



California Vocational Agriculture Curriculum Guidelines Instructional Unit

PLUMBING

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PLUMBING

Unit Goal:

The goal of this unit is to provide the student with the necessary skills and knowledge of plumbing which will enable him/her to accomplish basic plumbing jobs.

Unit Performance Objectives:

Upon completion of this unit the student will be able to:

1. Properly identify plumbing tools and materials.
2. Exhibit safe handling and working with tools.
3. Understand the purposes for the various plumbing fittings and materials.
4. Figure a simple bill of materials for a job.
5. Make an installation using various materials.
6. Cut pipe to length and install fittings on steel, plastic, and copper.

Teaching Outline

I. Introduction - Orientation

- A. The plumbing industry and trade is one of the most rewarding economic phases of the construction trades. The areas of plumbing skills in the transmission of water, natural gas, sewage, petroleum liquids, as well as their usage in the areas of food processing, sprinkler fire protection, sprinkler coolants, gaseous scrubbers, and irrigation, will enable a person that has acquired the skills involved with the installation, maintenance, and repair of plumbing systems a very satisfying livelihood.
- B. Unionization: Generally, most skills of occupational employment are governed by union apprenticeship through the training period to qualify for the journeyman plumber classification.
- C. Building Codes: These are a set of local, state, and federally adopted laws governing the plumbing trade.
- D. Employment Opportunities: Some of the areas where those interested in the plumbing profession may be employed include:
 - 1. Construction - superintendent, foreman, journeyman and apprentice pipe fitters and plumbers, and laborer
 - 2. Maintenance and repair of building complexes - both public and private
 - 3. Wholesaler - representatives of manufacturers to retailers
 - 4. Retailers - representatives of the products they handle to the general public
 - 5. Inspection - representatives of local, state and federal governments to insure the compliance of the building codes
 - 6. Architects - engineers who design liquid transmission systems

II. Tool Identification: Should include, but not limited to the following:

- | | |
|-------------------|----------------------|
| A. Pipe cutter | I. Pipe tap |
| B. Tubing cutter | J. Pipe vise |
| C. Flaring tool | K. Pipe wrench |
| D. Pipe snapper | L. Monkey wrench |
| E. Pipe reamer | M. Chain wrench |
| F. Pipe die stock | N. Spanner wrench |
| G. Pipe die | O. Water pump pliers |
| H. Tap wrench | P. Gas torch |

III. Material Identification: Should include the following:

- A. Black malleable iron - used mainly with natural gas and steam fittings
- B. Cast iron - sewer lines
- C. Cast steel - high pressure lines

Suggested Learning Activities

- I. 1. Create an interest and awareness in the plumbing industry.

- II. 2. Have students identify the tools listed in this unit.

- III. 3. Have students identify the various materials listed in this unit.

Suggested Resource Materials

- 1. Speakers: Local contractors, inspectors, wholesalers.

Field trips: plumbing shops, construction sites, waste disposal plants, farms, etc.

- 2. Use actual tools or tool I.D. cards (can be obtained from old catalogs). TM 1, 1A

- 3. Obtain samples from retailers, school maintenance, scrap piles, or use pictures.

- III. D. Galvanized - used mainly on water lines
- E. PVC (polyvinylchloride) - used for water, chemicals (except ethers)
- F. Rigid plastic - sewers, vent pipes
- G. AC (asbestos cement) - water, sewers, where soil salts are corrosive to metal
- H. Copper - water and gas
- I. Concrete - water, sewer, irrigation systems using low pressure
- J. Clay - used mainly on sewer lines
- K. Other - laminations of the above using coatings of tar, vinylcoated, e.g., "tru-coat"

IV. Fitting Identification: Should include the following:

- | | |
|---------------------|-------------------------|
| A. Tee | M. Close nipple |
| B. 90° ell | N. Dresser coupling |
| C. 45° ell | O. Dresser tee |
| D. Street ell | P. Hose bib or faucet |
| E. Coupling | Q. Globe valve |
| F. Reducer coupling | R. Gate valve |
| G. Bushing | S. Check valve (poppet) |
| H. Cross | T. Check valve (swing) |
| I. Cap | U. Cock valve |
| J. Plug | V. Anti-syphon valve |
| K. Ground union | W. Hose clamp |
| L. Nipple | X. Pipe clamp |

V. Other Materials:

- A. Plumber's tape
- B. Tape dope
- C. Pipe joint compound
- D. Threading oil
- E. Plumber's putty

VI. Nomenclature of Fittings: A few general rules to follow when ordering or selecting plumbing fittings and materials.

- A. The largest size is stated first and then its composition (e.g., 1-1 1/4" x 1" galvanized reducer coupling)

Suggested Learning Activities

- IV. 1. Have students identify the fittings listed in this unit.

Suggested Resource Materials

1. Obtain samples from retailers, school maintenance, scrap piles, or use pictures. TM-2,2A

- VI. B. Reducing tees are named by stating the end sizes first and the middle opening last (e.g., 3/4" x 3/4" x 1/2" galvanized reducer tee); if one end is larger than the other, the largest end is named first
- C. PVC fittings are either threaded or slip-type. The letter "T" is used to denote a threaded outlet, and the letter "S" is used to designate a slip (glued or clamped) outlet (e.g., 1" x 1/2" 90° PVC ST reducer ell)
- D. OD refers to the outside diameter of the pipe
- E. ID refers to the inside diameter of the pipe
- F. Valves are sized by the inside diameter of the pipe they receive (e.g., 3/4" gate valve)
- VII. Plumbing Safety - A few of the general safety rules or procedures include the following:
- A. Secure pipe to be cut or threaded in PIPE vises...not machinist vises to prevent slippage which could cause injuries to the operator and damage to the materials.
- B. Be sure to ream all pipes after cutting to remove the sharp inside burr left from cutting. This reduces danger of you cutting your finger as well as keeping the flow of liquids unimpaired. Unreamed pipes are dangerous and reduce the flow of materials through them.
- C. Be sure to wear proper eye protection when using power tools in threading and reaming pipe.
- D. Get assistance in carrying long lengths of pipe.
- E. Do not apply pipe joint compound with your fingers...you may cut yourself on the threads.
- F. Use the proper size wrench for the job.
- G. Dress properly for the job...no loose clothing.
- H. Refer to the workman's compensation laws regarding safety requirements.

Suggested Learning Activities

Suggested Resource Materials

- VII.
- | | |
|--|---|
| 1. Use of proper safety practices and procedures. | 1. Texts (several to choose from) |
| 2. Demonstrate cutting, reaming, and threading pipe. | 2. Texts and reference materials. |
| 3. Demonstrate the use of cutting oil, pipe joint compound, and tape dope. | 3. Trial and error. |
| 4. Demonstrate how to replace faucet washers. | 4. Experience; trial and error. |
| 5. Demonstrate the use of cleaner and glue on PVC pipe. | 5. Follow directions on can. |
| 6. Have students figure a bill of materials on a plumbing job you have designated. | 6. Obtain prices from your local retail plumbing shop on materials. |
| 7. Have students assemble various plumbing fittings according to a designated plan. | 7. Use materials on hand. |
| 8. Have students submit a bid on a plumbing job such as a sprinkler layout for a yard (including labor). | 8. Use a problem you have designated. |

Student Evaluation

Written

Directions: Student will successfully pass the safety material and tool identification, fitting description tests. Student will properly cut, debur and thread pipe.

Safety Test: (Example) could be as True or False

1. To hold a piece of pipe while threading use a _____ vise.
2. The cutter handle should be turned _____ turn at a time.
3. Tightening the cutter handle too tight can cause _____ to the _____.
4. Deburring is done with a _____.
5. You should check burr on inside of pipe with finger if you do it easy.
6. You can reverse threader on short piece of pipe.
7. Cutting oil does not have to be used on threader.
8. Proper clothing and gloves prevents accidents.
9. Small metal chips should be cleaned up.
10. Since cutting oil is thin it is not slippery.

Performance (Ref. CATA Curricular Code)

Tool Identification

pipe cutters	pipe spanners
pipe wrenches	pipe saws
pipe snappers	

Material Identification - Pipe

Visually tested - number each item and have student identify.	
black pipe	copper
galvanized	concrete
cast steel	clay
cast iron	true coated
PVC	etc.
asbestos cement - AC	

Fittings Identification

Valves: globe	butterfly
gate	gas or stop cock
check-poppet	hose bibs
check swing	etc.
flow valves	

Fittings Description

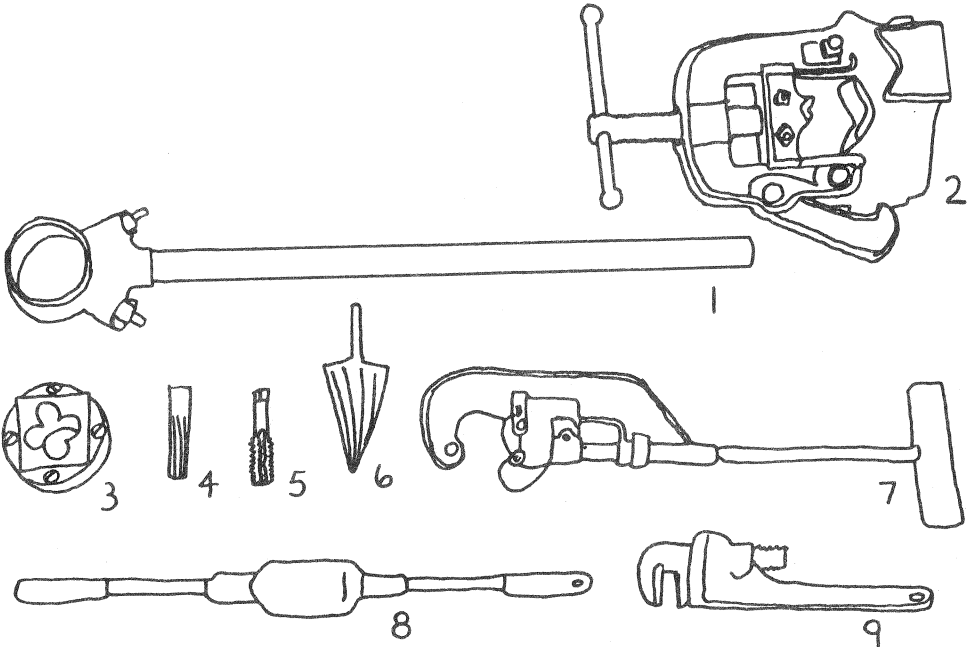
Number each fitting (PVC and/or steel) and have student give the proper description as to correct size, its composition and what it is. They should do 25 items in 5 minutes, e.g. #2 - 1 x 1 x 3/4 SST - PVC reducing tee; #4 - 1 x 1 x 3/4 galvanize reducing tee; #6 - 1 1/2" bronze gate valve.

Student Evaluation answers

1. pipe
2. 1/4
3. damage, cutter
4. tapered cutter
5. False
6. False
7. False
8. True
9. True
10. False

PLUMBING TOOLS

TM-1

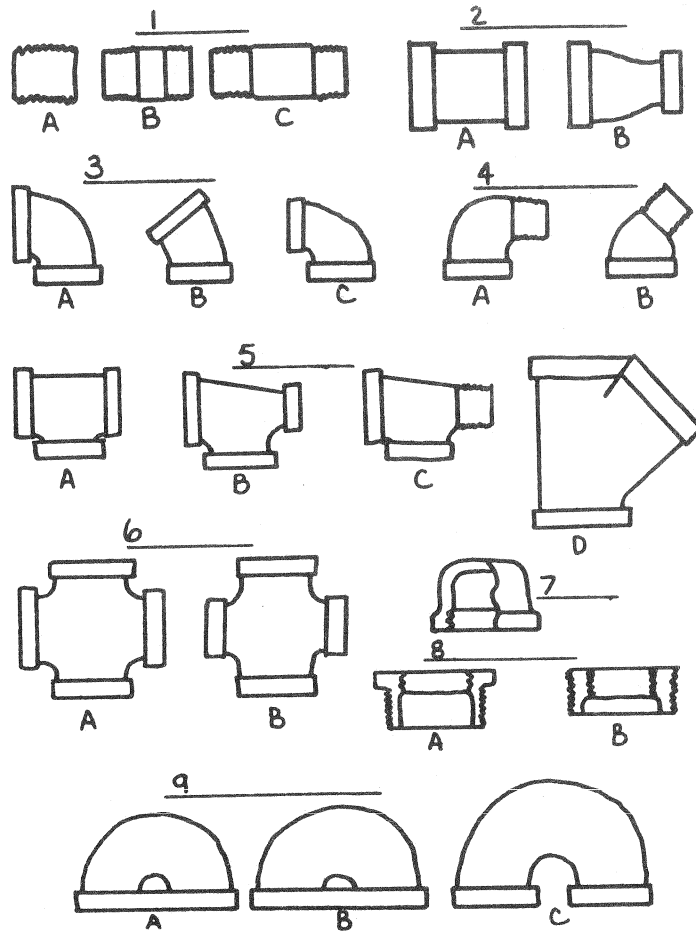


PLUMBING TOOLS

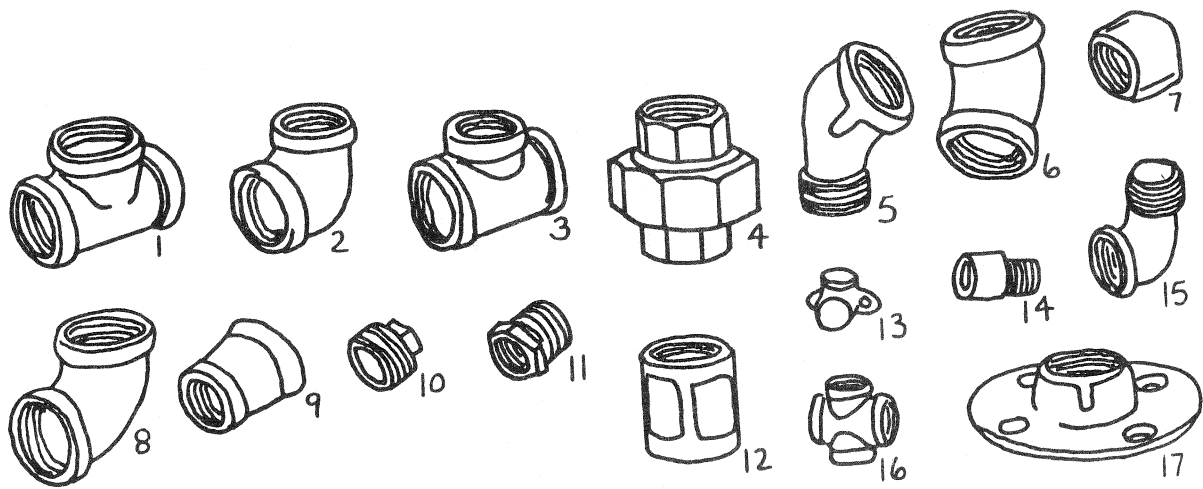
TM-1A

1. Ratchet Ring and Handle
2. Pipe Vise
3. Ratchet Head with Die
4. Pipe Reamer
5. Pipe Tap
6. Burr Reamer
7. Pipe Cutter
8. Tap Wrench
9. Pipe Wrench

PLUMBING IRON PIPE FITTINGS ^{TM-2}



GALVANIZED FITTINGS



PLUMBING

TM-2A

Iron Pipe Fittings

Galvanized Fittings

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Nipples <ol style="list-style-type: none"> A. Close B. Short C. Long 2. Couplings <ol style="list-style-type: none"> A. Straight B. Reducing 3. Elbows <ol style="list-style-type: none"> A. 90 B. 45 C. Reducing 4. Street Elbows <ol style="list-style-type: none"> A. 90 B. 45 5. Tees <ol style="list-style-type: none"> A. Straight B. Reducing C. Street or Service D. 45 Y-Branch 6. Crosses <ol style="list-style-type: none"> A. Straight B. Reducing 7. Cap 8. Bushings <ol style="list-style-type: none"> A. Outside Head B. Face 9. Return Bends <ol style="list-style-type: none"> A. Close B. Medium C. Open | <ol style="list-style-type: none"> 1. T 2. 90 L (Reducing) 3. T (Reducing) 4. Ground-Joining Union 5. 45 L Street 6. 45 L 7. Pipe Cap 8. 90 L 9. Reducer 10. Plug 11. Bushing 12. Coupling 13. Bracketed 90 L 14. Extension Piece 15. 90 L Street 16. Cross 17. Floor Flange |
|--|---|

General References

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The Interstate Publishers, 1959.

Southern Association of Agriculture Engineering and Vocational Agriculture,
Planning the Farm Water System, Athens, Georgia.

Hicks, Pump Operation and Maintenance and Pump Selection and Application,
McGraw-Hill Book Company, New York, New York, 1958.

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Distribution Center, Pueblo, Colorado 81009.

Western Plumbing Officials Association, Uniform Plumbing Code, P.O. Box 11,
Los Angeles, California.