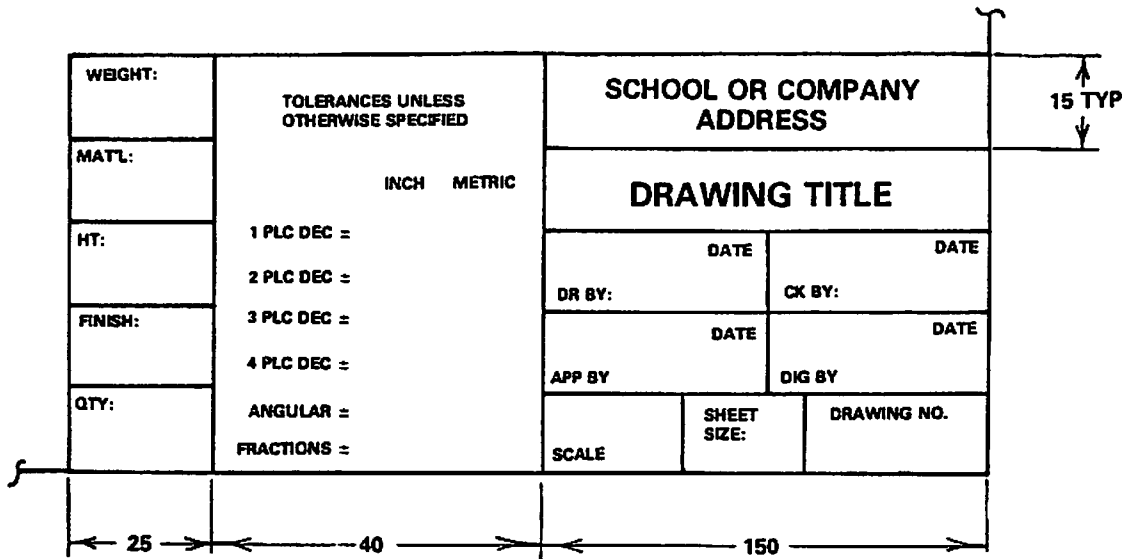
NOTE: Avoid vertical and horizontal leaders.



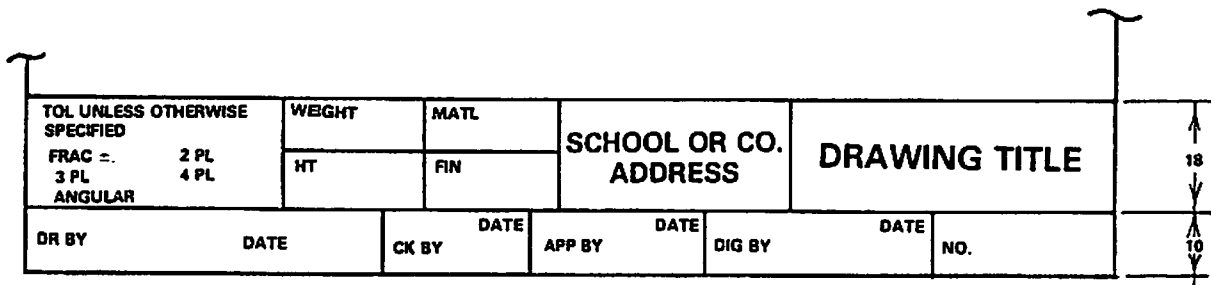
ENGINEERING CHANGE NOTICE

NO.	AN					
DATE ISSUED:		CONT. ON SHEET	SHEET NO.			
APPARATUS:		SERIES AN		NO <input type="checkbox"/>	YES <input type="checkbox"/>	FINAL <input type="checkbox"/>
		AR NO.		REQ		
ENG. PROD. PLAN		AFFECTED <input type="checkbox"/>	PREVIOUS SERIES AN:		CLASS OF CHG. - 1 EMERGENCY - 2 MEET SPEC. 3 EXC'D SPEC. - 4 NEW MODEL	
		NOT AFFECTED <input type="checkbox"/>				
IT.	NAME OF PART	DWG. NO.	REV	UNITS AFFECTED	SERIAL NOS.	
REASON FOR CHANGE/PROBLEM						
SUMMARY OF CHANGE/SOLUTION						
STATUS OF MATERIAL:						
TMBS		MOBS		RTBS		
SERIAL NUMBERS TO BE REWORKED						
PROGRAMMING AFFECTED		NO <input type="checkbox"/>	YES <input type="checkbox"/>	DIAGNOSTICS AFFECTED		
				NO <input type="checkbox"/>	YES <input type="checkbox"/>	
				PGMS.		
PRODUCT SERVICE INFORMATION						
DOCUMENTATION IS AFFECTED		<input type="checkbox"/>	EQUIP. CHANGE IS MANDATORY		<input type="checkbox"/>	
NOT AFFECTED		<input type="checkbox"/>	NOT AFFECTED		<input type="checkbox"/>	
SPARE PARTS ARE AFFECTED		<input type="checkbox"/>		NOT AFFECTED		
NOT AFFECTED		<input type="checkbox"/>		<input type="checkbox"/>		
ISSUED BY:		DATE:	APPROVALS:		DIST. KEY	
APPROVED BY:		DATE:				

TITLE FORMS



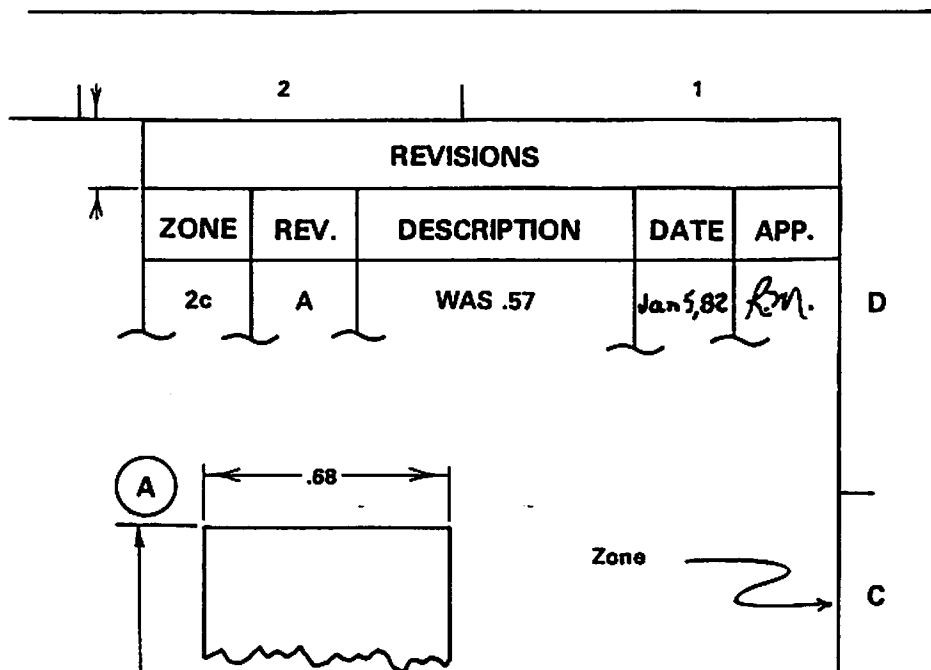
Title Block



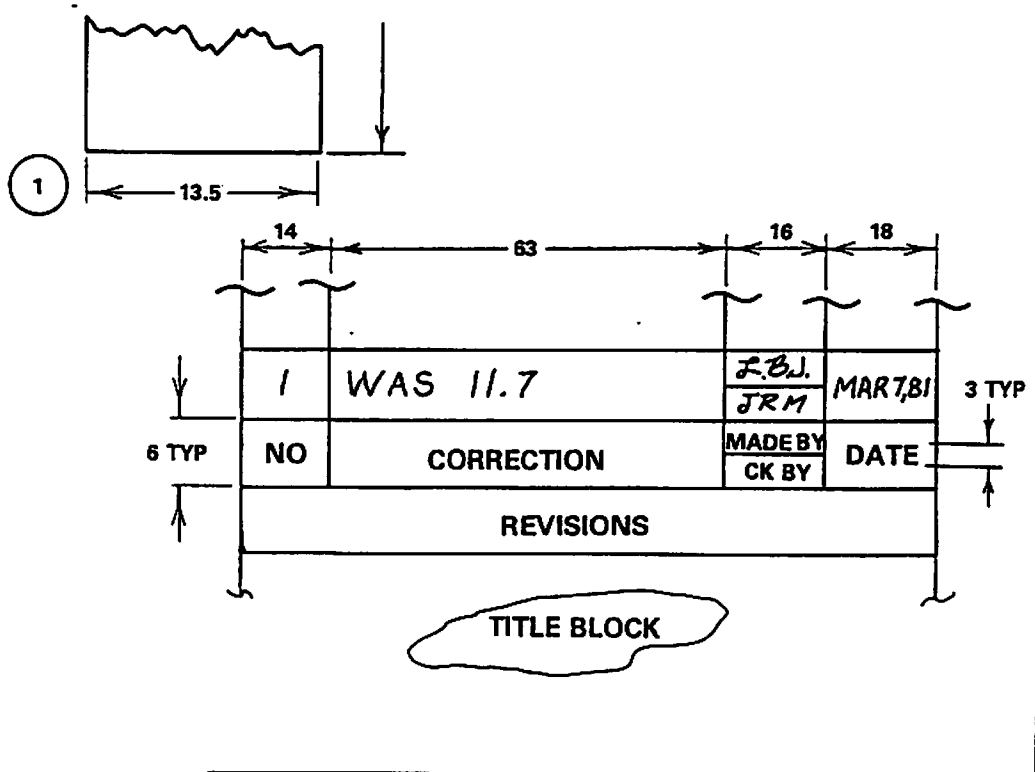
Title Strip

(NOTE: All lettering is 3mm high except Title and Drawing numbers which are 6mm high.)

REVISIONS



Revision Form With Zones

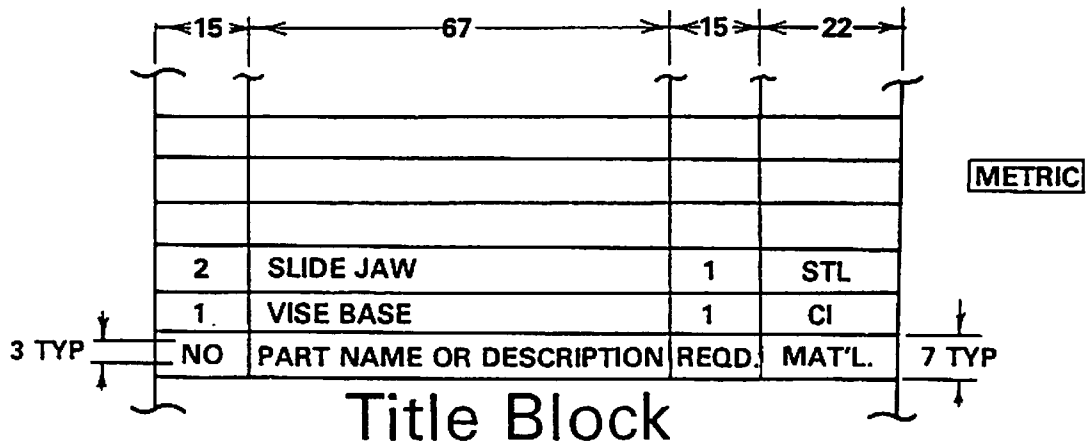


Revision Form Without Zones

BILL OF MATERIALS/PARTS LIST

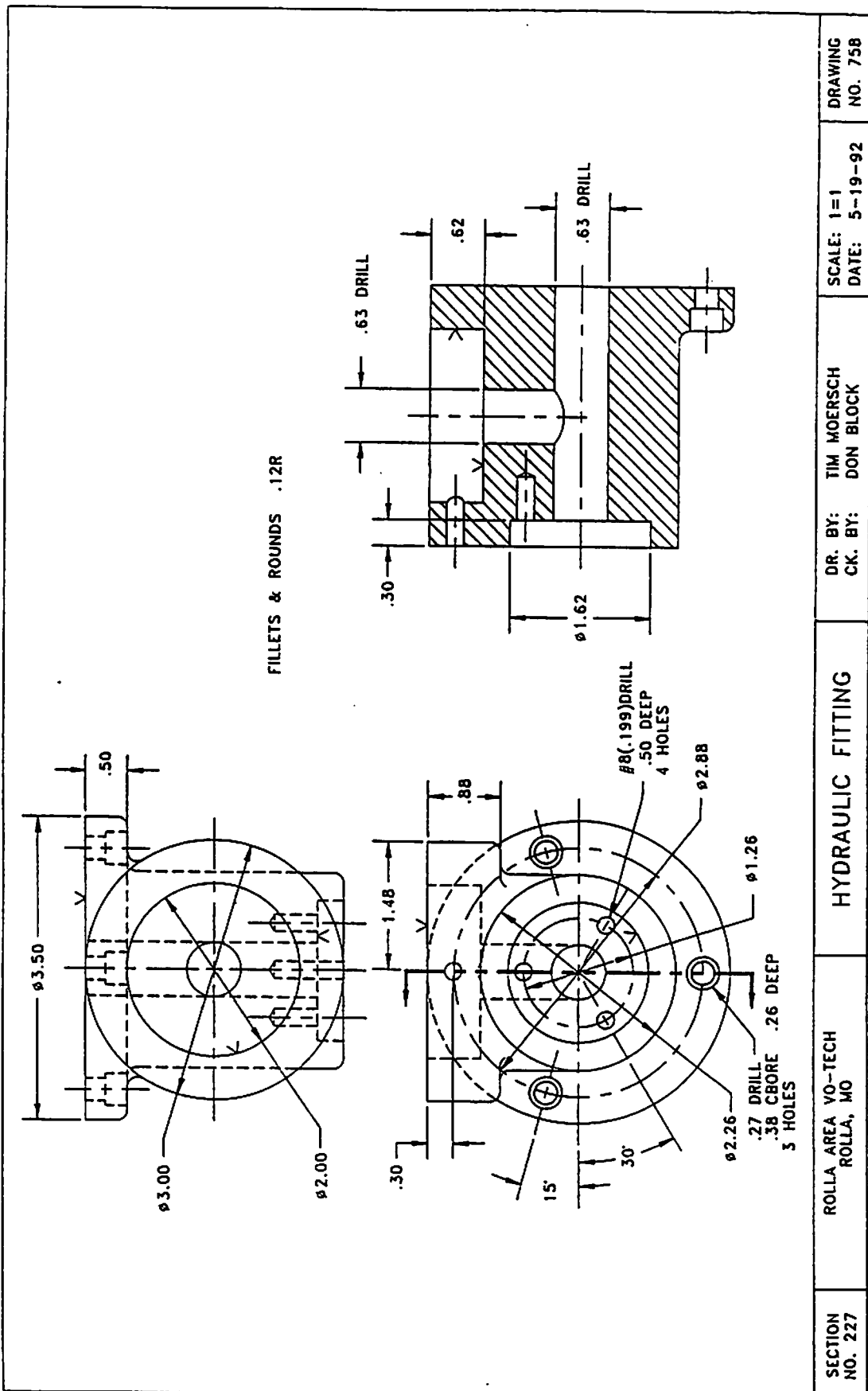
DRAWING CODES 1. VENDOR ITEM—SPEC. CONTROL DWG. 2. VENDOR ITEM—SOURCE CONTROL DWG. 3. ALTERED OR SELECTED PART			COMPANY XYZ 2715 GLASSCO NEWTOWN, OK 72073			UNIT OF MEASURE CODES 0. GRAMS 5. SETS 1. PIECES 6. OUNCES 2. FEET 7. INCHES 3. POUNDS 8. PINTS 4. GALLONS 9. AS REQ'D.				
PARTS LIST FOR		REV.	TITLE		PARTS LIST FOR		SHEET NO.		XYZ USE ONLY	
ITEM NO.	DWG CODE	IDENTIFICATION NUMBERS		DESCRIPTION OR NOMENCLATURE		GROUP NO. AND QUANTITY			U/M	RTG.
PRINTS TO		REV.		REV.		REV.				
ORIGINATOR		DATE RELEASED		APPROVALS		CONT. ON OR FINAL				

Bill of Materials/Parts List



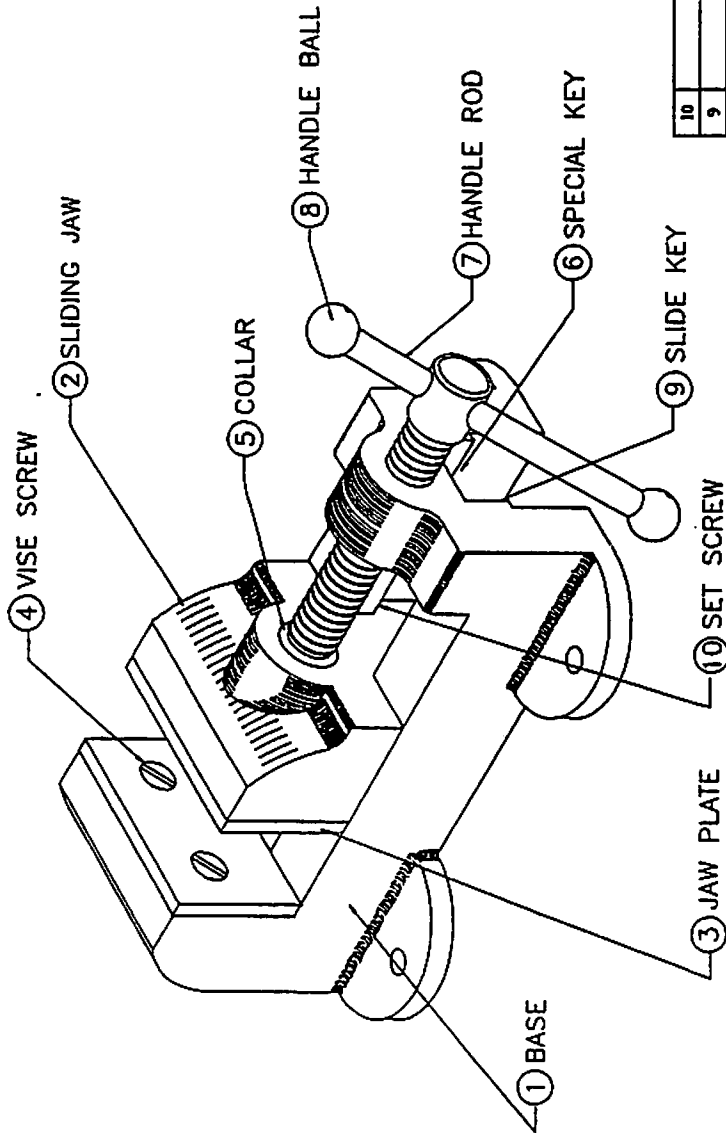
Parts List--Short Form Over Title Block

DETAIL DRAWING



SECTION NO. 227	ROLLA AREA VO-TECH ROLLA, MO	HYDRAULIC FITTING	DR. BY: TIM MOERSCH CK. BY: DON BLOCK	SCALE: 1=1 DATE: 5-19-92	DRAWING NO. 758
-----------------	---------------------------------	-------------------	--	-----------------------------	-----------------

ASSEMBLY DRAWING



10	SET SCREW	2	SAE#1016
9	SLIDE KEY	2	SAE#1020
8	HANDLE BALL	2	SAE#1020
7	HANDLE ROD	1	C R S
6	SPECIAL KEY	1	SAE#1020
5	COLLAR	1	SAE#1020
4	VISE SCREW	1	SAE#3140
3	JAW PLATE	2	SAE#3140
2	SLIDING JAW	1	C I
1	BASE	1	C I
NO	PART NAME		RECD MATERIAL

R. A. V. T. S.
ROLLA

MACHINE VISE

DR BY JOHN PAINE

TR BY

CK BY

APPR BY

SEC 1687

SCALE 1"-1"

03/12/92

SHEET 1

DRAW A DESIGN LAYOUT

Directions: For the project assigned by your instructor, sketch the desired layout to include standard parts and fixed dimensions. Tape drawing media to drawing surface, and draw your design layout. Letter in information in its proper place, using correct lettering techniques.

DRAW A SET OF DETAIL DRAWINGS

Directions: Using the design layout of the project from AS 2.1, sketch each detail to include proper placement of dimensions, tolerances, and notes. Tape drawing media to drawing surface, and draw each detail on a separate sheet of paper of appropriate size. Letter in information in its proper place, using correct lettering techniques.

DRAW AN ASSEMBLY DRAWING

Directions: For this assignment, use details from either AS 2.2 or a different project appropriate to time. Sketch an assembly drawing to include appropriate sections, views, and dimensions. Tape drawing media to drawing surface, and draw an assembly drawing. Lettering in information in its proper place, using correct lettering techniques.

COMPLETE A DETAILED TITLE BLOCK AND REVISION BLOCK

Directions: With a lettering guide and the drawing media from AS 2.2 and 2.3, use the procedure in the following example to complete a detailed title block and revision block.

Example:

1. Tape drawing media to drawing surface.
2. Select correct pencils.
3. Select appropriate title block for detail information.

NOTE: Refer to the following examples of title strips and title blocks. Select one shown or devise one of your own which has been approved by the instructor.

Example:

WEIGHT:	TOLERANCES UNLESS OTHERWISE SPECIFIED INCH METRIC 1 PLC DEC = 2 PLC DEC = 3 PLC DEC = 4 PLC DEC = ANGULAR = FRACTIONS =	SCHOOL OR COMPANY ADDRESS		15 TYP	
MAT'L:		DRAWING TITLE			
HT: -		DATE	DATE	DR BY:	CK BY:
FINISH:		DATE	DATE		APP BY
QTY:		SCALE	SHEET SIZE:	DRAWING NO.	
<div style="display: flex; justify-content: space-around; width: 100%;"> ← 25 → ← 40 → ← 150 → </div>					

NOTE: This title block can be used with "C," "D," and "E" size sheets.

TOL UNLESS OTHERWISE SPECIFIED FRAC = 2 PL 3 PL 4 PL ANGULAR	WEIGHT	MATL	SCHOOL OR CO. ADDRESS	DRAWING TITLE				
	HT	FIN						
DR BY	DATE	CK BY	DATE	APP BY	DATE	DIG BY	DATE	NO.

NOTE: This title block can be used with "A" and "B" size sheets.

4. Draw title block in lower right hand corner.
5. Draw guidelines for lettering.
6. Letter in information in its proper place, using correct lettering techniques.
7. Select revision block containing zone reference.
8. Draw revision block in upper right hand corner.
9. Letter in information in its proper place, using correct lettering techniques.

COMPLETE A PARTS LIST

Directions: Tape either the drawing from AS 2.3 or a separate parts list (PL) form on drawing surface. Draw a parts list. Letter in information in the parts list, using correct lettering techniques.

MODULE: INTRODUCTION TO PRODUCTION/MANUFACTURING DRAFTING

UNIT II: INTRODUCTION TO MACHINE DRAWINGS

ANSWERS TO ASSIGNMENT SHEETS

All assignment sheets are to be evaluated to the satisfaction of the instructor.

MODULE: INTRODUCTION TO PRODUCTION/MANUFACTURING DRAFTING

UNIT II: INTRODUCTION TO MACHINE DRAWINGS

LESSON 2: DIMENSIONING AND TOLERANCING

I. Terms and definitions

- A. **Actual size**--the measured size of an object
- B. **Allowance**--the minimum international difference in the dimensions of mating parts to provide for different classes of fits; the minimum clearance or maximum interference when parts are at maximum material condition (MMC)
- C. **Anthropometric data**--measurements of the human body and its parts
- D. **Basic size**--the size of a part determined by engineering and design requirements from which the limits of size are determined; the line of zero deviation
- E. **Basic dimension**--a theoretically exact value used to describe the size, shape, or location of a feature

NOTE: Basic dimensions are indicated on the drawing by the word BASIC or the abbreviation BSC, or by placing dimensions in a box (see TM 2.7).

- F. **Basic shaft system**--the basic size of the shaft is the design size and the allowance is applied to the hole

NOTE: The fundamental deviation for a shaft system is h.

- G. **Basic size**--the measured size of an object
- H. **Basic hole system**--the basic size of the hole is the design size (basic size) and the allowance is applied to the shaft

NOTE: The fundamental deviation for a hole system is H.

- I. **Bilateral tolerance**--the variations permitted are in both directions from the specified dimensions
- J. **Chain dimensioning**--successive dimensions that extend from one feature to another, rather than each originating at a datum

NOTE: Tolerances accumulate with chain dimensions unless the note, "Tolerances do not accumulate," is placed on the drawing.

- K. **Clearance fit**--limits of size are determined so that a loose fit or positive allowance occurs between mating parts
- L. **Datum dimensioning**--method where features are dimensioned individually from a datum

NOTE: System does not accumulate tolerances or dimensions from feature to feature.

- M. **Datums**--points, lines, or other geometric shapes assumed to be exact from which the location or geometric form of features of a part may be established
- N. **Design size**--the size of a feature after an allowance for clearance has been applied and tolerances have been assigned
- O. **Dimension**--measurements given on a drawing such as size and location
- P. **Feature**--a portion of a part, such as a diameter, hole, keyway, or flat surface
- Q. **Fit**--degree of tightness or looseness between mating parts
- R. **Form tolerances**--Maximum allowable variations of a perfect geometric shape
- S. **Fundamental deviation**--the deviation nearer the basic size for the hole and near the basic size for the shaft

NOTE: The fundamental deviation is an upper case letter for holes and a lower case letter for shafts.
- T. **Geometric shapes**--shapes such as prisms, cylinders, pyramids, cones, and spheres
- U. **Interchangeability**--the condition that refers to a part made to limit dimensions so that it will fit any part similarly manufactured; the ability of mating parts to fit properly together
- V. **Interference fit**--limits of size are determined so that a negative allowance or tight fit occurs between mating parts
- W. **International tolerance grade**--group of tolerances numbered 01-16

NOTE: 01 through 5 are used for gages, 6 through 12 are used for fits, and 13 through 16 are used for general dimensioning.
- X. **Lay**--direction of the major surface pattern determined by manufacturing method used
- Y. **Least material condition (LMC)**--used when the least material is present in a feature

NOTE: This is the largest hole, smallest shaft.
- Z. **Limit dimensioning**--method of dimensioning where only the maximum and minimum dimensions are given
- AA. **Limits**--the extreme permissible dimensions of a part resulting from the application of a tolerance; the maximum and minimum size indicated by a tolerance
- BB. **Location dimension**--any type of dimension that locates a feature on an object
- CC. **Lower deviation**--difference between the minimum limit and the basic size
- DD. **Maximum material condition (MMC)**--used when maximum material is present in a feature

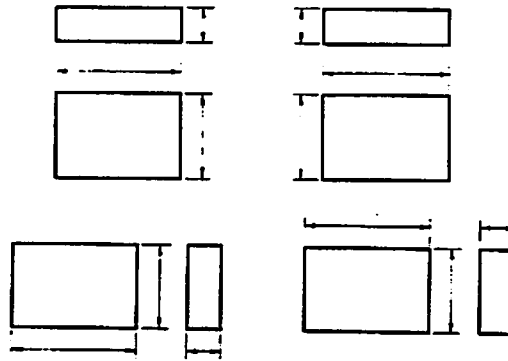
NOTE: This is the smallest hole, largest shaft.

- EE. **Nominal size**--the classification size given to manufactured products such as pipe or lumber
NOTE: It may or may not indicate exact size of the product.
- FF. **Positional tolerance**--exact theoretical position of a feature established by basic dimensions
NOTE: The term "positional tolerancing" has the same meaning as "true position tolerancing."
- GG. **Reference dimension**--untoleranced dimensions placed on drawings for the convenience of engineering and manufacturing
NOTE: Reference dimensions are indicated by the abbreviation REF.
- HH. **Roughness**--fine irregularities in surface texture.
- II. **Size dimension**--any type of dimension that tells how large or small an object is
- KK. **Surface quality**--roughness, waviness, and lay of a surface which may include certain flaws
- JJ. **Tolerance zone**--the association of a fundamental deviation (letter) with an international tolerance grade (IT number)
- KK. **Tolerance**--the total amount of variation permitted in limit dimensioning of a part; the difference between the limit dimensions
- LL. **Tolerancing**--system designed to control dimensions to allow interchangeability in manufacturing
- MM. **Transition fit**--limits of size are determined so that the allowance may be either a clearance fit or an interference fit
- NN. **Unilateral tolerance**--the variation is in only one direction from the specified dimensions
- OO. **Upper deviation**--difference between the maximum limit and the basic size
- PP. **Variation**--the extent to which or the range in which a dimension or size varies
- QQ. **Waviness**--widely spaced element of a surface texture

II. Size and location dimensions for geometric shapes (TM 2.8)

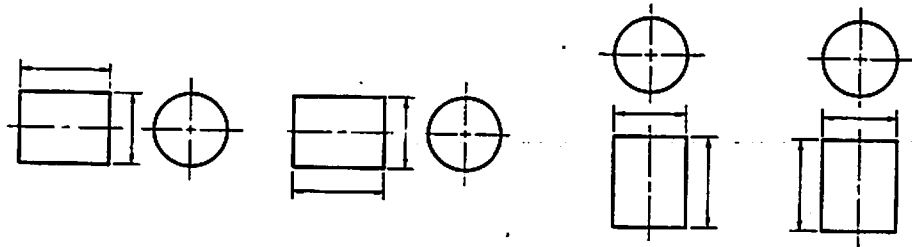
A. Size dimensions

1. Prisms

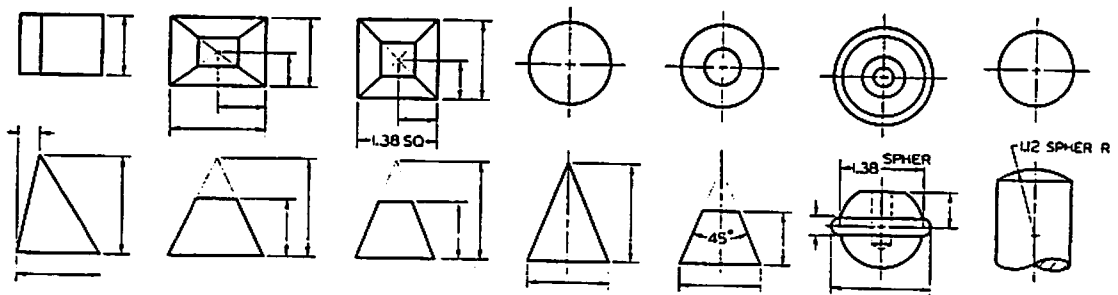


2. Cylinders

NOTE: Diameter is not recommended for circular view, but ANSI does approve its use.

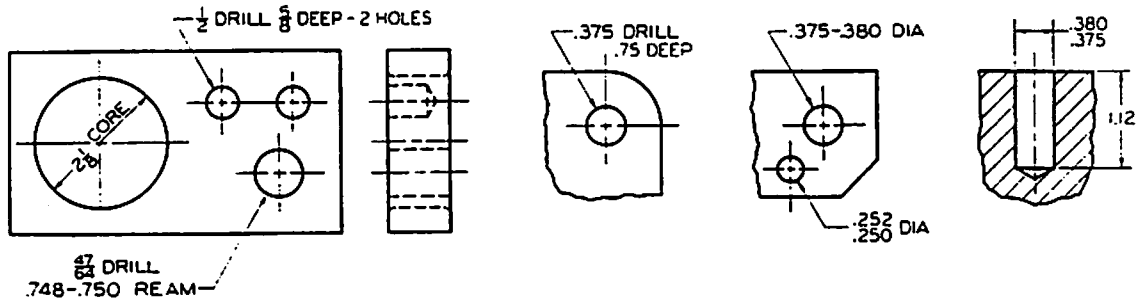


3. Miscellaneous shapes



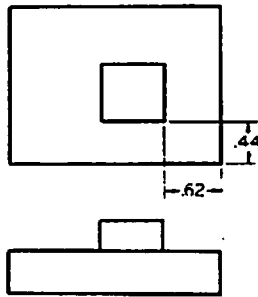
4. Holes (negative cylinders)

NOTE: These may be drilled, reamed, bored, punched, or cored specified by standard notes.



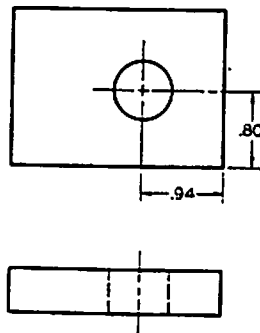
B. Location dimensions

1. Rectangular shapes—references to their faces



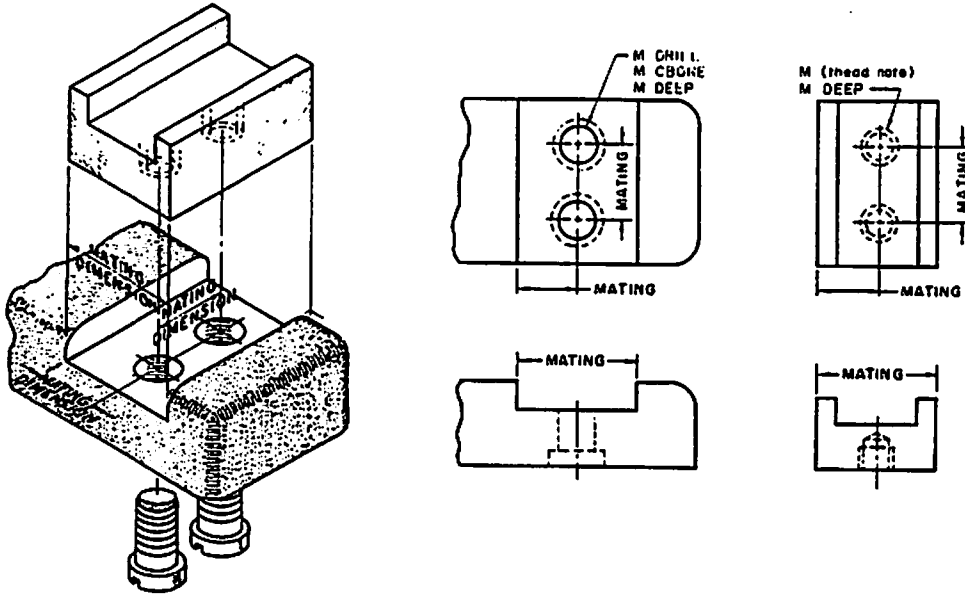
2. Cylinders or holes—reference to their center lines

NOTE: Location dimensions are best located in circular view.



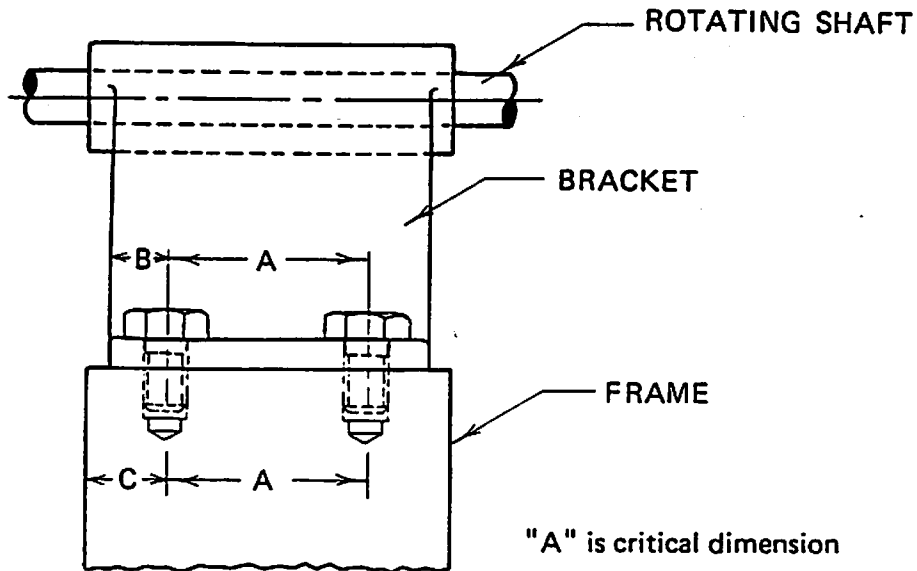
III. Mating dimensions in an assembly drawing

A. Dimensions common to both parts (TM 2.9)



B. Single bracket assembly

NOTE: Critical dimension "A" of frame must mate critical dimension "A" of bracket.

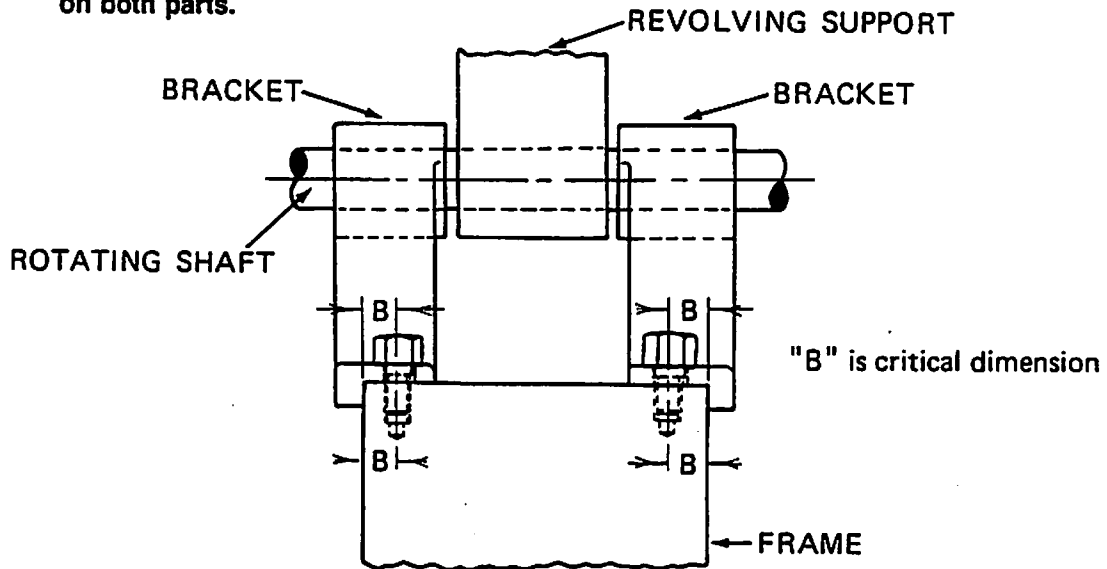


"A" is critical dimension

"B" and "C"
are not critical dimensions

C. Double bracket assembly

NOTE: With double bracket design, dimension "B" is critical dimension that must mate on both parts.

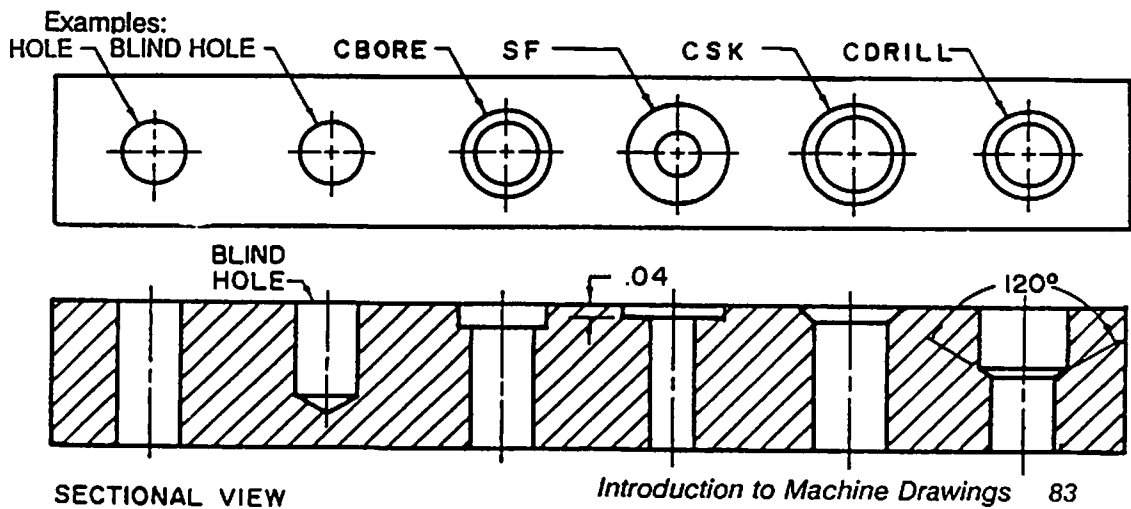


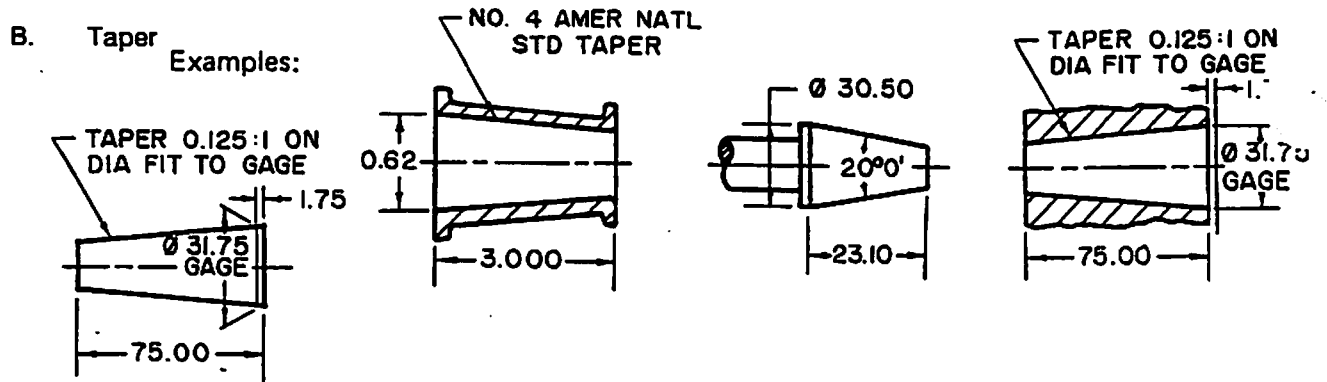
IV. Various standard machine manufactured features

A. Types of holes

1. Through hole
2. Blind hole
3. Counterdrill
4. Counterbore
5. Countersink
6. Spot faced

NOTE: Refer to terms and definitions for descriptions. Refer to symbol chart for symbols.



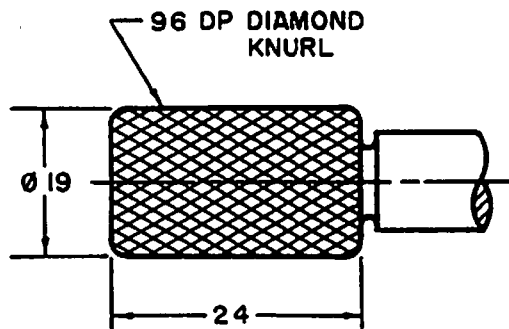


METRIC

C. Knurl

1. Diamond pattern

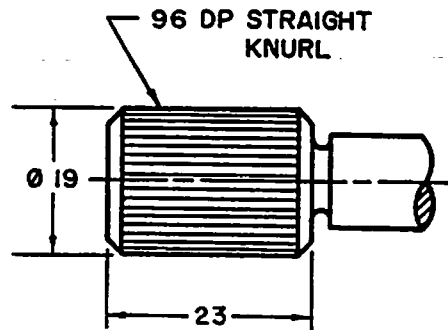
Example:



METRIC

2. Straight line

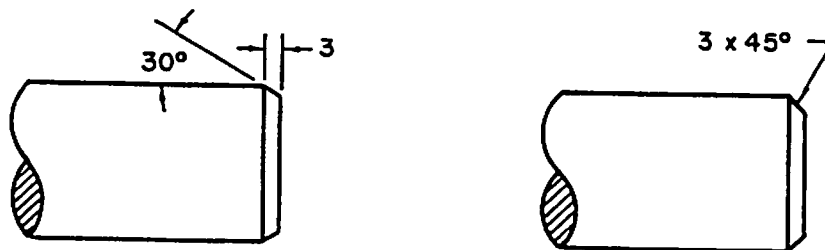
Example:



METRIC

D. Chamfers:

Examples:

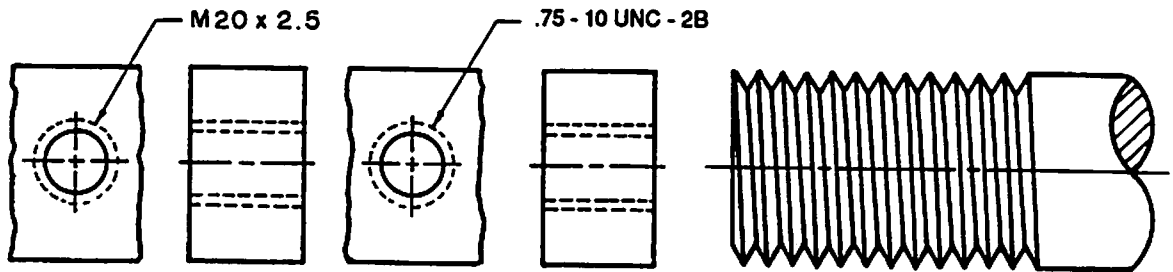


METRIC

E. Threads

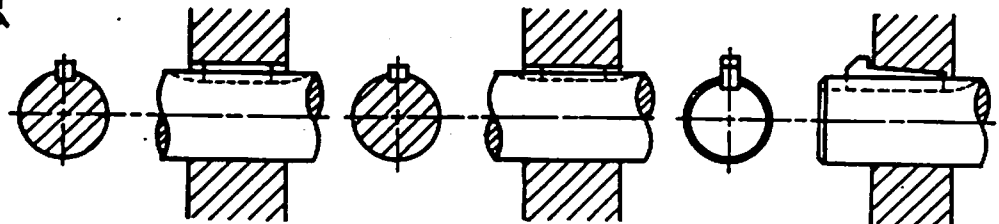
1. Internal
2. External

Examples:



F. Keyways and keyseats

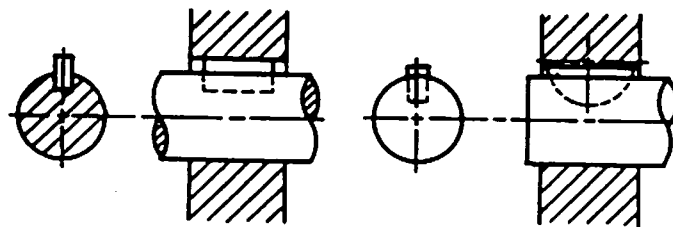
1. Square
2. Flat
3. Gib head
4. Pratt and Whitney
5. Woodruff



(1) SQUARE KEY

(2) FLAT KEY

(3) GIB HEAD KEY

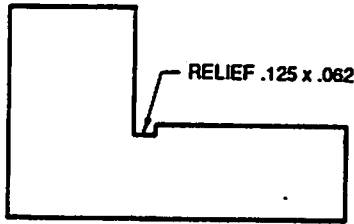


(4) PRATT & WHITNEY KEY

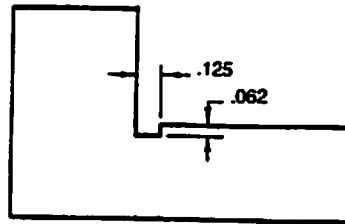
(5) WOODRUFF

G. Relief groove

Examples:



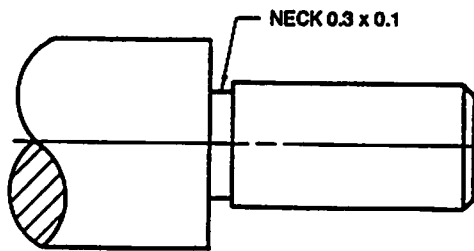
USING A NOTE



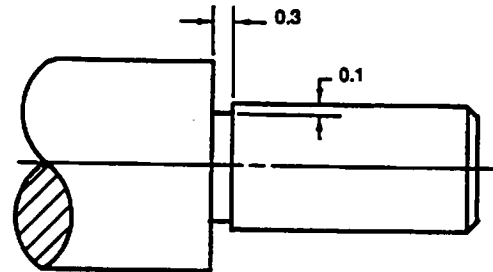
USING DIMENSIONS

H. Neck

Examples:



USING A NOTE



USING DIMENSIONS

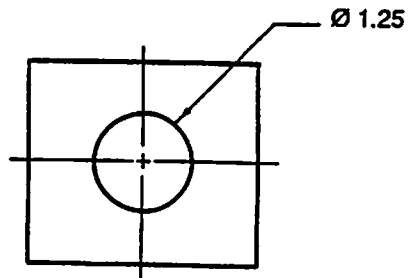
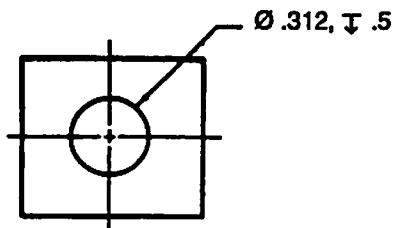
V. Proper dimension notes for standard machine manufactured features

A. Hole operations—holes are always dimensioned on the view in which they appear as a circle (TM 2.10)

1. Drilled, reamed, or bored holes are dimensioned as shown.

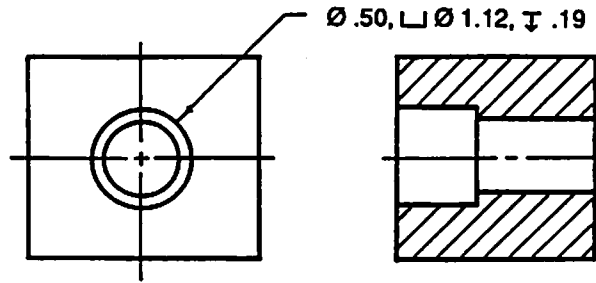
NOTE: For drills designated by number or letter, the decimal size must be given.

Examples:



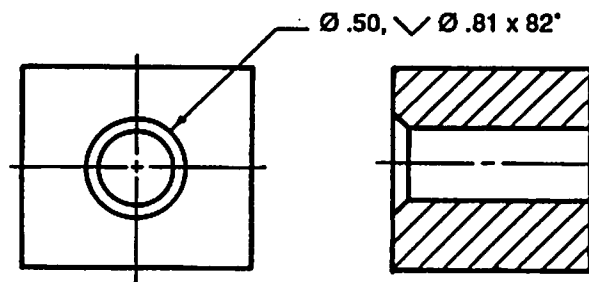
- B. Counterbore—diameter of the drill is given first, then the diameter of the bore by the depth it is to be cut.

Example:



- C. Countersink—diameter of the drill is given first, then the diameter of the top of countersink by the included angle of the countersink.

Example:

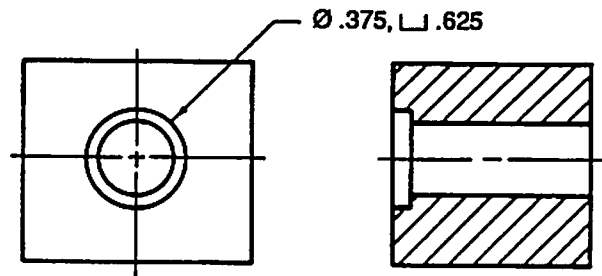


NOTE: The standard countersink for manufacturing is 82°.

- D. Spot faced—diameter of the drill is given first, then the diameter is given; the depth is not normally given for a spot face

NOTE: Common practice is for a spot face to be cut 1/16" deep.

Example:

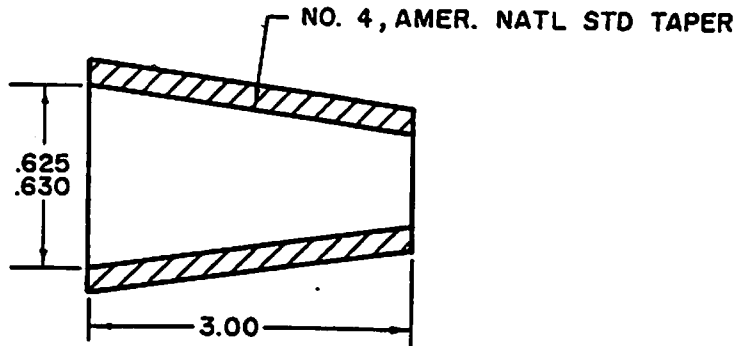


- E. Tapers

NOTE: There are three methods of dimensioning a taper; the accuracy required and the machine process available to cut the taper will determine the method to use.

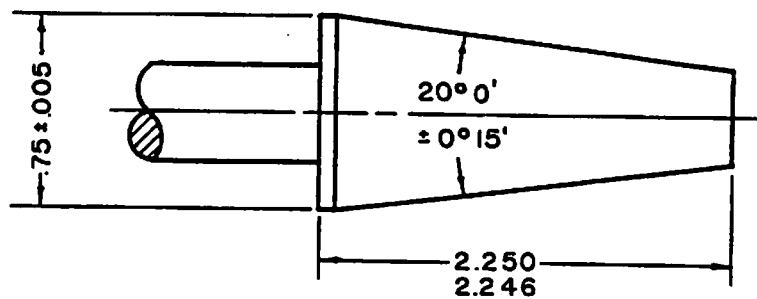
1. Standard machine tapers—the diameter, usually at the large end, and the length are applied to the view in the form of dimensions; the actual taper is given as a note such as "No. 4 AMER. NATL STD TAPER"

Example:



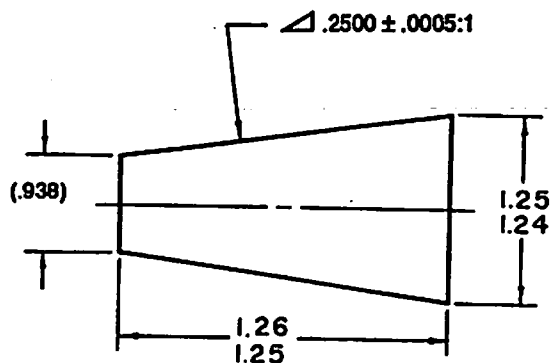
2. Non-critical tapers—the diameter at the large end, the length, and the included angle are applied to the view in the form of dimensions

Example:



3. Critical tapers—the diameter of the large end and the length are applied to the view as dimensions and the "taper per unit on diameter" is indicated on a note.

Example:



NOTE: Taper on diameter means the difference in diameter per unit of length.

F. Knurl

1. Diamond pattern

- a. Coarse knurl (33 pitch)

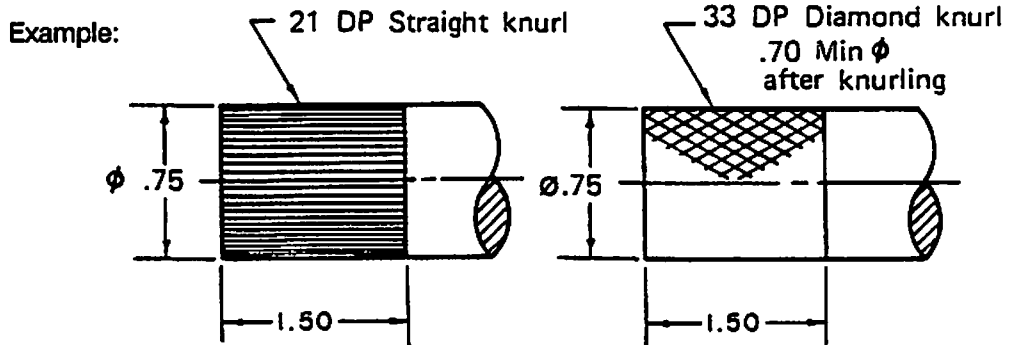
NOTE: Pitch is the distance between two points per inch.

- b. Medium knurl (21 pitch)
- c. Fine knurl (14 pitch)

2. Straight pattern

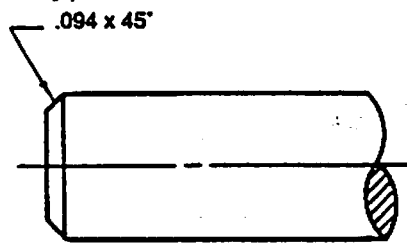
- a. Coarse knurl (33 pitch)
- b. Medium knurl (21 pitch)
- c. Fine knurl (14 pitch)

3. The pitch, type of knurl, and the minimum diameter after knurling are applied to the view in the form of a note.



G. Chamfer—the length of the offset and the angle are applied to the view in the form of a note

Example:



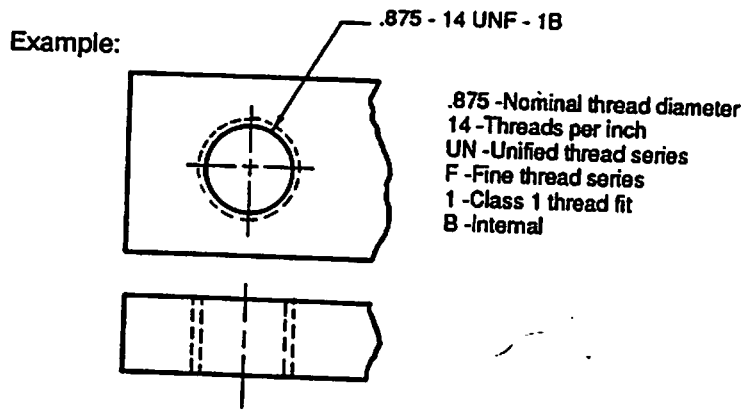
H. Threads

1. Internal thread

- a. Through-drill—the following items are applied to the view in the form of a note

NOTE: All dimensions should be in decimal.

- 1) Nominal thread diameter in decimal
- 2) Threads per inch
- 3) Thread series type
- 4) Class of thread fit
- 5) LH (if it is left handed)

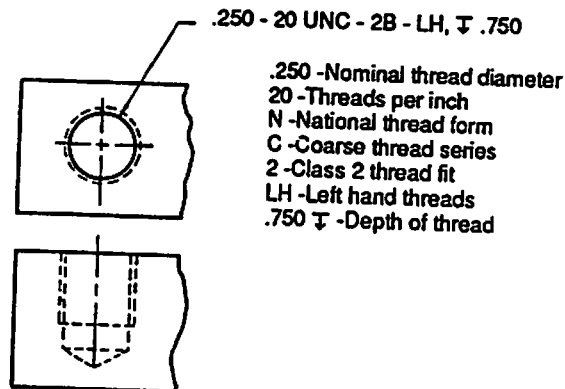


NOTE: Tap drill size is determined by referring to American National Standard Thread tables, Machinery Handbook, or various textbook appendixes.

b. Blind drill—the following items are applied to the view in the form of a note

- 1) Depth of tap drill
- 2) Nominal thread diameter
- 3) Threads per inch
- 4) Thread series type
- 5) Class of thread fit
- 6) LH (if it is left handed)
- 7) Depth of thread

Example:

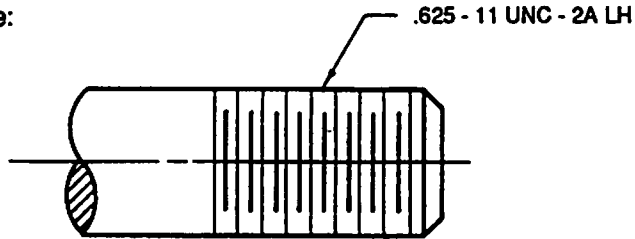


2. External thread—the following items are added to the view in the form of a note

- a. Nominal thread diameter
- b. Threads per inch

- c. Thread series types
- d. Class of thread fit
- e. LH (if it is left handed)

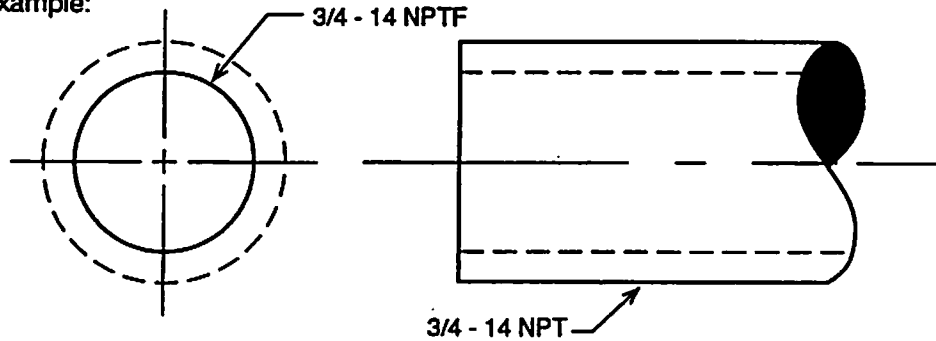
Example:



3. Pipe threads

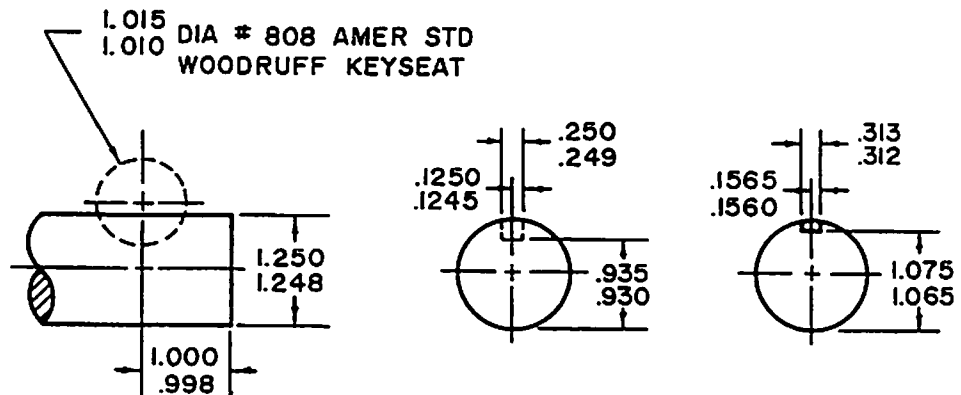
- a. Nominal pipe size in decimal or fractional inches
- b. Threads per inch
- c. Thread type symbol

Example:



- I. Keyways--the size and number of the required key are given in the form of a note and the location on the shaft of the keyway is given in the form of dimensions on the two views showing the keyway

Example:

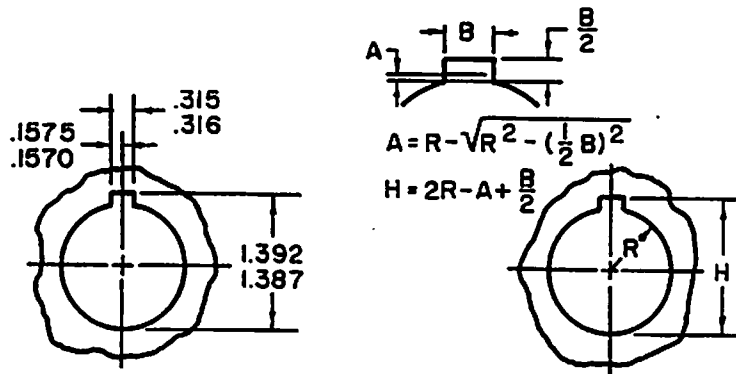


NOTE: Notice the use of a dimension to center the keyway in the shaft.

- J. Keyseats—the size and location of the slot are given in the form of dimensions applied to the view

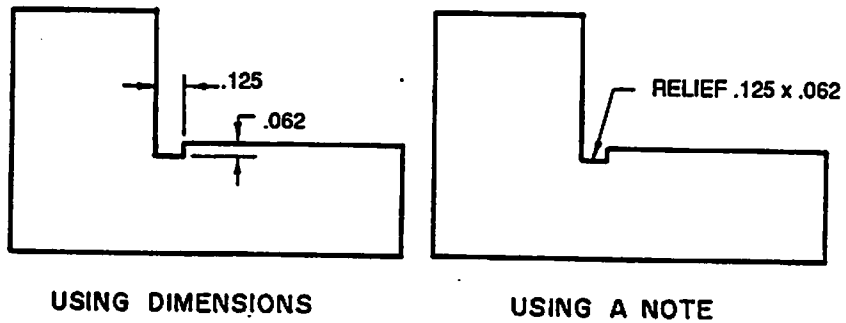
NOTE: The proper clearance for various keys can be obtained from a machine handbook.

Example:



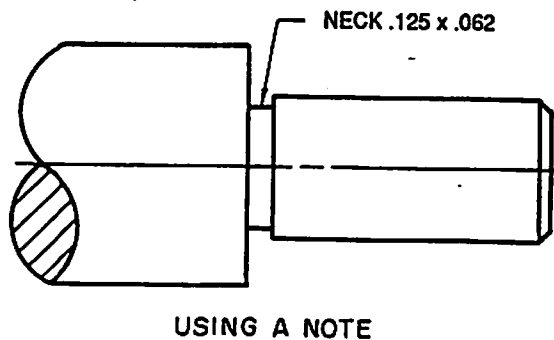
- K. Relief groove—the width and depth of a relief can be given by placing dimensions on the view or in the form of a note

Example:



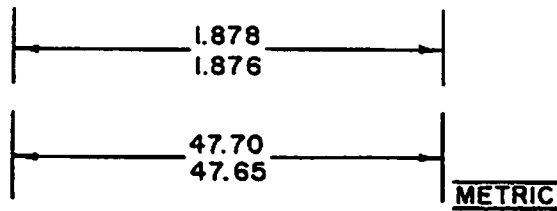
- L. Neck—the width and depth of a neck are given in the form of a note

Example:



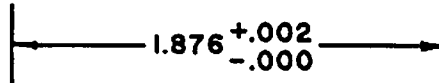
VI. Systems of dimensioning tolerances on drawings (TMs 2.7 and 2.8)

A. Limits

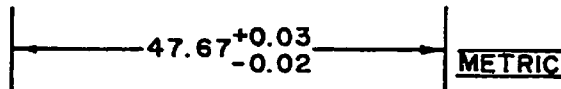


B. Plus and minus

1. Unilateral



2. Bilateral



C. Notes

NOTE: In cases where all tolerances are the same, it is more convenient to list the information in a note than to list the tolerances separately.

Example: Note: Tolerances are $\pm .010$ unless otherwise specified.

VII. Numerical control dimensioning

- A. Datum or reference planes must be selected that are mutually perpendicular in the X, Y, and Z axes.
- B. Dimensions originate from the three planes.
- C. Dimensions must be in decimals.
- D. Angles should be in degrees and decimal parts of degrees.
- E. Standard tools such as reamers, drills, and tapers should be specified wherever possible.
- F. Tolerances should be used based on design requirements rather than tolerances of manufacturing machines.

VIII. Fits for inch units

A. Running and sliding fits

- a. RC 1 (Close sliding fits)
- b. RC 2 (Sliding fits)
- c. RC 3 (Precision running fits)

- d. RC 4 (Close running fits)
 - e. RC 5-RC 6 (Medium running fits)
 - f. RC 7 (Free running fits)
 - g. RC 8-RC 9 (Loose running fits)
- B. Locational fits
- a. LC 1-LC 11 (Locational clearance fits)
 - b. LT 1-LT 6 (Locational transition fits)
 - c. LN 1-LN 2 (Locational interference fits)

3. Force fits

- a. FN 1 (Light drive fits)
- b. FN 2 (Medium drive fits)
- c. FN 3 (Heavy drive fits)
- d. FN 4-FN 5 (Force fits)

IX. Calculation of limits in inch units using basic hole system

A. Calculation of limits for clearance fit

1. Refer to tolerance fit table for inch units, and locate basic hole size in "nominal size range, inches" column.

NOTE: Limits are in thousandths of an inch. Multiply limit by .001 for calculations.

Example: Basic hole size 2.00 fit RC 6 –Go to table–

Nominal size range, inches	Limits of clearance	Standards limits	
		Hole	Shaft
1.97-3.15	2.5 7.3	+3.0 - 0	-2.5 -4.3

2. Calculate limits for the hole.

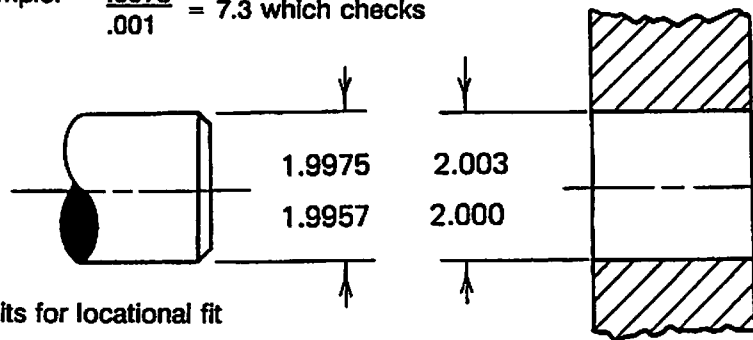
Example: $2.000 + 3.0 (.001) = 2.003$ Max. limit (LMC)–largest hole
 $2.000 - 0 = 2.000$ Min. limit (MMC)–smallest hole

3. Calculate limits for the shaft.

Example: $2.000 - 2.5 (.001) = 1.9975$ Max. limit (MMC)–largest shaft
 $2.000 - 4.3 (.001) = 1.9957$ Min. limit (LMC)–smallest shaft

4. Calculate allowance in inch units.
 - a. Calculate tightest fit (MMC of hole - MMC of shaft) smallest hole - largest shaft
 Example: $2.000 - 1.9975 = .0025$
 - b. Look at table under limits of clearance and check your answer against table
 Example: $\frac{.0025}{.001} = 2.5$ which checks
 - c. Calculate loosest fit (LMC of hole - LMC of shaft) largest hole - smallest shaft
 Example: $2.0030 - 1.9957 = .0073$
 - d. Look at table under limits of clearance and check your answer against table
 Example: $\frac{.0073}{.001} = 7.3$ which checks

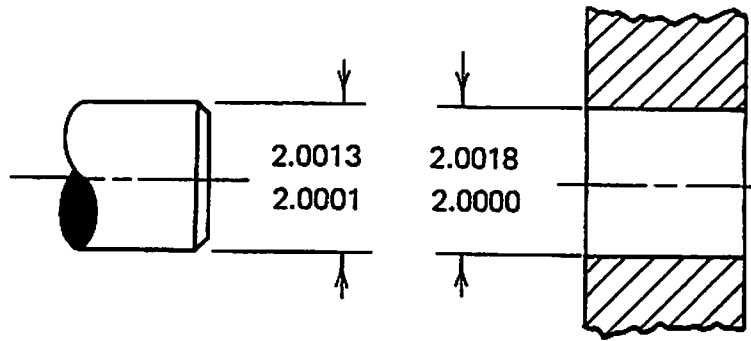
5. Dimension



B. Calculation of limits for locational fit

1. Refer to fit table for inch units, and locate basic hole size in "nominal size range, inches" column.
 Example: Basic size 2.00 fit LT 4--Go to table--
2. Calculate limits for the hole.
 Example: $2.00 + 1.8 (.001) = 2.0018$ LMC
 $2.00 - 0 = 2.0000$ MMC
3. Calculate limits for the shaft.
 Example: $2.00 + 1.3 (.001) = 2.0013$ MMC
 $2.00 + 1 (.001) = 2.001$ LMC
4. Calculate fit.
 - a. Calculate tightest fit (MMC of hole - MMC of shaft)
 Example: $2.0000 - 2.0013 = .0013$
 - b. Calculate loosest fit (LMC of hole--LMC of shaft)
 Example: $2.0018 - 2.0001 = +.0017$
 - c. Check table under fit to check your answer

5. Dimension



C. Calculation of limits for force fit

1. Refer to fit table for Inch units, and locate basic hole size in "nominal size range, inches" column.

Example: Basic size 2.00 fit FN 3; --Go to table--

2. Calculate limits for the hole.

Example: $2.00 + (1.2)(.001) = 2.0012$ LMC
 $2.00 - 0 = 2.0000$ MMC

3. Calculate limits for the shaft

Example: $2.00 + 3.2 (.001) = 2.0032$ MMC
 $2.00 + 2.5 (.001) = 2.0025$ LMC

4. Calculate limits of interference

- a. Calculate tightest interference (MMC of hole - MMC of shaft).

Example: $2.0000 - 2.0032 = -.0032$

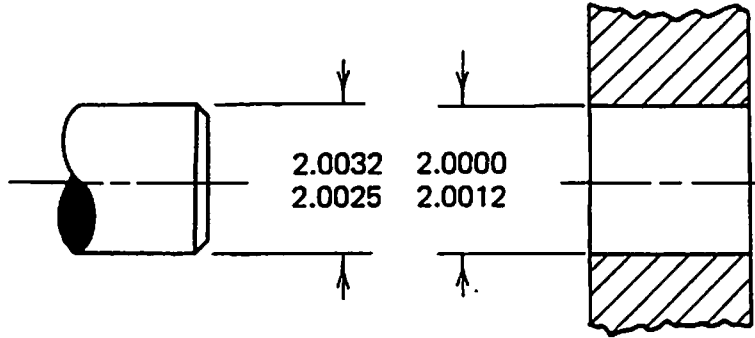
- b. Calculate loosest interference (LMC of hole - LMC of shaft).

Example: $2.0012 - 2.0025 = -.0013$

NOTE: Notice both have negative values.

- c. Check table under limits of interference to check your answer.

5. Dimension



X. Calculation of limits in inch units using basic shaft system

A. Refer to fit table for inch units, and locate the basic shaft size.

Example: Basic shaft size 2.00 fit RC 6 –Go to table–

Nominal size range, inches	Limits of clearance	Standards limits	
		Hole	Shaft
1.97-3.15	2.5	+3.0	-2.5
	7.3	- 0	-4.3

B. Calculate basic hole size by adding allowance at MMC to basic shaft size.

Example: $2.000 + .00025 = 2.0025$ basic hole size

NOTE: Now use table as we did in basic hole system.

C. Calculate limits for the hole.

Example: $2.0025 + 3.0 (.001) = 2.0055$ LMC
 $2.0025 - 0 = 2.0025$ MMC

D. Calculate limits for the shaft.

Example: $2.0025 - 2.5 (.001) = 2.0000$ MMC
 $2.0025 - 4.3 (.001) = 1.9982$ LMC

E. Calculate allowance.

1. Calculate tightest fit (MMC of hole - MMC of shaft)

Example: $2.0025 - 2.0000 = .0025$

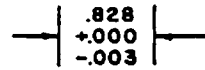
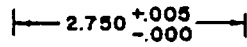
2. Check allowance from table

3. Calculate loosest fit (LMC of hole - LMC of shaft)

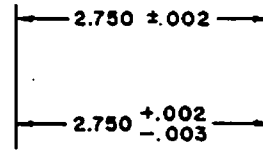
Example: $2.0055 - 1.9982 = .0073$

4. Check allowance from table

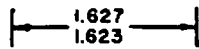
TYPES OF TOLERANCES



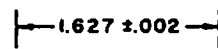
UNILATERAL TOLERANCES



BILATERAL TOLERANCES



TOLERANCE EXPRESSED AS LIMITS



TOLERANCE EXPRESSED AS VARIATION

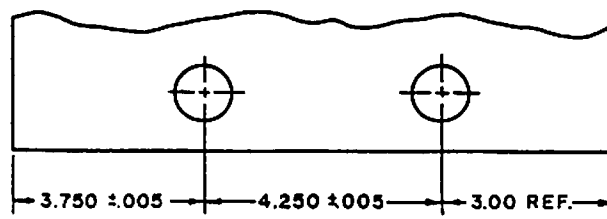
NOTE:
TOLERANCES ARE ±.006 UNLESS OTHERWISE SPECIFIED

NOTE GOVERNING TOLERANCE

Indicating tolerances on drawings

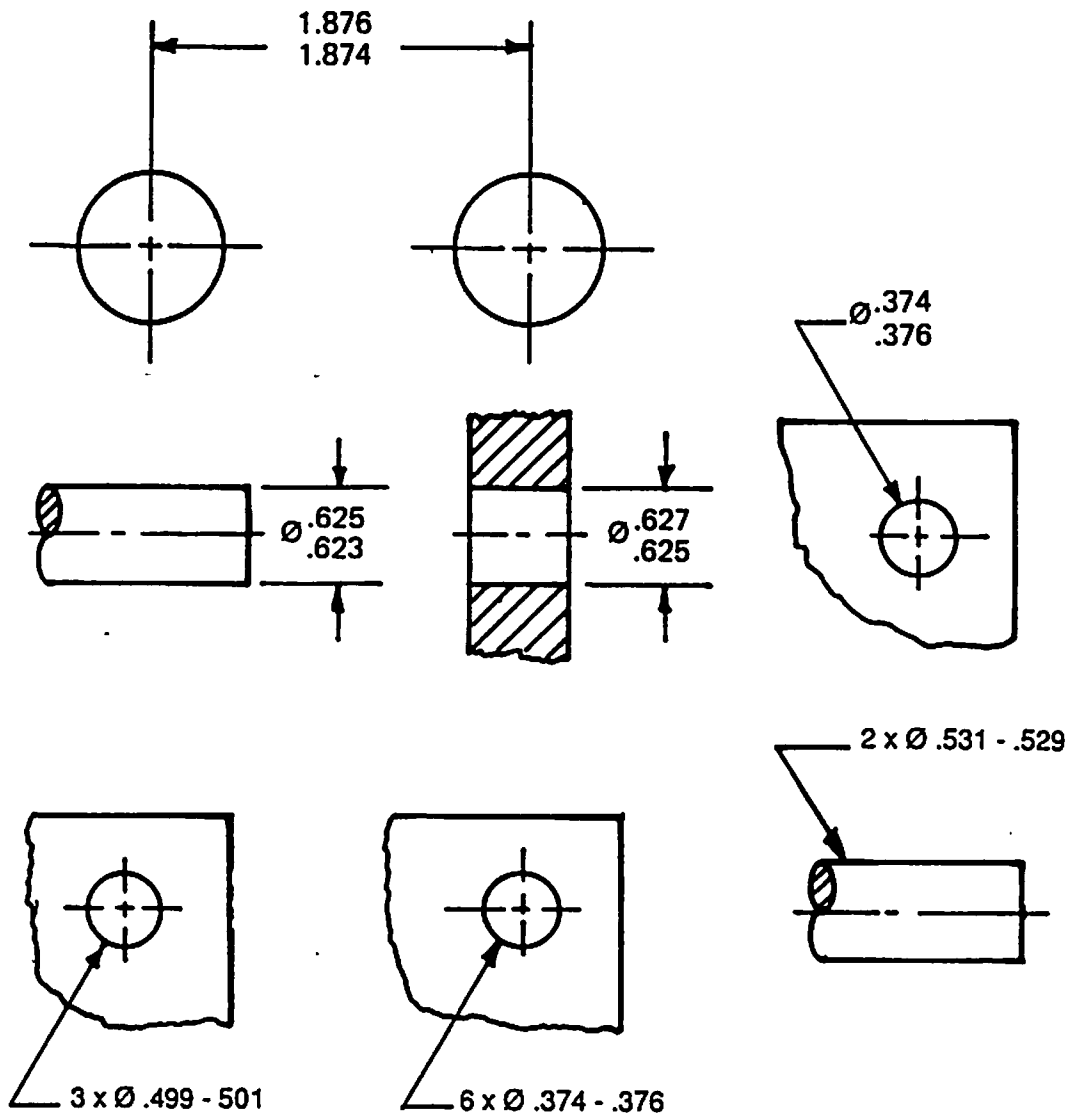


Indicating BASIC dimensions

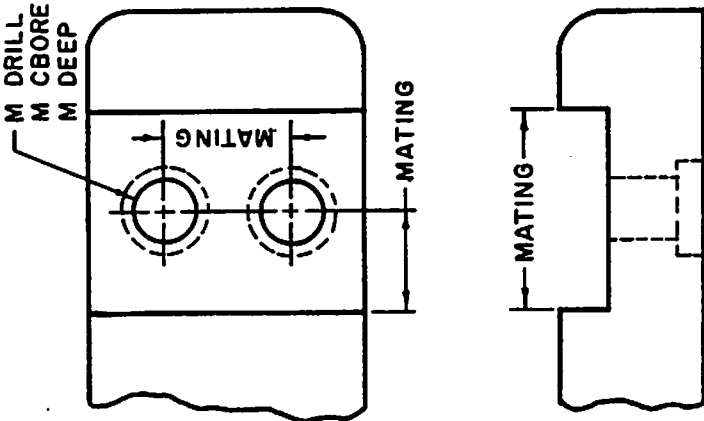
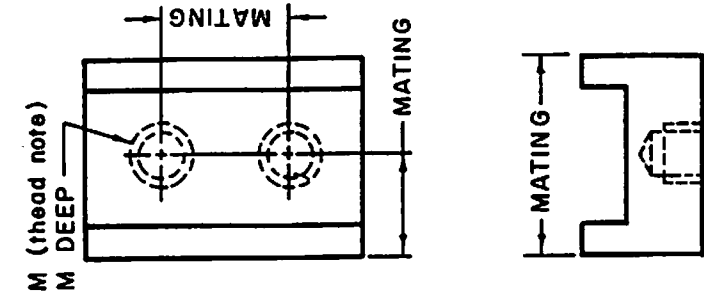
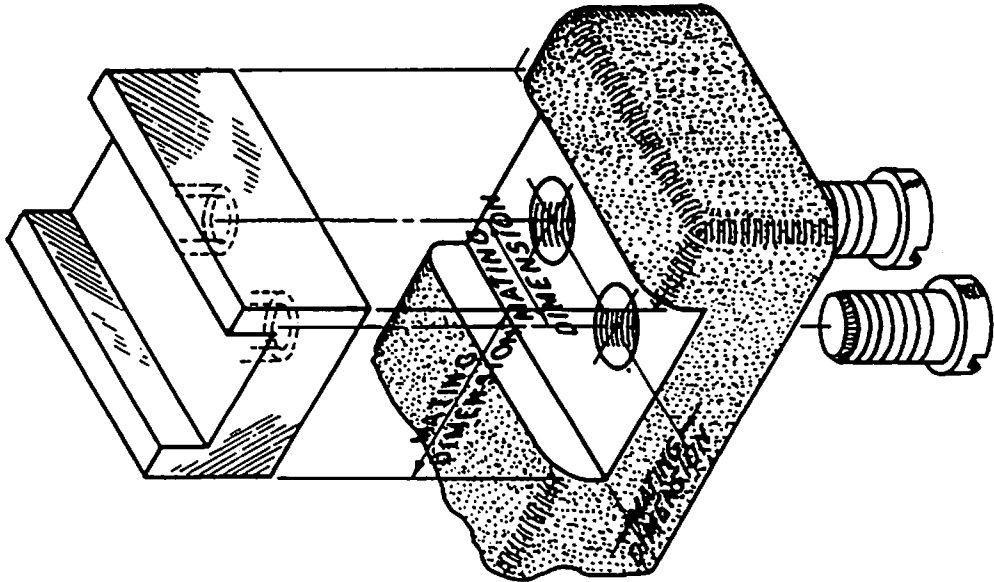


Indicating reference dimensions

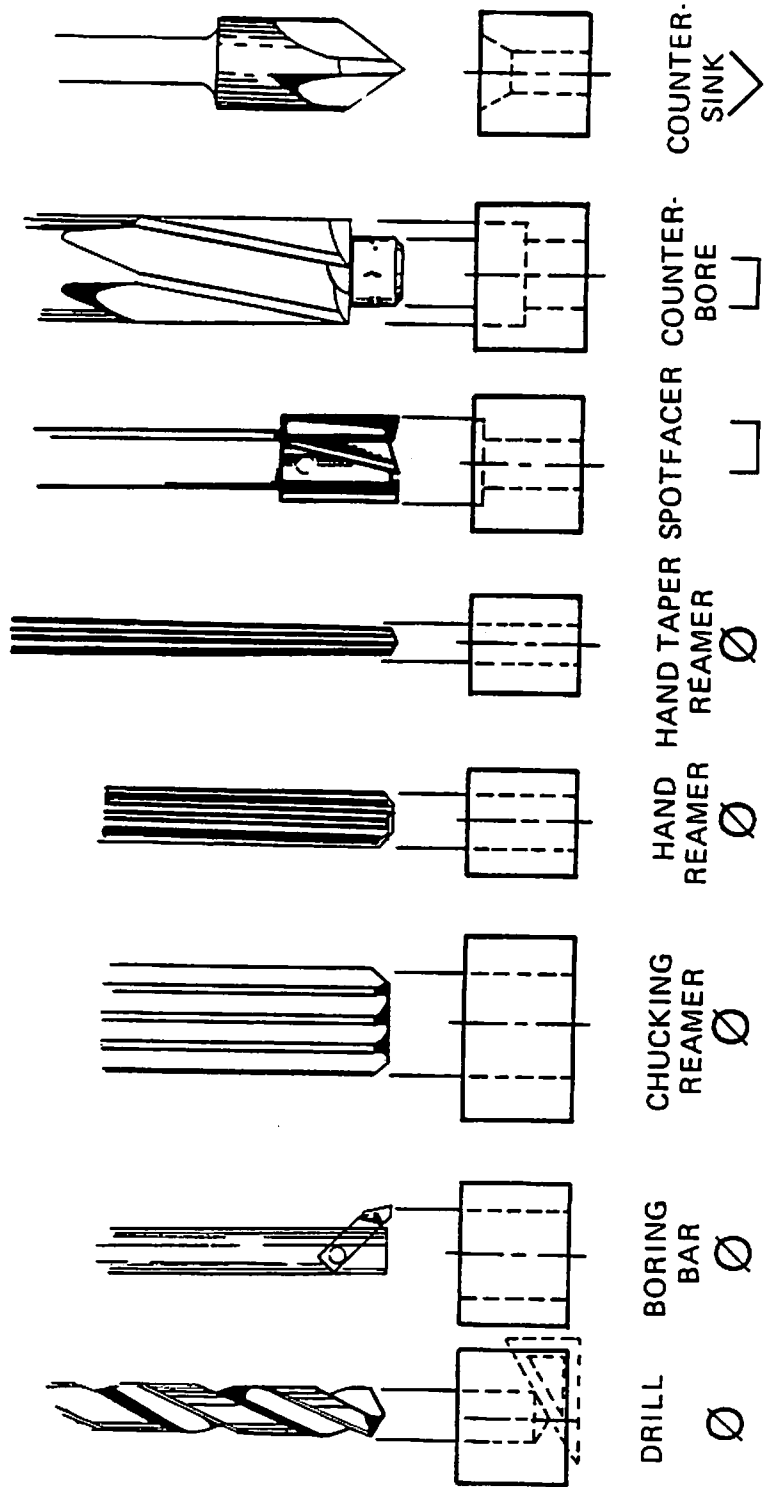
APPLICATION OF DIMENSIONING



MATING DIMENSIONS



HOLE OPERATIONS



WRITE PROPER DIMENSION NOTES FOR STANDARD MACHINE MANUFACTURED FEATURES

Premise: Proper dimension notes for standard machine manufactured features can be written by using the procedure in the following example.

Example:

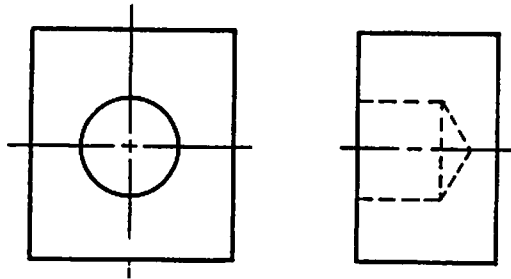
1. Determine what information goes into the note.

NOTE: This may require using reference tables for features such as tap drill sizes or key sizes.

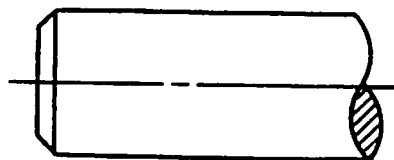
2. Determine in what order machining operations will be performed.
3. Add leader lines to views.
4. Add guidelines for lettering.
5. Letter note.

Directions: Dimension the following standard features correctly by adding all necessary notes and dimensions to the views. Dimension can be taken directly from the views.

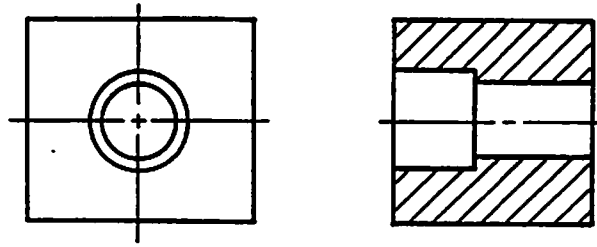
Problem A: Blind drill 25/64 deep



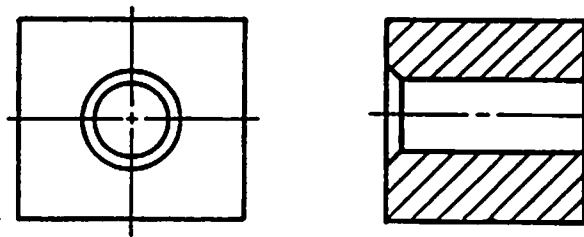
Problem B: Chamfer 3/32



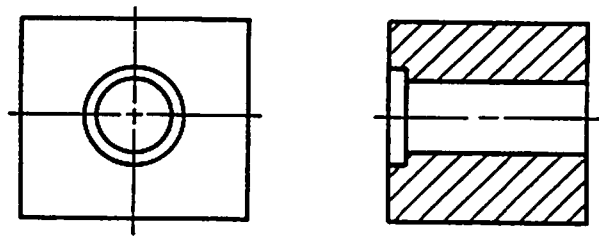
Problem C: Counterbore 12mm, 10mm deep, 9mm drill



Problem D: Countersink 82-degree countersink, 13mm, 9mm drill



Problem E: Spot faced 1/2" spot faced, 3/8 drill

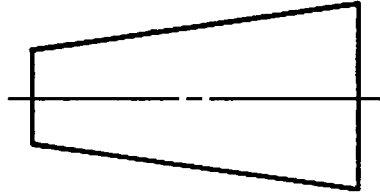


Problem F: Non-critical taper

Major diameter $.93 \pm .006$

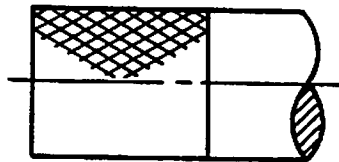
Length of taper 1.630/1.620

The included angle is $12 \text{ degrees} \pm 30 \text{ seconds}$

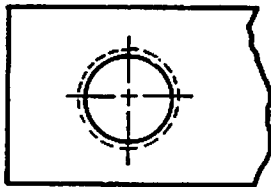


Problem G: Knurl, Diamond with pitch of 33

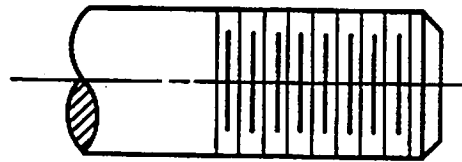
Minimum diameter $.70$ after knurling



Problem H: Thread $1/2''$ internal, $3/4''$ external



UNF



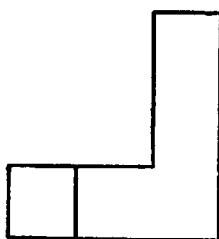
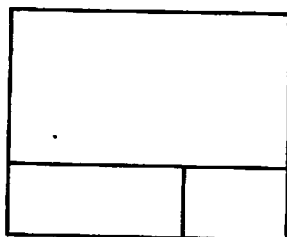
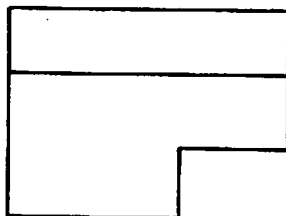
UNC

DIMENSION AN OBJECT COMPLETELY

Directions: With drafting tools and machine, dimension the objects below using proper dimensioning rules and techniques.

Problems:

Full size-inch system-fractions

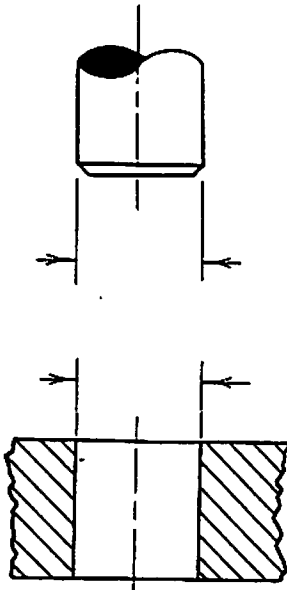


CALCULATE AND DIMENSION CLEARANCE FIT TOLERANCES USING STANDARD FIT TABLES

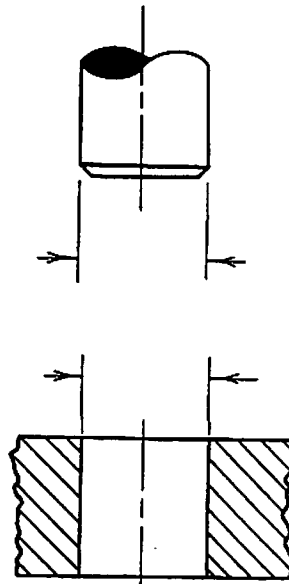
Directions: Calculate and dimension the following clearance fit tolerances using standard fit tables.

Problems:

Inch system using ANSI B 4.1 - 1967, R 1974



Fit RC 4
Basic Size 1.00
Check fit



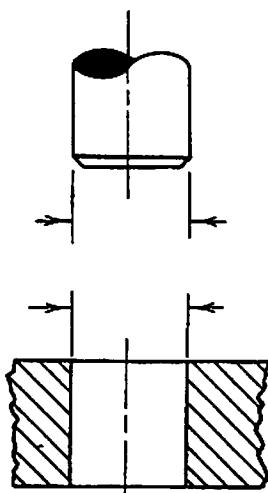
Fit RC 2
Basic Size 2.50
Check fit

CALCULATE AND DIMENSION INTERFERENCE FIT TOLERANCES USING STANDARD FIT TABLES

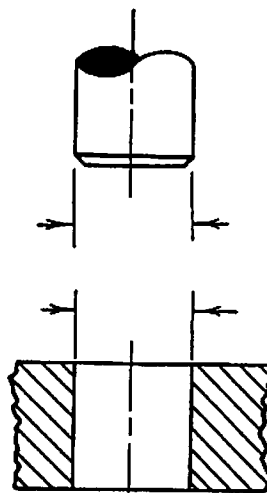
Directions: Calculate and dimension the following interference fit tolerances using standard tables.

Problem:

Inch system using ANSI B 4.1 - 1967, R 1974



Fit FN 4
Basic Size 3.00
Check fit



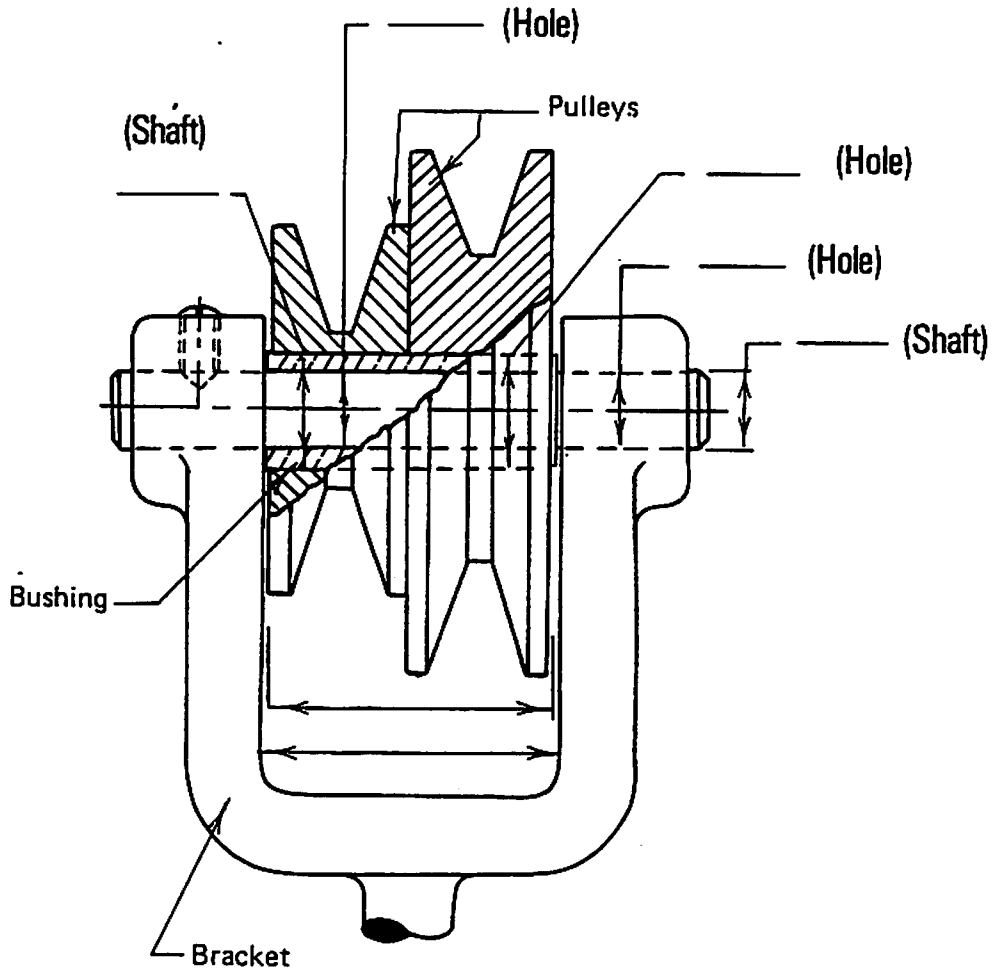
Fit LN 2
Basic Size .5
Check fit

CALCULATE AND ASSIGN TOLERANCES TO MATING PARTS USING STANDARD FIT TABLES

Directions: Calculate and assign tolerances to mating parts using standard fit tables for the pulley assembly below.

Problem:

Inch System



Specifications

SHAFT-BRACKET FIT .75 Nominal diameter Fit RC7	SHAFT-BUSHING FIT .75 Nominal diameter Fit RC 4
BUSHING-PULLEY FIT 1.25 Nominal diameter Fit LN1	BUSHING-BRACKET FIT 3 Nominal length Fit RC8

Show calculations below

SHAFT- BRACKET	SHAFT- BUSHING
BUSHING- PULLEY	BUSHING- BRACKET

MODULE: INTRODUCTION TO PRODUCTION/MANUFACTURING DRAFTING

UNIT II: INTRODUCTION TO MACHINE DRAWINGS

LESSON 2: DIMENSIONING AND TOLERANCING

ANSWERS TO ASSIGNMENT SHEETS

AS 2.6 – Evaluated to the satisfaction of the instructor

AS 2.7 – Evaluated to the satisfaction of the instructor

AS 2.8

.9992	2.4996
.9984	2.4991

1.0008	2.5007
1.0000	2.5000

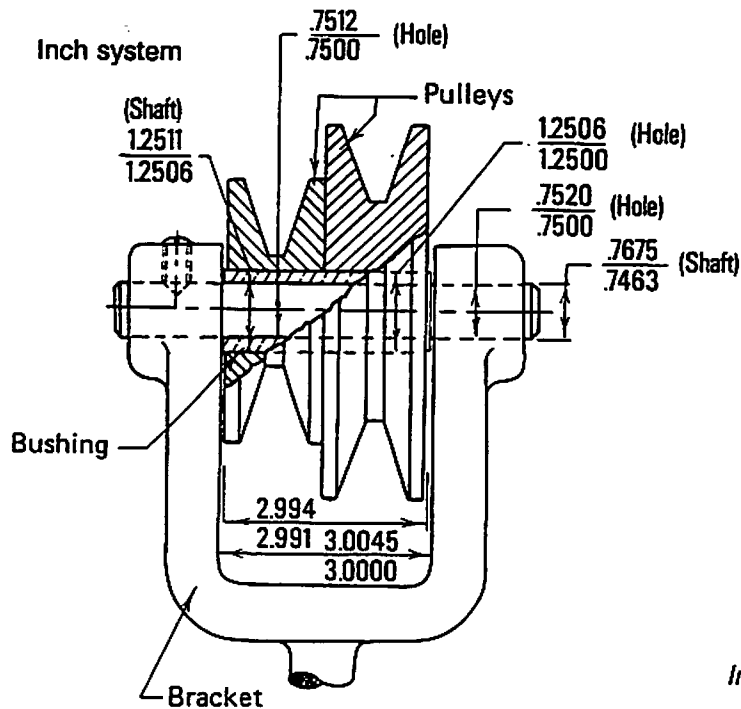
AS 2.9

3.0047	.5011
3.0040	.5007

3.0012	.5007
3.0000	.5000

AS 2.10

A. Inch system



STUDENT EVALUATION
LEWIS & CLARK CAREER CENTER
 2400 Zumbuhl Road
 St. Charles, MO 63301
 Phone (636)946-7726 Fax (636)946-8472

Student	Employer	Supervisor	To Time Period Covered
---------	----------	------------	---------------------------

Please rate the student according to how well he/she performs the task or meets the specific objectives taking into consideration the amount of time or training received on the job.

Ratings:

1. Exceptional or superior performance.
2. Very good or above average performance.
3. Satisfactory or average performance.
4. Below average performance.
5. Unsatisfactory performance.
- N. Does not apply or I have not had a chance to observe as yet.

Dates absent or late: _____

*Please call 723-4829 or 946-7726 on any days tardy or absent.

Specific Rating (use above scale):

- _____ 1. Does the student report to work at the scheduled time?
- _____ 2. Does the student notify you in case of illness with enough notice that you can get a replacement if needed?
- _____ 3. Does the student keep requests to be absent from work to a minimum and give adequate notice to the employer?
- _____ 4. Does the student attempt to get along well with other employees/customers?
- _____ 5. Does the student attempt to get along well with the employer?
- _____ 6. Does the student dress appropriately for work and is neat and clean about physical appearance?
- _____ 7. Does the student keep confidences concerning business procedure or operations?
- _____ 8. Does the student perform his/her task willingly?
- _____ 9. Does the student accept criticism graciously and then attempt to correct the problem?
- _____ 10. Does the student seek tasks to do when none are assigned?
- _____ 11. Does the student, in general, use common sense and is he/she conscientious about the welfare of the company?
- _____ 12. Does the student know and observe proper safety habits at all times?
- _____ 13. Does the student remain attentive at all times and follow all instructions given?
- _____ 14. Does the student correctly identify, use, and maintain hand tools, power tools, and equipment?
- _____ 15. Does the student perform his/her tasks and duties to the best of his/her ability and is willing to learn from coworkers?

Overall rating of student: _____

Comments: _____

LEWIS & CLARK CAREER CENTER

COOPERATIVE WORK RELEASE PROGRAM AGREEMENT

- I
1. The cooperative work release program provides an opportunity for a student to work during the time he/she would normally be attending classes at Lewis & Clark Career Center. The program is available to students who have completed the first semester of their second year of instruction at Lewis & Clark.
 2. To qualify for this program, a student must have good attendance, good work habits, make at least a "B" average for the current school year, and be recommended by his/her vocational instructor.
*Current Grade: _____ *Days Missed this Year: _____
*Must be initialed by vocational instructor.
 3. The earliest beginning date for the work program will be the first day of the last semester of the program.
 4. The work experience must be in the occupational field in which the student has received training at Lewis & Clark Career Center.
 5. Students will not be allowed to work for members of their immediate families.
 6. The work release program requires the approval of the vocational instructor, the high school principal, the student's parents, and the vocational director.
 7. The student is responsible for providing a completed employer training agreement prior to the first day of employment.
 8. The student must attend his/her classes at the home school. Should a student fail to attend classes on a day that he/she worked, the agreement is immediately terminated and the student must return to class at Lewis & Clark Career Center.
 9. The student must be on the job during the agreed hours of employment.
 10. Should the employment terminate for any reason, the student must report for classes at Lewis & Clark immediately.
 11. Lewis & Clark Career Center and the home high school will not be responsible for any accidents or job related problems while the student is in route to the job site or during the employment.

This agreement has been read and approved by the following:

Student

Vocational Director

Vocational Instructor

Parent

High School Principal

Date

EMPLOYER-STUDENT AGREEMENT

II Student's Name _____ Employer's Name _____

Employer's Address _____
City State Zip

Employer's Telephone _____ Starting Date _____

Hours of Employment _____ Days to Work M T W TH F
(Select one day)

Description of work to be performed: _____

III The EMPLOYER agrees to provide a training station which will offer as much variety in work experiences for the student as is practically and economically possible, so that the student will receive broad occupational training. This includes adequate supervision and instruction, evaluating the student's progress once every week, not discharging the student without first consulting the coordinator in regard to such matters, not discriminating against students on the basis of race, color, national origin, gender, or disability in making available opportunities in cooperative education; and paying a beginning wage of \$ _____ per hour for _____ hours per school week. The employer/supervisor agrees to notify the school in case the student is absent or if there are other problems relating to the student's employment.

Employer or Supervisor's Signature Date Student's Signature Date

NOTE: Return completed form to Lewis & Clark Career Center

Private Transportation Consent Form

Dear Parent or Guardian, and Student,

At times it becomes necessary to use private vehicles to transport students to and from school sponsored activities. When this occurs, the school district requires the student and their parent or guardian sign the Private Transportation Release Consent Form that appears below:

Name of Activity: _____

Location of Activity: _____

Date(s) of Activity: _____

Name of Sponsor: _____

RETURN THIS FORM TO THE SCHOOL BY: (Date) _____

My child, _____, has my permission to travel from school property (or other location) to this activity by private transportation, either as the driver or as a passenger in a private automobile driven by another student, parent, or other person. I understand and acknowledge that the St. Charles R-VI School District will have no financial or legal responsibility for injuries arising out of such travel.

By signing this form, I hereby release the District, as well as its directors, officers, administrators, employees, and other agents from all liability for any and all injuries arising from my child's travel to this activity via private transportation. I further agree to indemnify and hold harmless the District, as well as its directors, officers, administrators, employees, and other agents, against any claims asserted by my child as a result of his or her travel to this activity via private transportation.

Parent or Guardian

Parent or Guardian

Date

Date

To be signed by students 16 years of age or older if either driving or riding in a private vehicle to a school sponsored event.

I acknowledge that the District will have no financial or legal responsibility for injuries arising out of my travel from school (or other location) to this activity. I further acknowledge that I have a responsibility to travel directly from school (or other location) to the activity and that failure to report to this activity on time may result in discipline, up to and including possible dismissal from this activity. I further acknowledge that inappropriate conduct during travel to this activity may result in such discipline, as well as additional discipline under Board of Education Policy, as such Policy applies to out-of-school misconduct.

Student Signature

Date

Lewis Clark Career Center

2005 - 2006 Placement Summary

Tiller, Phil

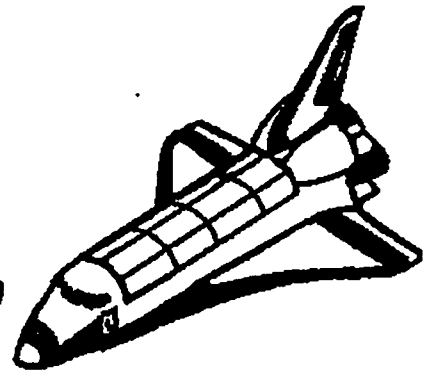
Total Students:	12	
Total Placed:	12	100%
Total Placed Related:	7	58%
Positive MSIP Placement:	9	75%

Employed Related:	2	17%
Employed Not Related:	3	25%
Military Related:	0	0%
Military Not Related:	0	0%
Continuing Education Related:	5	42%
Continuing Education Not Related:	2	17%
Not Available:	0	0%
Not Placed:	0	0%
Status Unknown (Not Found):	0	0%

Program Evaluation

Sample

Trade and Industrial Program Evaluation



**Industrial and Engineering Technology Career Pathway
Wholesale, Retail, Sales & Service Career Cluster**

Course: Electronics Technology

Instructor: Stan Baker

Pike/Lincoln Technical Center, Fall 2000

TRADES INDUSTRIAL EDUCATION PROGRAM STANDARDS

RESOURCE STANDARDS

1.A. The program offers a coherent sequence of courses leading to occupational competence.	2 Met ___ Not Met
--	----------------------

- | | | |
|--|-------------------------------------|--------------------------|
| | Yes | No |
| • The program offers at least 5 courses. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The program offers at least 3 units of credit. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

1.B. The teacher has a valid renewable teaching certificate for the program area.	2 Met ___ Not Met
---	----------------------

- | | | |
|---|-------------------------------------|--------------------------|
| • The district has on file a current teaching certificate for the teacher for the program area. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The teacher maintains a file containing documentation of completion of the requirements for renewal of the teaching certificate. (kept in office) | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

1.C. Course offerings are appropriate for meeting the needs of students and employers.	1 Met ___ Not Met
--	----------------------

- | | | |
|--|-------------------------------------|--------------------------|
| • Course offerings are based on enrollment trends, and employment needs. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|--|-------------------------------------|--------------------------|

1.D. Class size is appropriate for the program area.	2 Met ___ Not Met
--	----------------------

- | | | |
|--|-------------------------------------|--------------------------|
| • Class size does not exceed 18. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The number of students enrolled in the supervised trade experience component does not exceed 2 per business. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Comments on Resource Standards	Number of Standards Met: <u>7/7</u> <u>4</u>
--------------------------------	--

PROCESS STANDARDS

2. Curriculum

2.A. The program has a written curriculum and services to meet the needs of students. The curriculum is congruent with the overall philosophy of the program.	<input checked="" type="checkbox"/> Met <input type="checkbox"/> Not Met
--	---

- | | Yes | No |
|---|-------------------------------------|-------------------------------------|
| • The written curriculum is formally adopted by the board. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The written curriculum guide includes the following components: | | |
| • rationale which relates the program goals to the district's mission and philosophy | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • a general description of the content of the program | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • general goals for graduates in the program area | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| • cross references to the knowledge (content), skills and competencies (process) students need to meet the goals established by the district and the Show Me Standards. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Curriculum and instructional strategies have been developed which integrate academic and vocational competencies. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

2.B. The curriculum has been developed with appropriate input and is reviewed on an annual basis.	<input checked="" type="checkbox"/> Met <input type="checkbox"/> Not Met
--	---

- | | | |
|--|-------------------------------------|--------------------------|
| • The curriculum guide is utilized by staff and advisory committee with the advisory committee in the delivery of educational services . | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Systematic procedures are in place to evaluate and revise the curriculum regularly based on actual student needs and indications of student mastery. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The curriculum is articulated through grade levels and common subject areas to ensure continuity of learning. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The curriculum is reviewed annually and revised as necessary to reflect changes occurring in industry, student needs, and instructional technology Internship. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Resources in the community are used to enrich the curriculum. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

2.C. Learner outcomes and competencies for each course are clearly stated.	<input checked="" type="checkbox"/> Met <input type="checkbox"/> Not Met
---	---

- | | | |
|--|-------------------------------------|--------------------------|
| • The curriculum for each course/program has identified competencies organized as units of instruction, with appropriate assessment methods and resources. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|--|-------------------------------------|--------------------------|

Comments on Curriculum Standards:	Number of Standards Met: <u>3</u>
--	--------------------------------------

3. Instruction

3.A Classroom instruction is congruent with the written curriculum.	<input checked="" type="checkbox"/> Met <input type="checkbox"/> Not Met
--	---

- | | Yes | No |
|---|-------------------------------------|--------------------------|
| • Daily lesson plans derived from the curriculum guide are used to direct the educational process. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The teacher is instructed in the use of non-biased practices and language which has been reinforced by policies, procedures and/or on-going awareness training to recognize racial, cultural, gender, or disability bias in curriculum and instructional practices. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

3.B Students have the opportunity to participate in Supervised Trade/Industrial Internship Experience.	<input checked="" type="checkbox"/> Met <input type="checkbox"/> Not Met <input type="checkbox"/> NA
---	--

- | | | |
|--|-------------------------------------|--------------------------|
| • Students are enrolled in both the class and the supervised employment simultaneously. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Training stations are appropriate for the occupational area of the program. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • There is a written Instructional Management Plan between the school and the training sponsor on file for each student. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • There is a written training agreement between the school and the training sponsor on file for each student. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The teacher provides both in class instruction and supervision. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The teacher and the workforce development specialist have adequate supervision time in his/her schedule based on the number of students participating in the supervised work experience component. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Evaluation of students on the job includes occupationally specific skills as well as general workplace readiness. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The teacher provides frequent supervision at the training station. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The teacher and/or workforce development specialist closely screens and approves training stations. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • There is evidence that the supervised internship experience component of the program has the support of the counselors, administrators and business community. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

3.C The program provides students with assistance in the transition to the workplace and/or continued education.	<input checked="" type="checkbox"/> Met <input type="checkbox"/> Not Met
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- | | | |
|--|-------------------------------------|--------------------------|
| • Worksite educational opportunities (job shadowing, experiential education, internships, etc.) are available. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Articulation agreements have been implemented with postsecondary institutions and/or with other community resources, where applicable. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

4. D. Sufficient breadth and depth of instruction is provided in the classroom to meet the needs of all learners. Met Not Met

- | | | |
|--|-------------------------------------|-------------------------------------|
| | Yes | No |
| • Varied instructional strategies are used to address all learning styles, including IEP, slow students. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Coordination procedures have been developed to insure appropriate instruction, review, and reinforcement for individual students served by special/support programs. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Students are provided appropriate support services (including supplementary aids and accommodations, when needed) to enter and succeed in the vocational education program. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • The teacher is knowledgeable about special/support programs offered by the district, and actively participates in the Individual Education Plan/Vocational Education Plan process. | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

4. E. The teacher monitors student progress toward course objectives and learner outcomes. Met Not Met

- | | | |
|--|-------------------------------------|--------------------------|
| • Program and/or course objectives, assessment methods and performance expectations are shared with students and parents/guardians prior to instruction. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • An instructional management system exists for reporting student and class mastery of curriculum competencies. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

4. F. The teacher and students have access to resources to effectively implement the curriculum of the program. Met Not Met

- | | | |
|---|-------------------------------------|--------------------------|
| • Resources in the community are utilized to enrich the curriculum. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Procedures are in place for the periodic updating and replacement of instructional materials. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

4. G. Equipment for the program supports the curriculum and instructional process. Met Not Met

- | | | |
|---|-------------------------------------|--------------------------|
| • Appropriate instructional technology is available for students and staff. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • Equipment is in good repair and proper working order. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| • There are procedures for reporting and requesting repairs, and repairs are made promptly. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Comments on Instruction Standards:	Number of Standards
	Met: <u>6</u>