NOVA SCOTIA APPRENTICESHIP CURRICULUM STANDARD
for the Occupation of Sheet Metal Worker Levels 1, 2, and 3 in September 2014
See Page 12 for NS Program Structure

Sheet Metal Worker 2020
Based on the CCDA Harmonization Recommendations

NOVA SCOTIA APPRENTICESHIP AGENCY

2020
Version #1.0
Nova Scotia
Curriculum Standard
Sheet Metal Worker
Preface

This Apprenticeship Curriculum Standard is intended to assist instructional staff in the design and delivery of technical, in-class training in support of the Sheet Metal Worker Apprenticeship Program.

This document contains all of the technical training elements required to complete the program and has been developed based on the 2017 Red Seal Occupational Standard (RSOS). The RSOS can be found on the Red Seal website (www.red-seal.ca).

Implementation of this Apprenticeship Curriculum Standard for apprenticeship training is outlined in the following table.

<table>
<thead>
<tr>
<th>Level</th>
<th>Implementation Effective</th>
</tr>
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<tbody>
<tr>
<td>Level 1</td>
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<td>Level 3</td>
<td>2020-2021</td>
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<td>Level 4</td>
<td>2021-2022</td>
</tr>
</tbody>
</table>

** The above implementation schedule was current at time of printing. Please confirm with Apprenticeship Staff prior to commencing training.

Granting of credit or permission to challenge level examinations for pre-employment or pre-apprenticeship training for the Automotive Service Technician trade will be based on the content outlined in this standard. Training providers must contact their provincial apprenticeship authority for more information on the process and requirements for determining eligibility for credit towards an apprenticeship program. Programs which have been deemed acceptable by the jurisdictional apprenticeship authority will be identified in transfer credit matrix developed through the Atlantic Apprenticeship Harmonization Project.
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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, which is administered by the Canadian Council of Directors of Apprenticeship (CCDA). 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.

With the support of Employment Services and Development Canada (ESDC), the provinces and territories have been working collaboratively to harmonize apprenticeship training programs across Canada. Four main areas of harmonization include:

- Use of the Red Seal trade name
- Consistent total training hours
- Same number of training levels
- Consistent sequencing of training content (at each level) using the most recent 2017 Red Seal Occupational Standard/National Occupational Analysis for the trade

This Apprenticeship Curriculum Standard is in alignment with the national CCDA harmonization recommendations.

Provincial-Territorial Apprentice Mobility Agreement and Protocol

The provincial-territorial apprenticeship mobility agreement and protocol obligates Apprenticeship Authorities across Canada to recognize hours worked and technical training successfully completed by apprentices, regardless of the jurisdiction in which they were completed. The protocol applies to apprentices moving permanently or temporarily, and to recent graduates of college trades program.
Atlantic Apprenticeship Curriculum Standards (AACS) are developed based on Red Seal Occupational Standards (RSOS), National Occupational Analyses (NOA), Interprovincial Program Guides (IPG), if available, and extensive industry consultation. This document represents the minimum content to be delivered as part of the harmonized Atlantic program for the Sheet Metal Worker trade.

The AACS’s are deliberately constructed for ease of use and flexibility of structure in order to adapt to all delivery requirements. They detail units of training, unit outcomes and objectives. They do 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 AACS does not dictate study materials, textbooks or learning activities to be used in delivery.

The document includes a Level Structure to facilitate mobility for apprentices moving from one jurisdiction to another.

Structure

The content of the AACS is divided into units. Unit codes are used as a means of identification and are not intended to convey the order of delivery. It is at the discretion of the training provider to deliver the content in the required logical sequence of delivery within the level. Jurisdictions are free to deliver units one at a time or concurrently within a level, provided all outcomes are met.

The Learning Outcomes describe what the apprentice should know or be able to do at the end of training. Wording of the Learning Outcomes, “Demonstrate knowledge of…” acknowledges the broad spectrum of ways in which knowledge can be assessed (i.e. practical projects, multiple choice testing, presentations, etc.) by instructional staff within the training.

Summative evaluation will be through a multiple-choice Level Examination administered through the jurisdictional Apprenticeship Authority.
The Red Seal Occupational Standard References (RSOS) to AACS Comparison chart outlines the relation between each RSOS sub-task and the AACS units. RSOS References have also been detailed in each unit to highlight the direct link between the unit and relevant sub-tasks in the RSOS.

In the Level Structure section, the document identifies suggested hours in order to provide an indication of the time it should take to cover the material in the unit and is provided as a guide only. Adjustments to the suggested hours for each unit may be required to account for rate of apprentice learning, statutory holidays, storm days, registration and examinations. These suggested hours detailed for each unit will represent both theory and practical training (if relevant) and for consistency will be based on a standard of 30 hours per week of training. The true length of time required to deliver an outcome successfully will depend upon the learning activities and teaching methods used.

There are two types of objectives found in the AACS document: theoretical and practical.

The theoretical objectives represent the material that is to be covered during the technical training in order to convey the required knowledge to the apprentice.

The practical objectives represent the tasks or skills that have been deemed by the Atlantic Trade Advisory Committee as critical for the apprentices to receive exposure to while attending technical training. For example, exposure could be done through instructor demonstration or individual or group performance of the skill or task. Training providers are encouraged to use practical demonstration and opportunities for hands-on learning whenever possible. Practical objectives are not intended to replace the on-the-job training component of the apprentice’s program or to mirror or replace the logbook skills that are to be taught and evaluated in the workplace.

Detailed content for each objective has not been developed. Where detail is required for clarity, content has been provided.
Glossary of Terms

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

**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.

**DIAGNOSE**
To analyze or identify a problem or malfunction.

**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.
Glossary of Terms (continued)

SERVICE
Routine inspection and replacement of worn or deteriorating parts.

An act or business function provided to a customer in the course of one’s profession. (e.g., haircut).

TECHNIQUE
Within a procedure, the manner in which technical skills are applied.

TEST
v. To subject to a procedure that ascertains effectiveness, value, proper function, or other quality.

n. A way of examining something to determine its characteristics or properties, or to determine whether or not it is working correctly.

TROUBLESHOOT
To follow a systematic procedure to identify and locate a problem or malfunction and its cause.
Essential Skills Profiles

Through extensive research, the Government of Canada and other national and international agencies have identified and validated key essential skills for the workplace. These skills are used in nearly every job and at different levels of complexity. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Essential Skills Profiles describe how workers in various occupations use each of the key essential skills. They include:

- A brief description of the occupation;
- Examples of tasks that illustrate how each essential skill is applied; and,
- Complexity ratings that indicate the level of difficulty of the example tasks.

Essential Skills profiles can be found on the Employment and Social Development Canada (ESDA) website at [www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml](http://www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml)

The development and improvement of these Essential Skills is inherent throughout the apprenticeship training program as apprentices work towards achieving journeyperson status.
# Profile Chart

## OCCUPATIONAL SKILLS

<table>
<thead>
<tr>
<th>SMW-100</th>
<th>SMW-105</th>
<th>SMW-110</th>
<th>SMW-115</th>
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</thead>
<tbody>
<tr>
<td>Safety</td>
<td>Stationary and Mobile Work Platforms</td>
<td>Hoisting, Lifting and Positioning Equipment</td>
<td>Tools and Equipment</td>
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<tr>
<td>SMW-120</td>
<td>SMW-125</td>
<td>SMW-170</td>
<td>SMW-445</td>
</tr>
<tr>
<td>Communication and Trade Documents</td>
<td>Sheet Metal Math Fundamentals</td>
<td>Mentoring 1</td>
<td>Mentoring 2</td>
</tr>
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<td>SMW-130</td>
<td>SMW-135</td>
<td>SMW-140</td>
<td>SMW-145</td>
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<td>Introduction to Welding</td>
<td>Resistance Spot Welding</td>
<td>Plasma Arc Cutting</td>
<td>Metallurgy</td>
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<td>SMW-150</td>
<td>SMW-155</td>
<td>SMW-200</td>
<td>SMW-300</td>
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<td>Soft Soldering</td>
<td>Drafting</td>
<td>Drawings 1</td>
<td>Drawings 2</td>
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<td>SMW-230</td>
<td>SMW-235</td>
<td>SMW-240</td>
<td>SMW-305</td>
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<td>Introduction to GMAW</td>
<td>Oxy-fuel Cutting, Heating and Brazing/Hard Soldering</td>
<td>SMAW</td>
<td>Advanced GMAW</td>
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<td>SMW-310</td>
<td>SMW-315</td>
<td>SMW-435</td>
<td>SMW-440</td>
</tr>
<tr>
<td>Introduction to GTAW</td>
<td>Advanced GTAW</td>
<td>Trade Related Documents</td>
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## SHEET METAL FABRICATION

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<thead>
<tr>
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<tr>
<td>Drafting</td>
<td>Pattern Development 1 (Simple and Straight Line)</td>
<td>Fabrication Installation Fundamentals</td>
<td>Parallel Line Development (Round Duct Fittings)</td>
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<td>SMW-210</td>
<td>SMW-215</td>
<td>SMW-220</td>
<td>SMW-320</td>
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<td>Radial Line Development (Right Cones)</td>
<td>Triangulation (From Plan View)</td>
<td>Air Handling Systems (Fabrication) 1</td>
<td>Parallel Line Development (Architectural Applications)</td>
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<td>SMW-325</td>
<td>SMW-330</td>
<td>SMW-400</td>
<td>SMW-335</td>
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<tr>
<td>Radial Line Development (Oblique Fittings)</td>
<td>Triangulation (From Elevation)</td>
<td>Triangulation (Rectangular Fittings and Computerized Technology)</td>
<td>Duct System Design</td>
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## AIR AND MATERIAL HANDLING SYSTEM INSTALLATION

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<th>SMW-225</th>
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<td>Chimneys, Breeching and Venting</td>
<td>Air Handling Systems (Installation) 1</td>
<td>Air Handling Systems (Installation) 2</td>
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<tr>
<td>SMW-350</td>
<td>SMW-405</td>
<td>SMW-410</td>
<td>SMW-415</td>
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### Profile Chart (continued)

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<td>Metal Roofing and Architectural Metal</td>
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<td><strong>SMW-340</strong></td>
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<td>Speciality Products</td>
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<td><strong>SMW-350</strong></td>
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<td>Air Handling Systems (Maintenance and Repair)</td>
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<td><strong>SMW-415</strong></td>
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<td>Material Handling Systems (Maintenance and Repair)</td>
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<td>Testing and Balancing</td>
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<td><strong>SMW-425</strong></td>
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<tr>
<td>Introduction to Commissioning</td>
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<td><strong>SMW-430</strong></td>
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<td>SMWA-1857</td>
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<td><strong>Level 2 (7 Weeks, 8 Courses)</strong></td>
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## Level Structure (Levels 3 & 4) based on the draft AACS

### Level 3 – 7 Weeks

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<td>SMW-300</td>
<td>Parallel Line Development (Architectural Applications)</td>
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<td>SMW-305</td>
<td>Radial Line Development (Oblique Fittings)</td>
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<td>SMW-315</td>
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<td>SMW-320</td>
<td>Gas Tungsten Arc Welding (GTAW)</td>
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<td>SMW-325</td>
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<td>SMW-335</td>
<td>Introduction to Leak Testing, Air Balancing and Commissioning</td>
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<td>SMW-340</td>
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<td>SMW-345</td>
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<td>SMW-350</td>
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<td>SMW-405</td>
<td>Material Handling Systems</td>
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<td>SMW-410</td>
<td>Thermal Insulation, Lagging/Cladding and Flashing</td>
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<td>111</td>
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<td>SMW-415</td>
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<td>SMW-420</td>
<td>Commissioning</td>
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<td>SMW-430</td>
<td>Drawings 2</td>
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<td>SMW-435</td>
<td>Mentoring</td>
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<td>SMW-440</td>
<td>Program Review</td>
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## Draft 2017 RSOS Sub-task to AACS Unit Comparison

<table>
<thead>
<tr>
<th>NOA Sub-task</th>
<th>IPG Unit</th>
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<tr>
<td><strong>Task 1 – Performs safety-related functions.</strong></td>
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</tr>
<tr>
<td>1.01 Uses personal protective equipment (PPE) and safety equipment.</td>
<td>SMW-100 Safety</td>
</tr>
<tr>
<td>1.02 Maintains safe work environment.</td>
<td>SMW-100 Safety</td>
</tr>
<tr>
<td>1.03 Performs lock-out/tag-out procedures.</td>
<td>SMW-100 Safety</td>
</tr>
<tr>
<td><strong>Task 2 – Uses and maintains tools and equipment.</strong></td>
<td></td>
</tr>
<tr>
<td>2.01 Uses hand and portable power tools.</td>
<td>SMW-115 Tools and Equipment</td>
</tr>
<tr>
<td>2.02 Uses shop tools and equipment.</td>
<td>SMW-115 Tools and Equipment</td>
</tr>
<tr>
<td>2.03 Uses gas metal arc welding (GMAW) equipment.</td>
<td>SMW-230 Introduction to GMAW, SMW-305 Advanced GMAW</td>
</tr>
<tr>
<td>2.04 Uses resistance spot welding equipment.</td>
<td>SMW-135 Resistance Spot Welding</td>
</tr>
<tr>
<td>2.05 Uses gas tungsten arc welding (GTAW) equipment.</td>
<td>SMW-310 Introduction to GTAW, SMW-315 Advanced GTAW</td>
</tr>
<tr>
<td>2.06 Uses shielded metal arc welding (SMAW) equipment.</td>
<td>SMW-130 Introduction to Welding, SMW-240 SMAW</td>
</tr>
<tr>
<td>2.07 Uses oxy-fuel and plasma arc cutting equipment.</td>
<td>SMW-150 Soft Soldering, SMW-140 Plasma Arc Cutting, SMW-235 Oxy-fuel Cutting, Heating and Brazing/Hard Soldering</td>
</tr>
<tr>
<td>2.08 Maintains measuring and layout equipment.</td>
<td>SMW-115 Tools and Equipment, SMW-155 Drafting</td>
</tr>
<tr>
<td>2.11 Uses stationary and mobile work platforms.</td>
<td>SMW-105 Stationary and Mobile Work Platforms</td>
</tr>
<tr>
<td>2.12 Uses hoisting, rigging and positioning equipment.</td>
<td>SMW-110 Hoisting, Rigging and Positioning Equipment</td>
</tr>
<tr>
<td><strong>Task 3 – Organizes work.</strong></td>
<td></td>
</tr>
<tr>
<td>3.01 Uses trade-related documentation.</td>
<td>SMW-120 Communication and Trade Documents, SMW-435 Trade Related Documents, SMW-440 Job Planning</td>
</tr>
<tr>
<td>3.02 Interprets drawings.</td>
<td>SMW-120 Communication and Trade Documents, SMW-200 Drawings 1, SMW-300 Drawings 2</td>
</tr>
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<td>NOA Sub-task</td>
<td>IPG Unit</td>
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<tr>
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<td>SMW-440</td>
</tr>
<tr>
<td>3.03 Organizes materials and equipment for project.</td>
<td>SMW-120 Communication and Trade Documents</td>
</tr>
<tr>
<td></td>
<td>SMW-440 Job Planning</td>
</tr>
<tr>
<td>3.04 Performs basic design and field modifications.</td>
<td>SMW-225 Air Handling Sys (Installation) 1</td>
</tr>
<tr>
<td></td>
<td>SMW-410 Material Handling Systems (Installation)</td>
</tr>
</tbody>
</table>

**Task 4 – Uses communication and mentoring techniques.**

| 4.01 Uses communication techniques. | SMW-120 Communication and Trade Documents |
| 4.02 Uses mentoring techniques. | SMW-170 Mentoring 1 |
|              | SMW-445 Mentoring 2 |

**Task 5 – Performs pattern development.**

| 5.01 Develops patterns using simple and straight-line layout. | SMW-160 Pattern Development 1 (Simple and Straight Line) |
| 5.02 Develops patterns using parallel line method. | SMW-205 Parallel Line Development (Round Duct Fittings) |
|              | SMW-320 Parallel Line Development (Architectural Applications) |
| 5.03 Develops patterns using radial line method. | SMW-210 Radial Line Development (Right Cones) |
|              | SMW-325 Radial Line Development (Oblique Fittings) |
| 5.04 Develops patterns using triangulation method. | SMW-215 Triangulation (From Plan View) |
|              | SMW-330 Triangulation (From Elevation) |
|              | SMW-400 Triangulation (Rectangular Fittings) and Computerized Technology |
| 5.05 Uses computer technology for pattern development. | SMW-400 Triangulation (Rectangular Fittings) and Computerized Technology |

**Task 6 – Fabricates sheet metal components for air and material handling systems.**

<p>| 6.01 Cuts ductwork, fittings and components. | SMW-165 Fabrication and Installation Fundamentals |
|              | SMW-220 Air Handling Systems (Fabrication) 1 |
|              | SMW-405 Material Handling Systems (Fabrication) |
| 6.02 Forms ductwork, fittings and components. | SMW-165 Fabrication and Installation Fundamentals |
|              | SMW-220 Air Handling Systems (Fabrication) 1 |
|              | SMW-335 Duct System Design |
|              | SMW-405 Material Handling Systems (Fabrication) |</p>
<table>
<thead>
<tr>
<th>NOA Sub-task</th>
<th>IPG Unit</th>
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<tbody>
<tr>
<td>6.03 Insulates ductwork, fittings and components.</td>
<td>SMW-165 Fabrication and Installation Fundamentals</td>
</tr>
<tr>
<td></td>
<td>SMW-220 Air Handling Systems (Fabrication) 1</td>
</tr>
<tr>
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<td>SMW-405 Material Handling Systems (Fabrication)</td>
</tr>
<tr>
<td>6.04 Assembles ductwork, fittings and components.</td>
<td>SMW-165 Fabrication and Installation Fundamentals</td>
</tr>
<tr>
<td></td>
<td>SMW-220 Air Handling Systems (Fabrication) 1</td>
</tr>
<tr>
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<td>SMW-335 Duct System Design</td>
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<td>SMW-405 Material Handling Systems (Fabrication)</td>
</tr>
<tr>
<td>6.05 Fabricates dampers.</td>
<td>SMW-165 Fabrication and Installation Fundamentals</td>
</tr>
<tr>
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<td>SMW-220 Air Handling Systems (Fabrication) 1</td>
</tr>
<tr>
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<td>SMW-405 Material Handling Systems (Fabrication)</td>
</tr>
<tr>
<td>6.06 Fabricates hanger systems, supports and bases.</td>
<td>SMW-165 Fabrication and Installation Fundamentals</td>
</tr>
<tr>
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<td>SMW-220 Air Handling Systems (Fabrication) 1</td>
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<tr>
<td></td>
<td>SMW-405 Material Handling Systems (Fabrication)</td>
</tr>
</tbody>
</table>

Task 7 – Fabricts flashing, roofing, sheeting and cladding.

| 7.01 Cuts metal for flashing, roofing, sheeting and cladding. | SMW-250 Chimneys, Breeching and Venting |
| 7.02 Forms flashing, roofing, sheeting and cladding. | SMW-250 Chimneys, Breeching and Venting |

Task 8 – Fabricts specialty products.

| 8.01 Cuts material for specialty products. | SMW-340 Specialty Products |
| 8.02 Forms specialty products. | SMW-340 Specialty Products |
| 8.03 Assembles specialty products. | SMW-340 Specialty Products |
| 8.04 Finishes specialty products. | SMW-340 Specialty Products |

Task 9 – Prepares installation site.

<p>| 9.01 Performs on-site measurements. | SMW-225 Air Handling Sys (Installation) 1 |
| 9.02 Performs demolitions for renovations. | SMW-225 Air Handling Sys (Installation) 1 |
| | SMW-250 Chimneys, Breeching and Venting |
| | SMW-410 Material Handling Sys (Install) |
| 9.03 Installs penetrations and sleeves. | SMW-225 Air Handling Sys (Installation) 1 |
| | SMW-410 Material Handling Sys (Install) |
| 9.04 Installs supports and bases. | SMW-225 Air Handling Sys (Installation) 1 |
| | SMW-410 Material Handling Sys (Install) |</p>
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<tr>
<th>Task</th>
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<th>IPG Unit</th>
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<tr>
<td>9.05</td>
<td>Installs hangers, cables, braces and brackets.</td>
<td>SMW-225</td>
<td>Air Handling Sys (Installation) 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SMW-410</td>
<td>Material Handling Sys (Install)</td>
</tr>
<tr>
<td>Task 10 – Installs and connects chimneys, breeching and venting to exhaust appliances &amp; mechanical equipment.</td>
<td></td>
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</tr>
<tr>
<td>10.01</td>
<td>Installs chimney.</td>
<td>SMW-250</td>
<td>Chimneys, Breeching and Venting</td>
</tr>
<tr>
<td>10.02</td>
<td>Connects single appliance or mechanical equipment to chimney and breeching.</td>
<td>SMW-250</td>
<td>Chimneys, Breeching and Venting</td>
</tr>
<tr>
<td>10.03</td>
<td>Installs high efficiency appliances and mechanical equipment.</td>
<td>SMW-250</td>
<td>Chimneys, Breeching and Venting</td>
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<tr>
<td>Task 11 – Installs air handling system components.</td>
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<td></td>
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<tr>
<td>11.01</td>
<td>Installs air handling equipment.</td>
<td>SMW-165</td>
<td>Fabrication and Installation Fundamentals</td>
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<tr>
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<td>SMW-225</td>
<td>Air Handling Sys (Installation) 1</td>
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<tr>
<td>11.02</td>
<td>Installs sheet metal ducts and fittings.</td>
<td>SMW-165</td>
<td>Fabrication and Installation Fundamentals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SMW-225</td>
<td>Air Handling Sys (Installation) 1</td>
</tr>
<tr>
<td>11.03</td>
<td>Installs dampers.</td>
<td>SMW-165</td>
<td>Fabrication and Installation Fundamentals</td>
</tr>
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<td></td>
<td>SMW-225</td>
<td>Air Handling Sys (Installation) 1</td>
</tr>
<tr>
<td>11.04</td>
<td>Installs fire and fire/smoke dampers.</td>
<td>SMW-165</td>
<td>Fabrication and Installation Fundamentals</td>
</tr>
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<td></td>
<td>SMW-225</td>
<td>Air Handling Sys (Installation) 1</td>
</tr>
<tr>
<td>11.05</td>
<td>Installs registers, grilles, diffusers and louvers.</td>
<td>SMW-165</td>
<td>Fabrication and Installation Fundamentals</td>
</tr>
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<td></td>
<td>SMW-225</td>
<td>Air Handling Sys (Installation) 1</td>
</tr>
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<td>11.06</td>
<td>Installs terminal boxes.</td>
<td>SMW-165</td>
<td>Fabrication and Installation Fundamentals</td>
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<td>SMW-345</td>
<td>Air Handling Systems (Installation) 2</td>
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<tr>
<td>11.07</td>
<td>Installs coils.</td>
<td>SMW-165</td>
<td>Fabrication and Installation Fundamentals</td>
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<tr>
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<td></td>
<td>SMW-345</td>
<td>Air Handling Sys (Installation) 2</td>
</tr>
<tr>
<td>11.08</td>
<td>Installs system component accessories.</td>
<td>SMW-165</td>
<td>Fabrication and Installation Fundamentals</td>
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<tr>
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<td>SMW-345</td>
<td>Air Handling Sys (Installation) 2</td>
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<tr>
<td>11.09</td>
<td>Installs plenums</td>
<td></td>
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<tr>
<td>Task 12 – Installs material handling system components.</td>
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<tr>
<td>12.01</td>
<td>Installs pneumatic and gravity material handling system components.</td>
<td>SMW-410</td>
<td>Material Handling Sys (Install)</td>
</tr>
<tr>
<td>12.02</td>
<td>Installs mechanical material handling system components.</td>
<td>SMW-410</td>
<td>Material Handling Sys (Install)</td>
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<tr>
<td>Task 13 – Applies thermal insulation, lagging, cladding and flashing.</td>
<td></td>
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<td>Task</td>
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<td>IPG Unit</td>
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<tr>
<td>13.01</td>
<td>Applies thermal insulation to components.</td>
<td>SMW-225 Air Handling Systems (Installation) 1</td>
<td></td>
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</tbody>
</table>
| 13.02 | Applies lagging and cladding to components. | SMW-250 Chimneys, Breeching & Venting  
SMW-405 Material Handling Systems (Fabrication) |
| 13.03 | Applies flashing to components. | SMW-250 Chimneys, Breeching & Venting  
SMW-255 Metal Roofing & Architect. Metal  
SMW-405 Material Handling Systems (Fabrication) |
| Task 14 – Performs leak testing, air balancing and commissioning. |  |
| 14.01 | Performs leak tests. | SMW-420 Testing and Balancing  
SMW-420 Testing and Balancing |
| 14.02 | Performs testing, adjusting and balancing (TAB). | SMW-420 Testing and Balancing  
SMW-425 Introduction to Commissioning |
| Task 15 – Installs metal roofing and cladding/siding systems. |  |
| 15.01 | Lays out roof and walls. | SMW-255 Metal Roof. and Archit. Metal  
SMW-255 Metal Roof. and Archit. Metal |
| 15.02 | Installs insulation, isolation material and building envelope components. | SMW-255 Metal Roof. and Archit. Metal |
| 15.03 | Installs roofing and cladding/siding system components. | SMW-255 Metal Roof. and Archit. Metal |
| 15.04 | Seals exposed joints. | SMW-255 Metal Roof. and Archit. Metal |
| 15.05 | Installs decking. | SMW-255 Metal Roof. and Archit. Metal |
| Task 16 – Installs exterior components. |  |
| 16.01 | Prepares surface. | SMW-255 Metal Roof. and Archit. Metal |
| 16.02 | Fastens exterior components. | SMW-255 Metal Roof. and Archit. Metal |
| Task 17 – Installs specialty products. |  |
| 17.01 | Installs stainless steel specialty products. | SMW-340 Specialty Products |
| 17.02 | Installs non-stainless steel specialty products. | SMW-340 Specialty Products |
| 17.03 | Installs marine products (Not Common Core) | Not covered. |
| Task 18– Performs scheduled maintenance. |  |
| 18.01 | Performs maintenance inspections. | SMW-350 Air Handing Systems (Maintenance and Repair)  
SMW-415 Material Handling Systems (Maintenance and Repair) |
| 18.02 | Services components. | SMW-350 Air Handing Systems (Maintenance and Repair)  
SMW-415 Material Handling Systems (Maintenance and Repair) |
<p>| Task 19 – Repairs faulty systems and components. |  |</p>
<table>
<thead>
<tr>
<th>NOA Sub-task</th>
<th>IPG Unit</th>
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<tr>
<td>19.01 Diagnoses system faults.</td>
<td>SMW-350 Air Handling Systems (Maintenance and Repair)</td>
</tr>
<tr>
<td></td>
<td>SMW-415 Material Handling Systems (Maintenance and Repair)</td>
</tr>
<tr>
<td>19.02 Repairs worn or faulty components.</td>
<td>SMW-350 Air Handling Systems (Maintenance and Repair)</td>
</tr>
<tr>
<td></td>
<td>SMW-415 Material Handling Systems (Maintenance and Repair)</td>
</tr>
</tbody>
</table>
Level 1
SMW-170         Mentoring 1

Learning Outcomes:

- Demonstrate knowledge of strategies for learning skills in the workplace.

2017 Red Seal Occupational Standard Reference:

4.02 Uses mentoring techniques.

Suggested Hours:

3 hours

Objectives and Content:

1. Describe the importance of individual experience.

2. Describe the shared responsibilities for workplace learning.

3. Determine one’s own learning preferences and explain how these related to learning new skills.

4. Describe the importance of different types of skills in the workplace.

5. Describe the importance of essential skills in the trade.
   i) reading
   ii) writing
   iii) document use
   iv) oral communication
   v) numeracy
   vi) thinking
   vii) working with others
   viii) digital technology
   ix) continuous learning

6. Identify different learning styles.
   i) seeing it
   ii) hearing it
   iii) learning it
7. Identify different learning needs and strategies to meet learning needs.
   i) learning disabilities
   ii) learning preferences
   iii) language proficiency

8. Identify strategies to assist in learning a skill.
   i) understanding the basic principles of instruction
   ii) developing coaching skills
   iii) being mature and patient
   iv) providing feedback
SMW-100  Safety

Learning Outcomes:

- Demonstrate knowledge of personal protective equipment (PPE) and safety equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of safe work practices.
- Demonstrate knowledge of regulatory requirements pertaining to PPE and safety equipment.
- Demonstrate knowledge of lock-out and tag-out procedures and equipment.

2017 Red Seal Occupational Standard Reference:

1.01 Uses personal protective equipment (PPE) and safety equipment.
1.02 Maintains safe work environment
1.03 Performs lock-out and tag-out procedures

Suggested Hours:

15 hours

Objectives and Content:

2. Identify types of personal protective equipment (PPE) and safety equipment and describe their applications and limitations.
   i) respirators
   ii) fall arrest harnesses
   iii) fall restraint equipment
   iv) welding face shields and screens
   v) hearing
   vi) eye
   vii) foot and hand protection
   viii) high visibility safety vests
   ix) fire extinguishers
   x) barricades

2. Describe the procedures used to care for, maintain and store PPE and safety equipment.

3. Identify workplace hazards and describe safe work practices and equipment.
   i) personal
   ii) workplace
electrical
- confined space (awareness of)
- fire
- lock-out/tag-out
- fall arrest
- hoisting (awareness of)
- asbestos
- hazardous openings
- overhead hazards
iii) environmental

4. Describe good housekeeping practices.
   i) sweeping
   ii) removing debris
   iii) storing materials and tools and equipment

5. Identify and interpret safety and health regulations and responsibilities with respect to the use of PPE and safety equipment.
   i) Workplace Hazardous Material Information System (WHMIS Material
   ii) Occupational Health and Safety (OH&S)
   iii) Workers compensation Board (WCB)
   iv) site-specific regulations

6. Describe the roles and responsibilities of employers and employees with respect to the selection and use of PPE and safety equipment.

7. Identify situations, circuits and equipment that require lock-out and tag-out.

8. Identify lock-out and tag-out equipment.
   i) lock and key
   ii) chains and tags
   iii) lock-out scissor clamps
   iv) lock-box

9. Describe the procedures used to lock-out and tag-out equipment and remove lock-out and tag-out devices.

10. Identify safety regulations pertaining to locking out and tagging hazardous energies equipment.
    i) electricity
    ii) steam
    iii) fuel sources
    iv) hydraulic systems
v) pneumatic systems
vi) magnetic systems
vii) gravitational systems
SMW-105  Stationary and Mobile Work Platforms

Learning Outcomes:

- Demonstrate knowledge of stationary and mobile work platforms, their applications, limitations and procedures for use.
- Demonstrate knowledge of safe work practices and procedures pertaining to stationary and mobile work platforms.
- Demonstrate knowledge of regulatory requirements pertaining to stationary and mobile work platforms.

2017 Red Seal Occupational Standard Reference:

2.11 Uses stationary and mobile work platforms

Suggested Hours:

6 hours

Objectives and Content:

1. Define terminology associated with stationary and mobile work platforms.

2. Identify hazards and describe safe work practices pertaining to stationary and mobile work platforms.
   i) fall protection and arrest
   ii) power lines
   iii) excess loads
   iv) uneven surfaces
   v) pinch points
   vi) crush injuries

3. Interpret codes and regulations pertaining to stationary and mobile platforms.

4. Identify types of stationary and mobile platforms, and describe their characteristics, limitations and applications.
   i) ladders
   ii) scaffolds
   iii) elevated platforms
5. Describe the procedures used to erect and remove stationary and mobile work platforms.

6. Describe the procedures used to inspect, maintain and store stationary and mobile work platforms.
SMW-110 Hoisting, Rigging and Positioning Equipment

Learning Outcomes:

- Demonstrate knowledge of hoisting, rigging and positioning equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of basic hoisting, rigging and positioning techniques.
- Demonstrate knowledge of safe work practices and procedures pertaining to hoisting, rigging and positioning.
- Demonstrate knowledge of regulatory requirements pertaining to hoisting, rigging and positioning.
- Demonstrate knowledge of inspection, maintenance and storage procedures used for hoisting, rigging and positioning equipment.

2017 Red Seal Occupational Standard Reference:

2.12 Uses hoisting, rigging and positioning equipment.

Suggested Hours:

9 hours

Objectives and Content:

1. Define terminology associated with hoisting, rigging and positioning equipment.

2. Identify hazards and describe safe work practices pertaining to the use of hoisting, rigging and positioning equipment.
   i) power lines
   ii) excess loads
   iii) ground conditioning
   iv) overhead hazards
   v) environmental hazards

3. Interpret codes and regulations pertaining to hoisting, rigging and positioning.
   i) training and certification requirements

4. Identify types of rigging equipment and accessories and describe their applications, limitations and procedures for use.
   i) ropes
ii) slings
iii) chains
iv) hooks
v) spreader bars
vi) shackles

5. Identify factors to consider when selecting rigging equipment.
i) load characteristics
ii) environment
iii) safety factors

6. Describe the considerations when rigging material/equipment for lifting.
i) load characteristics
ii) equipment and accessories
iii) environmental factors
iv) anchor points
v) sling angles

7. Identity types of slings.

8. Identify types of knots, hitches, splices and bends and describe the procedures used to tie them.
i) bowline
ii) running bowline
iii) square/reef
iv) half-hitch
vi) barrel hitch

9. Identify types of hoisting and positioning equipment and accessories, and describe their applications, limitations and procedures for use.
i) duct lift
ii) overhead cranes
iii) come-alongs
iv) grip hoists
v) chainfalls

10. Describe the procedures used to inspect, maintain and store hoisting, rigging and positioning equipment.

11. Explain sling angle when preparing for hoisting and positioning operations.

12. Describe the procedures used to attach rigging equipment to the load.
13. Identify and interpret basic hand signals used for hoisting and positioning operations.

14. Identify the procedures used to communicate during hoisting, rigging and positioning operations.
   i) hand signals
   ii) electronic communications
   iii) audible/visual

15. Describe the procedures used to ensure the work area is safe for hoisting, rigging and positioning operations.
   i) supervision of lift
   ii) securing of work area
   iii) communication

16. Describe the procedures used to perform a lift.
   i) load determination
   ii) communication methods
   iii) pre-lift checks
   iv) placement of load
   v) post-lift inspection

17. Describe the procedures used to perform calculations to determine the weight of a load.
SMW-115 Tools and Equipment

Learning Outcomes:

- Demonstrate knowledge of hand and portable power tools, their applications, maintenance and procedures for use.
- Demonstrate knowledge of shop tools and equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of measuring and layout equipment, their applications, maintenance and procedures for use.

2017 Red Seal Occupational Standard Reference:

2.01 Maintains hand and portable power tools.
2.02 Maintains shop tools and equipment.
2.04 Maintains measuring and layout equipment.

Suggested Hours:

24 hours

Objectives and Content:

1. Identify hazards and describe safe work practices pertaining to tools and equipment.

2. Identify types of hand and tools and describe their applications and procedures for use.

3. Identify types of portable power tools and describe their applications and procedures for use.

4. Identify types of powder actuated tools and describe their applications.

5. Identify types of shop tools and equipment and describe their applications and procedures for use.

6. Identify types of Computer Numerical Control (CNC) equipment and describe their applications.
   i) plasma tables
   ii) punches
   iii) brake presses
7. Identify types of measuring and layout tools and equipment and describe their applications and procedures for use.

8. Identify criteria for replacement or repair of tools and equipment.

9. Describe the procedures used to inspect, maintain and store tools and equipment.
SMW-120 Communication and Trade Documentation

Learning Outcomes:

- Demonstrate knowledge of effective communication practices.
- Demonstrate knowledge of communication equipment and their applications.
- Demonstrate knowledge of trade documents and their use.
- Demonstrate knowledge of planning and organizing work tasks.

2017 Red Seal Occupational Standard Reference:

3.01 Uses trade-related documentation. (Introduction)
3.02 Interprets drawings. (Introduction)
3.03 Organizes materials and equipment for project. (Introduction)
4.01 Uses communication techniques.

Suggested Hours:

6 hours

Objectives and Content:

1. Describe the importance of using effective verbal and non-verbal communication practices in the workplace.
   i) other tradespeople
   ii) colleagues/co-workers
   iii) apprentices
   iv) supervisors
   v) customers
   vi) authorities having jurisdiction
   vii) manufacturers

2. Describe the importance of the coaching and mentoring relationship between journeyperson and apprentice.

3. Describe effective listening and speaking skills.

4. Identify personal responsibilities and attitudes that contribute to on-the-job success.
   i) asking questions
   ii) working safely
iii) accepting constructive feedback
iv) time management and punctuality
v) respect for authority
vi) good stewardship of materials
vii) tools and property
viii) efficient work practice

5. Describe the importance of communicating with others to organize materials and supplies on site and effectively plan work tasks.

6. Identify types of sources of information and trade documents and describe their use.
   i) time cards
   ii) as-builts
   iii) work orders
   iv) change orders
   v) change directive
   vi) invoices
   vii) requests for information (RFI)
   viii) manufacturers’ specifications
   ix) codes and regulations
   x) specifications
   xi) company and client documentation
   xii) drawings

7. Explain responsibilities associated with completing and signing safety-related documentation.
   i) accident/incident reports
   ii) near-miss reports
   iii) safety inspection reports
   iv) WHMIS labels
   v) safety data sheets (SDS)
   vi) job hazard assessments

8. Identify the value of diversity in the workplace.

9. Identify communication that constitutes harassment and discrimination
   i) objectionable conduct, comment or display made either on a one-time or continuous basis that demeans, belittles or causes personal humiliation or embarrassment to the recipient
   ii) race
   iii) national or ethnic origin
iv) colour
v) religion
vi) age
vii) sex
viii) sexual orientation
ix) marital status
x) family status
xi) disability or conviction for which a pardon has been granted
SMW-125  Sheet Metal Math Fundamentals

Learning Outcomes:

- Demonstrate knowledge of basic mathematical calculations and formulas used in the trade.

2017 Red Seal Occupational Standard Reference:

N/A

Suggested Hours:

24 hours

Objectives and Content:

1. Describe metric and imperial systems of measurement.

2. Perform basic mathematical calculations.
   i) whole numbers
   ii) decimals
   iii) fractions
   iv) ratios

3. Perform conversions.
   i) metric to imperial
   ii) imperial to metric
   iii) fractions to decimals
   iv) decimals to fractions

4. Perform geometric calculations.

5. Solve problems using trade formulas (see Sample Formula Sheet at end of document).
SMW-130  

Introduction to Welding

Learning Outcomes:

- Demonstrate knowledge of welding processes and their applications.

2017 Red Seal Occupational Standard Reference:

2.06 Uses shielded metal arc welding (SMAW) equipment.

Suggested Hours:

9 hours

Objectives and Content:

1. Identify certification requirements for performing welding.

2. Identify codes and standards pertaining to welding.
   i) Canadian Standards Association (CSA).
   ii) American Society of Mechanical Engineers (ASME)

3. Identify welding processes and describe their applications.
   i) Shielded metal arc welding (SMAW)
   ii) Gas metal arc welding (GMAW)
   iii) Gas tungsten arc welding (GTAW)
   iv) Oxy-fuel welding (OFW)
   v) Resistance spot welding (RSW)

4. Identify welding consumables.
   i) Welding rods
   ii) Flux
   iii) Grinding discs

5. Identify basic welds and describe their applications.
   i) Plug
   ii) Fillet
   iii) Stitch
   iv) Tack
v) Edge
vi) Corner

6. Describe the procedures used to tack weld using GMAW equipment.

Practical Objectives:

1. Perform a tack weld using GMAW equipment.
SMW-135  
Resistance Spot Welding

Learning Outcomes:

- Demonstrate knowledge of resistance spot welding equipment, consumables and accessories.
- Demonstrate knowledge of the procedures used to weld using resistance spot welding equipment.

2017 Red Seal Occupational Standard Reference:

2.04 Uses resistance spot welding equipment.

Suggested Hours:

6 hours

Objectives and Content:

1. Define terminology associated with resistance spot welding.

2. Identify hazards and describe safe work practices pertaining to resistance spot welding.

3. Interpret information pertaining to resistance spot welding found on drawings and specifications.

4. Describe the resistance spot welding process and its applications.

5. Identify resistance spot welding equipment and accessories and describe their applications.

6. Identify considerations when determining resistance spot welding equipment set-up.
   i) specification requirements
   ii) base metal
      - properties
      - thickness
   iii) electrode size

7. Describe the procedures used to set-up and adjust resistance spot welding equipment.
   i) set time
   ii) determine amperage
iii) adjust pressure

8. Describe the procedures used to inspect and maintain resistance spot welding equipment.

9. Describe the procedures used to prepare base metals for resistance spot welding.

10. Describe the procedures used to weld using the resistance spot welding process.
SMW-140       Plasma Arc Cutting

Learning Outcomes:

- Demonstrate knowledge of plasma arc cutting equipment, accessories and applications.
- Demonstrate knowledge of the procedures used to cut using plasma arc equipment.

2017 Red Seal Occupational Standard Reference:

2.07 Uses oxy-fuel and plasma arc cutting equipment.

Suggested Hours:

6 hours

Objectives and Content:

1. Define terminology associated with plasma arc cutting.

2. Identify hazards and describe safe work practices pertaining to the use of plasma arc cutting equipment.
   i) personal
   ii) shop/facility
   iii) equipment
   iv) ventilation

3. Interpret codes and regulations pertaining to plasma arc cutting.

4. Identify types of plasma arc cutting equipment and accessories and describe their applications, limitations and procedures for use.

5. Identify types of consumables and accessories used with plasma arc cutting equipment and describe their applications.

6. Describe the procedures used to set-up, adjust and shut-down plasma arc cutting equipment.

7. Describe the procedures used to maintain and troubleshoot plasma arc cutting equipment.

8. Describe the procedures used to cut using plasma arc cutting equipment.
9. Describe cutting defects, their causes and the procedures to prevent and correct them.
SMW-145 Metallurgy

Learning Outcomes:

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

2017 Red Seal Occupational Standard Reference:

N/A

Suggested Hours:

6 hours

Objectives and Content:

1. Define terminology associated with metallurgy.

2. Describe the properties of metals.
   i) ductility
   ii) malleability
   iii) elasticity
   iv) hardness
   v) composition
   vi) physical

3. Describe identification systems for metals.
   i) numbering
   ii) gauging
   iii) colour coding

4. Identify types of metals and describe their applications.
   i) steel
      - hot rolled
      - cold rolled
      - coated
   ii) copper
   iii) brass
   iv) aluminum
v) cast iron
iv) stainless steel

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. Identify types of basic surface finishes and describe their applications.
i) mill
ii) brushed
iii) mirrored
iv) dull

7. Identify methods used to work with metals.
i) forming
ii) cutting/shearing
iii) punching
iv) drilling
v) joining

8. Identify practices that can create problems when working with metals and describe the procedures used to prevent or correct these problems.
i) forming
ii) cutting/shearing
iii) punching
iv) drilling
v) joining
vi) storage and handling
SMW-150          Soft Soldering

Learning Outcomes:

- Demonstrate knowledge of soldering equipment, its maintenance and procedures for use.
- Demonstrate knowledge of procedures used to solder materials.

2017 Red Seal Occupational Standard Reference:

2.07 Uses oxy-fuel and plasma arc cutting equipment.

Suggested Hours:

6 hours

Objectives and Content:

1. Define terminology associated with soldering.

2. Identify hazards and describe safe work practices pertaining to the use of soldering equipment.
   i) personal
   ii) shop/facility
   iii) equipment
   iv) ventilation

3. Describe soldering processes and their applications.
   i) soft
   ii) hard

4. Identify types of soldering equipment and accessories and describe their applications and procedures for use.

5. Describe the procedures used to set-up, adjust and shut-down soldering equipment.

6. Describe the procedures used to maintain and troubleshoot soldering equipment.

7. Identify materials used to solder and describe their applications.
   i) fluxes
   ii) solders
iii) fillers

8. Describe the procedures used to solder materials.
SMW-155  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.

2017 Red Seal Occupational Standard Reference:

2.04 Maintains measuring and layout equipment.

Suggested Hours:

30 hours

Objectives and Content:

1. Define terminology associated with drafting.

2. Identify basic drafting tools and equipment and describe their applications and procedures for use.

3. Identify different views used when drafting and describe their applications.
   i) elevation
   ii) plan
   iii) section
   iv) auxiliary

4. Describe the procedures used to develop basic drawings and sketches.
   i) pictorial
   ii) orthographic
SMW-160 Pattern Development 1 (Simple and Straight Line)

Learning Outcomes:

- Demonstrate knowledge of simple and straight line layout, its applications and associated calculations.
- Demonstrate knowledge of basic pattern development using simple and straight line layout.
- Demonstrate knowledge of pattern development methods.
- Demonstrate knowledge of basic geometric shapes.

2017 Red Seal Occupational Standard Reference:

5.01 Develops patterns using simple and straight line layout.

Suggested Hours:

45 hours

Objectives and Content:

1. Define 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 layout methods and describe their applications.
   i) simple/straight line
   ii) parallel line
   iii) radial line
   iv) triangulation
   v) computerized
   vi) combination

5. Identify types of basic patterns and fittings that require simple and straight line layout.

6. Identify calculations used in simple and straight line layout and describe the procedures used to perform them.
7. Describe the procedures used to develop basic patterns using simple and straight line layout.
   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 stretch-outs
   viii) check pattern accuracy
   ix) cut pattern
   x) label pieces
SMW-165 Fabrication and Installation Fundamentals

Learning Outcomes:

- Demonstrate knowledge of air handling system components, their accessories and applications.
- Demonstrate knowledge of the procedures used to fabricate basic ductwork and fittings.
- Demonstrate knowledge of the procedures used to fabricate hangers and supports.
- Demonstrate knowledge of the procedures used to install basic ductwork and fittings.

2017 Red Seal Occupational Standard Reference:

6.01 Cuts ductwork, fittings and components.
6.02 Forms ductwork, fittings and components.
6.03 Insulates ductwork, fittings and components.
6.04 Assembles ductwork, fittings and components.
6.05 Fabricates dampers.
6.06 Fabricates hanger systems, supports and bases.
11.01 Installs air handling equipment. (Introduction)
11.02 Installs sheet metal ducts and fittings.
11.03 Installs dampers. (Introduction)
11.04 Installs fire and fire/smoke dampers. (Introduction)
11.05 Installs registers, grilles, diffusers and louvers. (Introduction)
11.06 Installs terminal boxes. (Introduction)
11.07 Installs coils. (Introduction)
11.08 Installs system component accessories. (Introduction)
11.09 Installs plenums. (Introduction)

Suggested Hours:

45 hours

Objectives and Content:

1. Define terminology associated with fabricating and installing sheet metal components.

2. Identify hazards and describe safe work practices associated with fabricating and installing basic sheet metal components.
3. Interpret codes and regulations pertaining to the fabrication and installation of basic sheet metal components.

4. Interpret information pertaining to the fabrication and installation of basic sheet metal components found on drawings and specifications.

5. Identify tools and equipment used to fabricate and install basic sheet metal components and describe their applications and procedures for use.

6. Identify basic air handling system components and accessories fabricated and installed by sheet metal workers and describe their applications.
   i) air handling equipment
      - furnaces
      - fans
      - rooftop units
      - built-up systems
      - air conditioners
   ii) ducts and fittings
   iii) flexible connectors
   iv) hanger systems
   v) supports and braces
   vi) dampers
   vii) registers, grilles, diffusers and louvers
   viii) fire and fire/smoke dampers
   ix) terminal boxes
   x) coils
   xi) system component accessories
      - humidifiers
      - dehumidifiers
      - air, noise and odour filtration systems
      - air flow sensors
      - temperature sensors
      - controls
   xii) plenums

7. Identify types of fastening and joining methods used to fabricate sheet metal components and describe their associated procedures.
   i) mechanical
   ii) adhesives
   iii) welding
8. Identify types of seams for fabrication of basic sheet metal components and describe the procedures and connectors used to produce them.
   i) longitudinal
      - Pittsburgh Lock
      - groove seam
      - acme lock
      - snap/button lock
   ii) transverse
      - slip & drive
      - duct mate
      - TDC/TDF
      - companion flanges
      - flexible connector

9. Identify types of edges for fabrication of basic sheet metal components and describe the procedures used to produce them.

10. Identify types of duct reinforcement.

11. Describe the procedures used to fabricate basic ductwork and fittings.

12. Describe the procedures used to fabricate hanger systems, supports and bases.

13. Describe the procedures used to install basic ductwork and fittings.

Practical Objectives:

1. Layout and fabricate a basic duct system.

2. Fabricate hangers and supports.
LEVEL 2
SMW-200       Drawings 1

Learning Outcomes:

- Demonstrate knowledge of drawings and their applications.
- Demonstrate knowledge of the procedures to interpret and extract information from drawings.

2017 Red Seal Occupational Standard Reference:

3.02 Interprets drawings.

Suggested Hours:

24 hours

Objectives and Content:

1. Define terminology associated with drawings.

1. Explain the purpose of drawings.

2. Identify types of drawings and describe their applications.
   i) pictorial
   ii) orthographic
   iii) architectural
   iv) mechanical
   v) structural
   vi) electrical
   vii) shop drawings
   viii) sketches
   ix) as-built
   x) prints

4. Identify the views used on drawings.
   i) elevation
   ii) plan
   iii) section
   iv) detail
   v) auxiliary
5. Identify the parts of a drawing and describe their purpose and applications.
   i) lines
   ii) legend
   iii) symbols and abbreviations
       - duct
       - welding
       - electrical
       - plumbing
       - architectural
   iv) title block
   v) notes
   vi) specifications

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

7. Describe how to use scale rulers.

8. Describe metric and imperial systems of measurement.

9. Interpret and extract information from drawings.
SMW-205 Parallel Line Development (Round Duct Fittings)

Learning Outcomes:

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

2017 Red Seal Occupational Standard Reference:

5.02 Develops patterns using parallel line method.

Suggested Hours:

24 hours

Objectives and Content:

1. Define terminology associated with parallel line development.

2. Describe the types of round duct fittings that require parallel line development.
   i) tee
   ii) round elbow
   iii) round offsets

3. Identify calculations used in parallel line development and describe the procedures used to perform them.

4. Describe the procedures used to develop and fabricate round duct 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 stretch-outs
   viii) check pattern accuracy
   ix) cut pattern
   x) label pieces
SMW-210  Radial Line Development (Right Cones)

Learning Outcomes:

- Demonstrate knowledge of radial line development for right cones/pyramids, its applications and associated calculations.
- Demonstrate knowledge of the procedures used to develop and fabricate right cones using radial line development.

2017 Red Seal Occupational Standard Reference:

5.03 Develops patterns using radial line method.

Suggested Hours:

24 hours

Objectives and Content:

1. Define terminology associated with radial line development.

2. Identify calculations used in radial line development and describe the procedures used to perform them.

3. Describe the procedures used to develop and fabricate fittings based on right cones 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 stretch-outs
   viii) check pattern accuracy
   ix) cut pattern
   x) label pieces
SMW-215 Triangulation (From Plan View)

Learning Outcomes:

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

2017 Red Seal Occupational Standard Reference:

5.04 Develops patterns using triangulation method.

Suggested Hours:

24 hours

Objectives and Content:

1. Define terminology associated with the triangulation method.

2. Describe the types of fittings that require triangulation from plan view.
   i) transitions
   ii) tapers
   iii) square-to-rounds

3. Identify calculations used in the triangulation method and describe the procedures used to perform them.

4. Describe the procedures used to develop and fabricate fittings using triangulation from plan view.
   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 stretch-outs
   viii) check pattern accuracy
   ix) cut pattern
   x) label pieces
SMW-220  Air Handling Systems (Fabrication) 1

Learning Outcomes:

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

2017 Red Seal Occupational Standard Reference:

6.01  Cuts ductwork, fittings and components.
6.02  Forms ductwork, fittings and components.
6.03  Insulates ductwork, fittings and components.
6.04  Assembles ductwork, fittings and components.
6.05  Fabricates dampers.
6.06  Fabricates hanger systems, supports and bases.

Suggested Hours:

24 hours

Objectives and Content:

1. Define terminology associated with air handling systems.

2. Identify hazards and describe safe work practices when fabricating sheet metal components for air handling systems.

3. Interpret codes and regulations pertaining to the fabrication of sheet metal components for air handling systems.
   i) SMACNA
   ii) ASHRAE
   iii) NBC

4. Interpret information pertaining to the fabrication of sheet metal components for air handling systems found on drawings and specifications.

5. Identify tools and equipment used to fabricate sheet metal components for air handling systems, and describe their applications, limitations and procedures for use.

6. Identify types of materials used to fabricate sheet metal components for air handling systems and describe their characteristics and applications.
7. Identify sheet metal components and accessories associated with air handling systems and describe their applications.
   i) air handling equipment
   ii) ducts and fittings
   iii) dampers
   iv) fire and fire/smoke dampers
   v) registers, grilles, diffusers and louvers
   vi) plenums
   vii) flexible connections
   viii) hangers
   ix) equipment supports/bases
   x) attenuators (silencer)

8. Identify considerations and requirements when fabricating sheet metal components for air handling systems.
   i) load bearing capacities
   ii) system specifications
   iii) environmental conditions

9. Describe the procedures used to fabricate sheet metal components for air handling systems.
   i) cut
   ii) label
   iii) form
   iv) insulate
   v) assemble
SMW-225 Air Handling Systems (Installation) 1

Learning Outcomes:

- Demonstrate knowledge of basic design and field modifications.
- Demonstrate knowledge of the procedures used to prepare the installation site.
- Demonstrate knowledge of the procedures used to install air handling equipment.
- Demonstrate knowledge of the procedures used to install ducts and fittings.
- Demonstrate knowledge of the procedures used to install dampers.
- Demonstrate knowledge of the procedures used to install registers, grilles, diffusers and louvers.

2017 Red Seal Occupational Standard Reference:

3.04 Performs basic design and field modifications.
9.01 Performs on-site measurements.
9.02 Performs demolitions for renovations.
9.03 Installs penetrations and sleeves.
9.04 Installs supports and bases.
9.05 Installs hangers, cables, braces and brackets.
11.01 Installs air handling equipment.
11.02 Installs sheet metal ducts and fittings.
11.03 Installs dampers.
11.04 Installs fire and fire/smoke dampers
11.05 Installs registers, grilles, diffusers and louvers.
13.01 Applies thermal insulation to components.

Suggested Hours:

12 hours

Objectives and Content:

1. Define terminology associated with the installation of air handling systems and components.

2. Identify hazards and describe safe work practices pertaining to the installation of air handling systems and components.

3. Interpret codes and regulations pertaining to the installation of air handling systems and components.
4. Interpret information, pertaining to the installation of air handling systems found on drawings and specifications.

5. Identify tools and equipment used for the installation of air handling systems, and describe their application and procedures for use.

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

7. Identify air handling system components and describe their applications.
   i) sheet metal components
      - ducts and fittings
      - hangers
      - equipment supports/braces
      - brackets
      - sheet and cladding
      - flashing
   ii) system components
      - units
      - dampers
      - fire and fire/smoke dampers
      - registers, grilles, diffusers and louvers
      - terminal boxes
      - coils
      - heat and energy recovery ventilators
      - automatic controls and instruments
      - insulation
        - thermal
        - acoustical

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

9. Describe the procedures used to prepare the installation site.
   i) perform on-site measurements
   ii) performs demolitions for renovations
   iii) installs penetrations and sleeves
   iv) installs supports and bases
v) installs hangers, cables, braces and brackets
vi) conducts final inspection

10. Identify considerations and requirements for installing air handling system components.
   i) manufacturers’ specifications
   ii) isolators
   iii) building materials
   iv) environmental conditions
   v) field design modifications

11. Describe the procedures used to install air handling equipment.

12. Describe the procedures used to install ducts and fittings.

13. Describe the procedures used to install dampers.

14. Describe the procedures used to install fire and fire/smoke dampers.

15. Describe the procedures used to install registers, grilles, diffusers and louvers.

16. Describe the procedures used to perform basic design and field modifications.
SMW-230 Introduction to GMAW

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.

2017 Red Seal Occupational Standard Reference:

2.03 Uses gas metal arc welding (GMAW) equipment.

Suggested Hours:

18 hours

Objectives and Content:

1. Define terminology associated with GMAW.

2. Identify hazards and describe safe work practices pertaining to the use of GMAW equipment.
   i) personal
   ii) shop/facility
   iii) equipment
   iv) ventilation

3. Interpret codes and regulations pertaining to the use of GMAW equipment for welding mild steel.

4. Describe the GMAW process and its applications.

5. Identify types of GMAW equipment, consumables and accessories used to weld mild steel, and describe their characteristics and applications.

6. Describe the procedures used to set-up, adjust and shut-down GMAW equipment for welding mild steel.

7. Describe the procedures used to maintain and troubleshoot GMAW equipment.

8. Identify the types of welds performed using the GMAW process.
   i) plug
ii) fillet (continuous) 
iii) stitch 
iv) tack 
v) edge 
vi) corner

9. Describe the procedures used to weld mild steel using the GMAW process.

10. Describe weld defects, their causes and the procedures to prevent and correct them. 
i) porosity 
ii) cracks 
iii) warping 
iv) undercut

11. Identify weld positions and describe their applications. 
i) flat 
ii) vertical 
iii) horizontal 
iv) overhead
SMW-235  Oxy-fuel Cutting, Heating and Brazing/Hard Soldering

Learning Outcomes:

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

2017 Red Seal Occupational Standard Reference:

2.07 Uses oxy-fuel and plasma arc cutting equipment.

Suggested Hours:

12 hours

Objectives and Content:

1. Define terminology associated with oxy-fuel cutting, heating and brazing/hard soldering.

2. Identify hazards and describe safe work practices pertaining to the use of oxy-fuel cutting, heating and brazing/hard soldering equipment.
   i) personal
   ii) shop/facility
   iii) equipment
   iv) ventilation

3. Interpret codes and regulations pertaining to oxy-fuel cutting, heating and brazing/hard soldering.

4. Interpret information pertaining oxy-fuel cutting, heating and brazing/hard soldering found on drawings and specifications.

5. Identify types of oxy-fuel cutting, heating and brazing/hard soldering equipment and accessories and describe their applications, limitations and procedures for use.

6. Describe the procedures used to set-up, adjust and shut-down oxy-fuel cutting and heating equipment.
7. Describe the procedures used to maintain and troubleshoot oxy-fuel cutting and heating equipment.

8. Describe the procedures used to set-up, adjust, and shut-down brazing/hard soldering equipment.

9. Describe the procedures used to maintain and troubleshoot brazing/hard soldering equipment.

10. Describe the procedures used to cut using oxy-fuel equipment.

11. Identify types of materials used for brazing/hard soldering.

12. Describe the procedures used to braze/hard solder materials.

13. Describe weld defects, their causes and the procedures used to prevent and correct them.
   i) porosity
   ii) cracks
   iii) warping
   iv) undercut
SMW-240 SMAW

Learning Outcomes:

- Demonstrate knowledge of Shielded metal arc welding (SMAW) equipment, its applications, maintenance and procedures for use.
- Demonstrate knowledge of the procedures used to weld using shielded metal arc welding (SMAW) equipment.

2017 Red Seal Occupational Standard Reference:

2.06 Uses shielded metal arc welding (SMAW) equipment.

Suggested Hours:

6 hours

Objectives and Content:

1. Define terminology associated with SMAW.

2. Identify hazards and describe safe work practices pertaining to the use of SMAW equipment.
   i) personal
   ii) shop/facility
   iii) equipment
   iv) ventilation

3. Interpret codes and regulations pertaining to SMAW.

4. Interpret information pertaining to SMAW found on drawings and specifications.

5. Describe the SMAW process and its applications.

6. Identify types of SMAW equipment and accessories, and describe their applications, limitations and procedures for use.

7. Describe the procedures to set-up, adjust and shut-down SMAW equipment.

8. Describe the procedures used to maintain and troubleshoot SMAW equipment.
9. Identify the types of welds performed using SMAW equipment.
   i) plug
   ii) fillet (continuous)
   iii) stitch
   iv) tack
   v) edge
   vi) corner

10. Describe the procedures used to weld materials using the SMAW process.

11. Describe weld defects, their causes and the procedures used to prevent and correct them.
   i) porosity
   ii) cracks
   iii) warping
   iv) undercut
SMW-245  Air Quality Management

Learning Outcomes:

- Demonstrate knowledge of air quality management.

2017 Red Seal Occupational Standard Reference:

N/A

Suggested Hours:

6 hours

Objectives and Content:

1. Define terminology associated with air quality management.

2. Identify hazards and describe safe work practices pertaining to air quality management.

3. Interpret codes and regulations pertaining to air quality management.

4. Describe considerations and requirements associated with air quality management.
   i) environmental conditions
   ii) intake locations
   iii) exhaust locations

5. Describe the importance of indoor air quality.

6. Identify methods of improving or correcting problems with air quality.
   i) heating/cooling
   ii) ventilation
   iii) conditioning
      - filtration
      - sterilization
      - purification
      - humidification/dehumidification

7. Identify areas requiring special air quality ventilation.
   i) clean/sterile rooms
   ii) industrial/commercial settings
8. Identify the methods used to determine air quality relating to humidity and temperature.

9. Identify air quality problems and describe the procedures used to prevent or correct them.
   i) contamination
   ii) humidity
   iii) temperature (hot/cold zones)
   iv) air motion

10. Describe the impact improper system or component installation can have on air quality.
SMW-250  Chimneys, Breeching and Venting

Learning Outcomes:

- Demonstrate knowledge of the procedures used to install a chimney.
- Demonstrate knowledge of the procedures used to connect chimney, breeching and venting to an appliance.
- Demonstrate knowledge of flashing requirements.
- Demonstrate knowledge of the procedures used to install cladding and lagging.
- Demonstrate knowledge of the procedures used to install high efficiency appliances and mechanical equipment.

2017 Red Seal Occupational Standard Reference:

7.01 Cuts metal for flashing, roofing, sheeting and cladding.
7.02 Forms flashing, roofing, sheeting and cladding.
8.02 Performs demolitions for renovations.
10.01 Installs chimney.
10.02 Connects appliances and mechanical equipment to chimney and breeching.
10.03 Installs high efficiency appliances and mechanical equipment.
13.02 Applies lagging and cladding to components.
13.03 Applies flashing to components.

Suggested Hours:

18 hours

Objectives and Content:

1. Define terminology associated with chimneys, breeching and venting.

2. Identify hazards and describe safe work practices associated with chimneys, breeching and venting.

3. Interpret codes, standards and regulations pertaining to the installation of chimneys, breeching and venting.
   i) jurisdictional requirements

4. Interpret information pertaining to the installation of chimneys, breeching and venting, found on drawings and specifications.
5. Identify tools and equipment relating to the installation of chimneys, breeching and venting, and describe their applications and procedures for use.

6. Identify types of chimney systems and their components and describe their applications.
   i) B-vent
   ii) BW-vent
   iii) A-vent
   iv) special venting systems
   v) combustion air

7. Describe the procedures used to remove and install chimneys.

8. Identify flashing requirements pertaining to chimneys.

9. Describe the procedures used to connect chimneys to the appliance.

10. Identify types of appliances and mechanical equipment and describe their applications.

11. Describe the procedures used to connect appliances and mechanical equipment to chimneys and breeching.

12. Identify types of breeching and describe their applications.

13. Describe the procedures used to install breeching.

14. Identify cladding and lagging materials and describe their characteristics and applications.

15. Describe the procedures used to install cladding and lagging.

16. Describe the procedures used to install high efficiency appliances and mechanical equipment.
SMW-255  Metal Roofing and Architectural Metal

Learning Outcomes:

- Demonstrate knowledge of metal roofing and walls.
- Demonstrate knowledge of the procedures used to install metal roofing and cladding/siding systems.
- Demonstrate knowledge of the procedures used to install insulation, isolation material and building envelope components.
- Demonstrate knowledge of the procedures used to install decking.
- Demonstrate knowledge of exterior components and their applications.
- Demonstrate knowledge of the procedures used to fasten exterior components.

2017 Red Seal Occupational Standard Reference:

12.03 Applies flashing to components.
15.01 Lays out roof and walls.
15.02 Installs insulation, isolation material and building envelope components.
15.03 Installs roofing and cladding/siding system components.
15.04 Seals exposed joints.
15.05 Installs decking.
16.01 Prepares surface.
16.02 Fastens exterior components.

Suggested Hours:

18 hours

Objectives and Content:

1. Define terminology associated with metal roofing, cladding and architectural metal.
2. Identify hazards and describe safe work practices pertaining to the fabrication and installation of metal roofing, cladding and architectural metal.
3. Interpret codes and regulations pertaining to the installation of metal roofing, cladding and architectural metal.
4. Interpret information pertaining to metal roofing, cladding and architectural metal found on drawings and specifications.
5. Identify tools and equipment used to fabricate and install metal roofing, cladding and architectural metals and describe their applications and procedures for use.

6. Identify types of materials used in fabricating metal roofing, cladding and architectural metals.

7. Identify types of components associated with metal roofing, cladding and architectural metals, and describe their applications.
   i) roof drainage
   ii) flashing
   iii) soffit and fascia
   iv) roof vents

8. 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

9. Identify considerations and requirements relating to installing metal roofing, cladding and architectural metals.
   i) building materials
   ii) roof slope
   iii) expansion and contraction

10. Identify types of fasteners for installing metal roofing, cladding and architectural metals and describe their applications.

11. Identify types of roof structures and construction features and describe their applications.
   i) hip
   ii) gable
   iii) pitched
   iv) flat

12. Describe the procedures used to layout metal roofing, cladding and architectural metals.
   i) check for square
   ii) determine starting point
   iii) establish reference lines
13. 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

14. Describe the procedures used to install materials to roofs or walls in preparation for installation of metal roofing, cladding and architectural metals.

15. Describe the procedures used to install metal roofing, cladding and architectural metals.
   i) cut
   ii) fit
   iii) secure
   iv) seal

16. Identify types of sealants and procedures used to seal exposed joints.

17. Identify types of material used for decking and describe their applications.
   i) metal pans
   ii) Q decking

18. Describe the procedures used to install decking.

19. Identify types of exterior components and describe their applications.
   i) awnings
   ii) signage.

20. Identify types of fasteners used to fasten exterior components.
   i) anchors
   ii) nail-ins
   iii) screws
   v) adhesives

21. Describe the procedures used to prepare surface for installation of exterior components.
   i) check alignment of exterior surface.
   ii) identify fastening points
   iii) clean installation area
   iv) score surface
   v) apply waterproofing membrane and flashing
   vi) install fastening system

22. Describe the procedures used to fasten exterior components.
Level 3
SMW-300  Parallel Line Development (Architectural Applications)

Learning Outcomes:

- Demonstrate knowledge of parallel line development for architectural applications and its associated calculations.
- Demonstrate knowledge of the procedures used to develop patterns for advanced or complex fittings for architectural applications using parallel line development.

2018 Red Seal Occupational Standard Reference:

5.02 Develops patterns using parallel line method.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with parallel line development for architectural applications.

2. Identify the types of fittings and components for architectural applications that require parallel line development.
   i) coping
   ii) gutters
   iii) mitred flashings
   iv) finials

3. Identify calculations used in parallel line development for architectural applications.

4. Describe the procedures used to perform calculations used in parallel line development for architectural applications.
   i) determining views
   ii) labelling lines and points
iii) preparing patterns  
iv) determining true length of lines  
v) determining types of seams, joints and edges  
vi) calculating allowances  
vii) determining stretch-outs  
viii) checking pattern accuracy  
ix) cutting pattern  
x) labelling pieces

5. Describe the procedures used to develop patterns for architectural applications using parallel line development.

Practical Objectives

1. Develop patterns and fabricate fittings using parallel line development.
SMW-305 Radial Line Development (Oblique Fittings)

Learning Outcomes:

- Demonstrate knowledge of radial line development for oblique fittings and components and its associated calculations.
- Demonstrate knowledge of the procedures used to develop patterns for oblique fittings and components using radial line development.

2018 Red Seal Occupational Standard Reference:

5.03 Develops patterns using radial line method.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with radial line development for oblique fittings and components.

2. Identify the types of oblique fittings and components that require radial line development.

3. Identify calculations used in radial line development for oblique fittings and components.

4. Describe the procedures used to perform calculations used in radial line development for oblique fittings and components.

5. Describe the procedures used to develop patterns for oblique fittings and components using radial line development.
   i) determining views
   ii) labelling lines and points
   iii) preparing patterns
   iv) determining true length of lines
v) determining types of seams, joints and edges  
vi) calculating allowances  
vii) determining stretch-outs  
viii) checking pattern accuracy  
ix) cutting pattern  
x) labelling pieces

**Practical Objectives**

1. Develop patterns and fabricate fittings using radial line development.
SMW-310   Triangulation 2

Learning Outcomes:

- Demonstrate knowledge of triangulation method from elevation, its applications and associated calculations.
- Demonstrate knowledge of the procedures used to develop patterns for advanced or complex fittings using triangulation method from elevation.

2018 Red Seal Occupational Standard Reference:

5.04 Develops patterns using triangulation method.

Suggested Hours:

42 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with the triangulation method from elevation.

2. Identify the types of fittings that require triangulation method from elevation.

3. Identify calculations used in the triangulation method from elevation and describe the procedures used to perform them.

4. Identify types of rectangular fittings that require the triangulation method.

5. Describe the procedures used to develop patterns for fittings and components using triangulation method from elevation and rectangular fittings.
   i) determining views
   ii) labelling lines and points
   iii) preparing patterns
   iv) determining true length of lines
   v) determining types of seams, joints and edges
   vi) calculating allowances
   vii) determining stretch-outs
viii) checking pattern accuracy
ix) cutting pattern
x) labelling pattern

Practical Objectives

1. Develop patterns and fabricate fittings using triangulation.
SMW-315 Duct System Design

Learning Outcomes:

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

2018 Red Seal Occupational Standard Reference:

6.02 Forms ductwork, fittings and components.
6.04 Assembles ductwork, fittings components.

Suggested Hours:

27 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with duct system design.

2. Explain air pressure and its impact on the operation of duct systems.

3. Identify types of duct systems and describe their associated design principles.
   i) air handling systems
      - dual duct
      - VAV (variable air volume)

4. Identify air patterns and describe their impact on the operation of duct systems.

5. Identify formulas used in duct system design and describe their applications.
   i) fan laws
   ii) velocity
   iii) quantity
   iv) pressure

6. Identify considerations and requirements used to determine duct system design.
   i) equal friction
      - air duct calculator
ii) static regain
iii) constant velocity

7. Describe the procedures used to perform heat gain/loss calculations and their applications.

Practical Objectives

1. Perform calculations pertaining to duct system design.
SMW-320  Gas Tungsten Arc Welding (GTAW)

Learning Outcomes:

- Demonstrate knowledge of GTAW equipment, its applications, maintenance and procedures for use.
- Demonstrate knowledge of the procedures used to weld using the GTAW process.
- Demonstrate knowledge of safe work practices and procedures pertaining to the use of GTAW equipment.

2018 Red Seal Occupational Standard Reference:

2.05 Uses gas tungsten arc welding (GTAW) equipment.

Suggested Hours:

30 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with GTAW.

2. Identify hazards and describe safe work practices and procedures pertaining to the use of GTAW equipment.

   i) hazards
      - fumes and particulate inhalation
      - arc flash
      - burns
      - damage to property
      - fire
      - electrical shock

   ii) safety
      - use of PPE
      - obtaining required permits
      - fire watch
      - positioning welding screens
3. Interpret symbols and information, pertaining to the use of GTAW equipment found on drawings and specifications.

4. Identify GTAW equipment, consumables and accessories used to weld, and describe their characteristics and applications.

5. Identify the types of welds performed using the GTAW process.
   i) plug
   ii) fillet (continuous)
   iii) stitch
   iv) tack
   v) edge
   vi) corner

6. Describe the procedures used to maintain and troubleshoot GTAW equipment.

7. Describe the procedures used to set up, adjust and shut down GTAW equipment.

8. Describe the procedures used to weld mild steel, aluminum and stainless steel using the GTAW process.

9. Describe weld defects, their causes and the procedures used to prevent and correct them.
   i) porosity
   ii) cracks
   iii) warping
   iv) undercut

Practical Objectives

1. Perform GTAW weld on mild steel, aluminum and stainless steel.
SMW-325 Specialty Products

Learning Outcomes:

- Demonstrate knowledge of industry standards pertaining to specialty products.
- Demonstrate knowledge of safe work practices and procedures pertaining to cutting material, forming, assembling and finishing specialty products.
- Demonstrate knowledge of calculations required to measure material for cutting.
- Demonstrate knowledge of materials and their properties, characteristics and applications.
- Demonstrate knowledge of inspection procedures.

2018 Red Seal Occupational Standard Reference:

8.01 Cuts material for specialty products.
8.02 Forms specialty products.
8.03 Assembles specialty products.
8.04 Finishes specialty products.
17.01 Installs stainless steel specialty products.
17.02 Installs non-stainless steel specialty products.

Suggested Hours:

18 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with specialty products and associated materials.

2. Identify hazards and describe safe work practices and procedures associated with cutting material, forming, assembling and finishing specialty products.

3. Identify codes, regulations, standards and job specifications pertaining to the fabrication and installation of specialty products.
   i) codes, regulations and standards
      - AHJ
      - SMACNA
- ASHRAE
- NFPA
- CSA
- ANSI
- NBC
- CWB
- Health Canada

ii) job specifications
- engineering
- architectural and manufacturers’ specifications
- penetrations
- structural supports
- drawings including shop drawings, details, sketches

4. Identify tools and equipment used with specialty products and describe their applications, limitations and procedures for use.

5. Identify types of specialty products and describe their applications.
i) kitchen
ii) medical
iii) food processing
iv) pharmaceutical
v) laboratory
vi) decorative
vii) underground ductwork
viii) marine
ix) awnings
x) signage

6. Identify types of materials used in specialty products and components, and describe their properties and applications.
i) ferrous
ii) non-ferrous
iii) plastics/PVC
iv) composites

7. Calculate and measure material to be cut.

8. Describe the procedures used to fabricate specialty products and their associated components.
9. Identify surface finishing methods and describe their associated procedures.
   i) grinding
   ii) filing
   iii) buffing
   iv) chemical compounds
   v) sealants

10. Describe the procedures used to finish specialty products and inspect to recognize deficiencies.

Practical Objectives

1. Fabricate specialty products.
SMW-330   Air Handling Systems 3

Learning Outcomes:

- Demonstrate knowledge of installation procedures for terminal boxes, coils, plenums and the associated tools and equipment.
- Demonstrate knowledge of safe work practices and procedures related to installing terminal boxes, coils and plenums.
- Demonstrate knowledge of regulatory requirements pertaining to the installation of terminal boxes and plenums.

2018 Red Seal Occupational Standard Reference:

11.01 Installs air handling equipment.
11.06 Installs terminal boxes.
11.07 Installs coils.
11.08 Installs system component accessories.
11.09 Installs plenum.

Suggested Hours:

6 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology and describe products associated with the installation of air handling components and accessories.
   i) terminal boxes
   ii) coils
   iii) plenums

2. Identify hazards and describe safe work practices pertaining to the installation of air handling components and accessories.

3. Interpret codes and standards pertaining to the installation of air handling components and accessories.
   i) SMACNA
ii) ASHRAE
iii) ANSI
iv) NBC
v) CSA
vi) ULC
vii) AHJ

4. Interpret information, pertaining to the installation of air handling system components and accessories found on drawings and specifications.
   i) terminal boxes
   ii) coils
   iii) plenums

5. Identify tools and equipment used for the installation of air handling components and accessories and describe their application and procedures for use.

6. Identify considerations and requirements for installing terminal boxes, coils and plenums.

7. Describe the procedures used to install terminal boxes, coils and plenums.

**Practical Objectives**

1. N/A
SMW-335  Introduction to Leak Testing, Air Balancing and Commissioning

Learning Outcomes:

- Demonstrate knowledge of the procedures used to perform leak tests and the associated tools and equipment.
- Demonstrate knowledge of drawings and specifications.
- Demonstrate knowledge of safe work practices and procedures pertaining to performing leak tests.
- Demonstrate knowledge of codes and regulations pertaining to performing leak tests.
- Demonstrate knowledge of the procedures used to perform testing, adjusting and balancing (TAB) on air handling systems, and the associated tools and testing equipment.
- Demonstrate knowledge of codes and regulations pertaining to performing TAB.
- Demonstrate knowledge of commissioning and its purpose.
- Demonstrate knowledge of the procedures used to commission air and material handling systems and components.
- Demonstrate knowledge of specifications.

2018 Red Seal Occupational Standard Reference:

14.01 Performs leak tests.
14.02 Performs testing, adjusting and balancing (TAB).
14.03 Participates in the commissioning of air and materials handling systems.
2.10 Uses testing and inspection devices.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with TAB/commissioning.
2. Identify tools and equipment used in performing TAB and describe their applications and procedures for use.
   i) testing and monitoring equipment
   ii) electrical testing devices
   iii) smoke bombs
   iv) velometers
   v) flow hoods
   vi) multimeters
   vii) thermometers
   viii) anemometers
   ix) psychrometers
   x) pitot tubes
   xi) manometers
   xii) tachometers

3. Identify requirements and limitations pertaining to performing leak tests.

4. Identify types of tests relating to air and material handling system components and describe the procedures used to perform them.
   i) pressure test
   ii) smoke test

5. Identify hazards and describe safe work practices and procedures associated with performing leak tests.

6. Identify codes and standards pertaining to performing TAB on air and material handling systems.
   i) SMACNA
   ii) ASHRAE
   iii) AHJ
   iv) NBC
   v) Testing, Adjusting and Balancing Bureau (TABB)
   vi) Atlantic Air Balance Council (AABC)

7. Define terminology associated with TAB.

8. Identify requirements and limitations pertaining to TAB.

9. Explain the importance of TAB to ensure optimal system performance.
10. Describe the procedures and techniques used to perform balancing on air handling systems.

11. Identify types of tests relating to air handling system equipment and components and describe the procedures used to perform them.
   i) airflow
   ii) pressure
   iii) velocity
   iv) volume

12. Explain the purpose of commissioning.

**Practical Objectives**

1. Practice TAB methods.
SMW-340 Electrical Principles

Learning Outcomes:

- Demonstrate knowledge of basic concepts of electricity.
- Demonstrate knowledge of safe work practices and procedures related to installing air handling equipment (or working with electrical equipment and sources).

2018 Red Seal Occupational Standard Reference:

2.10 Uses testing and inspection devices.
11.01 Installs air handling equipment.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with electricity.

2. Identify hazards and describe safe work practices pertaining to working on or around electrical equipment and sources.

3. Explain the basic principles of electricity.

4. Identify electrical devices and describe their purpose.
   i) circuit breakers
   ii) disconnects
   iii) overload heaters
   iv) ground fault interrupters (GFI)
   v) fuses
   vi) programmable logic controllers (PLC)
   vii) motors
   viii) capacitors
   ix) motor starters
5. Explain the mathematical relationship between amps, volts, ohms and watts.

6. Identify the types of electrical test meters and describe their applications and procedures for use.

Practical Objectives

1. Use metering devices.
SMW-345 System Maintenance and Repair

Learning Outcomes:

- Demonstrate knowledge of testing and inspection devices and their applications.
- Demonstrate knowledge of the procedures used to maintain and service air handling system components.
- Demonstrate knowledge of the procedures used to diagnose and repair air handling system components.

2018 Red Seal Occupational Standard Reference:

2.10 Uses testing and inspection devices.
18.01 Performs maintenance inspections.
18.02 Services components.
19.01 Diagnoses system faults.
19.02 Repairs worn or faulty components.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with the maintenance and repair of air and material handling systems.

2. Identify hazards and describe safe work practices pertaining to the maintenance and repair of air and material handling systems.

3. Interpret codes and standards pertaining to the maintenance and repair of air and material handling systems.
   i) SMACNA
   ii) ASHRAE
   iii) NBC
   iv) ANSI
   v) CSA
vi) NFPA

4. Identify tools and equipment used to maintain and repair system components and describe their applications and procedures for use.
   i) maintenance inspection
   ii) service
   iii) diagnostic
   iv) repair

5. Identify considerations for the inspection of system components.
   i) sounds
   ii) vibrations
   iii) odours
   iv) heat build-up

6. Describe the procedures for using testing devices.
   i) thermal imaging devices
   ii) multimeters
   iii) tachometers
   iv) belt-tensioning tools
   v) thermometers
   vi) stethoscope
   vii) refrigeration gauges
   viii) leak detectors
   ix) manometer

7. Describe the procedures used to service system components.
   i) changing consumables
      - filters
      - pads
      - trays
      - seals
   ii) cleaning components
   iii) lubricating
   iv) making adjustments
   v) performing lock-out

8. Identify symptoms of system faults.
   i) sounds
   ii) vibration
ii) odours
iv) heat build-up
v) increased amperage draw
vi) mould
vii) decreased airflow

9. Identify types of tests and readings required to diagnose system faults.
i) amperage draws
ii) air pressure readings
iii) vibration
iv) temperature
v) resistance
vi) voltage
vii) gas pressure
viii) humidity

10. Identify considerations for the repair of worn or faulty components.
i) type of replacement components
ii) manufacturers’ specifications
iii) location of components
iv) downtime during repair

11. Describe the procedures used to repair or replace worn or faulty components.

12. Identify electrical devices and describe their purpose.
i) circuit breakers
ii) disconnects,
iii) overload heaters
iv) GFI
v) fuses
vi) PLC
vii) motors
viii) variable speed drives (VSD)
ix) flow switches
x) thermostats

13. Perform calculations to determine system performance.

Practical Objectives
1. N/A
SMW-350  Marine Products

Learning Outcomes:

- Demonstrate knowledge of marine products and their applications.
- Demonstrate knowledge of safe work practices and procedures pertaining to installing marine products.
- Demonstrate knowledge of regulatory requirements pertaining to marine products.
- Demonstrate knowledge of drawing interpretation.

2018 Red Seal Occupational Standard Reference:

17.03 Installs marine products.

Suggested Hours:

3 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with marine products.

2. Identify hazards and safe work practices and procedures pertaining to the installation of marine products.

3. Interpret job specifications pertaining to the installation of marine products.
   i) engineering, architectural and manufacturers’ specifications
   ii) penetrations
   iii) structural supports
   iv) drawings including shop drawings, details, sketches

4. Identify tools and equipment used to install marine products, and describe their applications, limitations and procedures for use.

5. Identify types of marine products and materials and describe their applications.
6. Identify types of fasteners and fastening methods used to install marine products and describe their applications.

7. Describe the procedures used to install marine products.

8. Identify special considerations for installing marine products.
   i) working without levels or squares on non-level or square surfaces
   ii) increased awareness of PPE, confined space
   iii) ventilation and life safety including flotation devices
   iv) working from a single benchmark

9. Describe differences in installing in dry dock versus floating locations.

**Practical Objectives**

1. N/A
Level 4
SMW-400 Pattern Development (Computer Technology)

Learning Outcomes:

- Demonstrate knowledge of computer technology used for pattern development and layout.
- Demonstrate knowledge of basic pattern development and layout.

2018 Red Seal Occupational Standard Reference:

5.05 Uses computer technology for pattern development.

Suggested Hours:

3 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with computerized pattern development and layout.

2. Identify types of computerized software and equipment used for pattern development and describe their applications.

3. Describe the procedures used to perform pattern development using computer technology.

Practical Objectives

1. Demonstrate method of pattern input using computer technology.
SMW-405    Material Handling Systems

Learning Outcomes:

- Demonstrate knowledge of the procedures used to fabricate dampers.
- Demonstrate knowledge of calculations related to dampers.
- Demonstrate knowledge of installation procedures for pneumatic, gravity and mechanized material handling system components, and the associated tools and equipment.
- Demonstrate knowledge of drawings and job specifications.
- Demonstrate knowledge of safe work practices and procedures related to fabricating dampers and components and installing pneumatic, gravity and mechanized material handling systems.
- Demonstrate knowledge of regulatory requirements pertaining to pneumatic, gravity and mechanized material handling system components.

2018 Red Seal Occupational Standard Reference:

6.02 Forms ductwork, fittings and components.
6.04 Assembles ductwork, fittings and components.
6.05 Fabricates dampers.
12.01 Installs pneumatic and gravity material handling system components.
12.02 Installs mechanized material handling system components.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with the installation of material handling system components.
   i) chutes
   ii) explosion ducts
   iii) blast gates/dampers
   iv) relief vents
   v) explosion dampers
vi) blowers
vii) separating devices (bag houses, cyclones)
viii) air locks
ix) isolators
x) hoppers
xi) bins

2. Identify hazards and describe safe work practices and procedures pertaining to fabricating and installing material handling system components.
   i) grounding
   ii) pneumatic
   iii) gravity
   iii) mechanized
       - lock-out and tag-out
       - identifying pinch point
       - working around moving equipment

3. Identify tools and equipment used for fabrication and installation of pneumatic and gravity material handling systems and procedures for use.

4. Identify codes and standards pertaining to the installation of material handling system components.
   i) SMACNA
   ii) ASHRAE
   iii) NBC
   iv) ANSI
   v) CSA
   vi) NFPA

3. Identify types of material handling systems and describe their associated design principles.
   i) positive
   ii) negative

4. Identify types of materials used to fabricate dampers and components for material handling systems, and describe their characteristics and applications.

5. Identify types of material handling system components, and describe their applications.
   i) pneumatic
ii) gravity
ii) mechanized

5. Identify considerations and requirements when fabricating sheet metal components for material handling systems.
i) load bearing capacities
ii) system specifications
iii) environmental conditions
iv) architectural conditions

6. Explain calculations related to material handling system and damper fabrication.
i) frame size
ii) bend allowances
iii) number of blades
iv) material thickness

7. Describe the procedures used to prepare for installation of pneumatic and gravity material handling system components.
i) determining equipment requirements
ii) verifying duct sizing
iii) determining penetration locations
iv) performing site measurements
v) demolishing and removing existing systems and components
vi) performing on-site coordination
vii) staging (storing material)
viii) planning
ix) distributing (material to installation area)
x) sectioning (pre-assembling on-site)
xii) completing final inspection

8. Identify considerations when installing pneumatic, gravity and mechanized material handling system components.

9. Describe the procedures used to install pneumatic and gravity material handling system components.

10. Interpret information pertaining to installing pneumatic, gravity and mechanized material handling system components found on drawings and specifications.
Practical Objectives

1. Perform basic system design and related calculations.
SMW-410  Thermal Insulation, Lagging/Cladding and Flashing

Learning Outcomes:

- Demonstrate knowledge of the procedures used to apply thermal insulation, lagging/cladding, and flashing to components and the associated tools and equipment.
- Demonstrate knowledge of safe work practices and procedures pertaining to applying thermal insulation to components.
- Demonstrate knowledge of regulatory requirements pertaining to insulating components.
- Demonstrate knowledge of calculations required to apply lagging/cladding, and flashing to components.

2018 Red Seal Occupational Standard Reference:

13.01 Applies thermal insulation to components.
13.02 Applies lagging and cladding to components.
13.03 Applies flashing to components.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Identify hazards and describe safe work practices and procedures associated with applying thermal insulation to components.

2. Identify codes and standards pertaining to insulating components.
   i) SMACNA
   ii) NFPA
   iii) NBC
   iv) TIAC

3. Interpret information pertaining to thermal insulation, lagging/cladding and flashing found on drawings and specifications.
4. Identify tools and equipment used to apply thermal insulation, lagging/cladding and flashing to components, and describe their applications, limitations and procedures for use.

5. Identify types and properties of thermal insulation, lagging/cladding and flashing used for insulating components.

6. Identify the methods used to secure and seal material, and seams and joints.

7. Identify the methods used to apply flashing.

8. Identify considerations when installing flashing to components.
   i) isolation
   ii) building materials
   iii) environmental conditions
   iv) field design modifications


10. Calculate measurements of materials before cutting.

Practical Objectives

1. N/A
SMW-415 Testing, Adjusting and Balancing (TAB)

Learning Outcomes:

- Demonstrate knowledge of the procedures used to perform testing, adjusting and balancing (TAB) on air handling systems, and the associated tools and testing equipment.
- Demonstrate knowledge of drawings and specifications.
- Demonstrate knowledge of codes and regulations pertaining to performing TAB.

2018 Red Seal Occupational Standard Reference:

14.02 Performs testing, adjusting and balancing (TAB).
2.10 Uses testing and inspection devices.

Suggested Hours:

24 Hours

Objectives and Content:

*Theoretical Objectives*

1. Define terminology associated with TAB.

2. Identify hazards and describe safe work practices pertaining to testing and balancing.

3. Interpret codes and standards pertaining to testing and balancing,
   i) Testing, adjusting and balancing bureau (TABB)
   ii) SMACNA
   i) Atlantic Air Balance Council (AABC)

4. Interpret information pertaining to performing testing and balancing found on drawings and specifications.

5. Explain the importance of TAB to ensure optimal system performance.
6. Identify tools and testing equipment used in TAB, and describe their applications and procedures for use.

7. Identify types of tests relating to air handling system equipment and components and describe the procedures used to perform them.
   i) airflow  
   ii) pressure  
   iii) velocity  
   iv) volume

8. Identify requirements and limitations pertaining to TAB.

9. Identify problems pertaining to air handling systems and describe procedures used to prevent and correct them.
   i) lack of air pressure  
   ii) excessive air pressure  
   iii) improper installation  
       - duct sizing  
       - noise

10. Describe the procedures and techniques used to perform balancing on air handling systems.
    i) sequential balancing  
    ii) proportional balancing

11. Describe the procedures used to adjust air handling system equipment and components to optimize performance.
    i) motor pulleys  
    ii) dampers  
    iii) blower pulleys  
    iv) three-stage motors  
    v) variable frequency drives (VFD)  
    vi) test port  
    vii) inlet vanes

Practical Objectives

1. Perform calculations related to balancing of air handling systems.
SMW-420 Commissioning

Learning Outcomes:

- Demonstrate knowledge of commissioning and its purpose.
- Demonstrate knowledge of the procedures used to commission air and material handling systems and components.

2018 Red Seal Occupational Standard Reference:

14.03 Participates in the commissioning of air and material handling systems.
2.10 Uses testing and inspection devices.

Suggested Hours:

9 Hours

Objectives and Content:

Theoretical Objectives

1. Define terminology associated with commissioning.
2. Interpret documentation pertaining to commissioning.
3. Explain the purpose of commissioning and identify the types of air and material handling systems and components.
4. Describe the procedures used to commission air and material handling systems and components.
   i) pre start-up checklist
      - remove all shipping bolts
      - check rotation and operation
      - filters
      - remove all plastic from ends of ductwork
   ii) confirm controls are terminated
   iii) equipment start-up
   iv) system training and verification
5. Identify requirements for project turnover.

Practical Objectives

1. N/A
SMW-425  Job Planning

Learning Outcomes:

- Demonstrate knowledge of the procedures used to plan and organize jobs.
- Demonstrate knowledge of the procedures used to take field measurements.
- Demonstrate knowledge of the procedures used to produce material take-off lists.

2018 Red Seal Occupational Standard Reference:

3.01 Uses trade-related documentation.
3.02 Interprets drawings.
3.03 Organizes materials and equipment for project.

Suggested Hours:

12 hours

Objectives and Content:

1. Identify sources of information relevant to job planning.
   i) documentation
   ii) drawings
   iii) specifications
   iv) related professionals
   v) clients
   vi) LEED requirements
   vii) computer technology

2. Describe the considerations for determining job requirements.
   i) personnel
   ii) tools and equipment
   iii) material and supplies
   iv) permits

3. Describe the procedures used to plan job tasks.
   i) scheduling
ii) estimating

4. Describe the procedures used to organize, store and maintain inventory.

5. Describe safety requirements for handling materials and equipment.

6. Describe the procedures used to plan for a job.
   i) determining equipment requirements
   ii) verifying duct sizing
   iii) determining penetration locations
   iv) performing site measurements
   v) demolishing and removing existing systems and components
   vi) performing on-site coordination
   vii) staging (storing material)
   viii) planning
   ix) distributing (material to installation area)
   x) sectioning (pre-assembling on-site)
   xi) erecting
   xii) completing final inspection

Practical Objectives

1. N/A
SMW-430 Drawings 2

Learning Outcomes:

- Demonstrate knowledge of the procedures used to interpret and extract information from drawings.
- Demonstrate knowledge of the procedures used to take field measurements.
- Demonstrate knowledge of the procedures used to produce material take-off lists.

2018 Red Seal Occupational Standard Reference:

3.02 Interprets drawings.

Suggested Hours:

30 hours

Objectives and Content:

1. Describe the procedures used to interpret and extract information from drawings.

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 types of material take-off lists and describe their applications and the procedures used to produce them.
   i) material estimation
   ii) material installation

Practical Objectives

1. Read and interpret drawings and specifications.
2. Produce material take-off list
SMW-435  

Mentoring

Learning Outcomes:

- Demonstrate knowledge of strategies for learning skills in the workplace.
- Demonstrate knowledge of strategies for teaching workplace skills.

2018 Red Seal Occupational Standard Reference:

4.02 Uses mentoring techniques.

Suggested Hours:

6 Hours

Objectives and Content:

*Theoretical Objectives*

1. Describe the importance of individual experience.

2. Describe the shared responsibilities for workplace learning.

3. Determine one’s own learning preferences and explain how these relate to learning new skills.

4. Describe the importance of different types of skills in the workplace.

5. Describe the importance of essential skills in the workplace.
   i) reading
   ii) writing
   iii) document use
   iv) oral communication
   v) numeracy
   vi) thinking
   vii) working with others
   viii) digital technology
   ix) continuous learning
6. Identify different learning styles.
   i) seeing it
   ii) hearing it
   iii) trying it

7. Identify different learning needs and strategies to meet learning needs.
   i) learning disabilities
   ii) learning preferences
   iii) language proficiency

8. Identify strategies to assist in learning a skill.
   i) understanding the basic principles of instruction
   ii) developing coaching skills
   iii) being mature and patient
   iv) providing feedback

9. Identify different roles played by a workplace mentor.

10. Describe teaching skills.
    i) identifying the point of the lesson
    ii) linking the lesson
    iii) demonstrating the skill
    iv) providing practice
    v) giving feedback
    vi) assessing skills and progress

11. Identify how to choose a good time to present a lesson.

12. Identify the components of the skill (the context).

13. Describe considerations in setting up opportunities for skill practice.

14. Explain the importance of providing feedback.

15. Identify techniques for giving effective feedback.

16. Describe a skills assessment.

17. Identify methods of assessing progress.
18. Explain how to adjust a lesson to different situations.

Practical Objectives

1. N/A
SMW-440 Program Review

Learning Outcomes:

- Demonstrate knowledge of the Red Seal Occupational Standard (RSOS) and its relationship to the Interprovincial Examination.
- Demonstrate knowledge of overall comprehension of the trade in preparation for the Interprovincial Examination.

2018 Red Seal Occupational Standard Reference:

Entire Red Seal Occupational Standard

Suggested Hours:

30 Hours

Objectives and Content:

Theoretical Objectives

1. Define and explain terminology associated with an RSOS.
   i) major work activities (MWA)
   ii) tasks
   iii) sub-tasks

2. Explain how an RSOS is developed and the link it has with the Interprovincial Red Seal Examination.
   i) development
   ii) validation
   iii) MWA and task weighting
   iv) examination breakdown (pie-chart)

3. Identify Red Seal products and describe their use for preparing for the Interprovincial Red Seal Examination.
   i) Red Seal website
   ii) examination preparation guide
   iii) sample questions
   iv) examination counselling sheets
4. Explain the relationship between the RSOS and the Atlantic Apprenticeship Curriculum Standard (AACS).

5. Review common occupational skills for the Sheet Metal Worker trade as identified in the RSOS.
   i) safety-related functions
   ii) tools and equipment
   iii) organizes work
   iv) communication and mentoring

6. Review process to perform fabrication for the Sheet Metal Worker trade as identified in the RSOS.
   i) pattern development
   ii) sheet metal components for air and material handling systems
   iii) flashing, roofing, sheeting and cladding
   iv) specialty products

7. Review process to install air and material handling systems for the Sheet Metal Worker trade as identified in the RSOS.
   i) installation site
   ii) chimneys, breeching and venting to exhaust appliances and mechanical equipment
   iii) air handling system components
   iv) material handling system components
   v) thermal insulations, lagging, cladding and flashing
   vi) leak testing, air balancing and commissioning

8. Review process to install roofing and specialty products for the Sheet Metal Worker trade as identified in the RSOS.
   i) metal roofing and cladding/siding systems
   ii) exterior components
   iii) specialty products

9. Review process to perform maintenance and repair for the Sheet Metal Worker trade as identified in the RSOS.
   i) scheduled maintenance
   ii) faulty systems and components

Practical Objectives
N/A
Sample Formula Sheet

1. \[ \frac{D_2}{D_1} = \frac{RPM_1}{RPM_2} \]

2. \[ C = \pi \times \text{Diameter} \]

3. \[ \frac{\text{CFM}_2}{\text{CFM}_1} = \frac{RPM_2}{RPM_1} \]

4. \[ \frac{\text{SP}_2}{\text{SP}_1} = \left( \frac{RPM_2}{RPM_1} \right)^2 \]

5. \[ 1.57 \times \text{Radius} \times \text{Degrees} = \text{Belt Length} \]

6. \[ \frac{\text{Offset}^2 + \text{Length}^2}{4 \times \text{Offset}} = \text{Swing Point Radius} \]

7. \[ 4 \left( \sqrt[3]{\text{Offset}^2 + \text{Length}^2} \right) - \text{Length} = \text{Wrapper/Belt Length} \]

8. \[ \frac{\text{Large Diameter} \times \text{Vertical Height}}{\text{Large Diameter} - \text{Small Diameter}} = \text{Apex Height} \]

9. \[ \frac{\text{Angle of Elbow}}{2 \times \#\text{Gores} - 2} = \text{Mitre Angle} \]

10. \[ \text{Degrees} \times (.01743R + .0078t) = \text{Bend Allowance} \]

11. \[ 1.08 \times \text{CFM} \times \text{Temperature Difference} = \text{BTU/hr} \]

12. \[ L = (\text{Offset} \times 1.414) - 2(\text{CLR} \times 0.414) \]

13. \[ \text{Slant Radius} = (\text{Base diameter} – \text{Flat pattern diameter}) \times \pi \]

14. \[ A^2 + B^2 = C^2 \]

15. \[ \pi R^2 = \text{Area of Circle} \]

16. \[ \text{Area} \times \text{FPM} = \text{CFM} \]

17. \[ \pi R^2 h = \text{Volume} \]

18. \[ \text{RPM} \times \text{Percent Increase} = \text{New RPM} \]
Nova Scotia Document Evaluation Form

Thank you for your interest in the development and revision of this document. Upon review of the document, please record your feedback in relation to the following items:
- course division and organization
- relevancy of the content
- errors or omissions
- other suggestions for improvement and consideration

Overall comments are to be entered on this evaluation form and specific changes are to be entered directly on the document in the relevant area(s). When making proposed corrections(s) in the document, please use red ink. When all feedback has been recorded, return this evaluation form along with the document to the Apprenticeship Office noted at the bottom of the page.

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