

Penn Foster's Welder Apprenticeship program

Course Title	Course Number	PF Price	Course Duration
Year 1:			
Basic Industrial Math	Block X31	\$450.00	30 hours
Addition and Subtraction	186303	(\$75.00)	(5 hours)
Multiplication and Division	186304	(\$75.00)	(5 hours)
Fractions, Percents, Proportions, and Angles	186305	(\$75.00)	(5 hours)
Metric System	186306	(\$75.00)	(5 hours)
Formulas	186307	(\$75.00)	(5 hours)
Introduction to Algebra	186308	(\$75.00)	(5 hours)
Practical Measurements	Block X32	\$375.00	25 hours
Linear and Distance Measurement	186125	(\$75.00)	(5 hours)
Bulk Measurement	186126	(\$75.00)	(5 hours)
Temperature Measurement	186127	(\$75.00)	(5 hours)
Energy, Force, and Power	186128	(\$75.00)	(5 hours)
Fluid Measurement	186129	(\$75.00)	(5 hours)
Trades Safety: Getting Started	186104	\$75.00	5 hours
Working Safely with Chemicals	186105	\$75.00	5 hours
Fire Safety	186106	\$75.00	5 hours
Material Handling Safety	186109	\$75.00	5 hours
Working Safely with Electricity	4400	\$75.00	10 hours
Jobs, Companies, and the Economy: Basic Concepts for Employees	186191	\$75.00	5 hours
Quality Concepts: Tools and Applications	186036	\$75.00	5 hours
Reading Prints and Schematics	Block X45	\$900.00	96 hours
Introduction to Print Reading	186325	(\$75.00)	(8 hours)
Print Reading Symbols and Abbreviations	186326	(\$75.00)	(8 hours)
Dimensioning and Tolerancing	186327	(\$75.00)	(8 hours)
Print Reading Applications	186328	(\$75.00)	(8 hours)
Building Drawings	186181	(\$75.00)	(8 hours)
Electrical Drawings and Circuits	186044	(\$75.00)	(8 hours)
Electronic Drawings	186045	(\$75.00)	(8 hours)
Hydraulic and Pneumatic Drawings	186046	(\$75.00)	(8 hours)
Piping: Drawings, Materials, and Parts	186047	(\$75.00)	(8 hours)
Welding Symbols	186048	(\$75.00)	(8 hours)
Sheet Metal Basics	186182	(\$75.00)	(8 hours)
Sketching	186050	(\$75.00)	(8 hours)
Year 2:			
Reading Shop Prints, Part 1	386043	\$75.00	10 hours
Reading Shop Prints, Part 2	386044	\$75.00	10 hours
Geometric Dimensioning/Tolerancing (was 386E01)	STP194	\$175.00	20 hours
Hand and Power Tools	Block X34	\$900.00	70 hours
Common Hand Tools, Part 1	186164	(\$75.00)	(5 hours)
Common Hand Tools, Part 2	186165	(\$75.00)	(5 hours)
Precision Measuring Instruments, Part 1	186188	(\$75.00)	(10 hours)
Electric Drilling and Grinding Tools	186166	(\$75.00)	(5 hours)
Power Cutting Tools	186167	(\$75.00)	(5 hours)
Pneumatic Hand Tools	186056	(\$75.00)	(5 hours)
Plumbing and Pipefitting Tools	286113	(\$75.00)	(5 hours)

Electricians' Tools	006026	(\$75.00)	(10 hours)
Tool Grinding and Sharpening	186057	(\$75.00)	(5 hours)
Woodworking Hand Tools	186169	(\$75.00)	(5 hours)
Woodworking Power Tools	186170	(\$75.00)	(5 hours)
Lifting Equipment	186168	(\$75.00)	(5 hours)
Bench Work, Part 3	5004C	\$75.00	10 hours
Lubrication, Part 1	286091	\$75.00	10 hours
Lubrication, Part 2	286092	\$75.00	10 hours
Algebra: Monomials and Polynomials	X0201	\$75.00	6 hours
Algebra: Factoring	X0202	\$75.00	6 hours
Algebra: Addition and Subtraction of Fractions	X0203	\$75.00	6 hours
Algebra: Multiplication and Division of Fractions	X0204	\$75.00	6 hours
Progress Examination for X0201 - X0204	X0221	\$0.00	0 hours
Fundamentals of Metal Cutting	386030	\$75.00	10 hours
Drilling, Part 1	386050	\$75.00	10 hours
Drilling, Part 2	386051	\$75.00	10 hours

Year 3:

Fundamentals of Welding, Part 1	286025	\$75.00	10 hours
Fundamentals of Welding, Part 2	286066	\$75.00	10 hours
Safety in Welding and Cutting	6154	\$75.00	10 hours
Safe Handling of Pressurized Gasses and Welding	186107	\$75.00	5 hours
Practical Metallurgy for Welders, Part 1	286104	\$75.00	10 hours
Practical Metallurgy for Welders, Part 2	286105	\$75.00	10 hours
Gas Welding Equipment	6272A-B	\$150.00	20 hours
Gas Welding Techniques	6276A-C	\$225.00	30 hours
Common Thermal Cutting Processes	286028	\$75.00	10 hours
Working Safely with Electricity	186108	\$75.00	5 hours
Advanced Electrical Safety	186111	\$75.00	5 hours
DC Principles	Block A31	\$450.00	30 hours
Nature of Electricity	086112	(\$75.00)	(5 hours)
Circuit Analysis and Ohm's Law	086113	(\$75.00)	(5 hours)
Capacitors and Inductors	086114	(\$75.00)	(5 hours)
Magnetism and Electromagnetism	086115	(\$75.00)	(5 hours)
Conductors, Insulators, and Batteries	086116	(\$75.00)	(5 hours)
DC Motors and Generator Theory	086117	(\$75.00)	(5 hours)
AC Principles	Block A32	\$600.00	40 hours
Alternating Current	086118	(\$75.00)	(5 hours)
Alternating Current Circuits	086119	(\$75.00)	(5 hours)
Inductors in AC Circuits	086120	(\$75.00)	(5 hours)
Capacitors in AC Circuits	086121	(\$75.00)	(5 hours)
Transformers	086122	(\$75.00)	(5 hours)
Alternators	086123	(\$75.00)	(5 hours)
Electrical Energy Distribution	086124	(\$75.00)	(5 hours)
Rectification and Basic Electronic Devices	086125	(\$75.00)	(5 hours)

Year 4:

Basic Test Equipment	086126	\$75.00	5 hours
T-Shooting w/ Volt-Ohm-Milliamp Meters (VOMs)	086127	\$75.00	5 hours
Arc Welding Equipment, Part 1	286032	\$75.00	10 hours
Arc Welding Equipment, Part 2	286033	\$75.00	10 hours
Arc Welding Equipment, Part 3	286053	\$75.00	10 hours
Shielded Metal Arc Welding Techniques, Part 1	286030	\$75.00	10 hours
Shielded Metal Arc Welding Techniques, Part 2	286031	\$75.00	10 hours
Gas Metal Arc Welding Fund. (GMAW or Mig)	286059	\$75.00	10 hours
Gas Tungsten Arc Welding Fund (GTAW or Tig)	286035	\$75.00	10 hours
Inspection and Testing of Welds	5160	\$75.00	10 hours
Arc Welding of Low Carbon Steel	5249A-B	\$150.00	20 hours
Arc Welding of Alloy Steels and Iron	5250	\$75.00	10 hours
Arc Welding of Nonferrous Metals and Overlaying	5251	\$75.00	10 hours
Fabrication of Pipe by Welding	6278A-B	\$150.00	20 hours

Estimated Total Curriculum Duration: 738 hours
Number of Exams: 99

*****SEE FULL COURSE DESCRIPTIONS BELOW**

Block X31

Basic Industrial Math

Duration:

30 hours (includes 6 tests)

What Students Learn:

This module of six study units offers the trainee arithmetic and basic mathematics, metric measurement, and calculator fundamentals. The Metric System is an introductory unit which includes metric conversions. Problem exercises and examples in this module are presented in on-the-job scenarios with applications drawn from the industrial context.

Special Notes:

This updated course replaces lessons contained within Practical Math and Measurements, Block X01. Each study unit contains a progress examination.

Components:

Addition and Subtraction (186303)

Multiplication and Division (186304)

Fractions, Percents, Proportions, and Angles (186305)

Metric System (186306)

Formulas (186307)

Introduction to Algebra (186308)

186303

Addition and Subtraction

Objectives:

- Define the terms: whole number, numeral, digit, decimal, place value, addend, sum, minuend, subtrahend, and difference.
- Explain the significance of the digit zero in a number.
- Differentiate between concrete and abstract numbers.
- Properly prepare numbers for addition and subtraction.
- Perform addition and subtraction on numbers.
- How to check your answers to both addition and subtraction problems.
- How to use a calculator to add and subtract numbers.

186304

Multiplication and Division

Objectives:

- Define the terms: factor, multiplicand, multiplier, partial product, dividend, divisor, quotient, and remainder.
- Recognize the various signs used for multiplication and division.
- Properly prepare numbers for multiplication and division.

- Perform multiplication and division on whole numbers and decimals.
- How to check your answers to both multiplication and division problems.
- How to find the average of a group of numbers.
- How to use a calculator to multiply and divide numbers.

186305

Fractions, Percents, Proportions, and Angles

Objectives:

- Define the terms: fraction, proper fraction, improper fraction, lowest common denominator, percent, ratio, and proportion.
- How to add, subtract, multiply, and divide fractions and decimals.
- How to change fractions to decimals and decimals to fractions.
- Solve problems involving percent.
- How to use a protractor to measure angles.
- Lay out templates for checking angles.
- How to use a calculator to solve percent problems and to convert fractions to decimals.

186306

Metric System

Objectives:

- Name the base units most commonly used in the metric system.
- Identify metric prefixes and their values.
- Apply conversion factors to increase or decrease metric base units.
- Estimate lengths in metric units.
- Express temperature in degrees Celsius.
- Define the terms: mass, density, force, torque, and pressure. Identify the metric units used to measure each one.
- How to use a calculator to convert one metric unit to another.

186307

Formulas

Objectives:

- Explain the use of letters in formulas.
- Prepare and use formulas to solve problems.
- The use of formulas to calculate the perimeter of a triangle and rectangle, distance, area of a triangle, rectangle, and circle, volume of a pyramid, current in a circuit, and volume of a sphere.

- How to use a calculator to find square root and solve formulas.
- Transform and solve an equation.
- Perform basic arithmetic operations with signed terms.
- Substitute given numerical values for letters in a formula and find the unknown quantity.

186308

Introduction to Algebra

Objectives:

- Define the terms: term, constant, coefficient, exponent, monomial, trinomial, and polynomial.
- Identify and combine like terms in an expression.
- Multiply and divide terms containing exponents.
- Remove parentheses from an expression and simplify the expression.
- Perform basic arithmetic operations with signed terms.

Block X32

Practical Measurements

Duration:

25 hours (includes 5 tests)

What Students Learn:

The five lessons in this block present the trainee with a broad overview of measurements found in an industrial setting. In addition to the basic measurements of length, temperature, energy, force, and power, the trainee will learn how materials are measured and handled in bulk quantities. Fluid measurements include the measuring of fluid flow, fluid pressure, and fluid level. All lessons include the metric conversions in addition to the English units.

Special Notes:

This updated course replaces the X0105 to X0109 lessons found in Practical Math and Measurements, Block X01. Each study unit contains a progress examination.

Components:

Linear and Distance Measurement (186125)
 Bulk Measurement (186126)
 Temperature Measurement (186127)
 Energy, Force, and Power (186128)
 Fluid Measurement (186129)

186125

Linear and Distance Measurement

Objectives:

- Recognize the difference between English and metric units of length.

- Find the perimeter of rectangular, square, or triangular areas or objects, such as rooms or machine bases, after measuring the sides.
- Calculate the circumference of circular objects like pipes of tanks after measuring the diameter.
- Measure lengths with the aid of rigid and flexible rules, thickness gauges and screw pitch gauges.
- Read a typical vernier scale and micrometer to take precise measurements.

186126

Bulk Measurement

Objectives:

- Measure an angle by degrees.
- Find the areas of rectangles, triangles, and circles.
- Find the volumes of prisms, cylinders, and cones.
- Find the weight of material stored in a container.
- Determine the amount of material that can be stored or handled.
- Discuss the types and uses of conveyors and weighing systems.

186127

Temperature Measurement

Objectives:

- Change temperature units from one system to another.
- Discuss the use of the various types of thermometers.
- Select the type of thermometer to be used at certain temperatures.

186128

Energy, Force, and Power

Objectives:

- Distinguish between the concepts of energy, force, and power.
- Explain what the term "work" means, and how it is measured.
- Know by sight the basic machines, lever, inclined plane, wedge, wheel and axle, and screw.
- Solve simple problems that involve levers, mechanical advantage, and machine efficiency.
- List the forms of energy that have important industrial applications, and the instruments used for measuring energy.

186129

Fluid Measurement

Objectives:

- Understand the properties of fluids.
- Determine the density, specific gravity, and viscosity of fluids.
- Express pressure in three different units.
- Measure the pressure of fluids using manometers and Bourdon tube pressure gauges.
- Measure the flow rate of fluids using different types of flowmeters.

186104

Trades Safety: Getting Started

Duration:

5 hours (includes 1 test)

What Students Learn:

Preview

A thorough knowledge of safe practices is an important part of working in any industrial setting. Every industrial worker should be familiar with accident prevention techniques, fire safety methods, and the use of personal protective equipment. Injuries in the workplace cost many millions of dollars in medical costs, lost wages, and production losses each year. Many injuries can be prevented by understanding how accidents and injuries can occur. This study unit is designed to help trainees understand why safety is so important, and to present students with information about safety that goes beyond common sense.

Objectives

When a student completes this study unit, he and she will be able to:

- Name the agencies that make and enforce safety regulations and explain an employee's responsibilities under those regulations.
- List the physical hazards associated with chemicals and describe how to avoid those hazards.
- Name several electrical shock hazards and the techniques used to prevent shocks.
- List the steps in a lock-out / tag-out procedure.
- Explain the importance of machine guarding and name several types of machine guards.
- Name the four classes of fire and how to extinguish each of them.
- Describe the proper technique used to lift a heavy load.
- Explain how to avoid hand injuries when using hand and power tools.
- List some of the hazards involved in welding and hot cutting operations and how to prevent them.
- Explain how job analysis and the science of ergonomics are used to improve the workplace.
- Explain the importance of personal protective equipment and name several types of PPE.

Contents

Introduction; Safety Regulations; Key safety Issues; Protecting Yourself and Your Co-workers.

186105

Working Safely with Chemicals

Duration:

5 hours (includes 1 test)

What Students Learn:

Preview

This study unit deals with the safe use of chemicals in the workplace. The two primary causes of chemical accidents are the misuse of chemicals and the improper disposal of chemical wastes. Understanding the hazards that chemicals can create is the first step in protecting people from harm.

The main goal of this study unit is to provide students with sound, practical knowledge about chemical use and disposal, both in the workplace and at home. You will learn how to recognize common chemical hazards and how to deal with them. Trainees will learn how to perform a job analysis to look for potential chemical dangers in your daily tasks. Finally, people will learn how to take precautions to avoid chemical accidents and make all jobs as safe as possible.

Objectives

When a student completes this study unit, he and she will be able to:

- Recognize the six different ways in which a chemical can cause physical injury.
- Name the routes or paths of entry by which chemicals can enter the body.
- Describe the types of injuries caused by chemicals.
- Identify potential chemical dangers in your workplace.
- Describe how to identify, store and label hazardous chemicals.
- List several methods used to prevent chemical accidents.
- Explain why proper training is important to chemical handling.
- Describe the types of personal protective equipment used and worn when handling chemicals.
- Explain the role of governmental agencies in enforcing chemical regulations.

Contents

Introduction: Living with Chemicals; Chemical Injuries; Accident Prevention; Handling Hazardous Wastes.

186106

Fire Safety

Duration:

5 hours (includes 1 test)

What Students Learn:

Preview

Fires are the most destructive and expensive of all accidents. However, fires can be effectively prevented through the combined use of technology and common sense. By understanding how fires get started and how to extinguish them, students will have much of the knowledge needed to protect people from fire. This study unit will introduce trainees to the information you need to practice fire safety and prevention in the workplace.

Objectives

When a student completes this study unit, he and she will be able to:

- Describe the types of property losses and injuries associated with fires.
- Explain how fires are ignited.
- Identify the four classes of fire.
- Describe the primary fire hazards found in the workplace.
- Explain the various ways in which fires can be prevented.
- Describe the operation of several different fixed fire protection systems.
- Identify the proper type of portable fire extinguisher to use on a fire.
- Describe the operation of several different types of fire extinguishers.
- Explain how to defend yourself and others in a fire situation.
- Describe how to safely evacuate a burning building.

Contents

Introduction to Fire; Fire Hazards in the Workplace; Preventing Fires; Fixed Fire Protection Equipment; Portable Fire Extinguishers; Fire Protection Techniques.

186109

Material Handling Safety

Duration:

5 hours (includes 1 test)

What Students Learn:

Preview

This study unit introduces the safe techniques and work practices commonly used when handling manufacturing and industrial materials. Trainees will learn the procedures necessary to avoid physical injury to yourself and those working with you, for both manual handling methods and mechanical handling methods. You will also learn procedures that minimize damage to the materials being moved and to facility property. Knowing the proper procedures will also give you the insight to decide when mechanical handling is necessary, or preferred, over traditional physical handling.

Objectives

When a student completes this study unit, he and she will be able to:

- Recognize the hazards associated with handling materials.

- Know the types of injuries that can be caused by these hazards.
- Understand how to effectively use safe material handling practices.
- Know how to avoid physical injury when handling loads.
- Know and follow the rules for safe operation of powered industrial material handling equipment.
- Understand and respect the limits and restrictions placed on powered material handling mechanisms.

Contents

Introduction to Material Handling; Housekeeping and Storage; Material Handling Equipment; Hoists and Cranes.

4400

Working Safely with Electricity

Duration:

10 hours (includes 1 test)

What Students Learn:

Electrician Categories and Classifications; Electrical Safety Standards and Codes, including OSHA, NEC, and NESC; Materials Standards; Listing and Labeling by Testing Laboratories; Electric Shock; Safety Precautions; First Aid for Electric Shock; Protective Clothing.

186191

Jobs, Companies, and the Economy: Basic Concepts for Employees

Duration:

5 hours (includes 1 test)

What Students Learn:

- Recognition of how the economy affects the actions of companies, employees, consumers, and investors.
- The concept of capitalism and the principles of supply and demand.
- How government policies affect the amounts of saving, spending, and investing by companies and individuals.
- Understand economic measuring tools such as the inflation rate, the unemployment rate and Gross Domestic Product (GDP).
- How labor is divided into three employment sectors and how wages are set, including the influence of labor unions and the benefits of a multi-functional workforce.
- Recognition of how both the employee and the company must compete in an increasingly international marketplace.

186036

Quality Concepts: Tools and Applications

Duration:

5 hours (includes 1 test)

What Students Learn:

- Describe how job roles change as a company evolves in its quality consciousness.
- Explain several ways in which you can support TQM.
- Identify approaches, practices and skills associated with positive organizational change.
- Differentiate between the "change process" at the company level and the manufacturing processes that require improvement.
- Describe major causes of process variation and give examples of how they may affect you in your job.
- Explain why and how the reduction of variability is a key factor in process improvement.
- Describe why and how quality and process improvement depend on data-driven decision making.
- Identify seven quality tools and explain their uses.

Block X45

Reading Prints and Schematics

Duration:

96 hours (includes 12 tests)

Course Prerequisites:

Basic Industrial Math (Block X31)

What Students Learn:

This block introduces the trainee to the various types of prints, drawings, and schematics used in an industrial environment. The trainee will learn how to read and interpret the different types of standard symbols and abbreviations found on these drawings. This block will benefit trainees entering any industrial trade. Each study unit contains a progress examination.

Special Notes:

This updated course replaces Reading prints and Schematics, Block X25. Each study unit contains a progress examination.

Components:

Introduction to Print Reading (186325)
Print Reading Symbols and Abbreviations (186326)
Dimensioning and Tolerancing (186327)
Print Reading Applications (186328)
Building Drawings (186181)
Electrical Drawings and Circuits (186044)
Electronic Drawings (186045)
Hydraulic and Pneumatic Drawings (186046)
Piping: Drawings, Materials, and Parts (186047)
Welding Symbols (186048)

Sheet Metal Basics (186182)
Sketching (186050)

186325

Introduction to Print Reading

What Students Learn:

- Describe the basic format for conveying technical information in a drawing
- Interpret the various drawing views used in technical drawings
- Extract information from notes and title blocks
- Recognize and interpret the different line types used in drawings
- Understand the concept of drawing scale and how it affects information shown in the drawing
- Identify various types of building, electrical, and mechanical drawings

186081

Print Reading Symbols and Abbreviations

Course Prerequisite:

Introduction to Print Reading (186325)

What Students Learn:

- Recognize, understand, and interpret the most common abbreviations used on a wide range of drawing types used in construction and maintenance trades
- Understand and interpret the various symbols and notations used on drawings for electrical, architectural, mechanical, welding, fluid power, and other types of applications
- Explain how symbols are used to show standard materials, parts, and assemblies.

186327

Dimensioning and Tolerancing

Course Prerequisite:

Introduction to Print Reading (186325)

Print Reading Symbols and Abbreviations (186326)

What Students Learn:

- Recognize the international standards and conventions that apply to drawings
- Explain how different numbering systems were developed and how they are applied to prints
- Read and interpret various systems of dimensions and tolerances on drawings
- Recognize and interpret common symbols and nomenclature used in geometric dimensioning and tolerancing (GD&T) systems

186328

Print Reading Applications

Course Prerequisite:

Introduction to Print Reading (186325)
Print Reading Symbols and Abbreviations (186326)
Dimensioning and Tolerancing (186327)

What Students Learn:

- Work with standard drawing formats to obtain information such as part titles, part numbers, dimensional standards, revisions, and materials
- Explain how various components shown on prints are connected or related to each other
- Obtain information from a drawing about quantities, materials, assembly processes, or dimensions
- Visualize the three-dimensional parts and assemblies represented by two-dimensional drawings
- Effectively interpret electrical

186181

Building Drawings

Course Prerequisite:

Introduction to Print Reading (186325)
Print Reading Symbols and Abbreviations (186326)
Dimensioning and Tolerancing (186327)

What Students Learn:

- Work with standard drawing formats to obtain information such as part titles, part numbers, dimensional standards, revisions, and materials
- Explain how various components shown on prints are connected or related to each other
- Obtain information from a drawing about quantities, materials, assembly processes, or dimensions
- Visualize the three-dimensional parts and assemblies represented by two-dimensional drawings
- Effectively interpret electrical, architectural, mechanical, fluid power, and other types of prints.

186044

Electrical Drawings and Circuits

Objectives:

- Identify electrical construction drawings, schematics, and wiring diagrams.
- Interpret various electrical symbols.
- Read standard abbreviations used in electrical diagrams.
- Tell if a diagram is a block diagram, a schematic diagram, or a wiring diagram.
- Compare closed circuits, open circuits, grounded circuits, and short circuits.

186045

Electronic Drawings

Objectives:

- Identify and interpret the various electronics symbols used on drawings.
- Identify and interpret the various types of drawings used in the electronics field.

186046

Hydraulic and Pneumatic Drawings

Objectives:

- Graphic symbols for lines, flows, and reservoirs.
- Pump and valve symbols.
- Fluid circuit and air circuit components.
- Graphical, circuit, cutaway, pictorial, and combined diagrams.

186047

Piping: Drawings, Materials, and Parts

Objectives:

- Define the term "piping drawings."
- Recognize plans, elevations, and sectional views.
- Identify a view by its placement on a drawing.
- List what working drawings include.
- Evaluate whether or not a freehand sketch serves its intended purpose.
- Interpret the standard symbols and abbreviations and "read" the color coding on piping in industrial and power plants.
- Interpret dimensions marked on piping drawings.

186048

Welding Symbols

Objectives:

- Identify by name the welding processes commonly used in plant maintenance work.
- Name the best welding processes for a given welding job.
- Identify by sight, the basic joint and groove designs used in welding.
- Identify by sight the basic types of welds and describe their uses.
- Interpret the weld symbols most often found in the drawings used in plant maintenance work.

186182

Sheet Metal Basics

Objectives:

- Identify sheet metal of known material and thickness by page and weight.
- Figure allowances for bends, circumferences, seams, locks, and edges.
- Know when and where to cut relief radi.
- Catalog and identify by sight the various seams, locks, and edges.
- Name and describe the major tools and machines used in sheet metal working.
- Explain how large fittings can be constructed.
- List the characteristics of PVC and PVF sheet and laminates.

186050 Sketching

Objectives:

- Use the right techniques for sketching straight and curved lines, and circles and arcs.
- Draw, with practice, multiview sketches of simple objects that accurately show all the details of the objects.
- Draw dimension sketches of simple machine parts with enough detail that parts can be made.
- Draw, with practice, realistic sketches of objects that have simple rectangular and circular shapes.

386043, 386044 Reading Shop Prints, Parts 1&2

Duration:

20 hours (includes 2 tests)

Course Prerequisites:

Basic Industrial Math (Block X21)
Practical Measurements (Block X22)
Elements of Print Reading (6719A-B)

What Students Learn:

PART 1 (386043). Unilateral and Bilateral Tolerances; Reading Detail Working Drawings; Pulley Bar: Studying the Print, Material Needed, Machining Operations; Idler Shaft: Reading the Print, Producing the Idler Shaft; Wheel Puller: Plate Details and Layout, Machining Operations, Finishing Operations.
PART 2 (386044). Examples of Prints: Bumper Band, Door-Latch Bracket, Roller; Chain Tightener, Bracket, Lateral; Gears: Spur-Gear Terms, Bevel-Gear Terms, Detail Drawing of Bevel Pinion, Worm and Worm Wheel, Assembly Drawings, Machining Operations, Assembly Procedures.

STP194 Geometric Dimensioning and Tolerancing

This course will cover important and fundamental concepts in geometric dimensioning and tolerancing (GD&T) in four parts. First, you'll work through the basics by studying the various symbols, dimensions, tolerances, annotations, and views of shop prints. Once you can recognize these elements of prints, you'll be able to more easily understand identify datum features, symbols, and terminology used in the manufacturing industry.

The second half of this course will help you recognize various types of orientation tolerances, geometric form tolerances, and runout geometric controls. You'll also learn about various concepts such as concentricity and symmetry. You'll end your study of GD&T with simple and composite forms of locational tolerances as they relate to true position.

Duration:

20 hours (includes 4 tests)

Course Prerequisites:

Basic Industrial Math (Block X21)
Reading Prints and Schematics (Block X45)

Course Objectives:

- Identify various symbols, dimensions, tolerances, annotations, and views found in shop prints
- Summarize the proper use of datum features, symbols, and terminology used in manufacturing
- Recognize various types of orientation tolerances and geometric form tolerances
- Explain the concepts of runout geometric controls, concentricity, symmetry, and locational tolerances

What Students Learn:

Lesson 1 (386125): Geometric Dimensioning and Tolerancing, Part 1 Overview:

This lesson introduces you to geometric *dimensioning and tolerancing*, or *GDT*. GDT is a collection of definitions, rules, symbols, and methods of application employed throughout modern manufacturing. The lesson begins by reviewing the basic skills you probably already use when interpreting shop drawings. After this refresher, you'll begin to learn the basics of GDT drawing systems. You'll study some GDT symbols and learn to recognize and interpret them when they're inserted into a drawing. Finally, this lesson serves as a foundation onto which you'll add more knowledge as you progress through additional GDT-related training topics.

Lesson 2 (386126): Geometric Dimensioning and Tolerancing, Part 2 Overview:

Datums and material condition modifiers will now be covered in greater depth. With any measurement, the location of a feature is referenced or measured from a theoretical perfect plane, point, line, axis, or surface called a datum. Datums may be physical features on a part, such as steps or edges, or theoretical features such as the center of a hole or the centerline of a slot. Understanding how a datum is defined is critical for properly setting up the part's machining or inspection operations.

The material condition modifier concepts of maximum material condition, least material condition, and regardless of feature size are also explained in this lesson. Along with the dimensional limits covered earlier, the material condition modifiers are used to vary, or modify, a dimension's nominal tolerance. You'll learn how properly using these material conditions allows for a wider variation in dimensions (compared to conventional dimensioning) while still providing proper fit and function of the assembled parts.

Lesson 3 (386127): Geometric Dimensioning and Tolerancing, Part 3 Overview:

In this lesson you'll learn about tolerances that relate to part profiles, forms and orientation. Many parts have functional features that can't be fully specified by geometric tolerances and material modifiers. Parts may have surfaces, profiles, and features oriented to a datum plane or have profiles and surfaces that must retain a defined shape. Round parts may be more accurately produced when tolerances are specified for cylindricity and circularity along with the size tolerances. Machined parts might be specified using size

and location tolerances while benefiting from increased controls for flatness or straightness.

Lesson 4 (386128): Geometric Dimensioning and Tolerancing, Part 4 Overview:

In this lesson, you'll learn about the geometric characteristics of location including position tolerances, symmetry tolerances, and runout tolerances as well as the concept of concentricity. Locational tolerances specify the position, concentricity, and symmetry of features on a part. Most mating or assembled components make use of location tolerances to ensure interchangeability among parts in a production run. The tolerances are commonly used on everything from standard fasteners such as screws, nuts, bolts, and pins to manufactured brackets, plates, and machine components. The proper use of location tolerances makes the manufacture and inspection of symmetric parts more efficient. Location tolerances also help control patterns of features such as a grid of holes, or features around the diameter of a part, while reducing the need for very close conventional tolerances.

Special Notes:

This course replaces 386E01.

Block X34

Hand and Power Tools

Duration:

70 hours (includes 12 tests)

Course Prerequisites:

Electrical Wiring Practices (086E02)
Basic Industrial Math (Block X31)
Practical Measurements (Block X32)
Trades Safety: Getting Started (186001)

What Students Learn:

In all industrial trades, a trainee will often have to use several and various tools to get the task done properly. This block introduces commonly used hand and power tools. Safety is stressed while the maintenance worker is learning what tools to use, what tasks the tool can effectively accomplish, and how to use the tools correctly.

Special Notes:

This course replaces Hand and Power Tools, Block X24.
Each study unit contains a progress exam.

Components:

Common Hand Tools, Part 1 (18164)
Common Hand Tools, Part 2 (186165)
Precision Measuring Instruments, Part 1 (186188)
Electric Drilling and Grinding Tools (186166)

Power Cutting Tools (186167)
Pneumatic Hand Tools (186056)
Plumbing and Pipefitting Tools (286113)
Electricians' Tools (006026)
Tool Grinding and Sharpening (186057)
Woodworking Hand Tools (186169)
Woodworking Power Tools (186170)
Lifting Equipment (186168)

186164

Common Hand Tools, Part 1

Objectives:

Preview

In the first part of a student's introduction to hand tools, you'll learn about various types of tools as well as how to use them safely. You'll also learn how workpieces are held in place, the manner in which workpieces are marked prior to actually starting a given job, and how to make the most of a workbench's many useful features.

Next, students will be introduced to a group of hand tools which most technicians use on a daily basis -- wrenches, pliers, screwdrivers, and hammers. Again, you'll learn the correct ways to safely use and take care of these tools. Equally important, students will learn how not to use these tools and the results of their improper use.

Objectives

When a student completes this study unit, he and she will be able to:

- Identify common hand tools and their function.
- Explain how to safely use common hand tools.
- Maintain most types of hand tools.
- Describe the benefits of several special features available for some hand tools.

Contents

Working with Hand Tools; Wrenches; Pliers;
Screwdrivers; Striking Tools; Tool Storage and
Benchwork.

186165

Common Hand Tools, Part 2

Objectives:

Preview

In this study unit, we'll continue the discussion of hand tools commonly used by technicians. While a broad range of technicians use many of the tools discussed here, such as chisels and punches, many others are more specialized and are commonly used by maintenance and machine trades technicians.

Students will learn how to choose the correct chisel or punch for the job, how to care for it, and use it safely.

Next, you'll learn about the variety of different cutting tools such as snips, knives, and hacksaws. Another important group of tools is shaping tools, such as files. Students will learn the different types of files, and again, how to care for them, and use them safely.

Also discussed in this unit are various specialized maintenance tools. These are tools used for specific types of maintenance jobs such as pulling or prying objects from machines, safely inspecting machines, and retrieving objects in areas that aren't easily accessible to the technician.

Objectives

When a student completes this study unit, he and she will be able to:

- Identify and use various chisels and punches safely.
- Use and care for cutting tools.
- Understand the need for specialized maintenance tools.
- Correctly use threading and other precision tools.

Contents

Struck Tools; Cutting Tools; Sheet Metal Tools; Shaping
Hand Tools; Hand Tools for Threading and other
Precision Work; Specialized Maintenance Hand Tools.

186188

Precision Measuring Instruments, Part 1

Objectives:

Purpose and Language of Measurement; Scale Instruments
and Accessories; Vernier Caliper; Micrometers, Gages, and
Protractors.

186166

Electric Drilling and Grinding Tools

Objectives:

Preview

The electric drill is one of the most widely used power tools. It has many uses and is simple to operate. Electric drills can be found in a variety of shapes and sizes, from a light household duty to the heavy-duty industrial grade hand drill and drill press. One variation of the electric drill is the hammer drill or rotary hammer. The hammer drill is a tool used for making holes in concrete and masonry.

Grinders are commonly used for shaping and finishing metal and other materials. Hand grinders are available in sizes ranging from those designed to do the intricate work of the die grinder to that of the 7-inch heavy-duty disc grinder. Bench grinders are standard equipment in most shops, ranging from a 6-inch bench model to the heavy-duty 12-inch pedestal grinder.

Objectives

When a student completes this study unit, he and she will be able to:

- Safely set up and operate a portable electric drill, electric drill press, and electric hammer.
- Choose the proper drill bit for many drilling applications.
- Set up and use a variety of hand and bench grinders.
- Safely use the proper grinder for various jobs.
- Follow the necessary steps for proper tool maintenance.
- Purchase the proper drilling tool for your application.

Contents

Electric Drills; Drill Presses; Drill Bits; Hammer Drills and Rotary Hammers; Electric Grinders; Abrasives.

186167

Power Cutting Tools

Objectives:

Preview

Power cutting tools fall into two categories: portable and stationary. Portable and stationary cutting tools perform many similar operations, but portable tools, carried easily by hand, are used most often at the job site. Stationary tools are used in workshops and on plant tools. Stationary saws range in size from small shop jigsaws to huge band saws used in paper mills to saw large trees into lumber. This unit introduces students to the most common portable power saws used in construction and repair work, namely circular, saber, jig-, and reciprocating saws, and the stationary cutting tools found in most maintenance and fabrication shops.

Objectives

When a student completes this study unit, he and she will be able to:

- Identify the most common portable and stationary power saws.
- Identify the various parts of a saw and explain how they work.
- Discuss the types of cuts made by each type of saw.
- Choose the most appropriate saw and blade for the type of work being done.
- Recognize a portable circular saw, name its parts, and (with practice) operate it safely.
- Select and (with practice) use the proper saw; saber saw, portable band saw, reciprocating saw, cut-out saw, cut-off saw, for a given application.
- Operate (with practice) the stationary circular, radial, band and scroll saws safely.

- Observe the various safety precautions when using power saws and stationary power tools.

Contents

Power Saw Safety; Portable Power Saws; Stationary Circular Power Saws; Other Stationary Power Saws.

186056

Pneumatic Hand Tools

Objectives:

Preview

Pneumatic tools are used in many areas of maintenance, construction, and production work. These tools harness the power of compressed air and convert this power to useful work. Compressed air can be a very powerful energy source. However, due to this power, you must be extremely careful when using these tools.

Pneumatic tools are normally made much heavier than standard-duty hand and power tools. You will notice this fact as soon as you lift an impact wrench or framing nailer. The cases of the tools are made intentionally heavy to contain the stresses of the impact hammers or piston and to absorb the normal day-to-day abuse that the tool takes. You have probably seen someone remove a tire's lug nuts with a pneumatic impact wrench. The operator picks up the wrench and blasts off four or five bolts. Next, the wrench is dropped the six inches or so to the floor while the operator's hands move to quickly grab the wheel and rim. Come back to this same shop a year later, and you will probably see the same wrench being used after thousands of tires have come and gone. The tool's case may be nicked and grooved, but if properly cleaned and lubricated, the tool could last for many thousand more tires.

This text discusses the selection, use and safe practices of using different types of pneumatic tools.

Objectives

When a student completes this study unit, he and she will be able to:

- Describe the various pneumatic tools used for plant maintenance.
- Identify and describe the safe use of impact, cutting, and grinding tools.
- Explain how pneumatic hammers, nailers, and staplers are selected and used in a safe manner.
- Describe the use of pneumatic assembly tools such as grinders, sanders, screwdrivers, and drills and how other types of production tools are selected and used.
- Identify the proper procedures for pneumatic tool and system care.
- Identify safe tool use procedures and how vibration and excess noise can cause bodily injury.

Contents

Pneumatic Tools for Maintenance; Pneumatic Tools for Construction; Pneumatic Tools for Production and Assemble; Pneumatic Tool Care; Using Pneumatic Tools Safely.

- Compare the methods used in grinding screwdrivers, snips, chisels, plane irons, and twist drills.

Contents

Tool Sharpening Equipment; Grinding and Sharpening Procedures.

286113

Plumbing and Pipefitting Tools

Objectives:

- Identify the various tools available for various tasks by appearance.
- Demonstrate your knowledge of job safety and tool safety.
- Identify the tools required to join and assemble pipes of different material composition.
- Determine when and how to use pipe-joint assembly tools.
- Identify the tools required to perform layout, cutting, and boring tasks.
- Identify the tools needed for testing and maintaining piping systems.
- Determine when and how to use finishing, testing, and maintenance tools for piping systems.

006026

Electricians' Tools

Objectives:

Electricians' Equipment: Basic Hand Tools; Wire-Working Tools; Conduit-Working Tools; Power Tools; Knowledge as a Tool with Basic Introduction to the Metric System; Units of Electricity; Static Electricity; Electric Current, Measuring Instruments, and the Symbols and Terminology Used by Electricians.

186057

Tool Grinding and Sharpening

Objectives:

Preview

Trades people must keep their hand tools in good working condition. They must follow a regular maintenance schedule for servicing them. Tools with cutting edges must have the edges sharpened. Other tools must be trued and shaped for their special uses. Screwdrivers, chisels, punches, snips, and twist drills are shaped or sharpened on a grinding machine.

Objectives

When a student completes this study unit, he and she will be able to:

- Use a grinding machine, following all safety procedures.
- Hone or whet tools with an oilstone.
- Explain the procedures for grinding metal stock.

186169

Woodworking Hand Tools

Objectives:

Preview

A person who does not really know the workings of industry might think that hand tools are not used that much any more. That is not so; in a maintenance job, trades people will use hand tools to do many different tasks. Hand tools are necessary for superior craftsmanship, and ideal for many maintenance operations. With hand tools, you supply the power and guide the tool.

This study unit focuses on the basic hand tools used when working with wood. Which woodworking hand tool you use will depend on the work you are doing. Often the same job can be done equally well with different tools.

Objectives

When a student completes this study unit, he and she will be able to:

- Distinguish between the types of hand saws and use them correctly.
- Bore and drill holes in wood.
- Explain the differences between planes and use planes effectively.
- Use abrasive tools correctly.

Contents

Layout Tools, Saws, and Hammers; Wood Boring and Removal Tools.

186170

Woodworking Power Tools

Objectives:

Preview

The correct use of routers, power planers, and sanders will be important to trades people in your maintenance job. You will cut contours and irregular shapes on both edges and surfaces with the portable router; or you will plane doors, lumber, and assembled work accurately with the portable power planer. Trades people will also finish wood, metal, and plastic, and prepare surfaces for painting with power sanders.

Objectives

When a student completes this study unit, he and she will be able to:

- Operate (with practice) the portable router.

- Outline the procedures for using a portable power planer.
- Recognize by sight the common stationary power sanders and compare their operation.
- Choose the right portable sander for a given job, and operate (with practice) the portable belt sander.

Contents

Routers; The Portable Power Planner; Power Sanders and Sanding Operations.

186168

Lifting Equipment

Objectives:

Preview

Maintenance work involves hoisting or lifting and moving machines, and other heavy loads. A new machine may have to be moved in, and installed on its foundation; a broken machine may have to be hoisted and taken to the maintenance area for repair. For such work, trades people will need hoisting equipment, plus certain accessories, such as rope and chain slings. Therefore, it is important for trainees to be familiar with the common types of hoisting equipment and slings.

In maintenance work, you will often have to remove parts, such as gears and bearings, from an assembly. Pullers are very useful tools for such purposes. The commonly used pullers are of the jaw and push types.

Objectives

When a student completes this study unit, he and she will be able to:

- Identify the many forms of jacks and hoists.
- Safely operate jacks and hoists.
- Understand the construction details of fiber ropes, wire ropes, and chains.
- Properly use and maintain fiber-rope, wire-rope, and chain slings.
- Properly use jaw and push pullers.

Contents

Jacks; Hoists; Fiber Ropes; Wire Ropes; Hoisting Chains; Pullers.

286091

Lubrication, Part 1

Duration:

10 hours (includes 1 test)

What Students Learn:

Preview

Since the development of machinery, there has been a war against friction. Friction causes machinery to vibrate excessively, sound louder, use more energy to do a given job, and, most importantly, wear out faster. To counter friction, lubricants have been developed.

Lubricants were once basic animal fats and plant oils used on simple machines. Today's lubricants are chemical compositions specially designed for specific types of machines and their work environment. There are now hundreds of types of oils and grease to select from, each tailored specifically for the machine or an individual component of any given machine.

This study unit is designed to give students the information they need to understand how lubricants are blended into these very special compounds and how they are selected for various applications.

Objectives

When a student completes this study unit, he and she will be able to:

- Describe the various types of friction.
- Discuss how materials wear.
- List the various functions lubricants perform in industry.
- Explain how lubricants reduce friction.
- Classify lubricants depending upon their composition, properties, and additives.
- Understand why certain lubricants are chosen for certain tasks.
- Explain how to safely handle and store lubricants.

Contents

Friction and Wear; The Purpose of Lubricants; How Lubricants are Classified; How Lubricants Work; Proper Lubricant Selection; Handling and Storing Lubricants Safely.

Special Notes:

This updated course replaces 2531A.

5004C

Bench Work, Part 3

Duration:

10 hours (includes 1 test)

What Students Learn:

Fitting Practice; Tolerance, Allowance, Clearance, and Fit; Babbitting; Hack Saw; Band Saw Machine; Clamping Work for Sawing; Soldering; Soft Solder; Soldering Copper; Sweat Soldering; Brazing; Hand Solders and Fluxes; Torch Brazing; Induction Brazing; Furnace Brazing.

286092

Lubrication, Part 2

Duration:

10 hours (includes 1 test)

What Students Learn:

Preview

Lubricating equipment is one of the most important industrial maintenance activities performed. Lubricants reduce friction, which saves on energy costs. They reduce wear, which saves on equipment maintenance costs. Proper lubrication significantly reduces machine downtime resulting from broken or worn out components. In addition, proper lubricating practices help keep a machine in tolerance for a longer period of time.

In today's world of twenty-four-hour-a-day, seven-days-a-week, plant operation, the role of lubrication takes on even greater importance. Equipment must be lubricated on a timely schedule, in the proper amounts, and with the correct lubricants to sustain long work cycles between planned shutdowns. This study unit will show you how to properly apply lubrication and maintain lubrication systems.

Objectives

When a student completes this study unit, he and she will be able to:

- Explain how to manually apply various types of lubricants in an industrial environment.
- Describe total-loss lubrication.
- Identify a nonloss lubrication system's components and describe their operation.
- Explain how to maintain a nonloss lubrication system.
- Identify the proper lubrication procedures to use for special industrial applications including sealed bearings, oil-impregnated bearings and food-processing plants.
- Explain how lubricant-conditioning systems work and how to maintain them.
- Describe how automatic lubrication systems work and how to maintain them.
- List the tasks involved in preventive and predictive lubrication maintenance.

Contents

Manual Methods of Lubrication; Lubricating Total-Loss Systems; Nonloss Lubrication Systems; Lubrication in Special Environments; Lubrication Conditioning; Automatic Lubrication Systems; Preventive and Predictive Lubrication Maintenance.

Special Notes:

This updated course replaces 2531B.

X0201

Algebra: Monomials and Polynomials

Duration:

6 hours

Course Prerequisites:

Basic Industrial Math (Block X21)

Practical Measurements (Block X22)

What Students Learn:

- Remove grouping symbols from algebraic expressions, dividing by a monomial when indicated.
- Multiply binomials by monomials, trinomials, and otherinomials.
- Calculate the square root and the third power of given monomials.
- Find special products involving binomials.
- Divide one polynomial by another polynomial of lower degree.

X0202

Algebra: Factoring

Duration:

6 hours

Course Prerequisites:

Basic Industrial Math (Block X21)

Practical Measurements (Block X22)

What Students Learn:

- Find the prime factors of certain binomials and trinomials.
- Factor a given trinomial.
- Use the Factor Theorem to factor a given polynomial.
- Use factoring to find the roots of an equation.
- Divide one polynomial by another polynomial of lower degree.
- Find the lowest common multiple of several polynomials.

X0203

Algebra: Addition and Subtraction of Fractions

Duration:

6 hours

Course Prerequisites:

Basic Industrial Math (Block X21)

Practical Measurements (Block X22)

What Students Learn:

- Recognize equivalent algebraic fractions.
- Perform additions and subtractions involving algebraic fractions.
- Reduce an algebraic fraction to its lowest terms.
- Find the least common denominator for a group of algebraic fractions.

X0204

Algebra: Multiplication and Division of Fractions

Duration:

6 hours

Course Prerequisites:

Basic Industrial Math (Block X21)

Practical Measurements (Block X22)

What Students Learn:

- Perform multiplications and divisions involving algebraic fractions.
- Reduce an algebraic fraction to its lowest terms.
- Find the least common denominator for a group of algebraic fractions.
- Solve equations involving fractions or decimals.
- Simplify complex fractions.

386030***Fundamentals of Metal Cutting*****Duration:**

10 hours (includes 1 test)

Course Prerequisites:

Basic Machining Skills (Block X08)

What Students Learn:**Preview**

In this study unit, students learn about the fundamental methods and principles related to machining metal. The study unit begins with a brief historical review of the evolution of machining. Then, you will be introduced to three key factors that are used to define all metal cutting operations: feed, depth of cut, and speed. These factors have interrelated roles in shaping metals. Students will then learn about the critical role of the cutting tool itself and how cutting tools are designed to improve metal cutting performance and to reduce tool wear. The study unit discusses a broad variety of materials from which cutting tools are made; steels, carbides, ceramics, diamond, and others, and explains which tool materials are best suited to certain machining jobs.

Trainees will then learn about single-point cutting tools and how small changes in tool design and construction can have a great effect on cutting effectiveness and on the quality of the machined part. Lathe tools are the primary focus of the study of single-point cutting tools, but the unit also describes shaping, planning, boring, and some special-purpose tools.

Multiple-point cutting tools are introduced. There is an extensive section on milling tools and all their variations. In addition to milling tools, this study unit covers other varieties of multiple-point cutting tools, including taps, reamers, broaches, saws, files, gear cutters, and many types of drills. You will learn how to use guidebooks and other information to help you plan your machining tasks and how to work successfully when you don't have written guidance. Finally, students will learn about the role of cutting fluids in various machining operations and how to select and use cutting fluids to improve machining performance.

Objectives

When a student completes this study unit, he and she will be able to:

- Describe the metal-cutting process and cutting tool requirements.
- Explain the role of feed, speed, and depth-of-cut in machining.
- Explain the advantages and limitations of carbon steel and carbide cutting tools.
- Describe the principles of single-point cutting tools and the factors governing tool wear.
- Explain multiple-point cutting tools and their uses.
- Describe the difference between lathe turning and milling.
- Explain tapping, threading, reaming, and broaching.
- Explain the role of cutting fluids in machining operations.

Contents

Introduction to Metal Cutting: Safety; Historical Perspective; New Developments; Metal Cutting Fundamentals; Cutting Tool Fundamentals; Cutting Tool Properties: Tool Material Requirements; Tool Materials; Single-Point Cutting Tools: Lathe Tools; Other Single-Point Cutting Tools; Multiple-Point Cutting Tools: Milling Tools; Other Multiple-Point Cutting Tools; Cutting Fluids: Advantages of Cutting Fluids; Other Considerations; Types of Cutting Fluids; Cutting Fluid Application.

386050, 386051***Drilling, Parts 1 & 2*****Duration:**

20 hours (includes 2 tests)

What Students Learn:

PART 1 (386050). Drilling Process; Upright Drill Press; Multiple-Spindle Drill Press; Radial Drill Presses; Numerical Control Drill Presses; Drilling Tools; Reconditioning of Drills. PART 2 (386051). Work-Holding Devices; Tool-Holding Devices; Drill Press Setup; Cutting Fluids; Related Tools and Practices; Care of Equipment.

Special Notes:

Covers subject at an advanced, in-depth level.

286025***Fundamentals of Welding, Part 1*****Duration:**

10 hours (includes 1 test)

What Students Learn:

Introduction to Welding; Definitions of Weld, Braze, and Braze Weld; Oxyfuel Gas Welding (OFW); Arc Welding (AW); Resistance Welding (RW); Solid-State Welding (SSW); The Brazing Welding Process; Soldering Process; Other Welding Processes.

Special Notes:

- This updated course replaces course 6151.
- The entire course consists of study units 286025 and 286066.

286066

Fundamentals of Welding, Part 2

Duration:

10 hours (includes 1 test)

What Students Learn:

Recognize basic joint designs used in welding – Butt, Corner, "T", Lap, and Edge; Selecting the best types of grooves for welding applications; Proper procedures for working on various positions when welding joints on pipes; Interpreting welding symbols, dimensions, and schematics.

Special Notes:

The entire course consists of study units 286025 and 286066.

6154

Safety in Welding and Cutting

Duration: 10 hours (includes 1 test)

Course Prerequisites:

Fundamentals of Welding, Parts 1-2 (286025, 286066)

What Students Learn:

Importance of Safe Work Habits; Organizations That Make Rules for Welding Safety; Safe Practices for Handling and Using Compressed Gases, Liquefied Gases, Acetylene, and Cryogenic Gases; Electric Arc Welding Safety; Fire Prevention; Welding Hazardous Containers; Eye and Body Protection; Harmful Fumes, Vapors, and Dusts.

186107

Safe Handling of Pressurized Gasses and Welding

Duration:

5 hours (includes 1 test)

What Students Learn:

Preview

This study unit will teach students important safety facts and practices involving the high pressure and low pressure gases used in welding. Covered are the fundamentals of electric arc welding, equipment requirements and proper operating procedures. Trainees will learn general welding safety and specific practices. You will learn about controlling heat sources from welding operations to protect yourself from harm and your facility from fire.

Objectives

When a student completes this study unit, he and she will be able to:

- Identify common welding gases and understand how they are used in welding operations.
- Point out the hazards associated with welding gases.
- Safely handle and store different types of gas cylinders.
- Safely operate a basic gas welding setup.
- Recognize the safety considerations involved in the setup and operation of electric arc welding equipment.
- Identify welding equipment malfunctions and take corrective action.
- Utilize fire prevention and protection methods specific to welding operations.
- Discuss the importance of the hot work permit program in your facility.
- Explain the correct use of protective clothing and equipment for welding.
- Utilize proper ventilation when welding.
- Effectively deal with confined spaces when performing welding operations.

Contents

Safety in Welding and Cutting; Safe Handling and Storage of Gas Cylinders; Use of Oxy-fuel Welding and Cutting Systems; Safe Operation of Welding Equipment; Safe Use of Electric Arc Welding Equipment; Protection of Welders and Welding Facilities.

286104

Practical Metallurgy for Welders, Part 1

Duration:

10 hours (includes 1 tests)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)

Fundamentals of Welding, Part 2 (286066)

What Students Learn:

- Understand the terminology used to describe metals and their properties.
- Use physical, mechanical, and chemical properties to identify metals.

- Understand how materials deform and fracture under mechanical load.
- Apply your knowledge of metal properties to understand problems encountered during welding.
- Recognize differences in material processes and how processing can later change the behavior of metal during welding.

286105

Practical Metallurgy for Welders, Part 2

Duration:

10 hours (includes 1 tests)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)

What Students Learn:

- Understand the welding process in terms of heat transfer, melting, and solidification.
- Understand how electrode coatings and fluxes change the way molten metal behaves and the properties of the finished weld.
- Differentiate between ferrous metals based on chemistry, processing, and weldability.
- Identify general types of nonferrous metals and distinguish common alloys within each family.
- Recognize the causes and corrective actions for common welding defects.

6272A-B

Gas Welding Equipment

Duration:

20 hours (includes 2 tests)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)

What Students Learn:

PART 1 (6272A). Source of Heat for Gas Welding; Gases Used in Welding: Oxygen, Acetylene, Hydrogen, Other Fuel Gases; Oxyacetylene-Welding Equipment; Regulators; Hoses and Hose Fittings; Check Valves; Welding Torches; Accessory Equipment.

PART 2 (6272B). Setting Up a Welding Outfit; Taking Down the Welding Outfit; Backfires and Flashbacks; Centralized Distribution of Oxygen; Centralized Fuel - Gas Distribution; Miscellaneous Welding Equipment.

6276A-C

Gas Welding Techniques

Duration:

30 hours (includes 3 tests)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Gas Welding Equipment (6272A-B)

What Students Learn:

PART 1 (6276A). Instructions for Practice Welds; Joint Preparation; Corner Joints, Butt Joints, Lap and Tee Joints, and Fillet Welds; Tests to Make on Practice Welds; Welding with Single and Two or More Weld Layers; Progress Tests and Supplementary Heating; Welding Production Data; Application to Estimating and Calculation of Costs.

PART 2 (6276B). Weight and Schedule Systems of Classifying Pipe; Positions in Which Pipe is Welded, the Joint Preparation, and the Techniques to Use; Changes in Direction with Commercial Fittings, by Bending, and with Fabricated Fittings; Stress Relieving Tests and Tables of Weld Requirements; Advantages and Disadvantages of Braze Welding; Filler Metals; Fluxes; Joint Preparations; Braze Welding Techniques; Groove Preparations; Fluxes; Heat Treatment; Joint Preparation; Estimating Requirements; Welding Cast Iron with Cast Iron Welding Rods and Braze Welding Cast Iron; Malleable Iron Welding.

PART 3 (6276C). Welding Procedures for Medium Carbon, High Carbon, and Stainless Steels; Preheating and Supplementary Heating; Welding Rods, Fluxes, and Joint Designs for Copper and Copper Alloys; Using Oxyacetylene and Oxyhydrogen for Welding Aluminum and Aluminum Alloys; Welding Rods, Fluxes, Joint Designs, and Techniques; Welding Procedures, Joint Designs, Fluxes, Welding Rods, and Techniques of Welding Magnesium and Magnesium Alloys, Nickel and Nickel Alloys, and Lead; Weld Sequence; Jigs and Fixtures; Joint Design; Drum Heading; Pre-deforming to Control Distortion.

286028

Common Thermal Cutting Processes

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)

Fundamentals of Welding, Part 2 (286066)

What Students Learn:

Introduces the Process of using Heat to Cut Metal and other Materials; Describes the Common Thermal Cutting Processes used in Industry and the capabilities of each; The Tables to use when Estimating Requirements for specific Cutting Operations; Describe the types of Equipment used for Oxyfuel Gas Cutting; Identify the appropriate Procedures used in Oxygen Cutting Processes.

186108

Working Safely with Electricity

Duration:

5 hours (includes 1 test)

What Students Learn:

Preview

This study unit will introduce students to many workplace situations that require you to work safely with electricity. You will learn how and why electricity can be dangerous. Trainees will also learn about various methods used for protection. Safety begins with the careful installation of electrical components by means of approved wiring methods. You should use safety procedures and practices that insulate you from electricity's power anytime you work with, or near, electrical equipment and components.

Objectives

When a student completes this study unit, he and she will be able to:

- Explain how electricity can harm you and your property.
- Discuss the importance of properly using quality electrical components.
- Follow the basic methods of protection when wiring electrical installations.
- Tell why it is important to ground electrical equipment and systems.
- Select the type of electrical equipment to use in a hazardous location.
- List the safety practices required in an electrical work area.
- Talk about the importance of a clear working space around electrical equipment.
- Educate your own level of safety training to be sure it matches the electrical work you are performing.

Contents

Introduction to Electrical Safety; Using Proper Materials and Components; Equipment Grounding; Hazardous Locations; Safe Working Clearances; Safety Practices.

186111

Advanced Electrical Safety

Duration:

5 hours (includes 1 test)

Objectives:

Preview

Electrical safety is a very important part of any type of electrical work. You must remain safe and you must create safe electrical installations. This lesson describes what you must know to work safely as an electrician in a commercial or industrial setting. You'll study electricity, electric shock, and first aid. This is followed by information on the use of listed materials when performing an installation or replacing components in a previous installation. You'll then study the proper methods of grounding and learn how hazardous areas are wired to prevent explosion or fire. This lesson ends with an overview of safe work practices.

Block A31

DC Principles

Duration:

30 hours (includes 6 tests)

Course Prerequisites:

Basic Industrial Math (Block X31)

What Students Learn:

In this block consisting of six study units, the trainee will learn the basics of electrical theory. These units introduce electrical terms, symbols, and the operation of simple circuits. Ohm's law receives extensive coverage including practical troubleshooting examples used to industry. A new unit specific to capacitors and inductors provides more in-depth coverage. Up-to-date information on conductors, insulation, and specialty batteries forms a revised study unit. Study units covering magnetism, electromagnetism, motors, and generators are included with industry related examples.

Special Notes:

This updated course replaces DC Principles, Block A01. Each study unit contains a progress examination.

Components:

Nature of Electricity (086112)

Circuit Analysis and Ohm's Law (086113)

Capacitors and Inductors (086114)

Magnetism and Electromagnetism (086115)

Conductors, Insulators, and Batteries (086116)

DC Motors and Generator Theory (086117)

086112

Nature of Electricity

Objectives:

- Explain the operation of a simple circuit.
- Define the terms: conductor, insulator, and resistor.
- Demonstrate that unlike charges attract and like charges repel.
- List the dangers and benefits of static electricity.
- Define the terms: volt, ampere, and ohm.
- Describe common notations and prefixes used to identify electrical and electronic values.
- Identify carbon resistors, potentiometers, and rheostats, and explain how they work.
- Identify the common electrical symbols used in schematic diagrams.
- Explain the difference between a series and parallel circuit.

086113***Circuit Analysis and Ohm's Law*****Objectives:**

- Find the total resistance in series, parallel, and series-parallel circuits.
- Use Ohm's law to calculate the current, voltage, or resistance in circuits.
- Calculate the amount of power supplied and dissipated in a DC circuit.
- List the steps for finding current, voltage, and resistance with a digital or analog meter.

086114***Capacitors and Inductors*****Objectives:**

- Explain how a capacitor holds a charge.
- Describe common types of capacitors.
- Identify common capacitor ratings.
- Calculate the total capacitance of a circuit containing capacitors in series or in parallel.
- Calculate the time constant of a resistance-capacitance or RC circuit.
- Explain how inductors are constructed.
- Describe the system used to rate inductors.
- Describe how an inductor regulates the flow of current in a DC circuit.
- Calculate the total inductance of series or parallel connected inductors.
- Calculate the time constant for a resistance-inductance or RL circuit.

086115***Magnetism and Electromagnetism*****Objectives:**

- Identify the north and south poles of permanent magnets and electromagnets.
- Name magnetic and nonmagnetic materials.
- Describe how to magnetize a piece of steel by induction.
- Explain the difference between simple, compound, and closed magnetic circuits.
- Locate the direction of magnetic lines of force around a conductor (if the direction of current is known).
- Use the right-hand rule to locate the poles of a solenoid.
- Describe the operation of simple electromagnetic relays, buzzers, and stepping switches.
- Explain how a DC motor operates.
- Give a simplified explanation for generator action and motor action with electromagnetic induction.

086116***Conductors, Insulators, and Batteries*****Objectives:**

- Describe the various types of conductors and discuss their conductivity.
- Explain the American Wire Gage System of sizing copper conductors.
- Determine the size of conductor needed for an application.
- Identify the various types of insulating materials and their temperature ratings.
- Explain the difference between a dry cell and a storage battery.
- How to connect cells together to obtain more voltage, more current, or more of both voltage and current.
- Describe the proper safety precautions used when working with storage batteries.
- Describe how to properly clean and care for storage batteries.
- Discuss the instruments used for testing storage batteries.
- Explain how NiCad, lithium, and other types of special batteries operate, and describe their ratings.

086117***DC Motors and Generator Theory*****Objectives:**

- Identify a series-, shunt-, and compound-wound motor and discuss their application.
- Explain how a permanent-magnet and stepper motor operate.
- List the steps to reversing a DC motor's direction.
- Discuss how the speed of a DC motor can be controlled.
- Explain the basic principle for generating a direct current.

- Name the factors that affect the strength of the induced voltage.
- Describe the purpose of a commutator and brush assembly.
- Discuss the difference between the field connections of series-, shunt-, and compound-wound machines.
- Give the reason for shifting brushes.
- Discuss the use of commutating poles and compensating windings for better generator operation.
- List the various types of machine losses.

Block A32

AC Principles

Duration:

40 hours (includes 8 tests)

Course Prerequisites:

Basic Industrial Math (Block X31)

DC Principles (Block A31)

What Students Learn:

Alternating current is the form of current most often used to furnish electrical energy. Students receive a complete introduction to AC terminology and basic AC circuit configurations. Individual study units on the uses of capacitors and inductors in AC circuits underlines the importance of these components in AC theory. The generation, control, and distribution of AC power are highlighted in study units on alternators, transformers, and energy distribution. How electricity is generated at a power plant and sent to consumers is covered. The student will also be introduced to basic electronics through a study unit on rectification and basic electronic components.

Special Notes:

This updated course replaces AC Principles and Components, Block A02. Each study unit contains a progress examination.

Components:

Alternating Current (086118)

Alternating Current Circuits (086119)

Inductors in AC Circuits (086120)

Capacitors in AC Circuits (086121)

Transformers (086122)

Alternators (086123)

Electrical Energy Distribution (086124)

Rectification and Basic Electronic Devices (086125)

086118

Alternating Current

Objectives:

- Draw a graph of an AC voltage and describe how AC voltage is created.
- Explain AC cycle terms: "alternation," "peak," "positive," and "negative."

- Define the time period of an AC voltage as expressed in degrees.
- List the characteristic values of an AC cycle and describe the relationship between the values.
- Define phase angle and describe how it relates to reactive circuits.
- Calculate power for single-phase and three-phase circuits.
- Describe how a 220 VAC single-phase circuit operates.
- Illustrate the phase relationship of three-phase wave forms.
- Determine real power by reading a power factor meter.
- Describe delta and wye three-phase circuit connections.

086119

Alternating Current Circuits

Objectives:

- Identify electric circuits in terms of their circuit characteristics.
- List several circuit characteristics that are used to describe a circuit for a particular load application.
- Connect electrical components in series and parallel circuits.
- Control loads from one or two switch points.
- Describe how delta- and wye-connected three phase circuits are different.
- Explain how grounding a circuit increases its safety.
- Recognize the difference between control circuits and power circuits.

086120

Inductors in AC Circuits

Objectives:

- Explain how an inductor is made and how it operates in a DC and AC circuit.
- Describe inductive reactance and impedance, and how AC frequency effects inductance.
- Use Ohm's law in an AC circuit that includes an inductor.
- Calculate the impedance of a series RL circuit.
- Calculate the impedance of a parallel RL circuit.

086121

Capacitors in AC Circuits

Objectives:

- Describe how a capacitor stores a charge and how series connected and parallel connected capacitance values are calculated.

- Discuss capacitive reactance and use Ohm's Law in AC circuits that contain a capacitor.
- Calculate the impedance of a series RC circuit.
- Explain how changing the frequency of an AC signal changes capacitive reactance.

086122

Transformers

Objectives:

- Explain what the main components of a transformer are.
- Tell how mutual inductance makes it possible to change an AC voltage from one value to another when using a transformer.
- Determine the turns ratio of a transformer when the primary and secondary voltages are known.
- Calculate primary or secondary voltages or current when either one of these and the turns ratio are known.
- Explain why transformers are laminated.
- Connect three single-phase transformers for three-phase operation.
- Calculate line current (if phase current is known) in delta-connected transformers.
- Explain the operating principles of an auto transformer.

086123

Alternators

Objectives:

- Explain how single- and three-phase alternators operate.
- List and describe the major components of an alternator.
- Discuss alternator ratings in terms of power, voltage, speed, and temperature.
- State the steps required for starting, stopping, and operating alternators.
- Describe the similarities and differences of the three main types of alternators.

086124

Electrical Energy Distribution

Objectives:

- Explain the difference between feeder and branch circuits.
- Describe the different types of systems available for distributing power within a plant.
- Recognize and identify utilization equipment.
- Discuss the use of transformers in energy distribution.
- Identify by name and describe the uses of various types of raceways.
- Distinguish between panel boards and switchboards.
- Describe the electrical system of a power utility.
- Describe how electricity is generated at a power station or utility.

086125

Rectification and Basic Electronic Devices

Objectives:

- Explain how diodes are used as rectifiers.
- Discuss the basic operation of a diode and a triode electron tube.
- Connect a PN junction for forward and reverse bias.
- Explain how a transistor operates as an amplifier.
- Recognize transistor input and output circuits.
- Compare rectifier circuits with and without filter circuits.
- Describe the operation of an SCR and a triac.
- Calculate the ripple frequency of a half-wave and full-wave single-phase and three-phase rectifier.

086126

Basic Test Equipment

Objectives:

- How to use the multimeter (also known as a volt-ohm-milliammeter or VOM).
- Define the terms voltage, current and resistance, and explain their relationship in a circuit.
- Discuss how voltage, current and resistance is measured with a multimeter.
- Identify the schematic symbols used to represent various reactive devices.
- Describe the major features of analog and digital VOMs.
- Explain how to use both analog and digital VOMs to measure voltage, resistance and current in a circuit.
- Learn about the special probes used with a digital VOM.
- Discuss the important safety precautions you must take when using a multimeter.

086127

Troubleshooting with Volt-Ohm-Milliamp Meters (VOMs)

Objectives:

- Review the functions of a multimeter.
- Name the safe practices you should use when troubleshooting with a VOM.
- How to measure circuit resistance.
- Learn the purpose of, and how to perform, tests for continuity and short circuits.
- Perform resistance tests on resistors, fuses, solenoids, relays, switches, transformers, motors and semiconductors.
- How to take basic current measurements on power supplies, AC feeder lines and other such circuit areas.

- Measure current by using a direct series connection or by using a clamp-type ammeter.
- How to take basic voltage measurements on both AC and DC systems.
- Measure the output voltage of a DC power supply and the voltage of an AC feeder line.
- Measure voltage at disconnect switches, circuit breakers, contactors and transformers.
- Perform voltage tests on circuit boards, PLC systems and motor circuits.

286032

Arc Welding Equipment, Part 1

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Electricity (4210A-C)

What Students Learn:

Terminology and Processes; Power Sources for Arc Welding; Arc Welding Machines; Transformer Types of Welding Power Source.

Special Notes:

- This updated course replaces course 6274A.
- The entire course consists of study units 286032, 286033, and 286053.

286033

Arc Welding Equipment, Part 2

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Electricity (4210A-C)

What Students Learn:

Sources of DC Welding Power; Sources of AC Welding Power; Supplemental Arc-Welding Equipment: Meters, Indicators, Cables, Electrode Holders; Face Shields, Helmets, Goggles, Protective Clothing, Screens.

Special Notes:

- This updated course replaces course 6274B.
- The entire course consists of study units 286032, 286033, and 286053.

286053

Arc Welding Equipment, Part 3

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Electricity (4210A-C)

What Students Learn:

Requirements for Mechanized, Semiautomatic, and Automatic Welding; Submerged-Arc Welding; Robotic and Adaptive Control; Electroslag Welding; Tubular Filler Metals; Gas Tungsten-Arc Welding; Gas Metal-Arc Welding; Spot-Welding Equipment; Electron-Beam, Plasma-Arc, Flux Cored Arc, and Laser Beam Welding, Equipment and Processes.

Special Notes:

- This updated course replaces 6274C.
- The entire course consists of study units 286032, 286033, and 286053.

286030

Shielded Metal Arc Welding Techniques, Part 1

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Practical Measurements (Block X22)
Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Arc Welding Equipment, Part 1 (286032)
Arc Welding Equipment, Part 2 (286033)
Arc Welding Equipment, Part 3 (286053)

What Students Learn:

Equipment and Materials; Weld Metal Testing; Welding Applications of Covered Mild-Steel Electrodes; Basic Arc Welding Operations; Single V-Groove Butt Welds.

Special Notes:

- This updated course replaces course 3536A.
- The entire course consists of study units 286030-286031.

286031

Shielded Metal Arc Welding Techniques, Part 2

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Practical Measurements (Block X22)
Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Arc Welding Equipment, Part 1 (286032)
Arc Welding Equipment, Part 2 (286033)
Arc Welding Equipment, Part 3 (286053)

What Students Learn:

The Vertical Position; The Horizontal Position; The Overhead Position; Fillet Welds: Welding Heavy Metal Plates; Sheet-Metal Welding.

Special Notes:

- This updated course replaces course 3536B.
- The entire course consists of study units 286030-286031.

286059

Gas Metal Arc Welding Fundamentals (GMAW or Mig)

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Safety in Welding and Cutting (6154)

What Students Learn:

Applications and Advantages of Gas Metal Arc Welding; Identify the Variables involved in the GMAW process; Explain the uses for Equipment and Supplies required for GMAW Applications; The use of components such as GMAW Welding Guns and Shielding Gas; How to select Welding Gun Positions for particular applications; List the requirements for preparing Workpieces prior to welding; Introduction to GMAW Welding Techniques and Practices; Using Tables to select appropriate Operating Data for a particular Welding application

5160

Inspection and Testing of Welds

Duration:

10 hours (includes 1 test)

What Students Learn:

Inspection of Equipment; Tests of Welders; Inspection of Preparation for Welding; Inspection of Structural Work, Tank Work; Tacking, Seam Spacing, Pipe Work, Welding in Progress; Visual Inspection of Completed Welds; Gauging of Fillets; Nondestructive Tests; Tests with Air, Water, and Oil; Magnetic and Sonic Tests; Radiography in Examining Welds; Polariscope Tests; Destructive Tests; Tests of Spot Welds; Code Requirements for Fusion Welding; Welding Symbols; Protection of Welders.

286035

Gas Tungsten Arc Welding Fundamentals (GTAW or Tig)

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Safety in Welding and Cutting (6154)

What Students Learn:

Applications and Advantages of Gas Tungsten Arc Welding; Identify the Variables involved in the GTAW process; Explain the uses for Equipment and Supplies required for GTAW Applications; Identify the different types of Tungsten Electrodes; How to select, prepare and use Tungsten Electrodes; List the requirements for preparing Workpieces prior to welding; Introduction to GTAW Welding Techniques and Practices.

5249A-B

Arc Welding of Low Carbon Steel

Duration:

20 hours (includes 2 tests)

Course Prerequisites:

Electricity (4210A-C)
Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Arc Welding Equipment, Part 1 (286032)
Arc Welding Equipment, Part 2 (286033)
Arc Welding Equipment, Part 3 (286053)

What Students Learn:

PART 1 (5249A). Welding Techniques; Joint Designs and Preparation; Steel Manufacture; Rimmed, Capped, Killed, and Semikilled Steels; Cast Steels; Specifications for Low Carbon Steel Electrodes; Electrode Classification; Electrode Groups; Chemical Composition of Electrodes; Electrode Coverings; Storage and Rebaking of Electrodes; Welding Current; Use of Low Hydrogen Electrodes; Electrode Tests; Welding Test Plates; Tension and Impact Tests; Fillet Weld Test; Establishment of Welding Procedures; Developing Welding Procedures; Identification of Welding Process, Base Metal, Filler Metal, and Supplementary Materials; Welding Position Qualifications; Arc Welding Single V-Groove Butt Joints, V-Groove with Backing Strip, Double V-Groove Butt Joints, and Fillet Welds; Application of Submerged Arc Welding; Classification of Submerged Arc Electrodes and Filler Metal; Submerged Arc Welding Fluxes; Submerged Arc Welding versus Metal Arc Welding; Selection of Submerged Arc Electrodes and Fluxes; Submerged Arc Welding Procedure; Electroslag Welding.

PART 2 (5249B). Gas Tungsten Arc (Tig) Welding; Application of Tig Welding; Filler Metals for Tig Welding; Tig Welding of Pipe; Techniques for Root Bead Welding; Gas Backup for Root Bead Welding; Volume of Backup Gas; Root Welding of Pipe; Pipe Welding Involving Two Welding Procedures; Tig Spot Welding; Basic Features of Gas Metal Arc (Mig) Welding; Mig Shielding Gases; Mig Filler Metal; Drop and Short Circuiting Metal Transfer in Mig Welding; Current Effect on Mig Welding; Pulsed Spray Arc Welding; Electrodes for Mig Welding; Mig Welding Procedures; Linde Equipment; Hobart and Airco Operating Data; Flux Cored Welding; Flux Cored Welding Electrodes; Operating Data on Flux Cored Welding Electrodes.

5250

Arc Welding of Alloy Steels and Iron

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Electricity (4210A-C)
Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Arc Welding Equipment, Part 1 (286032)
Arc Welding Equipment, Part 2 (286033)
Arc Welding Equipment, Part 3 (286053)

What Students Learn:

Alloy Steels; Alloy-Steel Electrodes; Arc Welding of Stainless Steel; Heat Treatment of Welded Stainless Steel; Arc Welding of Manganese Steel, Silicon Steel, and High-Carbon Steels; Welding Band and Circular Saws; Arc Welding of Cast Iron; Welding Wrought Iron; Electric Welding in Ship Construction; Repairing Wobblers and Coupling Boxes; Welding of Rail Joints; Building Up Rail Ends; Welding Firebox Sheets, Locomotive Frames, Tanks, and Boilers; Pipe Welding; Welding of Structural Shapes; Carbon Arc Cutting.

5251

Arc Welding of Nonferrous Metals and Overlaying

Duration:

10 hours (includes 1 test)

Course Prerequisites:

Electricity (4210A-C)
Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)
Arc Welding Equipment, Part 1 (286032)
Arc Welding Equipment, Part 2 (286033)
Arc Welding Equipment, Part 3 (286053)

What Students Learn:

Metals considered: Aluminum, Copper, Nickel, Magnesium, and Their Various Alloys; Metallic and Carbon Electrodes; Welding Clad Metals; Welding Galvanized Sheets; Overlaying; Soft Facing; Hard Facing; Electric Arc Cutting.

6278A-B

Fabrication of Pipe by Welding

Duration:

20 hours (includes 2 tests)

Course Prerequisites:

Fundamentals of Welding, Part 1 (286025)
Fundamentals of Welding, Part 2 (286066)

What Students Learn:

PART 1 (6278A). Uses of Welded Piping; Reliability; Effects of Pipe Threads; Determining Wall Thickness; Making Pipe by Piercing, Extrusion, Cupping and Drawing, and Welding; Compositions and Designations of Steel, Copper, Wrought Iron, Aluminum, Nickel, and Lead Pipe; Fabricated and Standard Fittings; Alignment of Pipes, Flanges, and Connections.

PART 2 (6278B). Applications, Advantages, Limitations of Each Welding Process Used in Fabrication of Pipe; Joint Design Backing Structures; Welding Steel, Wrought Iron, and Stainless Steel Pipe; Welding Copper, Aluminum, Nickel, Lead, and Titanium Piping.