
Air Force Training Command, Sheppard AFB, Tex.; Ohio State Univ., Columbus. National Center for Research in Vocational Education.  

Office of Vocational and Adult Education (ED), Washington, DC.  

144p.; For related documents see, CE 033 346-347.  

Behavioral Objectives; *Building Trades; *Equipment Maintenance; Equipment Utilization; Instructional Materials; Learning Modules; Lesson Plans; Military Personnel; Military Training; Occupational Safety and Health; *Plumbing; Postsecondary Education; Safety; *Sanitary Facilities; Skilled Occupations; *Vocational Education; *Waste Disposal; Waste Water; Water  

Military Curriculum Project  

These military-developed curriculum materials consist of a course description, course chart, plan of instruction, and lesson plans for use in training a plumbing specialist I. Study guides and workbooks for student use are also included. This course on Introduction to Plumbing covers plumbing safety; plumbing systems, terminology, and engineering drawings; exterior sewer systems; maintenance of tools; installation of building sewer systems; individual waste disposal systems; and structural openings. (MN)
MILITARY CURRICULUM MATERIALS

The military-developed curriculum materials in this course package were selected by the National Center for Research in Vocational Education Military Curriculum Project for dissemination to the six regional Curriculum Coordination Centers and other instructional materials agencies. The purpose of disseminating these courses was to make curriculum materials developed by the military more accessible to vocational educators in the civilian setting.

The course materials were acquired, evaluated by project staff and practitioners in the field, and prepared for dissemination. Materials which were specific to the military were deleted, copyrighted materials were either omitted or approval for their use was obtained. These course packages contain curriculum resource materials which can be adapted to support vocational instruction and curriculum development.
The National Center
Mission Statement

The National Center for Research in Vocational Education's mission is to increase the ability of diverse agencies, institutions, and organizations to solve educational problems relating to individual career planning, preparation, and progression. The National Center fulfills its mission by:

- Generating knowledge through research
- Developing educational programs and products
- Evaluating individual program needs and outcomes
- Installing educational programs and products
- Operating information systems and services
- Conducting leadership development and training programs

FOR FURTHER INFORMATION ABOUT Military Curriculum Materials
WRITE OR CALL
Program Information Office
The National Center for Research in Vocational Education
The Ohio State University
1980 Kenny Road, Columbus, Ohio 43210
Telephone: 614/486-3655 or Toll Free 800/848-4815 within the continental U.S. (except Ohio)
Military Curriculum Materials Dissemination Is...

an activity to increase the accessibility of military-developed curriculum materials to vocational and technical educators.

This project, funded by the U.S. Office of Education, includes the identification and acquisition of curriculum materials in print form from the Coast Guard, Air Force, Army, Marine Corps and Navy.

Access to military curriculum materials is provided through a "Joint Memorandum of Understanding" between the U.S. Office of Education and the Department of Defense.

The acquired materials are reviewed by staff and subject matter specialists, and courses deemed applicable to vocational and technical education are selected for dissemination.

The National Center for Research in Vocational Education is the U.S. Office of Education's designated representative to acquire the materials and conduct the project activities.

Project Staff:

Wesley E. Budke, Ph.D., Director
National Center Clearinghouse

Shirley A. Chase, Ph.D., Project Director

What Materials Are Available?

One hundred twenty courses on microfiche (thirteen in paper form) and descriptions of each have been provided to the vocational-curriculum Coordination Centers and other instructional materials agencies for dissemination.

Course materials include programmed instruction, curriculum outlines, instructor guides, student workbooks and technical manuals.

The 120 courses represent the following sixteen vocational subject areas:

Agriculture          Food Service
Aviation             Health
Building & Construction Conditioning
Trades               Machine Shop
Clerical             Management & Supervision
Occupations          Meteorology & Navigation
Communications       Photography
Drafting             Public Service
Electronics
Engine Mechanics

The number of courses and the subject areas represented will expand as additional materials with application to vocational and technical education are identified and selected for dissemination.

How Can These Materials Be Obtained?

Contact the Curriculum Coordination Center in your region for information on obtaining materials (e.g., availability and cost). They will respond to your request directly or refer you to an instructional materials agency closer to you.

CURRICULUM COORDINATION CENTERS

EAST CENTRAL
Rebecca S. Douglass, Director
100 North First Street
Springfield, IL 62777
217/782-0759

MIDWEST
Robert Patton, Director
1515 West Sixth Ave.
Stillwater, OK 74704
405/377-2000

NORTHEAST
Joseph F. Kelly, Ph.D., Director
225 West State Street
Trenton, NJ 08625
609/292-6562

NORTHWEST
William Daniels, Director
1 Building 17
Air Industrial Park
Olympia, WA 98504
206/753-0879

SOUTHEAST
James F. Shill, Ph.D., Director
Mississippi State University
Drawer DX
Mississippi State, MS 39762
601/325-2510

WESTERN
Lawrence F. H. Zane, Ph.D., Director
1776 University Ave.
Honolulu, HI 96822
808/948-7834
PLUMBING SPECIALIST, I

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Course Chart Page 3
Plan of Instruction Page 6
Lesson Plans Page 24
Block I - Introduction to Plumbing

Introduction to Plumbing - Study Guides Page 124
Introduction to Plumbing - Workbooks Page 225
# PLUMBING SPECIALIST, I

**Classroom Course**

**Developed by:**
United States Air Force

**Development and Review Dates:**
July 2, 1975

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**D.O.T. No.:**
862.287

**Occupational Area:**
Building and Construction

**Target Audiences:**
Grades 10-adult

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**Print Pages:**
290

**Cost:**
$6.00

**Availability:**
Military Curriculum Project, The Center for Vocational Education, 1960 Kenny Rd., Columbus, OH 43210

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### Contents:

<table>
<thead>
<tr>
<th>Block</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block I</td>
<td>Introduction to Plumbing</td>
</tr>
<tr>
<td>Plumbing Safety</td>
<td></td>
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<tr>
<td>Plumbing Systems, Terminology, and Engineering Drawings</td>
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<tr>
<td>Exterior Sewer Systems</td>
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<tr>
<td>Maintenance of Tools</td>
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<tr>
<td>Installation of Building Sewer Systems</td>
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<td>Individual Waste Disposal Systems</td>
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<td>Structural Openings</td>
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### Type of Materials:

<table>
<thead>
<tr>
<th>Lesson Plans</th>
<th>Programmed Text</th>
<th>Student Workbook</th>
<th>Handouts</th>
<th>Texts</th>
<th>Materials</th>
<th>Audio-Visuals</th>
<th>Performance Objectives</th>
<th>Tests</th>
<th>Review Exercises</th>
<th>Additional Materials Required</th>
<th>Group Instruction</th>
<th>Individualized</th>
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</thead>
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</tbody>
</table>

- Materials are recommended but not provided.

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**Expires July 1, 1978**
Course Description

Because of its long length Plumbing Specialist has been divided into three (3) courses for inclusion in the "Trial Implementation of a Model System to Provide Military Curriculum Materials for Use in Vocational and Technical Education." Training for this series of courses includes instruction on plumbing system operating principles and configurations, construction and maintenance of fixtures, faucets and plumbing system valves, and utilization and maintenance of tools, equipment, and supplies. There are 243 hours of instruction in the series.

Plumbing Specialist I is the first course in the series and includes Block I—Introduction to Plumbing. There are seven lessons with 42 hours of instruction. An additional three lessons were deleted because they deal with military organization and procedures. The selected lesson titles and hours follow:

- Plumbing Safety (2 hours)
- Plumbing Systems, Terminology, and Engineering Drawings (12 hours)
- Exterior Sewer Systems (4 hours)
- Maintenance of Tools (2 hours)
- Installation of Building Sewer Systems (4 hours)
- Maintenance of Tools (2 hours)
- Installation of Building Sewer Systems (6 hours)
- Individual Waste Disposal Systems (12 hours)
- Structural Openings (4 hours)

This course contains materials for both student and teacher use. Printed materials for the instructor include a plan of instruction for the block and lesson plans for each lesson. These contain an outline of instruction, objectives, activities, materials and tools needed, text assignments, and references. Student materials consist of a study guide and workbook for the block. Shop drawings are attached to the workbook. Thirty-two slide sets and eight films are suggested for the series but these are not provided.
### COURSE CHART

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>POS CODE</th>
<th>DATE</th>
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<tbody>
<tr>
<td>3ABR55235</td>
<td>ARL</td>
<td>2 July 1975</td>
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</table>

**COURSE TITLE**

Plumbing Specialist

**ATC OPR AND APPROVAL DATE**

TTMS, 13 November 1974

**CENTER OPR**

Sheppard/TTOXU

**SUPERSEDES COURSE CHART**

3ABR55235, 5 April 1973

**DEPARTMENT OPR**

Department of Civil Engineering Training

**LOCATION OF TRAINING**

Sheppard AFB, Texas

**SUPERSEDES COURSE CHART**

552X5, 15 Feb 73; Ch1, 25 Feb 74

**INSTRUCTIONAL DESIGN**

Group/Lock Step: Proficiency Advancement

**TARGET READING GRADE LEVEL FOR PREPARATION OF TRAINING LITERATURE**

9

**LENGTH OF TRAINING**

(9 Weeks, 0 Days)

<table>
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<tr>
<th>Technical Training</th>
<th>Classroom/Laboratory (C/L)</th>
<th>Complementary Technical Training (CTT)</th>
<th>Related Training</th>
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<tbody>
<tr>
<td></td>
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<td>Standard Traffic Safety, Course I (AFR 50-24)</td>
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<td>Local Conditions Course, Course II (AFR 50-24)</td>
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<td>Supplemental Military Training (SMT) (ATCR 50-20)</td>
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<td></td>
<td>Commander's Calls/Briefings</td>
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<tr>
<td></td>
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<td></td>
<td>End of Course Appointments; Predeparture Safety Briefing (ATCR 127-1)</td>
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</tbody>
</table>

Total: 360

**REMARKS**

Effective date: 11 August 1975 with class 750811.

### TABLE I - MAJOR ITEMS OF EQUIPMENT

<table>
<thead>
<tr>
<th>Lavatory</th>
<th>Soil Pipe</th>
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<tbody>
<tr>
<td>Urinals</td>
<td>Copper Pipe</td>
</tr>
<tr>
<td>Valve Repair Kits</td>
<td>Galvanized Pipe</td>
</tr>
<tr>
<td>Water Heaters</td>
<td>Black Pipe</td>
</tr>
<tr>
<td>Shower Unit</td>
<td>Vitrified Tile</td>
</tr>
<tr>
<td>Water Closet</td>
<td>Traps</td>
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<tr>
<td>Grooving Tool</td>
<td>Valves</td>
</tr>
<tr>
<td>Tapping Machine</td>
<td>Insulating Materials</td>
</tr>
<tr>
<td>Test Plugs</td>
<td>Pipe Locator</td>
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<tr>
<td>Die Sets</td>
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<tr>
<td>Shop Benches</td>
<td></td>
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<tr>
<td>Power Grinder</td>
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<tr>
<td>Plumber Furnaces</td>
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<tr>
<td>Plumber Fire Pot</td>
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<tr>
<td>Sewer Augers</td>
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<tr>
<td>Centrifugal Pumps</td>
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<tr>
<td>Diaphragm Pump</td>
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ATC FORM DEC 74 449  REPLACES PREVIOUS EDITIONS AND ATC FORM 449B, NOV 72
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
<td>C/L</td>
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<tr>
<td>BLOCK I - Introduction to Plumbing</td>
<td>54 Hours TT</td>
<td>18 Hours RT</td>
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<td>1</td>
<td>Orientation (2 hrs); Career Field and Civil Engineer Organization (2 hrs); Plumbing Safety (2 hrs); Plumbing Systems, Terminology, and Engineering Drawings (12 hrs); Publications (6 hrs); Exterior Sewer Systems (4 hrs); Maintenance of Tools (2 hrs); Installation of Building Sewer Systems (6 hrs); Individual Waste Disposal Systems (12 hrs); Structural Openings (4 hrs); Measurement Test and Test Critique (2 hrs).</td>
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<tr>
<td>BLOCK II - Building Waste Systems</td>
<td>72 Hours TT</td>
<td>8 Hours RT</td>
<td>12 Hours CTT</td>
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<tr>
<td>2(1/5)</td>
<td>Building Drains (12 hrs); Vents and Stacks (12 hrs); Floor Drains and Roof Drains (3 hrs); Waste Rough-In for Lavatories (3 hrs); Installation of Back Vents (6 hrs); Rough-In for Urinal Drains (6 hrs); Rough-In for Showers and Tub Drains (6 hrs); Rough-In for Water Closet Drains (6 hrs); Testing Drainage Systems (4 hrs); Measurement Test and Test Critique (2 hrs).</td>
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<td>3</td>
<td>(Safety as Applicable)</td>
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<tr>
<td>BLOCK III - Exterior and Interior Water Supply Systems</td>
<td>62 Hours TT</td>
<td>2 Hours RT</td>
<td>14 Hours CTT</td>
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<td>4(1/5)</td>
<td>Exterior Water Supply (3 hrs); Steel Pipe Assembly (3 hrs); Installation of Building Service Lines (6 hrs); Building Distribution Systems (12 hrs); Copper Tubing Assembly (12 hrs); Water Supply Rough-In for Fixtures (6 hrs); Installation of Domestic Water Heaters (4 hrs); Measurement Test and Test Critique (2 hrs).</td>
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</table>
### COURSE CHART - TABLE II - TRAINING CONTENT

**NOTE:** Include time spent on technical training (TT) (classroom/laboratory (C/L) and complementory technical training (CTT) and related training (RT)). Exclude time spent on individual assistance (remedial instruction). A single entry of time shown for a unit is C/L time. When a double entry is shown, the second entry is CTT time.

<table>
<thead>
<tr>
<th>WK OF TNG</th>
<th>1</th>
<th>2</th>
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<td><strong>Course Material - UNCLASSIFIED</strong></td>
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<td><strong>BLOCK IV - Fixtures and Appurtenances</strong></td>
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<tr>
<td>** Installation of Bathtubs and Showers (6 hrs); Installation of Water Closets (6 hrs); Installation of Urinals (6 hrs); Installation of Lavatories (6 hrs); Insulation of Water Lines (6 hrs); Inspection and Maintenance of Plumbing Systems (6 hrs); Recovery and Restoration (12 hrs); Planning and Layout of Plumbing Systems (10 hrs); Measurement Test and Test Critique (2 hrs).**</td>
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<td><strong>BLOCK V - Utility Equipment</strong></td>
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<tr>
<td>** Winterization of Piping (2 hrs); Maintenance of Valves (4 hrs); Maintenance of Sewers and Grease Traps (6 hrs); Emergency Maintenance of Exterior Piping (6 hrs); Fire Hydrants and Sprinkler Systems (12 hrs); Utility Equipment (6 hrs); Corrosion Control (3 hrs); Project and Resource Management (3 hrs); Communication Security (2 hrs); Measurement Test and Test Critique (2 hrs); Course Critique and Graduation (2 hrs).**</td>
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<td><strong>48 Hours C/L</strong></td>
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ATC FORM 449A PREVIOUS EDITION OBSOLETE.
PLAN OF INSTRUCTION
(Technical Training)

PLUMBING SPECIALIST

SHEPPARD TECHNICAL TRAINING CENTER
2 July 1975–Effective 11 August 1975 with class 750811

Changed 20 January 1976–Effective 20 January 1976 with class 760120
LIST OF CURRENT PAGES

This POI consists of 80 current pages issued as follows:

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<thead>
<tr>
<th>Page No.</th>
<th>Issue</th>
<th>Page No.</th>
<th>Issue</th>
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<tr>
<td>*Title</td>
<td>20 Jan 76</td>
<td>38 thru 42</td>
<td>Original</td>
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<tr>
<td>*A</td>
<td>20 Jan 76</td>
<td>*43 and 44</td>
<td>20 Jan 76</td>
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<td>45 thru 66</td>
<td>Original</td>
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<tr>
<td>*1 and 2</td>
<td>20 Jan 76</td>
<td>Annex (11 pages)</td>
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<td>3 thru 16</td>
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<td>*17 and 18</td>
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<td>19 thru 33</td>
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<td>*34 thru 37</td>
<td>20 Jan 76</td>
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CHANGE NOTICE INSTRUCTIONS

Effective 20 January 1976, POI 3ABR55235, 2 July 1975, is changed as follows:

1. Remove pages replaced or deleted and insert changed and new pages according to above listing.

2. The (*) in the above page listing indicates that the page is a replacement or addition or has been deleted by this Change Notice.

FOR THE COMMANDER

LEONARD A. HAMILTON, Col, USAF
Chief, Dept of Civil Engineering Tng


Changed 20 January 1976
FOREWORD

1. PURPOSE. This plan of instruction prescribes the qualitative requirements for Course Number 3ABR55235, Plumbing Specialist, in terms of criterion objectives, presented by units of instruction, and shows duration, correlation with the training standard, support materials, and instructional guidance. It was developed under the provisions of ATCR 50-5, Instructional System Development and ATCR 52-7, Plans of Instruction.

2. COURSE DESCRIPTION. This technical training course trains airmen to perform duties prescribed in AFM 39-1 for Apprentice Plumbers, AFSC 55235. Training includes instruction on plumbing system operating principle and configuration; construction, maintenance and repair of main and building water supply, vent and waste systems; installation and maintenance of fixtures, faucets and plumbing system valves; and utilization and maintenance of tools, equipment, and supplies. In addition, related training is provided on driver education, supplemental military training, troop information program, commander's calls/briefings, etc.

3. EQUIPMENT ALLOWANCE AND AUTHORIZATION. Training equipment required to conduct this course is listed in Equipment Authorization Inventory Data Number 3ABR552350000. Training equipment authorizations for this course are based on the following Tables of Allowance:

   TA 008 Civil Engineer Equipment
   TA 484 Civil Engineer Plumbing Shop

NOTE: Group size is shown in parentheses after equipment listed in column 3 of numbered pages of this POI.

4. MULTIPLE INSTRUCTOR REQUIREMENTS. Units of instruction which require more than one instructor per instructional group are identified in the multiple instructor annex to this POI.

5. REFERENCES. This plan of instruction is based on SPECIALTY TRAINING STANDARD 552X5, 15 February 1973, Change 1, 25 February 1974, and Course Chart 3ABR55235, 2 July 1975.

FOR THE COMMANDER

LEONARD A. HAMILTON, Col, USAF
Chief, Dept of Civil Engineering Tng
USAF Sch of Applied Aerosp Sci

Supersedes Plan of Instruction 3ABR55235, 27 February 1974, Changed 28 August 1974
OPR: Department of Civil Engineering Training
DISTRIBUTION: See Page A
MODIFICATIONS

Pages 1 - 2 of this publication has (have) been deleted in adapting this material for inclusion in the "Trial Implementation of a Model System to Provide Military Curriculum Materials for Use in Vocational and Technical Education." Deleted material involves extensive use of military forms, procedures, systems, etc. and was not considered appropriate for use in vocational and technical education.
### PLAN OF INSTRUCTION (Continued)

<table>
<thead>
<tr>
<th>UNIT OF INSTRUCTION AND CRITERION OBJECTIVES</th>
<th>DURATION (HOURS)</th>
<th>SUPPORT MATERIALS AND GUIDANCE</th>
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<tbody>
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</tbody>
</table>

**Audio Visual Aids**
- Slides, BCE Organization Structure
- Slides, Structural Pavement Career Field

**Training Methods**
- Discussion (1.5 hrs)
- Performance (0.5 hr)

**Instructional Environment/Design**
- Classroom (1.5 hrs)
- Laboratory (0.5 hr)
- Group/Lockstep: Proficiency Advancement

**Instructional Guidance**

**Plumbing Safety**

a. Given publications containing plumbing safety instructions, list five safety precautions to be observed by plumbers, each referenced to a publication which verifies their accuracy.

<table>
<thead>
<tr>
<th>Column 1 Reference</th>
<th>_STS Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a</td>
<td>3a(1), 3a(2), 3a(3), 3a(4), 3a(5), 3a(6), 3a(7), 3a(9), 3a(10), 3b, 3c</td>
</tr>
<tr>
<td>3b</td>
<td>3a(8)</td>
</tr>
</tbody>
</table>
b. After viewing training film FLC 16/149, Piping Safety, list six safety precautions to be observed when using ladders and scaffolds. The listed safety precautions must be those illustrated in the training film.

<table>
<thead>
<tr>
<th>UNITS OF INSTRUCTION AND CRITERION OBJECTIVES</th>
<th>DURATION (HOURS)</th>
<th>SUPPORT MATERIALS AND GUIDANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1.5/0)</td>
<td>Instructional Materials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SG 3ABR55235-I-3, Plumbing Safety</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WB 3ABR55235-I-3-P1, Plumbing Safety</td>
<td></td>
</tr>
</tbody>
</table>

Audio Visual Aids
- Training Film: FLC 16/149, Piping Safety

Training Methods
- Discussion (1 hr)
- Performance (1 hr)

Instructional Environment/Design
- Classroom (1 hr)
- Laboratory (1 hr)
- Group/Lockstep: Proficiency Advancement

Instructional Guidance
Discuss the safety precautions that the students should know when working with or in the vicinity of flammable materials. When possible, display the item being discussed. Use personal experiences to emphasize the importance of observing all safety procedures and regulations.

Point out areas in the course where the students must recognize the hazards and exercise appropriate precautions. Explain that additional safety precautions will be discussed when applicable during his performance. Emphasize that many safety precautions practiced in this course are also applicable in the field, barracks, or home. Accomplish the workbooks. The following reference should be used in preparing the lesson: AFR 127-101, Ground Accident Prevention Handbook.
### PLAN OF INSTRUCTION (Continued)

<table>
<thead>
<tr>
<th>UNITS OF INSTRUCTION AND CRITERION OBJECTIVES</th>
<th>DURATION (HOURS)</th>
<th>SUPPORT MATERIALS AND GUIDANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Plumbing Systems, Terminology, and Engineering Drawings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Given the names and definitions of plumbing systems, accurately match each name with its definition.</td>
<td>12 (12/0) Days 2, 3 (4/0)</td>
<td>Column 1 Reference Column 2 Reference</td>
</tr>
<tr>
<td>b. Given a sketch of four different plumbing systems, write the correct name of each in the blank space provided.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Given selected samples of pipe, tubing, joints, and fittings, each identified with a letter, correctly name each item.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Given a list of definitions, select the one that defines a code, a standard and a specification. Each definition must be selected correctly.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Given a list of tools, materials and equipment, select and underline those items that are shop equipment. Selection must be 100% accurate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Given an engineering drawing of a basement and second floor plumbing plan and a list of eight questions concerning the type, location and configuration of the plumbing system, correctly answer each question.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Instructional Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG 3ABR55235-I-4, Plumbing Systems, Terminology, and Engineering Drawings</td>
</tr>
<tr>
<td>WB 3ABR55235-I-4-P1, Plumbing System Terminology</td>
</tr>
<tr>
<td>WB 3ABR55235-I-4-P2, Identification of Plumbing Materials</td>
</tr>
<tr>
<td>WB 3ABR55235-I-4-P3, Codes, Standards, and Specifications</td>
</tr>
<tr>
<td>WB 3ABR55235-I-4-P4, Shop Equipment</td>
</tr>
<tr>
<td>WB 3ABR55235-I-4-P5, Engineering Drawing</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Audio Visual Aids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slides, Plumbing System</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Training Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Board, Plumbing Hardware (12)</td>
</tr>
<tr>
<td>Samples of Plumbing Materials (12)</td>
</tr>
<tr>
<td>Shop Tools, for Fabricating Plumbing Systems (12)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Training Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion (9 hrs)</td>
</tr>
<tr>
<td>Performance (3 hrs)</td>
</tr>
</tbody>
</table>
### Instructional Environment/Design

- **Classroom** (9 hrs)
- **Laboratory** (3 hrs)
- **Group/Lockstep**: Proficiency Advancement

### Instructional Guidance

After discussing the plumbing system terms and expressions, direct the students to complete WB 3ABR55235-1-4-P1, Plumbing Systems Terminology. Discuss the construction features and operating principles of plumbing systems and the materials required to properly construct various plumbing systems. Direct the students to complete WB 3ABR55235-1-4-P2, Identification of Plumbing Materials. Explain the meaning of plumbing codes and standards and why they vary in different sections of the country. Define and discuss specifications and the necessity for adhering to them when constructing plumbing systems. Accomplish WB 3ABR55235-1-4-P3. Explain and show the students plumbing materials, tools, and shop equipment. Complete WB 3ABR55235-1-4-P4. Explain the symbols and other characters that are used on engineering drawings and the interpretation of symbols when constructing and maintaining plumbing systems. Direct the students to complete WB 3ABR55235-1-4-P5 on engineering drawings. Emphasize the need for safety practices when applicable. The following reference should be used in preparing the lesson: National Plumbing Code

<table>
<thead>
<tr>
<th>Column 1 Reference</th>
<th>STS Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a</td>
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<tr>
<td>5b</td>
<td>4b, 4c</td>
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<tr>
<td>5c</td>
<td>4d</td>
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<tr>
<td>6d</td>
<td>4f</td>
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<tr>
<td>5e</td>
<td>4g</td>
</tr>
<tr>
<td>5f</td>
<td>4h</td>
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<tr>
<td>5g</td>
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</tbody>
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**PLANT OF INSTRUCTION NO.** 3ABR55235

**DATE:** 2 July 1975

**PAGE NO.:** 6
Note: Page 14 has been deleted due to military-specific material.
### Exterior Sewer Systems

#### a. Given a sketch of an exterior sewage collection system, name the major components of the system. All items must be named correctly.

- **Instructional Materials**
  - SG 3ABR55235-1-6, Exterior Sewer Systems
  - WB 3ABR55235-1-6-P1, Exterior Sewer Components
  - WB 3ABR55235-1-6-P2, Preparation of a Graded Trench

- **Audio Visual Aids**
  - Slides, Exterior Plumbing System
  - Training Film: FLC 19/0286, Sewer Construction

- **Training Equipment**
  - Septic Tank (12)
### PLAN OF INSTRUCTION (Continued)

<table>
<thead>
<tr>
<th>UNIT OF INSTRUCTION AND CRITERION-OBJECTIVES</th>
<th>DURATION (HOURS)</th>
<th>SUPPORT MATERIALS AND GUIDANCE</th>
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<tbody>
<tr>
<td><strong>Training Methods</strong></td>
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<tr>
<td>Discussion and Demonstration (2 hrs)</td>
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<td>Performance (2 hrs)</td>
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</tr>
<tr>
<td><strong>Instructional Environment/Design</strong></td>
<td></td>
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</tr>
<tr>
<td>Classroom (2 hrs)</td>
<td></td>
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<tr>
<td>Laboratory (2 hrs)</td>
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<tr>
<td>Group/Lockstep: Proficiency Advancement</td>
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<tr>
<td><strong>Instructional Guidance</strong></td>
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</tr>
<tr>
<td>Use slides of a waste collection system to identify building and sewer mains. Describe a lift station and discuss its purpose. Discuss identification and locations of manholes and treatment plants. Show the relationship of building drains, building sewer, and the main sewer system. Emphasize the symbols that are used to identify joints and fittings, and show the importance of the legend. Show the student samples of materials that are used in the construction of a waste system. Discuss such factors as pipe sizing, fall per foot, directional changes, and obstructions which aid or retard proper function of the system. Mention the codes and the effect of the design and construction of waste systems. Discuss the different types of shoring methods and instances where each may be used. Have the students complete the work projects. The following references should be used in preparing the lesson:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFM 85-14, Operation and Maintenance of Sewage and Industrial Waste Plants and Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Plumbing Code</td>
<td></td>
<td></td>
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</table>
## Units of Instruction and Criterion Objectives

<table>
<thead>
<tr>
<th>Support Materials and Guidance</th>
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<tbody>
<tr>
<td>Column 1 Reference, STS Reference, 6e, 3b, 3c, 4e, 6e, 9b, 9c</td>
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</table>

### Duration

<table>
<thead>
<tr>
<th>Day</th>
<th>2 (2/0)</th>
<th>0.5/0</th>
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<tbody>
<tr>
<td>5</td>
<td>(1.5/0)</td>
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</table>

### Support Materials and Guidance

- **Instructional Materials**
  - SG 3ABR55235-I-7, Maintenance of Tools
  - WB 3ABR55235-I-7-P1, Sharpening and Dressing Plumbing Tools
  - TO 32-1-101, Maintenance of Hand Tools

- **Training Equipment**
  - Bench Grinder (12)
  - Hand Tools for Plumbing (1)
  - Face Shield (4)

- **Training Methods**
  - Discussion and Demonstration (1 hr)
  - Performance (1 hr)

- **Instructional Environment/Design**
  - Classroom (1 hr)
  - Laboratory (1 hr)
  - Group/LOCKSTEP; Proficiency Advancement

### Instructional Guidance

Discuss the relationship, purpose and use of hand and shop tools. Demonstrate the inspection and operation of the grinder. Have the student identify and inspect cold chisels. Using TO 32-1-101 as a reference, demonstrate the sharpening of a cold chisel. Have the students sharpen and dress tools from the tool room IAW TO 32-1-101. Enforce proper safety precautions.
### PLAN OF INSTRUCTION (Continued)

<table>
<thead>
<tr>
<th>UNITS OF INSTRUCTION AND CRITERION OBJECTIVES</th>
<th>DURATION (HOURS)</th>
<th>SUPPORT MATERIALS AND GUIDANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Installation of Building Sewer Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Given operating procedures and</td>
<td>6 (8/0)</td>
<td>Column 1 Reference</td>
</tr>
<tr>
<td>working as a team member, pump all</td>
<td>Day 6 (2/0)</td>
<td>STS Reference</td>
</tr>
<tr>
<td>standing water from a trench or</td>
<td></td>
<td>12j</td>
</tr>
<tr>
<td>reservoir.</td>
<td></td>
<td>11e(8)</td>
</tr>
<tr>
<td>b. Cut a section of vitrified pipe with</td>
<td>(2/0)</td>
<td>3a(2), 11f(5), 11f(6), 15a</td>
</tr>
<tr>
<td>a hammer and chisel. Completed work must</td>
<td></td>
<td>Instructional Materials</td>
</tr>
<tr>
<td>be ± 1/8 of given length.</td>
<td></td>
<td>SG 3ABR55235-I-8, Installation</td>
</tr>
<tr>
<td>c. Using oakum and mortar, assemble a</td>
<td>(2/0)</td>
<td>of Building Sewer Systems</td>
</tr>
<tr>
<td>clay tile joint. Mortar must be tapered</td>
<td></td>
<td>WB 3ABR55235-I-8-P1, Pumping a</td>
</tr>
<tr>
<td>approximately 45° from end of bell to</td>
<td></td>
<td>Trench</td>
</tr>
<tr>
<td>pipe.</td>
<td></td>
<td>WB 3ABR55235-I-8-P2, Cutting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vitrified Tile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WB 3ABR55235-I-8-P3, Assembling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clay Tile Pipe</td>
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<tr>
<td></td>
<td></td>
<td>Audio Visual Aids</td>
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<td></td>
<td></td>
<td>Slides, Installing Sewer</td>
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<tr>
<td></td>
<td></td>
<td>System</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Training Equipment</td>
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<tr>
<td></td>
<td></td>
<td>Hand Tools for Plumbing (1)</td>
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<tr>
<td></td>
<td></td>
<td>Shop and Special Tools for</td>
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<tr>
<td></td>
<td></td>
<td>Plumbing (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water Pump, Engine Driven (12)</td>
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**PLAN OF INSTRUCTION NO.** 3ABR55235  **DATE** 2 July 1975  **BLOCK NO.** 1  **PAGE NO.** 11
## PLAN OF INSTRUCTION (Continued)

<table>
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<th>UNITS OF INSTRUCTION AND CRITERION OBJECTIVES</th>
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<th>SUPPORT MATERIALS AND GUIDANCE</th>
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<tr>
<td>Training Methods</td>
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<td></td>
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<tr>
<td>Discussion and Demonstration (2 hrs)</td>
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<td>Performance (4 hrs)</td>
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<tr>
<td>Instructional Environment/Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classroom (2 hrs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory (4 hrs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group/Lockstep: Proficiency Advancement</td>
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<tr>
<td>Instructional Guidance</td>
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</tr>
<tr>
<td>Discuss the use of water pumps in pumping out excavations filled with water. Mention several other methods, such as digging drainage ditches and bucket bailing. Accomplish criterion 8a as a team project.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify vitrified tile pipe and demonstrate the assembling of a joint using mortar. Explain how to make a bell-type joint using bituminous material and a rolling ring. Demonstrate cutting pipe using a hammer and chisel. Discuss the purpose of a thimble and the codes governing its installation and use. Demonstrate the proper lifting techniques, and enforce these techniques during the performance. Demonstrate the method of grading pipe. Show some illustrations of backfill preparation and application. Discuss the importance of having properly prepared and applied backfill in trenches. Have the students complete the work project. The following reference should be used in preparing the lesson: National Plumbing Code</td>
<td></td>
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</tr>
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</table>

**National Plumbing Code**

**Plan of Instruction No.** 3ABR55235

**Date:** 2 July 1975

**Block No.:** 1

**Page No.:** 12
## PLAN OF INSTRUCTION (Continued)

<table>
<thead>
<tr>
<th>Units of Instruction and Criterion Objectives</th>
<th>Duration (Hours)</th>
<th>Support Materials and Guidance</th>
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</thead>
<tbody>
<tr>
<td>9. Individual Waste Disposal Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. View training films FLC 9/209, Principles of Operation and Design of Septic Tanks, and FLC 9/210, Typical Household Systems. Sketch a typical household septic tank system and name the major components. All major components must be included and correctly named.</td>
<td>12 (12/0) Days 7, 8 (2/0)</td>
<td>Column 1 Reference STS Reference 9a 8c(1), 15b 9b 3a(1), 11e(3) 9c 3a(1), 11e(12) 9d 3a(1), 11f(8), 15a</td>
</tr>
<tr>
<td>b. Cut bituminous fiber pipe with a handsaw. Completed work must be square with the end of the pipe and within ± 1/8 inch of given length.</td>
<td></td>
<td>Instructional Material SG 3ABR55235-I-9, Individual Waste Disposal Systems WB 3ABR55235-I-9-P1, Bituminous Fiber Pipe Assembly WB 3ABR55235-I-9-P2, Laying a Drainage Field</td>
</tr>
<tr>
<td>c. Using a tapering tool, cut a taper on a fiber pipe so that a coupling can be installed to fit snugly.</td>
<td></td>
<td>Audio Visual Aids Training Film: FLC 9/209, Principles of Operation and Design of Septic Tanks Training Film: FLC 9/210, Typical Household Systems Slides, Individual Waste Disposal System</td>
</tr>
<tr>
<td>d. Following prescribed procedures and using either bituminous fiber or plastic pipe with swedged connections, assemble a typical leaching field to a grade of 2 to 6 inch fall per 100 feet.</td>
<td></td>
<td>Training Equipment Hand Tools for Plumbing (1)</td>
</tr>
</tbody>
</table>

**Instructional Environment/Design**
- Classroom (6 hrs)
- Laboratory (6 hrs)
- Group/Lockstep: Proficiency Advancement

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### PLAN OF INSTRUCTION NO. 3ABR55235

**Date:** 2 July 1975  **Block No.:** 1  **Page No.:** 13
### PLAN OF INSTRUCTION (Continued)

<table>
<thead>
<tr>
<th>UNITS OF INSTRUCTION AND CRITERION OBJECTIVES</th>
<th>DURATION (HOURS)</th>
<th>SUPPORT MATERIALS AND GUIDANCE</th>
</tr>
</thead>
</table>
| 10. Structural Openings | 4 (4/0) Day 9 (1/0) | Instructional Guidance  
With the aid of films and schematics, describe the various types of individual systems and discuss pros and cons of each. Identify the types of pipe materials used in individual waste systems. Demonstrate how joints are assembled. Discuss such factors as freeze depths, absorbent ability, leaching field design, location and operation. Discuss maintenance of septic tanks. Demonstrate the use of a tapering machine. Have the students make a sketch of a leaching field and determine the quantity and types of pipe required to construct the leaching field. Emphasize the importance of proper backfill preparation. Have the students recover the pipe, clean the piping and tools, and return them to storage. Have the students complete the workbook projects. The following reference should be used in preparing the lesson: National Plumbing Code  
Column 1 Reference: STS Reference  
10a 8c(1), 11d  
10b 3a(1)  
10c 11d  
Instructional Materials  
SG 3ABR55235-I-10, Structural Openings  
WB 3ABR55235-I-10-P1, Preparing Structural Openings  
Manufacturer's Rough-in Specifications  
Audio Visual Aids  
Slides, Structural Openings |
c. Using the procedures provided and working as a member of a team, cut holes in the booth area for the passage of pipe. The completed holes must be within + 1/8 inch of specifications.

<table>
<thead>
<tr>
<th>UNITS OF INSTRUCTION AND CRITERION OBJECTIVES</th>
<th>DURATION (HOURS)</th>
<th>SUPPORT MATERIALS AND GUIDANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2/0)</td>
<td>Training Equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shop Tools for Plumbing (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hand Tools for Plumbing (1)</td>
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<tr>
<td></td>
<td></td>
<td>Training Methods</td>
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<tr>
<td></td>
<td></td>
<td>Discussion and Demonstration: (2 hrs)</td>
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<td></td>
<td></td>
<td>Performance: (2 hrs)</td>
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<tr>
<td></td>
<td></td>
<td>Instructional Environment/Design</td>
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<tr>
<td></td>
<td></td>
<td>Classroom (2 hrs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laboratory (2 hrs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Group/Lockstep: Proficiency Advancement</td>
</tr>
</tbody>
</table>

**Instructional Guidance**

Discuss the human desire to hide what otherwise cannot be made attractive. It then becomes necessary to route piping within the walls of a building. Use a building drawing to demonstrate how a plumber would plan the routing of pipe to avoid passing through structural members. Demonstrate how to use manufacturer's rough-in specifications to determine the height and locations of piping. Draw a plumber's sketch to identify the locations of the holes. Give the student a drawing of the booth area, identify the locations of holes to be cut. Demonstrate measuring and cutting tool techniques. Give the students assistance when required and stress safety when using plumb bob, hammer, wood chisel, saws, brace, and bits. Have the students complete the workbooks. The following references should be used in preparing the lesson:

AFR 127-101, Ground Accident Prevention Handbook
National Plumbing Code
<table>
<thead>
<tr>
<th>UNIT OF INSTRUCTION AND CRITERION OBJECTIVES</th>
<th>DURATION (HOURS)</th>
<th>SUPPORT MATERIALS AND GUIDANCE</th>
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</thead>
<tbody>
<tr>
<td>11. Related Training (as shown on the course chart)</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>12. Measurement Test and Test Critique</td>
<td>2 (2/0)</td>
<td></td>
</tr>
</tbody>
</table>

PLAN OF INSTRUCTION N°: 3ABR55235
DATE: 2 July 1975
BLOCK NO.: 1
PAGE NO.: 16
3a. Given publications containing plumbing safety instructions, list five safety precautions to be observed by plumbers; each referenced to a publication which verifies their accuracy:

(1) Housekeeping
(2) Personal cleanliness
(3) Clothing and equipment
(4) Tools and equipment
(5) Excavations
(6) Toxic gases
(7) Molten lead
(8) Heated compounds
(9) Caustics
(10) Storage and handling of flammable liquids
(11) Storage and handling of compressed gas cylinders
(12) Open flame heating devices
(13) Lifting
(14) Electrical hazards
(15) Fire extinguishing agents
(16) Ground Accident Prevention Handbook AFR 127-101

3b. After viewing training film FLC 16/149, Piping Safety, list six safety precautions to be observed when using ladders and scaffolds. The listed safety precautions must be those illustrated in the training film.

(1) Types of ladders
(2) Ladder safety
(3) Scaffolds
(4) Erection of ladders and scaffolds
PART II

INTRODUCTION (5 Minutes)

REVIEW: NONE

ATTENTION:

OVERVIEW:

MOTIVATION:
PRESENTATION:

Given publications containing plumbing safety instructions, list five safety precautions to be observed by plumbers, each referenced to a publication which verifies their accuracy.

(1) Housekeeping

(a) Keep floors and aisles clean

(b) Clean up spilled liquids immediately

(c) Store materials to prevent tripping

(d) Have adequate lighting

(e) Keep oil rags in storage containers

(f) Dispose of scrap metal (salvage)

(2) Personal cleanliness
(3) Clothing and equipment

(a) Wear safety glasses or face shield

(b) Wear clothing suited for job

1. Leather gloves
2. Asbestos gloves
3. Safety toe shoes
4. Remove jewelry—could get caught in moving machinery
5. Do not wear loose or torn clothing

(4) Tools and equipment

(a) Good quality tools

(b) Keep tools and equipment in good condition

(c) Use proper type wrench
(d) Pull on wrench

(e) Don't hold objects in hand when using screwdriver (put in vise)

(f) Don't have mushroom head on chisels

(g) Always use safety glasses when using chisels

(h) Keep cutting tools sharp

(i) Ground all power tools

(j) When passing tools handles first

(5) Excavations

(a) Danger of cave-in (shore-trench)

(b) If 5 feet or more in depth, trench will be shored

(6) Toxic gases
(a) Asphyxiants—prevent a person’s blood from absorbing oxygen

(b) Irritants—causes inflammation of the respiratory system

(c) Anesthetics—have sleeplike affect

(d) Poisons—act directly on body

(7) Melted lead

(a) Burn

(b) Explosion

(c) Moisture

(d) Protective clothing

(8) Heated compounds

(a) Burns

(b) Asphyxiation
(9) Caustics

(a) Burns

(b) Asphyxiation

(10) Storage and handling of flammable liquids

(a) Store in approved area

(b) Keep away from heat

(c) Keep area well ventilated

(d) Use approved storage containers

(e) No smoking

(11) Storage and handling of compressed gas cylinders

(a) Storage
1 In approved areas

2 Cylinders should be protected from extreme heat and cold

3 Keep area well ventilated

4 Electrical circuits will be nonsparking

5 Secure all cylinders

6 Plainly mark empties

7 Store empties separate from full

8 Store different gases separately

9 Store acetylene upright

(b) Handling

1 Use hand truck when possible

2 Close valve

3 Don't lift by valve

4 Protect valve (use cover)

5 Load acetylene upright
(12) Open flame heating devices

(a) Keep area well ventilated

(b) Keep away from flammable and explosive materials

(c) Inspect bottles

(d) No horseplay

(13) Lifting

(a) Keep back straight

(b) Don't lift objects that are too heavy

1. 50 lbs male workers

2. 25 lbs female workers

(14) Electrical hazards

(a) Shock
(b) Turn off electricity before working on equipment

(c) Shorts can cause fires

(d) Caution when working on wet ground

(e) Ground outlets

15. Fire extinguishing agents

(a) Class A: wood, paper and trash—use water

(b) Class B: Flammable liquids—use foam or CO₂ (carbon dioxide)

(c) Class C: Electrical—use dry chemicals or CO₂

16. Ground accident prevention handbook
AFR 127-101

3b. After viewing training film FLC 16/149, Piping Safety, list six safety precautions to be observed when using ladders and scaffolds. The listed safety precautions must be those illustrated in the training film.
(1) Types of ladders

(a) Fixed ladders (permanently installed)

(b) Extension ladders

(c) Step ladders

(2) Ladder safety

(a) Sufficient length

(b) Secure footing

(c) Check rungs

(d) Base, 1/4 the length away from wall

(e) Ladder made of nonconductive material if used near electrical hazard

(3) Scaffolds
(a) Platforms made of 2 x 10 planks

(b) Railings

(c) Cross bracing

(d) Secure braces and top if over 10' high

APPLICATION:
Have students complete WB 3ABR55235-I-3-P1.

EVALUATION:
Evaluate by oral, written questions, and/or observation of student's performance during lesson. This may be accomplished at any time during lesson for increased effectiveness.

CONCLUSION (5 Minutes)

SUMMARY:
REMOVTATION:

STUDY ASSIGNMENT: Complete SG 3ABR55235-I-4.
4a. Given the names and definitions of plumbing systems, accurately match each name with its definition.

(1) Building water service line
(2) Building plumbing system
(3) Sanitary sewer system
(4) Drainage system
(5) Cross connections
(6) Building gas piping system
(7) Building air system
4b. Given a sketch of four different plumbing systems, write the correct name of each in the blank space provided.

   (1) Base water distribution system
   (2) Service lines
   (3) Building plumbing systems
   (4) Sanitary waste system

4c. Given selected samples of pipe, tubing, joints, and fittings, each identified with a letter, correctly name each item.

   (1) Types of pipes and tubing
   (2) Joints and fittings

4d. Given a list of definitions, select the one that defines a code, a standard and a specification. Each definition must be selected correctly.

   (1) Codes
   (2) Standards
   (3) Specifications

4e. Given a list of tools, materials and equipment, select and underline those items that are shop equipment. Selections must be 100% accurate.

   (1) Shop tools, handtools, and equipment
   (2) Materials

4f. Given an engineering drawing of a basement and second floor plumbing plan and a list of eight questions concerning the type, location and configuration of the plumbing system, correctly answer each question.

   (1) Blueprints
   (2) Working drawing
   (3) Bill of materials
PART II

INTRODUCTION (40 Minutes)

CHECK PREVIOUS DAY'S STUDY ASSIGNMENT:

REVIEW: Give daily quiz.

ATTENTION:

OVERVIEW:

MOTIVATION:
**PRESENTATION:**

4a. Given the names and definitions of plumbing systems, accurately match each name with its definition.

(1) **Building water service line**

(a) **Definition** - the pipe from the water main or other source of water supply to the building served.

(b) **Components**

1. **Starts at corporation stop**

2. **Curb stop**

3. **Meter stop**

4. **Water meter** - indicates volume of water flow.
5 Stop and waste valve

6 Piping

(2) Building plumbing system

(a) Definition - all piping and fixtures used for water supply, gas, air and waste disposal installed in the building

(b) Components

1 Cold water system

2 Hot water system

3 Gas and air system

4 Drainage system
(3) **Sanitary sewer system**

(a) **Definition** - the part of the piping system that receives the discharge from soil, waste and other drainage pipes, but does not carry any storm, surface, or ground water.

(b) **Components**

1. **Public sewer** - a common sewer controlled by public authority.

2. **Private sewer** - a sewer privately owned and not directly controlled by public authority.

3. **Disposal plant** - removes impurities from water.
4) Drainage system

(a) Definition - piping which conveys sewage, rain water, or other liquid waste to a point of disposal. This excludes the public sewer system.

(b) Components

1. Storm drainage system - carries runoff water caused by rain or snow.

2. Industrial drainage system - collects contaminated liquid waste and carries it to an industrial waste plant.

5. Cross connections

(a) Definition - connection between two otherwise separate piping systems, one of which contains potable water and the other of questionable quality.
(b) Components

1 Piping

2 Fittings

(6) Building gas piping system

(a) Definition - piping that conveys gas from gas service line to building fixtures and appliances

(b) Components

1 Black iron piping

2 Valves and fittings
(7) Building air system

(a) Definition - piping that conveys compressed air from source to air operated equipment and devices

(b) Components

1. Black iron piping

2. Valves and fittings

4b. Given a sketch of four different plumbing systems, write the correct name of each in the blank space provided.

(1) Base water distribution systems
1. Source

2. Pumps

3. Treatment plant

4. Storage tanks

5. Control valves

6. Fire hydrants

7. Water mains

(b) Symbols

(2) Service lines

(a) Components
1. Gas service

2. Air service

3. Water service

(b) Symbols

(3) Building plumbing systems

(a) Components

1. Cold water distribution system
   a. Mains
   b. Branches
   c. Risers

2. Hot water distribution systems
4.00111111.1111;

a Heaters

b Main

c Risers

d Branches

3. Air and gas distribution systems

a Mains

b Branches

c Risers

(b) Symbols

(4) Sanitary waste system
(a) Components

1. Interior

   a. House (building) drain-lowest part of drainage system which receives discharge from soil and waste piping and conveys it to the house sewer

   b. Soil Pipe - carries discharge from water closets and urinals and similar fixtures to building drain

   c. Soil branch - horizontal part of soil piping which carries waste from water closets, urinals and similar fixtures to the vertical part of soil piping
d Waste pipe -
  conveys waste
  from all other
  fixtures to
  building drain

2 Exterior

a Building (house)
  sewer - horizontal
  part of drainage
  system which
  conveys the
  discharge of the
  building drain to
  a public sewer
  or other point
  of disposal
  (begins five feet
  outside of building
  wall)

b Main sewer line
  (public sewer)

c Lift station

(b) Symbols
APPLICATION:
Have students complete WB I-4-P1.

CONCLUSION (Day 2)

SUMMARY:

STUDY ASSIGNMENT:
Read SG 3ABR55235-I-4.

INTRODUCTION (Day 3)

CHECK PREVIOUS DAY'S STUDY ASSIGNMENT:

REVIEW: Give daily quiz.

ATTENTION:

OVERVIEW:

MOTIVATION:
PRESENTATION:

4c. Given selected samples of pipe, tubing, joints, and fittings, each identified with a letter, correctly name each item.

(1) Types of pipes and tubing

(a) Composition

1. Cast iron
2. Steel
3. Copper
4. Brass
5. Fiber
6. Cement asbestos
7. Plastics
8 Glass

9 Rubber

(b) Methods of identity

1 Weight

2 Color

3 Density

(2) Joints and fittings

(a) Composition

1 Material

a Steel

b Copper
c. Brass
d. Fiber
e. Cement asbestos
f. Plastic
g. Glass
h. Rubber

2 Types
a. Screwed
b. Flanged
c. Soldered
d. Welded
e. Caulked
3 Purpose

a Change direction

b Reduce in-size

c Join pipe

d Drainage (recessed)

(b) Methods of identity

1 Size

2 Shape

a Y (Wye)

b T (Tee)
4d. Given a list of definitions, select the one that defines a code, a standard and a specification. Each definition must be selected correctly.

(1) Codes

(a) Definition - rules and regulations that govern the use of materials and design of the plumbing system

(b) Types

1. Local codes
2. State codes
3. National codes
4. AFM 85-20
Standards - rules or basis of comparison in measuring or judging capacity, quantity, quality of material and safe efficient plumbing techniques. Standards are directives on how fixtures are installed.

Specifications - made by an architect to specify the size, type, quality, quantity, and strength of materials to be used. They state exact measurements for an installation.

4e. Given a list of tools, materials and equipment, select and underline those items that are shop equipment. Selection must be 100% accurate.

(1) Shop tools, hand tools, and equipment

(a) Pipe vise

(b) Pipe cutter

(c) Pipe reamer
(d) Pipe dies
(e) Tube cutters
(f) Tube benders
(g) Flaring tools
(h) Joint runners
(i) Melting furnace
(j) Power threaders
(k) Bench grinders
(l) Chain tongs
(m) Wrenches
(n) Pliers
(o) Hacksaws

(p) Hammers

(q) Cold chisels

(r) Rulers

(s) Level

(t) Plumb bob

(u) Files

(v) Screwdrivers

(w) Brace

(x) Bits

(y) Saws
41. Given an engineering drawing of a basement and second floor plumbing plan and a list of eight questions concerning the type, location and configuration of the plumbing system, correctly answer each question.
(1) Blueprints

(a) Definition - engineering drawings that show the type, location and configuration

(b) Plot plan - building and streets identified by symbols

(c) Roof

(d) Floor

(e) Elevation

(f) Foundation

(g) Maps

1 Water

2 Gas
3 Drainage

4 Air

(2) Working drawing

(a) Top

(b) Side

(c) Isometric

(3) Bill of materials

(a) Can be obtained from

1. Engineering drawings

2. Working drawing

3. Specification sheets
(b) Purpose

1. List materials needed
2. For project
3. Save time
4. Save money

APPLICATION:
Have student complete WB 3ABR5235-I-4-P2 thru P5.

EVALUATION:
Evaluate by oral, written questions, and/or observation of student's performance during lesson. This may be accomplished at any time during lesson for increased effectiveness.

CONCLUSION (10 Minutes)

SUMMARY:
REMOTIVATION:

STUDY ASSIGNMENT:

Complete next study guide and answer questions. 3ABR55235-I-5.
6a. Given a sketch of an exterior sewage collection system, name the major components of the system. All items must be named correctly.

(1) Building sewer
(2) Mains
(3) Manholes
(4) Lift station
(5) Treatment plant
6b. Grade and backfill a trench to a fall of 1/4 inch per foot from an existing building drain to the inlet of an installed septic tank. (The backfill procedures may be simulated.)

<table>
<thead>
<tr>
<th>Purpose to assure proper fall per foot of a sewer line.</th>
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</thead>
<tbody>
<tr>
<td>Methods of grading</td>
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<tr>
<td>Shoring methods</td>
</tr>
<tr>
<td>Backfilling procedures</td>
</tr>
</tbody>
</table>
PART II

INTRODUCTION (45 Minutes)

CHECK PREVIOUS DAYS STUDY ASSIGNMENT:

DAILY QUIZ

REVIEW:

ATTENTION:

OVERVIEW:

MOTIVATION:
PRESENTATION:

6a. Given a sketch of an exterior sewage collection system, name the major components of the system. All items must be named correctly.

1. Building sewer

   (a) Function—conveys waste from the building to the main sewer or a point of disposal

2. Construction

   1. Materials

      a. Cement asbestos
      b. Vetrified clay
      c. Cast iron
      d. Plastic
      e. Fittings
Design

(a) 3 inch diameter or less, fall not less than 1/4 inch per foot

(b) Larger than 3 inch, fall is 1/8 inch/foot

(2) Mains

(a) Function—conveys sewers from submains, laterals, outfall to disposal plant

(b) Construction

1. Lateral sewer

   a. Building sewer to submain

   b. Found in alley or street

2. Submain

   a. Receives sewer from 2 or more laterals
b. Conveys sewer from laterals to sewer main

3. Sewer main
   a. Receives sewer from submain, laterals and building sewer
   b. Conveys sewer to outfalls sewer

4. Outfall sewer
   a. Receives all sewer
   b. Conveys all sewer to disposal plant

(3) Manholes
   (a) Function
      1. Allow access to sewer for cleaning
      2. Change direction sewage flow
(b) Construction

1. Brick and concrete body.

2. Cast iron lid

3. Located at end of laterals

4. Not to exceed 300 feet apart

(4) Lift station

(a) Function—pump sewage to a higher elevation

(b) Construction

1. Concrete enclosure

2. Submersible pump/controls

3. Located where gravity will not allow sewage to flow to treatment plant
(5) Treatment plant

(a) Function

1. Removes disease producing organism from liquid.

2. Removes solids from liquid.

3. Removes unpleasant odor.

(b) Construction

1. Grit chamber—removes inorganic materials (sand, gravel).

2. Bar screen—removes floating materials.

3. Settling tank—allows heavy object to settle out of liquid.

6b. Grade and backfill a trench to a fall of 1/4 inch per foot from an existing building drain to the inlet of an installed septic tank. (The backfill procedures may be simulated.)
(1) Purpose to

(a) Loose dirt causes settling

(b) Settling causes bad joints and sagging pipe

(2) Methods of grading

(a) Engineer's transit

(b) Butter board

(c) Level

(d) String level from Bldg drain to highest septic tank opening.

(3) Shoring methods

(a) Purpose—to prevent cave in

1 Dept of trench

2 Type of soil
(b) Materials

1. 1 x 6 boards

2. Plywood

3. Shoring jacks

   a. Spacing determined by soil

   b. Spacing determined by depth of trench

   NOTE: Demonstrate grading a trench.

(4) Backfilling procedures

(a) Fill and tamp bottom

(b) Fill 3 to 4 inches of soil on sides of pipe

(c) Cover pipe with 6 inches of fill
(d) Continue with 9-12 inches layers of backfill

(e) Overfill

APPLICATION:

Have students complete SW 3ABR55235-I-6-P1 and P2, Evaluate.

EVALUATION:

Evaluate by oral, written questions, and/or observation of student's performance during lesson. This may be accomplished at any time during lesson for increased effectiveness.

CONCLUSION (10 Minutes)

SUMMARY:
REMOTIVATION:

STUDY ASSIGNMENT: Read SG 3ABR55235-I-7 and answer questions at the end of SG
### LESSON PLAN (Part I, General)

**Course Number:** 3ABR55235  
**Course Title:** Plumbing Specialist  
**Block Number:** 1  
**Block Title:** Introduction to Plumbing

**Lesson Title:** Maintenance of Tools (Day 5)

<table>
<thead>
<tr>
<th>Classroom/Laboratory</th>
<th>Complementary</th>
<th>Total</th>
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<tr>
<td>2 Hrs</td>
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**Page Number:** 10  
**Page Date:** 2 July 1975  
**Paragraph:** 7

**STG/CTS Reference:** 552X5  
**Date:** 15 February 1973, Chg 1, 25 Feb 1974

**Preclass Preparation**

<table>
<thead>
<tr>
<th>Equipment Located in Laboratory</th>
<th>Equipment from Supply</th>
<th>Classified Material</th>
<th>Graphic Aids and Unclassified Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bench grinder</td>
<td>Face Shield</td>
<td>None</td>
<td>SG I-7</td>
</tr>
<tr>
<td>Plumber's hand tools</td>
<td></td>
<td></td>
<td>WB I-7-P1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TO 32-1-101</td>
</tr>
</tbody>
</table>

**Criterion Objectives and Teaching Steps**

7a. Inspect and maintain plumber's hand tools in accordance with TO 32-1-101.

1. Categories of tools  
2. Inspection and maintenance

7b. Using a grinder, dress and sharpen a cold chisel as required in accordance with TO 32-1-101.

1. Types of grinders  
2. Use of a bench grinder  
3. Safety precautions
PART II

INTRODUCTION (5 Minutes)

CHECK PREVIOUS DAY'S STUDY ASSIGNMENT

REVIEW: NONE

ATTENTION:

Have you ever tried to do a job and you didn't have the right tools available?

OVERVIEW:

Today we will discuss: (1) Inspection and maintenance of tools
                    (2) Use of Bench grinder

MOTIVATION:

TO DO a job you must have the right tool and it must be in good shape.
PRESENTATION:

7a. Inspect and maintain Plumber’s Hand tools in accordance with TO 32-1-101.

(1) Categories of tools

(a) Hand

(b) Shop

(c) Special

(2) Inspection and maintenance (inspect tools before and during use)

(a) Hand tools

Pipe wrenches

a) Sharpen teeth with file

b) Replace worn parts
1. Clean and oil

2. Pliers
   a. Keep teeth clean and sharp
   b. Keep pivot pin tight
   c. Clean and oil

3. Swing brace
   a. Lubricate brace bearing
   b. Do not disassemble chuck
   c. Do not drop the brace for the wood parts will break

4. Bits
   a. Sharpen nibs and lips
   b. If spur is damaged, turn bit in
5 Hammers

a. Clean and oil heads

b. Check and replace broken handles

c. Grind face

6 Center punch

a. Grind to cone shape

b. Check to assure 90° angle

c. Grind mushroom heads

7 Cold chisel

a. Grind to proper angle

   aa. 90° hard metal

   bb. 70° soft metal
b. Grind mushroom heads

c. To temper for hardness

aa. Heat to cherry red

bb. Dip cutting about 1-1/4" in cold water

cc. Dip head about 1" in cold water

dd. Polish harden ends with file or abrasive cloth

ee. When red disappears, dip entire chisel

Screwdriver

a. Grind sides parallel

b. Square tip

c. Temper similar to chisels
9 Rulers
   a. Lubricate joints
   b. Keep clean
   c. Use care when folding and unfolding

10 Tapes
   a. Lubricate lightly
   b. Keep clean
   c. Roll up when not in use

11 Level
   a. Avoid careless handling
   b. Store in safe place

12 Plumb Bob
a. Replace string when frayed

b. Wrap string up when not in use

c. Keep metal oiled

13 Goggles

a. Keep clean and protected

b. Replace if broken

14 Gloves

a. Clean with saddle soap

b. Check for holes

c. Replace if torn

(b) Special Tools

1. Tapering tool
2 Watermain taping machine.

3 Sewer snake.

4 Pipe threaders (Before operating make sure pipe is secure.)

(c) Shop tools

1 Chain Vise

2 Chain tongs

3 Melting furnace

4 Bench grinder

Using a grinder, dress and sharpen a cold chisel as required in accordance with TO.32-1-101.

1. Types of grinders

(a) Hand grinder

(b) Bench grinder
(c) Stand grinder

(2) Use of bench grinder

(a) Perform peroperation inspection

1. Check power cord

2. Check switch

3. Check grinding wheel

(b) Adjust tool rest

(c) Remove all jewelry

(d) Turn on grinder allowing it to reach peak RPM

(e) Grind tool in accordance with TO 32-1-101

(3) Safety precautions
(a) Never wear jewelry while operating grinder

(b) Never wear glove while using grinder

(c) Always give grinder a pre-operation inspection

(d) Always wear safety shield when using grinder

(e) Always wear long sleeved garment when using grinder

NOTE: Demonstrate grinder to students.

APPLICATION:

Have the students operate the grinder and sharpen a cold chisel using WB I-7-P1. (This will be accomplished as required during Day 6)

EVALUATION:

Evaluate by oral, written questions, and/or observation of student's performance during lesson. This may be accomplished at any time during lesson for increased effectiveness.
SUMMARY:

Today we have discussed tools, and how they should be maintained. Why tools should be checked before and during use, and how sharpen tools using a bench grinder.

REMOIVATION:

Care and use of all tools is very important to all tradesmen. Without this knowledge a person is a hazard on any construction or maintenance job.

STUDY ASSIGNMENT:

Read study guide on installation of building sewers and answer the questions at the end of the study guide. 3ABR55235-1-8
LESSON PLAN (Part 1, General)

INSTRUCTOR: Master Copy

COINHSE TITLE: Plumbing Specialized

LESSON TITLE: Installation of Building Sewer Systems (Day 6)

LESSON DURATION
CLASSROOM/LABORATORY  6 Hrs

EQUIPMENT FROM SUPPLY

PRECLASS PREPARATION

CRITERION OBJECTIVES AND TEACHING STEPS

8a. Given operating procedures and working as a team member, pump all standing water from a trench or reservoir.

(1) Manually draining a trench
(2) Mechanical pumps

8b. Cut a section of vitrified pipe with a hammer and chisel. Completed work must be ± 1/8" of a given length.

(1) Tools for cutting
(2) Cutting procedures
8c. Using oakum and mortar, assemble a clay tile joint. Mortar must be tapered approximately 45° from end of bell to pipe.

(1) Methods used for assembly
(2) Tools and materials
(3) Procedures
(4) Thimbles
PART II

INTRODUCTION (45 Minutes)

CHECK PREVIOUS DAYS STUDY ASSIGNMENT:

REVIEW:

ATTENTION:

OVERVIEW:

MOTIVATION:
Given operating procedures and working as a team member, pump all standing water from a trench or reservoir.

(1) Manually draining a trench

(a) Digging a drainage trench or ditch

(b) Bailing trench out using buckets

(2) Mechanical pumps

(a) Diaphragm pump

(b) Centrifugal pump

NOTE: Before using preform a visual check (preoperative check)

Cut a section of vitrified pipe with a hammer and chisel. Completed work must be \(\pm \frac{1}{8}\) of given length.

(1) Tools for cutting
(a) 8 oz ball peen hammer

(b) 1/4 inch cape chisel

(c) 1/2 inch cold chisel

(d) Gloves

(e) Face shield

(2) Cutting procedures

(a) Sound out pipe

(b) Measure and mark (Base of bell to end of spigot).

(c) Lay pipe on mound of dirt, or wood blocks

(d) Score pipe with cape chisel and hammer (rotate pipe so chisels on top)

(e) Cut pipe with cold chisel and hammer
1. Sound out cut pipe

2c. Using oakum and mortar, assemble a clay tile joint. Mortar must be tapered approximately 45° from end of bell to pipe.

1. Methods used for assembly

   a. Lead and oakum (cast iron pipe only)

   b. Cement-and-oakum (2 parts sand, 1 part cement)

   c. Bituminous compound and oakum (restricts root growth)

   d. Precast rubber seals

2. Tool and material

3. Procedures

4. Thimbles

   a. Lay out a thimble
(b) Cutting procedures

APPLICATION:

Have students complete WB 3AUR55235-I-8-P1,
WB 3AUR55235-I-8-P2, Part I, WB 3AUR55235-I-8-P2,
Part II, and WB 3AUR55235-I-8-P3.

EVALUATION:
Evaluate by oral, written questions, and/or
observation of student's performance during
lesson.

CONCLUSION (10 Minutes)

SUMMARY:

REINVENTION:

STUDY ASSIGNMENT: SG 3AUR55235-I-9. Read and
answer questions.
Individual Waste Disposal Systems (Day 7 & 8)

**Lesson Duration**
- Classroom/Laboratory: 12 Hours
- Laboratory Complementary: 0
- Total: 12 Hours

**Preclass Preparation**
- Equipment Located in Laboratory: Tapering Tools, Shop Tools
- Equipment, From Supply: NONE
- Classified Material: SG I-9, WB I-9-P1, P2, FLC 9/209, Principles of Operation and Design of Septic Tanks, FLC 9/210, Typical Household Systems
- Graphic Aids and Unclassified Material: NONE

**Criterion Objectives and Teaching Steps**

9a. View training films FLC 9/209, Principles of Operation and Design of Septic Tanks; and FLC 9/210, Typical Household Systems. Sketch a typical household septic tank system and name the major components. All major components must be included and correctly named.

1. Use
2. Purpose
3. Construction
4. Maintenance
5. Distribution
6. Leaching or drainage field
7. Types of Joints
9b. Cut bituminous fiber pipe with a handsaw. Complete work must be square with the end of the pipe and within ± 1/8 inch of given length.

(1) Types of handsaws suitable
(2) Procedures
(3) Safety precautions

9c. Using a tapering tool, cut a taper on a fiber pipe so that a coupling can be installed to fit snugly.

(1) Purpose of tapering
(2) Tapering procedures

9d. Following prescribed procedures and using either bituminous fiber or plastic pipe with swaged connections, assemble a typical leaching field to a grade of 2 to 6 in fall per 100 feet.
PRESENTATION:

9a. View training films FLC 9/209, Principles of Operation and Design of Septic Tanks, and FLC 9/210, Typical Household Systems. Sketch a typical household septic tank system and name the major components. All major components must be included and correctly named.

(1) Use

(a) When public sewer connection is not feasible

(b) When community or private sewer system and treatment plant not available

(2) Purpose

(a) Hold soluble influent until changed into a liquid form by bacterial action (animal and vegetable solids)

(b) Hold insoluble influent until separation occurs and septic tank is cleaned

(3) Construction

(a) Design
PART II

INTRODUCTION (45 Minutes)

CHECK PREVIOUS DAYS STUDY ASSIGNMENT:

REVIEW:

ATTENTION:

OVERVIEW:

MOTIVATION:
1. Best when bacteria scum is undisturbed

2. Single-compartment tanks

3. Multi-compartment tanks

4. Minimum size 500 gallons

(b) Components

1. Manholes

2. Baffles

3. Pipe inlet and outlet

4. Invert

5. Dosing chambers

(c) Capacity

(d) Connection with garbage disposal
    50% larger
(e) Hermetical seal

(f) Material selection

1. Must resist corrosion

2. Resist earth loads

(g) Common materials

1. Concrete

2. Brick-mortar joints

3. Metal-corrosion treated

4. Plastic

5. Fiberglass

6. Cinder block-mortar joints

(h) Installation techniques 1 2 3
1. Inplace construction

2. Pre-fab installations

(i) General dimensions and requirements

(4) Maintenance

(a) Cleaning

1. Pumping

2. Flushing

(b) Repair

(5) Distribution

(a) Box

1. Purpose—to distribute liquid to all distribution lines evenly

2. Construction and installation
(b) Heater

1. Purpose—same as for distribution box

2. Construction and installation

6. Leaching or drainage field

(a) Factors to consider

1. Lay of the land

2. Water supply—location of lakes

3. Types of soil

(b) Distribution lines

1. Construction

4. Depth—18" thru 24"
b Grade - 2" thru 6"/100 ft
(Best is transit)

c Width - 18" thru 24"

d Space between lines - min 6'

e Gravel bed - min of 6"

2 Materials

- a Perforated pipe (facing down)

- b Open joint clay tile

- c Untreated building paper

(7) Types of joints

(a) Split coupling

(b) Solid coupling (Swedged connections)

(c) Open joint
Cut bituminous fiber pipe with a handsaw. Completed work must be square with the end of the pipe and within ± 1/8 inch of given length.

(1) Types of handsaws suitable

(a) Crosscut

(b) Rip (Use strap vise to hold)

(2) Procedures

(a) Measure and mark pipe

(b) Place pipe in vice

(c) Oil saw

(d) Use drip pan

(e) Use long even strokes applying oil as required

(3) Safety precautions
(a) Wear gloves to protect hands

(b) Avoid oil spills to prevent falls

9c. Using a tapering tool, cut a taper on a fiber pipe so that a coupling can be installed to fit snugly.

(1) Purpose of tapering—enable ends of pipe to be joined by swedges connection

(2) Tapering procedures

(a) Wipe inside and outside of pipe to remove cuttings and foreign material

(b) Always read instructions when using tapering tool

(c) Insert tapering tool insuring that it is centered and tightened

(d) Turn handle clockwise cutting a 2° taper

(e) Remove tapering tool and inspect taper
(3) Safety precautions

(a) Wear gloves to protect the hands

(b) Be extremely careful with cutting blade which is very sharp

APPLICATION:
Complete Parts I, II, and III of WB 3ABR55235-I-9-P1.

EVALUATION:
Evaluate by oral, written questions, and/or observation of students performance during lesson.
STUDY ASSIGNMENT:

Have students study SG 3ABR55235-I-9 and review their notes.

INTRODUCTION (Day 8)

CHECK PREVIOUS DAYS STUDY ASSIGNMENT

REVIEW:

OVERVIEW:

MOTIVATION:
9d. Following prescribed procedures and using either bituminous fiber or plastic pipe with swedged connections, assemble a typical leaching field to a grade of 2 to 6 inch fall per 100 feet.

(1) Advantages and application of swedged connections

(2) Tools

(a) Hammer
(b) Board

(3) Swedging procedures

(a) Place coupling on tooled end by hand

(b) Place another pipe into other side of coupling

(c) Place coupling no. 2 on other end of pipe no. 2
(d) Place board over end of coupling no. 2 insuring coverage of complete coupling.

(e) Drive entire arrangement using hammer.

(4) Trench Preparation

(a) Place stake at each end of the trench 2 feet beyond each end and near one side.

(b) Stretch string between stakes and level

(c) Determine fall required

(d) Adjust string to fall per foot

(e) Using a stick with required depth marked, grade the trench and fill with 6" of gravel

(5) Procedures for laying and checking the pipe

(a) Assemble pipe--outside trench
(b) Checking with grade stick

(n) Backfill procedures

(a) Gravel-2" minimum over pipe

(b) Top soil-free of rocks and foreign materials

APPLICATION:

Complete Part I, II, and III of B-3ABR55235-I-3-P1

EVALUATION:

Evaluate by oral, written questions, and/or observation of students performance during lesson.

CONCLUSION (10 Minutes)
STUDY ASSIGNMENT:

Read SC 3ABR55235-I-10, answer the questions at the end of the text and review for measurement test over block I.
10a. Using working drawings and manufacturer's rough-in specifications, mark the openings for pipe passage through structural members. Marks must be within ± 1/8 inch of specifications.

1. Types of structures
2. Types of wood buildings
3. Masonary buildings
4. Metal buildings
5. Structural members
Given five different situations which require a hole to be cut in a structural member and five hole-cutting tools, select the tool which is best suited to accomplish the task.

1. Keyhole saw
2. Brace and bits
3. Wood chisels
4. Star drill
5. Masonry bit
6. Tin snips
7. Power drill
8. Cutting torch

Using the procedures provided and working as a member of a team, cut holes in the booth area for the passage of pipe. The completed holes must be within ± 1/8 inch of specifications.

1. Blueprints
2. Working drawings
3. Types of openings
4. Shower drain
5. Water closet drain
INTRODUCTION (5 Minutes)
CHECK PREVIOUS DAY'S STUDY ASSIGNMENT
REVIEW:
ATTENTION:
OVERVIEW:
MOTIVATION:
10a. Using working drawings and manufacturer's rough-in specifications; mark the opening for pipe passage through structural members. Marks must be within ± 1/8 inch of specifications.

(1) Type of structures

(a) Wood

(b) Masonry

(c) Metal

(2) Types of wood buildings

(a) Box

1. Single wall,

2. Piping exposed

3. Usually for temporary use
(b) Frame

1. Double wall

2. Piping concealed

3. Usually for permanent use

3. Masonry buildings

(a) Brick

(b) Stone

(c) Cement blocks

(d) Concrete

4. Metal buildings

(a) All piping exposed

(b) Sheet metal covering fastened to a metal frame
(5) Structural members

(a) Foundation

(b) Sill

(c) Floor joist

(d) Subfloorings

(e) Sole plate

(f) Studs

(g) Top plate

(h) Rafters

(i) Ceiling joist

(j) Rafters

(k) Roof decking
10b. Given five different situations which require a hole to be cut in a structural member and five hole-cutting tools, select the tool which is best suited to accomplish the task.

1

(1) Keyhole saw

(2) Brace and bit (3" and under, can use expansion bit)

(3) Wood chisel

(4) Star drill

(5) Masonary bit

(6) Tin snips

(7) Power drill

(8) Cutting torch

(9) Hand saw

(a) Rip saw

(b) Cross cut
10c. Using the procedures provided and working as a member of a team, cut holes in the booth area for the passage of pipe. The completed holes must be within ± 1/8 inch of specifications.

(1) Blueprints

(a) Show location of all fixtures
   (refer to blueprints before cutting holes)

(b) Gives all of the dimensions for the building

(c) Gives the exact location of windows, wall, and doors

(2) Working drawings

(a) Side view

(b) Top view

(c) Isometric view

(3) Types of opening

(a) Overcut
(b) Undercut

(c) Center cut

(4) Shower drain

(5) Water closet drain

APPLICATION:

Complete WB3ADR55235-I-10-P1.

EVALUATION:

Evaluate by oral, written questions, and/or observation of students performance during lesson.

CONCLUSION (10 Minutes)
STUDY ASSIGNMENT:

Read SC 3ABR55235-11-1 and answer questions.