

Note that member discounts do not apply to material available from sources other than API through IHS.

## Exploration and Production

### PUBLICATIONS

The following publications may be ordered from IHS.

#### **Introduction to Oil and Gas Production** (Book 1 in the Vocational Training Series)

Serves as a primer for oil and gas operations. It covers the origins and accumulation of oil and gas, the well, well treatment and wellhead, artificial lift, well testing, separation, treatment and storage, gauging and metering, production, offshore production and structures, corrosion, enhanced recovery, production personnel, tools and equipment, pipe, valves and fittings, reports and records, state and federal regulations, environmental, health and safety concerns, economic considerations, and future trends. Pages: 120

5th Edition | June 1996 | Reaffirmed: March 2007  
Product Number: GVT015 | Price: \$152.00

#### **Subsurface Salt Water Injection and Disposal** (Book 3 in the Vocational Training Series)

A handbook for the planning, installation, operation, and maintenance of subsurface disposal systems. Design criteria and formulas are given for gathering systems, treating plants, and injection facilities. Alternative equipment and methods are discussed and illustrated. Economic considerations are presented. Pages: 47

3rd Edition | January 1995 | Reaffirmed: March 2007  
Product Number: GVT033 | Price: \$94.00

#### **Wireline Operations and Procedures** (Book 5 in the Vocational Training Series)

A handbook outlining to operators of oil and gas wells what applications are possible with wireline tools and equipment. Also a guide for field personnel. Surface equipment, service tools (standard and special), and subsurface equipment (both permanent and removable) are described and illustrated. Their various applications are included. Also presented is a general discussion of special problems which wireline operations and procedures may serve to eliminate, minimize, or control, and methods by which this may be accomplished. Pages: 60

3rd Edition | January 1994 | Reaffirmed: March 2007  
Product Number: GVT053 | Price: \$118.00

#### **Gas Lift** (Book 6 in the Vocational Training Series)

Familiarizes field personnel with basic gas lift principles; operating procedures for adjusting, regulating, operating, and troubleshooting gas-lift equipment; and well conditions. Covers conventional practices and concepts. Illustrated with drawings of typical gas-lift installations and related equipment, as well as actual charts illustrating operation of and problems encountered in gas-lifted wells. Pages: 143

3rd Edition | January 1994 | Reaffirmed: March 2007  
Product Number: GVT063 | Price: \$152.00

#### **RPT-1**

##### **Orientation Programs for Personnel Going Offshore for the First Time**

Serves as a guide to developing orientation standards and programs applicable to all employees and visitors going offshore. Orientation programs ensure that all new personnel know what is expected of them during their

first trip offshore, as well as what they may expect to encounter during this trip. Employers have the option to institute broader procedures commensurate with their own policies and standards. Pages: 4

4th Edition | October 1995 | Reaffirmed: March 2007

Product Number: GT1004 | Price: \$57.00

You may access RPT-1 in a read-only platform: [publications.api.org](http://publications.api.org)

#### **RPT-2** ◆

##### **Qualification Programs for Offshore Production Personnel Who Work With Safety Devices**

Provides guidelines for the qualification of personnel engaged in installing, inspecting, testing, and routinely maintaining surface and subsurface devices that are used to insure safety and to prevent pollution during the production of oil and gas on offshore platforms. The guidelines provide expected candidate performance levels, instructional content and recommendations for testing. The guidelines are divided into instructional and testing phases. Pages: 3

2nd Edition | December 2001 | Reaffirmed: March 2007

Product Number: GT7002 | Price: \$57.00

You may access RPT-2 in a read-only platform: [publications.api.org](http://publications.api.org)

#### **RPT-4**

##### **Training of Offshore Personnel in Nonoperating Emergencies**

Represents an industry guide for the training of workers who work offshore. It presents recommendations for training these personnel in handling nonoperating emergencies, such as fires, transportation emergencies, platform abandonment procedures, use of survival crafts, and water survival guidelines. Pages: 3

2nd Edition | November 1995 | Reaffirmed: September 2010

Product Number: GT4002 | Price: \$57.00

You may access RPT-4 in a read-only platform: [publications.api.org](http://publications.api.org)

#### **RPT-6**

##### **Recommended Practice for Training and Qualification of Personnel in Well Control Equipment and Techniques for Wireline Operations on Offshore Locations**

Provides criteria for the qualification of wireline personnel in well control equipment operations and techniques. Although it does include recommendations for training wireline personnel on general rig well control equipment and theory, it should be noted that the main focus for training should be those operations using a lubricator as the primary well control mechanism. Wireline personnel classifications to which this RP is applicable are the Helper/Assistant and Operator/Supervisor. Pages: 2

1st Edition | October 2002 | Reaffirmed: March 2007

Product Number: GT0601 | Price: \$57.00

You may access RPT-6 in a read-only platform: [publications.api.org](http://publications.api.org)

#### **RPT-7**

##### **Training of Personnel in Rescue of Person in Water**

Applies to personnel who work offshore. It represents an industry guide for training personnel in techniques for rescuing persons from the water and using survival devices. It broadly identifies rescue devices, describes their operations, and presents recommendations for training personnel. Training recommendations are designed to develop personnel rescue proficiency while minimizing an individual's exposure to injury or loss of life. Pages: 8

2nd Edition | October 1995 | Reaffirmed: March 2007

Product Number: GT7002 | Price: \$55.00

You may access RPT-7 in a read-only platform: [publications.api.org](http://publications.api.org)



API University is dedicated to providing excellence in oil and natural gas industry training. We offer a wide variety of instructor-led courses developed and taught by the most knowledgeable industry experts. Whether you want a public course or a customized course at your facility, API University has training any way you want it, anywhere you want it.

## Classroom Courses

For more information on Classroom Courses, visit:  
[www.api.org/apiucalendar](http://www.api.org/apiucalendar)

### *Equipment, Design, and Maintenance*

#### TANKS

##### **Introduction to 650 and 653 Aboveground Storage Tanks**

This training program will provide a comprehensive introduction to API Stds 650 and 653, highlighting the most recent revisions and upcoming changes. The attendees are introduced to Std 620, a tank construction standard that deals with field built tanks that are primarily designed to be used with higher storage pressures and colder storage temperature.

##### **Training on Fiberglass and Plastic Tank Inspection**

Many tank owners believe that since The EPA's SPCC Program makes little mention of the tank's "material of construction" then perhaps FRP and Plastic tanks are exempt from tank integrity inspection.

##### **Advanced Aboveground Storage Tank Training**

This course is on an Advanced level and is designed for those individuals wanting a comprehensive understanding of the codes and standards that are included in the API 653 Inspectors Certification Program. This course is not designed around becoming an API-653 inspector, it's better. We teach you the standards and do not focus on memorization of questions that have appeared on past exams.

##### **API Standard 12F and 12R1: Field Production Tanks**

This training program will provide a comprehensive introduction to the specifications and practices detailed in API Spec 12F and API RP 12R1 for Field Production Tanks.

##### **Safe Tank Entry Workshop**

Learn to enter and work safely in aboveground petroleum storage tanks in accordance with Std 2015 and RP 2016 in the Safe Tank Entry Workshop offered by NFPA and API. This 2-day, interactive seminar uses video, case studies, group discussions and hands-on activities to help you learn the proper practices and procedures.

#### INSPECTION OF REFINERY EQUIPMENT

##### **Fitness-For-Service (FFS) Based on API RP 579**

The instructors, who are also the principal authors of RP 579, give their insights into the background and logic behind the assessment procedures. In addition, both courses include other highlights: discussion of damage mechanisms and the importance of identification; various detailed inspection techniques for damage mechanisms, with focus on flaw characterization (this is not covered in the 1 1/2-day course); overview of remaining life assessment, remediation, and methods to extend the life of damaged equipment; presentation of practical examples of FFS procedures; and details on how to assess damage/flaws that are not directly covered in RP 579.

##### **Risk-Based Inspection (RBI) Based on API RP 580/581**

Using semi-quantitative and quantitative approaches, the course covers technical content that is both broad and deep. Class discussions are an effective way for students to gain insights about the focus of various RBI methods and parameters to include in an effective analytical program.

##### **Damage Mechanisms in Refining Based on API RP 571**

This course, which is taught by the primary authors of RP 571, includes many special features: an overview of basic metallurgy applicable to refinery construction materials, a description of common refining processes on the process flow diagram level, highlighting where various damage mechanisms are usually observed, an analysis of typical NDE methods and their ability to detect and characterize equipment damage, detailed discussions of the more than 60 damage mechanisms that are found in refineries covered by RP 571, examples of equipment damage and failures, as well as learning exercises for students.

#### PRESSURE RELIEVING SYSTEMS

##### **Pressure Relieving Systems Based on API RP 520/521**

API's 3-day course, taught by the Equity Engineering Group, Inc. provides real-world case studies about incidents involving pressure relief valves (PRV). There also are classroom exercises that illustrate procedures for determining relief rates and valve size.

#### VALVES AND WELLHEAD EQUIPMENT

##### **Overview of API Spec 6A**

Spec 6A has been revised in many significant ways. New products have been added to the scope; requirements have been changed. The specification is now primarily in the ISO metric system, with traditional dimensions in parentheses or annexes. Additionally, the specification addresses the rules of the new NACE Standard MR0175-2003.

##### **Overview of API Spec 6D and API Spec 6DSS**

Each section of the current edition of Spec 6D is covered in detail, followed by a section-by-section coverage of Spec 6DSS highlighting the common requirements and the differences between the two specifications. The relationship of these specifications and ASME B16.34, *Steel Valves*, and Spec 6A/ISO 10423 will be clarified.

#### SECURITY, SAFETY, REGULATIONS, AND QUALITY

##### **Workshop on Industry Security Vulnerability Assessments (SVAs)**

API presents the leading SVA training for the petroleum, petrochemical and chemical industries. The objective of an SVA is to identify security hazards, threats and vulnerabilities facing a facility and to evaluate the countermeasures to provide for the protection of the public, workers, national interests, the environment, and the company.

##### **Workshop on USCG Regulations for Facility Security Officers (FSOs)**

Learn about the requirements for FSOs released in the U.S. Coast Guard (USCG) Final Rule: Part 105, Subpart B. Course materials include a reference CD of over 30 helpful related documents including the regulation, Navigation and Vessel Inspection Circulars (NVICs), API's Security Vulnerability Assessment Methodology for the Petroleum and Petrochemical Industries, and numerous U.S. Department of Homeland Security bulletins.

##### **API RP 752 and 753: Facility Siting Regulations and Compliance**

This course is a management-level overview and addresses the regulatory requirements for facility siting, a review of RPs 752 and 753, and an overview of the methods to satisfy the requirements. Anyone managing, performing, or reviewing facility siting needs should attend.

## Facility Siting Update: Process Plant Building Hazard Management

Learn what you need to do to respond to the new recommended practice on *Management of Hazards Associated With Location of Process Plant Buildings*. Learn what issues are being addressed in revising RP 752 and what you will need to prepare for in response. The first day is a management overview; the second day is a more technical course designed for the process safety professional who is performing facility siting studies and requires each student to bring a calculator.

## Facility Siting Consequence Analysis Techniques

This course is a continuation of the *API RP 752 and 753: Facility Siting Regulations and Compliance* course and is designed for the process safety professional performing facility siting studies. Topics covered will include a review of common methodologies to calculate blast loads and building damage for a facility siting study for both permanent and portable buildings. A significant portion of the course will be spent performing example calculations. Note: each student will need to bring a calculator.

## API Specification Q1 Training for Quality Programs

In two information-packed days, you'll get an overview of the requirements of Spec Q1, what makes it so valuable, and why you need to know about these essential elements of the program.

## API Lead Auditor Training: ISO 19011 Guidelines for Auditing Management Systems

During the course participants will gain a thorough understanding of how to audit an API Spec. Q1, Quality Management System. At the same time enhancing their knowledge and skills through an interactive and practical approach to auditing. The course offers a hands on approach that enables the student to better understand the purpose and viewpoint of a second/third party auditor. Also learning how to communicate with external auditors.

## PIPELINE

### Oil and Gas Pipeline Fundamentals

This two day course; designed, produced, and taught by pipeline industry veteran Tom Miesner, former president of Conoco Pipe Line Company and author of *Oil and Gas Pipelines in NonTechnical Language* explains the industry and how pipelines work in straightforward language. "Limiting the use of equations while providing pictures, charts, graphs, and examples really made this course come alive for me," said a recent class participant.

## Executive Education

For more information on Executive Education, visit:  
[www.api.org/apiuacalendar](http://www.api.org/apiuacalendar)

*Presented by SMU-Cox*

## Developing a New Generation of Oil and Gas Leaders: Strategic Financial Skills

Hundreds of executives have chosen our Strategic Financial Skills program for its concentrated coverage of financial management techniques uniquely tailored to the complexities of their industry. This comprehensive weeklong program uses a hands-on approach to help you understand and master the energy sector's financial essentials. Your instructors are senior teachers with significant experience in executive development, business, consulting and energy industry financial management. You'll share ideas and discuss industry issues with participants from around the world in small discussion groups and lively classroom sessions. You'll meet mid-level to senior-level professionals from many segments of the energy industry and a variety of functional areas within their companies. In a series of information-packed class sessions, you'll learn the essentials of the business side of the energy industry. By the end of the week, you'll have a working knowledge of the key areas of financial management.

## Developing a New Generation of Oil and Gas Leaders: Strategic Leadership Skills

Research has shown that effective leaders have developed a pattern of success based on critical competencies that have been honed throughout their careers. In this program you'll be exposed to a highly creative faculty who will give you the tools to think and work differently as you move through the leadership roles and challenges of the oil and gas industry for the next decade.

## E-Learning Courses

For more information on these E-Learning Courses, visit:  
[www.api.org/apiuelearning](http://www.api.org/apiuelearning)

*Presented and Delivered by GP*

## ELECTRICAL MAINTENANCE

### AC Circuit Fundamentals

At the completion of this course, the student will be able to explain basic AC theory and describe the common connections used to build single-phase and three-phase AC circuits.

### AC Circuit Troubleshooting and Repair

At the completion of this course, the student will be able to describe the basic steps for troubleshooting and repairing AC circuits.

### Battery Chargers

At the completion of this course, the student will be able to describe the operational concepts associated with industrial battery chargers; explain the principles of rectifying AC power; describe the basic steps required for placing battery chargers in service; and describe the basic steps required for removing them from service.

### Circuit Breakers—Low and Medium Voltage

At the completion of this course, the student will be able to determine the current flow in a circuit; describe how to match overload devices with selected types of load; describe circuit breaker testing; and explain how to perform breaker contact inspections.

### Control Devices

At the completion of this course, the student will be able to explain the function and operation of control device components; identify common electrical control device faults; and describe the basic steps for troubleshooting electrical control devices.

### DC Circuit Fundamentals

At the completion of this course, the student will be familiar with electron theory as it relates to direct current (DC) electrical circuits. The student will be able to state Ohm's and Kirchoff's laws as they relate to DC circuits; determine circuit outputs from specified inputs in DC circuits; and construct basic DC circuits.

### DC Circuit Troubleshooting and Repair

At the completion of this course, the student will be able to evaluate DC circuit performance; describe the major steps for troubleshooting DC circuits; and describe the major steps for performing repairs of DC circuits.

### Freeze Protection

At the completion of this course, the student will be able to describe self-limiting (regulating) cables, constant wattage heating cables, and the concept of series resistance heating cables. The student will also be able to explain the use of heat transfer cement and tape and describe how to troubleshoot, replace, and repair freeze protection equipment.

## Generator Basics

At the completion of this course, the student will be able to explain how AC generators produce AC voltage. The student will also be able to describe the operating characteristics of various types of generators, various generator applications, and the common types of generator construction.

## Generator Maintenance

At the completion of this course, the student will be able to describe the basic steps required to perform internal cleaning, troubleshooting, and disassembly and reassembly of generators.

## Ground Detection

At the completion of this course, the student will be able to explain equipment grounding concepts; how to perform DC ground detection; how to use DC ground detection switches as supplied by a battery charger, and which DC breakers cannot be turned off during operation. The student will also be able to identify unwanted circuit grounds; describe the process for eliminating ground faults; and describe the basic steps required for testing of proper equipment grounds.

## Inverters

At the completion of this course, the student will be able to describe the operating principles of inverters and the function and operation of inverter components. The student will also be able to describe how to place inverters in service and remove them from service.

## Limitorque Valves

At the completion of this course, the student will be able to explain how to stroke a Limitorque valve; describe common maintenance procedures on limit and torque switches; and describe the basic steps required to remove a Limitorque actuator from a valve.

## Motor Basics

At the completion of this course, the student will be able to describe the basic types of motors and explain their operating characteristics.

## Motor Maintenance

At the completion of this course, the student will be able to describe basic steps for troubleshooting, cleaning, disassembling, and reassembling a motor, and performing operational checks when a motor is returned to service.

## Prints and Drawings

At the completion of this course, the student will be able to describe the following types of drawings and diagrams: schematic, connection, logic, elementary, single-line, and P&ID.

## Transformers

At the completion of this course, the student will be able to describe transformer characteristics; list the essential parts of a simple transformer; state the relationship between primary and secondary voltages and transformer turns ratio; and define the terms potential transformer and current transformer. The student will also be able to state the safety hazards related to transformers; describe transformer troubleshooting techniques; and identify causes of transformer failure.

## INDUSTRIAL MATH AND SCIENCE

### Basic Math Operations

At the completion of this course, the student will be able to solve arithmetic problems using addition, subtraction, multiplication, and division; and problems requiring conversion between decimals, fractions, and percentages. In addition, the student will be able to solve math problems requiring averages of a given number set and problems with powers of ten notation.

## Chemistry

At the completion of this course, the student will be able to describe the fundamental principles of chemistry. The student will also be able to calculate the density of various materials and calculate specific gravity.

## Geometry

At the completion of this course, the student will be able to identify various geometric shapes and calculate their area; calculate the correct dimensions relating to the hypotenuse of a right triangle; and calculate the volume of various geometric shapes.

## Tables and Graphs

At the completion of this course, the student will be able to recognize and describe tables, charts, and graphs, and explain how to read the data represented by them.

## INSTRUMENTATION AND CONTROL

### Control Devices and Indicators

At the completion of this course, the student will be able to explain the terminology associated with controllers and control action. The student will also be able to describe the following: the operation of solenoid valves; the function of square root extractors; the operation and application of pressure regulators; the function of volume boosters; the operation of temperature and pressure switches; the function and operation of limit switches; the function of indicators and recorders; the basic types of final control actuators; and the basic types of valves. In addition, the student will be able to explain the basic steps used to troubleshoot and repair electronic control valves.

### Digital Electronics

At the completion of this course, the student will be able to describe the use of decimal, octal, binary, and hexadecimal numbering systems; explain the use of BCD and ASCII codes in digital electronic circuits; and describe positive and negative logic as related to digital electronic circuits. The student will also be able to determine the appropriate digital circuit outputs from specified inputs, and construct simple digital circuits. In addition, the student will be able to describe the basic steps for troubleshooting and repairing digital circuits.

### Electronic Circuits

At the completion of this course, the student will be able to explain the basic steps for constructing basic electronic circuits. The student will also be able to identify the symptoms of defective operational amplifier circuits; determine the proper feedback circuits to achieve desired operational amplifier gain; and explain the basic steps for evaluating the performance of a power supply circuit. In addition, the student will be able to describe the proper techniques for soldering in electronic circuits.

### Fire Protection Instrumentation

At the completion of this course, the student will be able to describe the instrumentation used in selected fire protection systems. In addition, the student will be able to describe the basic steps in troubleshooting and repair of selected fire protection instrumentation.

### Fundamentals of Instrumentation and Control

At the completion of this course, the student will be able to define terminology associated with control instruments; describe block diagrams; distinguish between open and closed loop systems; and describe the function and operating characteristics of various sensing devices, transmitters, valve positioners, and final control elements.

### Microprocessors

At the completion of this course, the student will be able to explain the purpose and function of the basic components of microprocessors. The student will be able to describe the types and operation of memory circuits; explain the use of expansion buses and 8-bit buses used to interface

microprocessors; and describe the theory of operation of microprocessor registers. In addition, the student will be able to describe the basic programming used by microprocessors and explain the basic steps for troubleshooting microprocessors.

## PLCs

At the completion of this course, the student will be able to explain the functions, basic operation and applications of programmable logic controllers. The student will also be able to explain the meaning of PLC status indicator lights and the basic steps for troubleshooting PLCs. In addition, the student will be able to interpret and draft ladder logic with bit instructions.

## Pneumatics—Controls

At the completion of this course, the student will be able to explain the operating characteristics of valve positioners and describe the basic steps required for calibrating and troubleshooting pneumatic control instruments. The student will be able to describe the operation of the Bailey Standatrol system and identify and state the function of the major components of Bailey pneumatic drives and positioners. In addition, the student will be able to describe the basic steps required for removing meters from and returning meters to service; the basic steps required to disassemble, clean, and calibrate a Ledoux bell meter; and the basic steps required to disassemble, inspect, and set up inlet and exhaust valves on Standatrols. The student will also be able to explain the operating characteristics of I/P and P/I transducers and the basic steps required for calibrating transducers.

## Pneumatics—Tubing

At the completion of this course, the student will be able to describe the steps required to select the proper tubing and fittings for specific applications, taking pressure and chemical compatibility into consideration. The student will also be able describe the steps required to correctly install the following types of tubing fittings: soldered copper, copper compression, and sleeve. In addition, the student will be able to describe the steps required to flare tubing, the proper use of tubing benders, and the steps required to plan and install tubing supports and hangers.

## Process Control and System Tuning

At the completion of this course, the student will be able to describe basic principles and types of process control and explain various methods of controller tuning.

## Process Measurement

At the completion of this course, the student will be able to explain the principles of pressure, temperature, level and flow measurement; describe the operation of devices that sense each process variable; and explain the basic steps for troubleshooting those devices.

## Semiconductors

At the completion of this course, the student will be able to explain the purpose and function of the basic components of microprocessors. The student will be able to describe the types and operation of memory circuits; explain the use of expansion buses and 8-bit buses used to interface microprocessors; and describe the theory of operation of microprocessor registers. In addition, the student will be able to describe the basic programming used by microprocessors and explain the basic steps for troubleshooting microprocessors.

## Test Equipment and Calibration

At the completion of this course, the student will be able to define basic instrumentation terms; identify various components in an instrumentation loop; and explain their function. In addition, the student will be able to explain the use of multimeters, oscilloscopes, and portable power supplies. The student will also be able to describe the operation of temperature sensing devices and how to test them. Finally, the student will be able to explain the basic principles of calibration.

## MECHANICAL MAINTENANCE

### Air Compressors—Fundamentals

At the completion of this course, the student will be able to describe the basic components and operation of common types of air compressors.

### Air Compressors—Maintenance

At the completion of this course, the student will be able to describe the major steps in disassembling, inspecting, replacing defective parts, and reassembling air compressors.

### Air Compressors—Positive Displacement—Overhauls

At the completion of this course, the student will be able to describe the major steps involved in overhauling multi-stage piston air compressors; the basic construction and operation of wet and dry screw compressors; and the major steps involved in overhauling screw type air compressors.

### Bearing Fundamentals

At the completion of this course, the student will be able to describe bearing types, components, and operating characteristics.

### Bearing Lubrication

At the completion of this course, the student will be able to explain types and uses of lubricants and describe proper lubrication techniques for various bearings.

### Bearing Maintenance

At the completion of this course, the student will be able to describe the major steps in the removal, inspection, repair, replacement, and installation of sliding surface and rolling contact bearings.

### Drive Belts

At the completion of this course, the student will be able to identify drive belts used in the plant; describe the use of drive belts; identify sheaves used in the plant; describe the major steps required to perform drive belt adjustments; and describe the major steps required to replace drive belts.

### Gaskets and O-Rings

At the completion of this course, the student will be able to describe how to make gaskets and O-rings. In addition, the student will be able to explain how to remove, select, and install O-rings, gaskets, and packing.

### Heat Exchanger Fundamentals

At the completion of this course, the student will be able to explain the theory of how heat exchangers transfer heat; list common types of heat exchangers; and describe heat exchanger design characteristics.

### Heat Exchanger Maintenance

At the completion of this course, the student will be able to describe the effects of fouling, corrosion, and erosion commonly found in heat exchangers; common techniques used to clean heat exchangers; basic steps used to inspect heat exchangers; steps used in performing common leak tests; and basic steps used to perform repairs.

### Hydraulics—Fundamentals

At the completion of this course, the student will be able to explain the basic principles of hydraulics; describe the major components common to most fluid power systems; and identify common hydraulic component symbols found on a hydraulic fluid flow diagram. In addition, the student will be able to identify fluids and additives used in hydraulic systems and to describe their characteristics.

## Hydraulics—Maintenance

At the completion of this course, the student will be able to identify fluid power system problems and remedies; locate various components of a fluid power system; explain the types of repairs made to selected fluid power system components; describe the major steps required in the replacement of parts and components in fluid power systems; and explain basic fluid power system routine maintenance activities.

## Machine Shop—Grinders, Saws and Drills

At the completion of this course, the student will be able to describe the procedure for dressing and truing a grinding wheel on a pedestal grinder and explain the proper use of a surface grinder. The student will also be able to describe the proper procedure to saw to layout lines using a band saw. In addition, the student will be able to describe the major steps required to drill, countersink, counterbore, spotface, ream, and tap holes on a drill press; and identify tap types and the different classifications of threads used for fasteners.

## Machine Shop—Lathes

At the completion of this course, the student will be able to explain the function and proper use of the basic components of an engine lathe and its controls. The student will also be able to describe the steps required to perform precision centering work; face the end surfaces and shoulders of a work specimen; perform drilling in a lathe; carry out straight and taper turning; cut steep tapers and chamfers; perform radius and fillet turning; mount, face and turn work on a mandrel; execute machine reaming; do parting and grooving; perform boring operations; knurl a work piece; cut internal and external unified standard screw threads; straighten a shaft; and grind radius, turning, facing, form, and threading tools.

## Machine Shop—Layout/Bench Work

At the completion of this course, the student will be able to perform a rough and a precision layout of a workpiece. The student will also be able to describe how to saw stock with a hand hacksaw; the correct procedure for straight and draw filing of metal; how to size holes with a hand reamer; and hand methods of deburring parts, removing broken studs, tapping threads, and cutting threads using a threading die and tap. In addition, the student will be able to describe how to cut threads by machine using a threading die; the procedure for broaching a keyway using an arbor press; and how to operate a powered keyway cutter.

## Machine Shop—Vertical Milling Machines

At the completion of this course, the student will be able to describe the basic components, controls, and operation of a vertical milling machine. The student will be able to describe the steps required to locate, drill, bore and ream holes using the coordinated method; step drill holes accurately; mill a slot or pocket; counter sink, counter bore, and spot face work pieces; mill a square and hexagon on a work piece; machine a flat surface using a flying cutter; mill multi-level surfaces; and mill a fillet with a ball end mill.

## Oil Analysis

At the completion of this course, the student will be able to explain the basic principles of lubrication, including oil and grease characteristics, lubricant additives, lubricant selection, and lubricant storage and handling. The student will also be able to explain the fundamentals of lubrication sampling and the basic methods of maintaining oil and grease lubricated systems. In addition, the student will be able to describe general lubricant problems and explain the basic principles of lubricant testing and analysis.

## Piping

At the completion of this course, the student will be able to identify and describe various pipe fittings, common pipe joining methods, and different types of pipe hangers and support systems. Students will also be able to identify piping symbols on piping and instrumentation drawings.

## Precision Measurement

At the completion of this course, the student will be able to describe how to use the following measurement tools: steel rules, protractors, outside micrometers, inside micrometers, telescoping gauges, depth rules, depth micrometers, hole gauges, Vernier calipers, dial indicators, dial calipers, radius gauges, thickness gauges, taper gauges, wire gauges, sheet metal gauges, screw pitch gauges, thread micrometers, and go/no go gauges.

## Pumps—Centrifugal—Fundamentals

At the completion of this course, the student will be able to describe basic centrifugal pump components and operation, including performance issues pertaining to centrifugal pumps.

## Pumps—Centrifugal—Maintenance

At the completion of this course, the student will be able to describe the major steps required to disassemble, inspect, and reassemble centrifugal pumps.

## Pumps—Centrifugal—Overhauls

At the completion of this course, the student will be able to describe the major steps required to overhaul horizontal single-stage centrifugal pumps; horizontal multi-stage centrifugal pumps; vertical single-stage centrifugal pumps; and vertical multi-stage centrifugal pumps.

## Pumps—Positive Displacement—Fundamentals

At the completion of this course, the student will be able to explain the basic theory of operation of centrifugal and positive displacement pumps; list the major safety devices associated with positive displacement pumps; and list common applications for positive displacement pumps.

## Pumps—Positive Displacement—Overhauls

At the completion of this course, the student will be able to describe the major steps involved in disassembling, inspecting, and reassembling screw type positive displacement pumps and identify parts that are commonly replaced. The student will also be able to describe the major steps involved in overhauling gear, piston, diaphragm, lobe, vane, and liquid ring pumps.

## Rigging and Lifting Practices

At the completion of this course, the student will be able to describe common types of rigging and lifting equipment, and explain how to use the equipment safely. In addition to rigging equipment, the following are covered: manual lifting devices, electric powered lifting devices, air operated lifting devices, hydraulic lifting devices, mobile cranes, and boom trucks.

## Scaffolds

At the completion of this course, the student will be able to describe the most common types of scaffolds; describe the proper and safe use of scaffolding; and explain the major steps required to assemble and disassemble scaffolding and stays.

## Shaft Alignment—Laser Aided

At the completion of this course, the student will be able to describe the major types and functions of couplings; explain the basic terminology and principles of shaft alignment; and describe soft foot, the conditions that can cause it, as well as how to correct soft foot using a laser-based alignment system. In addition, the student will be able to explain the operation of a laser-based alignment system and how to troubleshoot some laser alignment problems.

## Tools

At the completion of this course, the student will be able to: identify common types of hand and power tools, and describe safety precautions associated with them. The student will also be able to identify common types of measuring tools and describe their uses. In addition, the student will be able to identify common types of fasteners, describe basic specification issues, and explain basic fastener usage and safety considerations.

## Valve Fundamentals

At the completion of this course, the student will be able to describe the major types of valves used in plants, their components, and their operating characteristics.

## Valve Maintenance

At the completion of this course, the student will be able to describe the major steps required in repairing valves and the basic steps in overhauling globe, gate, safety, relief, ball, plug, diaphragm, butterfly, check, and control valves.

## Welding—Arc

At the completion of this course, the student will be able to explain how to perform shielded metal arc welding on carbon steel plate and carbon steel pipe. The student will also be able to explain what the various welding positions are, their orientations, and the processes for welding in various positions. In addition, the student will be able to explain the proper usage of polarities ( DC power) and current flow in electric arc welding with covered electrodes; demonstrate the setup of electric arc welding equipment for S.M.A.W. welding in both polarities on steel plate; match electric arc welding filler metals to their application positions; and explain the setup of gas tungsten arc welding equipment for straight polarity welding with argon shielding gas.

## Welding—Oxyacetylene

At the completion of this course, the student will be able to explain the proper setup for oxyacetylene cutting equipment; demonstrate safe usage of oxyacetylene cutting equipment; and explain how to perform oxyacetylene cutting. The student will also be able to describe how to match filler metal requirements to base metals for fusion welding and explain how to perform oxyacetylene fusion welding on carbon steel. In addition, the student will also be able to explain how to perform oxyacetylene brazing on various metal alloys and describe how to braze weld various joint configurations.

