

Interprovincial Program Guide

Sheet Metal Worker

2007

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The Joint Planning Committee (JPC) recognizes this Interprovincial Program Guide as the national curriculum for the occupation of Sheet Metal Worker.

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Table of Contents

| | |
|----------------------------------|----|
| Acknowledgements | 2 |
| Introduction | 4 |
| User Guide | 5 |
| IPG Glossary of Terms | 7 |
| Essential Skills Profiles | 9 |
| Profile Chart..... | 10 |
| Recommended Level Structure..... | 12 |
| NOA Comparison Table | 13 |

PROGRAM CONTENT

| | |
|--------------|----|
| Level 1..... | 19 |
| Level 2..... | 33 |
| Level 3..... | 47 |
| Level 4..... | 57 |

Introduction

Jurisdictions have long recognized the benefit of pooling resources in the development and maintenance of apprenticeship training standards. A successful example of this is the Interprovincial Standards (Red Seal) program itself. Essential to the establishment of standards is the development of suitable training systems and programs which enable tradespeople to acquire certification based on these standards. While certification is the responsibility of Apprenticeship administrators throughout Canada, the development and delivery of technical training is the responsibility of jurisdictions.

In 1999, work to develop common training for apprenticeship programs within the Atlantic Provinces began. To date, 22 Standards have been developed through the Atlantic Standards Partnership (ASP) project to assist programming staff and instructors in the design and delivery of technical training. Similarly, the Canadian Council of Directors of Apprenticeship (CCDA) embarked on a process for the development of national Interprovincial Program Guides (IPGs) for the Boilermaker, Carpenter and Sprinkler System Installer trades. At its January 2005 strategic planning session, the CCDA identified developing common training standards as one of key activities in moving towards a more cohesive apprenticeship system.

With the support of Human Resources and Social Development Canada (HRSDC), several provinces and territories have partnered to build on the ASP and the CCDA processes to further develop IPGs to be used across the country. This partnership will create efficiencies in time and resources and promote consistency in training and apprentice mobility.

User Guide

According to the Canadian Apprenticeship Forum, the Interprovincial Program Guide (IPG) is: "a list of validated technical training outcomes, based upon those sub-tasks identified as common core in the National Occupational Analysis, and validated by industry in the provinces and territories as incorporating the essential tasks, knowledge and skills associated with a given trade."

Learning outcomes contained in the IPG represent the minimum common core content for the development of jurisdictional training standards and outlines. IPGs are developed based on the National Occupational Analyses and extensive industry consultation. The IPG is intended to assist program development staff in the design of jurisdictional plans for training. Each jurisdiction has the flexibility to add additional content.

The IPG was deliberately constructed for ease of use and flexibility of structure in order to adapt to all delivery requirements. It details units of training, unit outcomes and objectives. It does not impose a delivery model or teaching format.

Jurisdictions and/or training providers will select and develop delivery materials and techniques that accommodate a variety of learning styles and delivery patterns. The IPG does not dictate study materials, textbooks or learning activities to be used in delivery.

The IPG document includes a recommended leveling structure to facilitate mobility for apprentices moving from one jurisdiction to another. Because of difference in jurisdictional regulations and program durations, levels are offered as suggestions only.

Structure

The content of the IPG is divided into units. Unit codes are used as a means of identification and are not intended to convey the order of delivery. Prerequisites have not been detailed. Jurisdictions are free to deliver units one at a time or concurrently provided all outcomes are met.

User Guide *(continued)*

The IPG does not indicate the amount of time to be spent on a particular unit. The length of time required to deliver an outcome successfully will depend upon the learning activities and teaching methods used. Jurisdictions are encouraged to use practical demonstration and opportunities for hands-on learning whenever possible.

The unit outcomes are the specific performances that must be evaluated. Wording of outcomes, "Demonstrate knowledge of...", acknowledges the broad spectrum of ways in which knowledge can be demonstrated. It is at the discretion of each jurisdiction to determine the manner in which outcomes are evaluated; theoretically, practically or a combination of both.

Detailed content for each objective has not been developed. Where detail is required for clarity, content has been provided. Content may be added or extended in jurisdictional training plans.

IPG Glossary of Terms

These definitions are intended as a guide to how language is used in the IPGs.

| | |
|-----------------------|---|
| ADJUST | To put in good working order; regulate; bring to a proper state or position. |
| APPLICATION | The use to which something is put and/or the circumstance in which you would use it. |
| CHARACTERISTIC | A feature that helps to identify, tell apart, or describe recognizably; a distinguishing mark or trait. |
| COMPONENT | A part that can be separated from or attached to a system; a segment or unit. |
| DEFINE | To state the meaning of (a word, phrase, etc.). |
| DESCRIBE | To give a verbal account of; tell about in detail. |
| EXPLAIN | To make plain or clear; illustrate; rationalize. |
| IDENTIFY | To point out or name objectives or types. |
| INTERPRET | To translate information from observation, charts, tables, graphs, and written material. |
| MAINTAIN | To keep in a condition of good repair or efficiency. |
| METHOD | A means or manner of doing something that has procedures attached to it. |
| OPERATE | How an object works; to control or direct the functioning of. |
| PROCEDURE | A prescribed series of steps taken to accomplish an end. |
| PURPOSE | The reason for which something exists or is done, made or used. |

IPG Glossary of Terms *(continued)*

| | |
|---------------------|---|
| SERVICE | <p>Routine inspection and replacement of worn or deteriorating parts.</p> <p>An act or business function provided to a customer in the course of one's profession. (e.g., haircut).</p> |
| TECHNIQUE | <p>Within a procedure, the manner in which technical skills are applied.</p> |
| TEST | <p>v. To subject to a procedure that ascertains effectiveness, value, proper function, or other quality.</p> <p>n. A way of examining something to determine its characteristics or properties, or to determine whether or not it is working correctly.</p> |
| TROUBLESHOOT | <p>To follow a systematic procedure to identify and locate a problem or malfunction and its cause.</p> |

Essential Skills Profiles

Essential Skills are the skills needed for work, learning and life. They provide the foundation for learning all the other skills that enable people to evolve within their jobs and adapt to workplace change.

Over the past several years, the Government of Canada has conducted research examining the skills people use at work. From this research, Essential Skills Profiles have been developed for various occupations.

For more information regarding Essential Skills and to access Essential Skills Profiles for specific occupations, visit Human Resources and Social Development Canada's Essential Skills website at:

http://srv108.services.gc.ca/english/general/home_e.shtml

Profile Chart

| OCCUPATIONAL SKILLS | | | |
|---|---|---|--|
| SMW-100 Safety Awareness | SMW-105 Communication | SMW-110 Tools and Equipment | SMW-115 Elevating Devices |
| SMW-120 Metallurgy | SMW-130 Introduction to Gas Metal Arc Welding (GMAW) | SMW-135 Plasma Arc Cutting | SMW-140 Soldering |
| SMW-145 Pattern Development and Layout | SMW-205 Basic Hoisting, Lifting and Rigging | SMW-210 Basic Blueprint Reading | SMW-230 Advanced Gas Metal Arc Welding (GMAW) |
| SMW-235 Introduction to Gas Tungsten Arc Welding (GTAW) | SMW-300 Advanced Gas Tungsten Arc Welding (GTAW) | SMW-305 Advanced Blueprint Reading | SMW-325 Duct System Design |
| SMW-425 Shielded Metal Arc Welding (SMAW) | SMW-430 Oxy-fuel Cutting, Heating and Brazing | | |
| SHEET METAL FABRICATION | | | |
| SMW-125 Drafting | SMW-150 Simple Layout | SMW-155 Fabrication Fundamentals | SMW-200 Trade Related Documents |
| SMW-215 Parallel Line Development (Introduction) | SMW-220 Radial Line Development (Introduction) | SMW-225 Triangulation (introduction) | SMW-240 Fabrication (Air Handling Systems and Components) |
| SMW-310 Parallel Line Development (Advanced Applications) | SMW-315 Radial Line Development (Advanced Applications) | SMW-320 Triangulation (Advanced Applications) | SMW-400 Fabrication (Material Handling Systems and Components) |
| AIR AND MATERIAL HANDLING SYSTEM INSTALLATION | | | |
| SMW-245 Installation (Air Handling Systems) | SMW-330 Air Quality Management | SMW-335 Chimneys, Breeching and Venting | SMW-405 Installation (Material Handling Systems) |

Profile Chart *(continued)*

| ROOFING, ARCHITECTURAL METAL AND SPECIALTY PRODUCT INSTALLATION | | |
|--|---|--|
| SMW-420 Metal Roofing and Architectural Metal | SMW-435 Specialty Products | |
| MAINTENANCE AND REPAIR | | |
| SMW-410 Maintenance and Repair (Air and Material Handling Systems) | SMW-415 Testing, Adjusting and Balancing (Air and Material Handling Systems) | |

Recommended Level Structure

| Level 1 | | | Level 2 | | |
|-----------|---|------|-----------|--|------|
| Unit Code | Title | Page | Unit Code | Title | Page |
| SMW-100 | Safety Awareness | 20 | SMW-200 | Trade Related Documents | 34 |
| SMW-105 | Communication | 21 | SMW-205 | Basic Hoisting, Lifting and Rigging | 35 |
| SMW-110 | Tools and Equipment | 22 | SMW-210 | Basic Blueprint Reading | 36 |
| SMW-115 | Elevating Devices | 23 | SMW-215 | Parallel Line Development (Introduction) | 38 |
| SMW-120 | Metallurgy | 24 | SMW-220 | Radial Line Development (Introduction) | 39 |
| SMW-125 | Drafting | 25 | SMW-225 | Triangulation (Introduction) | 40 |
| SMW-130 | Introduction to Gas Metal Arc Welding (GMAW) | 26 | SMW-230 | Advanced Gas Metal Arc Welding (GMAW) | 41 |
| SMW-135 | Plasma Arc Cutting | 28 | SMW-235 | Introduction to Gas Tungsten Arc Welding (GTAW) | 42 |
| SMW-140 | Soldering | 29 | SMW-240 | Fabrication (Air Handling Systems and Components) | 43 |
| SMW-145 | Pattern Development and Layout | 30 | SMW-245 | Installation (Air Handling Systems) | 45 |
| SMW-150 | Simple Layout | 31 | | | |
| SMW-155 | Fabrication Fundamentals | 32 | | | |
| Level 3 | | | Level 4 | | |
| Unit Code | Title | Page | Unit Code | Title | Page |
| SMW-300 | Advanced Gas Tungsten Arc Welding (GTAW) | 48 | SMW-400 | Fabrication (Material Handling Systems and Components) | 58 |
| SMW-305 | Advanced Blueprint Reading | 49 | SMW-405 | Installation (Material Handling Systems) | 60 |
| SMW-310 | Parallel Line Development (Advanced Applications) | 50 | SMW-410 | Maintenance and Repair (Air and Material Handling Systems) | 62 |
| SMW-315 | Radial Line Development (Advanced Applications) | 51 | SMW-415 | Testing, Adjusting and Balancing (Air and Material Handling Systems) | 63 |
| SMW-320 | Triangulation (Advanced Applications) | 52 | SMW-420 | Metal Roofing and Architectural Metal | 65 |
| SMW-325 | Duct System Design | 53 | SMW-425 | Shielded Metal Arc Welding (SMAW) | 68 |
| SMW-330 | Air Quality Management | 54 | SMW-430 | Oxy-fuel Cutting, Heating and Brazing | 70 |
| SMW-335 | Chimneys, Breeching and Venting | 55 | SMW-435 | Specialty Products | 71 |

NOA Comparison Table

| NOA Sub-task | | IPG Unit | |
|---|--|----------|--|
| Task 1 – Uses tools and equipment. | | | |
| 1.01 | Uses hand tools. | SMW-110 | Tools and Equipment |
| 1.02 | Uses portable power tools. | SMW-110 | Tools and Equipment |
| 1.03 | Uses shop tools and equipment. | SMW-110 | Tools and Equipment |
| 1.04 | Uses welding/cutting equipment. | SMW-110 | Tools and Equipment |
| | | SMW-120 | Metallurgy |
| | | SMW-130 | Introduction to Gas Metal Arc Welding (GMAW) |
| | | SMW-135 | Plasma Arc Cutting |
| | | SMW-230 | Advanced Gas Metal Arc Welding (GMAW) |
| | | SMW-235 | Introduction to Gas Tungsten Arc Welding (GTAW) |
| | | SMW-300 | Advanced Gas Tungsten Arc Welding (GTAW) |
| | | SMW-425 | Shielded Metal Arc Welding (SMAW) |
| | | SMW-430 | Oxy-fuel Cutting, Heating and Brazing |
| 1.05 | Uses soldering/brazing equipment. | SMW-140 | Soldering |
| | | SMW-430 | Oxy-fuel Cutting, Heating and Brazing |
| 1.06 | Uses measuring and layout equipment. | SMW-145 | Pattern Development and Layout |
| 1.07 | Uses ladders and platforms. | SMW-115 | Elevating Devices |
| 1.08 | Uses hoisting and rigging equipment. | SMW-205 | Basic Hoisting, Lifting and Rigging |
| 1.09 | Uses testing devices. | SMW-415 | Testing, Adjusting and Balancing (Air and Material Handling Systems) |
| 1.10 | Uses computers. | SMW-125 | Drafting |
| 1.11 | Uses personal protective equipment (PPE) and safety equipment. | SMW-100 | Safety Awareness |
| Task 2 – Organizes work. | | | |
| 2.01 | Maintains safe work environment. | SMW-100 | Safety Awareness |
| 2.02 | Interprets documentation. | SMW-200 | Trade Related Documents |
| 2.03 | Completes documentation. | SMW-200 | Trade Related Documents |
| 2.04 | Interprets drawings. | SMW-145 | Pattern Development and Layout |
| | | SMW-210 | Basic Blueprint Reading |
| | | SMW-305 | Advanced Blueprint Reading |
| 2.05 | Communicates with others. | SMW-105 | Communication |
| 2.06 | Organizes materials. | SMW-200 | Trade Related Documents |
| 2.07 | Performs basic design. | SMW-145 | Pattern Development and Layout |
| | | SMW-325 | Duct System Design |

| NOA Sub-task | | IPG Unit | |
|--|---|----------|--|
| 2.08 | Performs inspection. | SMW-410 | Maintenance and Repair (Air and Material Handling Systems) |
| Task 3 – Performs pattern development. | | | |
| 3.01 | Develops pattern using triangulation method. | SMW-225 | Triangulation (Introduction) |
| | | SMW-320 | Triangulation (Advanced Applications) |
| 3.02 | Develops pattern using radial line method. | SMW-220 | Radial Line Development (Introduction) |
| | | SMW-315 | Radial Line Development (Advanced Applications) |
| 3.03 | Develops pattern using parallel line method. | SMW-215 | Parallel Line Development (Introduction) |
| | | SMW-310 | Parallel Line Development (Advanced Applications) |
| 3.04 | Develops pattern using simple and straight line layout. | SMW-150 | Simple Layout |
| 3.05 | Develops pattern using computer technology. | SMW-125 | Drafting |
| 3.06 | Labels pieces. | SMW-150 | Simple Layout |
| | | SMW-215 | Parallel Line Development (Introduction) |
| | | SMW-220 | Radial Line Development (Introduction) |
| | | SMW-225 | Triangulation (Introduction) |
| | | SMW-240 | Fabrication (Air Handling Systems and Components) |
| | | SMW-400 | Fabrication (Material Handling Systems and Components) |
| Task 4 – Fabricates sheet metal components for air and material handling systems. | | | |
| 4.01 | Cuts ductwork, fittings and components. | SMW-155 | Fabrication Fundamentals |
| | | SMW-240 | Fabrication (Air Handling Systems and Components) |
| | | SMW-400 | Fabrication (Material Handling Systems and Components) |
| 4.02 | Forms ductwork, fittings and components. | SMW-155 | Fabrication Fundamentals |
| | | SMW-240 | Fabrication (Air Handling Systems and Components) |
| | | SMW-400 | Fabrication (Material Handling Systems and Components) |
| 4.03 | Insulates ductwork, fittings and components. | SMW-155 | Fabrication Fundamentals |
| | | SMW-240 | Fabrication (Air Handling Systems and Components) |
| | | SMW-400 | Fabrication (Material Handling Systems and Components) |
| 4.04 | | SMW-155 | Fabrication Fundamentals |

| NOA Sub-task | | IPG Unit | |
|---|---|----------|--|
| | Assembles ductwork, fittings and components. | SMW-240 | Fabrication (Air Handling Systems and Components) |
| | | SMW-400 | Fabrication (Material Handling Systems and Components) |
| 4.05 | Fabricates dampers. | SMW-240 | Fabrication (Air Handling Systems and Components) |
| | | SMW-400 | Fabrication (Material Handling Systems and Components) |
| 4.06 | Fabricates flexible connections. | SMW-240 | Fabrication (Air Handling Systems and Components) |
| | | SMW-400 | Fabrication (Material Handling Systems and Components) |
| 4.07 | Fabricates hanger systems. | SMW-240 | Fabrication (Air Handling Systems and Components) |
| | | SMW-400 | Fabrication (Material Handling Systems and Components) |
| 4.08 | Fabricates equipment supports and bases. | SMW-240 | Fabrication (Air Handling Systems and Components) |
| | | SMW-400 | Fabrication (Material Handling Systems and Components) |
| Task 5 – Fabricates roofing, sheeting and cladding. | | | |
| 5.01 | Determines seams. | SMW-420 | Metal Roofing and Architectural Metal |
| 5.02 | Cuts metal for roofing, sheeting and cladding. | | |
| 5.03 | Forms flashing and roofing. | | |
| Task 6 – Fabricates specialty products. | | | |
| 6.01 | Determines specialty products for application and measurements. | SMW-435 | Specialty Products |
| 6.02 | Cuts material for specialty products. | | |
| 6.03 | Forms specialty products. | | |
| 6.04 | Assembles products. | | |
| 6.05 | Finishes material. | | |
| Task 7 – Installs chimneys, breeching and venting. | | | |
| 7.01 | Installs bracing, hangers and supports. | SMW-335 | Chimneys, Breeching and Venting |
| 7.02 | Installs flashing. | | |
| 7.03 | Connects chimney to appliance. | | |
| 7.04 | Installs cladding and lagging to mechanical components. | | |
| Task 8 – Installs air and material handling system sheet metal components. | | | |
| 8.01 | Prepares installation site. | SMW-245 | Installation (Air Handling Systems) |
| | | SMW-405 | Installation (Material Handling Systems) |
| 8.02 | Installs hangers, braces and brackets. | SMW-245 | Installation (Air Handling Systems) |
| | | SMW-405 | Installation (Material Handling Systems) |

| NOA Sub-task | | IPG Unit | |
|--|--|----------|--|
| 8.03 | Installs sheet metal ducts and fittings. | SMW-245 | Installation (Air Handling Systems) |
| | | SMW-405 | Installation (Material Handling Systems) |
| 8.04 | Finishes seams, joints and penetrations. | SMW-245 | Installation (Air Handling Systems) |
| | | SMW-405 | Installation (Material Handling Systems) |
| 8.05 | Applies insulation and cladding to outside ducting. | SMW-245 | Installation (Air Handling Systems) |
| | | SMW-405 | Installation (Material Handling Systems) |
| Task 9 – Installs air handling system components. | | | |
| 9.01 | Installs air handlers. | SMW-245 | Installation (Air Handling Systems) |
| 9.02 | Installs dampers. | SMW-245 | Installation (Air Handling Systems) |
| 9.03 | Installs fire dampers. | SMW-245 | Installation (Air Handling Systems) |
| 9.04 | Installs registers, grilles diffusers and louvers. | SMW-245 | Installation (Air Handling Systems) |
| 9.05 | Installs coils. | SMW-245 | Installation (Air Handling Systems) |
| | | SMW-330 | Air Quality Management |
| 9.06 | Installs heat and energy recovery ventilators. | SMW-245 | Installation (Air Handling Systems) |
| | | SMW-330 | Air Quality Management |
| 9.07 | Installs system component accessories. | SMW-245 | Installation (Air Handling Systems) |
| | | SMW-330 | Air Quality Management |
| Task 10 – Installs material handling system components. | | | |
| 10.01 | Installs equipment supports and bases. | SMW-405 | Installation (Material Handling Systems) |
| 10.02 | Installs fans. | | |
| 10.03 | Installs collection devices. | | |
| 10.04 | Installs separating devices. | | |
| Task 11 – Performs testing, adjusting and balancing. | | | |
| 11.01 | Performs leak tests. | SMW-415 | Testing, Adjusting and Balancing (Air and Material Handling Systems) |
| 11.02 | Performs air balancing. | | |
| Task 12 – Installs metal roofing and cladding systems. | | | |
| 12.01 | Lays out roof and walls. | SMW-420 | Metal Roofing and Architectural Metal |
| 12.02 | Installs insulation, waterproof membrane, isolation material, and building envelope. | | |
| 12.03 | Installs roofing and cladding system components. | | |
| 12.04 | Seals exposed joints. | | |
| 12.05 | Installs decking. | | |
| Task 13 – Installs exterior components. | | | |
| 13.01 | Prepares surface. | SMW-420 | Metal Roofing and Architectural Metal |
| 13.02 | Fastens exterior components. | | |
| Task 14 – Installs specialty products. | | | |
| 14.01 | Installs stainless steel specialty products. | SMW-120 | Metallurgy |
| | | SMW-435 | Specialty Products |

| NOA Sub-task | | IPG Unit | |
|---|--|----------|--|
| 14.02 | Installs non-stainless steel products. | SMW-435 | Specialty Products |
| Task 15 – Performs scheduled maintenance. | | | |
| 15.01 | Performs maintenance inspection. | SMW-410 | Maintenance and Repair (Air and Material Handling Systems) |
| 15.02 | Services components. | | |
| Task 16 – Repairs faulty systems and components. | | | |
| 16.01 | Identifies worn, faulty or missing components. | SMW-410 | Maintenance and Repair (Air and Material Handling Systems) |
| 16.02 | Repairs worn, faulty or obsolete components. | | |

LEVEL 1

SMW-100 Safety Awareness

Learning Outcomes:

- Demonstrate knowledge of safety equipment, its applications and procedures for use.
- Demonstrate knowledge of safe work practices.
- Demonstrate knowledge of regulations pertaining to safety.

Objectives and Content:

1. Identify types of personal protective equipment (PPE) and describe their applications.
 - i) clothing
 - ii) equipment
2. Describe the procedures for care and maintenance of PPE.
3. Identify hazards and describe safe work practices and equipment.
 - i) personal
 - ii) workplace
 - electrical
 - confined space (awareness of)
 - fire
 - tag out/lockout
 - fall arrest
 - iii) environmental
4. Identify and describe workplace safety and health regulations.
 - i) federal
 - MSDS
 - WHMIS
 - ii) provincial/territorial

SMW-105 Communication

Learning Outcomes:

- Demonstrate knowledge of effective communication practices.
- Demonstrate knowledge of communication equipment and their applications.

Objectives and Content:

1. Identify effective communication practices.
 - i) respectful
 - ii) organized
2. Describe the importance of effective communication practices.
 - i) customers
 - ii) co-workers
 - iii) related industry people
3. Describe the importance of the coaching and mentoring relationship between journey person and apprentice.
 - i) effective communication
 - ii) respect
4. Identify the types of communication methods and equipment and describe their applications.

SMW-110 Tools and Equipment

Learning Outcomes:

- Demonstrate knowledge of tools and equipment, their applications, maintenance and procedures for use.

Objectives and Content:

1. Identify types of hand tools and describe their applications and procedures for use.
2. Identify types of portable power tools and describe their applications and procedures for use.
3. Identify types of powder actuated tools and describe their applications.
4. Identify types of shop tools and equipment and describe their applications and procedures for use.
5. Identify types of measuring and layout tools and equipment and describe their applications and procedures for use.
6. Identify types of welding and cutting equipment and describe their applications.
 - i) welding
 - metal
 - non-metal/plastic
 - ii) cutting
 - oxy-fuel
 - plasma
7. Describe the procedures used to clean, maintain and store tools and equipment.

SMW-115 Elevating Devices

Learning Outcomes:

- Demonstrate knowledge of ladders, scaffolds and hydraulic lifts, their applications and procedures for use.

Objectives and Content:

1. Identify safety considerations pertaining to ladders, scaffolding and hydraulic lifts.
 - i) occupational health and safety regulations
 - ii) safe work practices
2. Identify types of ladders, scaffolding and hydraulic lifts and describe their applications.
3. Describe the procedures for erecting and dismantling ladders and scaffolding.
 - i) limitations
4. Describe the procedures used to assess and maintain ladders, scaffolding and hydraulic lifts.

SMW-120 Metallurgy

Learning Outcomes:

- Demonstrate knowledge of metals and their characteristics.
- Demonstrate knowledge of metallurgic principles.

Objectives and Content:

1. Define and explain terminology associated with metallurgy.
2. Describe the properties of metals.
 - i) composition
 - ii) physical
3. Describe identification systems for metals.
 - i) numbering
 - ii) colour coding
 - iii) gauging
4. Identify methods used to work with metals.
 - i) forming
 - ii) cutting/shearing
 - iii) punching
 - iv) drilling
 - v) joining
5. Describe the effects metal working has on metallurgic properties.
 - i) stress
 - ii) contraction
 - iii) expansion
 - iv) distortion
 - v) work hardening
 - vi) annealing
 - vii) galvanic action
6. Describe the procedures to prevent or correct problems that occur when working metals.

SMW-125 Drafting

Learning Outcomes:

- Demonstrate knowledge of basic drafting.
- Demonstrate knowledge of basic drafting tools and equipment and their procedures for use.
- Demonstrate basic knowledge of Computer Aided Drafting (CAD) and its use.

Objectives and Content:

1. Define and explain terminology associated with drafting.
 - i) basic
 - ii) computerized (CAD)
2. Identify basic drafting tools and equipment and describe their applications and procedures for use.
3. Describe the procedures used to develop basic drawings and sketches.
 - i) pictorial
 - ii) orthographic
4. Identify types of computer technology used for pattern development and describe their applications.
 - i) CAD

Learning Outcomes:

- Demonstrate knowledge of GMAW equipment, its applications and maintenance.
- Demonstrate knowledge of the procedures used to weld mild steel using the GMAW process.

Objectives and Content:

1. Define and explain terminology associated with GMAW.
2. Describe metal inert gas (MIG) welding and its applications.
 - i) GMAW (gas)
 - ii) FCAW (flux-core)
3. Identify safety precautions when using GMAW equipment.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
4. Identify and describe GMAW equipment, consumables and accessories.
5. Describe the procedures to set-up, adjust and shut-down GMAW equipment for welding mild steel.
6. Describe the procedures used to maintain and troubleshoot GMAW equipment.
7. Identify the types of welds performed using the GMAW process.
 - i) plug
 - ii) fillet (continuous)
 - iii) stitch
 - iv) tack
 - v) edge
 - vi) corner

8. Describe the procedures used to weld mild steel using the GMAW process.
9. Describe weld defects, their causes and the procedures to prevent and correct them.

SMW-135 Plasma Arc Cutting

Learning Outcomes:

- Demonstrate knowledge of plasma arc cutting equipment, its maintenance and procedures for use.

Objectives and Content:

1. Identify plasma arc cutting equipment and accessories and describe their applications.
2. Identify safety precautions when using plasma arc cutting equipment.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
3. Describe the procedures to set-up, adjust and shut-down plasma arc cutting equipment.
4. Describe the procedures used to maintain and troubleshoot plasma arc cutting equipment.
5. Describe the procedures used to cut using plasma arc cutting equipment.

SMW-140 Soldering

Learning Outcomes:

- Demonstrate knowledge of materials and equipment used for soldering.
- Demonstrate knowledge of procedures used to solder various materials.

Objectives and Content:

1. Define and explain terminology associated with soldering.
2. Describe soldering and its applications.
3. Identify safety precautions when using soldering equipment.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
4. Identify and describe soldering equipment and accessories.
5. Describe the procedures to set-up, adjust and shut-down soldering equipment.
6. Describe the procedures used to maintain and troubleshoot soldering equipment.
7. Identify materials used for soldering and describe their applications.
 - i) fluxes
 - ii) solders
8. Describe the procedures used to solder various materials.

SMW-145 Pattern Development and Layout

Learning Outcomes:

- Demonstrate knowledge of basic pattern development and layout.
- Demonstrate knowledge of basic geometric shapes.

Objectives and Content:

1. Define and explain terminology associated with pattern development and layout.
2. Identify layout tools and describe their applications and procedures for use.
3. Identify basic geometric shapes and describe their characteristics.
4. Identify different views used when sketching and describe their applications.
 - i) elevation
 - ii) plan
 - iii) section
 - iv) auxiliary
5. Identify layout methods and describe their applications.
 - i) simple/straight line
 - ii) parallel line
 - iii) radial line
 - iv) triangulation
 - v) computerized
 - vi) combination

SMW-150 Simple Layout

Learning Outcomes:

- Demonstrate knowledge of simple layout, its applications and associated calculations.
- Demonstrate knowledge of basic pattern development using simple layout.

Objectives and Content:

1. Define and explain terminology associated with simple layout.
2. Describe the types of basic patterns and fittings that require simple layout.
3. Identify calculations used in simple layout and the procedures used to perform them.
4. Describe the procedures used to develop basic patterns and fabricate fittings using simple layout.
 - i) determine views
 - ii) label lines and points
 - iii) prepare pattern
 - iv) determine types of seams, joints and edges
 - v) calculate allowances
 - vi) determine stretchouts
 - vii) confirm pattern accuracy
 - viii) cut pattern
 - ix) label pieces

SMW-155 Fabrication Fundamentals

Learning Outcomes:

- Demonstrate knowledge of the procedures used in fabricating basic ductwork and fittings.

Objectives and Content:

1. Define and explain terminology associated with fabrication.
2. Identify tools and equipment used to fabricate basic sheet metal components.
3. Identify types of fastening methods used when fabricating ductwork and fittings and describe their associated procedures.
4. Identify types of seams for fabrication of ductwork and fittings and describe the procedures and connectors used to produce them.
 - i) longitudinal
 - ii) transverse
5. Identify types of edges for fabrication of ductwork and fittings and describe the procedures used to produce them.
6. Identify types of duct reinforcement.

LEVEL 2

SMW-200 Trade Related Documents

Learning Outcomes:

- Demonstrate knowledge of trade related documents and their use.
- Demonstrate knowledge of procedures used to prepare documentation.

Objectives and Content:

1. Identify types of trade related documents and describe their applications.
 - i) manufacturers' specifications
 - ii) blueprints
 - iii) codes and standards
 - SMACNA
 - ASHRAE
 - National Building Code (NBC)
 - iv) work orders
 - change
 - job
 - material

2. Identify types of documentation and describe the procedures used to prepare it.
 - i) work orders
 - ii) reports
 - hazard assessment
 - safety
 - Worker's Compensation
 - iii) maintenance/service records
 - iv) stock/inventory records
 - shop
 - job site
 - vehicle

Learning Outcomes:

- Demonstrate knowledge of hoisting, lifting and rigging equipment, their applications and procedures for use.

Objectives and Content:

1. Identify safety considerations pertaining to hoisting, lifting and rigging.
 - i) occupational health and safety regulations
 - ii) safe work practices
2. Identify types of rigging equipment and accessories and describe their applications and procedures for use.
3. Identify types of hoisting and lifting equipment and accessories and describe their applications and procedures for use.
4. Describe the procedures used to assess, store and maintain rigging, hoisting and lifting equipment.
5. Identify types of basic knots and describe the procedures used to tie them.
 - i) bowline
 - ii) running bowline
 - iii) square/reef
 - iv) half-hitch
6. Describe the procedures used to rig material for lifting.
7. Identify and describe procedures used to communicate during hoisting, lifting and rigging operations.
 - i) hand signals
 - ii) electronic communications

SMW-210 Basic Blueprint Reading

Learning Outcomes:

- Demonstrate knowledge of blueprints and their applications.

Objectives and Content:

1. Identify the types of drawings and describe their applications.
 - i) civil/site
 - ii) architectural
 - iii) mechanical
 - iv) structural
 - v) electrical
 - vi) shop drawings
 - vii) sketches
 - viii) as-built

2. Identify the views used on blueprints.
 - i) elevation
 - ii) plan
 - iii) section
 - iv) detail
 - v) auxiliary

3. Identify the parts of a blueprint and describe their purpose and applications.
 - i) lines
 - ii) legend
 - iii) symbols and abbreviations
 - duct
 - welding
 - electrical
 - plumbing
 - architectural
 - iv) title block
 - v) notes and specifications

4. Identify and interpret common symbols and abbreviations found on drawings.

5. Identify the types of scales and describe their applications and procedures for use.
6. Describe metric and imperial systems of measurement.

SMW-215 Parallel Line Development (Introduction)

Learning Outcomes:

- Demonstrate knowledge of parallel line development, its applications and associated calculations.
- Demonstrate knowledge of the procedures used to develop and fabricate basic fittings using parallel line development.

Objectives and Content:

1. Define and explain terminology associated with parallel line development.
2. Describe the types of basic fittings that require parallel line development.
 - i) tee
 - ii) round elbow
3. Identify calculations used in parallel line development and the procedures used to perform them.
4. Describe the procedures used to develop and fabricate basic fittings using parallel line development.
 - i) determine views
 - ii) label lines and points
 - iii) prepare pattern
 - iv) determine true length of lines
 - v) determine types of seams, joints and edges
 - vi) calculate allowances
 - vii) determine stretchouts
 - viii) confirm pattern accuracy
 - ix) cut pattern
 - x) label pieces

Learning Outcomes:

- Demonstrate knowledge of radial line development, its applications and associated calculations.
- Demonstrate knowledge of the procedures used to develop and fabricate basic fittings using radial line development.

Objectives and Content:

1. Define and explain terminology associated with radial line development.
2. Describe the types of basic fittings that require radial line development.
 - i) right cone
3. Identify calculations used in radial line development and the procedures used to perform them.
4. Describe the procedures used to develop and fabricate basic fittings using radial line development.
 - i) determine views
 - ii) label lines and points
 - iii) prepare pattern
 - iv) determine true length of lines
 - v) determine types of seams, joints and edges
 - vi) calculate allowances
 - vii) determine stretchouts
 - viii) confirm pattern accuracy
 - ix) cut pattern
 - x) label pieces

SMW-225 Triangulation (Introduction)

Learning Outcomes:

- Demonstrate knowledge of triangulation, its applications and associated calculations.
- Demonstrate knowledge of the procedures used to develop and fabricate basic fittings using triangulation.

Objectives and Content:

1. Define and explain terminology associated with the triangulation method.
2. Describe the types of basic fittings that require the triangulation method.
 - i) transitions
 - ii) on-center
 - square to round
3. Identify calculations used in the triangulation method and the procedures used to perform them.
4. Describe the procedures used to develop and fabricate basic fittings using the triangulation method.
 - i) determine views
 - ii) label lines and points
 - iii) prepare pattern
 - iv) determine true length of lines
 - v) determine types of seams, joints and edges
 - vi) calculate allowances
 - vii) determine stretchouts
 - viii) confirm pattern accuracy
 - ix) cut pattern
 - x) label pieces

Learning Outcomes:

- Demonstrate knowledge of the procedures used to weld aluminum, stainless steel and copper using the GMAW process.

Objectives and Content:

1. Identify and describe GMAW equipment, consumables and accessories used to weld aluminum, stainless steel and copper.
2. Describe the procedures to set-up, adjust and shut-down GMAW equipment for welding aluminum, stainless steel and copper.
3. Describe the procedures used to weld aluminum, stainless steel and copper using the GMAW process.
 - i) plug
 - ii) fillet (continuous)
 - iii) stitch
 - iv) tack
 - v) edge
 - vi) corner
4. Describe weld defects, their causes and the procedures to prevent and correct them.

Learning Outcomes:

- Demonstrate knowledge of GTAW equipment, its applications and maintenance.
- Demonstrate knowledge of the procedures used to weld mild steel using the GTAW process.

Objectives and Content:

1. Define and explain terminology associated with GTAW.
2. Describe GTAW and its applications.
3. Identify safety precautions when using GTAW equipment.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
4. Identify and describe GTAW equipment, consumables and accessories.
5. Describe the procedures to set-up, adjust and shut-down GTAW equipment for welding mild steel.
6. Describe the procedures used to maintain and troubleshoot GTAW equipment.
7. Identify the types of welds performed using the GTAW process.
 - i) plug
 - ii) fillet (continuous)
 - iii) stitch
 - iv) tack
 - v) edge
 - vi) corner
8. Describe the procedures used to weld mild steel using the GTAW process.
9. Describe weld defects, their causes and the procedures to prevent and correct them.

Learning Outcomes:

- Demonstrate knowledge of sheet metal components for air handling systems and the procedures used to fabricate them.

Objectives and Content:

1. Define and explain terminology associated with air handling systems.
2. Identify tools and equipment used to fabricate sheet metal components for air handling systems and describe their applications.
3. Identify types of materials used in fabricating sheet metal components for air handling systems and describe their characteristics and applications.
4. Identify and describe sheet metal components associated with air handling systems.
 - i) ductwork
 - ii) fittings
 - iii) dampers
 - iv) fire dampers
 - v) flexible connections
 - vi) hangers
 - vii) equipment supports/bases
 - viii) louvers
 - ix) attenuators (silencer)
5. Identify considerations and requirements when fabricating sheet metal components for air handling systems.
 - i) load bearing capacities
 - ii) system specifications
 - iii) codes and regulations
 - SMACNA
 - ASHRAE
 - NBC
 - iv) environmental conditions

6. Describe the procedures used to fabricate sheet metal components for air handling systems.
 - i) cut
 - ii) label
 - iii) form
 - iv) insulate
 - v) assemble

7. Identify the types of basic surface finishes and describe their applications.

SMW-245 Installation (Air Handling Systems)

Learning Outcomes:

- Demonstrate knowledge of installation procedures for air handling systems.

Objectives and Content:

1. Identify types of air handling systems and describe their principles and operation.
 - i) exhaust
 - ii) make-up air
 - iii) supply/return air (central)

2. Identify air handling system components and describe their applications.
 - i) sheet metal components
 - ductwork
 - fittings
 - hangers
 - braces
 - brackets
 - cladding/lagging
 - ii) system components
 - units
 - dampers
 - fire dampers
 - registers/diffusers
 - grilles
 - louvers
 - coils
 - heat and energy recovery ventilators
 - automatic controls and instruments
 - iii) accessories
 - humidifiers
 - filters
 - mixing boxes

3. Identify the types of fasteners and describe their applications.
 - i) concrete
 - ii) metal
 - iii) wood

4. Describe the procedures used to prepare for installation of residential and commercial/industrial air handling systems and components.
 - i) determine equipment requirements
 - ii) determine penetration locations
 - iii) perform site measurements
 - iv) on-site co-ordination
 - staging (storing material)
 - planning
 - distributing (material to installation area)
 - sectioning (pre-assembling on site)
 - erecting
 - v) final inspection (completing)

5. Identify considerations and requirements for installing air handling system components.
 - i) codes and regulations
 - ii) manufacturers' specifications
 - iii) isolators
 - iv) building materials
 - v) environmental conditions

6. Describe the methods used to install air handling system components.

LEVEL 3

Learning Outcomes:

- Demonstrate knowledge of the procedures used to weld aluminum, stainless steel and copper using the GTAW process.

Objectives and Content:

1. Identify and describe GTAW equipment, consumables and accessories used to weld aluminum, stainless steel and copper.
2. Describe the procedures to set-up, adjust and shut-down GTAW equipment for welding aluminum, stainless steel and copper.
3. Describe the procedures used to weld aluminum, stainless steel and copper using the GTAW process.
 - i) plug
 - ii) fillet (continuous)
 - iii) stitch
 - iv) tack
 - v) edge
 - vi) corner
4. Describe weld defects, their causes and the procedures to prevent and correct them.

Learning Outcomes:

- Demonstrate knowledge of blueprint reading and interpretation.
- Demonstrate knowledge of the procedures used to take field measurements.
- Demonstrate knowledge of the procedures used to produce material take-off lists.

Objectives and Content:

1. Describe the procedures used to interpret and extract information from blueprints.
2. Identify the purpose of submittals and shop drawings and describe the procedures used to interpret them.
3. Describe the procedures used to take field measurements.
4. Identify the types of material take-off lists and describe their applications and the procedures used to produce them.
 - i) material estimation
 - ii) material installation

SMW-310 Parallel Line Development (Advanced Applications)

Learning Outcomes:

- Demonstrate knowledge of the procedures used to develop and fabricate advanced or complex fittings using parallel line development.

Objectives and Content:

1. Describe the types of advanced or complex fittings and components that require parallel line development.
2. Describe the procedures used to develop and fabricate advanced fittings and components using parallel line development.

SMW-315 Radial Line Development (Advanced Applications)

Learning Outcomes:

- Demonstrate knowledge of the procedures used to develop and fabricate advanced or complex fittings using radial line development.

Objectives and Content:

1. Describe the types of advanced or complex fittings and components that require radial line development.
2. Describe the procedures used to develop and fabricate advanced fittings and components using radial line development.

SMW-320 Triangulation (Advanced Applications)

Learning Outcomes:

- Demonstrate knowledge of the procedures used to develop and fabricate advanced or complex fittings using triangulation.

Objectives and Content:

1. Describe the types of advanced or complex fittings and components that require the triangulation method.
2. Describe the procedures used to develop and fabricate advanced fittings and components using the triangulation method.

SMW-325 Duct System Design

Learning Outcomes:

- Demonstrate knowledge of duct systems and their associated design principles.

Objectives and Content:

1. Define and explain terminology associated with duct system design.
2. Identify the types of basic duct systems and describe their associated design principles.
3. Describe the procedures used to perform heat gain/loss calculations and their applications.
4. Identify air patterns and describe their impact on the operation of air handling systems.
5. Identify air pressure and its impact on the operation of air handling systems.
 - i) positive
 - ii) negative
6. Identify formulas used in duct system design and describe their applications.
 - i) fan laws
 - ii) velocity
 - iii) quantity
 - iv) pressure
7. Identify considerations and requirements used to determine duct system design.
 - i) equal friction
 - air duct calculator
 - ii) static regain
 - iii) constant velocity

SMW-330 Air Quality Management

Learning Outcomes:

- Demonstrate knowledge of air quality management.

Objectives and Content:

1. Define and explain terminology associated with air quality management.
2. Describe considerations and requirements associated with air quality management.
 - i) safety
 - ii) codes and regulations
 - iii) environmental conditions
3. Describe the importance of indoor air quality.
4. Identify methods of improving air quality.
 - i) heating
 - ii) ventilation
 - iii) conditioning
 - filtration
 - sterilization
 - purification
 - humidification/dehumidification
5. Identify areas requiring special air quality ventilation.
 - i) clean/sterile rooms
 - ii) industrial/commercial settings
 - factory
 - public
6. Identify air quality problems and describe procedures used to prevent or correct them.
 - i) rigid fibrous ducts
 - ii) out/off-gasing
 - iii) humidification/dehumidification
 - iv) improper installation

Learning Outcomes:

- Demonstrate knowledge of installation procedures for chimneys, breeching and venting.

Objectives and Content:

1. Define and explain terminology associated with chimneys, breeching and venting.
2. Identify codes, standards and regulations pertaining to installing chimneys, breeching and venting.
 - i) jurisdictional requirements
3. Identify types of chimneys, breeching and venting systems and their components and describe their applications.
 - i) chimney classifications
 - ii) vent classifications/combustion air
4. Describe the procedures used to install chimneys, breeching and venting.
5. Describe the procedures used to connect chimneys, breeching and venting to the appliance.
6. Identify types of flashings and describe their applications.
7. Identify cladding and lagging materials used for chimneys, breeching and venting and describe their characteristics and applications.
8. Describe the procedures used to install cladding and lagging on chimneys, breeching and venting.
9. Describe the factors to consider when installing flashing.
 - i) environmental conditions
 - ii) architectural conditions
10. Describe the procedures used to install flashing.

LEVEL 4

SMW-400 Fabrication (Material Handling Systems and Components)

Learning Outcomes:

- Demonstrate knowledge of sheet metal components for material handling systems and the procedures used to fabricate them.

Objectives and Content:

1. Define and explain terminology associated with material handling systems.
2. Identify tools and equipment used to fabricate sheet metal components for material handling systems and describe their applications.
3. Identify types of materials used in fabricating sheet metal components for material handling systems and describe their characteristics and applications.
4. Identify and describe sheet metal components associated with material handling systems.
 - i) ductwork
 - ii) fittings
 - iii) dampers
 - iv) fire dampers
 - v) flexible connections
 - vi) hangers
 - vii) equipment supports/bases
 - viii) louvers
 - ix) attenuators (silencer)
5. Identify considerations and requirements when fabricating sheet metal components for material handling systems.
 - i) load bearing capacities
 - ii) system specifications
 - iii) codes and regulations
 - SMACNA
 - ASHRAE
 - NBC

- iv) environmental conditions
 - v) architectural conditions
6. Describe the procedures used to fabricate sheet metal components for material handling systems.
- i) cut
 - ii) label
 - iii) form
 - iv) insulate
 - v) assemble
7. Identify the types of basic surface finishes and describe their applications.

SMW-405 Installation (Material Handling Systems)

Learning Outcomes:

- Demonstrate knowledge of installation procedures for material handling systems and their components.

Objectives and Content:

1. Identify the types of material handling systems and describe their applications, principles and operation.
 - i) conveyors
 - ii) chutes
 - iii) blow pipe/dust collection

2. Identify material handling system components and describe their applications.
 - i) system components
 - fans
 - collection devices
 - cyclone
 - separating devices
 - automatic controls and instruments
 - ii) sheet metal components
 - ductwork
 - fittings
 - hangers
 - braces
 - brackets
 - iii) accessories
 - access doors
 - blast gates

3. Describe the procedures used to prepare for installation of material handling system components.
 - i) determine equipment requirements
 - ii) verify duct sizing
 - iii) determine penetration locations
 - iv) perform site measurements
 - v) on-site co-ordination

- staging (storing material)
 - planning
 - distributing (material to installation area)
 - sectioning (pre-assembling on site)
 - erecting
- vi) final inspection (completing)
4. Identify considerations for installing material handling system components.
- i) codes and regulations
 - ii) manufacturers' specifications
 - iii) isolators
 - iv) building materials
 - v) environmental conditions
5. Describe the procedures used to install material handling system components.

SMW-410 Maintenance and Repair (Air and Material Handling Systems)

Learning Outcomes:

- Demonstrate knowledge of maintenance and repair procedures for air handling systems.
- Demonstrate knowledge of maintenance and repair procedures for material handling systems.
- Demonstrate knowledge of testing devices and their applications.

Objectives and Content:

1. Identify tools and equipment used in maintenance and repair of air and material handling system components and describe their applications.
 - i) testing devices

2. Identify considerations for maintenance inspection of air and material handling system components.
 - i) sounds
 - ii) vibration
 - iii) odors
 - iv) heat build-up
 - v) visual

3. Describe the procedures used to troubleshoot air and material handling system components.

4. Describe the procedures used to service air and material handling system components.
 - i) scheduled
 - filters
 - lubrication
 - adjustments
 - ii) emergency
 - iii) lock out

5. Describe the procedures used to repair or replace worn, faulty or defective components of air or material handling systems.

SMW-415 Testing, Adjusting and Balancing (Air and Material Handling Systems)

Learning Outcomes:

- Demonstrate knowledge of testing, adjusting and balancing procedures for air handling systems.
- Demonstrate knowledge of testing, adjusting and balancing procedures for material handling systems.

Objectives and Content:

1. Define and explain terminology associated with testing, adjusting and balancing air and material handling systems.
2. Identify requirements and limitations relating to testing, adjusting and balancing air handling systems.
3. Identify tools and instruments used in testing, adjusting and balancing systems and describe their applications and procedures for use.
 - i) electrical devices
 - ii) air balancing devices
 - iii) charts
 - psychometric
 - fan
4. Describe the importance of testing, balancing and adjusting to ensure optimal system performance.
5. Identify types of tests relating to air and material handling system components and describe the procedures used to perform them.
 - i) leak/pressure test
6. Describe the procedures and techniques to perform air balancing on air handling systems.
7. Describe the procedures to adjust air handling system components to optimize performance.

8. Describe the procedures to adjust material handling system components to optimize performance.
9. Identify problems pertaining to air handling systems and describe the procedures used to prevent and correct them.
 - i) positive pressure
 - ii) negative pressure
 - iii) improper installation
 - duct sizing
 - noise

Learning Outcomes:

- Demonstrate knowledge of fabrication procedures for metal roofing, cladding and architectural metals.
- Demonstrate knowledge of installation procedures for metal roofing, cladding and architectural metals.

Objectives and Content:

1. Define and explain terminology associated with metal roofing, cladding and architectural metals.
2. Identify tools and equipment used to fabricate and install metal roofing, cladding and architectural metals and describe their applications and procedures for use.
3. Identify types of materials used in fabricating metal roofing, cladding and architectural metals.
4. Identify types of components associated with metal roofing and cladding and architectural metals and describe their applications.
 - i) roof drainage
 - ii) flashing
 - iii) soffit and fascia
 - iv) roof vents
5. Describe the procedures used to fabricate metal roofing, cladding and architectural metals and their associated components.
 - i) layout
 - ii) determine seam
 - iii) cut
 - iv) form
6. Identify considerations and requirements relating to installing metal roofing, cladding and architectural metals.
 - i) safety
 - ii) building materials
 - iii) codes and regulations

- iv) roof slope
 - v) expansion and contraction
7. Identify types of fasteners for installing metal roofing, cladding and architectural metals and describe their applications.
8. Identify types of roof structures and construction features and describe their applications.
- i) hip
 - ii) gable
 - iii) pitched
 - iv) flat
9. Describe the procedures used to layout metal roofing and cladding and architectural metals.
- i) check for square
 - ii) determine starting point
 - iii) establish reference lines
10. Identify materials to be installed to prepare surfaces for installation of metal roofing, cladding and architectural metals.
- i) insulation
 - ii) waterproof membrane
 - iii) isolation material
 - iv) building envelope
11. Describe the procedures used to install materials to roofs or walls in preparation for installation of metal roofing, cladding and architectural metals.
12. Describe the procedures used to install metal roofing, cladding and architectural metals.
- i) cut
 - ii) fit
 - iii) secure
 - iv) seal
13. Identify types of metal decking and describe their applications.
- i) metal pan
 - ii) Q decking

14. Describe the procedures used to install decking.
15. Identify types of exterior components and describe their applications.
 - i) awnings
 - ii) signage

SMW-425 Shielded Metal Arc Welding (SMAW)

Learning Outcomes:

- Demonstrate knowledge of SMAW equipment, its applications, maintenance and procedures for use.
- Demonstrate knowledge of weld defects, their causes and the procedures used to prevent and correct them.

Objectives and Content:

1. Define and explain terminology associated with SMAW.
2. Describe SMAW and its applications.
3. Identify safety precautions when using SMAW equipment.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
4. Identify and describe SMAW equipment and accessories.
5. Describe the procedures to set-up, adjust and shut-down SMAW equipment.
6. Describe the procedures used to maintain and troubleshoot SMAW equipment.
7. Identify the types of welds performed using SMAW equipment.
 - i) plug
 - ii) fillet (continuous)
 - iii) stitch
 - iv) tack
 - v) edge
 - vi) corner
8. Describe the procedures used to weld various materials using the SMAW process.

9. Describe weld defects, their causes and the procedures used to prevent and correct them.

Learning Outcomes:

- Demonstrate knowledge of oxy-fuel cutting and heating equipment, its maintenance and procedures for use.
- Demonstrate knowledge of brazing equipment, its maintenance and procedures for use.

Objectives and Content:

1. Identify oxy-fuel cutting, heating and brazing equipment and accessories and describe their applications.
2. Identify safety considerations when using oxy-fuel cutting, heating and brazing equipment.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
3. Describe the procedures used to set-up, adjust and shut-down oxy-fuel cutting and heating equipment.
4. Describe the procedures used to maintain and troubleshoot oxy-fuel cutting and heating equipment.
5. Describe the procedures used to set-up, adjust, and shut-down brazing equipment.
6. Describe the procedures used to maintain and troubleshoot brazing equipment.
7. Describe the procedures used to cut using oxy-fuel equipment.
8. Identify types of materials used for brazing.
9. Describe the procedures used to braze various materials.

SMW-435 Specialty Products

Learning Outcomes:

- Demonstrate knowledge of specialty products and their applications.
- Demonstrate knowledge of fabrication procedures for specialty products.
- Demonstrate knowledge of installation procedures for specialty products and their related components.

Objectives and Content:

1. Define and explain terminology associated with the fabrication of specialty products.
 - i) metal
 - ii) non-metal

2. Identify types of specialty products and accessories and describe their applications.
 - i) kitchen
 - ii) medical
 - iii) food processing
 - iv) pharmaceutical laboratory
 - v) decorative

3. Identify types of materials used in fabricating specialty products and components and describe their applications.
 - i) ferrous
 - ii) non-ferrous
 - iii) plastics/PVC
 - iv) composites (i.e. awnings)

4. Identify tools and equipment used to fabricate and install specialty products and describe their applications and procedures for use.

5. Describe the procedures used to fabricate specialty products and their associated components.
 - i) handling
 - ii) design
 - iii) cut

- iv) form
 - v) assemble
 - vi) join
 - vii) finish
6. Identify considerations and requirements for installing specialty products.
- i) codes and regulations
 - ii) manufacturers' specifications
 - iii) environmental conditions
 - iv) sanitation
7. Identify types of fasteners and fastening methods used to install specialty products and describe their applications.
8. Describe the procedures used to install specialty products.