PROGRAM OUTLINE

Insulator (Heat and Frost) (Heat and Frost Insulator)
HEAT AND FROST INSULATOR
PROGRAM OUTLINE

APPROVED
NOVEMBER 2011

BASED ON
NOA 2007

Developed by
Industry Training Authority
Province of British Columbia
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Section 1

INTRODUCTION

Heat and Frost Insulator
Foreword

This revised Heat and Frost Insulator Program Outline is intended as a guide for instructors, apprentices, and employers of apprentices as well as for the use of industry organizations, regulatory bodies, and provincial and federal governments. It reflects updated standards based on the new Heat and Frost Insulator Occupational Analysis (2007) and British Columbia industry and instructor Subject Matter Experts.

Practical instruction by demonstration and student participation should be integrated with classroom sessions. Safe working practices, even though not always specified in each operation or topic, are an implied part of the program and should be stressed throughout the apprenticeship.

This Program Outline includes a list of recommended reference textbooks that are available to support the learning objectives and the minimum shop requirements needed to support instruction.

This Program Outline was prepared with the advice and assistance of the Heat and Frost Insulator Review Committee and will form the basis for further updating of the British Columbia Heat and Frost Insulator Program and learning resources by the Construction Industry Training Organization on behalf of the Industry Training Authority.

Each competency is to be evaluated through the use of written examination in which the individual must achieve a minimum of 70% in order to receive a passing grade. The types of questions used on these exams must reflect the cognitive level indicated by the learning objectives and the learning tasks listed in the related competencies.

Achievement Criteria are included for those competencies that require a practical component. The intent of including Achievement Criteria in the Program Outline is to ensure consistency in training across the many training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the individual’s ability to apply the theory to practice. It is important that these performances be observable and measureable and that they reflect the skills spelled out in the competency as those required of a competent journeyperson. The conditions under which these performances will be observed and measured must be clear to the individual as well as the criteria by which the individual will be evaluated. The individual must also be given the level of expectation of success.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

While some competencies might appear to be very similar in different levels of training, more advanced skills are taught at each level. This can be seen in the types of fittings and components being taught and in the type of Achievement Criteria required in each competency. The fittings involve higher levels of skill to be used in both pattern development and in fabrication and assembly.

SAFETY ADVISORY

Be advised that references to the WorkSafeBC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: 
http://www.worksafebc.com. Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.
Acknowledgements

This Program Outline was prepared with the advice and direction of an industry steering committee convened initially by the BC Construction Industry Training Organization (CITO). Members include:

- Lee Loftus
- Ken Jacobsen

Industry Subject Matter Experts retained to assist in the development of Program Outline content:

- Lee Loftus
- Ken Jacobsen

The Industry Training Authority would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the Heat and Frost Insulator occupation.
How to Use this Document

This Program Outline has been developed for the use of individuals from several different audiences. The table below describes how each section can be used by each intended audience.

<table>
<thead>
<tr>
<th>Section</th>
<th>Training Providers</th>
<th>Employers/ Sponsors</th>
<th>Apprentices</th>
<th>Challengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Credentialing Model</td>
<td>Communicate program length and structure, and all pathways to completion</td>
<td>Understand the length and structure of the program</td>
<td>Understand the length and structure of the program, and pathway to completion</td>
<td>Understand challenger pathway to Certificate of Qualification</td>
</tr>
<tr>
<td>Program Assessment</td>
<td>Communicate program completion requirements and assessment methods</td>
<td>Understand the various assessment requirements for the program</td>
<td>Understand the various assessment requirements for the program</td>
<td>Understand the assessment requirements they would have to fulfill in order to challenge the program</td>
</tr>
<tr>
<td>OAC</td>
<td>Communicate the competencies that industry has defined as representing the scope of the occupation</td>
<td>Understand the competencies that an apprentice is expected to demonstrate in order to achieve certification</td>
<td>View the competencies they will achieve as a result of program completion</td>
<td>Understand the competencies they must demonstrate in order to challenge the program</td>
</tr>
<tr>
<td>Training Topics and Suggested Time Allocation</td>
<td>Shows proportionate representation of general areas of competency (GACs) at each program level, the suggested proportion of time spent on each GAC, and percentage of time spent on theory versus practical application</td>
<td>Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application</td>
<td>Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application</td>
<td>Understand the relative weightings of various competencies of the occupation on which assessment is based</td>
</tr>
<tr>
<td>Program Content</td>
<td>Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measurable achievement criteria for objectives with a practical component</td>
<td>Identifies detailed program content and performance expectations for competencies with a practical component; may be used as a checklist prior to signing a recommendation for certification (RFC) for an apprentice</td>
<td>Provides detailed information on program content and performance expectations for demonstrating competency</td>
<td>Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels</td>
</tr>
<tr>
<td>Section</td>
<td>Training Providers</td>
<td>Employers/Sponsors</td>
<td>Apprentices</td>
<td>Challengers</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Training Provider Standards</strong></td>
<td>Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program</td>
<td>Identifies the tools and equipment an apprentice is expected to have access to; which are supplied by the training provider and which the student is expected to own</td>
<td>Provides information on the training facility, tools and equipment provided by the school and the student, reference materials they may be expected to acquire, and minimum qualification levels of program instructors</td>
<td>Identifies the tools and equipment a tradesperson is expected to be competent in using or operating; which may be used or provided in a practical assessment</td>
</tr>
</tbody>
</table>
Section 2
PROGRAM OVERVIEW

Heat and Frost Insulator
Program Content

Program Credentialing Model

CROSS-PROGRAM CREDITS
None

Insulator (Heat & Frost) (Heat and Frost Insulator)  Industry Training Authority  01-12

Program Credentialing Model

RECOMMENDATION FOR CERTIFICATION

Insulator (Heat & Frost) Level 4
Technical Training: 600 hours (4 weeks*)
Work-Based Training: 5,920 hours total
Interprovincial Red Seal Exam

Insulator (Heat & Frost) Level 3
Technical Training: 600 hours (4 weeks*)
Accumulate Work-Based Training hours

Insulator (Heat & Frost) Level 2
Technical Training: 600 hours (4 weeks*)
Accumulate Work-Based Training hours

Insulator (Heat & Frost) Level 1
Technical Training: 600 hours (4 weeks*)
Accumulate Work-Based Training hours

APPRENTICESHIP - DIRECT ENTRY

*Suggested duration based on 30-hour week
Program Assessment

Apprentices will be assessed fairly and accurately throughout the program on the various skills required to be a professional tradesperson. Assessment activities are designed to provide feedback and allow for further development of skills that have been identified as essential for on-the-job performance.

The forms of assessment used in this program are described below.

<table>
<thead>
<tr>
<th>Completion Requirement</th>
<th>Evidence of Achievement</th>
<th>Level of Achievement Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Technical Training</td>
<td>In-school testing and practical assessment</td>
<td>Minimum 70%</td>
</tr>
<tr>
<td>Level 2 Technical Training</td>
<td>In-school testing and practical assessment</td>
<td>Minimum 70%</td>
</tr>
<tr>
<td>Level 3 Technical Training</td>
<td>In-school testing and practical assessment</td>
<td>Minimum 70%</td>
</tr>
<tr>
<td>Level 4 Technical Training</td>
<td>In-school testing and practical assessment</td>
<td>Minimum 70%</td>
</tr>
<tr>
<td>Work-based Training Hours</td>
<td>Work-based training report completed by Sponsor or Employer</td>
<td>5,920 hours</td>
</tr>
<tr>
<td>Interprovincial Exam</td>
<td>ITA-administered exam</td>
<td>Minimum 70%</td>
</tr>
<tr>
<td>Recommendation for Certification</td>
<td>Approval or sign-off by Sponsor, Employer, or other individual with sign-off authority</td>
<td>Declared competent</td>
</tr>
</tbody>
</table>
# Program Overview

## Occupational Analysis Chart

### HEAT AND FROST INSULATOR

#### USE TOOLS AND EQUIPMENT

<table>
<thead>
<tr>
<th>Use measuring tools</th>
<th>Use cutting tools</th>
<th>Use fastening tools</th>
<th>Use trowels and slicks</th>
<th>Use brushes and rollers</th>
<th>Use portable pin welding machines (PPWM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
<td>A6</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use access equipment and rigging techniques</th>
<th>Use sheet metal tools and equipment</th>
<th>Use layout tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>A7</td>
<td>A8</td>
<td>A9</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

#### USE SAFE WORK PRACTICES

<table>
<thead>
<tr>
<th>Use WorkSafeBC Health and Safety Regulations</th>
<th>Identify potential causes of accidents</th>
<th>Follow safe work procedures for power tools</th>
<th>Follow lockout/tagout procedures</th>
<th>Use personal protective equipment (PPE)</th>
<th>Explain adhesive and solvent hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>B2</td>
<td>B3</td>
<td>B4</td>
<td>B5</td>
<td>B6</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

#### SELECT INSULATION MATERIALS

<table>
<thead>
<tr>
<th>Select and use insulation materials</th>
<th>Select and use fasteners and reinforcing materials</th>
<th>Select and use adhesives, solvents and thinners</th>
<th>Select and use cements</th>
<th>Select and use tapes, vapour barriers and weather proofing</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C4</td>
<td>C5</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

#### APPLY INSULATION

<table>
<thead>
<tr>
<th>Apply insulation to pipes, fittings and valves</th>
<th>Apply insulation to duct work and equipment</th>
<th>Interpret specifications and drawings for choice of materials</th>
<th>Fabricate materials</th>
<th>Determine allowances for expansion or contraction</th>
<th>Apply low temperature insulation systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>D2</td>
<td>D3</td>
<td>D4</td>
<td>D5</td>
<td>D6</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>2 3 4</td>
</tr>
</tbody>
</table>
## Program Overview

<table>
<thead>
<tr>
<th>Insulator (Heat and Frost) Industry Training Authority 01-12</th>
<th>Insulator (Heat and Frost) Industry Training Authority 01-12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apply high temperature insulation systems</strong> D7</td>
<td><strong>Describe underground installation of insulation</strong> D10</td>
</tr>
<tr>
<td><strong>Use insulation spray methods</strong> D13</td>
<td><strong>Apply insulation to heat traced systems</strong> D12</td>
</tr>
<tr>
<td><strong>Apply finishing techniques</strong> D8</td>
<td><strong>Make insulation pads</strong> D14</td>
</tr>
<tr>
<td><strong>Apply metal and plastic jacketing</strong> D9</td>
<td><strong>Apply soundproofing insulation for commercial and industrial applications</strong> D15</td>
</tr>
<tr>
<td><strong>Apply caulking</strong> D10</td>
<td><strong>Apply insulation for marine applications</strong> D16</td>
</tr>
<tr>
<td><strong>Describe underground installation of insulation</strong> D11</td>
<td><strong>Use insulation spray methods</strong> D13</td>
</tr>
<tr>
<td><strong>Use insulation spray methods</strong> D13</td>
<td><strong>Make insulation pads</strong> D14</td>
</tr>
<tr>
<td><strong>Describe fire stopping and smoke sealing</strong> E1</td>
<td><strong>Describe fire stopping and smoke sealing techniques</strong> E3</td>
</tr>
<tr>
<td><strong>Describe fire stopping penetrations and applications</strong> E2</td>
<td><strong>Use fire stopping and smoke sealing techniques</strong> E3</td>
</tr>
<tr>
<td><strong>Use trade related mathematics</strong> F1</td>
<td><strong>Use International System of Units (SI Units)</strong> F4</td>
</tr>
<tr>
<td><strong>Use trade related geometry</strong> F2</td>
<td><strong>Describe the fundamentals of Ohms Law</strong> F5</td>
</tr>
<tr>
<td><strong>Use trade related trigonometry</strong> F3</td>
<td><strong>Describe the heating and cooling of metals</strong> F6</td>
</tr>
<tr>
<td><strong>Use trade related heat calculations</strong> F7</td>
<td><strong>Describe types of corrosion</strong> F8</td>
</tr>
<tr>
<td><strong>Use science related to choice of insulation materials</strong> F9</td>
<td><strong>Develop patterns for elbows</strong> G3</td>
</tr>
<tr>
<td><strong>Lay out geometric shapes</strong> G1</td>
<td><strong>Develop drawings and patterns</strong> G5</td>
</tr>
<tr>
<td><strong>Use lines and symbols</strong> G2</td>
<td><strong>Lay out removable insulation covers</strong> G6</td>
</tr>
</tbody>
</table>
### Program Overview

#### Lay out patterns for seams on metal covers

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>G7</td>
<td>Lay out patterns for seams on metal covers</td>
<td>3</td>
</tr>
</tbody>
</table>

#### READ BLUEPRINTS AND SPECIFICATIONS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Describe blueprint lines, abbreviations and symbols</td>
<td>2</td>
</tr>
<tr>
<td>H2</td>
<td>Describe sectional and projection views</td>
<td>2</td>
</tr>
<tr>
<td>H3</td>
<td>Sketch pictorial drawings</td>
<td>2</td>
</tr>
<tr>
<td>H4</td>
<td>Read specifications and blueprints for industrial projects</td>
<td>3 4</td>
</tr>
<tr>
<td>H5</td>
<td>Read details and addenda</td>
<td>4</td>
</tr>
</tbody>
</table>

#### USE ASBESTOS ABATEMENT PROCEDURES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>Describe asbestos abatement</td>
<td>2</td>
</tr>
<tr>
<td>I2</td>
<td>Use personal protective equipment</td>
<td>2</td>
</tr>
<tr>
<td>I3</td>
<td>Remove asbestos</td>
<td>2</td>
</tr>
<tr>
<td>I4</td>
<td>Encapsulate or enclose asbestos materials</td>
<td>2</td>
</tr>
</tbody>
</table>

#### USE LEAD ABATEMENT PROCEDURES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>Describe health effects of lead abatement</td>
<td>4</td>
</tr>
<tr>
<td>J2</td>
<td>Use lead abatement procedures</td>
<td>4</td>
</tr>
</tbody>
</table>
# Training Topics and Suggested Time Allocation

## HEAT AND FROST INSULATOR – LEVEL 1

<table>
<thead>
<tr>
<th>Line</th>
<th>Training Topic</th>
<th>% of Time Allocated to:</th>
<th>Theory</th>
<th>Practical</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% of Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>16%</td>
<td>90%</td>
<td>10%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Line A</strong></td>
<td><strong>USE TOOLS AND EQUIPMENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>Use measuring tools</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Use cutting tools</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>Use fastening tools</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>Use trowels and slicks</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>Use brushes and rollers</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td>Use portable pin welding machines (PPWM)</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>Use access equipment and rigging techniques</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A8</td>
<td>Use sheet metal tools and equipment</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Line B</strong></td>
<td><strong>USE SAFE WORK PRACTICES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>Use WorkSafeBC Health and Safety Regulations</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>Identify potential causes of accidents</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>Follow safe work procedures for power tools</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>Follow lockout/tagout procedures</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td>Use personal protective equipment (PPE)</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>Explain adhesive and solvent hazards</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Line C</strong></td>
<td><strong>SELECT INSULATION MATERIALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>Select and use insulation materials</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>Select and use fasteners and reinforcing materials</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>Select and use adhesives, solvents and thinners</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>Select and use cements</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>Select and use tapes, vapour barriers and weatherproofing</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Line D</strong></td>
<td><strong>APPLY INSULATION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>Apply insulation to pipes, fittings and valves</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>D2</td>
<td>Apply insulation to duct work and equipment</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td><strong>Line E</strong></td>
<td><strong>USE FIRE STOPPING AND SMOKE SEALING TECHNIQUES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E1</td>
<td>Describe fire stopping and smoke sealing</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>Describe fire stopping penetrations and applications</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>Use fire stopping and smoke sealing techniques</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
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**Program Overview**

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<td>F4</td>
<td>Use International System of Units (SI Units)</td>
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<td>F9</td>
<td>Use science related to choice of insulation material</td>
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Total Percentage for Heat and Frost Insulator Level 1 100%
## Training Topics and Suggested Time Allocation

### HEAT AND FROST INSULATOR – LEVEL 2

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<td>A3</td>
<td>Use fastening tools</td>
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<tr>
<td>A8</td>
<td>Use sheet metal tools and equipment</td>
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<tr>
<td>A9</td>
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<td>Interpret specifications and drawings for choice of materials</td>
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<td>D6</td>
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<td>Describe the fundamentals of Ohms Law</td>
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<td>F8</td>
<td>Describe types of corrosion</td>
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<td>F9</td>
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<td>G3</td>
<td>Develop patterns for elbows</td>
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<td>Describe blueprint lines, abbreviations and symbols</td>
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<td>Describe asbestos abatement</td>
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<td>I2</td>
<td>Use personal protective equipment</td>
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<td>I3</td>
<td>Remove asbestos</td>
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<td>I4</td>
<td>Encapsulate or enclose asbestos materials</td>
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### Program Overview

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## Training Topics and Suggested Time Allocation

### HEAT AND FROST INSULATOR – LEVEL 3

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<td>D7</td>
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<tr>
<td>D8</td>
<td>Use finishing techniques</td>
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<td>✓</td>
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<tr>
<td>D9</td>
<td>Apply metal and plastic jacketing</td>
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<tr>
<td>D10</td>
<td>Apply caulking</td>
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<td>Describe underground installation of insulation</td>
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<td>Develop drawings and patterns</td>
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<td>G6</td>
<td>Lay out removable insulation covers</td>
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<tr>
<td>G7</td>
<td>Lay out patterns for seams on metal covers</td>
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<td>Read specifications and blueprints for industrial projects</td>
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Total Percentage for Heat and Frost Insulator Level 3: 100%
## Training Topics and Suggested Time Allocation

**HEAT AND FROST INSULATOR – LEVEL 4**

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<td>Determine allowances for expansion or contraction</td>
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<td>Apply low temperature insulation systems</td>
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<tr>
<td>D7</td>
<td>Apply high temperature insulation systems</td>
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<td>D9</td>
<td>Apply metal and plastic jacketing</td>
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Section 3

PROGRAM CONTENT

Heat and Frost Insulator
Level 1
Heat and Frost Insulator
Line (GAC): A USE TOOLS AND EQUIPMENT

Competency: A1 Use measuring tools

Objectives
To be competent in this area the individual must be able to use and maintain measuring and layout tools.

LEARNING TASKS

1. Use measuring and layout tools
   - Safety hazards
   - Measuring tapes
   - Folding rulers
   - Spring tempers (circumference)
   - Scale rulers (metric and Imperial)
   - Carpenter’s square
   - T-square
   - Straight edge
   - Trammel point
   - Compass
   - Protractor
   - Dividers
   - Mitre chart

2. Maintain measuring and layout tools
   - Storage
   - Maintenance
   - Accuracy and calibration
Line (GAC): A USE TOOLS AND EQUIPMENT
Competency: A2 Use cutting tools

Objectives
To be competent in this area the individual must be able to use and maintain cutting tools.

LEARNING TASKS

1. Select and use knives
   - Safety hazards and precautions
   - Types and uses
     - Armaflex cutting knife for foams
     - Slicing knife for fibreglass and mineral fibre
     - Utility knife for plastic and paper
     - Boning knife for calcium silicate

2. Maintain knives
   - Safety hazards and precautions
   - Lubrication
   - Knife sharpening devices
     - Stones
     - Files
     - Grinders

3. Describe types of hand and power saws
   - Safety hazards and precautions
   - Materials to be cut
     - Fibreglass
     - Foam and foam-glass
     - Plastics
     - Ferrous and non-ferrous metals
     - Calcium silicate
   - Hand Saws
     - Keyhole
     - Hand
   - Power saws
     - Band
     - Circular
   - Features

4. Describe saw blades
   - Size
   - Number of teeth
   - Characteristics
   - Cutting speed
LEARNING TASKS

5. Use hand and power saws

6. Maintain saws

7. Use scissors

8. Maintain scissors

9. Use snips and nippers

CONTENT
• Safety hazards and precautions
• Sawing techniques
  o Start of cut
  o Effects of binding
  o Support of material being cut
• Sharpening
• Setting
• Care and storage
• Safety hazards and precautions
• Types
• Uses
• Techniques
• Limitations
• Materials to be cut
  o Canvas
  o Glass fabrics
  o Vinyl
  o Cloth jacketing
• Material handling
  o Physical protection
  o Material protection
  o Storage
• Cleaning
• Sharpening techniques
• Sharpening devices
• Storage
• Types
• Uses
• Materials to cut
• Maintenance and storage
Line (GAC): A USE TOOLS AND EQUIPMENT
Competency: A3 Use fastening tools

Objectives
To be competent in this area the individual must be able to use fastening tools to install seals and banding.

LEARNING TASKS

1. Use pliers
   - Safety hazards and precautions
   - Types
     - Side, end and diagonal cutters
     - Combination
     - Specialty (hog ring)
   - Sizes
   - Uses
     - Twisting
     - Cutting
     - Pulling
     - Pressing
     - Finishing wire

2. Describe staple guns
   - Types
   - Sizes

3. Describe characteristics of materials to be stapled
   - Fibreglass, plain and foil faced
   - Plastics, plain or lead impregnated
   - Corner bead
   - Pipe covering

4. Use staple guns
   - Safety hazards and precautions
   - Techniques
   - Cleaning
   - Lubrication
   - Storage

5. Describe banding tools
   - Types and purposes
     - Plastics
     - Iron
     - Aluminum
     - Stainless steel
LEARNING TASKS

6. Describe types and purposes of crimping tools

7. Install banding and seals

CONTENT

- Size of seals
- Size of banding
- Location of seals
- Safety hazards and precautions
- Operating procedures
- Storage and care

Achievement Criteria

Performance The individual will use fastening tools to install seals and banding.

Conditions The individual will be given:
- Tools and equipment
- Materials
- Project specifications

Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Accuracy
- Safety
- Use of PPE
- Completed within specified time
Line (GAC): A USE TOOLS AND EQUIPMENT
Competency: A4 Use trowels and slicks

Objectives
To be competent in this area the individual must be able to select and use trowels and slicks.

LEARNING TASKS
1. Describe types of trowels and slicks
   - Flat
   - Gauging
   - Pointing
   - Flexible
     - Rubber
     - Brass
     - Spring steel

2. Describe types of cements
   - Insulating
   - Finishing
   - Refractory
   - Mastics

3. Select and use trowels and slicks
   - Safety hazards and precautions
   - Materials to be used
   - Technique
   - Proper consistency of material
Line (GAC): A USE TOOLS AND EQUIPMENT
Competency: A5 Use brushes and rollers

Objectives
To be competent in this area the individual must be able to apply materials using brushes and rollers.

LEARNING TASKS

1. Describe types, purposes and uses of brushes and rollers
   - Paste brush
   - Coating brush
   - Mastic/adhesive brush
   - Various rollers

2. Use brushes and rollers
   - Selection of tools
   - Materials to be applied
   - Cleaning and storage
   - Safety hazards and precautions
Program Content
Level 1

Line (GAC): A USE TOOLS AND EQUIPMENT
Competency: A6 Use portable pin welding machines (PPWM)

Objectives
To be competent in this area the individual must be able to:
- Place and space pins according to specifications and drawing.
- Demonstrate techniques for pin welding.

LEARNING TASKS

1. Interpret drawings and specifications
   - Size of pin
   - Type of pin and washer
   - Type of substrate
   - Location of job

2. Describe portable pin welding machines
   - Purpose
   - Characteristics
   - Operating procedures
   - Types and sizes of machines
   - Power source

3. Describe anchors
   - Size
   - Purpose
   - Pins
   - Threaded attachments
   - Support-rings
   - Expansion joints
   - Limitations of pin weld connections

4. Use pin welder
   - Surface preparation
   - Placing and spacing of pins
   - Setting for optimum welding condition
   - Techniques
     - Avoiding oxidation on substrate
     - Preventing overheating of welds
   - Safety hazards
   - Potential fire hazards
   - Electrical shock
   - Safety precautions
     - Available fire fighting equipment
     - Personal protective equipment
   - Storage and maintenance of PPWM
LEARNING TASKS
5. Describe conditions affecting the satisfactory operation of pin welding machines

CONTENT
- Cleanliness of substrate
- Type of substrate
- Condition of substrate
- Incorrect setting
- Incorrect setting
- Insufficient pre-setting time
- Improper ground
- Loose connections
- Insufficient power

Achievement Criteria
Performance
The individual will demonstrate techniques for pin welding.

Conditions
The individual will be given:
- Tools and equipment
- Materials
- Drawing
- Project specifications

Criteria
The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Accuracy
- Safety
- Use of PPE
- Completed within specified time
### Program Content

#### Level 1

**Line (GAC):** A

**Competency:** A7 Use access equipment and rigging techniques

### Objectives

To be competent in this area the individual must be able to:
- Use ladders and scaffolds.
- Tie knots and hitches.
- Demonstrate slinging of various loads.

### LEARNING TASKS

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<tr>
<td>1. Describe platform scaffolds</td>
<td>Types</td>
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<td>o Single and multiple plank</td>
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<td></td>
<td>o Rigid platform</td>
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<td>o Ladder and plank</td>
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<td>Uses</td>
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<td>o Assembly locks</td>
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<td>o Wheel locks</td>
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<td>o Guard rails</td>
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<td>o Braces</td>
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<td>o Levellers</td>
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<td>2. Use platform scaffolds</td>
<td>Power line hazard</td>
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<td>Safe erection and work procedures</td>
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<td>3. Describe suspended work platforms</td>
<td>Suspension methods</td>
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<td>Swing stage</td>
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<td>Advantages and disadvantages</td>
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<td>Safety factors</td>
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<tr>
<td></td>
<td>Safe erection and work procedures</td>
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<td>Training requirements</td>
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</table>
## LEARNING TASKS

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<td>4.</td>
<td>Describe aerial work platforms</td>
<td>• Scissor lifts&lt;br&gt;• Boom lifts&lt;br&gt;• Safety&lt;br&gt;• Training requirements</td>
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<tr>
<td>5.</td>
<td>Describe ladders</td>
<td>• Types&lt;br&gt;  o Straight and extension&lt;br&gt;  o Platform&lt;br&gt;  o Step&lt;br&gt;  o Specialty i.e. combination&lt;br&gt;• Uses&lt;br&gt;• Advantages and disadvantages</td>
</tr>
<tr>
<td>6.</td>
<td>Use ladders</td>
<td>• Safety Regulations&lt;br&gt;• Safe erection and work procedures&lt;br&gt;  o Transporting&lt;br&gt;  o Securing and lashing&lt;br&gt;  o Power line hazard&lt;br&gt;  o Overreaching hazard</td>
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<tr>
<td>7.</td>
<td>Describe fibre ropes</td>
<td>• Types&lt;br&gt;• Strengths&lt;br&gt;• Composition&lt;br&gt;• Characteristics&lt;br&gt;• Care&lt;br&gt;• Quality</td>
</tr>
<tr>
<td>8.</td>
<td>Tie knots and hitches used in the heat and frost insulator trade</td>
<td>• Protection of material and equipment from rope cuts and marks&lt;br&gt;• Types and purposes of knots and hitches&lt;br&gt;  o Bowline&lt;br&gt;  o Half hitch&lt;br&gt;  o Timber hitch with half-hitch&lt;br&gt;  o Bowline on a bight&lt;br&gt;• Maintenance and storage</td>
</tr>
<tr>
<td>9.</td>
<td>Describe equipment used for rigging</td>
<td>• Come-a-longs&lt;br&gt;• Chain falls and rope falls&lt;br&gt;• Outriggers&lt;br&gt;• Pulley systems&lt;br&gt;• Tuggers</td>
</tr>
</tbody>
</table>
LEARNING TASKS

10. Sling various loads

CONTENT

- Use of hand signals
- Inspection of equipment
- Safety work procedures
Program Content
Level 1

Line (GAC): A USE TOOLS AND EQUIPMENT
Competency: A8 Use sheet metal tools and equipment

Objectives
To be competent in this area the individual must be able to use sheet metal tools and equipment.

LEARNING TASKS

1. Describe types of hand shears
   • Types
     o Straight
     o Combination
     o Circular
     o Double cut
   • Purposes

2. Select and use hand shears
   • Safety
   • Selection of shears for type of material being cut
   • Characteristics of materials to be cut
     o Sheet metal
     o Fabrics for removable pads
     o Lead laminated sheets
     o Mesh and lath
   • Importance of clean cut
   • Supporting material being cut
   • Care and storage

3. Describe types of screwdrivers
   • Types
     o Standard (slot)
     o Phillips
     o Robertson
     o Socket
   • Features
   • Purposes

4. Describe types of screws
   • Types
   • Size
   • Characteristics

5. Select and use screwdrivers
   • Safety
   • Importance of selecting correct type of screwdriver
   • Care and storage
Line (GAC): B  USE SAFE WORK PRACTICES
Competency: B1  Use WorkSafeBC Health and Safety Regulations

Objectives
To be competent in this area the individual must be able to locate and interpret WorkSafeBC Occupational Health and Safety Regulation as it applies to the heat and frost insulator’s workplace.

LEARNING TASKS

1. Locate and interpret WorkSafeBC regulations
   - Employee and employer rights and responsibilities
   - General conditions
   - Chemical and biological substances
   - Substance specific requirements
   - Noise, vibration, radiation and temperature
   - Personal protective clothing and equipment
   - Confined spaces
   - De-energization and lockout
   - Fall protection
   - Tools, machinery and equipment
   - Ladders, scaffolds and temporary work platforms
   - Cranes and hoists
   - Rigging
   - Mobile equipment
   - Transportation of workers
   - Traffic control
   - Electrical safety

2. Follow WHMIS regulations
   - Training requirements
   - Hazardous material classifications
   - Material Safety Data Sheets (MSDS)
   - Symbols
   - Labels
Line (GAC): B USE SAFE WORK PRACTICES
Competency: B2 Identify potential causes of accidents

Objectives
To be competent in this area the individual must be able to identify potential causes of accidents.

LEARNING TASKS

1. Identify potential causes of accidents
   - Horseplay
   - Alcohol
   - Drugs
   - Poor attitude towards safety
   - Improper selection and/or use of tools
   - Excess haste
   - Electrical hazards
   - Fire hazards
   - Sharp objects
   - Insufficient light in work area
   - Poor housekeeping practices
   - Improper training

2. Develop general safety habits for all locations
   - Location of fire escape route
   - Location of fire fighting equipment
   - Safety and information meetings
   - Work permits for hot work
   - Good housekeeping practices
     - Clean work area
     - Removal of debris
     - Proper storage of materials
     - Posting of signs where needed
     - Roping off/barricading where needed
Line (GAC): B  USE SAFE WORK PRACTICES
Competency: B3  Follow safe work procedures for power tools

Objectives
To be competent in this area the individual must be able to follow safe work practices for power tools.

LEARNING TASKS
1. Follow safe work practices when using power tools
   - Inspection of ground wire
   - Proper care and maintenance
   - Awareness of site condition
   - Overcoming torque
   - Personal physical limitations
   - Proper posture

2. Explain the importance of checking pipes before working on them
   - Methods for checking pipes
   - Condition
   - Pressure
   - Temperature
   - Contents
   - Corrosives
   - Method used to fasten pipes
   - Additional weight
   - Additional strain
Line (GAC): B USE SAFE WORK PRACTICES
Competency: B4 Follow lockout/tagout procedures

Objectives
To be competent in this area the individual must be able to understand and follow lockout/tagout procedures.

LEARNING TASKS
1. Follow lockout/tagout procedures

CONTENT
- WorkSafeBC Regulation
- Importance and purpose of tagging out electrical equipment
- Rules for removal of tags
- Results of misuse of tags
- Worker responsibilities
- Removal of locks
Line (GAC): B USE SAFE WORK PRACTICES
Competency: B5 Use personal protective equipment (PPE)

Objectives
To be competent in this area the individual must be able to select and use personal protective equipment.

LEARNING TASKS

1. Use personal protective equipment

   • Hearing protection
   • Safety footwear
   • Eye protection
   • Hard hats
   • Respiratory protection
   • Protective Clothing
   • Fall protection
   • Face shields
   • Hand protection
   • Limitations of PPE

2. Use safety equipment

   • Showers
   • Eye washes
   • Antidotes for gas, acids and chemicals
   • Gloves specific to job
   • Welding screens
   • First aid kit
Line (GAC): B USE SAFE WORK PRACTICES
Competency: B6 Explain adhesive and solvent hazards

Objectives
To be competent in this area the individual must be able to describe the types, uses and hazards of solvents.

LEARNING TASKS
1. Describe the types of solvents and adhesives used in the trade
   - Types
   - Properties
   - Applications

2. Describe the hazards of vapours
   - Fire
   - Explosion
   - Respiratory
   - Skin and eye damage
   - Use in confined spaces
Line (GAC): C SELECT INSULATION MATERIALS
Competency: C1 Select and use insulation materials

Objectives
To be competent in this area the individual must be able to select and use insulation materials for specific to job requirements.

LEARNING TASKS

1. Describe forms of flexible and rigid insulation
   • Block
   • Pipe covering
   • Radius and bevelled segments

2. Describe types of insulation materials
   • Properties
   • Types
     o Calcium silicate
     o Diatomaceous earth
     o Mineral wool
     o Cellular glass
     o Glass fibre
     o Extruded foam plastic
     o Polyurethane
     o Polystyrene

3. Describe types of loose fill insulation materials
   • Health hazards
   • Uses
   • Types
     o Aluminum silicate fibre
     o Perlite
     o Vermiculite
     o Mineral fibres
     o Cellular glass
     o Granular hydro carbons

4. Describe types of spray type insulation materials
   • Health hazards
   • Uses
   • Types
     o Mineral fibre
     o Cellulose
     o Ceramic fibre
     o Chemical component foam
LEARNING TASKS

5. Describe types of poured insulation materials
   - Health hazards
   - Uses
   - Types
     - Polyisocyanurate foam
     - Z-crete
     - Z-crete-splate

6. Select and use insulation material
   - Installation method to be used
   - Object to be insulated
   - Purpose of insulation
Line (GAC): C SELECT INSULATION MATERIALS
Competency: C2 Select and use fasteners and reinforcing materials

Objectives
To be competent in this area the individual must be able to select and use insulation fasteners and reinforcing materials specific to job requirements.

LEARNING TASKS

1. Select fasteners
   - Purposes
   - Materials to be fastened
   - Types
     - Adhesives
     - Band and seals
     - Staples
     - Stick clips
     - Welded pins and studs
     - Tapes
     - Wires
     - Twine
     - Skewers
     - Hog rings

2. Select and use reinforcement materials
   - Purposes
   - Objects to be reinforced
   - Types
     - Corner bead
     - Expanded metal lath
     - Glass fibre cloth
     - Road mesh
     - Check wire
     - Tapes
     - Stainless steel mesh
Line (GAC): C  SELECT INSULATION MATERIALS
Competency: C3  Select and use adhesives, solvents and thinners

Objectives
To be competent in this area the individual must be able to select and use adhesives, solvents and thinners specific to job requirements.

**LEARNING TASKS**

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| 1. Describe adhesives                              | • Safety hazards  
|                                                   | • Properties  
|                                                   | o Resistance to water, acids and chemicals  
|                                                   | o Resistances  
|                                                   | o Flexibility in relation to bonded surfaces  
|                                                   | o Open time  
|                                                   | o Vapour contamination and leaching to food products  
|                                                   | • Types  
|                                                   | o Contact  
|                                                   | o Non-contact  
|                                                   | o Fibrous  
|                                                   | o Lagging  
|                                                   | o Paste  
|                                                   | • Application methods  
|                                                   | o Brush  
|                                                   | o Spray  
|                                                   | o Dauber  
| 2. Explain importance of keeping containers covered | • Tightly closed containers  
|                                                   | • Prevent evaporation of solvents  
|                                                   | • Preventing contamination of environment  
| 3. Explain safety precautions                      | • Manufacturer’s recommendations  
|                                                   | • Material Safety Data Sheets (MSDS)  
|                                                   | • Using personal protective equipment  
|                                                   | o Eye  
|                                                   | o Hand  
|                                                   | o Face  
|                                                   | o Respiratory  
| 4. Describe compatibility factors between material being bonded and adhesives | • Expansion and contraction  
|                                                   | • Electrolytic reaction  
|                                                   | • Chemical reaction  |
### LEARNING TASKS

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<td>5.</td>
<td>Describe solvents</td>
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<tr>
<td>6.</td>
<td>Prepare surfaces for adhesive application</td>
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<td>7.</td>
<td>Select and use adhesives and solvents</td>
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### CONTENT

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<tr>
<td>Properties</td>
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<tr>
<td>Types</td>
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<tr>
<td>Preparation requirements specific to adhesive and surface</td>
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<tr>
<td>Cleaning methods</td>
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<tr>
<td>Surface contaminants</td>
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<tr>
<td>- Oil and grease</td>
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<tr>
<td>- Water, ice or snow</td>
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<tr>
<td>- Dust and dirt</td>
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<tr>
<td>- Paint or mastics</td>
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<tr>
<td>Manufacturer’s recommendations</td>
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<tr>
<td>Adherence to temperature requirements</td>
</tr>
<tr>
<td>Compatibility to surface being bonded</td>
</tr>
<tr>
<td>Job requirements</td>
</tr>
</tbody>
</table>
SELECT INSULATION MATERIALS

Competency: C4 Select and use cements

Objectives
To be competent in this area the individual must be able to select and use various types of cements.

LEARNING TASKS

1. Describe types of cements
   - Finishing
   - Insulating
   - One coat (hydraulic setting)
   - Heat transfer
   - Refractory
   - Aggregate

2. Select and use cement
   - Specific job requirements
   - Manufacturers’ recommendations
   - MSDS
   - Personal protective equipment
Program Content
Level 1

Line (GAC): C SELECT INSULATION MATERIALS
Competency: C5 Select and use tapes, vapour barriers and weather proofing

Objectives
To be competent in this area the individual must be able to select and use various types of tapes, vapour barriers and weather proofing.

LEARNING TASKS

1. Describe vapour barriers
   - Purposes
   - Types
     - Mastic
     - Roofing felt
     - Plastic
     - Metals

2. Create vapour barriers
   - Rolling
   - Brushing
   - Trowelling
   - Spraying

3. Describe metal jacketing/cladding materials
   - Purposes
   - Types
     - Galvanized iron
     - Coated steel jack
     - Stainless steel
     - Aluminum
     - Lead
   - Gauge
   - Expansion and contraction
   - Environmental conditions
   - Compatibility of materials

4. Describe insulation protectors
   - Saddles for pipe hangers
   - Sleeves through walls

5. Use tapes, vapour barriers and weather proofing
   - Manufacturer’s recommendations
   - Specific job requirements
Line (GAC): D APPLY INSULATION
Competency: D1 Apply insulation to pipes, fittings and valves

Objectives
To be competent in this area the individual must be able to apply insulation to pipes.

LEARNING TASKS

1. Describe the application of single layer insulation
   - Application methods
     - Plain
     - Screwed
   - Application to fittings
   - Application to valves

2. Describe the purposes of drawings and specifications
   - Location of insulation
   - Type, size and quantity of materials
   - Purpose of insulation
   - Number of mitres
   - Pipe dimensions
     - Heel
     - Throat
   - Fitting requirements

3. Describe the importance of material’s physical properties
   - Fragility
   - Flexibility
   - Weight
   - Density
   - Ease of cutting and fitting

4. Select and apply insulation to pipes, fittings and valves
   - Safety
     - Ladders and scaffolds
     - PPE
   - Types and hazards of insulation material
     - Fibreglass
     - Calcium silicate
     - Cellular glass
     - Urethane
   - Manufacturer’s recommendations
   - Work procedures
   - Fitting techniques
   - Finishing requirements
   - Avoiding damage to vapour barrier
   - Specific job requirements
LEARNING TASKS

- Housekeeping
  - Avoiding waste
  - Keeping work area clean and tidy

Achievement Criteria

Performance: The individual will apply insulation to pipes, fittings and valves.

Conditions: The individual will be given:
- Tools and equipment
- Materials
- Project specifications

Criteria: The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Accuracy
- Safety
- Use of PPE
- Completed within specified time
Program Content
Level 1

Line (GAC): D APPLY INSULATION
Competency: D2 Apply insulation to duct work and equipment

Objectives
To be competent in this area the individual must be able to apply insulation to duct work and auxiliary equipment.

LEARNING TASKS

1. Describe the application of insulation to duct work and auxiliary equipment
   - Application methods
   - Purposes
   - Materials
     - Fibreglass
     - Rigid board
     - Elastomeric
     - Flexible blankets/batts
   - Mechanical equipment
     - Pumps
     - Fans
     - Boilers
     - Chillers
     - Plumbing systems
   - Mechanical ducting system
     - Supply
     - Return
     - Fresh air
     - Plenum
     - Exhaust
     - Combustion air ducts
   - Existing, renovation and maintenance work

2. Describe the purposes of drawings and specifications
   - Location of insulation
   - Type, size and quantity of materials
   - Purpose of insulation
   - Fitting requirements

3. Describe the importance of material’s physical properties
   - Fragility
   - Flexibility
   - Weight
   - Density
   - Ease of cutting and fitting
LEARNING TASKS

4. Describe safety hazards and precautions
   - Hazard from adhesive vapours
   - Impalement hazard from anchors
   - Use of personal protective equipment
   - Safe use of ladders and scaffolds

5. Select and apply insulation to duct work and equipment
   - Manufacturer’s recommendations
   - Work procedures
   - Fitting techniques
   - Avoiding damage to vapour barrier
   - Specific job requirements
   - Housekeeping
     - Avoiding waste
     - Keeping work area clean and tidy
     - Removal of waste from internal insulated ducts

6. Demonstrate finishing and attachment techniques
   - Fasteners
   - Vapour barriers
     - Tar paper
     - Mastics
     - Reinforced foil flame retardant kraft (RFFRK)
   - Sealing and covering attachment to avoid thermal bridging
   - Use of corner bead to protect or enhance corners

7. Describe the application of lead impregnated jacketing
   - For additional acoustical accomplishments
   - Time required
   - Safety factors
   - Avoidance of waste
   - High cost
   - Extra weight of material
   - Caution when handling membranes of material
Achievement Criteria

Performance  The individual will apply insulation to duct work and equipment.

Conditions  The individual will be given:
Tools and equipment
Materials
Project specifications

Criteria  The individual will score 70% or better on a rating sheet that reflects the following criteria:
Accuracy
Safety
Use of PPE
Completed within specified time
Line (GAC): E USE FIRE STOPPING AND SMOKE SEALING TECHNIQUES
Competency: E1 Describe fire stopping and smoke sealing

Objectives
To be competent in this area the individual must be able to explain the types and uses of fire stopping and smoke sealing.

LEARNING TASKS

1. Explain fire stopping and smoke sealing
   - Importance of fire stopping and smoke sealing
   - Purposes of installations
   - Importance of approved installations in specifications
   - Terms
     - Fire prevention
     - Fire suppressing
     - Smoke sealing
     - Fire protection

2. Describe standards related to fire stopping, smoke seal installations
   - ASTM E84 flame rating
   - ASTM E84 smoke development
   - ASTM E119 floor test and hose stream

3. Describe standards related to fire stopping, smoke seal installations
   - F rating
   - T rating
   - FT rating
   - ULC rating

4. Describe types of fire stopping materials
   - Intumescent
   - Endothermic
   - Silicones
   - Non burnable
   - Grouts
   - Damming materials
   - Self-levelling caulking
   - Firebrick
   - Ceramic cloth
   - Intumescent putty, caulking and strips
Program Content
Level 1

Line (GAC): E USE FIRE STOPPING AND SMOKE SEALING TECHNIQUES
Competency: E2 Describe fire stopping penetrations and applications

Objectives
To be competent in this area the individual must be able to describe fire stopping penetrations and applications.

LEARNING TASKS

1. Describe materials used for fire stopping
   - Boards
   - Fillers
   - Foams
   - Putty
   - Caulk

2. Describe material properties
   - Cure time
   - Flash point
   - Application temperature
   - Shelf life
   - Mixing methods
   - Snap time

3. Describe locations and types of penetrations
   - Fire walls
   - Industrial and commercial buildings
   - Conduits and cable trays
   - Pipe chases and pipe sleeves
   - Ductwork and shafts

4. Describe safety precautions
   - Safety goggles
   - Approved respirator
   - Checking substrate
   - Housekeeping
     - Avoiding waste
     - Keeping work area clean and tidy
   - Checking MSDS
Program Content
Level 1

Line (GAC): E USE FIRE STOPPING AND SMOKE SEALING TECHNIQUES
Competency: E3 Use fire stopping and smoke sealing techniques

Objectives
To be competent in this area the individual must be able to use fire stopping and smoke sealing techniques.

**LEARNING TASKS**

<table>
<thead>
<tr>
<th>Learning Task</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| 1. Describe methods for damming installations | • Preparation of substrate  
• Damming  
• Temporary form installation |
| 2. Calculate material | • Quantities  
• Avoiding waste |
| 3. Describe fireproofing structural components | • Legs on vessels  
• Beams  
• Skirts  
• Hangers |
| 4. Describe fireproofing electrical components | • Cable trays  
• Conduits |
| 5. Select and apply materials | • Materials selection  
• Job specifications  
• Application methods  
  - Liquid by poured  
  - Liquid by pump  
  - Wrap strip (with or without metal cover)  
  - Composite sheet  
  - Fire stopping system  
  - Spray  
    - Operation of equipment used for fire stopping  
    - Equipment maintenance |
| 6. Describe housekeeping procedures | • Removal and repair of fire stopping materials  
• Procedures for removing all forming and masking materials  
• Worksite cleanup and debris removal  
• Tool cleanup and storage |
Achievement Criteria

Performance: Use fire stopping and smoke sealing techniques.

Conditions: The individual will be given:
- Tools and equipment
- Materials
- Project specifications

Criteria: The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Accuracy
- Safety
- Use of PPE
- Completed within specified time
Program Content  
Level 1

Line (GAC): F USE TRADE RELATED MATHEMATICS AND SCIENCE
Competency: F1 Use trade related mathematics

Objectives
To be competent in this area the individual must be able to solve basic trade related math problems.

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
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</thead>
<tbody>
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<td>1. Add, subtract, multiply and divide numbers</td>
<td>• Whole numbers</td>
</tr>
<tr>
<td></td>
<td>• Fractions</td>
</tr>
<tr>
<td></td>
<td>• Decimals</td>
</tr>
<tr>
<td>2. Solve trade related math problems</td>
<td>• Imperial and metric systems</td>
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<td>• Converting numbers</td>
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<td>o Fractions to decimals</td>
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<tr>
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<td>o Decimals to fractions</td>
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<tr>
<td></td>
<td>• Computing square root</td>
</tr>
<tr>
<td></td>
<td>• Use of calculators</td>
</tr>
</tbody>
</table>
Line (GAC): F USE TRADE RELATED MATHEMATICS AND SCIENCE
Competency: F2 Use trade related geometry

Objectives
To be competent in this area the individual must be able to solve trade related geometry problems.

LEARNING TASKS

1. Calculate circumference and perimeter
   - Circles
   - Segments
   - Ellipses
   - Oblongs
   - Cylinders
   - Triangles
   - Squares
   - Rectangles
   - Arcs

2. Calculate area
   - Circles
   - Segments
   - Squares
   - Rectangles
   - Trapezoids
   - Ellipses
   - Spheres
   - Cones
   - Frustums
   - Triangles
   - Pyramids
   - Cylinders

3. Calculate volumes
   - Cylinders
   - Cones
   - Cone frustums
   - Pyramids
   - Pyramid frustums
     - Square, rectangular and triangular based
   - Spheres
   - Cubes
Objectives
To be competent in this area the individual must be able to solve trade related trigonometry problems.

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Explain trigonometry terms</td>
<td>• Pythagorean theorem and the law of right angles</td>
</tr>
<tr>
<td></td>
<td>• Hypotenuse</td>
</tr>
<tr>
<td></td>
<td>• Opposite side</td>
</tr>
<tr>
<td></td>
<td>• Adjacent side</td>
</tr>
<tr>
<td>2. Explain trigonometry functions</td>
<td>• Sine</td>
</tr>
<tr>
<td></td>
<td>• Cosine</td>
</tr>
<tr>
<td></td>
<td>• Tangent</td>
</tr>
<tr>
<td>3. Use trigonometry to solve problems</td>
<td>• Length of the side of a triangle given one angle and the length of one side</td>
</tr>
<tr>
<td></td>
<td>• Rise of an elbow</td>
</tr>
<tr>
<td>4. Describe angular measurement</td>
<td>• Degrees</td>
</tr>
<tr>
<td></td>
<td>• Minutes</td>
</tr>
<tr>
<td></td>
<td>• Seconds</td>
</tr>
</tbody>
</table>
Objectives
To be competent in this area the individual must be able to:
- Use S.I. Units.
- Perform calculations using S.I. units.

LEARNING TASKS

1. Use trade related S.I. units
   - Definitions
   - Derived units
   - Abbreviations
   - Common S.I. multiples and sub-multiples
   - Volume
   - Temperature
   - Symbols
   - Prefixes
   - Derived units with special names
   - Lengths
   - Area
   - Mass
   - Time

2. Describe and calculate using S.I. units
   - Density
   - Thermal conductivity (K-values)
   - Thermal conductance (U-values)
   - Latent heat
   - Sensible heat
   - Power
   - Co-efficient of expansion
   - Thermal resistance (R-value)
   - Specific heat capacity
   - Moisture content
   - Permeability
   - Heat capacity

3. Calculate linear measurement
   - Millimetres (mm)
   - Centimetres (cm)
   - Decimetres (dm)
   - Metres (m)
LEARNING TASKS

4. Calculate areas

5. Calculate volumes

CONTENT

- sq. mm
- sq. cm
- sq. dm
- sq. m
- cu. mm
- cu. cm
- cu. dm
- cu. m
Program Content
Level 1

Line (GAC): F USE TRADE RELATED MATHEMATICS AND SCIENCE
Competency: F9 Use science related to choice of insulation material

Objectives

To be competent in this area the individual must be able to:
• Calculate heat flow.
• Calculate the insulation value of insulation materials.

LEARNING TASKS

1. Describe the properties and sources of materials
   • Metals
   • Glass (foam and fibre)
   • Plastics
   • Cements
   • Mastics
   • Polyurethane

2. Describe matter
   • Matter and molecules
   • Molecular motion
   • Internal energy
   • Effect of heat and cold on the state of matter
   • Total heat
   • Expansion and contraction

3. Describe density
   • Density and specific weight
   • Finding specific weight of solids
   • Finding specific weight of liquids
   • Physical properties of compressive and shear material stresses

4. Perform calculations
   • Heat flow calculations
   • Insulation value of insulation materials

5. Explain the K-factor
   • Definition
   • Relation to insulating value
Level 2

Heat and Frost Insulator
Line (GAC): A USE TOOLS AND EQUIPMENT
Competency: A3 Use fastening tools

Objectives
To be competent in this area the individual must be able to successfully complete the examination to become a qualified powder actuated tool operator.

LEARNING TASKS
1. Describe powder actuated tools
   - Uses
   - Fasteners
   - Loads

2. Use powder actuated tools
   - WorkSafeBC Regulations
   - Operating procedures
   - Manufacturer’s recommendations
Insulator (Heat and Frost) (Heat and Frost Insulator)

Industry Training Authority

01-12

Program Content
Level 2

Line (GAC): A USE TOOLS AND EQUIPMENT
Competency: A8 Use sheet metal tools and equipment

Objectives
To be competent in this area the individual must be able to:
- Describe the uses of sheet metal tools and equipment.
- Demonstrate the safe use of sheet metal tools.

LEARNING TASKS

1. Use squaring shears
   - Safety precautions for operating shears
   - Squaring a sheet
   - Front gauge
   - Back gauge
   - Adjustments
   - Maintenance

2. Describe the uses of roll forming machines
   - Safety precautions for operating rolling machines
   - Solid housing roll forming machine
   - Slip roll forming machine
   - Methods of forming cylindrical objects
   - Methods of forming conical shaped objects
   - Adjustments
   - Maintenance

3. Describe the uses of beading
   - Safety precautions
   - Types and uses
   - Setting and adjusting for intended job requirements
   - Checking for exact roller alignment
   - Maintenance
LEARNING TASKS
4. Describe brakes and folders

CONTENT
- Safety precautions
  - Handling of the machine
  - Mounting
  - Carrying
  - Maintenance
- Types
- Standard hand brake
- Bar folder
- Setting and adjusting procedures
- Allowance and marking for folds on material
- Procedures when folding including safety
- Gauge of the metal
- Good housekeeping
- Avoiding waste
Line (GAC): A USE TOOLS AND EQUIPMENT
Competency: A9 Use layout tools

Objectives
To be competent in this area the individual must be able to use layout tools.

LEARNING TASKS

1. Describe dividers and callipers
   • Types and features
     o Inside
     o Outside
     o Transfer
   • Selection for given job
   • Adjustments

2. Use dividers and callipers in layout procedures
   • Elbows
   • Tee’s and flanges
   • Cones and cylinders
   • Care and storage

3. Use scribers and awls
   • Uses
   • Sharpening
   • Care and storage

4. Describe hand levelling devices
   • Types and uses
     o Spirit
     o Plumb-bob
     o Chalk line
     o Straight edge

5. Use hand levelling devices
   • Procedures for levelling
   • Care and storage
### Program Content
Level 2

**Line (GAC):** C  SELECT INSULATION MATERIALS

**Competency:** C4  Select and use cements

### Objectives
To be competent in this area the individual must be able to:
- Apply insulation cement to various substrates.
- Apply finishing cement to various substrates.

### LEARNING TASKS

<table>
<thead>
<tr>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Interpret specifications</td>
</tr>
<tr>
<td>2. Describe mixing procedures</td>
</tr>
<tr>
<td>3. Describe insulating cements</td>
</tr>
<tr>
<td>4. Describe cement additives</td>
</tr>
<tr>
<td>5. Describe mixing considerations</td>
</tr>
<tr>
<td>6. Describe the application of reinforcements</td>
</tr>
</tbody>
</table>

#### 1. Interpret specifications
- Thickness
- Number of coats required
- Type of finish required

#### 2. Describe mixing procedures
- Safety
- Manufacturer’s recommendations

#### 3. Describe insulating cements
- Purposes
- Types
  - Thermokote (MW)
  - Mineral fibre type
  - Plastic cement with various binders

#### 4. Describe cement additives
- Purposes
- Types
  - Portland cement
  - Plaster of Paris
  - Latex
  - Adhesives

#### 5. Describe mixing considerations
- Importance of correct mixing procedures
- Proportion of water mix
- Effects of freezing of wet cement
- Chemical reaction
- Allowance for shrinkage
- Sufficient drying time between coats

#### 6. Describe the application of reinforcements
- Application methods
- Types
  - Wire mesh (diament)
  - Poultry mesh
  - Metal lath
  - Fabric (textile)
<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| 7. Apply insulation cement to various substrates | • Safety precautions  
• Manufacturer’s recommendations  
• Mixing  
• PPE  
• Housekeeping procedures  
• Making  
• Cleanup  
• Mixing correct amount  
• Cleanup of mixing equipment |
| 8. Select finishing cement | • Factors in selecting a finish  
• Specification requirements  
• Appearance  
• Environment  
• Exposure to damage |
| 9. Apply finishing cement to various substrates | • Safety precautions  
• Additives  
• Mixing procedures  
• Curing time  
• Application to substrates  
  o Very hot  
  o Wet  
  o Very dry  
  o Cold  
  o Very porous |

**Achievement Criteria**

**Performance**  
The individual will apply finishing cement to various substrates.

**Conditions**  
The individual will be given:  
Tools and equipment  
Materials  
Project specifications

**Criteria**  
The individual will score 70% or better on a rating sheet that reflects the following criteria:  
Accuracy  
Safety  
Use of PPE  
Completed within specified time
Line (GAC): D APPLY INSULATION  
Competency: D3 Interpret specifications and drawings for choice of materials

Objectives
To be competent in this area the individual must be able to select insulation materials by interpreting specifications and drawings.

LEARNING TASKS
1. Interpret drawings and specifications
   - Location of parts to be insulated
   - Type, size and quantity of material
   - Purpose of insulation
   - Type of required finish
   - Application procedures

2. Describe the physical properties of insulation materials
   - Fragility
   - Flexibility
   - Weight
   - Density
   - Ease of cutting and fabricating
Program Content
Level 2

Line (GAC): D APPLY INSULATION
Competency: D4 Fabricate materials

Objectives
To be competent in this area the individual must be able to fabricate and attach insulation.

LEARNING TASKS

1. Demonstrate techniques for fabricating and attaching insulation
   - Safety
   - Finishing required
   - Use and lay out of materials to avoid waste
   - Good housekeeping
   - Reasons and methods for using expansion bands or strapping
   - Importance of determining substrate temperature
   - Fabrication tools

2. Describe application techniques
   - Flanges and support rings
   - Skirts and expansion joints
   - Man holes and gauge glasses
   - Pressure gauges, name plates and unions

Achievement Criteria
Performance The individual will fabricate and attach insulation.
Conditions Drawings
Tools and equipment
Materials
Project specifications
Criteria Safety
Accuracy
Completed within specified time
Program Content
Level 2

Line (GAC): D APPLY INSULATION
Competency: D6 Apply low temperature insulation systems

Objectives
To be competent in this area the individual must be able to explain the application of low temperature insulation systems.

LEARNING TASKS

1. Describe the application of low temperature single layer and multi-layer insulation

   - Pipes
   - Fittings
   - Valves
   - Contraction joint designs
   - Installation techniques on cold systems
   - Importance of staggering successive joints
     - Longitudinal
     - Circumferential

2. Describe the elimination of thermal bridging

   - Hangers
   - Anchors
   - Brackets
   - Vessel and insulation support rings

3. Describe application procedures

   - Safety considerations
   - PPE
   - Support ring installation to absorb extra weight
   - Filling of all voids
   - Vapour sealing all joints
   - Avoiding cold spots on insulated surface
   - Avoiding damage to vapour barrier when jacketing
   - Good housekeeping

Achievement Criteria:

Performance The individual will fabricate and attach various types or insulation for a low temperature system.

Conditions The individual will be given:
Tools and equipment
Materials
Project specifications

Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:
Accuracy
Safety
Use of PPE
Completed within specified time
Line (GAC): D  APPLY INSULATION

Competency: D7  Apply high temperature insulation systems

Objectives
To be competent in this area the individual must be able to explain the application of high temperature insulation systems.

LEARNING TASKS

1. Describe the application procedures for high temperature piping systems in single and multi-layer insulation
   - Safety considerations when working on high temperature systems
   - PPE
   - Importance of designs and techniques of expansion joints
   - Importance of staggering successive joints
     o Longitudinal
     o Circumferential
   - Importance of avoiding hot spots with regards to safety and damage to jackets
   - Insulation fasteners
   - Insulation support rings
   - Housekeeping

2. Describe the elimination of thermal bridging
   - Hangers
   - Anchors
   - Brackets
   - Sleeve
   - Expansion joints
Program Content
Level 2

Line (GAC): F USE TRADE RELATED MATHEMATICS AND SCIENCE
Competency: F3 Use trade related trigonometry

Objectives
To be competent in this area the individual must be able to calculate areas of various geometric shapes.

LEARNING TASKS

1. Describe methods of angular calculations
   - Lengths of triangle sides
   - Angles of a triangle
   - Perimeter of a triangle
   - Use of right angle
   - Common units of measurements

2. Calculate areas of various geometric shapes
   - Squares and rectangles
   - Triangles
   - Trapezoids
   - Circles
   - Spheres
   - Pyramids
   - Cones
   - Frustums
   - Sectors
   - Common units of measurements
     o Layout procedures
     o Quantity surveys

3. Use trigonometry to calculate part sizes
   - Elbows
   - Cones
   - Cone frustums
   - Cyclones
   - Angular valve bonnets
   - Bevels
Program Content
Level 2

Line (GAC):       F    USE TRADE RELATED MATHEMATICS AND SCIENCE
Competency:       F5    Describe the fundamentals of Ohms Law

Objectives
To be competent in this area the individual must be able to describe the fundamentals of Ohms Law.

LEARNING TASKS

1. Describe the fundamentals of Ohms Law

   CONTENT
   • Voltage
   • Resistance
   • Amperage
   • Polarity
Objectives
To be competent in this area the individual must be able to describe the methods of heat transfer.

LEARNING TASKS
1. Describe the heating and cooling of metals

CONTENT
- Methods of heat transfer
  - Conduction
  - Convection
  - Radiation
Line (GAC): F USE TRADE RELATED MATHEMATICS AND SCIENCE
Competency: F7 Use trade related heat calculations

Objectives
To be competent in this area the individual must be able to describe methods of measuring temperature.

LEARNING TASKS
1. Describe methods of measuring temperature
   - Celsius
   - Kelvin
   - Rankin
Program Content
Level 2

Line (GAC): F USE TRADE RELATED MATHEMATICS AND SCIENCE
Competency: F8 Describe types of corrosion

Objectives
To be competent in this area the individual must be able to describe types of corrosion.

LEARNING TASKS

1. Describe types and forms of corrosion

CONTENT
- Atmospheric
- Electrolytic and galvanic
- Chemical
Line (GAC): F USE TRADE RELATED MATHEMATICS AND SCIENCE
Competency: F9 Use science related to choice of insulation material

Objectives
To be competent in this area the individual must be able to select insulation materials.

LEARNING TASKS

1. Describe types of insulation
   - Metals
   - Glass (fibres)
   - Plastic (jacketing, extruded foam)
   - Cements
   - Mastics
   - Polyurethane

2. Describe properties of insulation materials
   - Abrasion resistance
   - Alkalinity or acidity
   - Breaking load
   - Capillarity
   - Chemical reactions
   - Coefficient of expansion
   - Combustibility
   - Flash point
   - Burning rate
   - Rate of flame travel
   - Smoke index
   - Melting point
   - Density
   - Alkalinity and acid resistance
   - Shrinkage
   - Specific gravity
   - Specific heat
   - Thermal conductivity
   - Thermal expansion
   - Vapour migration
   - Water absorption
   - Adhesion
   - Compaction and recovery
LEARNING TASKS

3. Select insulation supports and fasteners

4. Describe methods for calculating humidity

CONTENT

- Strength of materials
- Type of thread
- Corrosion factor
- Dissimilar metals

- Importance of considering humidity
- Wet bulb temperature
- Dry bulb temperature
- Relation between wet and dry bulb temperature
- Temperature of substrate
Line (GAC): G USE DRAFTING AND LAYOUT TECHNIQUES
Competency: G1 Lay out geometric shapes

Objectives
To be competent in this area the individual must be able to lay out geometric shapes.

LEARNING TASKS

1. Describe lines, lettering and layout of various geometric shapes
   - Angles
   - Triangles
   - Squares
   - Circles
   - Ovals
   - Ellipses
   - Tapers

2. Use layout tools
   - T-squares
   - Set squares
   - 45°, 30° and 60° angles
   - Scale rulers
   - Compass sets
   - Splines
   - French curves
   - Pencils and drafting pens
Line (GAC): G USE DRAFTING AND LAYOUT TECHNIQUES
Competency: G2 Use lines and symbols

Objectives
To be competent in this area the individual must be able to demonstrate the use of various line developments.

LEARNING TASKS
1. Describe line developments
   - Straight line
   - Parallel line
   - Radial line
   - Triangulation

2. Demonstrate the use of line developments
   - Simple layout
   - Seam allowance
   - Edge allowance
Objectives
To be competent in this area the individual must be able to:
- Develop patterns for elbows.
- Lay out elbows.

**LEARNING TASKS**

<table>
<thead>
<tr>
<th>Task</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demonstrate techniques used to develop patterns for elbows</td>
<td>- 45° elbow miter development</td>
</tr>
<tr>
<td></td>
<td>- Elbow pattern development</td>
</tr>
<tr>
<td></td>
<td>- Use of the elbow rule to lay out multi-piece 90° elbows</td>
</tr>
<tr>
<td>2. Describe the types of patterns used</td>
<td>- Dependant on amount of elbows required</td>
</tr>
<tr>
<td>3. Lay out elbows</td>
<td>- Hems</td>
</tr>
<tr>
<td></td>
<td>- Lap</td>
</tr>
<tr>
<td></td>
<td>- Bead</td>
</tr>
<tr>
<td></td>
<td>- Crimping</td>
</tr>
</tbody>
</table>

**Achievement Criteria**

<table>
<thead>
<tr>
<th>Performance</th>
<th>The individual will lay out a multi-gore elbow.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditions</td>
<td>Drawings</td>
</tr>
<tr>
<td></td>
<td>Tools and equipment</td>
</tr>
<tr>
<td></td>
<td>Materials</td>
</tr>
<tr>
<td></td>
<td>Project specifications</td>
</tr>
<tr>
<td>Criteria</td>
<td>Accuracy</td>
</tr>
<tr>
<td></td>
<td>Completed within specified time</td>
</tr>
</tbody>
</table>
Line (GAC): G USE DRAFTING AND LAYOUT TECHNIQUES
Competency: G4 Lay out tees and equipment

Objectives
To be competent in this area the individual must be able to lay out tees and equipment.

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describe methods of obtaining a</td>
<td>● 45°</td>
</tr>
<tr>
<td>mitre line for drawing an equal</td>
<td>● 90°</td>
</tr>
<tr>
<td>tee</td>
<td></td>
</tr>
<tr>
<td>2. Draw the stretchout and pattern</td>
<td>● Tabs</td>
</tr>
<tr>
<td>for an equal tee</td>
<td>● Bead</td>
</tr>
<tr>
<td></td>
<td>● Lap</td>
</tr>
<tr>
<td></td>
<td>● Hem</td>
</tr>
<tr>
<td></td>
<td>● End caps</td>
</tr>
<tr>
<td>3. Obtain mitre lines for an unequal</td>
<td>● 45°</td>
</tr>
<tr>
<td>tee</td>
<td>● 90°</td>
</tr>
<tr>
<td>4. Lay out the stretchout for an</td>
<td>● Tabs</td>
</tr>
<tr>
<td>unequal tee</td>
<td>● Bead</td>
</tr>
<tr>
<td></td>
<td>● Lap</td>
</tr>
<tr>
<td></td>
<td>● Hem</td>
</tr>
<tr>
<td></td>
<td>● End caps</td>
</tr>
<tr>
<td></td>
<td>Creating a template</td>
</tr>
</tbody>
</table>

Achievement Criteria
Performance The individual will lay out and fabricate an unequal tee.
Conditions Drawings
Tools and equipment
Materials
Project specifications
Criteria Accuracy
Completed within specified time
Line (GAC):  H    READ BLUEPRINTS AND SPECIFICATIONS
Competency:  H1  Describe blueprint lines, abbreviations and symbols

Objectives
To be competent in this area the individual must be able to:
• Describe the types and meaning of symbols and abbreviations used on blueprints.
• Describe and identify lines used on blueprints.

LEARNING TASKS
1. Describe the types and meanings of symbols and abbreviations used on blueprints
   • Architectural
   • Mechanical
   • Duct work
   • Plumbing and heating
   • Refrigeration
   • Electrical

2. Describe and identify lines used on blueprints
   • Visible
   • Hidden edge
   • Extension
   • Dimension
   • Centre
   • Log and short break
   • Leader
   • Cutting plane
   • Phantom
Line (GAC):  H  READ BLUEPRINTS AND SPECIFICATIONS  
Competency:  H2  Describe sectional and projection views 

Objectives  
To be competent in this area the individual must be able to describe the purpose of sectional views.

LEARNING TASKS  
1. Describe the purpose of sectional views  
   - Large scale detail interpretations  
   - Cutting planes  
   - Section lining  

2. Describe projections used in blueprint reading  
   - Types  
   - Uses
Line (GAC): H READ BLUEPRINTS AND SPECIFICATIONS
Competency: H3 Sketch pictorial drawings

Objectives
To be competent in this area the individual must be able to sketch various pictorial drawings from a given view.

LEARNING TASKS

1. Describe and sketch orthographics
   - Top projection
   - Front projection
   - Side or end projection
   - Use of metric and Imperial scale rulers

2. Describe the use of pictorial drawings
   - Oblique
   - Isometric
   - Perspective
   - Orthographic

3. Sketch various pictorial drawings from a given view
   - Isometric drawings from an orthographic
   - Orthographic drawing from an isometric projection

4. Use elevation drawings
   - Number and height of floors
   - Roof height and shape
   - Elevation of pipes, ducts and equipment in relation to floor level
   - Difference of directional view (north, south, east and west)

5. Describe scale relationship between elevation and floor plan
   - Shape of building
   - Arrangement of rooms
   - Shape and size of rooms
   - Location and size of elevators, stairs and hallways
   - Location, shape and size of mechanical equipment

6. Read and quality survey various blueprints and specifications
   - Architectural
   - Mechanical
   - Plumbing
   - Identification of insulation termination points for various systems
Achievement Criteria

Performance  The individual will sketch various pictorial drawings from a given view.

Conditions  Tools and equipment
            Materials
            Project specifications

Criteria  Accuracy
            Completed within specified time
Objectives
To be competent in this area the individual must be able to:
- Explain abatement considerations.
- Describe control options.

LEARNING TASKS

1. Explain asbestos abatement considerations
   - Asbestos products
   - Hazard considerations
   - Assessment of risk
   - Regulations
   - Specifications
   - Inspection
   - Sampling tools
   - Analysis
   - Personal protective equipment
   - Air monitoring
   - Control options
   - Temporary control of asbestos fibres
   - Equipment and materials
   - Tools and equipment required
   - Disposal of waste material

2. Describe control options and their advantages and disadvantages
   - Removal
   - Encapsulation
   - Enclosure
   - Management and surveillance
   - Deferred action

3. Describe regulations and standards regarding asbestos fibres
   - WorkSafeBC
   - Health and Welfare Canada
   - Environments Protection Branch
   - Ministry of labour, British Columbia
   - Fibre exposure limits
   - Maximum allowable concentrations of fibres
   - Disposal of asbestos fibres
   - Air sampling
   - Asbestos material samples
Line (GAC): I USE ASBESTOS ABATEMENT PROCEDURES
Competency: I2 Use personal protective equipment

Objectives
To be competent in this area the individual must be able to select and use appropriate personal protective equipment.

LEARNING TASKS

1. Demonstrate the use of personal protective equipment for asbestos removal
   - Respiratory Protection
     - Supplied air
     - Self contained breathing apparatus
     - Air purifying equipment
     - Powered air purifying equipment
     - Face masks and filters
   - Disposable coveralls, boots and gloves
   - Decontamination procedure

2. Maintain personal protective equipment
   - Cleaning
   - Inspection
   - Storage
Line (GAC): I USE ASBESTOS ABATEMENT PROCEDURES
Competency: I3 Remove asbestos

Objectives
To be competent in this area the individual must be able to follow asbestos removal procedures.

LEARNING TASKS

1. Describe considerations for asbestos removal
   - Tools and equipment
   - Collection, storage and disposal of asbestos
   - Amended water

2. Follow asbestos removal procedures
   - Setting up enclosure
   - High Efficiency Particulate Air (HEPA) vacuum
   - Negative air machines
   - Personal protective equipment
   - Safe work procedures
   - Work area entry and exit
   - Removal of enclosure

Achievement Criteria

Performance The individual demonstrate asbestos removal procedures.
Conditions Tools and equipment
Materials
Project specifications
Criteria Accuracy
Following safe work procedures
Line (GAC):  I  USE ASBESTOS ABATEMENT PROCEDURES
Competency:  I4  Encapsulate or enclose asbestos materials

Objectives
To be competent in this area the individual must be able to:
- Set up enclosures for encapsulation procedures.
- Use encapsulation procedures.

LEARNING TASKS

1. Encapsulate asbestos materials
- Use of penetrating sealants
- Use of bridging sealants
- Effect of sealants on fire ratings
- Safe work procedures

2. Use enclosures for the covering of pipe and block insulation containing asbestos
- Mastics
- Canvas
- Metal
- Vinyl covering
- Safe work procedures
Level 3

Heat and Frost Insulator
# Program Content

**Level 3**

**Line (GAC):** D APPLY INSULATION  
**Competency:** D6 Apply low temperature insulation systems

## Objectives
To be competent in this area the individual must be able to:
- Interpret drawings and specifications for low temperature insulation systems.
- Fabricate and attach various types on insulation.

## LEARNING TASKS

<table>
<thead>
<tr>
<th>CONTENT</th>
<th>LEARNING TASKS</th>
</tr>
</thead>
</table>
| 1. Describe the purposes of insulation of low temperature equipment | • Pumps  
• Vessels  
• Tanks  
• Chillers |
| 2. Interpret drawings and specifications | • Location of insulation  
• Operating temperature of equipment  
• Type, size and quantity of insulation  
• Purpose of insulation  
• Fitting requirements |
| 3. Describe the materials’ physical properties | • Fragility  
• Flexibility  
• Weight  
• Density  
• Ease of cutting and fitting |
| 4. Fabricate and attach various types of insulation | • Safety requirements  
• Vapour sealing of all joints  
• Filling voids  
• Staggering joints of multi-layer application  
• Eliminating thermal bridging on support rings, brackets and hangers  
• Chemical reaction of mastic or caulking on insulation  
• Finishing requirements  
• Avoiding material waste  
• High cost of material  
• Contraction joints  
• Safety requirements  
• Good housekeeping  
  o Proper clean up  
  o Storage of materials |
Achievement Criteria

Performance  The individual will fabricate and attach various types or insulation for a low temperature system.

Conditions  The individual will be given:
Tools and equipment
Materials
Project specifications

Criteria  The individual will score 70% or better on a rating sheet that reflects the following criteria:
Accuracy
Safety
Use of PPE
Completed within specified time
Line (GAC): D APPLY INSULATION
Competency: D7 Apply high temperature insulation systems

Objectives
To be competent in this area the individual must be able to:
- Interpret drawings and specifications for high temperature insulations systems.
- Fabricate and attach various types on insulation.

LEARNING TASKS

1. Describe the purposes of insulation on high temperature equipment

   - Pumps
   - Vessels
   - Turbines
   - Breechings

2. Interpret drawings and specifications

   - Location of insulation
   - Operating temperature of equipment
   - Type, size and quantity of insulation
   - Purpose of insulation
   - Fitting and placement requirement

3. Describe the material's physical properties

   - Fragility
   - Flexibility
   - Weight and density
   - Ease of cutting and fitting

4. Fabricate and attach various types of insulation

   - Safety requirements
   - Providing air space when required
   - Ribbed lath
   - Spacers and lath
   - Welded channels
   - Rod mesh
   - Staggering of joints
   - Filling voids
   - Avoiding hot spots
   - Avoiding thermal bridging at supports, brackets and hangers
   - Material cost
   - Avoiding waste
   - Care of tools
   - Housekeeping
     - Clean up
     - Storage of material
Achievement Criteria

Performance  The individual will fabricate and attach various types of insulation for a high temperature system.

Conditions  The individual will be given:
Tools and equipment
Materials
Project specifications

Criteria  The individual will score 70% or better on a rating sheet that reflects the following criteria:
Accuracy
Safety
Use of PPE
Completed within specified time
**Line (GAC):** D  APPLY INSULATION  
**Competency:** D8  Use finishing techniques

**Objectives**  
To be competent in this area the individual must be able to:  
- Finish using various methods, techniques and fabrics for finishing.  
- Apply fabric to surfaces.  
- Use various tools and techniques for applying mastics.

**LEARNING TASK** | **CONTENT**  
--- | ---  
1. Demonstrate methods and techniques for finishing with various fabrics  
   - Cutting  
   - Tearing  
   - Sewing  
2. Demonstrate techniques for attaching fabrics  
   - Adhering  
   - Sewing  
   - Stapling  
   - Taping  
3. Apply fabric to surfaces  
   - Safety considerations  
     - Toxic effects of chemical adhesives  
     - Personal protective equipment  
   - Mixing of adhesive compounds  
   - Effects of shrinkage during and after application  
   - Correct sewing techniques  
   - Adequate overlap  
   - Care of tools  
4. Interpret specifications for applying mastic finishes  
   - Condition of substrate  
   - Type of mastic required  
   - Method of application  
5. Describe the work environment  
   - Ambient temperature  
   - Surface temperature  
   - Atmospheric condition  
   - Masking off of work area  
   - Work gear and tools  
   - Safety and environments
LEARNING TASK

6. Describe the types and functions of membranes and reinforcements used with mastic finishes

7. Use various tools and techniques for applying mastic finishes

8. Describe factors and effects when applying mastics

9. Describe methods of applying metal and plastic finishes

10. Describe the type, purpose and characteristics of finishes

CONTENT

- Glassfab
- Glass cloth
- Wire netting
- Metal lath
- Brushes
- Trowels (flat and pointing)
- Spray
- Gloves
- Improperly dried or cured insulation surface
- Number of coats required
- Expansion or contraction of substrate
- Toxic effects on chemically or solvent based mastics
- Cleanliness of tools and work area
- Shrinkage of material
- Fire hazard
- Good housekeeping
- Interpretation of specification
- Type of finish required
- Method of application
- Galvanized iron
- Aluminum
- Stainless steel
- Plastic
- Canvas
- Cement
- Lagging

Achievement Criteria

Performance The individual will apply fabric and/or mastics to various substrates.

Conditions The individual will be given:
Tools and equipment
Materials
Project specifications

Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:
Accuracy
Safety
Use of PPE
Completed within specified time
Objectives
To be competent in this area the individual must be able to:
• Select and apply metal and plastic jacketing.
• Demonstrate methods caulking and sealing procedures.

Learning Task
1. Describe factors to be considered in the selection and application of finishes
   • Environmental conditions
   • Durability and appearance
   • Characteristics and shape of surface
   • Co-efficient of expansion
   • Cost versus return on investment
   • Permanency of job requirement

2. Apply and attach metal and plastic finishes
   • Attaching methods
     o Bands and tapes
     o Threaded fasteners
     o Rivets and staples
     o Mechanical locks
     o Adhesives
     o Combined attachments
     o Self-sealing PVC jacketing
   • Cutting, starting and fitting of materials
   • Safe handling of sheet metal
   • Spacing and location of anchors and attachments
   • Caulking and sealing procedures
   • Methods of mixing and using “S” clips
   • Joint concealment

Achievement Criteria
Performance
The individual will apply metal and/or plastic jacketing.

Conditions
The individual will be given:
Tools and equipment
Materials
Project specifications

Criteria
The individual will score 70% or better on a rating sheet that reflects the following criteria:
Accuracy
Safety
Use of PPE
Completed within specified time
Line (GAC): D APPLY INSULATION
Competency: D10 Apply caulking

Objectives
To be competent in this area the individual must be able to select and use caulking tools and materials.

LEARNING TASKS

1. Select caulking guns
   - Types and features
   - Bulk loaded
   - Cartridge loaded

2. Select type of nozzle to be used for finish required
   - Type of bead required
   - Size of opening to be sealed
   - Location of work area

3. Select the type of sealant to be used
   - Job requirements
   - Application to various substrates
     - Cladding
     - Foam glass
     - Polyvinyl chloride (PVC)
   - Material requirements
   - Manufacturer's specifications

4. Apply caulking
   - Procedures for loading gun
   - Safety precautions
     - Personal protective equipment
     - Working in confined spaces
   - Cleaning and storage of guns and other caulking equipment

Achievement Criteria

Performance
The individual will select apply caulking.

Conditions
The individual will be given:
Tools and equipment
Materials
Project specifications

Criteria
The individual will score 70% or better on a rating sheet that reflects the following criteria:
Accuracy
Safety
Use of PPE
Completed within specified time
Line (GAC): D APPLY INSULATION
Competency: D11 Describe underground installation of insulation

Objectives
To be competent in this area the individual must be able to:
• Describe underground installation of insulation.
• Interpret specifications.

LEARNING TASKS

1. Check site before insulating underground with granular hydrocarbons
   • Pipe anchors
   • Guides and supports of pipes
   • Foundation of trench
   • Water in trench

2. Interpret specifications
   • Thickness of material
   • Type of material
   • Grade of material

3. Describe the application procedures
   • Sufficient clearance for full thickness
   • Trench free of water and debris
   • Methods for erecting forms
   • Installation of proper backfill forms
   • Polyethylene film applied to forms
   • Clearance for expansion loops
   • Operating vibrating equipment
   • Tamping to achieve correct density
   • Caulking at wall sleeves
   • Filling trench with pour-in-place insulation
   • Protecting work from inclement weather
   • Form removal
   • Backfilling for protection

4. Explain safety hazards and precautions
   • Stability of trench wall
   • Protective masks and gloves
   • Fire hazard from dust
Line (GAC): D APPLY INSULATION
Competency: D12 Apply insulation to heat traced systems

Objectives
To be competent in this area the individual must be able to:
- Apply insulation over heat traced piping and equipment.
- Apply heat transfer cement.

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Apply insulation over heat traced piping and</td>
<td>• Types of systems</td>
</tr>
<tr>
<td>equipment</td>
<td>o Steam</td>
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<td></td>
<td>o Electric</td>
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<td>• Application methods</td>
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<td>• Application of insulation to allow for air</td>
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<td>circulation</td>
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<td>• Bridging over bolts at joints of insulation</td>
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<td></td>
<td>• Checking to have tracer as close as</td>
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<td></td>
<td>possible to substrate</td>
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<tr>
<td>2. Apply heat transfer cement</td>
<td>• Applying channels or corner angles</td>
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<tr>
<td></td>
<td>• Reading of manufacturer's instructions</td>
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<td>• Correct mixing procedures</td>
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<td>• Correct trowelling techniques</td>
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<td>• Set-up time of material</td>
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<td>• Curing time of material</td>
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<td>3. Follow all safety guidelines</td>
<td>• Good housekeeping procedures</td>
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<td></td>
<td>• Avoiding material waste</td>
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<td></td>
<td>• Cleaning tools and equipment</td>
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<td>• Personal protective equipment</td>
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<td>• Reading labels on product</td>
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<td>• Avoiding eye contact</td>
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<td>• Protection from burns if tracer is in</td>
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<td></td>
<td>operation</td>
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</tbody>
</table>
Achievement Criteria

Performance  The individual will apply insulation over heat traced piping and equipment and apply heat transfer cement.

Conditions  The individual will be given:
Tools and equipment
Materials
Project specifications

Criteria  The individual will score 70% or better on a rating sheet that reflects the following criteria:
Accuracy
Safety
Use of PPE
Completed within specified time
Line (GAC): D APPLY INSULATION
Competency: D13 Use insulation spray methods

Objectives
To be competent in this area the individual must be able to use insulation spray methods.

LEARNING TASKS

1. Describe the equipment used for spraying insulation
   - Air spray systems
   - Airless spray systems
   - Guns
   - Hoses
   - Heaters
   - Pumps
   - Compressors
   - Mixers
   - Hoppers
   - Air blowers for ventilation

2. Install reinforcing material for spraying
   - Layout of anchors
   - Fastening and securing anchors
   - Attaching reinforcing materials to anchors

3. Use of personal safety equipment and clothing
   - Masks and face shields
   - Clothing
   - Goggles
   - Gloves

4. Describe safety aspects and protection of the environment
   - Local combustion
   - Atmospheric contamination
   - Existing facilities, existing machines
   - Work area and other workers
   - Electrical
   - Electrical circuits
   - Scaffolding, guard rails, ladders
   - Barriers, signs and warning tape
   - Manufacturer's specifications
   - Directives and manuals in the application of spray materials
   - Combustion of product
   - Equipment pressures
   - Monitoring air quality
   - Proper storage of product
## LEARNING TASKS

### CONTENT

- Temperature of substrate
- Ambient air (humidity and temperature)

### 5. Describe the types and characteristics of spray materials

#### CONTENT

- Foams
- Primers
- Coatings
- Mastics
- Fibres
- Solvents
- Sealers
- Cleaners
- Adhesives
- Urethanes
- Cellulose fibres
- Insulation values

### 6. Interpret drawings and specifications

#### CONTENT

- Type of material
- Material thickness
- Density of material
- Type of finish required
- Method of applications
- Schedules, start and finish time tables
- Extent of scaffolds and crew required
- Ease or difficulty of the project

### 7. Prepare surfaces to be sprayed and adjacent areas

#### CONTENT

- Protection of equipment and facilities
- Masking and taping of adjacent areas
- Cleanliness and texture of substrate
- Cleaning materials
  - Tri-sodium phosphate (TSP)
  - Solvents
- Priming surface where necessary

### 8. Prepare work area

#### CONTENT

- Mixing facilities
- Availability of air, heat, ventilation and water
- Electrical supply
- Isolating work area including signs
## LEARNING TASKS

### CONTENT

<table>
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<tr>
<th>Task</th>
<th>Detailed Content</th>
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<td>9. Describe methods of application for various materials</td>
<td>- Mastics</td>
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<td>- Adhesives</td>
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<td>- Sealers</td>
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<td>- Coatings</td>
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<td></td>
<td>- Fibres</td>
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<td>- Considerations to follow when spraying</td>
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<td>- Knocking down/tamping</td>
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<td>10. Describe shut down procedures for spray equipment</td>
<td>- Cleaning, servicing and maintenance</td>
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<td>- Turning off all power and pumps</td>
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<td>- Clean up of work area</td>
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<td>- Storage of guns, hoses and equipment</td>
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<td>- Storage of materials</td>
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<td>11. Describe considerations to follow when spraying</td>
<td>- Environmental</td>
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<td></td>
<td>- Drying between coats</td>
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<td>- Number of coats</td>
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<td>- Curing time of material</td>
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<td>- Textures of sprayed surface</td>
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<td>- Shrinkage of sprayed materials</td>
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<td>- Weight of material</td>
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<td>12. Describe troubleshooting procedures for equipment and components</td>
<td>- Hoses and guns</td>
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<td>- Motors</td>
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<td>- Blowers</td>
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<td>- Nozzles</td>
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<td>- Filters</td>
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<td>- Compressors</td>
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<td>- Interrupted material supply</td>
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<td>- Power failures</td>
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<td>- Plugged hoses and nozzles</td>
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<td>- Poor application pattern</td>
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<td>- Damaged tips</td>
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<td>13. Describe correct housekeeping procedures</td>
<td>- Clean up and storage of spray equipment</td>
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<td></td>
<td>- Clean up and removal of debris from worksite</td>
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<td></td>
<td>- Masking materials, dismantling and removal</td>
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<td></td>
<td>- Protective gear and machines</td>
</tr>
</tbody>
</table>

Insulator (Heat and Frost) (Heat and Frost Insulator) Industry Training Authority
Line (GAC):  F  USE TRADE RELATED MATHEMATICS AND SCIENCE
Competency:  F7  Use trade related heat calculations

Objectives
To be competent in this area the individual must be able to perform trade related heat calculations.

LEARNING TASKS

1. Define terms used in heat calculations
   - Specific heat
   - Sensible heat
   - Latent heat of fusion
   - Latent heat of vapourization

2. Use trade related terms
   - Specific heat of ice, water and steam
   - Vapourization and fusion temperatures of water
   - Latent heat of vapourization of water

3. Use trade related heat calculations
   - BTUs involved in heating or cooling of a substance
   - Heating areas on boilers
   - BTUs necessary for boiler size
Line (GAC): G USE DRAFTING AND LAYOUT TECHNIQUES
Competency: G5 Develop drawings and patterns

Objectives
To be competent in this area the individual must be able to develop drawings and patterns.

LEARNING TASKS

1. Demonstrate techniques used for developing drawings and patterns
   - Freehand drawing
   - Actual shop drawings

2. Develop patterns for jacketing
   - Flange covers
   - Valve and bonnet covers
   - Cyclones
   - Frustums
   - Tees and laterals
   - Elbows

3. Select type of development required
   - Parallel line
   - Radial line
   - Triangulation
   - Rollation
   - Trimulation

4. Explain other considerations for developing drawings and patterns
   - Allowance for seams and edges
   - Elbow rule
   - Correction for growth on elbows
   - Location of mitre line

5. Describe the development of square, circular and triangular prism patterns
   - Calculation of circumference
   - Calculation of area
   - Pattern development
Line (GAC): G USE DRAFTING AND LAYOUT TECHNIQUES
Competency: G6 Lay out removable insulation covers

Objectives
To be competent in this area the individual must be able to:
- Lay out removable insulation covers.
- Bend and form sheet metal manually.

LEARNING TASKS

1. Describe considerations for laying out removable insulation covers
   - Use of views
   - Parallel method development
   - Allowances for hems, laps, Pittsburgh seams and edges
   - Importance of accuracy in the layout procedures
   - Importance of avoiding waste
   - Types of removable covers
     - Pads
     - Blankets
     - Metal boxes
   - Materials
     - Fibreglass
     - Ceramic fibre
     - Steel knit mesh
     - Silicone cloth
   - Good housekeeping

2. Draw elbows with interlocking beads
   - 5-piece 90° elbows
   - 2-piece 45° elbows
   - 3-piece 45° elbows

3. Draw and lay out tees and laterals
   - Unequal tees at 90°
   - Equal tees at 90°
   - Equal tees at 45°
   - Unequal tees at 45°
   - Endcaps one and piece
Line (GAC): G     USE DRAFTING AND LAYOUT TECHNIQUES
Competency: G7 Lay out patterns for seams on metal covers

To be competent in this area the individual must be able to:
- Lay out patterns for various seams on metal covers.
- Bend and form sheet metal manually.

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lay out seams for metal covers</td>
<td>- Type and size required</td>
</tr>
<tr>
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<td>- Single, double and lap</td>
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<td>- Consideration for position</td>
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<td>- Allowance for lap or seam</td>
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<td>- Technique of forming</td>
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<tr>
<td>2. Describe edges of metal covers</td>
<td>- Type and size required</td>
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<td>- Single, double and wired</td>
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<td>- Edge allowance</td>
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<td>- Technique of forming</td>
</tr>
<tr>
<td>3. Describe various beads, crimps, burrs and folds</td>
<td>- Type and size required</td>
</tr>
<tr>
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<td>- Amount of material required for the job</td>
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<td>- Technique of forming</td>
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<td>- Checking setting to avoid waste</td>
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<tr>
<td>4. Describe the fabricating of multi-gore elbows</td>
<td>- Elbow rule</td>
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<tr>
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<td>- Consideration for position of lap</td>
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<td>- Allowance for bead</td>
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<td>- Allowance for growth</td>
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<td>- Consideration of layout method</td>
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<td>- Standard</td>
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<td>- Quarter points</td>
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<td>- Rise method</td>
</tr>
</tbody>
</table>
5. Bend and form sheet metal manually

- "C" clamps
- Angle iron
- Rubber mallet
- 90° bend
- Acute angle bend
- Obtuse angle bend
- Gradual curve
- Care in handling sheet metal
- Limitations
- Adherence to safety guidelines

**Achievement Criteria**

**Performance**

The individual will bend and form sheet metal manually.

**Conditions**

The individual will be given:
- Tools and equipment
- Materials
- Project specifications

**Criteria**

The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Accuracy
- Safety
- Use of PPE
- Completed within specified time
Line (GAC): H READ BLUEPRINTS AND SPECIFICATIONS
Competency: H4 Read specifications and blueprints for industrial projects

Objectives
To be competent in this area the individual must be able to interpret various blueprints and specifications.

LEARNING TASKS

1. Describe the various types of blueprints and specifications
   - Symbols
   - Sections
   - Details
   - Abbreviations
   - Scope
   - Isometric views
   - Flow sheets
   - Elevation views
   - Plan views
   - Revisions

2. Interpret various blueprints and specifications
   - Refineries
   - Chemical plants
   - Pulp mills
   - Power boilers
   - Marine
   - Hospitals
   - Office buildings
   - Mines

3. Describe the importance of being accurate and precise in the reading of blueprints and specifications
   - Correct quantity survey
   - Labour costs
   - Material costs
   - Customer satisfaction
   - Ease or difficulty of work at hand
   - Storage facility
Level 4

Heat and Frost Insulator
Line (GAC): D  APPLY INSULATION
Competency: D5  Determine allowances for expansion or contraction

Objectives
To be competent in this area the individual must be able to:
- Determine low and high temperature expansion and contraction joints.
- Select insulation for low and high temperature pipes and equipment.

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| 1. Interpret drawings and specifications to determine low temperature expansion and contraction joints on pipes and equipment | • Type and temperature of system  
• Co-efficient of expansion or contraction of substrate  
• Location of installation  
• Purpose of insulation |
| 2. Select material for low temperature systems | • Fragility of insulation material  
• Flexibility  
• Weight  
• Density  
• Co-efficient of expansion or contraction |
| 3. Determine location of the contraction joint | • Allowance for axial movement  
• Proper spacing depending on size of item to be insulated  
• Weight of insulation  
• Attachments for insulation |
| 4. Interpret drawings and specifications to determine high temperature expansion and contraction joints on pipes and equipment, boilers and breechings | • Type and temperature of system  
• Co-efficient of expansion or contraction of substrate  
• Location of installation  
• Purpose and type of insulation  
• Thickness and amount of layers |
| 5. Select insulation | • Fragility of insulation material  
• Flexibility  
• Weight  
• Density  
• Recovery after compression  
• Abrasion resistance |
<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Determine location of the contraction joint</td>
<td>• Tightness of insulation</td>
</tr>
<tr>
<td></td>
<td>• Temperature of substrate</td>
</tr>
<tr>
<td></td>
<td>• Size of substrate</td>
</tr>
<tr>
<td></td>
<td>• Type of attachments</td>
</tr>
<tr>
<td>7. Describe types and considerations in installing stainless steel expansion</td>
<td>• Insulation may be single or double layer</td>
</tr>
<tr>
<td>joints on piping</td>
<td>• Size of pipe and straight length between</td>
</tr>
<tr>
<td></td>
<td>elbows</td>
</tr>
<tr>
<td></td>
<td>• Temperature of pipe</td>
</tr>
<tr>
<td></td>
<td>• Fitting of insulation</td>
</tr>
<tr>
<td></td>
<td>• Amount of mechanical expansion joints</td>
</tr>
<tr>
<td>8. Describe the installation of flange cover expansion joints</td>
<td>• Location of expansion joint</td>
</tr>
<tr>
<td></td>
<td>• Installation of stainless steel under flange</td>
</tr>
<tr>
<td></td>
<td>• Cover insulation</td>
</tr>
<tr>
<td></td>
<td>• Freedom of movement for insulation</td>
</tr>
<tr>
<td></td>
<td>• Allowance for caulking</td>
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<tr>
<td></td>
<td>• Secure insulation on one side</td>
</tr>
<tr>
<td></td>
<td>• Sealing of weather barrier</td>
</tr>
<tr>
<td></td>
<td>• Consideration of fractional pull</td>
</tr>
<tr>
<td></td>
<td>• Consideration to the ability of the material to resist cutting</td>
</tr>
<tr>
<td></td>
<td>• Selection of securement for stainless steel sleeves</td>
</tr>
</tbody>
</table>
Line (GAC): D APPLY INSULATION
Competency: D6 Apply low temperature insulation systems

Objectives
To be competent in this area the individual must be able to:
- Interpret blueprints and specification for loose fill insulation applications.
- Interpret specifications and drawings for installing the slab system.

LEARNING TASKS

1. Interpret blueprints and specification for loose fill insulation applications
   - Type
   - Thickness
   - Density

2. Remove insulation for maintenance and inspection
   - Ease of removal
   - Re-use of material
   - Avoiding material waste

3. Describe insulation considerations
   - Filling all voids with insulations
   - Use of low permeability insulation to ensure low thermal conductivity
   - Use of completely dry insulation
   - Safety gear
   - Deterioration of insulation due to sunlight exposure
   - Complete vapour seal of insulation
   - Protective, breathable metal sheeting

4. Interpret specifications and drawings for installing the slab system
   - Type of material to be used
   - Thickness of material
   - Method of application
   - Working temperature of substrate

5. Describe substrate considerations
   - Free of foreign matter
   - Joints staggered and tightly butted
   - Sealed joints
   - Contraction of substrate
Line (GAC): D APPLY INSULATION
Competency: D7 Apply high temperature insulation systems

Objectives
To be competent in this area the individual must be able to:
• Interpret drawings and specifications for pre-krete and refractory applications.
• Apply and trowel material.

LEARNING TASKS

1. Interpret drawings and specifications to determine application of pre-krete and refractory
   • Location of refractory
   • Type and thickness
   • Purpose of job

2. Determine the condition of the substrate
   • Scaling
   • Chemical cleaning
   • Sand blasting

3. Select the type of metallic key
   • Metal lath
   • Road mesh
   • Diamond expanded lath

4. Apply and trowel material
   • Manufacturer's instructions for preparation, mixing and curing

5. Describe safe work practices
   • Hazards of material
   • Personal protective equipment
   • Slumping
   • Fast set-up time
   • Avoiding skin contact
   • Retarding dry out time because of cracking
   • Keeping work area clean
   • Good housekeeping to avoid waste

Achievement Criteria

Performance The individual will apply and trowel material.
Conditions The individual will be given:
   Tools and equipment
   Materials
   Project specifications
Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:
   Accuracy
   Safety
   Use of PPE
   Completed within specified time
Program Content  
Level 4

Line (GAC): D APPLY INSULATION  
Competency: D9 Apply metal and plastic jacketing

Objectives

To be competent in this area the individual must be able to apply metal and plastic jacketing.

**LEARNING TASKS**

<table>
<thead>
<tr>
<th>Task Description</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| 1. Interpret specifications to select materials for finishing | • Type of finish required  
• Method of application  
• Purpose of application |
| 2. Describe type of jacketing | • Aluminum  
• Stainless steel  
• Plastics  
• Laminated |
| 3. Describe factors to be considered in the selection and application of finish | • Environmental conditions  
• Strength, durability and appearance  
• Characteristics and shape of surface to be covered  
• Co-efficient of expansion  
• Economic consideration of material |
| 4. Apply and attach metal and plastic finishes | • Bands and tapes  
• Threaded fasteners  
• Various types of rivets  
• Mechanical locks  
• Adhesives  
• Combined attachments  
• Cutting and fitting during application of jacketing  
• Spacing and location of anchors  
• Caulking and sealing procedures  
• Making and using “S” clips |
**LEARNING TASKS**

5. Describe problems related to handling and applying jacketing

<table>
<thead>
<tr>
<th>CONTENT</th>
</tr>
</thead>
</table>
| • Joint concealment for appearance  
• Hot or cold spots on equipment  
• Damage to insulation, vapour barrier or adjacent equipments  
• Effects of using dissimilar metals  
• Care and storage of tools and equipment  
• Checking dimensions to avoid waste  
• Good housekeeping to avoid waste |

6. Describe physical hazards associated with handling and applying jacketing

<table>
<thead>
<tr>
<th>CONTENT</th>
</tr>
</thead>
</table>
| • Safety regulations  
• Contact with electrical circuitry and equipment  
• Physical injury  
• Handling and lifting sheet metal in quantity  
• Hazards of untidy workshop area  
• Cutting tools when working with stainless steel jacketing |

**Achievement Criteria**

**Performance**  The individual will apply metal and plastic jacketing.

**Conditions**  The individual will be given:
- Tools and equipment
- Materials
- Project specifications

**Criteria**  The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Accuracy
- Safety
- Use of PPE
- Completed within specified time
Line (GAC): D APPLY INSULATION
Competency: D14 Make insulation pads

Objectives
To be competent in this area the individual must be able to make various insulation pads.

LEARNING TASKS

1. Describe material selection
   • Temperature of substrate
   • Location of job
   • Purpose of pads
   • Frequency of removal of pads

2. Describe fabrication methods
   • Checking measurements for correct size and proper allowances for insulation packing
   • Layout
   • Cutting
   • Fabricating, type and number of stitches
   • Assembling of pads
   • Location of joints or seams
   • Type and design of fasteners
   • Consideration of weather barrier where needed

3. Describe the types, purposes and uses of needles
   • Straight
   • Off-set
   • Semi-circular

4. Describe the types, features and characteristics of fabrics and thread
   • Glass
   • Nylon
   • Linen-metal combination

5. Describe safety considerations
   • Use of palm for hand sewing
   • Consider machine sewing
   • Safety in handling of needles
   • Good housekeeping
Achievement Criteria

Performance  The individual will make insulation pads.

Conditions   The individual will be given:
              Tools and equipment
              Materials
              Project specifications

Criteria     The individual will score 70% or better on a rating sheet that reflects the following criteria:
              Accuracy
              Safety
              Use of PPE
              Completed within specified time
Line (GAC): D APPLY INSULATION
Competency: D15 Apply soundproofing insulation for commercial and industrial applications

Objectives
To be competent in this area the individual must be able to apply soundproofing insulation for industrial applications.

LEARNING TASKS

1. Apply soundproofing for commercial applications
   - Basics of sound transmission
   - Applications
     - Recording studios
     - Movie theatres
     - Hotels
     - Mechanical rooms
   - Selection of materials
     - Lead
     - Barium
     - Fibreglass acoustic liner
     - Mineral fibre
     - Acoustical panels for walls and ceilings
   - Personal protective equipment

2. Apply soundproofing for industrial piping
   - Types of pipes requiring soundproofing and associated hazards
     - Natural gas
     - High pressure steam
     - Process piping
   - Soundproofing insulation materials
     - Fibreglass
     - Mineral fibre
     - Lead
     - Barium
   - Personal protective equipment

3. Apply soundproofing insulation to piping
   - Selection of materials
   - Application of insulation
   - Jacketing
   - Securing insulation

4. Describe soundproofing for turbines and equipment
   - Industrial components requiring soundproofing insulation
   - Hazards
LEARNING TASKS

5. Apply soundproofing insulation to turbines and equipment

CONTENT

- Noise
- Extreme heat
- Moving parts
- Soundproofing insulation materials
  - Ceramic fibre
  - Mineral fibre
- Jacketing
  - Cutting and fitting insulation
  - Jacketing
  - Fasteners
  - Securing methods
  - Applying finishes
Program Content
Level 4

Line (GAC): D APPLY INSULATION
Competency: D16 Apply insulation for marine applications

Objectives
To be competent in this area the individual must be able to apply insulation for marine applications.

LEARNING TASKS

1. Apply insulation for marine applications
   - Areas requiring insulation
   - Purposes
     - Thermal
     - Fire prevention
   - Noise suppression
   - Confined space hazard
   - Materials and associated hazards
     - Mineral fibre
     - Fibreglass
     - Fabric-faced insulation
   - Insulation application sequence
   - Pin and clip fastening systems
   - Pin welding
   - Customizing insulation boards

2. Install finishes on marine applications
   - Finish material
     - Perforated metal
     - RFFRK
     - Fabric finish system
     - Aluminum and steel
Line (GAC): F USE TRADE RELATED MATHEMATICS AND SCIENCE

Competency: F3 Use trade related trigonometry

Objectives
To be competent in this area the individual must be able to perform calculations using trigonometry.

LEARNING TASKS CONTENT

1. Perform frustum calculations using trigonometry and the Pythagorean Theorem
   - True heights of frustum
   - Circumference
   - Slant heights
   - Total degrees
   - Angle and degrees

2. Calculate various parts of metal jacketing using trigonometry
   - Hypotenuse
   - Side opposite
   - Side adjacent
   - Sine function
   - Tangent function

3. Calculate layout measurements
   - Length of arc
   - Lengths of top and bottom chords
   - Heights of chords
   - Central angle

4. Calculate cone frustums into workable parts
   - Allowances for crimps, beads, and seams
   - Accurate calculations to minimize waste of time and material
Line (GAC): G USE DRAFTING AND LAYOUT TECHNIQUES
Competency: G5 Develop drawings and patterns

Objectives
To be competent in this area the individual must be able to develop drawings and patterns.

LEARNING TASKS

<table>
<thead>
<tr>
<th>Number</th>
<th>Task Description</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Interpret drawings and specifications for layouts, cutting and fabricating</td>
<td>• Shape of surface to be covered</td>
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<tr>
<td></td>
<td></td>
<td>• Location and environment of job</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Material type and thickness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Method of attachment</td>
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<td></td>
<td></td>
<td>• Economic consideration</td>
</tr>
<tr>
<td>2.</td>
<td>Lay out and draw shapes of equipment</td>
<td>• Pipes, cones, frustums</td>
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<tr>
<td></td>
<td></td>
<td>• Equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ducts and breechings</td>
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<td></td>
<td></td>
<td>• Vessels</td>
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<td></td>
<td></td>
<td>• Boilers and other equipment</td>
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<td></td>
<td></td>
<td>• Location of seams on shortest dimensions in geometric layout</td>
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<tr>
<td>3.</td>
<td>Describe the importance of allowing adequate overlapping of jacketing</td>
<td>• Waterproofing</td>
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<td></td>
<td></td>
<td>• Appearance</td>
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<td></td>
<td></td>
<td>• Expansion or contraction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Strength of joint or seam</td>
</tr>
<tr>
<td>4.</td>
<td>Use tools for metal or plastic layout work</td>
<td>• Rules and tapes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Squares and protractors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Scribers and awls</td>
</tr>
<tr>
<td></td>
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<td>• Dividers and calipers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cutting tools</td>
</tr>
<tr>
<td>5.</td>
<td>Determine fabrication and installation sequence</td>
<td>• Necessity for preforming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Allowances for installation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Speed of installation</td>
</tr>
</tbody>
</table>
LEARNING TASKS

6. Form, roll and bend materials

CONTENT
- Metal brakes
- Metal rollers
- Forming pliers
- Clamps
- Allowance for dimensional changes when rolling, forming and bending
- Minimizing material and time wastage during layout, cutting, forming and bending
- Handling hazards

7. Select field or shop layout for cutting and forming finishes

CONTENT
- Quantity to be produced
- Availability of equipment
- Space requirements and/or limitations

8. Use mathematics for laying out

CONTENT
- Linear dimensions
- Geometry for geometric layout
- Calculating bending and forming allowance
- Conversion of fractional and decimal values for determining gauges and thickness of metal or plastic

Achievement Criteria

Performance The individual will lay out and draw equipment.

Conditions Drawings
- Tools and equipment
- Materials
- Project specifications

Criteria Accuracy
- Completed within specified time
Line (GAC): G USE DRAFTING AND LAYOUT TECHNIQUES
Competency: G6 Lay out removable insulation covers

Objectives
To be competent in this area the individual must be able to lay out removable insulation covers.

LEARNING TASKS
1. Interpret specifications of removable insulated sheet metal valve and flange covers
   - Type and size of metal
   - Required finish
   - Location of installation
   - Surface characteristics to be covered
   - Choice of material
   - Allowance for insulation material
   - Allowance for seams and edges
   - Allowance for clearance to facilitate ease of removal
   - Allowance for lap and locks (Pittsburgh)

2. Lay out covers
   - Rolling to correct form
   - Installing flange ends
   - Avoiding crushing of pockets
   - Types of fastening devices
   - Proper spacing of fasteners
   - Location of mitre lines
   - Importance of proper rolling to form
   - Use of inserts
   - Installing ends
   - Centering the work
   - Adherence to safety rules

Achievement Criteria
Performance The individual will lay out removable insulation covers.
Conditions Drawings
   - Tools and equipment
   - Materials
   - Project specifications
Criteria Accuracy
   - Completed within specified time
Line (GAC): H READ BLUEPRINTS AND SPECIFICATIONS

Competency: H4 Read specifications and blueprints for industrial projects

Objectives

To be competent in this area the individual must be able to interpret industrial and domestic construction drawings for take offs and quantity surveying.

1. Read domestic type construction drawings for take offs and quantity surveying
   - Elevation drawings
   - Mechanical drawings
   - Floor plans
   - Nomenclature
   - Special details
   - Boiler drawings
   - Manufacturer’s drawings
   - Metric and Imperial scale presentation
   - Plot plans
   - Schedules
   - Revisions
   - Sections

2. Interpret drawings
   - Take offs
   - Material requirements
   - Work force required
   - Scaffolding required
   - Avoiding waste of material and labour
### Program Content

**Level 4**

**Line (GAC):** H

**READ BLUEPRINTS AND SPECIFICATIONS**

**Competency:** H5 Read details and addenda

### Objectives

To be competent in this area the individual must be able to:

- 

### LEARNING TASKS

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| 1. Describe the interpretation of various specifications | - Architect’s specifications  
- Manufacturer’s specifications  
- Addenda                                           |
| 2. Describe how to read the very important items of a mechanical specification | - General clauses  
- Scope  
- List of materials  
- Application  
- Finish schedule  
- Notes  
- Details  
- Standards  
- Addenda                                           |
| 3. Read and interpret specifications and addenda    | - Perform take offs  
- Evaluate type of material required  
- Evaluate type of workforce required  
- Obligations on the job site  
  - First aid  
  - Temporary light  
  - Water  
  - Clean up  
  - Refuse disposal  
  - Time tables (duration of the job) |
| 4. Use good communication with other trades         | - Following and coordinating specifications |
Line (GAC): J USE LEAD ABATEMENT PROCEDURES
Competency: J1 Describe health effects of lead abatement

Objectives
To be competent in this area the individual must be able to describe the health effects of lead abatement.

LEARNING TASKS
1. Describe lead and its health effects
   - Locations
   - Properties
   - How lead enters and affects the body
   - How lead affects children and pregnancy
   - Lead levels in the body
   - Signs and symptoms of lead poisoning
     - Brain disorders
     - Brain and nerve problems
     - Blood pressure
     - Kidney problems
     - Reproductive problems
     - Decreased red blood cells (Anemia)
     - Slower reflexes

2. Describe how to identify and evaluate lead paint hazards
   - Paint chip analysis
   - X-ray fluorescence analysis
   - Dust wipe test
   - Sodium sulfide test
   - Soil sampling

3. Describe employer responsibilities
   - Engineering controls
   - Changing areas and washing facilities
   - Separate break area
   - Exposure monitoring
   - Protective clothing and equipment
   - Medical surveillance
   - Worker training

4. Select and use personal protective equipment
   - Respirator types
   - Respirator care
   - Other safety equipment
Line (GAC): J
Competency: J2  Use lead abatement procedures

Objectives
To be competent in this area the individual must be able to follow lead abatement procedures.

LEARNING TASKS

1. Use safe work practices
   - Notification to authorities
   - Following all regulations
   - Containing the work area
   - Keeping dust level low
   - Using personal protective gear and clothing
   - Good housekeeping practice and clean up

2. Describe the types of lead abatement and their advantages and disadvantages
   - Replacement
   - Removal
   - Encapsulation

3. Describe proper cleanup and disposal procedures
   - Packing waste
   - Storing of waste
   - Permits for disposal
Section 4

TRAINING PROVIDER STANDARDS
Facility Requirements

Classroom Area
- Minimum 30 square feet per student (accommodates drafting tables)
- Comfortable seating and tables suitable for learning
- Compliance with the local and national fire code and occupational safety requirements
- Meets applicable municipal zoning bylaws for technical instruction and education facilities
- Overhead and multimedia projectors with a projection screen
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/Air conditioning for comfort all year round
- In-room temperature control to ensure comfortable room temperature
- Acoustics in the room must allow students to hear the instructor
- 1 drafting table per student

Shop Area
- Minimum 7000 square feet of shop area including a tool crib and work stations.
- 12 foot ceiling height
- Adequate heating, lighting and ventilation
- Refuse and recycling bins for used shop materials
- First-aid facilities
- Portable fire extinguishers as per WorkSafeBC requirements
- Posted evacuation plans
- Eye wash stations
- 1 work table per 2 students

Lab Requirements

Student Facilities
- Adequate eating area as per WorkSafeBC requirements (4.84 OHS Regulation and Guidelines)
- Adequate washroom facilities as per WorkSafeBC requirements (4.85 OHS Regulation and Guidelines)
- Personal Storage lockers
Instructor's Office Space

Other

- Desk and filing space
- Computer
- Phone
## Tools and Equipment

### Shop Equipment

**Required**
- Band cutting machine
- Band saw
- Blow torch
- Circular saw
- Drills (cordless and electric)
- Electric combination machine
- Electric roller
- Electric shears
- Extension cords
- Foot operated shears (guillotine)
- Grinders
- Heat gun
- HEPA (high efficiency particulate air) vacuum
- Jig saw
- Lock former
- Mitre saw
- Mixers
- Negative air machine
- Nibblers
- Notchers
- Pin gun
- Pin welder
- Pneumatic tools
- Powder actuated tools
- Pump sprayer
- Safety edge machine
- Sewing machine
- Slitter
- Stud gun
- Stud welder
- Table saw

### Shop (Facility) Tools

**Standard Tools**
- Aviation snips (M1, M2, M3)
- Band tensioner
- Brake
- Brooms
- Bungee cords
- Caulking gun
- Chisels
- Clamps
- Combination machine (beader/crimper)
- Easy edger
- End nippers
- Flare staple gun
- Foam gun
- Glove bag
- Hammer
- Hog ring pliers / C-ring pliers
- Knife and sheath
- Lagging brush
- Paint brush
- Paint roller
- Pliers
- Rake
- Rasp
- Rivet gun
- Rollers
- Rubber bands
- Saws (keyhole and hand)
- Scissors
- Scraper
- Scratch awl
- Screwdrivers
- Sealer
- Shears
- Shovel
- Staple gun
- Thermometer
### Program Content

#### Section 4

- Thickness gauge
- Tie-down straps
- Tin snips
- Tool pouch
- Trowels (pointer and flat)
- Water hoses
- Wire brush

---

#### Student Equipment (supplied by school)

**Required**

##### Layout Equipment
- Calculator
- Carpenter's square
- Chalk line
- Circumference rule
- Clamps
- Compass
- Dividers
- Felt pens
- Levels
- Mitre chart
- Pencils
- Protractor
- Scale ruler
- Straight edge
- Tape measure
- T-square
- Trammel point

##### Spray Equipment
- Airless sprayer
- Hopper
- Sprayer
- Spray pumps
- Tip cleaners

##### Access Equipment
- Aerial lift
- Bosun chair
- Ladders
- Scaffoldings
- Scissor lift
- Swing stage

##### Personal Protective Equipment
- Acid suits
- Disposable booties
- Disposable coveralls (whites)
- Eye wash station
- Face shields
- Fall arrest equipment
- Fire and chemical resistant coveralls
- Fire extinguisher
- First aid kit
- Wristlets
- Gloves
- Goggles
- Hard hat
- Hearing protection
- Reflective vest
- Respirator
- Safety boots
- Safety glasses
Reference Materials
REQUIRED TEXTBOOKS, LAB OR SHOP MANUALS LEVELS 1 TO 4:

No reference materials required at this time
Instructor Requirements

Occupation Qualification
The instructor must possess:
- B.C. Certificate of Qualification preferably with a Red Seal Endorsement.
  Or
- Certificate of Qualification from another Canadian jurisdiction complete with Red Seal Endorsement.

Work Experience
A minimum of 5 years experience working in the industry as a journeyperson.

Instructional Experience and Education
It is preferred that the instructor also possesses one of the following:
- An Instructors Diploma or equivalent
- A Bachelors Degree in Education
- A Masters Degree in Education