

Guide for the Training of Welding Personnel: SENSE Level I— Entry Welders



Documents

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Foreword

This foreword is not part of this standard but is included for informational purposes only.

Advances in welding technology, along with the advent of new materials and manufacturing processes, require that welders have a better knowledge of the science associated with welding in addition to manipulative skills. Thus, it is imperative that welder training adequately prepare individuals for industrial assignments at various levels of knowledge and skill development.

The American Welding Society (AWS), recognizing the need for competent welders, through a grant by the U.S. Department of Education, formed the Education Grant Committee in 1992, and assigned them the task of preparing a set of national specifications and guidelines for welding education. The result of this effort was AWS QC10, *Specification for Qualification and Certification of SENSE Level I—Entry Welders*, and AWS EG2.0, *Guide for the Training of Welding Personnel: SENSE Level I—Entry Welders*, which were introduced in 1995. Specifications and guidelines for SENSE Level II—Advanced Welder and SENSE Level III—Expert Welder were introduced in 1996.

SENSE specifications and guidelines were developed according to the DACUM method, and are based on the results of a national survey of industry, trade organizations, and educational institutions to identify requisite welder skills and knowledge. In 2008, SENSE Level I—Entry Welder was modularized. In 2015, SENSE Level I—Entry Level was reviewed and minor revisions were made by the AWS Education Committee. Level II—Advanced Welder was also revised and updated to accommodate modular implementation. In addition, the performance tests for Level III—Expert Welding were incorporated into SENSE Level II—Advanced Welder as optional endorsements. There are currently two levels of SENSE: Level I—Entry Welder, and Level II—Advanced Welder.

AWS EG2.0, *Guide for the Training of Welding Personnel: SENSE Level I—Entry Welders*, is intended to provide guidelines for the implementation of an entry-level welder training program that complies with the national SENSE standards for welding education. The guidelines contained in this document are based on AWS QC10, *Specification for Qualification and Certification of SENSE Level I—Entry Welders*.

AWS QC10 and EG2.0 represent the consensus of the AWS Education Committee regarding the minimum training requirements for a Level I—Entry Welder based on industry requirements. AWS EG2.0 establishes the guidelines necessary to standardize the training of entry-level welders on a national basis.

This latest revision of EG2.0 makes reference to the AWS EG2.0 Supplement, *Supplement SENSE Level I—Entry Welder Training Performance Testing Procedures*. This supplement provides a Welder Performance Qualification Technique Sheet and accompanying AWS SWPS for each SENSE Level I workmanship and welder performance qualification test. These procedures are for educational use only, and shall not be used by employers for welder performance qualification tests or for production welding.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Director, Education Services Department, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

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Guide for the Training of Welding Personnel: SENSE Level I—Entry Welders

1. General Provisions

1.1 Scope. EG2.0 establishes a skill standard by defining the recommended minimum welder training requirements for a Level I—Entry Welder in accordance with AWS QC10, *Specification for Qualification and Certification of SENSE Level I—Entry Welders*.

This guide is intended to specify a credible path for training organizations to implement new welding programs or to enhance existing programs to administer Level I—Entry Welder training.

Use of this guide is voluntary. Training organizations desiring to register a trainee as an AWS SENSE Entry Welder, or to record completion of modules or units, shall consider these guidelines as the minimum specified under AWS QC10. Training organizations are free to exceed these minimum requirements.

1.2 Objectives

1.2.1 Provide training organizations with an industrial awareness of the occupational description, conditions, task listing, and profile that encompasses the job classification of Level I—Entry Welder.

1.2.2 Establish a national consensus guideline, based on an industry-wide survey of skills needed in industry, detailing the minimum acceptable skill requirements for the training of a Level I—Entry Welder.

1.2.3 Provide training organizations with a list of *key indicators (desired outcomes), objectives, evaluation criteria, and recommended instructional activities* necessary to accomplish Level I—Entry Welder training.

1.2.4 Provide training organizations with a national consensus guideline with which to compare their own curriculum, evaluate third party curricula, or develop a new curriculum that is aligned with this national consensus, modular SENSE guideline.

1.2.5 Provide training organizations with AWS documents and standards to be used as a basis for evaluating or developing training materials.

1.2.6 Provide training organizations participating in SENSE with information related to the administration of Level I—Entry Welder testing necessary to meet the requirements of AWS QC10.

1.3 Implementation

1.3.1 Accredited Training Program. Training organizations shall be a SENSE Accredited Training Program (ATP) per AWS QC21, *Specification for AWS Accreditation of SENSE Welder Training Programs*, to be eligible to list training completers in the AWS SENSE Certificate Database.

1.3.2 Completion Status. AWS QC10, Clauses 6, 7, and 9 define the requirements for trainees to receive “partial completion” or “full completion” status as an AWS SENSE Entry Welder. In order to be registered in the AWS SENSE Certificate Database, the ATP shall prepare and submit the trainees scores to the AWS Education Department.

1.3.2.1 Continuation of Full Completers in the AWS SENSE Certificate Database. AWS QC10, Clause 11 indicates an individual with full completion as a Level I—Entry Welder status shall remain in the AWS SENSE Certificate Database for three (3) years, after which time a permanent record shall be archived.

1.3.2.2 Continuation of Partial Completers in the AWS SENSE Certificate Database. AWS QC10, Clause 11 indicates that an individual with partial completion status shall remain in the AWS SENSE Certificate Database for three (3) years from the date of their last completed arc welding process competency, after which time a permanent record shall be archived.

2. Industrial Awareness

2.1 Scope. Training organizations should understand the needs of industry and provide welder training programs that prepare students to fill these needs. This is difficult because of the diverse nature of the welding function, along with the fact that it varies from industry-to-industry and from company-to-company.

Recognizing this diversity, AWS conducted an industry-wide survey, covering a broad base of businesses, job classifications, and educational institutions, to gather and analyze data concerning the skills and knowledge that a Level I—Entry Welder should possess. From a needs assessment and analysis, a profile of the Level I—Entry Welder was developed. This profile identifies skill and knowledge areas common to all Level I—Entry Welders, regardless of their unique situation in industry.

The second step used to understand the function of a welder in industry, was to prepare a task analysis based on the Level I—Entry Welder profile. The results of this analysis included a definition (see 2.2), an occupational description (see 2.3), and the occupational conditions (see 2.4). The resulting information is considered common to all Level I—Entry Welders.

Upon completion of the task analysis, technical information topics, materials, equipment, and tools were identified. This information was then converted from occupational data to a guide with key indicators (desired outcomes), objectives, evaluation criteria, and recommended instructional activities. The following sections include portions of the occupational data collected during the needs and task analysis phases of this project to help institutions increase their awareness of industry needs.

2.2 Level I—Entry Welder Definition. An individual employed in this position is considered to possess a prerequisite amount of knowledge, attitude, skills, and habits required to perform routine, predictable, repetitive, and procedural tasks involving motor skills, and limited theoretical knowledge while working under close supervision.

2.3 Level I—Entry Welder Occupational Description. The Level I—Entry Welder position is comprised of the following areas:

2.3.1 Common Work Assignments (Occupational Orientation)

1. Follow detailed verbal or written instructions given by an immediate supervisor to set up and carry out specific job assignments.
2. Perform general housekeeping duties to maintain workspace, equipment, and tool cleanliness.
3. Fill out, maintain, and submit a time card, or work assignment card, and other records as required by the employer or institution.
4. Follows safe practices in the performance of daily duties.

2.3.2 Safety and Health of Welders

1. Wears applicable Personal Protective Equipment (PPE) while conducting, or in the vicinity of welding and cutting activities.
2. Follows procedures established using the concepts and requirements from NFPA and OSHA for “Hot Zone” management to ensure the safety of the work area and the general public.
3. Is aware of the dangers associated with welding and brazing fumes, and uses the best possible means of ventilation available for the capture of welding and brazing fumes as close to the source as possible.
4. Follows established procedures and policies for implementing emergency action plans and for the use of safety equipment.
5. Performs fire safety inspections of the work area.
6. Follows established procedures and policies for working in confined areas.
7. Follows written instructions and precautions provided on applicable documentation for materials used in support of welding and cutting activities.

8. Is aware of the purpose of precautionary labels as well as Safety Data Sheets (SDSs) and Material Safety Data Sheets (MSDSs), and refers to them for materials used in support of welding and cutting activities.

2.3.3 Drawing and Welding Symbol Interpretation

1. Prepares an applicable bill of materials.
2. Performs conversions of standard inch and metric measurements.
3. Prepares parts from simple sketches or drawings.
4. Prepares weld joints and performs welding operations using welding symbol information.

2.3.4 Shielded Metal Arc Welding (SMAW). Performs minor external repairs to equipment and accessories, and sets up and performs SMAW operations, making fillet and groove welds in all positions within a limited thickness range on carbon steel.

2.3.5 Gas Metal Arc Welding (GMAW). Performs minor external repairs to equipment and accessories, and sets up and performs:

1. Gas metal arc welding (short circuit transfer) operations, making fillet and groove welds in all positions within a limited thickness range on carbon steel.
2. Gas metal arc welding (spray transfer) operations, making fillet and groove welds in limited positions within a limited thickness range on carbon steel.

2.3.6 Flux Cored Arc Welding (FCAW). Performs minor external repairs to equipment and accessories, and sets up and performs FCAW-G/GM (gas shielded) and FCAW-S (self-shielded) operations, making fillet and groove welds in all positions within a limited thickness range on carbon steel.

2.3.7 Gas Tungsten Arc Welding (GTAW). Performs minor external repairs to equipment and accessories, and sets up and performs gas tungsten arc welding operations, making fillet and groove welds in all positions within a limited thickness range on carbon steel, and in limited positions within a limited thickness range of austenitic stainless steel and aluminum.

2.3.8 Thermal Cutting Processes. Performs minor external repairs to equipment and accessories, and sets up and performs:

1. Manual oxyfuel gas cutting and gouging operations, making straight, bevel, and shape cuts, and base and weld metal removal in limited positions within a limited thickness on carbon steel.
2. Mechanized oxyfuel gas cutting (e.g., track burner) operations, making straight and bevel cuts in limited positions within a limited thickness range on carbon steel.
3. Manual plasma arc cutting operations, making straight, bevel, and shape cuts, and base and weld metal removal in limited positions within a limited thickness range on carbon steel, stainless steel, and aluminum.
4. Manual air carbon arc cutting and gouging operations, making straight, bevel, and shape cuts, and base and weld metal removal in limited positions within a limited thickness range on carbon steel.

2.3.9 Welding Inspection and Testing. Visually examines all work for discontinuities and defects:

1. Examines cut surfaces and edges of prepared base metal parts.
2. Examines tacks, root passes, intermediate layers, and completed welds.

2.4 Level I—Entry Welder Occupational Conditions

2.4.1 Work Environment. Level I—Entry Welders are employed in a wide range of industries that use welding and welding-related tasks during the course of daily operations.

2.4.2 Occupational Hazards. As is the case in most industries, there is always the potential for injuries and hazardous situations. Machinery and welding equipment present electrical hazards. Machinery for shearing, forming, and punching can pose the risk of serious injury if proper safety procedures are not followed. Fuel gases and other compressed gases used during flame cutting and welding operations can cause fires or explosions. The welder may be

required to work in confined spaces, at high elevations, in awkward positions, or may be exposed to high noise levels. Therefore, the welder must take safety precautions and be safety conscious at all times.

2.4.3 Level I—Entry Welder Profile. This position involves concentration, hand-eye coordination, limited decision-making, and physical tasks. Additionally, they shall possess the following capabilities and character traits:

2.4.3.1 Physical Requirements. The Level I—Entry Welder shall meet the physical requirements established by the employer.

2.4.3.2 Employability. The Level I—Entry Welder should exhibit good written, oral, and listening skills, as well as basic problem solving and decision-making skills. This individual should show sound judgment, be dependable, and interact well with others.

2.4.3.3 Education. The Level I—Entry Welder training is accomplished through secondary, post-secondary, vocational-technical schools, junior colleges, universities, apprenticeship, and employer-based welder training programs. Sufficient basic skills such as reading, writing, math, and communication skills are required to complete welding-related knowledge and skills training.

3. Guidelines

3.1 General Guidelines. It is the sole intent of this document to provide guidelines for a “modular,” competency-based welding curriculum for the Level I—Entry Welder. Thus, the training organization shall provide an adequate curriculum to achieve Level I—Entry Welder welding skills and knowledge requirements.

In addition, it is the responsibility of the training organization to establish any prerequisites and guidelines for use during training related to basic skills (i.e., reading, writing, mathematics, and listening/oral communications). Training activities should consistently reinforce the use of these basic skills, as well as employability skills.

NOTE: The learning modules in this guide contain sufficient information for instructors and training organizations to develop or acquire a suitable curriculum, and to evaluate trainee performance. (See 3.3 Recommended Modular Guidelines for Level I—Entry Welder Training.)

3.1.1 Placement Assessment. Industry wants entry level welders with reading, writing, mathematics, and communication skills adequate for successful job performance. Therefore, it is strongly recommended that a prospective trainee undergo a placement assessment before entering the welding program to ensure that they have an aptitude for welding as well as sufficient basic skills to succeed in the program.

3.1.2 Implementation—Modular Design. AWS SENSE Level I—Entry Welder is designed to facilitate the implementation of a modular welder training program based on best practices. The Level I—Entry Welder guidelines can be implemented in two ways:

3.1.2.1 As a “full completion” program covering SMAW, GMAW, FCAW, and GTAW, along with occupational orientation, safety, drawing and welding symbol interpretation, thermal cutting processes, and welding inspection.

3.1.2.2 As a “partial completion” program covering selected welding processes (SMAW, GMAW, FCAW, or GTAW) along with occupational orientation, safety, drawing and welding symbol interpretation, thermal cutting processes, and welding inspection.

3.1.2.3 The requirements for a trainee to receive full or partial completion status as an AWS SENSE Level I—Entry Welder are specified in AWS QC10, Clauses 6 and 7.

3.1.3 Curriculum Comparison. Each training organization’s course of study should reflect the objectives and key indicators of this guide as outlined in 3.2 *Recommended Modular Competency-Based Program Outline* and detailed in 3.3, *Recommended Modular Guidelines for Level I—Entry Welder Training*.

3.1.4 Teaching Sequence. The program sequence as outlined in 3.2 *Recommended Modular Competency Based Program Outline* and detailed in 3.3 *Recommended Modular Guidelines for Level I—Entry Welder Training* is not mandatory. The teaching sequence should be determined by the instructor, the training organization, and the state educational authority, based on the needs of industry and the trainee population.

3.1.5 Practical Knowledge Examinations. Each module in the SENSE Level I—Entry Welder program includes a practical knowledge exam except Module 1, Occupational Orientation.

3.1.5.1 Trainees shall achieve a score 100% on the welding AWS SENSE safety practical knowledge exam before proceeding with skill training.

3.1.5.2 A minimum score of 75% is required to pass all AWS SENSE practical knowledge exams other than safety.

3.1.5.3 Trainees seeking full or partial completion are required to complete the entire Thermal Cutting Processes knowledge exam (Module 8) covering all four (4) units, even if they do not take the hands-on portions of Mechanized OFC (Unit 2) and CAC-A (Unit 4).

3.1.5.4 It is recommended that practical knowledge exams be administered at the completion of each module of training. Alternatively, knowledge exams may be administered at other intervals at the discretion of the instructor and the training organization.

3.1.5.5 It is recommended that instructors develop and administer frequent and appropriate tests during and after the completion of classroom instruction to measure mastery of key concepts. Tests may be written, or administered over a learning management system (LMS).

3.1.6 Welder Performance Qualification Testing. AWS SENSE Level I—Entry Welder provides an introduction to plate welder performance qualification tests. There are performance qualification tests for 2G and 3G limited thickness SMAW on carbon steel only. Upon completion of Level I, trainees should be encouraged to pursue AWS SENSE Level II—Advanced Welder as this program concentrates on multiple pass plate and pipe welder performance qualification tests. Level II welder performance qualification tests are representative of the tests that trainees will typically be required to pass on the job.

3.1.7 Workmanship Qualification Testing. AWS SENSE Level I—Entry Welder focuses on workmanship qualification tests to build basic skills in part layout, cutting, grinding, fitting, tacking, and positional welding with GMAW, FCAW, and GTAW. These tests require a visual examination of the weldment only.

3.1.8 EG2.0 Supplement, SENSE Level I—Welder Training Performance Testing Procedures. A training supplement guide is available to augment workmanship and welder performance qualification tests specified in this guide. The supplement contains recommended Welder Performance Qualification Technique Sheets (WPQTSs) for all workmanship and welder performance qualification tests. It also includes AWS Standard Welding Procedure Specifications (SWPSs) per AWS B2.0 where available. AWS SWPSs are made available to SENSE training organizations for educational use only. These WPQTSs and corresponding SWPSs are representative of the welding procedures that are used by Accredited Test Facilities (ATFs).

3.1.9 Radiographic Examination. Radiographic examination (RT) may be substituted in lieu of AWS standard guided bend tests for welder performance qualification tests.

3.1.10 Record Keeping. It is recommended that training organizations develop appropriate records to track each trainee's achievements. In addition, appropriate records should be developed so that trainees may keep a record of achievement.

3.1.11 New Technology. AWS SENSE Level I—Entry Welder assumes that many training organizations may not have the latest welding technology available for training. Nevertheless, training organizations should ensure that instructors have access to information about advances in welding technology, and that the welding curriculum be updated regularly to reflect these advances.

3.1.12 Participation in AWS. Trainees should be encouraged to participate in AWS student chapters or in regular AWS sections as student members in order to develop their industry awareness, and to network with welding professionals. Likewise, training organizations can promote their welding training facilities and develop credibility with local welding industry by hosting AWS student nights, hosting local and regional welding skills competitions, and organizing student chapters.

3.1.13 Field Trips and Industry Involvement. If time and policies permit, training organizations are encouraged to arrange field trips to local manufacturers, union training centers, and metal fabricators involved with welding. The opportunity to experience welding applications used in real-world settings can be extremely motivational and enlighten-

ing for trainees. Field trips and industry involvement also build important relationships between training organizations and potential employers.

3.1.14 Guest Speakers and Job Fairs. Training organizations are also encouraged to invite industry and trade union representatives to discuss career opportunities and employment requirements with trainees. Job fairs also provide excellent networking opportunities between trainees and potential employers.

3.1.15 Budget. Adequate financial resources should be provided to maintain and enhance the welding program. Primary funding is for all necessary equipment (power sources, filler metals, gases, power equipment, hand tools, etc.). Additional monies should be available to provide the materials necessary for adequate welding instruction. Budget resources should also be available for staff and faculty technical and professional development.

Table 3.1
Level I—Entry Welder Program Structure

Learning Module or Unit	Competency	Verification—Qualification Test			Competency Achieved by:
		Knowledge Exam	Visual	Destructive	
Module 1	Occupational Orientation	N/A	N/A	N/A	Instructor/Advisor observation
Module 2	Safety and Health of Welders	Yes	N/A	N/A	Knowledge Exam Score 100% minimum
Module 3	Drawing and Welding Symbol Interpretation	Yes	N/A	N/A	Knowledge Exam Score 75% minimum
Module 4	Shielded Metal Arc Welding (SMAW)	Yes	Yes	Yes	Knowledge Exam Score 75% minimum Visual Examination Passed Destructive Test Passed
Module 5	Gas Metal Arc Welding (GMAW, GMAW-S)	Yes	Yes	N/A	Knowledge Exam Score 75% minimum Visual Examination Passed
Module 6	Flux Cored Arc Welding (FCAW-G/GM, FCAW-S)	Yes	Yes	N/A	Knowledge Exam Score 75% minimum Visual Examination Passed
Module 7	Gas Tungsten Arc Welding (GTAW)	Yes	Yes	N/A	Knowledge Exam Score 75% minimum Visual Examination Passed
Module 8	Thermal Cutting Processes	Yes	N/A	N/A	Knowledge Exam Score 75% minimum Visual (see below)
Unit 1	Manual Oxyfuel Gas Cutting (OFC)	Yes	Yes	N/A	Included in Module 8 Exam
Unit 2*	Mechanized Oxyfuel Gas Cutting (OFC)	Yes	Yes	N/A	Included in Module 8 Exam
Unit 3	Manual Plasma Arc Cutting (PAC)	Yes	Yes	N/A	Included in Module 8 Exam Visual Examination Passed
Unit 4*	Manual Air Carbon Arc Cutting (CAC-A)	Yes	Yes	N/A	Included in Module 8 Exam
Module 9	Welding Inspection and Testing	Yes	N/A	N/A	Knowledge Exam Score 75% minimum

**Mechanized OFC & CAC-A hands-on training is optional and not required for full or partial SENSE Level I—Entry Welder completion.*

N/A = Not applicable.

Table 3.2
Level I—Entry Welder Workmanship and Qualification Tests

Test	Drawing AWS EDU-	Process	Workmanship/ Performance	Material	SWPS ^a
1	3	GMAW-S	Workmanship	Steel	B2.1-1-004
2	2	GMAW-Spray	Workmanship	Steel	B2.1-1-235
3	1	FCAW-G	Workmanship	Steel	B2.1-1-019 or B2.1-1-020
4	1	FCAW-S	Workmanship	Steel	B2.1-1-027 or B2.1-1-018
5	3	GTAW	Workmanship	Steel	B2.1-1-008
6	4	GTAW	Workmanship	Stainless	B2.1-8-009
7	5	GTAW	Workmanship	Aluminum	B2.1-1-015
8	6	SMAW	Performance	Steel	B2.1-1-016
9	6	SMAW	Performance	Steel	B2.1-1-016

^a Any applicable qualified WPS may be used in lieu of SWPS; AWS D1.1 (prequalified, company furnished, etc.).

3.2 Recommended Modular Competency-Based Program Outline

Program: (LI) LEVEL I—ENTRY WELDER TRAINING

Reference: Entry Welder Program Structure AWS QC10, Table 6.1.

3.2.1 LI MODULE 1: OCCUPATIONAL ORIENTATION

KEY INDICATORS

1. Prepares time or job cards, reports, or records.
2. Performs housekeeping duties.
3. Follows verbal instructions to complete work assignments.
4. Follows written instructions to complete work assignments.

3.2.2 LI MODULE 2: SAFETY AND HEALTH OF WELDERS

KEY INDICATORS

1. Demonstrates proper use and inspection of personal protection equipment (PPE).
2. Demonstrates proper safe operation practices in the work area.
3. Demonstrates proper use and inspection of ventilation equipment.
4. Demonstrates proper Hot Zone operation.
5. Demonstrates proper work actions for working in confined spaces.
6. Demonstrates proper use of precautionary labeling as well as SDS and MSDS information.
7. Demonstrates proper inspection and operation of equipment used for each welding and thermal cutting process.
(This is best done as part of the process module/unit for each of the required welding and thermal cutting processes.)

3.2.3 LI MODULE 3: DRAWING AND WELDING SYMBOL INTERPRETATION

KEY INDICATORS

1. Interprets basic elements of a drawing or sketch.
2. Interprets welding symbol information.
3. Fabricates parts from a drawing or sketch.

3.2.4 LI MODULE 4: SHIELDED METAL ARC WELDING (SMAW)

KEY INDICATORS

1. Performs safety inspections of SMAW equipment and accessories.
2. Makes minor external repairs to SMAW equipment and accessories.
3. Sets up for SMAW operations on carbon steel.
4. Operates SMAW equipment on carbon steel.
5. Makes fillet weld, in all positions, on carbon steel.
6. Makes groove welds, in all positions, on carbon steel.
7. Passes SMAW welder performance qualification tests (2G and 3G, uphill, limited thickness test plates) on carbon steel.

3.2.5 LI MODULE 5: GAS METAL ARC WELDING (GMAW-S, GMAW spray transfer)

KEY INDICATORS

1. Performs safety inspections of GMAW equipment and accessories.

2. Makes minor external repairs to GMAW equipment and accessories.

Short Circuiting Transfer

3. Sets up for GMAW-S operations on carbon steel.
4. Operates GMAW-S equipment on carbon steel.
5. Makes fillet welds, in all positions, on carbon steel.
6. Makes groove welds, in all positions, on carbon steel.
7. Passes GMAW-S workmanship qualification test on carbon steel.

Spray Transfer

8. Sets up for GMAW (spray) operations on carbon steel.
9. Operates GMAW (spray) equipment on carbon steel.
10. Makes fillet welds in the 1F and 2F positions on carbon steel.
11. Makes groove welds in the 1G position on carbon steel.
12. Passes GMAW (spray) workmanship qualification test on carbon steel.

3.2.6 LI MODULE 6: FLUX CORED ARC WELDING (FCAW-G/GM, FCAW-S)

KEY INDICATORS

1. Performs safety inspections of FCAW equipment and accessories.
2. Makes minor external repairs to FCAW equipment and accessories.

Gas Shielded

3. Sets up for FCAW-G/GM operations on carbon steel.
4. Operates FCAW-G/GM equipment on carbon steel.
5. Makes fillet welds, in all positions, on carbon steel.
6. Makes groove welds, in all positions, on carbon steel.
7. Passes FCAW-G/GM workmanship qualification test on carbon steel.

Self-Shielded

8. Sets up for FCAW-S operations on carbon steel.
9. Operates FCAW-S equipment on carbon steel.
10. Makes fillet welds, in all positions, on carbon steel.
11. Makes groove welds, in all positions, on carbon steel.
12. Passes FCAW-S workmanship qualification test on carbon steel.

3.2.7 LI MODULE 7: GAS TUNGSTEN ARC WELDING (GTAW)

KEY INDICATORS

1. Performs safety inspections of GTAW equipment and accessories.
2. Makes minor external repairs to GTAW equipment and accessories.

Carbon Steel

3. Sets up for GTAW operations on carbon steel.
4. Operates GTAW equipment on carbon steel.

5. Makes fillet welds, in all positions, on carbon steel.
6. Makes groove welds, in all positions, on carbon steel.
7. Passes GTAW workmanship qualification test on carbon steel.

Austenitic Stainless Steel

8. Sets up for GTAW operations on austenitic stainless steel.
9. Operates GTAW equipment on austenitic stainless steel.
10. Makes fillet welds in the 1F, 2F, and 3F positions, on austenitic stainless steel.
11. Makes groove welds in the 1G and 2G positions, on austenitic stainless steel.
12. Passes GTAW workmanship qualification test on austenitic stainless steel.

Aluminum

13. Sets up for GTAW operations on aluminum.
14. Operates GTAW equipment on aluminum.
15. Makes fillet welds in the 1F and 2F positions, on aluminum.
16. Makes groove welds in the 1G position, on aluminum.
17. Passes GTAW workmanship qualification test on aluminum.

3.2.8 LI MODULE 8: THERMAL CUTTING PROCESSES

UNIT 1: MANUAL OXYFUEL GAS CUTTING (OFC)*

KEY INDICATORS

1. Performs safety inspections of manual OFC equipment and accessories.
2. Makes minor external repairs to manual OFC equipment and accessories.
3. Sets up for manual OFC operations on carbon steel.
4. Operates manual OFC equipment on carbon steel.
5. Performs straight, square edge cutting operations, in the flat position, on carbon steel.
6. Performs shape, square edge cutting operations, in the flat position, on carbon steel.
7. Performs straight, bevel edge cutting operations, in the flat position, on carbon steel.
8. Performs scarfing and gouging operations to remove base and weld metal, in the flat and horizontal positions, on carbon steel.

**OFC is a compulsory unit required for full or partial SENSE Level I—Entry Welder completion.*

UNIT 2: MECHANIZED OXYFUEL GAS CUTTING (OFC)* [e.g., TRACK BURNER]

KEY INDICATORS

1. Performs safety inspections of mechanized OFC equipment and accessories.
2. Makes minor external repairs to mechanized OFC equipment and accessories.
3. Sets up for mechanized OFC operations on carbon steel.
4. Operates mechanized OFC equipment on carbon steel.
5. Performs straight, square edge cutting operations in the flat position, on carbon steel.

6. Performs straight, bevel edge cutting operations in the flat position, on carbon steel.

**Mechanized OFC hands-on training is optional and is not required for full or partial SENSE Level I—Entry Welder completion.*

UNIT 3: MANUAL PLASMA ARC CUTTING (PAC)*

KEY INDICATORS

1. Performs safety inspections of manual PAC equipment and accessories.
2. Makes minor external repairs to manual PAC equipment and accessories.
3. Sets up for manual PAC operations on carbon steel, austenitic stainless steel, and aluminum.
4. Operates manual PAC equipment on carbon steel, austenitic stainless steel, and aluminum.
5. Performs straight, square edge cutting operations, in the flat position, on carbon steel, austenitic stainless steel, and aluminum.
6. Performs shape, square edge cutting operations, in the flat position, on carbon steel, austenitic stainless steel, and aluminum.

**PAC is a compulsory unit required for full or partial SENSE Level I—Entry Welder completion.*

UNIT 4: MANUAL AIR CARBON ARC CUTTING (CAC-A)*

KEY INDICATORS

1. Performs safety inspections of manual CAC-A equipment and accessories.
2. Makes minor external repairs to manual CAC-A equipment and accessories.
3. Sets up for manual CAC-A scarfing and gouging operations on carbon steel.
4. Operates manual CAC-A equipment on carbon steel.
5. Performs scarfing and gouging operations to remove base and weld metal, in the flat and horizontal positions, on carbon steel.

**CAC-A hands-on training is optional and is not required for full or partial SENSE Level I—Entry Welder completion.*

3.2.9 LI MODULE 9: WELDING INSPECTION AND TESTING

KEY INDICATORS

1. Examines cut surfaces and edges of prepared base metal parts.
2. Examines tacks, root passes, intermediate layers, and completed welds.

3.3 Recommended Modular Guidelines for Level I—Entry Welder Training

Each key indicator is presented on a separate page by module to help organize curriculum development learning objectives, evaluation criteria, and recommended instructional activities.

3.3.1 LI MODULE 1: OCCUPATIONAL ORIENTATION

KEY INDICATOR 1: Prepares time or job cards, reports, or records.

OBJECTIVE: Provided with a period of instruction and demonstration, a time record, and job or work assignment number, the trainee records personal training and job assignment information.

EVALUATION CRITERIA: The trainee's time records are completed in accordance with the institution's standard operating procedures. The trainee performs the task on a continuous basis over the length of the program. The trainee's completed record is compared against the instructor's master record for accuracy.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Develop a Training Achievement Record (TAR) (see Annex E).
2. Develop a trainee time record.
3. Demonstrate procedures for completion of training achievement records and time cards.
4. Provide instruction related to time and job recording methods related to the welding industry.
5. Provide training exercises related to trainee maintenance of a TAR.
6. Provide training exercises related to trainee maintenance of a time card.
7. Observe each trainee's ability to carry out training exercises.
8. Monitor individual training achievement records and time cards.
9. Keep training records reflecting trainee achievement and attendance.

3.3.1 LI MODULE 1: OCCUPATIONAL ORIENTATION

KEY INDICATOR 2: Performs housekeeping duties.

OBJECTIVE: Provided with a period of orientation, housekeeping equipment or tools, and given a housekeeping assignment in the work area, the trainee will carry out housekeeping activities.

EVALUATION CRITERIA: The trainee's completed assignments show evidence of good housekeeping and safety practices. The assignment is completed in accordance with the institution's standard operating procedure. The task is completed in a timely manner. The trainee's workmanship is observed by the instructor on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Outline common housekeeping activities shared by all trainees.
2. Outline individual housekeeping responsibilities.
3. Provide housekeeping activities for all trainees.
4. Monitor and inspect completed individual and shared housekeeping assignments.
5. Keep training records reflecting trainee housekeeping habits.
6. Observe each trainee's ability to carry out training exercises.

3.3.1 LI MODULE 1: OCCUPATIONAL ORIENTATION

KEY INDICATOR 3: Follows verbal instructions to complete work assignments.

OBJECTIVE: Given verbal work assignment instructions and the required materials, equipment, and tools, the trainee will carry out a job assignment.

EVALUATION CRITERIA: The trainee's work assignment is completed according to verbal instructions. The instructor observes the trainee selecting the necessary materials, equipment, and tools to meet service conditions for the job requirements. The trainee sets up and completes assignments in a timely manner. Verbal instructions are carried out on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Develop training exercises that require a trainee to follow verbal instructions.
2. Observe each trainee selecting the required material, equipment, and tools for each exercise.
3. Observe each trainee's ability to carry out training exercises.
4. Keep training records reflecting each trainee's listening skills.

3.3.1 LI MODULE 1: OCCUPATIONAL ORIENTATION

KEY INDICATOR 4: Follows written instructions to complete work assignment.

OBJECTIVE: Given written work assignment instructions and the required materials, equipment, and tools, the trainee will carry out a job assignment.

EVALUATION CRITERIA: The trainee's work assignment is completed according to written instructions. The trainee is observed by the instructor selecting the necessary materials, equipment, and tools to meet service conditions for the job requirements. The trainee sets up and completes the assignment in a timely manner. Written instructions are carried out on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Develop training exercises that require a trainee to follow written instructions.
2. Observe each trainee selecting the required materials, equipment, and tools for each exercise.
3. Keep training records reflecting each trainee's ability to follow written instructions.
4. Observe each trainee's ability to carry out training exercises.

3.3.2 LI MODULE 2: SAFETY AND HEALTH OF WELDERS

KEY INDICATOR 1: Demonstrates proper use and inspection of personal protection equipment (PPE).

OBJECTIVE: Provided with a period of instruction, orientation, and demonstration about general welding safety, and given the necessary personal protective clothing and equipment, the trainee demonstrates proper use and inspection of personal protective equipment (PPE).

EVALUATION CRITERIA: The trainee inspects and wears proper personal protective clothing and equipment while conducting, or in the vicinity of welding and cutting activities; and follows established procedures to ensure the safety of the work area and the general public.

NOTE: In accordance with the requirements of AWS QC10, the trainee scores a minimum of 100% on the safety knowledge exam for Module 2: Safety and Health of Welders.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide an orientation to Personal Protective Equipment (PPE) required for welding.
2. Provide demonstrations related to ANSI Z49.1, Section 4, *Protection of Personnel and the General Area*.
3. Keep records reflecting successful completion of safe practice training.
4. Observe each trainee's ability to carry out training exercises.

NOTES:

1. The safety knowledge exam for Module 2: Safety and Health of Welders shall be administered prior to skill training. Trainees shall achieve a minimum score of 100% on the safety exam before proceeding with skill training.
2. Proper safety procedures should be reinforced and observed in all modules and units.

3.3.2 LI MODULE 2: SAFETY AND HEALTH OF WELDERS

KEY INDICATOR 2: Demonstrates proper safe operation practices in the work area.

OBJECTIVE: Provided with a period of instruction, orientation, and demonstration about general welding safety, and given the necessary personal protective clothing and equipment, the trainee demonstrates safe practices in the work area.

EVALUATION CRITERIA: The trainee: wears proper personal protective clothing and equipment while conducting, or in the vicinity of welding and cutting activities; and follows established procedures to ensure the safety of the work area and the general public; and achieves a score of 100% on the safety exam for Module 2: Safety and Health of Welders, based on ANSI Z49.1.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide safety tour and orientation of the institution's welding work area.
2. Provide demonstrations related to ANSI Z49.1, Section 4, *Protection of Personnel and the General Area*.
3. Provide demonstrations related to ANSI Z49.1, Part I—*General Aspects*.
4. Keep records reflecting successful completion of safe practice training.
5. Observe each trainee's ability to carry out training exercises.

NOTES:

1. The safety knowledge exam for Module 2: Safety and Health of Welders shall be administered prior to skill training. Trainees shall achieve a minimum score of 100% on the safety exam before proceeding with skill training.
2. Proper safety procedures should be reinforced and observed in all modules and units.

3.3.2 LI MODULE 2: SAFETY AND HEALTH OF WELDERS

KEY INDICATOR 3: Demonstrates proper use and inspection of ventilation equipment.

OBJECTIVE: Provided with a period of instruction, orientation, and demonstration about the operation, inspection, and positioning of ventilation equipment, the trainee demonstrates the proper use and inspection of ventilation equipment.

EVALUATION CRITERIA: The trainee: conducts a proper inspection of ventilation equipment; uses the best possible means of ventilation available for the capture of welding and brazing fumes as close to the source as possible; and achieves a score of 100% on the safety exam for Module 2: Safety and Health of Welders, based on ANSI Z49.1.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations related to ANSI Z49.1, Section 5, *Ventilation*.
2. Keep records reflecting successful completion of safe practice training.
3. Observe each trainee's ability to carry out training exercises.

NOTES:

1. The safety knowledge exam for Module 2: Safety and Health of Welders shall be administered prior to skill training. Trainees shall achieve a minimum score of 100% on the safety exam before proceeding with skill training.
2. Proper safety procedures should be reinforced and observed in all modules and units.

3.3.2 LI MODULE 2: SAFETY AND HEALTH OF WELDERS

KEY INDICATOR 4: Demonstrates proper Hot Zone operation.

OBJECTIVE: Provided with a period of instruction, orientation, and demonstration about safety in the Hot Zone, the trainee demonstrates safe practices in the Hot Zone.

EVALUATION CRITERIA: The trainee: follows established procedures to ensure the safety of the work area and the general public; follows established procedures and policies regarding emergency action plans and for the use of safety equipment; performs fire safety inspections of the work area; and demonstrates proper safety procedures in the Hot Zone.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide safety tour and orientation of the institution's Hot Zone areas.
2. Explain the concepts and use of Hot Zone permits.
3. Provide demonstrations related to ANSI Z49.1, Section 4, *Protection of Personnel and the General Area*.
4. Provide demonstrations related to ANSI Z49.1, Section 6, *Fire Prevention and Protection*.
5. Keep records reflecting successful completion of safe practice training.
6. Observe each trainee's ability to carry out training exercises.

NOTES:

1. The safety knowledge exam for Module 2: Safety and Health of Welders shall be administered prior to skill training. Trainees shall achieve a minimum score of 100% on the safety exam before proceeding with skill training.
2. Proper safety procedures should be reinforced and observed in all modules and units.

3.3.2 LI MODULE 2: SAFETY AND HEALTH OF WELDERS

KEY INDICATOR 5: Demonstrates proper work actions for working in confined spaces.

OBJECTIVE: Provided with a period of instruction, orientation, and demonstration about safety precautions for working in confined spaces, the trainee demonstrates safe practices related to working in confined spaces.

EVALUATION CRITERIA: The trainee: follows established procedures to ensure the safety of the work area; uses the best possible means of ventilation available for the capture of welding and brazing fumes as close to the source as possible; follows established procedures and policies regarding emergency action plans for working in confined spaces; performs fire safety inspections of the work area; and follows established procedures and policies for working in confined areas.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations related to ANSI Z49.1, Section 7, *Confined Spaces*.
2. Provide demonstrations related to ANSI Z49.1, Section 5, *Ventilation*.
3. Provide demonstrations related to ANSI Z49.1, Section 6, *Fire Prevention and Protection*.
4. Provide demonstrations related to ANSI Z49.1, Section 9, *Precautionary Information*.
5. Keep records reflecting successful completion of safe practice training.
6. Observe each trainee's ability to carry out training exercises.

NOTES:

1. The safety knowledge exam for Module 2: Safety and Health of Welders shall be administered prior to skill training. Trainees shall achieve a minimum score of 100% on the safety exam before proceeding with skill training.
2. Proper safety procedures should be reinforced and observed in all modules and units.

3.3.2 LI MODULE 2: SAFETY AND HEALTH OF WELDERS

KEY INDICATOR 6: Demonstrates proper use of precautionary labeling and MSDS information.

OBJECTIVE: Provided with a period of instruction, orientation, and demonstration about the purpose and design of precautionary labels, Safety Data Sheets (SDSs), and Material Safety Data Sheets (MSDSs), and other written materials used in support of welding and cutting activities, the trainee can demonstrate the proper use of label and data sheet information to identify proper safety procedures for work related materials and solvents.

EVALUATION CRITERIA: The trainee: wears proper personal protective clothing and equipment while conducting, or in the vicinity of welding and cutting activities; follows established procedures to ensure the safety of the work area and the general public; identifies proper safety procedures for work related materials and solvents based on label and data sheet information; and follows written instructions and precautions for materials used in support of welding and cutting activities.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations related to ANSI Z49.1, Section 9, *Precautionary Information*.
2. Provide demonstrations related to ANSI Z49.1, Section 4, *Protection of Personnel and the General Area*.
3. Provide demonstrations related to ANSI Z49.1, Section 5, *Ventilation*.
4. Provide demonstrations related to ANSI Z49.1, Section 6, *Fire Prevention and Protection*.
5. Keep records reflecting successful completion of safe practice training.
6. Observe each trainee's ability to carry out training exercises.

NOTES:

1. The safety knowledge exam for Module 2: Safety and Health of Welders shall be administered prior to skill training. Trainees shall achieve a minimum score of 100% on the safety exam before proceeding with skill training.
2. Proper safety procedures should be reinforced and observed in all modules and units.

3.3.2 LI MODULE 2: SAFETY AND HEALTH OF WELDERS

KEY INDICATOR 7: Demonstrates proper inspection and operation of equipment used for each welding and thermal cutting process.

OBJECTIVE: Provided with a period of instruction, orientation, and demonstration at the beginning of each welding and thermal cutting process module or unit, and given the necessary personal protective clothing and equipment, the trainee demonstrates proper inspection and operation of equipment for each welding and thermal cutting process included in the course of study.

EVALUATION CRITERIA: The trainee: follows correct procedures for the inspection of welding and cutting equipment; uses the best possible means of ventilation available for the capture of welding and cutting fumes as close to the source as possible; and follows correct procedures for the operation of welding and cutting equipment.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations related to ANSI Z49.1, Section 11, *Arc Welding and Cutting Equipment Safety*.
2. Provide demonstrations related to ANSI Z49.1, Section 10, *Oxyfuel Gas Welding and Cutting Safety*.
3. Provide demonstrations related to ANSI Z49.1, Section 4, *Ventilation*.
4. Keep records reflecting successful completion of safe practice training.
5. Observe each trainee's ability to carry out training exercises.

NOTES:

1. The safety knowledge exam for Module 2: Safety and Health of Welders shall be administered prior to skill training. Trainees shall achieve a minimum score of 100% on the safety exam before proceeding with skill training.
2. Proper safety procedures should be reinforced and observed in all modules and units.

3.3.3 LI MODULE 3: DRAWING AND WELDING SYMBOL INTERPRETATION

KEY INDICATOR 1: Interprets basic elements of a drawing or sketch.

OBJECTIVE: Provided with a period of instruction and demonstration, a drawing, and base material, the trainee will layout the individual parts of a welded assembly.

EVALUATION CRITERIA: The trainee identifies the fabrication requirements according to drawings or sketch specifications on a routine basis. The instructor observes the trainee preparing to layout according to fabrication requirements. Workmanship sample information is correctly interpreted during workmanship and performance qualification testing and verified by the test supervisor.

NOTE: In accordance with the requirements of AWS QC10, the trainee scores a minimum of 75% on the Drawing and Welding Symbol Interpretation knowledge exam.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide an introduction to drawing or sketch reading.
2. Provide instruction in drawing view interpretation.
3. Provide instruction in title block interpretation.
4. Provide instruction in drawing notes interpretation.
5. Provide instruction in version control system for drawings.
6. Provide instruction in drawing list of materials and parts list interpretation.
7. Provide instruction in drawing dimensions and tolerance for both U.S. (customary) and SI (metric) units.
8. Demonstrate drawing element interpretation.
9. Introduce related terms and definitions.
10. Provide training exercises related to drawing and sketch interpretation.
11. Develop and administer formative (diagnostic) tests relevant to drawing fundamentals.
12. Keep training records reflecting results of drawing element interpretation.

3.3.3 LI MODULE 3: DRAWING AND WELDING SYMBOL INTERPRETATION

KEY INDICATOR 2: Interprets welding symbol information.

OBJECTIVE: Provided with instruction and demonstration, drawings or sketches with welding symbols and supplementary data, the trainee locates and determines welding requirements.

EVALUATION CRITERIA: The trainee identifies welding requirements according to welding symbol information on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide instruction in welding symbol interpretation.
2. Demonstrate welding symbol interpretation.
3. Provide training exercises related to welding symbol interpretation.
4. Introduce related terms and definitions.
5. Observe trainee carrying out welding requirements from welding symbol information.
6. Develop and administer formative (diagnostic) tests relative to welding symbol information.
7. Keep training records reflecting results of welding symbol interpretation requirements.

3.3.3 LI MODULE 3: DRAWING AND WELDING SYMBOL INTERPRETATION

KEY INDICATOR 3: Fabricates parts from a drawing or sketch.

OBJECTIVE: Provided with a drawing or sketch, layout tools, measuring devices, a handheld calculator, fabrication and welding equipment, and base metals, the trainee fabricates a weldment from parts.

EVALUATION CRITERIA: The trainee prepares, assembles, and tack welds parts according to drawings or sketch specifications on a routine basis.

NOTE: In accordance with the requirements of AWS QC10, before proceeding with skill training, the trainee shall achieve a score of 100% on the written safety exam for Module 2: Safety and Health of Welders.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide safety tour and orientation to fabrication tools and equipment.
2. Provide instruction in fabrication tools and equipment safe practices.
3. Provide instruction in the care and use of fabrication tools and equipment.
4. Provide instruction in base metal identification and shapes.
5. Provide instruction in welded joint geometry.
6. Demonstrate the selection and use of fabrication tools and equipment.
7. Demonstrate fabrication techniques.
8. Demonstrate the preparation of welded joints.
9. Provide written fabrication exercises with U.S. (customary) elements for welding practices.
10. Provide written fabrication exercises with SI (metric) elements for welding practices.
11. Observe trainee selecting fabrication tools and equipment.
12. Observe trainee selecting base metals.
13. Observe trainee performance during various stages of fabrication.
14. Observe trainee following safe practices.
15. Develop and administer formative (diagnostic) tests relevant to fabrication and weld symbol interpretation.
16. Prepare trainee for the Drawing and Welding Symbols Interpretation knowledge examination.
17. Keep training records reflecting results of the Drawing and Welding Symbols Interpretation knowledge examination.

3.3.4 LI MODULE 4: SHIELDED METAL ARC WELDING (SMAW)

KEY INDICATOR 1: Performs safety inspections of SMAW equipment and accessories.

OBJECTIVE: Provided with a period of instruction and demonstration on safety inspection guidelines, protective clothing and equipment, hand tools, and SMAW equipment and accessories, the trainee performs safety inspections of protective equipment and clothing, hand tools, SMAW equipment and accessories, and work area.

EVALUATION CRITERIA: The trainee's protective equipment and clothing, hand tools, SMAW equipment and accessories, and work area meet safety requirements. Hazard warnings are communicated to others in the immediate area prior to the start of SMAW operations. In the course of daily operations, the trainee is observed following safe SMAW practices on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide safety tour and orientation to SMAW equipment and accessories.
2. Provide demonstrations on ANSI Z49.1, Section 11, *Arc Welding and Cutting Equipment Safety*.
3. Provide demonstrations on routine safety inspections of protective equipment and clothing, hand tools, SMAW equipment and accessories, and work area.
4. Provide instruction on ANSI Z49.1, Section 11.
5. Reinforce previous instruction from ANSI Z49.1, Part I—*General Aspects*.
6. Introduce relevant terms and definitions and observe trainee using proper SMAW terms and definitions.
7. Observe trainee conducting safety inspections for SMAW.
8. Observe trainee following safe SMAW practices.
9. Develop and administer formative or diagnostic tests on safe SMAW practices.
10. Keep records reflecting each trainee's successful completion of training in SMAW safe practices.

3.3.4 LI MODULE 4: SHIELDED METAL ARC WELDING (SMAW)

KEY INDICATOR 2: Makes minor external repairs to SMAW equipment and accessories.

OBJECTIVE: Provided with a period of instruction and demonstration on repair materials, equipment, and tools, the trainee will make minor external repairs to SMAW equipment and accessories.

EVALUATION CRITERIA: The trainee's repairs to SMAW equipment and accessories are made in accordance with the manufacturer's recommendations and the institution's repair policy. The correct repair materials, equipment, and tools are selected. The assignment is completed in a timely manner. The objective is performed as required during the SMAW portion of the program.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide instruction and demonstrations on SMAW equipment and accessories identification.
2. Provide instruction and demonstrations on minor external repairs on SMAW equipment and accessories.
3. Introduce relevant terms and definitions and observe trainee using proper SMAW terms and definitions.
4. Provide training exercises on making minor external repairs on SMAW equipment and accessories.
5. Observe each trainee's ability to carry out training exercises on making minor external repairs on SMAW equipment and accessories.
6. Observe trainee following safe practices for SMAW while making repairs.
7. Develop and administer formative or diagnostic tests on SMAW equipment and accessories identification and making minor external repairs.
8. Keep records reflecting each trainee's successful completion of training in SMAW equipment and accessories identification, and making minor external repairs.

3.3.4 LI MODULE 4: SHIELDED METAL ARC WELDING (SMAW)

KEY INDICATOR 3: Sets up for SMAW operations on carbon steel.

OBJECTIVE: Provided with a period of instruction and demonstration, verbal or written instructions, protective clothing and equipment, SMAW equipment and accessories, hand tools, carbon steel base metal and E6010 or E6011, and E7018 electrodes, the trainee will set up and prepare to perform SMAW operations on carbon steel.

EVALUATION CRITERIA: The trainee is prepared to weld. Protective clothing and equipment are suitable for job requirements. The proper hand tools, equipment, base metal, and electrodes are selected. SMAW equipment and accessories are set up and adjusted for the proper current and polarity. Parts are assembled according to job requirements. The objective is performed on a routine basis during the SMAW portion of the program.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide instruction on AC and DC welding principles.
2. Provide demonstrations on SMAW equipment and accessory set up on carbon steel.
3. Provide instruction on SMAW principles of operations on carbon steel.
4. Provide instruction on carbon steel shapes, identification and selection.
5. Provide instruction on SMAW filler metal identification and selection for carbon steel.
6. Introduce relevant terms and definitions and observe trainee using proper SMAW terms and definitions.
7. Provide trainee with practice setting up SMAW equipment and accessories for carbon steel.
8. Observe trainee setting up SMAW equipment and accessories for carbon steel.
9. Observe trainee following safe SMAW practices.
10. Develop and administer formative or diagnostic tests on SMAW equipment set up, principles of operation, and carbon steel base and filler metal identification and selection.
11. Keep training records reflecting each trainee's successful completion of training in SMAW equipment set up, principles of operation, carbon steel base and filler metal identification and selection.

3.3.4 LI MODULE 4: SHIELDED METAL ARC WELDING (SMAW)

KEY INDICATOR 4: Operates SMAW equipment on carbon steel.

OBJECTIVE: Provided with a period of instruction and demonstration verbal or written instructions, protective clothing and equipment, SMAW equipment and accessories, hand tools, carbon steel base metal and E6010 or E6011, and E7018 electrodes, the trainee will perform SMAW operations on carbon steel.

EVALUATION CRITERIA: The trainee's SMAW is completed as required by the welding assignment. During and after the operation, welds are visually examined by the trainee and accepted by the instructor on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations on SMAW equipment operations on carbon steel.
2. Provide instruction on SMAW principles of operation on carbon steel.
3. Provide instruction on essential process variables for SMAW on carbon steel.
4. Provide training exercises on SMAW equipment operation on carbon steel.
5. Provide training exercises on starting and maintaining an arc SMAW, using E6010 or E6011, and E7018 electrodes, on carbon steel.
6. Provide training exercises on making 1G, single layer, multiple pass, SMAW stringer bead welds, using E6010 or E6011, and E7018 electrodes, on carbon steel.
7. Provide training exercises on making 1G, multiple layer, multiple pass, SMAW stringer bead welds using E6010 or E6011 and E7018 electrodes, on carbon steel.
8. Observe trainee operating SMAW equipment on carbon steel.
9. Observe trainee following safe SMAW practices.
10. Visually inspect trainee's SMAW stringer bead welds.
11. Develop and administer formative or diagnostic tests on SMAW principles of operation and essential process variables.
12. Keep training records reflecting each trainee's successful completion of training in SMAW principles of operation, essential process variables, and performance exercises on carbon steel.

3.3.4 LI MODULE 4: SHIELDED METAL ARC WELDING (SMAW)

KEY INDICATOR 5: Makes fillet welds, in all positions, on carbon steel.

OBJECTIVE: Provided with a period of instruction and demonstration, verbal or written instructions, protective clothing and equipment, SMAW equipment and accessories, hand tools, carbon steel base metal and E6010 or E6011, and E7018 electrodes, the trainee will make SMAW fillet welds, in all positions, on carbon steel.

EVALUATION CRITERIA: The trainee produces sound SMAW fillet welds, in all positions, on carbon steel. During and after each operation, welds are visually examined by the welder and accepted by the instructor on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations on SMAW fillet welding, in all position, on carbon steel.
2. Provide instruction on visual examination of SMAW fillet welds made on carbon steel.
3. Provide instruction on welding procedures and workmanship for SMAW fillet welding, in all positions, on carbon steel.
4. Provide training exercises on making 1F, single and multiple pass SMAW fillet welds, using E6010, or E6011, and E7018 electrodes, on carbon steel.
5. Provide training exercises on making 2F, single and multiple pass SMAW fillet welds, using E6010, or E6011, and E7018 electrodes, on carbon steel.
6. Provide training exercises on making 3F, uphill, single and multiple pass SMAW fillet welds, using E6010, or E6011, and E7018 electrodes, on carbon steel.
7. Provide training exercises on making 4F, single and multiple pass SMAW fillet welds, using E6010, or E6011, and E7018 electrodes, on carbon steel.
8. Observe trainee operating SMAW equipment on carbon steel.
9. Observe trainee following safe SMAW practices.
10. Visually inspect trainee's SMAW fillet welds.
11. Develop and administer formative or diagnostic tests on SMAW fillet welding principles of operation and essential process variables.
12. Keep training records reflecting each trainee's successful completion of making fillet welds, in all positions, on carbon steel.

3.3.4 LI MODULE 4: SHIELDED METAL ARC WELDING (SMAW)

KEY INDICATOR 6: Makes groove weld, in all positions, on carbon steel.

OBJECTIVE: Provided with a period of demonstration, protective clothing and equipment, SMAW equipment and accessories, E6010 or E6011, and E7018 electrodes, carbon steel base metal, hand tools, and a welding assignment, the trainee will make SMAW groove welds, in all positions, on carbon steel.

EVALUATION CRITERIA: The trainee produces sound groove welds, in all positions, on carbon steel. During and after each operation, welds are visually examined by the welder and accepted by the instructor on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations on SMAW groove welding, in all position, on carbon steel.
2. Provide instruction on visual examination of SMAW groove welds made on carbon steel.
3. Provide instruction on welding procedures and workmanship for SMAW groove welding, in all positions, on carbon steel.
3. Provide training exercises on making 1G, single and multiple pass SMAW groove welds, using E6010, or E6011, and E7018 electrodes, on carbon steel.
4. Provide training exercises on making 2G, single and multiple pass SMAW groove welds, using E6010, or E6011, and E7018 electrodes, on carbon steel.
5. Provide training exercises on making 3G, uphill, single and multiple pass SMAW groove welds, using E6010, or E6011, and E7018 electrodes, on carbon steel.
6. Provide training exercises on making 4G, single and multiple pass SMAW groove welds, using E6010, or E6011, and E7018 electrodes, on carbon steel.
7. Observe trainee operating SMAW equipment on carbon steel.
8. Observe trainee following safe SMAW practices.
9. Visually inspect trainee's SMAW groove welds.
10. Develop and administer formative or diagnostic tests on SMAW groove welding principles of operation and essential process variables.
11. Keep training records reflecting each trainee's successful completion of making groove welds, in all positions, on carbon steel.

3.3.4 LI MODULE 4: SHIELDED METAL ARC WELDING (SMAW)

KEY INDICATOR 7: Passes SMAW welder performance qualification tests (2G and 3G, uphill, limited thickness test plates) on carbon steel.

OBJECTIVE: Provided with protective clothing and equipment, hand tools, SMAW equipment, accessories, E7018 electrodes, 3/8 in. thick carbon steel base metal, 1/4 in. to 3/8 in. thick carbon steel backing material, SWPS B2.1-1-016, and drawing number AWS EDU-6, the trainee will perform SMAW welder performance qualification tests (2G and 3G, uphill, limited thickness test plates) on carbon steel with no assistance from the instructor.

EVALUATION CRITERIA: The trainee produces sound SMAW groove welds in the 2G, and 3G, uphill positions on carbon steel. Test assemblies are prepared according to drawing specifications and approved by the instructor. In accordance with the requirements of AWS QC10, SWPS B2.1-1-016, and drawing number AWS EDU-6, the trainee passes the fabrication, weld symbol interpretation and welding elements of SMAW welder performance qualification test (2G and 3G, uphill, limited thickness test plates) on carbon steel.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Prepare trainee for the fabrication, weld symbol interpretation and 2G and 3G, uphill, SMAW groove welding elements of SMAW welder performance qualification tests (2G and 3G, uphill, limited thickness test plates) on carbon steel.
2. Administer SMAW welder performance qualification tests (2G and 3G, uphill, limited thickness test plates) on carbon steel, in accordance with the requirements of AWS QC10.
3. Keep training records reflecting each trainee's successful completion of the SMAW welder performance qualification bend test (2G and 3G, uphill, limited thickness test plates) on carbon steel.

NOTE: For Training Organizations participating in SENSE Level I—Entry Welder, the scores for the Safety and Health of Welders, Drawing and Welding Symbol Interpretation, SMAW, Thermal Cutting Processes, and Welding Inspection and Testing knowledge exams, along with the results of the SMAW welder performance qualification bend tests (2G and 3G, uphill, limited thickness test plates) on carbon steel, may be reported to AWS to obtain a Level I—Entry Welder training certificate in SMAW. See AWS QC10, Clauses 9, 10, and 11 for details.

3.3.5 LI MODULE 5: GAS METAL ARC WELDING (GMAW-S, GMAW spray transfer)

KEY INDICATOR 1: Performs safety inspections of GMAW equipment and accessories.

OBJECTIVE: Provided with a period of instruction and demonstration on safety inspection guidelines, protective clothing and equipment, hand tools, GMAW equipment and accessories, and GMAW shielding gas supply system equipment and accessories, the trainee performs safety inspections of protective clothing, hand tools, GMAW equipment and accessories, GMAW shielding gas supply system equipment and accessories, and work area.

EVALUATION CRITERIA: The trainee's protective clothing and equipment, hand tools, GMAW equipment and accessories, GMAW shielding gas supply system equipment and accessories, and work area meet safety requirements. Hazard warnings are communicated to others in the immediate area prior to the start of GMAW operations. In the course of daily operations, the trainee is observed following safe GMAW practices on a routine basis.

NOTE: In accordance with the requirements of AWS QC10, before proceeding with skill training, the trainee shall achieve a score of 100% on SENSE safety exam for Module 2: Safety and Health of Welders.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide safety tour and orientation to GMAW equipment and accessories, and GMAW shielding gas supply system equipment and accessories.
2. Provide demonstrations on ANSI Z49.1, Section 11, *Arc Welding and Cutting Equipment Safety*.
3. Provide demonstration on routine safety inspections of protective equipment and clothing, hand tools, GMAW equipment and accessories, shielding gas supply system equipment and accessories, and work area.
4. Provide Instruction on ANSI Z49.1, Section 11.
5. Reinforce previous instruction from ANSI Z49.1, Part I—*General Aspects*.
6. Introduce relevant terms and definitions and observe trainee using proper GMAW terms and definitions.
7. Observe trainee conducting safety inspections for GMAW.
8. Observe trainee following safe GMAW practices.
9. Develop and administer formative or diagnostic tests on safe GMAW practices.
10. Keep training records reflecting each trainee's successful completion of training in GMAW safe practices.

3.3.5 LI MODULE 5: GAS METAL ARC WELDING (GMAW-S, GMAW spray transfer)

KEY INDICATOR 2: Makes minor external repairs to GMAW equipment and accessories.

OBJECTIVE: Provided with a period of instruction and demonstration on repair materials, equipment, and tools, the trainee will make minor external repairs to GMAW equipment and accessories, and GMAW shielding gas supply system equipment and accessories.

EVALUATION CRITERIA: The trainee makes minor repairs to GMAW equipment and accessories, and GMAW shielding gas supply system equipment and accessories as required, in accordance with the manufacturer's recommendations and the institution's repair policy. The correct materials, equipment, and tools are selected. The assignment is completed in a timely manner. The objective is performed as required during the GMAW portion of the program.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide instruction and demonstrations on GMAW equipment and accessories identification.
2. Provide instruction and demonstrations on GMAW shielding gas supply system equipment and accessories identification.
3. Provide instruction and demonstrations on minor external repairs on GMAW equipment and accessories.
4. Provide instruction and demonstrations on minor external repairs on GMAW shielding gas supply system equipment and accessories.
5. Introduce relevant terms and definitions and observe trainee using proper GMAW terms and definitions.
6. Provide training exercises on making minor external repairs on GMAW equipment and accessories.
7. Observe each trainee's ability to carry out training exercises on making minor external repairs on GMAW equipment and accessories.
8. Observe trainee following safe practices for GMAW while making repairs.
9. Develop and administer formative or diagnostic tests on GMAW equipment and accessories, and GMAW shielding gas equipment and accessories identification and making minor external repairs.
10. Keep records reflecting each trainee's successful completion of training in GMAW component and accessories, GMAW shielding gas equipment and accessories identification, and making minor external repairs.

3.3.5 LI MODULE 5: GAS METAL ARC WELDING (GMAW-S, GMAW spray transfer)

KEY INDICATOR 3: Sets up for GMAW-S operations on carbon steel.

OBJECTIVE: Provided with a period of instruction and demonstration, verbal or written instructions, protective clothing and equipment, hand tools, GMAW-S equipment and accessories, CO₂ or 75% Ar/25% CO₂ shielding gas, 0.035 in. or 0.045 in. E70S-X electrodes, and carbon steel base metal, the trainee will set up and prepare to perform GMAW-S operations on carbon steel.

EVALUATION CRITERIA: The trainee is prepared to weld. Protective clothing and equipment are suitable for job requirements. The proper hand tools, equipment, base metal, shielding gas, and filler metals are selected. GMAW-S equipment and accessories are set up and adjusted for proper voltage, polarity and wire feed speed. GMAW-S shielding gas supply system equipment and accessories are set up and adjusted to the proper flow rate. Parts are assembled according to job requirements. The objective is performed on a routine basis during the GMAW-S portion of the program.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations on GMAW-S equipment and accessories set up for carbon steel.
2. Provide demonstrations on GMAW-S shielding gas supply system equipment and accessories set up for carbon steel.
3. Provide instruction on GMAW-S principles of operation on carbon steel.
4. Provide instruction on carbon steel shapes, identification and selection.
5. Provide instruction on shielding gases for GMAW-S on carbon steel.
6. Provide instruction on GMAW-S filler metal identification and selection for carbon steel.
7. Introduce relevant terms and definitions and observe trainee using proper GMAW-S terms and definitions.
8. Provide trainee with practice setting up GMAW-S equipment and accessories for carbon steel.
9. Provide trainee with practice setting up GMAW-S shielding gas supply system equipment and accessories for carbon steel.
10. Observe trainee setting up GMAW-S equipment and accessories for carbon steel.
11. Observe trainee setting up GMAW-S shielding gas supply system equipment and accessories for carbon steel.
12. Observe trainee following safe GMAW-S practices.
13. Develop and administer formative or diagnostic tests on GMAW-S equipment set up, principles of operation, and carbon steel base and filler metal identification and selection.
14. Keep training records reflecting each trainee's successful completion of training in GMAW-S equipment set up, principles of operation, and carbon steel base and filler metal identification and selection.

3.3.5 LI MODULE 5: GAS METAL ARC WELDING (GMAW-S, GMAW spray transfer)

KEY INDICATOR 4: Operates GMAW-S equipment on carbon steel.

OBJECTIVE: Provided with a period of instruction and demonstration, verbal or written instructions, protective clothing and equipment, hand tools, GMAW-S equipment and accessories, CO₂ or 75% Ar/25% CO₂ shielding gas, 0.035 in. or 0.045 in. E70S-X electrodes, carbon steel base metal, and a welding assignment, the trainee will perform GMAW-S operations on carbon steel.

EVALUATION CRITERIA: The trainee's GMAW-S welding is completed as required by the welding assignment on a routine basis. During and after the operation, welds are visually examined by the trainee and accepted by the instructor on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations on GMAW-S equipment operation on carbon steel.
2. Provide instruction on GMAW-S principles of operation on carbon steel.
3. Provide instruction on essential process variables for GMAW-S on carbon steel.
4. Provide training exercises on GMAW-S equipment operation on carbon steel.
5. Provide training exercises on starting and maintaining a GMAW-S arc on carbon steel.
6. Provide training exercises on making 1G, single layer, multiple pass, GMAW-S stringer bead welds, using 0.035 in. or 0.045 in. diameter E70S-X electrodes and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
7. Provide training exercises on making 1G, multiple layer, multiple pass, GMAW-S stringer bead welds, using 0.035 in. or 0.045 in. diameter E70S-X electrodes and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
8. Observe trainee operating GMAW-S equipment on carbon steel.
9. Observe trainee following safe GMAW-S practices.
10. Visually inspect trainee's GMAW-S stringer bead welds.
11. Develop and administer formative or diagnostic tests on GMAW-S principles of operation and essential process variables.
12. Keep training records reflecting each trainee's successful completion of training in GMAW-S principles of operation, essential process variables, and performance exercises on carbon steel.

3.3.5 LI MODULE 5: GAS METAL ARC WELDING (GMAW-S, GMAW spray transfer)

KEY INDICATOR 5: Makes fillet welds, in all positions, on carbon steel.

OBJECTIVE: Provided with a period of instruction and demonstration, verbal or written instructions, protective clothing and equipment, hand tools, GMAW-S equipment and accessories, CO₂ or 75% Ar/25% CO₂ shielding gas, 0.035 or 0.045 diameter E70S-X electrodes, carbon steel base metal, and a welding assignment, the trainee will make GMAW-S fillet welds on carbon steel in all positions.

EVALUATION CRITERIA: The trainee produces sound GMAW-S fillet welds in all position on carbon steel. During and after each operation, welds are visually examined by the trainee and accepted by the instructor on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations on GMAW-S fillet welding, in all positions, on carbon steel.
2. Provide instruction on visual examination of GMAW-S fillet welds made on carbon steel.
3. Provide instruction on welding procedures and workmanship for GMAW-S fillet welding, in all positions, on carbon steel.
4. Provide training exercises on making 1F single and multiple pass GMAW-S fillet welds, using 0.035 or 0.045 diameter E70S-X electrodes, and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
5. Provide training exercises on making 2F single and multiple pass GMAW-S fillet welds, using 0.035 or 0.045 diameter E70S-X electrodes, and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
6. Provide training exercises on making 3F single and multiple pass GMAW-S fillet welds, using 0.035 or 0.045 diameter E70S-X electrodes, and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
7. Provide training exercises on making 4F single and multiple pass GMAW-S fillet welds, using 0.035 or 0.045 diameter E70S-X electrodes, and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
8. Observe trainee operating GMAW-S equipment on carbon steel.
9. Observe trainee following safe GMAW-S practices.
10. Visually inspect trainee's GMAW-S fillet welds.
11. Develop and administer formative or diagnostic tests on GMAW-S fillet welding principles of operation and essential process variables.
12. Keep training records reflecting each trainee's successful completion of making fillet welds, in all positions, on carbon steel.

3.3.5 LI MODULE 5: GAS METAL ARC WELDING (GMAW-S, GMAW spray transfer)

KEY INDICATOR 6: Makes groove welds, in all positions, on carbon steel.

OBJECTIVE: Provided with a period of instruction and demonstration, verbal or written instructions, protective clothing and equipment, hand tools, GMAW-S equipment and accessories, CO₂ or 75% Ar/25% CO₂ shielding gas, 0.035 in. or 0.045 in. diameter E70S-X electrodes, carbon steel base metal, and a welding assignment, the trainee will make GMAW-S groove welds on carbon steel in all positions.

EVALUATION CRITERIA: The trainee produces sound GMAW-S groove welds in all position on carbon steel. During and after each operation, welds are visually examined by the trainee and accepted by the instructor on a routine basis.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations on GMAW-S groove welding, in all positions, on carbon steel.
2. Provide instruction on visual examination of GMAW-S groove welds made on carbon steel.
3. Provide instruction on welding procedures and workmanship for GMAW-S groove welding, in all positions, on carbon steel.
4. Provide training exercises on making 1G, single and multiple pass GMAW-S groove welds, using 0.035 or 0.045 diameter E70S-X electrodes, and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
5. Provide training exercises on making 2G, single and multiple pass GMAW-S groove welds, using 0.035 or 0.045 diameter E70S-X electrodes, and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
6. Provide training exercises on making 3G, uphill, single and multiple pass GMAW-S groove welds, using 0.035 or 0.045 diameter E70S-X electrodes, and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
7. Provide training exercises on making 4G, single and multiple pass GMAW-S groove welds, using 0.035 or 0.045 diameter E70S-X electrodes, and CO₂ or 75% Ar/25% CO₂ shielding gas, on carbon steel.
8. Observe trainee operating GMAW-S equipment on carbon steel.
9. Observe trainee following safe GMAW-S practices.
10. Visually inspect trainee's GMAW-S groove welds.
11. Develop and administer formative or diagnostic tests on GMAW-S fillet welding principles of operation and essential process variables.
12. Keep training records reflecting each trainee's successful completion of making groove welds, in all positions, on carbon steel.

3.3.5 LI MODULE 5: GAS METAL ARC WELDING (GMAW-S, GMAW spray transfer)

KEY INDICATOR 7: Passes GMAW-S workmanship qualification test on carbon steel.

OBJECTIVE: Provided with protective clothing and equipment, hand tools, GMAW-S equipment and accessories, CO₂ or 75% Ar/25% CO₂ shielding gas, 0.035 in. or 0.045 in. diameter E70S-X electrodes, 10-14 gauge carbon steel base metal, SWPS B2.1-1-004, and drawing number AWS EDU-3, the trainee will perform GMAW-S workmanship qualification test on carbon steel with no assistance from the instructor.

EVALUATION CRITERIA: The trainee produces sound GMAW-S fillet and groove welds on carbon steel. Test assembly is prepared according to drawing specifications. In accordance with the requirements of AWS QC10, SWPS B2.1-1-004, and drawing number AWS EDU-3, the trainee passes the fabrication, weld symbol interpretation and welding elements of GMAWS workmanship qualification test on carbon steel.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Prepare trainee for the fabrication, weld symbol interpretation and GMAW-S fillet and groove welding elements of GMAW-S workmanship qualification test on carbon steel.
2. Administer GMAW-S workmanship qualification test on carbon steel upon completion of GMAW-S on carbon steel training in accordance with the requirements of AWS QC10.
3. Keep training records reflecting each trainee's successful completion of GMAW-S workmanship qualification test on carbon steel.

NOTE: For Training Organizations participating in SENSE Level I—Entry Welder, the scores for Safety and Health of Welders, Drawing and Welding Symbol Interpretation, GMAW, Thermal Cutting Processes, and Welding Inspection and Testing knowledge exam, along with the results of the GMAW-S and GMAW (spray) workmanship qualification tests on carbon steel, may be reported to AWS to obtain a Level I—Entry Welder training certificate in GMAW. Alternatively, documentation may be submitted at the end of the complete Level I—Entry Welder program for certificate as a Level I—Entry Welder. See AWS QC10, Clauses 9, 10, and 11 for details.

3.3.5 LI MODULE 5: GAS METAL ARC WELDING (GMAW-S, GMAW spray transfer)

KEY INDICATOR 8: Sets up for GMAW (spray) operations on carbon steel.

OBJECTIVE: Provided with a period of instruction and demonstration, verbal or written instructions, protective clothing and equipment, hand tools, GMAW (spray) equipment and accessories, 90% Ar/10% CO₂ shielding gas (or other acceptable mixture for spray transfer) with supply system equipment and accessories, 0.035 in. or 0.045 in. diameter E70S-X electrodes, and carbon steel base metal, the trainee will set up and prepare to perform GMAW (spray) operations on carbon steel.

EVALUATION CRITERIA: The trainee is prepared to weld. Protective clothing and equipment are suitable for job requirements. The proper hand tools, equipment, base metal, shielding gas, and filler metals are selected. GMAW (spray) equipment and accessories are set up and adjusted for proper voltage, polarity and wire feed speed. GMAW (spray) shielding gas supply system equipment and accessories are set up and adjusted to the proper flow rate. Parts are assembled according to job requirements. The objective is performed on a routine basis during the GMAW (spray) portion of the program.

RECOMMENDED INSTRUCTIONAL ACTIVITIES:

1. Provide demonstrations on GMAW (spray) equipment and accessory set up for carbon steel.
2. Provide demonstrations on GMAW (spray) shielding gas supply system equipment and accessories set up for carbon steel.
3. Provide instruction on GMAW (spray) principles of operation on carbon steel.
4. Provide instruction on carbon steel shapes, identification and selection.
5. Provide instruction on shielding gases for GMAW (spray) on carbon steel.
6. Provide instruction on GMAW (spray) filler metal identification and selection for carbon steel.
7. Introduce relevant terms and definitions and observe trainee using proper GMAW (spray) terms and definitions.
8. Provide trainee with practice setting up GMAW (spray) equipment and accessories for carbon steel.
9. Provide trainee with practice setting up GMAW (spray) shielding gas supply system equipment and accessories for carbon steel.
10. Observe trainee setting up GMAW (spray) equipment and accessories for carbon steel.
11. Observe trainee setting up GMAW (spray) shielding gas supply system equipment and accessories for carbon steel.
12. Observe trainee following safe GMAW (spray) practices.
13. Develop and administer formative or diagnostic tests on GMAW (spray) principles of operation and essential process variables.
14. Keep training records reflecting each trainee's successful completion of training in GMAW (spray) equipment set up, principles of operation, and carbon steel base and filler metal identification and selection.