

Shielded Metal Arc Welding and Carbon Arc Cutting—Air

Instructional/Task Analysis

**Related Information: What
the Student Should Know**

**Application: What the
Student Should Be Able to Do**

Unit 1: SMAW Safety

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| 1. Terms and definitions | 11. Solve problems concerning shielded metal arc welding safety |
| 2. Electrical safety for arc welding | |
| 3. Rules for handling welding cables | |
| 4. Rules for handling hollow castings and containers | |
| 5. Solutions for hazards from arc ray | |
| 6. Guidelines for duty cycle safety | |
| 7. Types of welding hoods | |
| 8. Guidelines in selecting a safe lens shade for shielded metal arc welding | |
| 9. Protective clothing required for arc welding | |
| 10. Environmental safety requirements | |

Unit 2: SMAW Equipment, Applications, and Techniques

1. Terms and definitions
2. Advantages of SMAW
3. Principles of SMAW
4. Relationship of arc, base metal, electrodes, and flux
5. Functions of flux-covered electrode functions
6. Benefits of learning SMAW
7. Welding machines and their electrical characteristics
8. Welding machines and their performance characteristics
9. SMAW accessories and their purposes
10. ASW electrode classifications for mild steel and low-alloy electrodes
11. Stainless steel and other alloy electrodes
12. Basic elements of arc welding and their importance

Instructional/Task Analysis

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Unit 2: SMAW Equipment, Applications, and Techniques (cont.)

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| 13. Essentials of a good weld | 32. Start and restart an arc, crater, and backfill at the edge while running a bead on mild steel plate |
| 14. Electrode angles | |
| 15. SMAW starting techniques | 33. Build a pad on mild steel plate in the flat position with an E6010 electrode |
| 16. Techniques for controlling arc gap | |
| 17. Techniques for using electrode angles | 34. Build a pad on mild steel plate in the flat position with an E7018 electrode |
| 18. Bead running techniques and their procedures | 35. Weld to specifications a fillet weld lap joint in the flat position with an E6010 electrode |
| 19. Techniques for stopping and restarting an arc | |
| 20. Techniques for filling a crater at the end of a weld | 36. Weld to specifications a multipass fillet weld on a T-joint in the flat position with an E6010 electrode |
| 21. Using feathered edges for tie-ins | |
| 22. Basic steps in joint preparation | 37. Weld to specifications a fillet weld lap joint in the flat position with an E7018 electrode |
| 23. Good and bad welds and their characteristics | |
| 24. Causes of and remedies for arc blow | 38. Weld to specifications a multipass fillet weld on a T-joint in the flat position with an E7018 electrode. |
| 25. Causes of and remedies for pinholes and porosity | |
| 26. Causes of and remedies for undercutting | 39. Weld to specifications a fillet weld lap joint in the flat position with an E7024 electrode. |
| 27. Causes of and remedies for weld splatter | |
| 28. Causes of and remedies for incomplete penetration | 40. Weld to specifications a multipass fillet weld on a T-joint in the flat position with an E7024 electrode. |
| 29. Causes of and remedies for slag inclusion | |
| 30. Causes of and remedies for excessive weld reinforcement | 41. Weld to specifications a fillet weld lap joint in the horizontal position with an E6010 electrode |
| 31. Electrode drying ovens | |
| | 42. Weld to specifications a multipass fillet weld on a T-joint in the horizontal position with an E6010 electrode |
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| | 43. Weld to specifications a fillet weld lap joint in the horizontal position with an E7018 electrode |
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| | 44. Weld to specifications a multipass fillet weld in the horizontal position with an E7024 electrode |
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| | 45. Weld to specifications a fillet weld lap joint in the horizontal position with an E7024 electrode |

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Unit 2: SMAW Equipment, Applications, and Techniques (cont.)

46. Weld to specifications a multipass fillet weld on a T-joint in the horizontal position with an E7024 electrode
47. Weld to specifications a fillet weld lap joint in the vertical position with an E6010 electrode
48. Weld to specifications a multipass fillet weld on a T-joint in the vertical position with an E6010 electrode
49. Weld to specifications a fillet weld lap joint in the vertical position with an E7018 electrode
50. Weld to specifications a multipass fillet weld on a T-joint in the vertical position with an E7018 electrode
51. Weld to specifications a fillet weld lap joint in the overhead position with an E6010 electrode
52. Weld to specifications a multipass fillet weld on a T-joint in the overhead position with an E6010 electrode
53. Weld to specifications a fillet weld lap joint in the overhead position of an E7018 electrode
54. Weld to specifications a multipass fillet weld on a T-joint in the overhead position with an E7018 electrode
55. Weld to specifications a V-groove butt joint in the flat position with an E6010 electrode
56. Bend test a welded V-groove joint
57. Weld to specifications a V-groove butt joint in the horizontal position with an E6010 electrode
58. Weld to specifications a V-groove butt joint in the vertical position with an E6010 electrode
59. Weld to specifications a V-groove butt joint in the overhead position with an E6010 electrode
60. Weld to specifications a V-groove butt joint in the flat position with an E6010 electrode root and an E7018 electrode fill and cap.

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Unit 2: SMAW Equipment, Applications, and Techniques (cont.)

61. Weld to specifications a V-groove butt joint in the horizontal position with an E6010 electrode root and an E7018 electrode fill and cap
62. Weld to specifications a V-groove butt joint in the vertical position with an E6010 electrode root and an E7018 electrode fill and cap
63. Weld to specifications a V-groove butt joint in the overhead position with an E6010 electrode root and an E7018 electrode fill and cap

Unit 3: Hardfacing

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| 1. Terms and definitions | 11. Build a pad on mild steel with a hardfacing electrode |
| 2. Benefits of hardfacing | |
| 3. Arc welding methods used for hardfacing | 12. Prepare and hardface simulated bucket teeth |
| 4. Advantages and limitations of manual electrode hardfacing | |
| 5. Types of wear and their characteristics | |
| 6. Guidelines for applying weld deposits | |
| 7. Ventilation safety for hardfacing | |
| 8. Heat treating cautions | |
| 9. Guidelines for heavy construction hardfacing | |
| 10. Hardness ratings for hardfacing electrodes | |

Unit 4: Carbon Arc Cutting—Air

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| 1. Terms and definitions | 12. Gouge a piece of mild steel with the air carbon arc process |
| 2. Principles of air carbon arc cutting | |
| 3. Air carbon arc power sources | 13. Backgouge a selected weld to prepare it for welding on the other side |
| 4. Carbon arc electrodes and their characteristics | |
| 5. Electrode shapes and their uses | |
| 6. Electrode angles and their applications | |
| 7. Amperage selection for gouging | |
| 8. Air pressure and how it affects gouging | |
| 9. Travel speed and how it affects gouging | |
| 10. Techniques for gouging and their procedures | |
| 11. When to use backgouging | |