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IDENTIFIERS	*Quinmester Program

ABSTRACT

The 135 hour course is designed to help the student become proficient in the technical and manipulative skills necessary to enter the various fields of industry and manufacturing. The necessary requirement for entering this course is the desire to use the acquired ability as a trade, in conjunction with another trade, or as background material for further schooling or in technical writing or welding engineering. It is a foundation course for oxy-acetylene welding and cutting and instructs the student in safety, practical applications, theory, and materials and tools used in the welding shop. Also included is instruction in light and heavy gauge metal and groove and fillet welding. A bibliography lists basic, supplementary, and technical references and audiovisual aids. Twenty-five pages of sample posttests conclude the curriculum guide. (MW)

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

Course Outline
WELDING 3 - 9947
(Basic Gas Welding)
Department 48 - Quin 9947.01

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1973

D A D E C O U N T Y P U B L I C S C H O O L S

1 4 5 0 N O R T H E A S T S E C O N D A V E N U E

M I A M I, F L O R I D A 33132

Course Outline

WELDING 3 - 9947
(Basic Gas Welding)

Department 48 - Quin 9947.01

county office of

VOCATIONAL AND ADULT EDUCATION

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Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

May, 1973

Published by the School Board of Dade County

Course Description

9947	48	9947.01	Basic Gas Welding
State Category Number	County Dept. Number	County Course Number	Course Title

A foundation course for oxy-acetylene welding and cutting to instruct the student in safety, practical applications, theory, and materials and tools used in the welding shop. The course includes instruction in light and heavy gage metal and groove and fillet welding. Three quinmester credits.

Indicators of Success: Desire of student to use welding skills as a trade, in relation to a trade requiring welding skills, or for further educational requirements. (Technical writing or welding engineering)

Clock Hours: 135

PREFACE

The following course outline in "Basic Gas Welding" has been prepared for quinmester use as a guide to help the student become proficient in the technical and manipulative skills necessary to enter the various fields of industry and manufacturing.

If the student possesses previous knowledge and training in oxy-acetylene welding and gives a demonstration of his ability, he may with the approval of the welding instructor and the school administrator, be given credit for this quin and enroll in the advanced Gas Welding Course.

The necessary requirement for entering this course is the desire to use the acquired ability as a trade, in conjunction with another trade, or as background material for further schooling as technical writing or welding engineering.

Welding is an art and science requiring both mechanical or manipulative ability and a degree of knowledgeable information of procedures.

This course consists of 45 days of instruction (shop and class), three (3) hours per day for a total of 135 hours and fifteen blocks.

The student is tested in conjunction with the classroom lectures and practical application. Work completion is examined for progress chart advancement.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee, and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

TABLE OF CONTENTS
with Suggested Hourly Breakdown

GOALS

The welding student must be able to demonstrate:

1. A thorough knowledge of the safety necessary in the care and handling of welding torches, regulators and high pressure gas cylinders.

2. The proper procedure for setting up a welding station for operation and the disassembly of same.

3. The proper care, handling and storage of gas cylinders.

4. The correct repairs to be made to maintain welding equipment in operant safe conditions.

5. The ability to use safely and correctly, related tools necessary to the welding trades.

6. The manipulative ability to correctly join in a prescribed manner such metals as meet the instructional criteria of this course of instruction.

7. The theory of welding applicable to the topics contained in this course of instruction.

8. The attitudes and acquired skills necessary to become the qualified mechanic that will be a credit to himself and the employer.

SPECIFIC BLOCK OBJECTIVES

BLOCK I - INTRODUCTION

The student must be able to:

1. Explain the purposes for training in the welding field and its advantages.
2. Write a brief background history of gas welding and its progress to present day advancements.
3. Explain and be conscious of all safety that is applicable to the gas welding industry.
4. Define and be thoroughly familiar with all shop rules and regulations.
5. Discuss all school procedures, drills, safety and other pertinent regulations.
6. Explain the objectives and goals of course.
7. Detail the scope and application of the oxy-acetylene flame.

BLOCK II - OXYGEN AND ACETYLENE

The student must be able to explain:

1. How oxygen and acetylene are manufactured, how they are shipped, and construction of the cylinders they are contained in.
2. What hydrostatic testing is.
3. National, state and local rules concerning storage and shipment of oxygen and acetylene.
4. The difference between the oxygen and acetylene valves and pressure regulators.
5. The difference between various types of acetylene generators and their operation.
6. General precautions and safety rules for operation of welding equipment, its storage and handling.

BLOCK III - THE OXY-ACETYLENE FLAME

The student must be able to list:

1. The three types of welding flames used in welding.
2. What is meant by primary and secondary combustion.
3. The fuel triangle and the inherent dangers of high fuel gases combined with oxygen.

BLOCK IV - EQUIPMENT FOR THE OXY-ACETYLENE PROCESS

The student must be able to explain:

1. The construction and operation of welding blowpipes.
2. The construction and operation of gas regulators.
3. The difference between acetylene and oxygen regulators.
4. The construction and function of hydraulic back pressure valves.

5. General precaution for maintenance of:
   a. Welding blowpipes
   b. Gas regulators
   c. Welding hose
   d. Clamps and ferrules
   e. Goggles
   f. Gloves
   g. Lighters

BLOCK V - SET UP AND OPERATION OF OXY-ACETYLENE WELDING EQUIPMENT

The student must be able to demonstrate:

1. The correct procedure to assemble an oxy-acetylene rig for welding.
2. The correct procedure for lighting up the torch and its adjustment.
3. How to leak check before lighting torch.
4. The correct closing down procedures for the oxy-acetylene rig.
5. And relate the general precautions to be observed when using the oxy-acetylene rig.
6. Preventive maintenance procedures and define backfire and backflash and their effects.

BLOCK VI - GENERAL PRECAUTIONS IN WELDING AND CUTTING

The student must be able to:

1. Write a list of general precautions used in welding and cutting.
2. Discuss general operating instructions for oxy-acetylene welding.

BLOCK VII - METAL PROPERTIES IMPORTANT TO WELDING

The student must be able to:

1. Define the difference between repair and production welding.
2. List and define the properties of metals.
3. Discuss the relationship of the properties of metals.
4. List the ways to identify metals in shop.

BLOCK VIII - PREPARATION FOR WELDING

The student must be able to explain:

1. The various types of joints used in welding and the edge preparation of joints for welding.
2. The need for preheating and where it is applicable.
3. The various welding, and brazing rods and their application.

BLOCK IX - EXPANSION AND CONTRACTION AFFECTING METALS

The student must be able to explain:

1. The general theory of expansion and contraction and describe the effects in light and heavy plate.
2. What jigging is and how it is employed to control expansion and contraction in welding.

BLOCK X - SOLDERING-SILVER BRAZING-BRAZING-BRONZE SURFACING

The student must be able to explain:

1. The theory of the tinning and wetting action and the necessity for clean metal when brazing or soldering.
2. Proper uses of fluxes and their purposes.
3. Which process of brazing and soldering to select for a specific process.

BLOCK XI - TYPES OF WELDED JOINTS AND THEIR USES

The student must be able to:

1. Give a detailed account of various types of joints used in industry and how they are aligned for welding.
2. Explain what type of joints may be used for pipe welding, heavy construction, and welding repairs.

BLOCK XII - FLAME CUTTING-MANUAL

The student must be able to:

1. Define the principles of oxygen cuttings.
2. Explain the cutting ability of metals.
3. Discuss the expansion and contraction involved with cutting.
4. Demonstrate the procedures necessary for cutting light and heavy plate.

BLOCK XIII - MANIPULATIVE TRAINING (SHOP)

The student must be able to:

1. Demonstrate his knowledge of the shop layout, location of all switches and pertinent equipment.
2. Explain all necessary safety rules for shop and power equipment.
3. Demonstrate the ability to complete designated instruction under the supervision of the welding instructor.

BLOCK XIV - WELDING EXERCISES (MANIPULATIVE PROCEDURES)

The student must be able to:

1. Practice all safety procedures.
2. Begin manipulative training and continue to advance through the course of instruction under the direction of welding instructor.

BLOCK XV - QUINMESTER POST-TEST

The student must be able to:

1. Satisfactorily complete Manipulative Exercises and the quinmester post-test.

Course Outline

WELDING 3 - 9947
(Basic Gas Welding)

Department 48 - Quin 9947.01

I. INTRODUCTION

A. Orientation
1. Present to the student the history of welding and its advancement to modern day uses, the advantages of the welding trades and the training necessary
2. Orientate the student in a strong safety program, exposing the danger of carelessness in welding, how dangerous hazards may be avoided by use of proper equipment
3. Express responsibility of student for tools, equipment and supplies, and a thorough knowledge in their use
4. Explain fully all shop rules and regulations designed to protect the student and promote safety
5. Orient the student to all school safety rules, drills, schedules and other pertinent data that the student should be cognizant of

B. Objectives of Course
1. Discuss objectives of course
   a. Welder qualifications
   b. Employability
2. Instructional aids
   a. Textbooks
   b. Other aids

C. Scope and Application of the Oxy-Acetylene Flame

II. OXYGEN AND ACETYLENE

A. Oxygen
1. Explain how oxygen is produced.
2. Explain the boiling point of oxygen

B. Oxygen Cylinders
1. Present details of oxygen cylinder construction, showing cutaway cylinder
2. Describe hydrostatic testing of oxygen cylinder
3. State rules and regulations of Interstate Commerce Commission (ICC)
4. Describe the meaning of U.S.P. on oxygen cylinders
5. Describe charging and pressure loads of oxygen cylinders and sizes of cylinders

C. Oxygen Cylinder Valves
   1. Present cutaway of oxygen cylinder valve and describe all parts
   2. Describe protecting caps on cylinders of oxygen

D. Storage, Handling and Use of Oxygen Cylinders (General Precautions)
   1. Describe how oxygen cylinders are stored in confined areas and open areas
   2. Detail regulations of National Board of Fire Underwriters, local, state and municipal regulations for oxygen cylinder storage

E. Care of Oxygen Cylinders
   1. State rules for the care of oxygen cylinders and cylinder valves
   2. Describe dangers of falling cylinders

F. Manifold and Pipe Line Distribution of Oxygen
   1. Describe how oxygen manifolds are assembled
   2. Describe why distribution piping is used and its advantages

G. Bulk Distribution of Oxygen
   1. State advantages of bulk distribution of oxygen
   2. Describe an Ls-156 oxygen cylinder
   3. Describe an LC-3 oxygen cylinder
   4. Describe a vaporizing manifold

H. Calcium Carbide and Acetylene
   1. Explain how calcium carbide is manufactured
   2. Explain and show how acetylene gas is manufactured from calcium carbide

I. Generated Acetylene
   1. Describe Water-to-Carbide Generators
   2. Describe Carbide-to-Water Generators
   3. Explain the difference between low-pressure and medium-pressure generators
   4. Discuss the advantages of both stationary and portable acetylene generators

J. Distribution of Acetylene Gas
   1. Discuss distribution from generators
   2. Explain installation of back-pressure valves

K. Dissolved Acetylene
   1. Describe cut-away of acetylene cylinders
   2. Explain how acetone absorbs acetylene gas
   3. Show location of safety fuse plugs

L. Acetylene Cylinder Valve
   1. Present cutaway of acetylene cylinder valve and detail all parts
   2. Discuss difference between oxygen cylinder valve and acetylene cylinder valve

M. Care of Acetylene Cylinders and Acetylene Generators
   1. Discuss the care, handling and storage of acetylene cylinders
   2. Discuss the care, handling and storage of acetylene generators
   3. State rules and regulations of Interstate Commerce Commission (ICC)
   4. Discuss regulations of National Board of Fire Underwriters, local, state and municipal regulations for acetylene cylinders

N. Generator Precautions
   1. Discuss precautions for handling and safe practices when operating acetylene generators
   2. Discuss compliance with National Board of Fire Underwriters, local and state regulations for acetylene generators

O. Storage and Handling of Calcium Carbide
   1. Discuss the safety measures necessary for handling and storage of calcium carbide
   2. Discuss compliance with the National Board of Fire Underwriters, local and state regulations for storage and handling

P. Uses of Carbide Residue
   1. Tell some of the uses of carbide residue

III. THE OXY-ACETYLENE FLAME

A. Welding Flames
   1. Describe
      a. The neutral flame
      b. The excess acetylene flame
      c. The excess oxygen flame
   2. Describe results of each flame on steel

B. Chemistry
   1. Explain the chemistry of the Oxy-acetylene flame
   2. Compare oxy-acetylene flame with other fuel flames

C. Primary and Secondary Combustion
   1. Explain primary and secondary combustion in the oxy-acetylene flame
   2. Explain how envelope protects hot metal
   3. Compare explosive force of the oxy-acetylene flame with other fuel gases

D. Fuel Triangle
   1. Discuss the fuel triangle
   2. Explain the relationship of fuel triangle to metals

IV. EQUIPMENT FOR THE OXY-ACETYLENE PROCESS

A. Construction and Operation of Welding Blowpipes
   1. Present and describe construction and operation of:
      a. Injector type blowpipe
      b. Medium pressure blowpipe
      c. Interchangeable heads or tips
      d. Cutting blowpipes
   2. Discuss assembly of various components of blowpipes

B. Construction and Operation of Welding Gas Regulators
   1. Present cutaways of and describe operation and construction of:
      a. Two stage regulators
      b. Single stage regulators
   2. Describe the difference between:
      a. Oxygen regulators
      b. Acetylene regulators

C. Hydraulic Back-Pressure Valves
   1. Explain construction of hydraulic back-pressure valves
   2. Describe uses and safety advantages of hydraulic back-pressure valves and where used

D. General Maintenance Precautions
   1. Discuss general maintenance of:
      a. Welding blowpipes
      b. Gas regulators
      c. Welding hose and connections
      d. Clamps and ferrules
      e. Goggles
      f. Gloves
      g. Lighters
   2. Discuss preventive maintenance versus repair costs

V. SET UP AND OPERATION OF OXY-ACETYLENE WELDING EQUIPMENT

A. Oxy-Acetylene Rig
   1. Explain in detail the following steps in setting up a welding rig:
      a. Attaching oxygen regulator to oxygen cylinder
      b. Attaching acetylene regulator to acetylene cylinder
      c. Connecting hose to regulators and to blowpipe
      d. Adjusting oxygen and acetylene working pressures
      e. Lighting blowpipe and adjusting flame
   2. Explain how to leak check and how to find leaks
   3. Explain how to shut down welding rig when stopping work
   4. Detail special precautions to be used with the oxy-acetylene rig

B. Preventive Maintenance
   1. Present damaged and burned out regulators and damaged welding blowpipes and tips
   2. Describe backfire and back flash and how they damage equipment
   3. Explain how to prevent damaged equipment by following proper usage and preventative maintenance programs

VI. GENERAL PRECAUTIONS IN WELDING AND CUTTING WORK

A. General Operating Instructions
   1. Describe general operating instructions for oxy-acetylene welding
   2. Show practical application of instructions

B. Precautions in Welding and Cutting
   1. Explain precautions to be employed when using welding and cutting equipment
   2. Discuss adequate ventilation
   3. Explain safety when welding on containers
   4. Discuss preventing fires in welding and cutting work

VII. METAL PROPERTIES IMPORTANT TO WELDING

A. Production and Repair Welding
   1. Explain the difference between production and repair welding
   2. Explain the different job environmental work conditions

B. Properties of Metals
   1. Define the following:
      a. Tensile strength
      b. Elasticity
      c. Yield point
      d. Yield strength
      e. Ductility
      f. Brittleness
      g. Toughness
      h. Hardness
   2. Discuss relationship of mechanical properties and how their closeness affects metals

C. Shop Methods for Measuring Properties
   1. Explain how to measure the properties of metal in shop with shop equipment
   2. Discuss the Brinell Hardness numbers of metals

D. Identification of Metals
   1. Define ways to identify metals in shop as:
      a. Appearance
      b. Weight
      c. File test
      d. Magnetic

e. Flame test
f. Sound
g. Chip test
h. Fracture

2. Discuss briefly chemical and electronic tests for identifying metals

VIII. PREPARATION FOR WELDING

A. Joint Design
1. Define the principals of joint design
2. Discuss the difference between joints of sheet steel and heavy plate
3. Explain edge preparation for welding
4. Discuss alignment of joints

B. Preheating
1. Relate the necessity of preheating certain weldments
2. Explain various methods of preheating

C. Welding Rods
1. Describe various types of welding rods
2. Explain the various types of brazing rods
3. Explain the advantages of each

IX. EXPANSION AND CONTRACTION AFFECTING METALS

A. Expansion and Contraction
1. Explain the general theory of expansion and contraction
2. Describe expansion in sheet metal as compared to heavy metal
3. Define upsetting

B. Jigging
1. Explain jigging for welding
2. Explain expansion and contraction for straightening
3. Explain expansion and contraction in restrained parts
4. Explain shrinkage in metals
5. Explain expansion and contraction stresses
6. Discuss heat conductivity and coefficient of thermal conductivity

X. SOLDERING-SILVER BRAZING-BRAZING-BRONZE SURFACING

A. Soldering and Brazing Processes
1. Explain in detail the necessity for:
a. Clean metal surfaces
b. Good tinning and wetting action
c. Proper uses of correct fluxes and what fluxing action is
d. The purpose of fluxes
2. Demonstrate flux action on sheet copper

B. Selection of Process
   1. Discuss selection of correct process
   2. Explain limitation of each process
   3. Describe how each process is applied to repairs and new construction

XI. TYPES OF WELDED JOINTS AND THEIR USES

A. Welded Joints
   1. Show in detail the following types of welding joints:
      a. Groove joint
      b. Fillet tee joint
      c. Butt joint
      d. Corner joint
      e. Lap joint
   2. Acquaint student with joint application
   3. Explain different combinations of joint application

B. Joint Preparation
   1. Explain the types of joints used in the construction industry
   2. Explain the joint preparation for pipe welding
   3. Explain the joint preparation for making various repairs

XII. FLAME CUTTING-MANUAL

A. Oxygen Cutting
   1. Describe the principles of oxygen cutting
   2. Explain the mechanical application of principles of oxygen cutting
   3. Discuss the cutting ability of metals
   4. Describe the effect of flame-cutting on steel
   5. Discuss air hardening and expansion and contraction

B. Manual Flame Cutting
   1. Explain cutting procedures for steel
   2. Explain cutting procedure for beveling
   3. Discuss cutting of heavy steel plate
   4. Explain how to remove rivets with cutting torch
   5. Explain gouging
   6. Discuss speed of cutting for good or bad cuts

XIII. MANIPULATIVE TRAINING (SHOP)

A. Orientation of Shop
   1. The instructor will ensure that the student has a complete understanding of the following:
      a. Shop layout
      b. Emergency and safety procedures
      c. Location of all pertinent equipment
      d. Location of all switches, doors and fans

B. Power Equipment Safety
   1. Ensure that student is able to operate all power equipment contained in shop
   2. Explain all safety regulations for each piece of power equipment

XIV. MANIPULATIVE EXERCISES

A. Welding Exercises
   1. See appendix for sample exercises
   2. Progress student through a series of exercises to acquire manipulative skills

B. Cutting Exercises
   1. See appendix for sample exercises
   2. Progress student through a series of exercises to acquire manipulative skills

XV. QUINMESTER POST-TEST

BIBLIOGRAPHY
(Basic Gas Welding)

Basic References:

1. The Oxy-Acetylene Handbook - Second edition, Union Carbide Corporation, Linde Division, New York, 1943. Pp. 592.

2. Welding and Cutting Manual, Linde Air Products Company, New York, 1950. Pp. 208.

3. Welding School Workbook - Oxy-Acetylene Welding and Cutting, Welding and Cutting EW 269 Sec. OX, Hobart Welding School, Troy, Ohio, 1967. Pp. 28.

Supplementary References:

4. Aircosil Silver Brazing Training Manual, Air Reduction, New York, 1966. Pp. 22.

5. Harris Instruction Manual - Gas Welding and Flame Cutting, The Harris Calorific Company, Cleveland, 1968. Pp. 15.

6. Smiths Instructors Manual for a Basic Course in Oxy-Acetylene Brazing and Welding. Smith Welding Equipment, Minneapolis, 1968. Pp. 36.

7. Smiths Short Course for Bas Cutting, Welding, Brazing, Education Department of Smith Welding Equipment, Minneapolis, 1968. Pp. 22.

8. Successful Brazing with Flagg Flow Threadless Bronze Fittings, Stanley G. Glagg & Company, Inc., Philadelphia, 1967. Pp. 36.

9. Welding and the World of Metals, Miller Electric Manufacturing Company, Appleton, Wisconsin, 1967. Pp. 31.

10. Welding, Cutting and Heating Guide, Victor Welding and Cutting Division, Denton, Texas, 1969. Pp. 32.

Technical References:

11. The American Welding Society Welding Handbook - Sixth edition. The American Welding Society, Miami, Florida, Current year. (This handbook consists of five sections, 6 volumes)

12. Safety in Welding and Cutting, The American Welding Society, Miami, Florida, 1963. Pp. 49.

NOTE: The American Welding Society is considered to be a foremost authority on all technical matters involving any and all types of welding procedures and processes.

13. The Welding Encyclopedia - Fourteenth Edition, Welding Engineer Publications, Incorporated, Morton Grove, Illinois, 1963. Pp. 1008.

14. Welding Qualifications - Section IX - ASME Boiler and Pressure Code, The American Society of Mechanical Engineers, United Engineering Center, New York, 1965. Pp. 73.

Audiovisual aids:

Films:

Safety

1. School Eye Safety, 20 min., Color, Sound, 16mm., 1967. National Society For The Prevention of Blindness, Washington, D. C.

2. Smartest Kid In Town, 20 min., Color-Sound, 16mm., 1967. National Society For The Prevention of Blindness, Washington, D. C.

3. It's Up To You, 20 min., Color-Sound, 16mm., 1967. National Society For The Prevention of Blindness, Washington, D. C.

4. Don't Push Your Luck, 20 min., Color-Sound, 16mm., 1968. National Society For The Prevention of Blindness, Washington, D. C.

Tool Use and Safety

5. Chissels, 12 min., B/W Sound, 16mm., 1942. Plumb Tool Company and Department of Defense Service School, Washington, D. C.

6. Hacksaws, 20 min., B/W Sound, 16mm., 1942. Plumb Tool Company and Department of Defense Service School, Washington, D. C.

7. Hammers, 11 min., B/W Sound, 16mm., 1942. Plumb Tool Company and Department of Defense Service School, Washington, D. C.

8. Pliers and Screw Drivers, 12 min., B/W Sound, 16mm., 1942. Plumb Tool Company and Department of Defense Service School, Washington, D. C.

9. Pliers and Screw Drivers, 15 min., B/W Sound, 16mm., 1942. Plumb Tool Company and Department of Defense Service School, Washington, D. C.

10. Punches, 15 min., B/W Sound, 16mm., 1942. Plumb Tool Company and Department of Defense Service School, Washington, D. C.

Filmstrips:

11. Introduction to Welding, 35mm., B/W, 41 Frames, 1942. Jam Handy - The Jam Handy Organization, Detroit, Michigan.

12. Welding Flat Ripples, 35mm., B/W, 31 Frames, 1942. Jam Handy - The Jam Handy Organization, Detroit, Michigan.

13. Flat Butt Weld-Steel, 35mm., B/W, 24 Frames, 1942. Jam Handy - The Jam Handy Organization, Detroit, Michigan.

14. Fillet Weld-Steel, 35mm., B/W, 47 Frames, 1942. Jam Handy - The Jam Handy Organization, Detroit, Michigan.

15. Vertical Weld-Steel, 35mm., B/W, 64 Frames, 1942. Jam Handy - The Jam Handy Organization, Detroit, Michigan.

16. Cluster Welds-Steel, 35mm., B/W, 59 Frames, 1942. Jam Handy - The Jam Handy Organization, Detroit, Michigan.

17. Qualification Tests for Welders, 35mm., 35 Frames, B/W, 1942. Jam Handy - The Jam Handy Organization, Detroit, Michigan.

A P P E N D I X

Quinmester Post-Test Samples

MATERIALS LIST FOR BASIC GAS WELDING

1. LECTURE AND DEMONSTRATION

Toy balloons
Steel wool
Oxygen cylinder cutaway
Acetylene cylinder cutaway
Oxygen valve cutaway
Acetylene valve cutaway
Oxygen regulator
Acetylene regulator
Various torches
Cutting attachments
Cutting torches
Damaged regulators
Damaged hose
Full acetylene cylinder
Full oxygen cylinder
Good welding hose
Hose connections for repairs
Calcium carbide chunks
Water in open can
Visual aids:
- a. safety film
- b. strip film, welding and cutting
- c. instructional films of oxy-acetylene welding and cutting
- d. industrial films of welding and cutting

Overlay transparencies
Instruction books and sheets
Information pass-outs
Gloves
Welding glasses or goggles
Safety glasses
Friction ignitor
Demonstration welds
Demonstration brazing joints
Various types of welding rods or filler metals
Welding fluxes
Brazing fluxes
Small steel plates
Small copper plates
Small cast iron sections
Tempil sticks of various temperatures
Silver solder
Silver solder flux
Soft solder
Soft solder paste
Classroom:
- a. chalk
- b. blackboard
- c. erasers
- d. demonstration charts

2. PRACTICAL AND MANIPULATIVE

Gas Welding Shop complete with:
- Gas supply (Cylinders or Manifolded)
- Torches - welding
- Torches - cutting
- Welding goggles
- Pliers
- Grinding machines
- Supply of welding rods
- Steel plates for welding exercises
- Brazing rods
- Brazing fluxes
- Friction ignitors

This shop shall include any and all pertinent equipment which may be recommended for safe and complete functional operation, and any other equipment or devices which may be deemed necessary to the instruction of this course of Oxy-Acetylene Welding and Cutting - Basic.

SAMPLE

WELDING EXERCISES (MANIPULATIVE PROCEDURES)

A. Welding Exercises

1. Run puddles on 1/16" x 6" x 6" sheet steel plate flat position.
2. Run beads on 1/16" x 6" x 6" sheet steel plate in flat, horizontal, vertical and overhead positions.

	Position
3. Weld butt weld 2-1/16" x 3" x 6" sheet steel plates	1G 2G 3G 4G
4. Weld butt weld 2-1/8" x 3" x 6" steel plates	1G 2G 3G 4G
5. Weld fillet tee 2-1/16" x 3" x 6" sheet steel plates	1F 2F 3F 4F
6. Weld fillet tee 2-1/8" x 3" x 6" steel plates	1F 2F 3F 4F
7. Braze butt joint 2-1/8" x 3" x 6" steel plates	1G 2G 3G 4G
8. Braze fillet tee 2-1/8" x 3" x 6" steel plates	1F 2F 3F 4F
9. Forehand Vee butt weld 1/4" steel plate	1G
10. Backhand Vee butt weld 1/4" steel plate	1G

B. Cutting Exercises:

1. Cut off sections by following marking made on 1/4" steel plate with soap stone or sheet metal scribe.
2. Practice methods of starting holes through 1/4" steel plate.

3. Cut out circles in 1/4" steel plate.
4. Cut off sections by following marking made on 1" or 2" steel plate with soap stone or sheet metal scribe.

QUINMESTER POST-TESTS

Quinmester Post-Test

Name_____ Date_____ Score_____

Gas Welding - The Oxy-Acetylene Handbook

Chapter One

1. Metals have been completely interwoven with the progress of civilization since early times. _____

2. The Alchemist was the first to experiment with metals, by seeking a way to change metals to gold. _____

3. By the Nineteenth Century man had progressed so far as to be completely dependent on the metals already developed. _____

4. Early in the Nineteenth Century, metal workers were provided with a tool with which metals could be readily joined, and iron and steel easily severed. _____

5. The Oxy-Acetylene process is built upon two fundamental principals. _____

6. The Oxy-Acetylene process was first used for simple welding and cutting. _____

7. Today practically all commercial metals can be successfully welded by the Oxy-Acetylene process. _____

8. The temperature of the oxy-acetylene flame is usually estimated to be approximately 6,000'F. _____

9. The oxy-acetylene flame is the only gas flame that is hot enough to melt all commercial metals. _____

10. Metal production, fabrication, and repair as it is known today would be utterly impossible without the oxy-acetylene process. _____

11. A fusion weld is where the base metals are melted and then flow together. _____

12. A fusion weld may be made on the following metals; steel, cast iron, copper, stainless steel, and aluminum. _____

13. There are certain variations of the fusion welding. _____

14. Braze-welding is the same as fusion welding. _____

15. Braze-welding is widely used for joining of cast iron, malleable iron, wrought iron, galvanized iron, carbon steels, cast steel, copper and copper alloys. _____

16. Bronze-surfacing is similar to bronze-welding. _____

17. The life of metal parts subjected to extreme wear can be greatly increased by applying a coating of hard-facing alloys such as Haynes, Haynes stellite, and Haystellite. _____

18. Brazing and hard-soldering are not true welding operations. _____

19. Forming is the shaping of metal parts with the use of heat. _____

20. Annealing is the softening of stress relieving of metals. _____

21. Above a red heat, iron combines with pure oxygen so rapidly that it actually burns. _____

22. Cutting blowpipes can be mounted to machines for cutting. _____

23. Oxy-acetylene cutting is based on a chemical reaction. _____

24. Thick metal may be cut almost as easily as very thin metal. _____

25. The oxygen lance is pipe with pure oxygen that is used for cutting heavy sections as riser castings. _____

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Name_____ Date_____ Score_____

Gas Welding - The Oxy-Acetylene Handbook

Chapter Two

1. The entire commercial development of the oxy-acetylene process has taken place since the beginning of this century. _____

2. The commercial success of the oxy-acetylene process depended upon the availability of both oxygen and acetylene in sufficient quantities. _____

3. In 1895 a machine for the production of liquid air was placed in operation. _____

4. In May 1892 a method for the commercial production of calcium carbide was discovered at Spray, North Carolina. _____

5. In 1901 blowpipes of a practical type were introduced. _____

6. Regulations were enacted to prohibit the generation, stowage, or use of acetylene gas exceeding 15 pounds. _____

7. Steel was the first metal experimented on with the oxy-acetylene flame. _____

8. World War 1, from 1914-1918 gave tremendous impetus to the development of the oxy-acetylene process. _____

9. Cutting blowpipes were introduced about 1905. _____

10. Oxygen and acetylene are shipped in hollow steel cylinders. _____

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Name_____ Date_____ Score_____

Chapter Three

1. Oxygen has a boiling point of -297.2 degrees F. _____
2. Oxygen has a higher boiling point than nitrogen. _____
3. U.S.P. on an oxygen cylinder means United States Pharmacopoeia conformity. _____
4. Describe the oxygen cylinder valve and draw a picture of it listing the principal parts.
5. Cylinders are charged with oxygen at a pressure of _____.
6. This charging is measured at _____ temperature.
7. There are _____ sizes of general oxygen cylinders manufactured.
8. The large commercial oxygen cylinder weighs _____pounds empty.
9. The large commercial oxygen cylinder weighs _____pounds full.
10. The large commercial oxygen cylinder has a capacity of _____ cubic feet.
11. Oil or grease should never be used on oxygen equipment. _____
12. Oxygen cylinders should never be placed in the sun without cover and the same applies to ice or snow. _____
13. Oxygen may be stored in its _____ state.
14. The LS-156 _____gas container holds _____cubic feet. equivalent of gaseous oxygen.
15. Acetylene is made from _____.
16. By smelting _____and _____ together in an electric furnace we get _____.
17. When _____ and _____ are combined we generate _____.
18. Acetylene generators are classified into two types called _____ and _____.
19. There are two classes of generators called _____pressure and _____ pressure generators.

20. The large commercial acetylene cylinder weighs _____pounds empty.

21. The large commercial acetylene cylinder weighs _____pounds full.

22. The large acetylene cylinder when full contains _____cubic feet of acetylene gas.

23. An acetylene cylinder has a filler made of _____, _____, and _____.

24. _____ or calcium hydroxide is the residue left in acetylene generators.

25. Open the acetylene valve not over _____ turns and the oxygen valve _____ on cylinders.

26. On the back of this page draw an acetylene cylinder valve and list the principal parts, and describe.

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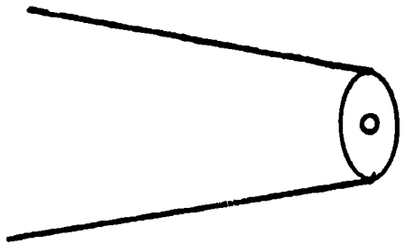
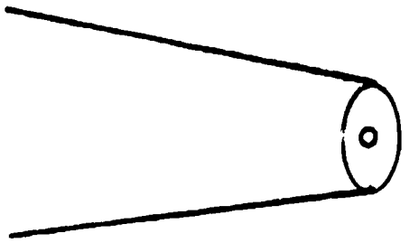
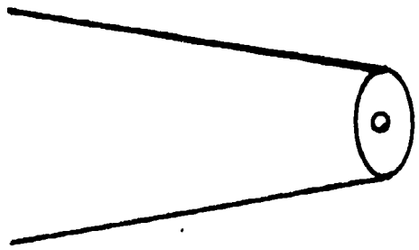
Name_____ Date_____ Score_____



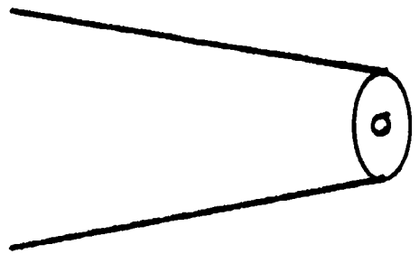
DRAW A NEUTRAL FLAME



DRAW AN OXIDIZING FLAME



DRAW A CARBURIZING FLAME



DRAW A REDUCING FLAME

1. Carbon monoxide and hydrogen are products of combustion of the inner cone. _____
2. The excess oxygen flame is greenish in color. _____
3. The neutral flame is blue in color. _____
4. The Oxy-acetylene flame is about 6300 C. _____
5. A slightly oxidizing flame is used for braze welding and bronze surfacing. _____
6. A carbonizing flame is used for aluminum welding. _____

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Name_____ Date_____ Score_____

Chapter Eight

1. Metals can be stretched, pulled apart, bent, twisted, broken off, compressed, dented, or scratched. _____

2. The measure of tensile strength is the amou:* of smoothly applied, direct pull that a part will stand t.fore it breaks. _____

3. Elasticity is the ability of a metal to return to its original shape after it is stretched. _____

4. The elastic limit is reached when a metal will not return to its shape. _____

5. Yield point of metal is when metal continues to stretch to its shape. _____

6. Yield strength of metal is where a permanent elongation of a small amount takes place at a given amount of pressure. _____

7. Ductility is the ability of metal to be permanently deformed. _____

8. There are two common ways to measure ductility. _____

9. Brittleness indicates of lack of ductility. _____

10. Toughness and hardness are defined as the same. _____

11. Rockwell Hardness test--is measured by the stretch of metal. _____

12. Sclerescope Hardness test--a diamond-tipped hammer is dropped on the steel and the rebound measured. _____

13. The Brinell Hardness test--a steel ball is bounced off the surface and the height of the bounce measured. _____

14. Monotron Hardness test--measures a load needed to make a definite penetration. _____

15. Mohs' Scale of Hardness measures the conversion of one type of test as compared to another. _____

16. A file may be used to measure the hardness of metal. _____

17. There is a closed relationship between the properties of any one metal. _____

18. The results of one hardness test can be accurately converted to those of another method. _____

19. Malleability is defined as "that property of a material by virtue of which it can be rolled or hammered into thinner sheets." _____

20. All metals are elastic to a certain degree. _____

NOTE

If any part of a statement is wrong or any part of a statement is omitted, that statement is to be considered false. To be true, the entire statement must be true to existing knowledge.

Quinmester Post-Test

Name_____ Date_____ Score_____

Chapter Nine

1. Name eight ways of identifying a piece of metal.

Chapter Eleven

1. Expansion does not cause much of a problem in light metal. _____
2. The amount of expansion in metal is proportionate to the amount of heat applied. _____
3. A part that is jigged against expansion will have no distortion. _____
4. A metal will contract the same amount that it expanded when it was heated if allowed to cool freely. _____
5. Uneven heating and cooling may be used to correct distortion. _____
6. Heat conduction has no importance in welding. _____
7. Thermal conductivity is the ability of metal to transfer or conduct heat. _____
8. A calorie is a unit of heat. _____
9. We can make shrinkage work for us. _____
10. Thermal expansion is the rate of expansion a given type of metal has with regard to the amount of heat energy applied to it. _____

NOTE

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Quinmester Post-Test

Name_____ Date_____ Score_____

Gas Welding Examination

1. Oxweld #7 is a high test steel rod. _____
2. Oxweld #7 is especially useful for welding material not over 1/4" thick. _____
3. Oxweld #1 H.T. is a high test welding rod containing 1% carbon and 1/2 of 1% (.5) per cent molybdenum. _____
4. Oxweld #1 H.T. increases the resistance to shock and vibration as compared to low carbon rod. _____
5. Oxweld #7 has a tensile strength of about 45,000 pounds. _____
6. Oxweld #1 H.T. has a tensile strength of about 55,000 pounds. _____
7. Oxweld #32 CMS has a tensile strength of 75,000 to 90,000 pounds tensile strength. _____
8. Oxweld #32 CMS rod is composed of chrome-moly steel. _____
9. Oxweld #7 is the best rod to use for place and pipe welding. _____
10. Oxweld #1 H.T. is never used for fine welding because of its hardness. _____
11. All welding rods are supplied in lengths of 36" except cast iron rods which come in 12" to 24". _____
12. The size welding rods which we use most are 1/16"-3/32" and 1/8", by 36" long. _____
13. Oxweld #1 H.T. is the #7 rod with .05 carbon added to it. _____
14. Oxweld #32 CMS rod is the #1 H.T. rod with .05 molybdenum added to it. _____
15. Tobin bronze rod is a rod for joining together cast iron, steel, aluminum, copper, bronze, and brass. _____
16. The tensile strength of bronze-to-steel bonds to about 35,000 pounds per square inch. _____
17. Oxweld #25M has brinell hardness of approximately 100 and unexcelled machinability. _____
18. The oxweld #25M weld withstand elongation up to 50 per cent as measured by free bend test. _____

19. Tobin bronze #481 is composed of copper, lead and zinc. _____

20. Tobin bronze rod #481 is composed-copper 59.40, zinc .60, and tin 40. _____

21. Oxweld 31T to harder than #25M but less ductile, the brinell hardness of #31T is 105. _____

22. When welding with the brazing rods we use a neutral flame. _____

23. The melting temperature of the bronze rods is in the 15.25" F. range. _____

24. #31T bronze rod has a higher tin content that makes the molten metal slightly more fluid than #25M. _____

25. #31T has a brinell hardness average of 105. _____

26. In the steel industry sheet and plate steel are divided by the measurement of 1/8" or about 11 gage. _____

27. The proper flame adjustment for welding most steel is the carbonizing flame. _____

28. In even ripple means that a good weld has been made. _____

29. The purposes of the tack weld is to hold the base metal in proper alignment for welding. _____

30. It is only necessary to melt into the base metal 1/64" for the depth of the weld metal for a complete weld to be made. _____

31. We do not have to consider the forces of expansion and those of contraction when welding as they counter balance each other. _____

32. We can design joints in sheet steel welding that do not require any additional welding rod, when welding. _____

33. The joint designs used in plate welding are single vee-double, vee-single, j-double, j-and open joint. _____

34. Stub ends of welding rods should be joined to full rods and used up to conserve welding rod. _____

35. The back hand technique is when the torch and rod are held at the same angle for forehand welding but the welding proceeds from left to right instead of right to left. _____

36. A feather edge is a single vee without a lands or surface. _____

37. We learn four positions of welding. _____

38. Rotation welding is considered the 1G position for pipe. _____

39. The horizontal position in pipe welding is considered as 2G. _____

40. The fixed horizontal pipe with a vertical weld is considered to be the 5G as there are three positions to welding it. _____

41. When making groove welds on plate the positions are called 1F, 2F, 3F, 4F for 1F flat-2F horizontal-3F vertical-4F overhead. _____

42. Multi-flame tips may be used in pipe welding. _____

43. The linde process of pipe welding uses an oxidizing flame. _____

44. A narrower angle of vee is satisfactory for backhand welding. _____

45. Brazing depends on both a tinning and wetting action. _____

46. The base metal must melt for a good bond in braze welding. _____

47. Braze welding is not restricted by any factors such as temperature, shock or vibration when considered for jointing of metals. _____

48. There are three important factors to consider when using the braze welding technique. _____

49. We use a brazing flux for protection of the brass weld from oxygen-nitrogen in the atmosphere and for fluxing and slagging of the molten base metal. _____

50. Cast iron brazing flux may be substituted for bronze brazing flux. _____

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Quinmester Post-Test

Name_____ Date_____ Score_____

Silver Soldering Examination

1. Describe what Silver Soldering processes are.

2. What does the flux indicate at the following temperature?
   a. 212'; b. 600', 650'; c. 800'; d. 1100'

3. Flux is active to _____ degrees. (F).

4. The melting range of Silver Solders is about _____ to_____.

5. What metals compose Silver Solder (4)?

6. What were the six steps stressed in the Handy Harman Film on Silver Soldering?

7. What type of torch flame is used for Silver Soldering?

8. What is the shape of the Silver Solder strips for Navy Grade #3_____, #4_____, #5_____.

9. What is the name of the flux we use for Silver Soldering?

10. What is added to Silver Solder as a flux for copper to copper soldering?

11. When no flux is used, how do you determine the proper temperature of the metal to be soldered?

12. Why is it necessary to be careful when soldering brass fittings?

13. Of what metals is brass composed?

14. What is the difference between Soft Soldering, Silver Soldering, and brazing? What is the temperature range of each?

15. What is a Walseal Fitting?

16. What is the tensil strength of Silver Solder 1-1/2 thousandths?

17. Is it true that the greater the clearance between fitting and pipe, the greater the strength of the joint?

18. How is the pipe and fitting cleaned for Silver Soldering?

19. What color is the copper pipe at the proper Silver Soldering temperature?

20. What is meant by a Peeltest?

ANSWER KEY TO QUINMESTER POST-TEST

Chapter One

1. True
2. True
3. True
4. False
5. True
6. True
7. True
8. True
9. True
10. True
11. True
12. True
13. True
14. False
15. True
16. True
17. True
18. True
19. True
20. True
21. True
22. True
23. True
24. True
25. True

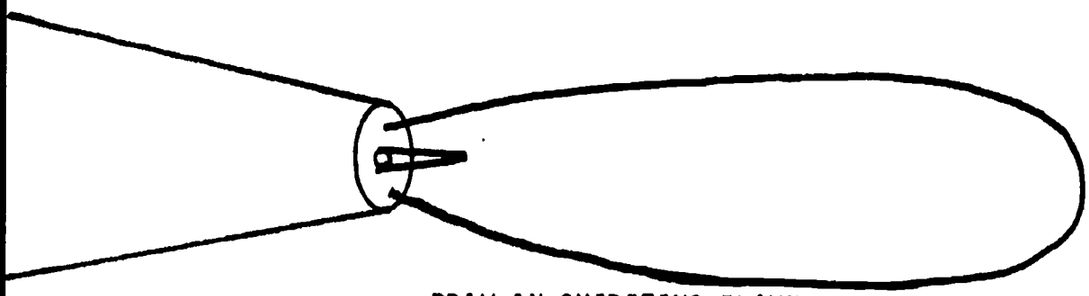
Chapter Two

1. True
2. True
3. True
4. True
5. True
6. True
7. True
8. True
9. True
10. False

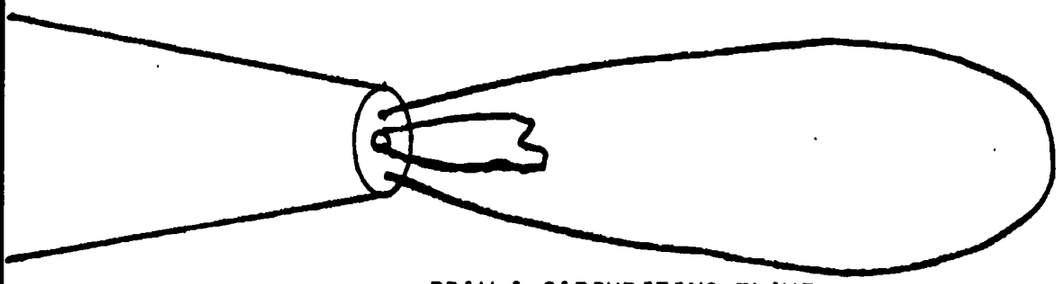
Chapter Three

1. True
2. True
3. True
4.
5. 2200
6. 70°
7. 3
8. 133
9. 152
10. 244
11. True
12. True
13. liquid
14. liquid; 4870
15. calcium carbide and water
16. coke; lime; calcium carbide
17. carbide; water; acetylene gas
18. carbide to water; water to carbide
19. low; medium
20. 223
21. 240
22. 300
23. asbestos, portland cement, and balsa wood charcoal
24. slaked lime
25. 1-1/2 - 2; all the way
26.

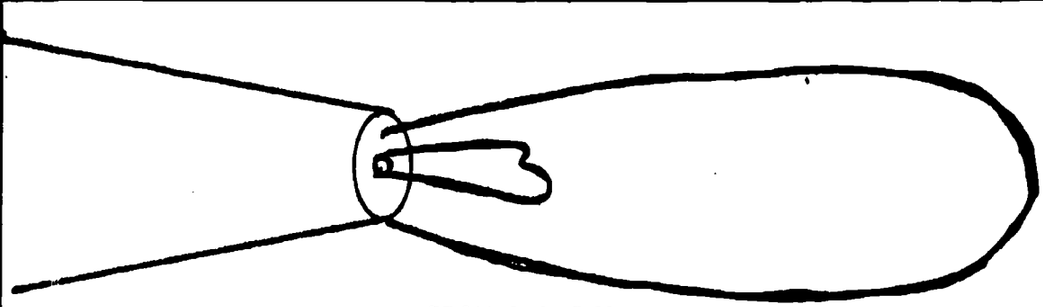
DRAW A NEUTRAL FLAME



DRAW AN OXIDIZING FLAME



DRAW A CARBURIZING FLAME



DRAW A REDUCING FLAME

1. True
2. False
3. True
4. False
5. True
6. False

Chapter Eight

1. True
2. True
3. True
4. True
5. True
6. True
7. True
8. True
9. True
10. False
11. False
12. True
13. False
14. True
15. False
16. True
17. True
18. False
19. True
20. True

Chapter Nine

1. a. appearance
   b. weight
   c. fracture
   d. magnetic
   e. flame test
   f. spark test
   g. file test
   h. sound

Chapter Eleven

1. False
2. True
3. True
4. True
5. True
6. False
7. True
8. True
9. True
10. True

Gas Welding Examination

1. True
2. True
3. False
4. True
5. True
6. False
7. True
8. False
9. False
10. False
11. True
12. True
13. True
14. True
15. False
16. False
17. True
18. True
19. False
20. True
21. True
22. False
23. False
24. True
25. True
26. True
27. False
28. False
29. True
30. True
31. False
32. True
33. True
34. True
35. True
36. True
37. True
38. True
39. True
40. True
41. False
42. True
43. False
44. True
45. True
46. False
47. False
48. True
49. False
50. False

Silver Soldering Examination

1. The jointing together of similar and dissimilar metals with a silver base alloy using a tinning or wetting action.

2. a. water boils off
   b. flux works and bubbles
   c. flux begins to melt
   d. flux clear and quiet

3. 1600 degrees

4. 1100, 1300

5. silver, copper, zinc and cadmium

6. a. cleaning--mechanical and chemical
   b. jigging or setting up
   c. fluxing
   d. heating
   e. soldering
   f. cleaning off flux

7. reducing

8. square or rectangle; round; hexagon or octagon

9. Handy-Harman

10. phosphorus

11. dull red on copper--by color

12. brass loses its strength at red heat--will crumble easily

13. Cu 59.34; Zn 40; Sn 66

14. Soft soldering--lead-tin alloys. 376-600 F
    Silver soldering--silver-copper alloys 1100-1300 F
    Brazing--Brass or copper-zinc alloys 1625-1800 F

15. A fitting designed for silver soldering for pipe with a solder ring in it.

16. 126,000

17. No

18. Chemically or mechanically

19. Dull red

20. Splitting the end of a pipe fitting and peeling the end of the pipe where brazed together. To cause a separation of the joint.

(Final Examination)

The instructor shall select five questions from each pre-quin test and also give a manipulative welding test consisting of a groove and fillet weld.

The instructor shall consider both the written and practical results of the testing for a quin grade average.