



## **Level One**

### **MODULE 29101-03 - WELDING SAFETY**

Transparencies  
Markers/chalk  
Blank acetate sheets  
Transparency pens  
Pencils and scratch paper  
Module Examinations  
Performance Profile Sheets  
Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate personal protective equipment  
Various welding gloves  
Auto-darkening helmet  
Full-face supplied-air respirator (SAR)  
Samples of protective welding footwear  
Earmuffs and ear plugs

## MODULE 29102-03 - OXYFUEL CUTTING

Overhead projector and screen  
Transparencies  
Blank acetate sheets  
Whiteboard/chalkboard  
Transparency pens  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Oxygen cylinder (with cap)  
Fuel gas cylinder (with cap)  
Regulators (oxygen and fuel gas)  
Hose set  
Combination cutting torch  
One-piece cutting torch  
Assorted torch nozzles (cutting, washing, gouging)  
Cylinder cart  
Motorized oxyfuel track cutter  
Framing squares  
Combination squares with protractor head  
Tape measure  
Soapstone  
Penknife  
Pliers  
Chipping hammer  
Friction lighter  
Vendor cutting tip chart  
Tip cleaners and file  
Wrenches (torch, hose, and regulator)  
Steel plate

- Thin (16 to 10 gauge)
- Thick (1/4 inch to 1 inch)

Module Examinations  
Performance Profile Sheets

## MODULE 29103-03 - BASE METAL PREPARATION

Overhead projector and screen Transparencies  
Blank acetate sheets  
Transparency pens  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Weld examples  
Chipping hammer  
Pliers  
Tape measure  
Soapstone  
File  
Framing square  
Combination square with protractor head  
Hand scrapers and wire brushes  
Power grinder with grinding and wire brush attachments  
Mechanical plate beveling equipment  
Mechanical pipe beveling equipment  
Oxyfuel cutting equipment  
Motorized oxyfuel track cutter  
Mild steel plate  
Mild steel pipe  
Module Examinations  
Performance Profile Sheet

## MODULE 29104-03 - WELD QUALITY

Transparencies

Markers/chalk

Blank acetate sheets

Transparency pens

Pencils and scratch paper

Module Examinations

Performance Profile Sheets

Overhead projector and screen

Whiteboard/chalkboard

Appropriate personal protective equipment

Welding samples showing:

- Porosity
- Inclusions
- Cracks
- Weld metal cracks
- Base metal cracks
- Incomplete joint penetration
- Incomplete fusion
- Undercut
- Arc strikes
- Spatter
- Unacceptable weld profiles

Undercut gauge

Butt weld reinforcement gauge

Fillet weld blade gauge set

Welding code examples

Examples of Welding Procedure Specifications and Procedure Qualification Records

Radiograph examples

Tested specimens of good and failed welds

## **MODULE 29105-03 - EQUIPMEN AND SETUP**

Transparencies  
Markers/chalk  
Blank acetate sheets  
Transparency pens  
Pencils and scratch paper  
Module Examinations  
Performance Profile Sheets  
Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate personal protective equipment  
Welding cables  
Lugs and quick disconnects  
Workpiece clamps  
Electrode holders  
Chipping hammers  
Wire brushes  
Files  
Pneumatic weld flux chipper  
Pneumatic needle scaler  
Transformer welding machine  
Transformer-rectifier welding machine  
Motor generator welding machine  
Engine-driven generator welding machine and alternator

## **MODULE 29106-03 - ELECTRODES AND SELECTION**

Transparencies  
Markers/chalk  
Blank acetate sheets  
Transparency pens  
Pencils and scratch paper  
Module Examinations  
Performance Profile Sheets  
Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate personal protective equipment  
Electrodes of various types  
Sample MSDS for an electrode

## MODULE 29107-03 - BEADS AND FILLET WELDS

Overhead projector and screen  
Transparencies  
Blank acetate sheets  
Transparency pens  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Sample electrodes  
Carbon steel for practice coupons, 1/4" thick minimum  
DC (or AC) welding machine  
Welding bench with arm for position work  
Oxyfuel cutting equipment  
Welding shield or helmet  
Grinders  
Framing square  
Soapstone  
Tape measure  
Pliers  
Wire brush  
Workpiece clamps  
Chipping hammer  
Electrode holder  
Electrodes, E6010 and E7018 (or E6011 and E6013 for AC)  
Friction lighter  
Module Examinations  
Performance Profile Sheets

## MODULE 29108-03 - SMAW - GROOVE WELDS WITH BACKING

Overhead projector and screen  
Transparencies  
Blank acetate sheets  
Transparency pens  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Sample electrodes  
Carbon steel for practice coupons,  $\frac{1}{4}$ " thick minimum  
DC (or AC) welding machine  
Welding bench with arm for position work  
Oxyfuel cutting equipment  
Welding shield  
Grinders  
Framing square  
Soapstone  
Tape measure  
Pliers  
Friction lighter  
Wire brush  
Chipping hammer  
Workpiece clamps  
Electrode holder  
Electrodes,  $\frac{5}{32}$  and  $\frac{3}{16}$  inch E7018 (or E6013 for AC)  
Module Examinations  
Performance Profile Sheets

## MODULE 29109-03 - JOINT FIT-UP AND ALIGNMENT

Transparencies  
Markers/chalk  
Blank acetate sheets  
Transparency pens  
Pencils and scratch paper  
Module Examinations  
Performance Profile Sheets  
Overhead projector and screen  
Whiteboard/chalkboard  
Appropriate personal protective equipment  
Straightedges  
Squares  
Levels  
Hi-Lo gauges  
Hydraulic jacks, chain hoists, come-alongs  
Strongbacks, clips, yokes, wedges  
Plate alignment tools  
Pipe jacks and rollers  
Chain clamps, cage clamps, rim clamps  
Small-diameter pipe clamping devices  
Pipe pullers  
Flange alignment tools  
Carbon steel plate and pipe of various sizes



## MODULE 29110-03 - OPEN V-GROOVE WELDS

Overhead projector and screen  
Transparencies  
Blank acetate sheets  
Transparency pens  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Sample electrodes  
Carbon steel for practice coupons, 1/4" thick minimum  
DC (or AC) welding machine  
Welding bench with arm for position work  
Oxyfuel cutting equipment  
Welding shield or helmet  
Grinders  
Framing square  
Soapstone  
Tape measure  
Pliers  
Friction lighter  
Wire brush  
Chipping hammer  
Workpiece clamps  
Electrode holder  
Electrodes, E6010 and E7018 (or E6011 and E6013 for AC)  
Module Examinations  
Performance Profile Sheets

## **MODULE 29111-03 - OPEN-ROOT PIPE WELDS**

Overhead projector and screen  
Transparencies  
Blank acetate sheets  
Transparency pens  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Sample electrodes  
Carbon steel pipe for practice coupons, 3" to 12" diameter Schedule 40 or Schedule 80  
DC (or AC) welding machine  
Welding bench with arm for position work  
Pipe rollers  
Oxyfuel cutting equipment  
Welding shield or helmet  
Grinders  
Framing square  
Soapstone  
Tape measure  
Friction lighter  
Wire brush  
Chipping hammer  
Workpiece clamps  
Electrode holder  
Pliers  
Electrodes, E6010 and E7018 (or E6011 and E6013 for AC)  
Module Examinations  
Performance Profile Sheets

# Level Two

## MODULE 29201-03 - WELDING SYMBOLS

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

*AWS Standard A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination*

Sample site quality standard

Sample fillet welds

Sample V-groove welds

Module Examinations

## MODULE 29202-03 - READING WELDING DETAIL DRAWINGS

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Welding drawings

Module Examinations

Performance Profile Sheets

## MODULE 29203-03 - SMAW – STAINLESS STEEL GROOVE AND PIPE WELDS

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of stainless steel with carbide precipitation

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Oxyfuel cutting equipment

DC welding machine

Stainless steel,  $\frac{3}{8}$ " thick minimum, or carbon steel plate,  $\frac{1}{4}$ " to  $\frac{3}{4}$ " thick, for practice coupons

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Electrode holder

Stainless steel electrodes,  $\frac{3}{32}$ " and  $\frac{1}{8}$ ", compatible with the base metal being welded

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 stainless or carbon steel pipe

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets

## MODULE 29204-03 - AIR CARBON ARC CUTTING AND GOUGING

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Scrap steel shapes containing bolts, rivets, protruding welds, eyes, clips, or other protrusions to be washed

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Earplugs

Soapstone

Tape measure

Pliers

Wire brush

Chipping hammer

DC welding machine, minimum 200 amp for light duty or 600 amp for medium duty

Air carbon arc torch and cable

Selection of carbon electrodes up to  $\frac{3}{8}$ "

Compressed air source, minimum 16 cfm at 80 psig for light and medium duty or minimum 50 cfm at 100 psig for heavy duty cutting

Module Examinations

Performance Profile Sheets

## **MODULE 29205-03 - PLASMA ARC CUTTING (PAC)**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Earplugs

Respirator

Soapstone

Tape measure

Pliers

Plasma arc cutting unit with cutting torch and appropriate gas sources

Scrap steel sheet or plate, 12 gauge to ½" thick

Scrap stainless steel sheet or plate, 12 gauge to ½" thick (if available)

Scrap aluminum plate, ⅜" to ½" thick (if available)

Wire brush

Chipping hammer

Module Examinations

Performance Profile Sheets

## MODULE 29206-03 - GMAW AND FCAW – EQUIPMENT AND FILLER METALS

Overhead projector and screen  
Transparencies  
Blank acetate sheets  
Transparency pens  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Samples of various types and sizes of electrode wires (labeled)  
Examples of welding guns (standard and one- pound spool, if available)  
Examples of shielding gas regulator-flow meters (if available)  
Examples of wire feeders (if available)  
Leather welding gloves  
Leather welding jacket or sleeves  
Welding shield or helmet  
Cutting goggles  
FCAW welding equipment  
Electrode wire, 0.45" dual shielded flux cored carbon steel  
GMAW welding equipment  
Carbon steel wire electrode  
Shielding gas  
Welding bench with arm for position work  
Portable angle-head grinders  
Framing square  
Soapstone  
Tape measure  
Pliers  
Half-round bastard file  
Friction lighter  
Wire brush  
Chipping hammer  
Workpiece clamps  
Pipe alignment clamps  
Pipe beveling equipment (optional)  
Module Examinations  
Performance Profile Sheets

## **MODULE 29207-03 - GMAW AND FCAW – PLATE**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

FCAW welding equipment

Electrode wire, 0.45" dual shield flux cored carbon steel (Class E71T-1)

GMAW welding equipment

Carbon steel wire electrode

Shielding gas

Welding bench with arm for position work

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Module Examinations

Performance Profile Sheets



## **MODULE 29208-03 - GTAW – EQUIPMENT AND FILLER MATERIALS**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Samples of various types and sizes of electrodes (labeled)

Examples of shielding gas regulators/flow meters (if available)

Examples of welding guns

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

GTAW welding equipment

Tungsten electrodes

Shielding gas

Welding bench with arm for position work

Module Examinations

Performance Profile Sheets

## **MODULE 29209-03 - GTAW – PLATE**

Overhead projector and screen  
Transparencies  
Blank acetate sheets  
Transparency pens  
Whiteboard/chalkboard  
Markers/chalk  
Pencils and scratch paper  
Appropriate personal protective equipment  
Leather welding gloves  
Leather welding jacket or sleeves  
Welding shield or helmet  
Cutting goggles  
GTAW welding equipment  
Tungsten electrodes  
Carbon steel filler metal  
Carbon steel plate  $\frac{3}{8}$ " thick  
Shielding gas  
Welding bench with arm for position work  
Portable angle-head grinders  
Framing square  
Soapstone  
Tape measure  
Pliers  
Half-round bastard file  
Friction lighter  
Wire brush  
Chipping hammer  
Workpiece clamps  
Module Examinations  
Performance Profile Sheets

# Level Three

## **MODULE 29301-03 - PREHEATING AND POSTWELD HEAT TREATMENT OF METALS**

Overhead projector and screen

Transparencies

Whiteboard/chalkboard

Markers/chalk

Blank acetate sheets

Transparency pens

Pencils and scratch paper

Appropriate personal protective  
equipment

Sample welds with proper preheating and postweld heat treatment

Sample welds with defects due to improper preheating or postweld heat treatment

Sample preheating tips for oxyfuel torches

Sample gas preheating torch

Sample temperature-indicating crayons

Sample pyrometer, thermocouple devices, or temperature-sensitive indicators

Module Examinations

## **MODULE 29302-03 - PHYSICAL CHARACTERISTICS AND MECHANICAL PROPERTIES OF METALS**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Samples of various types of steels, metals, and filler metals

Magnet

Metal analyzer

Module Examinations

## **MODULE 29303-03 – GAS METAL ARC WELDING (GMAW) – PIPE**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Mechanical, plasma, and/or oxyfuel cutting equipment

Gas-shielded GMAW welding machine and gun

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Appropriately sized wire electrode compatible with the base metal being welded

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 carbon steel pipe

Pipe alignment clamps

Pipe beveling equipment (optional)

Antispatter compound

Module Examinations

Performance Profile Sheets

## **MODULE 29304-03 – FLUX CORED ARC WELDING (FCAW) – PIPE**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Oxyfuel cutting equipment

FCAW welding machine and FCAW-S and/or FCAW-G gun

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Appropriately sized wire electrode compatible with the base metal being welded

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 carbon steel pipe

Pipe alignment clamps

Pipe beveling equipment (optional)

Hi-Lo gauge

Module Examinations

Performance Profile Sheets

## **MODULE 29305-03 – GAS TUNGSTEN ARC WELDING (GTAW) – CARBON STEEL PIPE**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of pipe with poor weld profiles

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Oxyfuel cutting equipment

GTAW welding machine and torch

Shielding gas

Backing gas

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Appropriately sized carbon steel wire electrodes

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 carbon steel pipe

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets

## **MODULE 29306-03 – GAS TUNGSTEN ARC WELDING (GTAW) – LOW-ALLOY AND STAINLESS STEEL PIPE**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of pipe with poor weld profiles

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Cutting goggles

Welding bench with arm for position work

Mechanical or plasma cutting equipment

GTAW welding machine and torch

Shielding gas

Backing gas

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Pipe for weld coupons: 3" to 12" Schedule 40 or Schedule 80 stainless, low-alloy, or carbon steel pipe

Low-alloy and stainless steel filler metal

Workpiece clamps

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets

## **MODULE 29307-03 – GAS TUNGSTEN ARC WELDING (GTAW) – ALUMINUM PIPE**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of pipe with poor weld profiles

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Welding bench with arm for position work

Mechanical or plasma cutting equipment

GTAW welding machine and torch

Shielding gas

Backing gas

Portable angle-head grinders

Framing square

Soapstone

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Chipping hammer

Workpiece clamps

Aluminum pipe for weld coupons: 3" to 12" Schedule 40

Aluminum filler metal compatible with the base metal being welded

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets



## **MODULE 29308-03 – GAS METAL ARC WELDING (GMAW) – ALUMINUM PLATE AND PIPE**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Examples of pipe with poor weld profiles

Leather welding gloves

Leather welding jacket or sleeves

Welding shield or helmet

Welding bench with arm for position work

Mechanical or plasma cutting equipment

GMAW welding machine and gun

Shielding gas

Backing gas

Portable angle-head grinders

Framing square

Tape measure

Pliers

Half-round bastard file

Friction lighter

Wire brush

Workpiece clamps

Appropriately sized aluminum wire electrode compatible with the base metal being welded

Aluminum plate for weld coupons:  $\frac{1}{4}$ " to  $\frac{3}{4}$ "

Aluminum pipe for weld coupons: 3" to 12" diameter Schedule 40

Pipe alignment clamps

Pipe beveling equipment (optional)

Module Examinations

Performance Profile Sheets