PROGRAM OUTLINE

Aircraft Maintenance Technician
AIRCRAFT MAINTENANCE TECHNICIAN
PROGRAM OUTLINE

APPROVED
MARCH 2002

Document Revised 2011

Developed by
Industry Training Authority
Province of British Columbia
## TABLE OF CONTENTS

Section 1 INTRODUCTION................................................................................................................ 4
  Foreword .................................................................................................................................. 5
  Acknowledgements .................................................................................................................. 6
  How to Use this Document...................................................................................................... 7

Section 2 PROGRAM OVERVIEW.................................................................................................... 9
  Program Credentialing Model ................................................................................................. 10
  Program Assessment ............................................................................................................. 11
  Occupational Analysis Chart ............................................................................................... 12
  Training Topics and Suggested Time Allocation Level 1 .................................................... 18
  Training Topics and Suggested Time Allocation Level 2 .................................................... 19
  Training Topics and Suggested Time Allocation Level 3 .................................................... 20
  Training Topics and Suggested Time Allocation Level 4 .................................................... 21

Section 3 PROGRAM CONTENT.................................................................................................... 23
  Level 1 Aircraft Maintenance Technician ........................................................................... 24
  Level 2 Aircraft Maintenance Technician ........................................................................... 99
  Level 3 Aircraft Maintenance Technician .......................................................................... 174
  Level 4 Aircraft Maintenance Technician .......................................................................... 225

Section 4 TRAINING PROVIDER STANDARDS .......................................................................... 309
  Facility Requirements .......................................................................................................... 310
  Tools and Equipment ........................................................................................................... 311
  Reference Materials ............................................................................................................ 313
  Instructor Requirements ...................................................................................................... 314
Section 1

INTRODUCTION

Aircraft Maintenance Technician
Introduction

Foreword

This Program Outline is issued by the Industry Training and Apprenticeship Commission for use in apprenticeship training classes sponsored by the Industry Training and Apprenticeship Commission. Indentured apprentices will be directed to the Apprenticeship Training classes in accordance with the General Regulations made pursuant to the Industry Training and Apprenticeship Act of British Columbia.

It is intended as a guide for instructors of apprenticeship. 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.

The Program Outline was prepared with the advice and assistance of Aircraft Maintenance Trade Advisory Committee comprised of representatives of management and labour and in cooperation with the Colleges and Institutes and the Industry Training and Apprenticeships Commission.

SAFETY ADVISORY

Be advised that references to the WorkSafe BC 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

The Program Outline was prepared with the advice and direction of the Canadian Aviation Maintenance Council (www.camc.ca) and the Government of Manitoba - Entrepreneurship, Training and Trade (www.gov.mb.ca).

The Industry Training Authority would like to acknowledge the dedication and hard work of all the industry representatives involved in identifying the training requirements of the Aircraft Maintenance Technician 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><strong>Program Credentialing Model</strong></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><strong>Program Assessment</strong></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><strong>OAC</strong></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><strong>Training Topics and Suggested Time Allocation</strong></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><strong>Program Content</strong></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>
</tbody>
</table>
### Training Provider Standards

<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></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

Aircraft Maintenance Technician
Program Overview

Program Credentialing Model

Transport Canada Licensing
AME-M

C of A
Aircraft Maintenance Technician

AME-M
Meet Transport Canada Licensing Requirements for Aircraft Maintenance Engineer (Maintenance)

Aircraft Maintenance Technician
Work-Based Training: 7200 hours total
Sponsor Attestation

RECOMMENDATION FOR CERTIFICATION

APPRENTICESHIP - DIRECT ENTRY

*Cuggested duration based on 30-hour week

CROSS-PROGRAM CREDITS

None
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>Recommendation for Certificate of</td>
<td>Hours and sponsor sign-off</td>
<td>Declared competent</td>
</tr>
<tr>
<td>Apprenticeship</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Occupational Analysis Chart

**AIRCRAFT MAINTENANCE TECHNICIAN**

**Occupation Description**: “Aircraft Maintenance Technician” means a person who performs inspections and troubleshooting of an aircraft, including airframe structures, engines and aircraft systems, disassembles and removes defective parts, assembles and installs replacement parts, interprets technical manuals, drawings and blueprints, tests aircraft systems, records problems and actions taken to rectify them, and maintains an accurate statement of the maintenance history of the aircraft.

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Code</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUND HANDLING</td>
<td>Fire Protection and Detection</td>
<td>1.01</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Aircraft Handling</td>
<td>1.04</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Equipment and Furnishings</td>
<td>1.02</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>WHMIS</td>
<td>1.03</td>
<td>1</td>
</tr>
<tr>
<td>AVIATION MATH AND PHYSICS</td>
<td>Aviation Math and Physics</td>
<td>2.01</td>
<td>1</td>
</tr>
<tr>
<td>TOOLS AND EQUIPMENT</td>
<td>Hand and Machine Tools</td>
<td>3.01</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Precision Measuring Instruments</td>
<td>3.02</td>
<td>1</td>
</tr>
<tr>
<td>AIRFRAME FUEL SYSTEMS</td>
<td>Fuel and Fuel Systems</td>
<td>4.01</td>
<td>1</td>
</tr>
<tr>
<td>AIRCRAFT HARDWARE</td>
<td>Aircraft Hardware</td>
<td>5.01</td>
<td>1</td>
</tr>
</tbody>
</table>
# Program Overview

<table>
<thead>
<tr>
<th>HYDRAULIC AND PNEUMATIC SYSTEMS</th>
<th>Environmental Systems</th>
<th>Hydraulic Systems</th>
<th>Controls and Rigging</th>
<th>Basic Hydraulics and Pneumatics</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>6.01</td>
<td>6.02</td>
<td>6.03</td>
<td>6.04</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LANDING GEAR</th>
<th>Landing Gear, Wheels, Tires and brakes</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>7.01</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRUCTURES, ASSEMBLY, RIGGING</th>
<th>Controls and Rigging</th>
<th>Metallic Structures</th>
<th>Theory of Flight-Fixed Wing</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8.01</td>
<td>8.2</td>
<td>8.03</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROTARY-WING CONTROL SYSTEMS</th>
<th>Controls and Rigging</th>
<th>Theory of Flight-Rotary Wing</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>9.01</td>
<td>9.02</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMPOSITES</th>
<th>Non-Metallic Structures</th>
<th>Materials and Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10.01</td>
<td>10.02</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>11.01</td>
<td>11.02</td>
<td>11.03</td>
<td>11.04</td>
<td>11.05</td>
<td>11.06</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
## Program Overview

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIBRATION ANALYSIS</td>
<td>Vibration Analysis and Rectification</td>
<td>17.01</td>
</tr>
<tr>
<td>WEIGHT AND BALANCE</td>
<td>Weight and Balance</td>
<td>19.01</td>
</tr>
<tr>
<td>DRAWINGS</td>
<td>Aircraft Drawings</td>
<td>20.01</td>
</tr>
<tr>
<td>METALLIC STRUCTURES</td>
<td>Metallic Structures</td>
<td>21.01</td>
</tr>
<tr>
<td></td>
<td>Hand and Machine Tools</td>
<td>21.02</td>
</tr>
<tr>
<td>MAINTENANCE PROCEDURES</td>
<td>Principles of Aircraft Maintenance Management</td>
<td>22.01</td>
</tr>
<tr>
<td>TURBINE ENGINES</td>
<td>Fire Protection and Detection</td>
<td>23.01</td>
</tr>
<tr>
<td></td>
<td>Ignition Systems</td>
<td>23.02</td>
</tr>
<tr>
<td></td>
<td>Engine Indicating and Warning Systems</td>
<td>23.03</td>
</tr>
<tr>
<td></td>
<td>Gas Turbine Engine Theory</td>
<td>23.04</td>
</tr>
<tr>
<td></td>
<td>Turbine Engine Maintenance</td>
<td>23.05</td>
</tr>
<tr>
<td></td>
<td>Gas Turbine Engine Fuel Systems</td>
<td>23.06</td>
</tr>
<tr>
<td>ENVIRONMENTAL SYSTEMS</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>Environmental Systems</td>
<td>24.01</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CANADIAN AVIATION REGULATIONS</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to CARS</td>
<td>25.01</td>
</tr>
<tr>
<td>CAR Part 1-General Provisions</td>
<td>25.02</td>
</tr>
<tr>
<td>CAR Part 2- Identification and Registration</td>
<td>25.03</td>
</tr>
<tr>
<td>CAR Part 4 Subpart 3 &amp; AWM Chapter 566</td>
<td>25.04</td>
</tr>
<tr>
<td>CAR 501,AWM 501- Annual Airworthiness Information Report</td>
<td>25.05</td>
</tr>
<tr>
<td>CAR 507,AWM 507 Flight Authority</td>
<td>25.06</td>
</tr>
<tr>
<td>CAR 509,AWM 509- Export Airworthiness Certificates</td>
<td>25.07</td>
</tr>
<tr>
<td>CAR 251 Division 2 Type Certificates</td>
<td>25.08</td>
</tr>
<tr>
<td>CAR 521 Division 4 Changes to a Type Design</td>
<td>25.09</td>
</tr>
<tr>
<td>AWM 561-Manufacture of Aeronautical Products</td>
<td>25.10</td>
</tr>
<tr>
<td>AWM 563-Distribution of Aeronautical Products</td>
<td>25.11</td>
</tr>
<tr>
<td>CAR 571,AWM 571- Aircraft Maintenance Requirements</td>
<td>25.12</td>
</tr>
<tr>
<td>CAR 573,AWM 573- Approved Maintenance Organizations</td>
<td>25.13</td>
</tr>
<tr>
<td>CAR 521 Division IX Service Difficulty Reporting</td>
<td>25.14</td>
</tr>
<tr>
<td>CAR 521 Division X Airworthiness Directives</td>
<td>25.15</td>
</tr>
<tr>
<td>CAR 604- Private Operator Passenger Transportation</td>
<td>25.16</td>
</tr>
<tr>
<td>CAR 605-Aircraft Requirements and CAR 625</td>
<td>25.17</td>
</tr>
<tr>
<td>CAR 625-Appendix A- Elementary Work</td>
<td>25.18</td>
</tr>
<tr>
<td>CAR 625-Appendix C-Out of Phase Tasks</td>
<td>25.19</td>
</tr>
<tr>
<td>CAR 625-Appendix I Specification Tables-Schedule I</td>
<td>25.20</td>
</tr>
<tr>
<td>CAR 706-Maintenance Requirements for Commercial Air Operators and Car 726</td>
<td>25.21</td>
</tr>
<tr>
<td>CAR on the Internet</td>
<td>25.22</td>
</tr>
<tr>
<td>AWM 561-Manufacture of Aeronautical Products</td>
<td>25.23</td>
</tr>
</tbody>
</table>
# Program Overview

## INSTRUMENTS
- **Engine Indicating and Warning Systems**
  - 27.01
  - Duration: 4

## AVIONICS
- **Controls and Rigging**
  - 28.01
  - Duration: 4

## ICE AND RAIN PROTECTION
- **Ice and Rain Protection Systems**
  - 29.01
  - Duration: 4

## ELECTRICAL
- **Basic Electricity - DC**
  - 30.01
  - Duration: 4

- **Basic Electricity - AC**
  - 30.02
  - Duration: 4

- **Electrical Systems**
  - 30.03
  - Duration: 4

## NON-DESTRUCTIVE TESTING
- **Non-Destructive Inspection**
  - 31.01
  - Duration: 4
## Training Topics and Suggested Time Allocation Level 1

<table>
<thead>
<tr>
<th>Line</th>
<th>Category</th>
<th>% of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>Fire Protection and Detection</td>
<td>8 %</td>
</tr>
<tr>
<td>1.02</td>
<td>Equipment and Furnishings</td>
<td></td>
</tr>
<tr>
<td>1.03</td>
<td>WHMIS</td>
<td></td>
</tr>
<tr>
<td>1.04</td>
<td>Aircraft Handling</td>
<td></td>
</tr>
<tr>
<td>2.01</td>
<td>Aviation Math and Physics</td>
<td>15 %</td>
</tr>
<tr>
<td>3.01</td>
<td>Hand and Machine Tools</td>
<td></td>
</tr>
<tr>
<td>3.02</td>
<td>Precision Measuring Instruments</td>
<td></td>
</tr>
<tr>
<td>4.01</td>
<td>Fuel and Fuel Systems</td>
<td>3 %</td>
</tr>
<tr>
<td>5.01</td>
<td>Aircraft Hardware</td>
<td>9 %</td>
</tr>
<tr>
<td>6.01</td>
<td>Environmental Systems</td>
<td></td>
</tr>
<tr>
<td>6.02</td>
<td>Hydraulic Systems</td>
<td></td>
</tr>
<tr>
<td>6.03</td>
<td>Controls and Rigging</td>
<td></td>
</tr>
<tr>
<td>6.04</td>
<td>Basic Hydraulic and Pneumatic</td>
<td></td>
</tr>
<tr>
<td>7.01</td>
<td>Landing Gear, Wheels, Tires and Brakes</td>
<td>11 %</td>
</tr>
<tr>
<td>8.01</td>
<td>Controls and Rigging</td>
<td></td>
</tr>
<tr>
<td>8.02</td>
<td>Metallic Structures</td>
<td></td>
</tr>
<tr>
<td>8.03</td>
<td>Theory of Flight-Fixed Wing</td>
<td></td>
</tr>
<tr>
<td>9.01</td>
<td>Controls and Rigging</td>
<td></td>
</tr>
<tr>
<td>9.02</td>
<td>Theory of Flight-Rotary Wing</td>
<td></td>
</tr>
<tr>
<td>15.01</td>
<td>Human Factors in Aircraft Maintenance</td>
<td>4 %</td>
</tr>
<tr>
<td>19.01</td>
<td>Weight and Balance</td>
<td>7 %</td>
</tr>
<tr>
<td></td>
<td><strong>Total Percentage for Aircraft Maintenance Technician Level 1</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>
## Training Topics and Suggested Time Allocation Level 2

<table>
<thead>
<tr>
<th>Line</th>
<th>Topic</th>
<th>% of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>COMPOSITES</td>
<td>11 %</td>
</tr>
<tr>
<td>10.01</td>
<td>Non-Metallic Structures</td>
<td></td>
</tr>
<tr>
<td>10.02</td>
<td>Materials and Processes</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>RECIPROCATING ENGINES</td>
<td>53 %</td>
</tr>
<tr>
<td>11.01</td>
<td>Bearings and Seals</td>
<td></td>
</tr>
<tr>
<td>11.02</td>
<td>Reciprocating Engine Principles</td>
<td></td>
</tr>
<tr>
<td>11.03</td>
<td>Reciprocating Engine Maintenance</td>
<td></td>
</tr>
<tr>
<td>11.04</td>
<td>Carburation and Engine Fuel Systems</td>
<td></td>
</tr>
<tr>
<td>11.05</td>
<td>Introduction to Fuel Systems</td>
<td></td>
</tr>
<tr>
<td>11.06</td>
<td>Fuel Injection Systems</td>
<td></td>
</tr>
<tr>
<td>11.07</td>
<td>Induction, Supercharging, Exhaust</td>
<td></td>
</tr>
<tr>
<td>11.08</td>
<td>Engine Starting Systems</td>
<td></td>
</tr>
<tr>
<td>11.09</td>
<td>Lubricants and Lubrication</td>
<td></td>
</tr>
<tr>
<td>11.10</td>
<td>Aircraft Engine: Operation and Installation</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>PROPELLERS</td>
<td>9 %</td>
</tr>
<tr>
<td>12.01</td>
<td>Propellers</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>AIRCRAFT STRUCTURAL MATERIALS</td>
<td>9 %</td>
</tr>
<tr>
<td>13.01</td>
<td>Non-Metallic Structures</td>
<td></td>
</tr>
<tr>
<td>13.02</td>
<td>Materials and Processes</td>
<td></td>
</tr>
<tr>
<td>13.03</td>
<td>Corrosion Control</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>WOOD AND FABRIC</td>
<td>5 %</td>
</tr>
<tr>
<td>14.01</td>
<td>Non-Metallic Structures</td>
<td></td>
</tr>
<tr>
<td>14.02</td>
<td>Materials and Processes</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>DYNAMIC DRIVE SYSTEMS</td>
<td>7 %</td>
</tr>
<tr>
<td>16.01</td>
<td>Dynamic Drivetrains</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>VIBRATION ANALYSIS</td>
<td>6 %</td>
</tr>
<tr>
<td>17.01</td>
<td>Vibration Analysis and Rectification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Percentage for Aircraft Maintenance</td>
<td>100 %</td>
</tr>
<tr>
<td></td>
<td>Technician Level 2</td>
<td></td>
</tr>
</tbody>
</table>
## Training Topics and Suggested Time Allocation Level 3

<table>
<thead>
<tr>
<th>Line</th>
<th>Topic</th>
<th>% of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.01</td>
<td>Aircraft Drawings</td>
<td>5 %</td>
</tr>
<tr>
<td>20.02</td>
<td>Hand and Machine Tools</td>
<td></td>
</tr>
<tr>
<td>21.01</td>
<td>Metallic Structures</td>
<td>34 %</td>
</tr>
<tr>
<td>21.02</td>
<td>Principles of Aircraft</td>
<td></td>
</tr>
<tr>
<td>22.01</td>
<td>Maintenance Management</td>
<td>7 %</td>
</tr>
<tr>
<td>23.01</td>
<td>Fire Protection and Detection</td>
<td></td>
</tr>
<tr>
<td>23.02</td>
<td>Ignition Systems</td>
<td></td>
</tr>
<tr>
<td>23.03</td>
<td>Engine Indicating and Warning Systems</td>
<td></td>
</tr>
<tr>
<td>23.04</td>
<td>Gas Turbine Engine Theory</td>
<td></td>
</tr>
<tr>
<td>23.05</td>
<td>Turbine Engine Maintenance</td>
<td></td>
</tr>
<tr>
<td>23.06</td>
<td>Gas Turbine Engine Fuel Systems</td>
<td></td>
</tr>
<tr>
<td>23.07</td>
<td>Engine Starting Systems</td>
<td></td>
</tr>
<tr>
<td>23.08</td>
<td>Lubricants and Lubrication-Turbine</td>
<td></td>
</tr>
<tr>
<td>23.09</td>
<td>Lubricants and Lubrication-Function</td>
<td></td>
</tr>
<tr>
<td>23.10</td>
<td>Aircraft Engine: Operation and Installation</td>
<td></td>
</tr>
<tr>
<td>23.11</td>
<td>Aircraft Engine: Operation and Installation</td>
<td></td>
</tr>
<tr>
<td>24.01</td>
<td>Environmental Systems</td>
<td>11 %</td>
</tr>
</tbody>
</table>

**Total Percentage for Aircraft Maintenance Technician Level 3**

100 %
### Training Topics and Suggested Time Allocation Level 4

<table>
<thead>
<tr>
<th>Line 25</th>
<th>CANADIAN AVIATION REGULATIONS</th>
<th>% of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.01</td>
<td>Introduction to CAR</td>
<td>19 %</td>
</tr>
<tr>
<td>25.02</td>
<td>CAR Part 1-General Provisions</td>
<td></td>
</tr>
<tr>
<td>25.03</td>
<td>CAR Part 2-Identification and Registration</td>
<td></td>
</tr>
<tr>
<td>25.04</td>
<td>CAR Part 4 Subpart 3 &amp; AWM Chapter 566</td>
<td></td>
</tr>
<tr>
<td>25.05</td>
<td>CAR 501, AWM 501-Annual Airworthiness Information Report</td>
<td></td>
</tr>
<tr>
<td>25.06</td>
<td>CAR 507, AWM 507-Flight Authority</td>
<td></td>
</tr>
<tr>
<td>25.07</td>
<td>CAR 509, AWM 509-Export Airworthiness Certificates</td>
<td></td>
</tr>
<tr>
<td>25.08</td>
<td>CAR 521 Division 2 Type Certificates</td>
<td></td>
</tr>
<tr>
<td>25.09</td>
<td>CAR 521 Division 4 Changes to a Type Design</td>
<td></td>
</tr>
<tr>
<td>25.10</td>
<td>AWM 561-Manufacture of Aeronautical Products</td>
<td></td>
</tr>
<tr>
<td>25.11</td>
<td>AWM 563-Distribution of Aeronautical Products</td>
<td></td>
</tr>
<tr>
<td>25.12</td>
<td>CAR 571, AWM 571-Aircraft Maintenance Requirements</td>
<td></td>
</tr>
<tr>
<td>25.13</td>
<td>CAR 573, AWM 573-Approved Maintenance Organizations</td>
<td></td>
</tr>
<tr>
<td>25.14</td>
<td>CAR 521 Division IX-Service Difficulty Reporting</td>
<td></td>
</tr>
<tr>
<td>25.15</td>
<td>CAR 521 Division X-Airworthiness Directives</td>
<td></td>
</tr>
<tr>
<td>25.16</td>
<td>CAR 604-Private Operator Passenger Transportation</td>
<td></td>
</tr>
<tr>
<td>25.17</td>
<td>CAR 605-Aircraft Requirements and CAR 625</td>
<td></td>
</tr>
<tr>
<td>25.18</td>
<td>CAR 625-Appendix A-Elementary Work</td>
<td></td>
</tr>
<tr>
<td>25.19</td>
<td>CAR 625-Appendix C-Out of Phase Tasks</td>
<td></td>
</tr>
<tr>
<td>25.20</td>
<td>CAR 625-Appendix I-Specification Tables-Schedule 1</td>
<td></td>
</tr>
<tr>
<td>25.21</td>
<td>CAR 706-Maintenance Requirements for Commercial Air Operators and CAR 726</td>
<td></td>
</tr>
<tr>
<td>25.22</td>
<td>CAR on the Internet</td>
<td></td>
</tr>
<tr>
<td>25.23</td>
<td>AME Publications</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Line 27</th>
<th>INSTRUMENTS</th>
<th>% of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.01</td>
<td>Engine Indicating and Warning Systems</td>
<td>14 %</td>
</tr>
<tr>
<td>27.02</td>
<td>Aircraft Instrumentation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Line 28</th>
<th>AVIONICS</th>
<th>% of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.01</td>
<td>Controls and Rigging</td>
<td>11 %</td>
</tr>
<tr>
<td>28.02</td>
<td>Avionics</td>
<td></td>
</tr>
<tr>
<td>28.03</td>
<td>Data Bus and Logic</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Line 29</th>
<th>ICE AND RAIN PROTECTION</th>
<th>% of Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.01</td>
<td>Ice and Rain Protection Systems</td>
<td>11 %</td>
</tr>
<tr>
<td>Line</td>
<td>Subject</td>
<td>% of Time</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>30</td>
<td>ELECTRICAL</td>
<td>5%</td>
</tr>
<tr>
<td>30.01</td>
<td>Basic Electricity- DC</td>
<td></td>
</tr>
<tr>
<td>30.02</td>
<td>Basic Electricity- AC</td>
<td></td>
</tr>
<tr>
<td>30.03</td>
<td>Electrical Systems</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>NON-DESTRUCTIVE TESTING</td>
<td>40%</td>
</tr>
<tr>
<td>31.01</td>
<td>Non-Destructive Inspection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Percentage for Aircraft Maintenance Technician Level 4</td>
<td>100%</td>
</tr>
</tbody>
</table>
Section 3
PROGRAM CONTENT

Aircraft Maintenance Technician
Level 1

Aircraft Maintenance Technician
### Program Content

**Line (GAC):** 1  
**Ground Handling**  
**Competency:** 1.01 Fire Protection and Detection

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

#### LEARNING TASKS

<table>
<thead>
<tr>
<th>Task</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.2.1</strong> Causes, Prevention, Extinguishing of Fires</td>
<td></td>
</tr>
<tr>
<td><strong>A2.1.1</strong> Classify fires</td>
<td></td>
</tr>
</tbody>
</table>
  - Class A  
  - Class B  
  - Class C  
  - Class D |
| **A2.1.2** Explain requirements for fires |  
  - Fire triangle  
  - Extinguishing fires |
| **A2.1.3** Describe dangers of fire in aircraft |  
  - Flammable materials  
  - Fuels and refuelling  
  - Fire exits and escape routes |
| **A2.1.4** Describe fire safety in workshops |  
  - Safety precautions  
  - Handling of flammable products  
  - Fire exits  
  - Welding |
| **A2.1.5** Locate fire extinguishers (Practical) |  |
| **A2.2** Fire Extinguisher Agents |  |
| **A2.2.1** Describe fire-extinguishing agents by class of fire |  
  - Water  
  - Halogen and its various forms  
    - Halon 1301  
    - CTC (Carbon Tetrachloride) – Halon 1401  
    - Freon  
    - BCF (Bromochlorodifluoromethane)  
    - CO (carbon dioxide)  
  - Dry powder  
  - Methyl Bromide |
A2.2.2 Identify types of extinguishers
- Properties
- Advantages
- Disadvantages
- Precautions

A2.2.3 Describe use of various fire extinguishers
- Color coding
- Markings
- Handling
- Safety checks
- Discharging
- Dangers of using wrong type

A2.2.4 Identify fire extinguishers from selection provided and state purpose including class of fire for which it is used (Practical)
### Line (GAC): 1 Ground Handling

#### Competency: 1.02 Equipment and Furnishings

**Objectives**

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A9.4 Aircraft Emergency and Life Saving Equipment</td>
<td>![Content](Life jackets, Liferafts, Airframe Flotation Devices)</td>
</tr>
<tr>
<td>A9.4.1 Describe types of emergency and lifesaving equipment:</td>
<td>![Content](Life jackets, Liferafts, Airframe Flotation Devices)</td>
</tr>
</tbody>
</table>
Line (GAC): 1  Ground Handling
Competency: 1.03  WHMIS

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>G15.1  WHMIS</td>
<td>• Purpose</td>
</tr>
<tr>
<td>G15.1.1 Explain WHMIS</td>
<td>• Background</td>
</tr>
<tr>
<td></td>
<td>• Right to know about health and safety</td>
</tr>
<tr>
<td></td>
<td>• Hazardous materials</td>
</tr>
<tr>
<td></td>
<td>• Controlled products</td>
</tr>
<tr>
<td></td>
<td>• Definition</td>
</tr>
<tr>
<td></td>
<td>• Three main components</td>
</tr>
<tr>
<td></td>
<td>• Labels</td>
</tr>
<tr>
<td></td>
<td>• MSDSs</td>
</tr>
<tr>
<td></td>
<td>• Training</td>
</tr>
<tr>
<td>G15.1.2 Discuss WHMIS legislation</td>
<td>• Federal</td>
</tr>
<tr>
<td></td>
<td>• Provincial</td>
</tr>
<tr>
<td></td>
<td>• Canada Labor Code</td>
</tr>
<tr>
<td></td>
<td>• Hazardous Products Act</td>
</tr>
<tr>
<td></td>
<td>• Prohibited products</td>
</tr>
<tr>
<td></td>
<td>• Restricted products</td>
</tr>
<tr>
<td></td>
<td>• Controlled products</td>
</tr>
<tr>
<td></td>
<td>• Penalties</td>
</tr>
<tr>
<td>G15.1.3 Explain WHMIS hazard classes</td>
<td>• Compressed gas</td>
</tr>
<tr>
<td></td>
<td>• Flammable and combustible materials</td>
</tr>
<tr>
<td></td>
<td>• Oxidizing materials</td>
</tr>
<tr>
<td></td>
<td>• Poisonous</td>
</tr>
<tr>
<td></td>
<td>• Corrosive materials</td>
</tr>
<tr>
<td></td>
<td>• Reactive materials</td>
</tr>
<tr>
<td></td>
<td>• Biohazards</td>
</tr>
<tr>
<td>G15.1.4 List exempted products</td>
<td>• Partially exempt:</td>
</tr>
<tr>
<td></td>
<td>• Consumer goods</td>
</tr>
<tr>
<td></td>
<td>• Cosmetics</td>
</tr>
</tbody>
</table>
G15.2 Supplier and Workplace Labels

G15.2.1 Describe hazardous product labeling

- Purpose
- Types of WHMIS labels
  - Supplier label
  - Workplace label
- Responsibilities for labeling
  - Suppliers
  - Employers
  - Workers

G15.2.2 Describe supplier label

- Seven categories that must appear on a typical WHMIS supplier label
  - Identifier
  - Material Safety Data Sheet reference
  - Hazard symbols
  - Risk phrases
  - Precautionary measures
  - First-aid measures
- Single-container labeling
  - Label applied
- Multi-container labeling
  - Label inner and outer containers
- Bulk shipments
  - Send label to employer
  - Refer to Transportation of Dangerous Goods Act and Regulations
- Design

G15.2.3 Describe employer's role in labeling materials used in workplace

- Check that supplier labels are provided and applied
- Procedure for improperly labeled products
- Post or apply labels for bulk shipments
- Develop workplace label system
- Provide training on workplace labels and labeling

G15.2.4 Describe workplace labels

- Content
  - Product identifier
- Safe handling information
- MSDS available (if applicable)

- Workplace labels must be used on:
  - Storage containers of controlled products used on site
  - Storage containers to receive bulk shipments
  - Portable containers for use longer than a shift
  - Supplier containers with illegible labels

- Design
- Symbols used

- Other means of identification:
  - When used?
  - Where used?

G15.3 MSDS

G15.3.1 Explain purpose of MSDS

- Technical bulletin providing detailed hazard, precautionary, and emergency information about a controlled product
- Supplements alert information provided on labels

G15.3.2 Explain MSDS responsibilities

- Suppliers
  - Provide employers with current MSDS before product sale or importation. Review every three years.
- Employers
  - Ensure up-to-date MSDS obtained first time controlled product is received in the workplace
  - Produce data sheets if producing controlled products for workplace use
  - Must make MSDS available to workers
  - Must provide instruction to workers on information important to health and safety
- Workers
  - Must learn information provided and apply it to the job

G15.3.3 Describe design of MSDS

- Any design may be used subject to basic rules
- MSDS must display nine sections of content covering approximately 60 items of information
G15.3.4 Describe type of information found in MSDS's
- Product information
- Hazardous ingredients
- Physical data
- Fire and explosion hazard
- Reactivity data
- Toxicological properties
- Preventive measures
- First-aid measures
- Preparation information

G15.3.5 Locate specified information on MSDSs (Practical)

G15.4 Implementation and Training

G15.4.1 Explain requirement for training in WHMIS
- How WHMIS works
- Hazards of products
- Procedures for safe storage, handling and disposal
- Emergency procedures
- Training provided by employer
  - Health and safety committees

G15.5 WHMIS in the Workplace

G15.5.1 List persons responsible for WHMIS, health and safety and, first aid

G15.5.2 List hazardous materials used in workplace/learning environment

G15.5.3 Locate and describe storage areas for hazardous materials

G15.5.4 Explain requirements associated with MSDSs
- Where data sheets are kept
- How to use data sheets
- Updating
- Accuracy of information
G15.5.5 Describe process for decanting materials used on the shop floor

G15.5.6 Describe process for disposing of unused and/or contaminated decanted materials
### Line (GAC): 1 Ground Handling

**Competency:** 1.04 Aircraft Handling

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| **G18.1** Housekeeping and Safety Precautions | - Proper storage of compressed gas cylinders  
- Air hoses and electrical wires  
- Tools and tool carts  
- Stands, hoists and ladders  
- Batteries and battery carts  
- Oils and volatile fluids stored in correct locations  
- Oil/fuel spills attended to immediately  
- Paint and paint products |
| **G18.1.1** Stress importance of keeping hangar/shop clean and organized | - Eye glasses and ear defenders  
- Location and maintenance of eyewash stations  
- Acid-proof aprons and gloves  
- Particle masks and air makeup units  
- Correct footwear and clothing |
| **G18.1.2** Discuss use of personal safety equipment | - Explosive dangers  
- Identification of contents  
- Correct caps  
- Regulators  
- Cleanliness  
- Restraint and storage  
- Spinning of bearings |
| **G18.1.3** Recall workplace hazardous materials (WHMIS) information system | |
| **G18.1.4** Explain dangers of compressed gas and explain correct handling | |
G18.1.5 Recall fire safety
- Nature and classification of fires
- Identification of markings on fire extinguishers
- Inspections of fire extinguishers
- Extinguishing agents and correct use of fire extinguishers

G18.1.6 Discuss flight line safety
- Ignition switches and propellers
- Correct chocking
- Cleanliness of ground run area especially with turbine engines
- Cockpit checks
- Use of control locks
- Dangers around inlet and exhaust areas
- Rotor blade clearances
- Open driveshafts
- Loose clothing, rags and other FOD
- Ground support equipment hookup
- Signals and communication with other crew members

G18.1.7 Describe system lockout and placarding procedures
- Tagging
- Safetying of systems
- Manufacturers’ procedures (maintenance manual)
- Documentation

G18.2 Ground Handling, Towing, Marshalling

G18.2.1 Discuss procedures for moving aircraft on ground
- Pushing small aircraft
  - Removal of control locks
  - Allowable handling areas
  - Correct inflation of wheels and oleos
- Towing large aircraft
  - Installation of towbars and ropes
  - Installation of steering lockout pins
  - Nose gear
  - Removal of linkages if required
  - Extra personnel requirements e.g., brakeman and wingman
- Hand signaling, day and night
- Procedures for moving aircraft around airports
- Installation and use of ground power
G18.3 Hoisting, Jacking, Tying down and Mooring

G18.3.1 Discuss jacking procedures
- Placarding aircraft
- Single wheel tire or brake servicing
- Retraction tests and landing gear servicing, e.g. weighting tail so aircraft doesn’t fall on its nose
- Leveling and weighing aircraft
- Tail support when servicing in tail boom or tail cone
- Bladder cell lifting

G18.3.2 Discuss lifting procedures
- Changing of undercarriage from floats to wheels to skis
- Changing helicopter landing gear types
- Salvaging
  - Precautions
  - Damages

G18.3.3 Discuss lowering procedures

G18.3.4 Discuss tie-down procedures
- Selection of ropes
- Landplanes – covering, disruption of lift surfaces in high winds, gustlocks, proper knots
- Seaplanes-mooring to buoys, jetty, sinking of floats for high winds, proper knots
- Skiplanes – covering, heating, distribution of power sources, prevention of freezing into ice surface for high winds
- Helicopters – covering and tying down of blades, covering of bubbles, heating, prevention of freezing into ice, purposely freezing into ice, prevention of torque spins on icy surfaces
- Discuss ground crew responsibilities and precautions applicable to helicopters slinging external loads
### Objectives
To be competent in this area the individual must be able to:

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.2 Use Different Numbering Systems</td>
<td></td>
</tr>
<tr>
<td>I.2.1.1 Utilize different numbering systems</td>
<td>• The decimal numbering system</td>
</tr>
<tr>
<td></td>
<td>• The binary number system</td>
</tr>
<tr>
<td></td>
<td>• Scientific notation</td>
</tr>
<tr>
<td>I.2.1.2 Perform calculations using the various numbering systems</td>
<td>• Performing calculations with whole numbers</td>
</tr>
<tr>
<td></td>
<td>• Describe the use of exponents</td>
</tr>
<tr>
<td></td>
<td>• Perform multiplication with scientific notation</td>
</tr>
<tr>
<td>I.2.2 Use Fractions in Aviation Related Math</td>
<td></td>
</tr>
<tr>
<td>I.2.2.1 Identify terms used with fractions</td>
<td>• Numerator</td>
</tr>
<tr>
<td></td>
<td>• Denominator</td>
</tr>
<tr>
<td></td>
<td>• Mixed numbers</td>
</tr>
<tr>
<td></td>
<td>• Improper fractions</td>
</tr>
<tr>
<td>I.2.2.2 Perform calculations using fractions</td>
<td>• Reducing fractions to lowest terms</td>
</tr>
<tr>
<td></td>
<td>• Changing mixed numbers to improper fractions and improper fractions to mixed numbers</td>
</tr>
<tr>
<td></td>
<td>• Perform addition and subtraction</td>
</tr>
<tr>
<td></td>
<td>• Perform multiplication and division</td>
</tr>
<tr>
<td></td>
<td>• Convert fractions to decimals</td>
</tr>
<tr>
<td></td>
<td>• Convert decimals to fractions</td>
</tr>
<tr>
<td>I.2.3 Use of Percentages in Aviation Math</td>
<td></td>
</tr>
<tr>
<td>I.2.3.1 Identify the use of percentage in aviation</td>
<td></td>
</tr>
</tbody>
</table>
I2.3.2 Perform calculations for percentage conversions

- Decimal/percentage conversions
- Fraction/percentage conversions
- Ratio/percentage problems

I2.4 Use of Ratios and Proportion in Aircraft Maintenance

I2.4.1 Solve ratio and proportion problems

- Express two quantities in the form of a ratio
- Express two ration in the form of a proportion
- Solve mechanical lever problems
- Solve hydraulic piston/actuator problems
- Identify and determine different gear ratios

I2.5 Use Area and Volume Calculations in Aircraft Maintenance

I2.5.1 Perform area calculations

- Rectangles
- Squares
- Triangles
- Quadrilaterals
- Circles

I2.5.2 Solve for the total area of aircraft related layout patterns

Using:
- Triangles
- Quadrilaterals
- Circles

I2.5.3 Perform volume calculations

- Rectangular solids
- Cubes
- Cylinders
- Spheres

I2.5.4 Calculate total volume in aviation-related problems

I2.6 Measuring Systems and Conversions
I2.6.1 Calculate total volume in aviation-related problems

I2.6.2 Solve aviation-related problems in Imperial Units for length, velocity, and weight.

I2.7 Angular Measurement and Trigonometric Functions.

I2.7.1 Solve problems involving addition and subtraction

I2.7.2 Calculate unknown quantities in right angle triangles, using trigonometric functions.

I2.8 The Physical States of Matter

I2.8.1 Identify the three physical states of matter

I2.8.2 Compare the difference between weight and mass

I2.8.3 Define density of a substance

I2.8.4 Define specific gravity of a substance

I2.9 The Basic Types of Energy

I2.9.1 Identify the difference between potential and kinetic energy

I2.9.2 Compute the quantity of potential energy of an elevated weight

I2.10 The Use of Simple Machines in Aviation Maintenance

I2.10.1 Define and express work, power, and force

I2.10.2 Calculate mechanical advantages of simple machines, and explain their function

Perform imperial/S.I. conversions of:
- Speed
- Length
- Mass
- Temperature
- Pressure
- Volumes

- Degrees
- Minutes
- Seconds

- Solid
- Liquid
- Gas

- Levers
I2.11 Stress and Strain

I2.11.1 Describe the five different types of stress, and the ways in which they act upon aircraft structures

- Tension
- Torsion
- Compression
- Bending
- Shear

I2.11.2 Explain the difference between stress and strain

I2.12 Motion and Laws of Motion

I2.12.1 Explain the effect of force on matter using Newton’s first, second and third laws

I2.12.2 Differentiate between speed and velocity

I2.12.3 Compare centrifugal and centripetal force

I2.13 Heat and Pressure

I2.13.1 Identify three methods of heat transfer

- Conduction
- Convection
- Radiation

I2.13.2 Differentiate between specific heat and latent heat

I2.13.3 Identify the parameters defining standard day conditions

I2.13.4 State the difference between the various types of pressures

- Absolute pressure
- Gage pressure
- Differential pressure

I2.14 Gas and Fluid Laws

I2.14.1 Identify the different gas laws

- Charles law
- Boyle’s law
- Dalton’s law

I2.14.2 Use gas laws to determine the results of changing parameters

I2.14.3 Compare the compressibility of gasses and fluids
I2.14.4 Determine the pressure exerted by a column of fluid

I2.14.5 Use Pascal’s law to explain the mechanical advantage of a simple hydraulic system

I2.14.6 Explain, using Bernoulli’s principle, the pressure changes that take place in a venturi

I2.15 Sounds and its Effects

I2.15.1 Explain the propagation of sound and its speed variations through different mediums

I2.15.2 Identify the effects of temperature and pressure on the speed of sound

I2.15.3 Explain the concept of Mach number as a measurement of the speed of sound, and how it varies with different atmosphere conditions affecting the flight of an aircraft
Line (GAC): 3 Tools and Equipment
Competency: 3.01 Hand and Machine Tools

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

LEARNING TASKS

G6.1 Safety Consideration and Procedures

G6.1.1 Discuss safety regulations (provincial and other governing safe operation of hand and machine tools)

- Eye protection
- Ear protection
- Respiratory protection
- Clothing
  - Coveralls
  - Apron
  - Gloves
  - Footwear
- Jewelry

G6.1.4 Demonstrate awareness of safety procedures and regulations related to operation of hand and machine tools (Practical)

G6.2 Cutting Tools

G6.2.1 Describe correct and safe use of cutting tools

- Diagonal cutters
- Chisels
  - Types
  - Cutting angles
- Hacksaws
  - Frames
  - Blades
  - Two-teeth rule
- Files
  - Nomenclature
  - Types
  - Cuts
  - File cards
- Twist drills
  - Nomenclature
  - Index sizes
  - Point angle
  - Cutting speeds
- Feed speed
- Lubricants
- Countersinks
  - Angles
  - Plain
  - Automatic
- Counterbores
  - Spot facing
- Reamers
  - Straight
  - Adjustable
  - Taper
- Taps and dies
  - Types
  - Thread forms (introduction), UNF and UNC internal and external
  - Tap drills
  - Body drills
  - Thread repairing devices
- Snips and scissors
  - Straight, left and right hand metal snips
- Hole cutters

G6.2.2 Demonstrate correct and safe use of a variety of cutting tools including items listed in G5.2.1

G6.3 Mechanical and Electrical Assembly Tools

G6.3.1 Discuss application and safe use of wrenches
- Open-end, box-end, combination and offset
- Six and twelve point
- Ratchetting box-end
- Flare nut
- Adjustable
- Allen wrenches

G6.3.2 Discuss application and safe use of socket wrenches and accessories
- Drive handles and sizes
- Shallow and deep sockets
- Six, eight and twelve point
- Crowsfoot wrenches
- Extensions
G6.3.3. Discuss application and safe use of torque wrenches

- Specialty attachments such as flex sockets, universal joints, Allen and screwdriver heads
- Use of torque and torque values
- Types (e.g., click, bar, gauge)
- Proper care/calibration
- Calculations of torque corrections for length length adapters

G6.3.4 Discuss special wrenches and precautions in their use

- Screw extractors
- Strap wrench
- Spanner wrenches

G6.3.5 Discuss screwdrivers and their applications

- Types:
  - Slotted (plain)
  - Phillips
  - Reed and prince
  - Clutch head, torx, hex and tri-wing
  - Stubbies, offsets and ratchets

G6.3.6 Discuss pliers and their applications

- Combination slip joints
- Adjustable slip joints
- Channellocks
- Vice grips (adjustable lever wrench)
- Needle nose
- Duckbills
- Safety-wire twisters
- Circlip pliers

G6.3.10 Calculate and demonstrate torque correction required for several situations requiring torque wrench extensions and crows-feet extensions

G6.4 Power and Abrasive Tools

G6.4.1 Explain safe use of power tools

- Saws
- Drill presses
- Routers

G6.4.2 Explain safe use of abrasive tools

- Belt and disc sander
  - Parts (nomenclature)
Program Content
Level 1

- Operation and maintenance
- Safety
- Pedestal and valve grinders
  - Parts (nomenclature)
  - Operation and maintenance
  - Safety
  - Abrasive wheels
- Media blasters
Line (GAC): 3 Tools and Equipment
Competency: 3.02 Precision Measuring Instruments

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

LEARNING TASKS

G8.1 Micrometers

G8.1.1. Describe micrometers
- Types
  - Caliper
  - Vernier
  - Inside and outside micrometer
  - Depth gauge
- Different sizes
- Nomenclature
- Principle of operation
- Master gauge block

G8.1.2 Read micrometers
- Imperial outside micrometer (.001”)
- Imperial outside with vernier scale (.0001”)
- Imperial depth micrometer
- Imperial inside micrometer
- Metric outside micrometer
- Metric inside micrometer

G8.1.3 Describe care and handling of micrometers
- Cleaning
- Oiling
- Storage
- Check for accuracy
- Make adjustments

G8.1.4 Measure components, and record correct reading, using micrometers (Practical)
- 0 to 1” outside micrometer
- Over 1” (25mm) outside micrometer
- Inside micrometer
- Depth micrometer

G8.2 Precision Measuring Calipers

G8.2.1 Describe precision measuring calipers
- Types:
  - Vernier
Program Content
Level 1

- Dial
- Digital
- Nomenclature
- Principle of operation

G8.2.2 Explain how to use and check for accuracy
- Vernier
- Dial
- Digital

G8.2.3 Explain use of precision measuring calipers for inside/outside and depth measurement

G8.2.4 Describe care and handling of precision measuring calipers
- Cleaning
- Oiling
- Storing
- Adjusting

G8.2.5 Demonstrate use of precision measuring calipers. Measure components and record readings (Practical)

G8.3 Bore and Dial Gauges

G8.3.1 Describe bore and dial gauges
- Nomenclature
- Principles of operation
- Correct use and limitations
  - Small-bore gauge
  - Telescoping gauge
  - Cylinder gauge (dial)
  - “Go no-go” gauges
  - Pin gauges
  - Feeler gauges
  - Universal dial indicators
  - Air
  - Electronic
- Surface plate

G8.3.2 Describe care and handling of bore and dial gauges
- Oiling
- Cleaning
- Storing
- Adjusting
G8.4    Comparators and Miscellaneous Instruments

G8.4.2   Explain use of miscellaneous measuring instruments

- Protractors
  - Bevel
  - Bubble
  - Propeller
  - Digital
  - Inclinometer
- Combination set
- Gauges
  - Height
  - Depth
  - Radius
  - Thread
  - Thickness
- Rules
  - Machinist
  - Steel
  - Flexible

G8.4.3   Explain tools used to transfer measurements

- Calipers
- Dividers

G8.4.4   Describe care and maintenance of gauges, rules and calipers

- Cleaning
- Oiling
- Storing
Line (GAC): 4  Airframe Fuel Systems  
Competency: 4.01  Fuel and Fuel Systems

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3.1  Aircraft Fuels</td>
<td></td>
</tr>
<tr>
<td>A3.1.1 Describe fuels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Production</td>
</tr>
<tr>
<td></td>
<td>- Sources</td>
</tr>
<tr>
<td></td>
<td>- Process</td>
</tr>
<tr>
<td></td>
<td>- Types of aircraft fuel</td>
</tr>
<tr>
<td></td>
<td>• Characteristics of aviation gasoline (AVGAS)</td>
</tr>
<tr>
<td></td>
<td>- Volatility</td>
</tr>
<tr>
<td></td>
<td>- Detonation</td>
</tr>
<tr>
<td></td>
<td>- Octane and performance rating</td>
</tr>
<tr>
<td></td>
<td>- Specific gravity</td>
</tr>
<tr>
<td></td>
<td>- Flash point</td>
</tr>
<tr>
<td></td>
<td>• Characteristics of turbine fuel</td>
</tr>
<tr>
<td></td>
<td>- Low viscosity</td>
</tr>
<tr>
<td></td>
<td>- Quick start</td>
</tr>
<tr>
<td></td>
<td>- Complete combustion</td>
</tr>
<tr>
<td></td>
<td>- High calorific action</td>
</tr>
<tr>
<td></td>
<td>- Non-corrosive</td>
</tr>
<tr>
<td></td>
<td>- Fire hazard</td>
</tr>
<tr>
<td></td>
<td>- Provide lubrication</td>
</tr>
<tr>
<td></td>
<td>- Specific gravity</td>
</tr>
<tr>
<td></td>
<td>- Flash point</td>
</tr>
<tr>
<td>A3.1.2 Identify fuels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Turbine fuels</td>
</tr>
<tr>
<td></td>
<td>- Jet A</td>
</tr>
<tr>
<td></td>
<td>- Jet A1</td>
</tr>
<tr>
<td></td>
<td>- Jet B</td>
</tr>
<tr>
<td></td>
<td>• Aviation gasoline</td>
</tr>
<tr>
<td></td>
<td>- AVGAS 80</td>
</tr>
<tr>
<td></td>
<td>- AVGAS100</td>
</tr>
</tbody>
</table>
A3.1.3 Describe fuel handling

- AVGAAS 100LL
- MOGAS
- Fuel lines (color codes)
- Filler cap markings
- Refueling vehicle markings
- Fire hazards
  - Static electricity
  - Volatility
  - Contamination control:
    - Water
    - Solids
    - Microbial
    - Incorrect grade
- Fueling procedures
  - Water contamination check:
    - Water detection tablets and paste
  - Filters for hand pumps and electric pumps
  - Spill and disposal procedures
  - Grounding
  - Static electricity
- De-fueling procedures
- Care and storage
  - Packed fuel
  - Fuel bowsers
  - Pumps
  - Filter units
  - Drums/plastic jerry cans
- Additives
  - Anti-icing
  - Microbial

A3.2 Aircraft Fuel Systems and components

A3.2.1 Describe fuel systems

- Types of fuel systems
- Gravity feed
- Pressure-feed
- Requirements for fuel systems

A3.2.2 Describe fuel tanks

- Integral
  - Materials
  - Construction
A3.2.3 Describe fuel tank filler caps
- Types
- Purpose
- Safety considerations
  - Venting
  - Preventing of incorrect grade
- Locking

A3.2.5 Describe fuel pumps
- Purpose
- Classification
  - Boost
  - Scavenge
  - Cross-feed
  - Main
  - Emergency
- Types
  - Vane
  - Variable-volume
  - Centrifugal: electrically operated and used to start engines, may be submerged
  - Ejector (used as a scavenge, take over when centrifugal switched off)
  - Wobble pump
  - Gear pump
  - Piston pump
  - Diaphragm pump

A3.2.6 Describe filters and strainers
- Reasons for filtering
- Warning system
- Location of filters
- Maintenance practices
- Drains
- Location purpose
A3.2.7 Describe fuel valves

- Selector
  - Purpose select
  - Shut-off
  - Flexible
  - Rigid
  - Integral
- Hand operated
  - Cone type
  - Poppet-type
- Motor-operated
- Solenoid-operated

A3.2.8 Describe fuel heaters

- Types
- Purpose
- Position on aircraft

A3.2.9 Describe fuel system indicators

- Quantity indicating
  - Low level warning system
- Flowmeters
- Temperature gauges
- Pressure gauges
- Discharge indicators

A3.3 Aircraft Fuel System Operation

A3.3.1 Describe fuel system operation

- Priming
- Venting
- Fuel jettisoning
- Oil dilution
- Cross-feed
- Indicating components
- Warning lights

A3.3.2 Describe single-engine aircraft fuel systems

- Gravity-feed
  - Components
  - Operation
- Pump-feed
  - Low-wing aircraft
  - Components
  - Operation
  - High-wing aircraft
    - Components
    - Operation

A3.3.3 Describe multi-engine aircraft fuel systems

- Small aircraft
  - Components
  - Operation
• Large reciprocating engine aircraft
  - Components
  - Operation
• Large gas turbine engine aircraft
  - Components
  - Operation

A3.4 Aircraft Fuel System Maintenance

A3.4.1 Explain importance of system grounding

A3.4.2 Describe re-fuelling and de-fueling of aircraft
  • Safety aspects
    - System bonding
    - Fire precautions
    - Clothing
    - Tools
    - Venting and tank (purging)
  • Procedures
  • Gravity fuelling
  • Pressure fuelling
  • De-fuelling
  • Hot fuelling

A3.4.3 Discuss leak detection and classification

A3.4.4 Describe water and sediment checks

A3.4.6 Describe fuel tank repair, installation and testing
Program Content
Level 1

Line (GAC): 5 Aircraft Handling
Competency: 5.01 Aircraft Handling

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

LEARNING TASKS

G7.1 Standards and Specifications
G7.1.1 Explain differences between approved and non-approved aircraft hardware
G7.1.2 Explain “standards” as used in aircraft industry

CONTENT

- Abbreviations
  - Army/Navy (AN)
  - Air Force/Navy/Aeronautical Design (AND)
  - Military Standard (MS)
  - National Aircraft Standard (NAS)
  - Naval Aircraft Factory (NAF)
  - Aeronautical Standard (AS)
  - Aeronautical Materials
  - Specifications (AMS)
- Industry standards
  - American Society for Testing and Materials (ASTM)
  - American National Standards Institute (ANSI)
  - American Iron and Steel Institute (AISI)
  - Society of Automotive Engineers (SAE)
  - Alloy Casting Institute (ACI)
  - Investment Casting Inst. (ICI)
  - Gray Iron Founders’ Society (GIFS)
  - Steel Founders’ Society of America (SFSA)
  - CGSB

G7.1.3 Explain “specifications” as used in aircraft industry

G7.2 Threaded Fasteners and Related Safetying Devices
G7.2.1 Describe characteristics of thread forms

- Military specifications (MIL)
- FAA/JAA/Transport Canada specs
- Terms:
  - Pitch
  - Lead
  - Crest
G7.2.2 Describe unified thread series

- Root
- Major diameter
- Minor diameter

- Forms and series:
  - AN
  - Whitworth
  - SI
  - Unified
  - Acme
  - American and British standard
  - Pipe
  - BA
  - Buttress
  - Metric taper

- UNF/UNC
  - Thread call-out and sizes
  - Class of fit
  - Internal and external thread
  - Designation (A/B)

G7.2.3 Describe characteristics and application of aircraft bolts

- Define
  - Grip
  - Length
  - Diameter

- Bolt size (diameter and length)
- Determine grip length with reference to tables
- Identify bolts by:
  - Head shape
  - Markings
- Application
- Aircraft bolts:
  - AN part number system
  - Close tolerance
  - Drilled head
  - Clevis
- MS and NAS bolts:
  - MS and NAS part number system
  - Use tables for correct size bolt, grip
- Review: method of identifying screws and determining part numbers
  - Size
  - Length
  - Thread
  - Shape of head
  - Material
  - Grip length
  - Special features
- Difference between bolts and screws
- Structural and non-structural screws
G7.2.5 Describe aircraft nuts

- Head style
- AN screw part number system
- Self-tapping screws and their uses:
  - Type A
  - Type B
- MS standard screws
- Use of nuts
- Various types of nuts
- Use designation codes to identify:
  - AN310 castle nut
  - AN320 shear nut
  - AN315 plain nut (L/R thread)
  - AN316 check nut
  - Self-locking nuts (NC/NF):
    - AN364 shear
    - AN365 fibre
    - AN363 metallic
    - Plate nuts
    - AN350 wing nuts
    - Sheet spring nuts
- AN nut part number system
- MS nuts

G7.2.6 Describe relationship of wrench size to bolt or nut size:

- Review “torque” and use of torque tables
- Metric
- SAE
- BSF/BSW

G7.2.7 Describe aircraft washers

- Use
- Types
  - AN960 flat
  - AN970 large-area flat
  - AN935 split-ring lock
  - AN936 shake proof (type A/B)
  - Thin series
- Washer sizes (to fit screw or bolt)
  - AN935, AN936 lock
  - AN950, AN955 Ball socket, seat washers
  - AN975 taper pin washers
  - NAS143 countersunk washers
- Installation

G7.2.8 Describe procedures for securing hardware

- Cotter pins
  - Uses
  - Sizes
  - Part numbers
  - Demonstrate
  - Installation/removal
- Safety wire
  - Uses
  - Sizes
Program Content
Level 1

- Part numbers
- Demonstrate
- Installation/removal

- Witness wire
- Witness marking
- Specialty locking devices
- Other methods for securing hardware
  - Peening
  - Staking
  - Lock/tab washers
  - "Loctite"
  - circlips
  - snap rings

G7.2.9 Describe various types of threaded insert devices and their installation

G7.2.10 Using acceptable standard practices, complete exercises (Practical)

G7.3 Non-Threaded Fasteners

G7.3.1 Describe types and uses of pins

Types:
- Clevis MS20392
- Taper AN385-386
- Roll
- Spring

Uses:
- Locking
- Securing
- Identification by:
  - Material
  - Head shape
  - Markings
  - Length
  - Diameter
- Rivet materials and identifying marks:
  - Aluminum and aluminum alloy rivets; discuss “ice-box” rivets
  - Magnesium
  - Copper
  - Steel
  - Monel

G7.3.2 Describe rivets
G7.3.3 Describe fasteners
- Titanium
- Part numbers
- MS20600 – MS20603 series and NAS1398, 1399, 1738 and 1739 series
- Uses and limitations
- Cherrylock
- Cherrymax
- Huck
- Pop rivets

G7.3.4 Describe uses of special fasteners
- K-bolts
- Hi-lock
- Hi-shear
- Jo-bolts
- Anchor nuts

G7.3.5 Describe quick release fasteners
- Dzus
- Camlock
- Airlock fasteners

G7.4 Fluid Lines and Fittings

G7.4.1 Describe piping and tubing as used in aircraft systems

G7.4.2 Describe flared tubing and connections

G7.4.3 Describe use of tapered pipe threads

G7.4.4 Describe various threaded fittings
- Universal and bulkhead fittings
- Universal fittings
- Nipples
- Reducers

G7.4.5 Describe flared fitting designations
- AN/MS no. indicates function of fitting
- Sizing
- Materials identification

G7.4.6 Describe flare less tube connections

G7.4.7 Describe swaged tube fittings

G7.4.8 Describe quick-disconnect fittings
G7.4.9 Describe installation procedures for flexible connectors

- Proper clamping procedures

G7.4.10 Identify materials and demonstrate installation techniques of fluid lines and fittings

- Identify various materials used in manufacture of tubing
- Identify various materials used on manufacture of hose
- Identify different categories of hose
  - Low pressure
  - Medium pressure
  - High pressure
- Identify different types of tube fittings
  - MS flare-less
  - AN flared
  - Pipe fittings
- Demonstrate installation procedures for different types of tube fittings
- Identify typical aircraft hose fittings
- Demonstrate installation procedures for aircraft hose fittings
- Explain AN numbering systems for aircraft tubing, hose, and fittings
- Identify “allowable damage tolerances for tubing and hose”
- Demonstrate proper installation procedures for tubing and hose
- Identify “allowable repair practices for tubing and hose”
- Identify quick-disconnect couplings in systems
- Identify aircraft fluid lines according to their colour coding
- Demonstrate safety procedures for high-pressure fluids
- Identify shelf and service life of aircraft flexible hose
- Demonstrate installation of flexible connectors
Line (GAC):  6  Hydraulic and Pneumatic Systems
Competency:  6.01  Environmental Systems

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4.5  Aircraft Pneumatic Systems</td>
<td>• Temperature regulation</td>
</tr>
<tr>
<td>A4.5.1 Explain the principles of operation of the</td>
<td>• Pressure control</td>
</tr>
<tr>
<td>pneumatic system</td>
<td>• Flow control</td>
</tr>
<tr>
<td></td>
<td>• Sources</td>
</tr>
<tr>
<td></td>
<td>• Common application</td>
</tr>
<tr>
<td>A4.5.2 Explain the maintenance and servicing of</td>
<td>• Relief valves</td>
</tr>
<tr>
<td>pneumatic system components</td>
<td>• Control valves</td>
</tr>
<tr>
<td></td>
<td>• Filters</td>
</tr>
<tr>
<td></td>
<td>• Air bottles</td>
</tr>
<tr>
<td></td>
<td>• Lines and tubing</td>
</tr>
</tbody>
</table>
Program Content
Level 1

Line (GAC): 6 Hydraulic and Pneumatic Systems
Competency: 6.02 Hydraulic Systems

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| A5.1 Hydraulic Components | • Reservoirs  
| |   - Non-pressurized  
| |   - Pressurized  
| | • Pressure control devices  
| |   - Relief valves  
| |   - Pressure regulator  
| |   - Unloading valves  
| |   - Thermal relief valve  
| |   - Debooster valve  
| | • Selector valves  
| |   - Rotary  
| |   - Poppet  
| |   - Open center  
| | • Automatic operating valves  
| |   - Restrictor/orifice  
| |   - Sequence value  
| |   - Check  
| |   - Metering  
| |   - Hydraulic fuse  
| |   - Shuttle  
| |   - Priority  
| | • Accumulators  
| |   - Diaphragm  
| |   - Bladder  
| |   - Piston  
| | • Filters  
| |   - Paper  
| |   - Metallic mesh  
| |   - Sintered metal  
| |   - Cuno filter  
| | • Pumps  
| |   - Hand pumps |
Aircraft Maintenance Technician Industry Training Authority

Program Content
Level 1

- Gear type
- Vane type
- Gerotor
- Piston
- Variable delivery

- Switches
  - Pressure
  - Thermal
  - Position
  - Limit

- Actuators
  - Single acting
  - Double acting
  - Servo actuators
  - Hydraulic motors

- Quill shaft

A5.2 Hydraulic Back-up Systems

A5.2.2 Explain operation of manual pump

- How it fits into hydraulic system to operate essential aircraft sub systems

A5.2.4 Explain operation of auxiliary electric pump

- How auxiliary electric pump can be used to operate essential aircraft systems

A5.2.5 Explain purpose of brake accumulator in aircraft hydraulic system

A5.3 Simple Hydraulic Systems

A5.3.1 Explain path of fluid flow required to

- Actuate flaps in simple closed-center hydraulic system
- Retract and extend landing gear

A5.3.2 Identify and describe purpose of components in system, using simple closed-center hydraulic system schematic

A5.3.3 Explain operational differences between open and closed-center systems, using schematic diagrams

A5.3.4 Explain hydraulic power pack

- Small aircraft hydraulic system
A5.4 Multiple, Independent Hydraulic Systems

A5.4.1 Explain sub-system operations using schematic diagrams

- Interconnection between systems A, B, and standby system
- Sub-systems operated by power systems
- Reservoir and pump configuration for power systems
- Operation of components:
  - Supply shutoff valves
  - Ground interconnect valve
  - Brake interconnect valve
  - Manual bypass valve
  - Heat exchanger
  - Accumulators

A5.4.2 Explain schematic diagram

- Explain method used for pressurization of reservoir
- Explain operation of engine-driven pressure pumps

A5.4.3 Explain function of ram air turbine in aircraft hydraulic system

A5.4.4 Explain hydraulic module or modular unit

A5.5 Helicopter Hydraulic Systems

A5.5.1 Explain purpose of using multi hydraulic systems in large helicopter.

A5.5.2 Discuss hydraulic system warning devices

A5.5.3 Explain operation of pulsation dampener

A5.6 Hydraulic System Maintenance

A5.6.1 Discuss safety and servicing practices

- Replenishing fluids
- Fluid types
- Handling of fluids
- Pressurization of reservoirs
- Accumulators
• Use of ground hydraulic test equipment

A5.6.2 Describe procedures for purging air from hydraulic system

A5.6.3 Describe procedures for flushing contaminants from hydraulic system.

A5.6.5 List items and inspection methods of a scheduled hydraulic system inspection.

A5.6.6 Inspect, service, operate, and test a hydraulic system (Practical)

A5.6.7 Service a high pressure accumulator (Practical)

A5.7 Hydraulic System Troubleshooting

A5.7.1 Identify best source of reference for troubleshooting hydraulic problems

A5.7.2 Given aircraft troubleshooting chart, discuss recommended steps in the troubleshooting process

A5.7.3 Given list of common hydraulic system malfunctions, formulate logical step-by-step troubleshooting process
## Objectives

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

### LEARNING TASKS

<table>
<thead>
<tr>
<th>A7.6</th>
<th>Hydraulic Control Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>A7.6.2</td>
<td>Describe hydraulic powered flying controls</td>
</tr>
<tr>
<td>A7.6.3</td>
<td>Describe artificial “feel”</td>
</tr>
<tr>
<td>A7.6.4</td>
<td>Explain rotary-wing hydraulic boosted controls</td>
</tr>
</tbody>
</table>

### CONTENT

- Reasons for powered flying controls
- Requirements of powered flying control systems
  - Performance
  - Response
  - Stability
  - Irreversibility
  - Safety and reliability
- Components
- Advantages/disadvantages
- Duplicate systems
- Manual reversion systems
- Reasons for
- Requirements
- Stall warning
- Force gradient
- Magnetic brakes
- Components
- System description
- System function
- Component location
Objectives
To be competent in this area the individual must be able to:

LEARNING TASKS

<table>
<thead>
<tr>
<th>G13.1</th>
<th>Fluids in Motion and under pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>G13.1.1</td>
<td>Explain laws concerning behavior of fluids</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Law of conservation of energy</td>
</tr>
<tr>
<td>• Static laws</td>
</tr>
<tr>
<td>• Pascal’s law</td>
</tr>
<tr>
<td>• Hydrostatic paradox</td>
</tr>
<tr>
<td>• Mechanical advantage</td>
</tr>
<tr>
<td>• Dynamic laws</td>
</tr>
<tr>
<td>• Bernoulli’s principle</td>
</tr>
<tr>
<td>• Fluid friction</td>
</tr>
<tr>
<td>• Boyles (Marriott Law)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>G13.2</th>
<th>Work and Power calculations</th>
</tr>
</thead>
<tbody>
<tr>
<td>G13.2.1</td>
<td>Explain work and power calculations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Define and discuss force, pressure, distance, area, volume, work,</td>
</tr>
<tr>
<td>• Discuss area of circle and volume of cylinder</td>
</tr>
<tr>
<td>• Apply appropriate units of measurement to force, pressure, work, power, etc.</td>
</tr>
<tr>
<td>• Explain relationships:</td>
</tr>
<tr>
<td>• For example</td>
</tr>
<tr>
<td>• Force = area x pressure</td>
</tr>
<tr>
<td>• Volume = area x distance</td>
</tr>
<tr>
<td>• Work = force x distance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>G13.3</th>
<th>Hydraulic Fluids</th>
</tr>
</thead>
<tbody>
<tr>
<td>G13.3.1</td>
<td>Describe properties of hydraulic fluids</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Requirements and purposes of hydraulic fluid</td>
</tr>
<tr>
<td>• Three different types of hydraulic fluids</td>
</tr>
<tr>
<td>• Vegetable base</td>
</tr>
<tr>
<td>• Mineral based</td>
</tr>
<tr>
<td>• Synthetic</td>
</tr>
<tr>
<td>• Incompatibilities</td>
</tr>
<tr>
<td>• Safety concerns, handling techniques and compatibility of hydraulic fluids</td>
</tr>
</tbody>
</table>
G13.4 Simple Hydraulic systems

G13.4.1 Define and discuss a simple, closed hydraulic system

- Difference between open and closed systems
- Definition of closed system
- Operation of simple hydraulic brake systems
- Components of simple, closed system:
  - Reservoir
  - Pump
  - Selector valve
  - Actuator

G13.5 Open and closed-centre systems

G13.5.1 Define and discuss difference between open- and closed-centre systems

- Open-centre system schematic vs. Closed-centre system
- Path of fluid flow through an open centre system
- Major operational differences between two systems
  - Selectors return to neutral
  - Only one subsystem can be fully operational at a time
- Advantages and disadvantages of two types of systems

G13.7 Pneumatics

G13.7.1 Explain function and operation of pneumatic system components

- Pressure source
  - Compressors
  - Storage bottles
- Pressure-control devices
  - Bleed valve
  - Relief valve
  - Unloading valve
  - Pressure-reducing valve
- Actuating Devices
- Flow control valves
  - Shuttle
  - Isolation
- Moisture control
- Filters
- Ground charging valve
- Monitoring devices
- Identify pneumatic lines according to their
Program Content  
Level 1

colour coding

- Discuss safety procedures for handling high-pressure air bottles

G13.8 Hydraulic Seals

G13.8.1 Discuss different types of seals

- O-rings
- Chevron seals
- U-ring seals
- Gaskets
- Crush washers
- Backup rings
- Uses
- Importance of fluid compatibility
- Installation of different types of seals

G13.8.2 Discuss pressure testing procedures of components
Program Content
Level 1

Line (GAC):  7  Landing Gear
Competency:  7.01  Landing Gear, Wheels, Tires, Brakes

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

LEARNING TASKS

A6.1  Landing Gear, Types and Configurations
A6.1.1  Discuss purpose of landing gear

A6.1.2  Describe landing gear types

A6.1.3  Describe non-shock-absorbing landing gear

A6.1.4  Describe shock-absorbing landing gear

CONTENT

- Configurations
  - Tricycle
    o Main wheels
    o Nose wheels
  - Conventional
    - Main wheels
    - Tail wheels
  - Large transport aircraft
    - Main wheel layout
  - Centre line
  - Skis
  - Floatplanes
    - Floats
    - Hulls
    - Amphibians
  - Fixed
  - Retractable
    - Mechanical
    - Electrical
    - Hydraulic
    - Emergency
  - Helicopter
    - Skids
    - Floats
    - Pop out (emergency floats)

- Rigid
- Shock-cord
- Spring-type

- Rubber block
- Spring shock struts
- Air/oil shock struts
A6.1.5 Identify landing gear components.

A6.1.6 Describe maintenance and servicing of air/oil shock struts

- Filling
  - Types of oil
- Bleeding
- Removal
  - Safety precautions
- Dismantling
- Components

A6.1.7 Describe shimmy dampers

- Purpose
- Types
  - Piston-type
  - Vane-type
- Servicing

A6.1.8 Describe nose-tail-wheel steering systems

- Small aircraft
- Large aircraft

A6.1.11 Disassemble, inspect, service and reassemble air/oil shock struts (Practical)

A6.2 Aircraft Floats and Skis

A6.2.1 Describe construction of aircraft floats and hulls

A6.2.2 Describe construction of aircraft skis

A6.2.3 Describe maintenance and installation of floats and skis

- Boxing of floats (symmetry)
- Alignment of skis
- Ski retraction system

A6.2.5 Perform installation and rigging check (Practical)

- Floats or Skis

A6.3 Aircraft Wheels

A6.3.1 Describe wheels

- Construction
  - Divided hubs
  - Detachable flange
  - Nose wheels
  - Main wheels
- Components
A6.3.2 Describe wheel maintenance

- Removal of wheels from aircraft
- Disassembly
  - Safety
- Cleaning
  - Wheel
  - Bearings
- Inspection
  - Typical defects
  - Wheels
  - Bearings
- Lubrication of bearings
- Assembly
- Inflation (see Tires)
  - Safety

A6.3.3 Describe wheel balancing (requires knowledge of tires to complete – see Tires).

A6.3.4 Describe wheel alignment

- Purpose
- Terminology
  - Toe-in
  - Toe-out
  - Camber
- Adjustments
  - Use of grease plates

A6.4 Aircraft Tires

A6.4.1 Describe tires

- Construction
  - Tubed
  - Tubeless
  - High pressure
- Markings
  - Size
  - Ply
  - Colour codes
  - Identification
- Rating
- Mounting
- Storage

A6.4.2 Describe inner tubes

- Construction
- Inflation
A6.4.3  Describe tire maintenance
- Disassembly
  - Safety
- Cleaning
- Inspection
  - Typical defects
  - Tires: cuts, scores, overheating, bulges, wear, creep, flat spots, sponginess, rejected take-off
  - Tubes
- Assembly – different wheel/tube types
- Inflation
  - Safety
  - Tire pressures
    - Air or nitrogen
    - Cold/hot tires
    - Differential pressures (bogies)

A6.4.4  Describe repair of tires and tubes
- Recap

A6.4.6  Inspect, service, and inflate aircraft tire (Practical)

A6.5  Aircraft Brakes

A6.5.1  Describe aircraft brakes
- Disk
  - Single
  - Multiple
  - Segmented rotor-disk
- Construction
  - Components
- Internal expanding-shoe
- Expander-tube
- Carbon brakes
- Linings
  - Material

A6.5.2  Explain function of aircraft braking systems
- Review hydraulics fundamentals
- Braking heat energy
- Brake limitation charts
- Independent brake systems (light aircraft)
  - Purpose
- Power boost systems
  - Purpose
A6.5.3 Describe procedures for braking system maintenance

- Power brakes
  - Control valves
  - De-boosters
- Emergency braking systems
- Lining wear
  - Indicators
  - Measuring methods
- Bleeding brakes
  - Types of fluid
  - Master cylinders
  - Power brakes
  - Gravity bleeding
  - Pressure bleeding
- System leak checks
- Bolt torque check
- Bolt condition
- Disc condition
- Seal condition
- Replacement of brake linings
  - Safety (asbestos linings)
  - Brake burn-in

A6.5.4 Describe brake system faults

- Overheating
- Dragging
- Uneven wear
- Rapid wear
- Squealing and chattering
- Ineffective braking
- Uneven braking (aircraft pulls to one side)
- Excessive pedal travel

A6.5.5 Describe procedures for testing brakes after maintenance

A6.5.6 Disassemble and identify parts of brakes; reassemble (Practical)

A6.5.7 Check condition of brake linings; change linings (Practical)

A6.5.8 Bleed aircraft brakes (Practical)

A6.6. Anti-Skid Systems
A6.6.1 Describe operation of anti-skid systems
- Mechanical system
- Electrical system
- Electronic system
- Wheel-speed sensors
- Control valves
- Control box
- Circuitry
- Indicating system

A6.6.2 Identify components of anti-skid systems
- Wheel-speed sensors
- Control valves
- Control box
- Circuitry
- Indicating system

A6.6.3 Describe maintenance and testing of anti-skid systems

A6.7 Gear Retraction Systems

A6.7.1 Review types of retraction systems

A6.7.2 Review landing gear systems

A6.7.3 Explain function of retractable gear systems
- Purpose
- Components
  - Gear-selector mechanism
  - Gear-centering system
  - Over-centre links
  - Locks
    - Up
    - Down
    - Ground
  - Door actuation
    - Sequencing valves
    - Proximity switches
- Squat switches
- Fail-safe systems
  - Auto gear-down
  - Anti-retraction
- Emergency gear-down systems
  - Free-fall
  - Hand pump
  - Compressed air
- Warning devices
  - Lights
  - Audible warning devices

A6.7.4 Describe maintenance of retractable landing gear
- Rigging and adjustment
- Door clearance checks
A6.7.5 Research and explain (Practical)
- Retraction check
- Inspection
- Undercarriage retraction and extension system on aircraft

A6.7.6 Under supervision (Practical)
- Prepare aircraft for jacking up
- Jack-up aircraft
- Retract gear
- Extend gear
- Confirm correct operation (IAW) maintenance manual
- Jack-down aircraft
Line (GAC): 8  Structures, Assembly, Rigging
Competency: 8.01 Control and Rigging

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

LEARNING TASKS

A7.1 Types of Controls

A7.1.4 Describe control surface balance
- Static balance
- Aerodynamic balance

A7.1.5 Identify (Practical)
- Various control surfaces
- Types of control surface balance devices installed

A7.2 Cable and Wire Control Systems

A7.2.1 Describe cable control system
- System operation
- Components
  - Cables: trim, balance, main
  - Terminals
  - Horns and arms
  - Bell cranks
  - Stops
  - Pulleys
  - Fairleads
  - Turnbuckles
  - Quadrants
  - Walking beams

A7.2.2 Describe control cables and fittings
- Cable construction and materials
  - Manufacture
  - Cleaning
  - Corrosion prevention methods
- Sizes
- Swaging
- Splicing

A7.2.3 Describe adjustment procedures for cables
- Tensioning
- Tensiometer
- Temperature allowance
  - Automatic
A7.2.4 Describe range of movement

A7.2.5 Describe other types cable control systems

A7.2.6 Locate and identify components of aircraft or helicopter cable control system (Practical)

A7.2.7 Tension and secure aircraft control cable(s) (Practical)

A7.2.8 Swage steel-wire cable (Practical)

A7.3 Rod and Tube Control Systems

A7.3.1 Describe rod and tube control systems

A7.3.2 Describe adjustment procedures for push-pull control rods

A7.3.3 Describe control stops

A7.3.4 Describe range of movement limitations of aircraft control systems
A7.3.5 Locate and identify control system of aircraft and/or helicopter (Practical)

A7.7 Aircraft Fixed Surfaces Rigging

A7.7.1 Explain reasons for rigging
- Scheduled inspection
- Heavy landings
- Flight through turbulence
- Improper loading

A7.7.2 Describe aircraft leveling
- Reasons
- Procedures

A7.7.3 Describe fixed surface alignment checks
- Symmetry
- Dihedral/Anhedral
- Incidence
- Wing/fuselage alignment
- Empennage alignment
- Engine alignment
- Wires and struts
- Tools and equipment

A7.7.4 Describe float installation, boxing and rigging

A7.8 Flying Control Surfaces Rigging

A7.8.1 Describe safety procedures to be followed when rigging aircraft
- Jacking and leveling
- Moving controls
- Tagging controls
- Use of stands and ladders
- Done indoors, out of wind
- Tool control

A7.8.2 Describe installation and assembly of control surfaces
**A7.8.3** Describe interlock and safety systems

**A7.8.5** Describe control system rigging

- Tools and equipment required
  - Pins and jigs
- Rigging data reference material
- Control surface balancing
- Correct assembly and locking checks
- Independent inspections
- Loose article checks

**A7.8.6** Explain rigging of control surfaces

- Trim tab
- Elevator
- Aileron
- Rudder
- Stabilator
- Flaps

**A7.8.7** Describe problems associated with installation and/or rigging of interconnected controls

- Flaps and aileron
- Rudder/aileron (PA31)
- Controls incorporating autopilot control briddles

**A7.8.8** Describe internal and external control and gust locks

- Importance of flagging

**A7.8.9** Explain inspection procedures for controls

- Importance of little, or no, wear in control runs
- Problem areas
- Cleanliness
- Correct assembly
- Correct locking
  - Turnbuckles
  - Control rods
  - Stops
- Loose article checks
- Cable inspection
  - Condition
  - Crossed cables
- Control sense and direction
- Range of movement
- Checks with power on/off
- Checks with panels removed/refitted
- Use of manuals
- Check Ads
Line (GAC):  8  Structures, Assembly, Rigging
Competency:  8.02  Metallic Structures

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

LEARNING TASKS               CONTENT
A11.1.  Aircraft Construction
A11.1.1 Define parts of aircraft  • Nomenclature
                                         • Terminology
A11.1.2 Describe airframe forms  • Wire-braced structures
                                         • Skin:
                                         - Unstressed
                                         - Stressed
                                         • Girder or truss structures:
                                         - Pratt
                                         - Warren
                                         • Semi-monocoque:
                                         • Skin
                                         - Bulkheads
                                         - Longerons
                                         - Stringers
                                         - Formers
                                         - Gussets
                                         - Advantages/disadvantages
                                         • Monocoque
                                         - Advantages/disadvantages
                                         • Sandwich construction
A11.1.3 Describe wing forms
                                         • Truss
                                         • Semi Monocoque
                                         • Cantilever
                                         • Semi-contilever
                                         • Spars
                                         - Fail safe
                                         - Mono-spar
                                         - Two-spar
                                         - Multi-spar
A11.1.4 Describe wing control surfaces
- Construction

A11.1.5 Describe tail structure
- Construction
- Horizontal stabiliser
- Vertical stabiliser (fin)
- Construction
- Control surfaces

A11.1.6 Describe cabins, cockpit and compartments

A11.1.7 Describe aircraft doors
- Cargo
- Pressurized
- Non-pressurized
- Emergency

A11.1.8 Discuss types of landing gear attachment structure
- Wheel type
- Hulls and floats, amphibian
- Skis
- Skids

A11.1.9 Describe powerplant structures
- Nacelles
- Struts
- Pylons
- Firewalls
- Engine mounts
- QEC
- Design features
  - Reciprocating engine
  - Turbine engine
- Vibration mounts
- Dynafocal Mounts
• Cowlings and fairings

A11.1.10 Discuss terms associated with aircraft shape and dimensions

• Aircraft Station Numbers
  – Fuselage stations
  – Datum line
  – Wing stations
  – Water line
  – Butt line
  – Component stations
  – Zones
Objectives
To be competent in this area the individual must be able to:

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>G9.1   Properties of Atmosphere</td>
<td>• Distribution of gases</td>
</tr>
<tr>
<td>G9.1.1 Describe composition of atmosphere</td>
<td>• Divisions and extent: stratosphere and troposphere</td>
</tr>
<tr>
<td>G9.1.2 Explain static pressure</td>
<td>• Definition</td>
</tr>
<tr>
<td></td>
<td>• Units of measurement</td>
</tr>
<tr>
<td></td>
<td>• Torricelli</td>
</tr>
<tr>
<td></td>
<td>• Absolute pressure</td>
</tr>
<tr>
<td></td>
<td>• Gauge pressure</td>
</tr>
<tr>
<td>G9.1.3 Explain temperature</td>
<td>• Units of measurement - °F; °C;</td>
</tr>
<tr>
<td></td>
<td>• Decrease in temperature with altitude</td>
</tr>
<tr>
<td></td>
<td>• Lapse rate</td>
</tr>
<tr>
<td></td>
<td>• Inversion</td>
</tr>
<tr>
<td>G9.1.4 Explain density</td>
<td>• Review</td>
</tr>
<tr>
<td></td>
<td>• Gas laws:</td>
</tr>
<tr>
<td></td>
<td>- Boyle’s</td>
</tr>
<tr>
<td></td>
<td>- Charles</td>
</tr>
<tr>
<td></td>
<td>- Dalton’s</td>
</tr>
<tr>
<td></td>
<td>• Effects of density on performance</td>
</tr>
<tr>
<td>G9.1.5 Explain humidity</td>
<td>• Definition and conditions</td>
</tr>
<tr>
<td></td>
<td>• Weight of humid air</td>
</tr>
<tr>
<td></td>
<td>• Effect of humidity on performance</td>
</tr>
<tr>
<td>G9.1.6 Explain the term “Standard Day”</td>
<td>• Definition</td>
</tr>
<tr>
<td></td>
<td>• Importance and use</td>
</tr>
<tr>
<td></td>
<td>• ICAO Standard Day</td>
</tr>
<tr>
<td></td>
<td>• ISA Standard</td>
</tr>
<tr>
<td>G9.2   Elementary Aerodynamics</td>
<td></td>
</tr>
</tbody>
</table>
G9.2.1 Review Bernoulli’s Principle
- Relationship of pressure and velocity
- Flow in venturi
- Flow over airfoil

G9.2.2 Review Newton’s Third law of Motion
- Definition
- Effect on airfoil

G9.2.3 Describe airfoils
- Definition
- Terminology
  - Chord
  - Chord line
  - Camber
  - Thickness
- Profiles
- NACA
- Characteristics
  - Coefficient of lift
  - Coefficient of drag
  - Lift/drag ratio
- Centre of pressure
- Centre of gravity
- Lift
- Drag
- Thrust
- Weight

G9.2.4 Explain factors affecting lift
- Air Flow types
- Definition of lift
- Fundamental equation for lift
- Spanwise Flow
- Skin friction/viscosity
- Laminar flow
  - Boundary layer
  - Turbulence
- Angle of attack
  - Relative wind
  - Critical angle
- Stall
- Area and lift
- Velocity and lift
- Density and lift

G9.2.5 Explain factors affecting drag
- Definition of drag
- Fundamental equation for drag
- D = CD

- Classification
  - Parasite drag
  - Induced drag

- Parasite drag
  - Definitions
    - Form drag
    - Skin friction
    - Interference drag
  - Streamlining
  - Air density
  - Speed squared rule

- Induced drag
  - Definition

G9.2.6 Explain aspect ratio

- Wing Area
  - Definitions of aspect ratio
    - A = span/chord
    - A = b²/S
  - Effects of A/R
  - Wing-tip vortices/Induced drags
    - Airflow over wing
    - Winglets

G9.2.7 Explain reasons for wing tapers and sweep angle

G9.2.8 Calculate lift using formulas when variables are changed (Practical)

G9.2.9 Calculate aspect ratio (Practical)

G9.3 Control and Stability

- Vertical or normal
- Longitudinal
- Lateral

G9.3.1 Discuss aircraft axes

G9.3.2 Discuss movement around (or about) and along axes and how it is achieved

G9.3.3 Describe flight controls

- Ailerons
  - Adverse yaw
  - Friese
  - Differential
G9.3.4 Discuss stability

G9.3.5 Explain factors affecting stability

- Aileron droop
- Elevators
- Rudder

- Compound
  - Elevons
  - Flaperons
  - Stabilator
  - Ruddervator

- Secondary
  - Trim devices
  - Balance tabs
  - Trim tabs
  - Servo tab
  - Spring tabs
  - Anti-servo tabs

- Auxiliary/Lift modifying devices

- Flaps: various types
- Leading edge flaps
- Slots
- Slats
- Spoilers and air brakes
- Vortex Generator
- Strakes
- Stall Strips
- Wing LETS
- Wing femes
- Delta Wing

- Balance of control surfaces
  - Static
  - Dynamic

- Definition
  - Static
  - Dynamic

- Angle of incidence
  - Wash-in/wash-out

- Lateral stability
  - Dihedral/anhedral
  - Sweepback

- Longitudinal stability
  - Center of gravity position
- Neutral
- Negative
- Positive
- Tail plane position
- Longitudinal dihedral (incidence of tail)

- Directional stability
  - Vertical stabilizer/tail fin
  - Propeller slipstream effect
  - Sweepback

- Limits of control and stability
  - Excessive stability
  - Controllability
  - Lower and upper limits

G9.3.7 Describe canards
  - Definition
  - Purpose

G9.3.8 Describe purpose of forward swept wings

G9.3.9 Describe purpose of T-tail arrangement

G9.3.10 Explain loads and load factors
  - Loads acting on fuselage
    - G forces
    - Pressurization
    - Landing
  - Loads acting on wings
    - Normal Category
    - Utility Category
    - Acrobatic Category
    - Mainplane in a turn
    - Aerodynamic forces
  - Wing loading
    - Ratio of a/c total gross wt over total wing area

G9.4 High-Speed Flight

G9.4.1 Discuss nature of compressibility
  - Compare air to water
  - Compare behavior of air at low speed to high speed
  - Convergence/divergence effects
G9.4.2 Explain speed of sound
- Pressure warning
- Mach number
- Effects of temperature on speed of sound

G9.4.3 Discuss subsonic flight
- Define <M 0.75
- Local speed of air over airfoil higher than M 0.75

G9.4.4 Discuss properties of sound related to high speed flight
- Vibration
- Wave motion
- Sound transmission
- Intensity

G9.4.5 Discuss transonic flight
- Define M O. 75-M 1, 20
- Formation of shock wave
- Loss of lift, control
- Mach trim
- Mach feel

G9.4.6 Discuss supersonic and hypersonic flight
- High-speed airfoil sections:
  - Low thickness ratio
  - Low camber
  - Sweepback
  - Aspect ratio and tip shape
  - Delta wing
- Critical Mach number
  - Area Rule
  - Weighting Function
    - C/D Duct
    - Bi convex
## Program Content

**Level 1**

### Line (GAC): 9  Rotary Wing Control Systems

**Competency:** 9.01 Controls and Rigging

### Objectives

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

### LEARNING TASKS

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A7.9</td>
<td>Rotary-Wing Control Systems</td>
</tr>
<tr>
<td>A7.9.1</td>
<td>Describe differences in fixed-wing and rotary wing flight controls and rigging.</td>
</tr>
<tr>
<td>A7.9.2</td>
<td>Describe rotary-wing controls</td>
</tr>
<tr>
<td>A7.9.3</td>
<td>Describe control system components</td>
</tr>
<tr>
<td>A7.9.4</td>
<td>Describe main/tail rotor static balancing</td>
</tr>
<tr>
<td>A7.9.5</td>
<td>Describe main rotor blade alignment</td>
</tr>
<tr>
<td>A7.9.6</td>
<td>Describe flying control rigging procedures</td>
</tr>
</tbody>
</table>

### CONTENT

- Collective
- Cyclic
- Tail rotor
- Engine controls
- Interlinks
  - Collective/tail rotor
  - Collective/throttle
  - Collective/cyclic
- Stabilizer bars
  - Dampeners
- Mixer box units
- Elevator
- Masts
- Stabilizer bar
- Swashplate
- Push-pull tubes, bell cranks
- Actuators
- Pitch change rods
- Stops
- Tools and equipment
- Neutral checks
- Range of movement
- Stops
- Adjustments
A7.9.7  Explain inspection procedures for rotary wing controls

- Friction off
- Power on/power-off

- Importance of little, or no, wear in control runs
- Problem areas
- Cleanliness
- Correct assembly
- Correct locking
  - Turnbuckles
  - Control rods
  - Stops
- Loose article checks
- Cable inspection
  - Condition
  - Crossed cables
- Control sense and direction
- Range of movement
- Checks with power (hydraulics) on/off
- Checks with panels removed/refitted
- Use of manuals
- Check Ads

A7.9.10  Identify control system components

- Flying controls
  - Rotating
  - Non-rotating

A7.9.11  Identify non-flying control system(s)

- Throttle
- Governor
# Program Content

## Level 1

**Line (GAC):** 9  
**Rotary Wing Control Systems**

**Competency:** 9.02  
**Theory of Flight-Rotary Wing**

### Objectives

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

### LEARNING TASKS

<table>
<thead>
<tr>
<th>G10.1</th>
<th>Aerodynamic Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>G10.1.1</td>
<td>Recall fixed wing theory of flight terminology</td>
</tr>
<tr>
<td>G10.1.2</td>
<td>Define terminology related to rotary wing flight theory</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>G10.2</th>
<th>Rotor Designs</th>
</tr>
</thead>
<tbody>
<tr>
<td>G10.2.1</td>
<td>Explain various rotor designs and terminology applicable to various rotor designs</td>
</tr>
</tbody>
</table>

### CONTENT

- **G10.1.1**  
  - Chord  
  - Span  
  - Angle of incidence  
  - Relative wind  
  - Angle of attack  
  - Lift, drag, thrust and weight  
  - Stall  
  - Centre of pressure  
  - Airfoil shapes

- **G10.1.2**  
  - Relative wind  
  - Pitch angle  
  - Angle of attack  
  - Tip path plane  
  - Track/balance  
    - Related vibrations  
  - Lift, thrust  
  - Drag, weight  
  - Blade stalls  
  - Centre of pressure  
  - Airfoil shapes

- **G10.2.1**  
  - Flapping  
  - Feathering (pitching)  
  - Lead/lag (sweep, hunting)  
  - Rigid  
  - Semi-rigid  
  - Fully articulated  
  - Coning
10.3 Forces Acting on Rotor

10.3.1 Describe forces acting on helicopter rotor systems

- Lift
- Drag
- Weight
- Thrust
- Centrifugal force
- Centrepital force
- Newton’s Three Law’s
- Torque
  - Power
  - Collective pitch
  - Anti-torque tail rotor input
- Gyroscopic forces
  - Precession
- Coriolis forces
- Translating tendency
- Ground effect
- Dissymmetry of lift
- Transverse flow effect
- Translational lift
- Retreating blade stall
- Settling with power

G10.4 Autorotation, Ground Resonance, and Stability

G10.4.1 Describe autorotation

- Definition and requirements
- Freewheel units
- Factors affecting autorotation RPM
  - Airspeed
  - Weight
  - Density altitude
  - Collective position
  - Rigging
- Autorotative charts and adjustments
G10.4.2 Describe ground resonance

- Definition
- Susceptible rotor systems
- Recognition and prevention
- Prevention devices
- Actions

G10.4.3 Describe stability

- Definition
  - Static
  - Dynamic
- Causes
- Compensation
  - Stab bar
  - Paddles
  - Offset hinge (‘delta’)
  - Stability systems

G10.4.4 Given an autorotative chart and performance figures, determine correct autorotative rpm.

G10.5 Rotary Wing Controls

G10.5.1 Describe rotary wing flight control systems

- Swashplate control system
  - Collective
  - Cyclic
- Anti-torque
- Synchronised elevators
- Boosted controls
- Mixing units
- Droop compensator
Objectives
To be competent in this area the individual must be able to:

LEARNING TASKS | CONTENT
--- | ---
G4.1 Introduction to Human Factors in Aircraft Maintenance | The number of accidents caused by maintenance error is increasing significantly
G4.1.1 Describe the impact of human error in aircraft maintenance on air carrier accidents | ・Maintaining fleets that are increasing in age
G4.1.2 Explain why the number of accidents caused by maintenance errors is increasing | ・Increasing pressure for meeting schedule departure times
G4.1.3 Explain the term human factors | ・New aircraft and advanced technology
G4.2 The relationship between physical factors and needs and aircraft maintenance errors | ・Increasing complexity of new aircraft
G4.2.1 Explain the legal and moral responsibilities of aircraft maintenance technicians and AME’S | ・Physical size
G4.2.2 Explain the relationship between physical factors and aircraft maintenance errors | ・Working in cramped or confined spaces
| ・Physical conditioning and health
| ・Climbing over wings and horizontal stabilizers
| ・Lack of conditioning or health might cause work to be skipped, improperly performed, or uncompleted
| ・Sensory systems
| ・Good vision required for many jobs (gradually decreasing vision may not be noticed by an individual)
| ・Normal color recognition required for some jobs
G4.2.3 Explain the relationship between physiological needs and aircraft maintenance errors

- Lack of Communication
- Complacency
- Lack of Knowledge
- Distraction
- Lack of Teamwork
- Fatigue
- Lack of Resources
- Pressure
- Lack of Assertiveness
- Stress
- Lack of Awareness
- Norms of the workplace

G4.3.2 Defend the need to adhere to established maintenance procedures

G4.3.3 Describe the relationship between maintenance errors and the chains of events leading to errors.

G4.3.4 Analyze case studies to determine causes of maintenance errors.
Line (GAC): 19  Weight and Balance
Competency: 19.01  Weight and Balance

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

**LEARNING TASKS**

<table>
<thead>
<tr>
<th>G17.1</th>
<th>Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>G17.1.1</td>
<td>Define applicable terminology</td>
</tr>
</tbody>
</table>

**CONTENT**

- Centre of gravity
  - Limits
  - Range
- Empty weight
  - Centre of gravity
  - Centre of gravity range
- Ballast
- Basic weight
- Arm
- Datum
- Mean aerodynamic chord include lemac and temac
- Maximum weight
  - Landing weight
  - Ramp weight
  - Takeoff weight
- Moment
- Stations
  - Longitudinal
  - Lateral
  - Water line
  - Butt line
- Tare

<table>
<thead>
<tr>
<th>G17.3</th>
<th>Weight and Balance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>G17.3.1</td>
<td>Explain applicable documentation</td>
</tr>
</tbody>
</table>

- Aircraft weight and balance control
- Weight and balance reports
- Amendments to weight and balance reports
- Alternative configurations (addendums)
G17.3.2 Describe empty weight configurations
- Fuels
- Oils
- Hydraulics
- Water

G17.3.3 Explain purpose of re-weighing and balancing aircraft

G17.4 Weighing Procedures

G17.4.1 Explain requirements for weighing

G17.4.2 Review documents
- Flight manual
- Operations manual
- Aircraft specifications
- Type approval/certificate
- Maintenance manual

G17.4.3 Describe preparation of aircraft for weighing
- Cleanliness
- Equipment list
- Fluid levels
- Fuel tanks (drained)
- Oil tanks (as applicable)
- Position of flight controls, seats, rotors

G17.4.4 Describe environment for weighing aircraft
- Fans
- Traffic
- Building doors and windows

G17.4.5 Explain importance of weight and balance with regard to safe operation of aircraft
- Differences between fixed wing and rotory wing weight and balance (lateral centre of gravity)

G17.4.6 Describe jacking and levelling of aircraft for weighing
- Safety
- Methods of levelling
  - Spirit levels
  - Plumb bobs
  - Longitudinal
  - Lateral
  - Laser (level 1 only)

G17.4.7 Describe use of various weighing equipment
- Calibration of scales
  - Platform
  - Electronic
G17.4.8  Describe recording of data
- Arms with reference to datum
  - Longitudinal
  - Lateral
- Weight
  - Aircraft weighing points
  - Tare

G17.4.9  Describe computing centre of gravity
- Compare data to previous reports for realistic data

G17.4.10 Describe ballast
- Location
- Calculation of weight

G17.5  Weight and Balance Report

G17.5.1 Describe information required in report
- Aircraft make, model, serial number, and registration
- Date of weighing
- Weighing data
- Empty weight
  - Including all items required by the basis of type approval
- Empty weight centre of gravity
- Equipment list
- Certification
- Ballast calculations
- Adverse load checks
- Centre of gravity limits

G17.5.2 Review various examples of weight and balance reports and equipment lists.

G17.5.3 Prepare weight and balance report with equipment list for samples provided (Practical)

G17.6  Weight and Balance Amendments

G17.6.1 Describe requirements of amendments to weight and balance reports
- Explanation of the change
- Identify the weight and balance document requiring amendment
- Identify the affected aircraft
- Date of the change
Program Content
Level 1

- Amendment number
- Replacement equipment list
  - Items affected
  - Revised weights
  - Revised moments arms
- New empty weight
- New empty weight centre of gravity
- Maintenance release certification

G17.6.2 Describe addenda to weight and balance reports

- Passenger/cargo configurations
- Seasonal equipment changes

G17.6.3 Amend weight and balance report and equipment list (Practical)
Level 2

Aircraft Maintenance Technician
### Objectives

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

### LEARNING TASKS

<table>
<thead>
<tr>
<th>Task</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>A12.3</td>
<td>Composite Structures</td>
</tr>
<tr>
<td>A12.3.1</td>
<td>Emphasis, at all points during this course, the importance of health and safety concerns when using composite materials</td>
</tr>
<tr>
<td></td>
<td>• WHMIS</td>
</tr>
<tr>
<td></td>
<td>• OHS</td>
</tr>
<tr>
<td>A12.3.2</td>
<td>Describe fibre weaves and weights and their uses</td>
</tr>
<tr>
<td></td>
<td>• Satin</td>
</tr>
<tr>
<td></td>
<td>• Crowfoot</td>
</tr>
<tr>
<td></td>
<td>• Plain</td>
</tr>
<tr>
<td></td>
<td>• Unidirectional</td>
</tr>
<tr>
<td>A12.3.3</td>
<td>Describe common reinforcement materials used for laminates and compare their qualities</td>
</tr>
<tr>
<td></td>
<td>• Fibreglass</td>
</tr>
<tr>
<td></td>
<td>• Aramid fibres (*Kevlar)</td>
</tr>
<tr>
<td></td>
<td>• Carbon fibers</td>
</tr>
<tr>
<td></td>
<td>• Ceramic</td>
</tr>
<tr>
<td></td>
<td>• Boron</td>
</tr>
<tr>
<td>A12.3.4</td>
<td>Describe importance of warp fibre direction</td>
</tr>
<tr>
<td>A12.3.5</td>
<td>Describe handling of materials in “prepreg” form</td>
</tr>
<tr>
<td></td>
<td>• Emphasis is on “out time” from refrigerated storage and, upon removal from cold storage, thawing it in moisture proof bag to prevent condensation</td>
</tr>
<tr>
<td>A12.3.6</td>
<td>Explain matrixes in composites</td>
</tr>
<tr>
<td></td>
<td>• Epoxies</td>
</tr>
<tr>
<td></td>
<td>• Polysters</td>
</tr>
<tr>
<td></td>
<td>• Microballoons</td>
</tr>
<tr>
<td>A12.3.7</td>
<td>Describe use and preparation of adhesives</td>
</tr>
<tr>
<td></td>
<td>• Paste adhesives</td>
</tr>
<tr>
<td></td>
<td>• Film adhesives</td>
</tr>
<tr>
<td>A12.3.8</td>
<td>Describe handling of composite materials</td>
</tr>
<tr>
<td></td>
<td>• Safety</td>
</tr>
<tr>
<td></td>
<td>• Preparation</td>
</tr>
<tr>
<td></td>
<td>• Mixing of resins</td>
</tr>
<tr>
<td></td>
<td>• Cleanliness</td>
</tr>
<tr>
<td></td>
<td>• Storage</td>
</tr>
</tbody>
</table>
A12.3.9 Explain foam core materials
- Styrofoam
- Urethane
- PVC

A12.3.10 Identify honeycomb core materials and core configuration
- Cell shapes
- Strength characteristic
- Dimension

A12.3.11 Describe care and handling of composites
- Protection
- Storage

A12.4 Fabrication and Repair of Composite Structures

A12.4.1 Describe fabrication of non-metallic composite structures
- Solid laminates
- Honeycomb sandwich
- Solid core sandwich
- Filament winding

A12.4.2 Explain manufacturers’ methods of lay-up, applying pressures, and

A12.4.3 State methods of machining cured and non-cured reinforcement materials (use of tools covered in G3)
- Hand and power tools for:
  - Cutting
  - Drilling
  - Sanding

A12.4.4 Describe workplace ventilation and vacuum requirements during machining.

A12.4.5 Describe methods of inspection and their application:
- Visual and tap testing
- NDI

A12.4.6 Classify damage
- Cosmetic
- Impact and delamination
- Cracks and hole damage

A12.4.7 Explain use of curing and heating equipment

A12.4.8 Explain composite repair techniques
- Removal of damage and surface preparation
- Surface and flush patch
- Core potting and replacement
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>A12.4.9</td>
<td>Explain electrical bonding of composite components</td>
<td>- Patch preparation &lt;br&gt; - Delamination repairs &lt;br&gt; - Applying pressures &lt;br&gt; - Release fabrics and films &lt;br&gt; - Heat curing &lt;br&gt; - Finishes-paint &lt;br&gt; - Gelcoat</td>
</tr>
<tr>
<td>A12.4.10</td>
<td>Describe personal safety equipment</td>
<td>- Lightning protection &lt;br&gt; - Continuity testing &lt;br&gt; - During machining &lt;br&gt; - While using resins</td>
</tr>
<tr>
<td>A12.4.11</td>
<td>Describe quality control processes</td>
<td></td>
</tr>
<tr>
<td>A12.4.12</td>
<td>Inspect composite panel (Practical)</td>
<td>- Tap test &lt;br&gt; - Visual &lt;br&gt; -</td>
</tr>
<tr>
<td>A12.4.13</td>
<td>Repair composite panel (Practical)</td>
<td>- Classify damage &lt;br&gt; - Remove damage and prepare surface &lt;br&gt; - Repair damaged sandwich panel &lt;br&gt; - Core potting and replacement &lt;br&gt; - Prepare patch &lt;br&gt; - Apply pressure using vacuum bag procedures &lt;br&gt; - Use controlled heat curing for patch repair</td>
</tr>
</tbody>
</table>
**LEARNING TASKS**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>G12.9</td>
<td>Composite Materials</td>
<td></td>
</tr>
<tr>
<td>G12.9.1</td>
<td>List applications of composite materials in aircraft</td>
<td>• Primary structures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dynamic components</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Secondary structures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fairings, cowlings</td>
</tr>
<tr>
<td>G12.9.2</td>
<td>Explain advantages and disadvantages of composite materials</td>
<td></td>
</tr>
<tr>
<td>G12.9.3</td>
<td>Define “composite materials”</td>
<td></td>
</tr>
<tr>
<td>G12.9.4</td>
<td>Describe types of composite construction</td>
<td>• Solid laminates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Honeycomb sandwich</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Solid-core sandwich</td>
</tr>
<tr>
<td>G12.9.5</td>
<td>Describe reinforcing materials</td>
<td>• Terms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Warp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Weave patterns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Plain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Crowfoot</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Bidirectional</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Unidirectional</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Fibers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o Fiberglass E glass</td>
</tr>
<tr>
<td>G12.9.6</td>
<td>Describe inspection and testing methods</td>
<td>• Fiberglass S glass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Aramide</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Carbon graphite</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ceramic cloth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Boron fiber patch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Safety Precautions</td>
</tr>
</tbody>
</table>
G12.9.7 Describe safety precautions and handling procedures

G12.9.8 Perform a composite repair (Practical)
Line (GAC): 11 Reciprocating Engines
Competency: 11.01 Bearings and Seals

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| G16.1 Types and Purposes of Bearings | • Friction  
  - Sliding  
  - Rolling  

| G16.1.1 Describe different forces on bearings | • Loads  
  - Radial  
  - Axial  
  - Combination  
  - Varying direction (misalignment)  
  - Speed  

| G16.1.2 Discuss bearing types and their nomenclature | • Ball bearings  
  - Balls  
  - Inner race  
  - Outer race  
  - Face  
  - Separator  
  - Outside diameter  
  - Bore  

| | • Roller bearings  
  - Rollers  
  - Outer ring  
  - Inner ring  
  - Separator  
  - Face  
  - Barrel rollers  

| | • Concave rollers  
| | • Tapered roller bearings  
  - Roll  
  - Cup  
  - Cone  
  - Cage  

| | • Elastomeric bearings |
G16.1.3 Discuss plain bearings (bushing)

- Spherical rod-end bearings
  - Lubricated and non-lubricated
- Loading
- Uses
- Material, for example
  - Bronze
  - Silver
  - Lead
  - Babbitt

G16.2 Lubrication and Sealing

G16.2.1 Describe different types of seals and their Function in sealing bearing areas

- Dust seals
  - Cap
  - Felt
- Labyrinth seals
- Lip seals
- "O" ring seals
- Carbon face seals
- Magnetic seals
- Chevron seals
- Gaskets
- Back-up rings

G16.3 Bearing Removal Inspection and Installation Techniques

G16.3.1 Discuss bearing inspection and handling techniques

- Cleaning bearings
- Storing bearings
- Inspecting defects
  - Pitting
  - Denting
  - Scratches
  - Corrosion
  - Spalling
  - Retainer (cage) elongation
  - Charring and cracks
  - Brinelling
  - Discolouration
  - Play
  - Inspection tools
  - New bearings
Program Content
Level 2

Line (GAC): 11 Reciprocating Engines
Competency: 11.02 Reciprocating Engine Principles

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

LEARNING TASKS | CONTENT
--- | ---
P1.1 History and Development | • Inventors
P1.1.1 Discuss early development of heat engines | • Types of engines
 | • Users
 | • Limitations
 | – Efficiency
 | – Materials
 | – Fuels
P1.1.2 Discuss factors affecting development of engines | • Needs of the industry
 | • Requirements for an aircraft engine
 | • Certification costs
P1.1.3 Describe types of engines developed for aviation use | • Rotary-radial engines
 | – Static radial
 | – Multiple row radial
 | – Wankel rotary
 | • In-line
 | – Inverted
 | • V-type
 | • Opposed
 | • Water-cooled
 | • Air-cooled
P1.1.4 Explain differences and advantages of different types of engines
P1.1.5 Describe engine development and application | • Two-stoke for home-built, lightweight aircraft use
 | • Wankel rotary
 | • Automobile engines adapted for aircraft
P1.1.6 Describe limitations of piston engines
P1.2 Engine Components and Accessories

P1.2.1 Describe internal engine components
- Pistons
- Piston rings
- Camshaft
- Crankshaft
- Connecting rods
- Drive shafts
- Valves
- Cam ring

P1.2.2 Describe external engine components
- Cylinders
- Crankcase
- Oil sump
- Exhaust
- Induction system

P1.2.3 Describe engine accessories
- Magnetos
- Starter motor
- Alternator/generator
- Propeller governor
- Propeller synchronizer
- Vacuum pump
- Hydraulic pump
- Fuel system components

P1.2.4 Explain the function of engine components

P1.2.5 Identify major engine components, state their purpose (Practical)

P1.3 Types of reciprocating engines

P1.3.1 Explain terms, identify by symbols, used in aircraft engine identification classification
- E.G., GTSIO-520-E1B4D

P1.3.2 Classify engines by cylinder arrangement or displacement
- Letters to indicate type and characteristics
- Letters to indicate displacement
P1.3.3 Explain purpose of engine data plates

P1.3.4 List and identify types of engines used in school (installed in aircraft and on shop floor) (Practical)

P1.3.5 Referencing engine data plates, determine characteristics of each engine type identified (Practical)

P1.4 Engine Theory

P1.4.1 Explain principles of energy transformation

P1.4.2 Explain Gas Laws, and how they apply to engine operation

P1.4.3 Explain piston displacement

P1.4.4 Explain power calculations

P1.4.5 Explain engine efficiency
P1.4.6 Explain factors affecting performance, including
- Manifold pressure
- RPM (revolutions per minute)
- Air volume
- Air density
- Weight-to-power ratio
- Detonation
- Pre-ignition
- Fuel octane

P1.4.7 Explain Otto cycle (constant volume cycle)

P1.4.8 Explain power curves

P1.4.9 Draw graph to represent indicator diagram for Otto Cycle (Practical)

P1.4.10 Compute horsepower using PLANK formula

P1.4.11 Calculate piston displacement

P1.4.12 Calculate compression ratio

P1.5 Operation Fundamentals

P1.5.1 Explain engine operation terminology
- Internal combustion engine
- Cycle
- Stroke
- Top dead centre
- Bottom dead centre
- Square engine
  - Over-
  - Under-
- Conversion of reciprocating motion to rotating motion
- Relationship of piston travel to crankshaft travel
- Ineffective crack angle
P1.5.2 Explain two-stroke cycle
- Uses
- Advantages
- Disadvantages
- Five events occur in each operating cycle
  - Intake
  - Compression
  - Ignition
  - Power
  - Exhaust
- Valve arrangement
- Fuel/induction system

P1.5.3 Explain four-stroke cycle
- Otto cycle
- Intake
- Compression
- Ignition
- Power
- Exhaust
- Valve timing
  - Lead
  - Lag
  - Overlap
- Compare with two-stroke cycle

P1.5.4 Explain cylinder-pressure indicating diagram

P1.5.6 Explain engine timing
- Valve operation and mechanisms
- Cylinder firing-order for different types of engines
  - Lycoming horizontally opposed
  - Continental horizontally opposed
  - Single bank radial
  - Multi-bank radial
  - Timing for engine balance
- “Formula” for determining firing order of large radial engines
- Valve operating components
  - Camshaft
  - Valve lifters/tappets
  - Cam
  - Cam plate/ring
  - Rocker arm
- Radial engine cam ring table (to determine speed and direction of rotation)

P1.5.7 Describe engine cooling
- Fins on cylinders
- Baffles on engine
- Sodium filled exhaust valves
- Air flow through engine
- Oil system
- Liquid cooling

P1.5.8 Determine firing order of various reciprocating engines (Practical)

P1.5.9 Identify combustion and valve timing components (Practical)

P1.5.10 Identify engine cylinder positions (e.g., No. 1 on the Continental) (Practical)
**Line (GAC):** 11  **Reciprocating Engines**  
**Competency:** 11.03  **Reciprocating Engine Maintenance**

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2.3 Engine overhaul procedures</td>
<td></td>
</tr>
</tbody>
</table>
| P2.3.3 Describe disassembly procedures: | • Use of check sheets  
| | • Use of manufactures’ technical  
| | publication manuals  
| | - Use of index marks  
| P2.3.4 Describe cleaning procedures | • Types of cleaning materials  
| | • Degreasing  
| | • Decarbonizing  
| | • Stripping  
| | • Abrasive blasting  
| | • Vapor bath  
| P2.3.5 Describe inspection procedures | • Visual  
| | • NDT  
| P2.3.6 Describe dimensional inspection procedures | • Typical wear items  
| | • Equipment  
| P2.3.7 Describe repair and replacement procedures | • Repairable items  
| | - Crankcase  
| | - Crankshaft (not usual)  
| | - Cylinders  
| | - Bushings  
| | - Valve seats  
| | - Valve (reconditioning)  
| | • Replacement items  
| | - Items that are not repairable  
| | - Pistons and rings  
| | - Cylinder heads  
| | - Cylinders  
| | - Bushings  
| | - Studs and fasteners  
| | - Valve guides and seats |
Program Content
Level 2

P2.3.8 Describe assembly procedures
- Rocker arms, shafts, and bearings
- Camshafts
- Crankshafts

P2.3.9 Describe testing procedures
- Assemblies
- Sub-assemblies
- Installation of engine onto test stand

P2.3.10 Describe preservation and packing procedures
- Recommended procedures
- Pre-oiling
- Engine running
- Operating parameters
  - Temperatures
  - Pressures
- Record keeping

P2.3.11 Describe documentation and certification
- Interior preservation
- Exterior preservation
- Short term storage
- Long term storage

P2.3.12 Disassemble, clean, and inspect engine or component for overhaul (Practical)

P2.3.13 Determine parts serviceability with reference to manufacturers' technical publications (Practical)

P2.3.14 Reassemble engine and install component (Practical)

P2.3.15 Test engine during run up (Practical)

P2.4 Maintenance Procedures

P2.4.1 Define “maintenance” and “service”
- Types of maintenance (include inspections)
- Scope of servicing Limitations
### Program Content
#### Level 2

| P2.4.2 | Describe servicing of aero engines | - Cleaning  
- Lubricating  
- Replenishing of fluids |
| --- | --- | --- |

| P2.4.3 | Describe maintenance of ignition systems | - Spark plug, inspection, cleaning, and replacement  
- Magneto timing, inspection, repair, and replacement  
- Harness testing and replacement |
| --- | --- | --- |

| P2.4.4 | Describe maintenance of fuel systems | - Leak checks  
- Float adjustments  
- Fuel flow and pressure adjustments  
- Nozzle cleaning  
- Carburetor/fuel injection, inspection, adjustment and replacement  
- Fuel pump inspection and replacement |
| --- | --- | --- |

| P2.4.5 | Describe maintenance of lubricating systems | - Oil system component, inspection, replacement and adjustment  
- Oil pump  
- Oil cooler  
- Fluid lines  
- Leak checks  
- Filters |
| --- | --- | --- |

| P2.4.6 | Describe maintenance of induction and exhaust systems | - Induction system inspection, repair and replacement  
- Exhaust system inspection, repair and replacement  
- Turbo-and super-charging systems inspection, adjustment and replacement |
| --- | --- | --- |

| P2.4.7 | Describe cylinder differential pressure testing | - Purpose  
- Equipment  
- Procedure  
- Frequency  
- Documentation |
| --- | --- | --- |

| P2.4.8 | Describe ground running and operational testing of reciprocating engines and components | - Starting procedures  
- Operating procedures  
- Oil consumption check  
- Engine run-in procedures  
- Instrument monitoring  
- Parameters |
Program Content
Level 2

- Shut down procedures

P2.4.9   Describe engine trouble shooting

P2.4.10  Describe certification of maintenance work

P2.4.11  Carry out reciprocating engine maintenance (Practical)
       - Inspect engine
       - Remove/install components
       - Test and adjust engine systems
       - Start and operate engine
       - Carry out cylinder pressure differential test

P2.4.12  Service reciprocating engine and its systems
       - Check fluid levels
       - Replenish fluids
       - Clean components
       - Check pressures
       - Check for leaks
Line (GAC): 11 Reciprocating Engines  
Competency: 11.04 Carburation and Engine Fuel Systems

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3.1 Requirements of Engine Fuel Systems</td>
<td>Fuel metering</td>
</tr>
<tr>
<td>P3.1.1 Explain requirements for carburation</td>
<td>Vaporization of fuel</td>
</tr>
<tr>
<td></td>
<td>Control of engine power</td>
</tr>
<tr>
<td></td>
<td>Control of fuel/air mixture</td>
</tr>
<tr>
<td>P3.1.2 Identify types of fuel carburation devices</td>
<td>Float carburetor</td>
</tr>
<tr>
<td></td>
<td>Pressure carburetor</td>
</tr>
<tr>
<td></td>
<td>Fuel injection</td>
</tr>
<tr>
<td>P3.2 Related Physics</td>
<td></td>
</tr>
<tr>
<td>P3.2.3 Explain how Bernoulli’s Principle relates to operation of simple carburetor</td>
<td></td>
</tr>
<tr>
<td>P3.2.4 Explain movement and metering of fuel in simple carburetor.</td>
<td></td>
</tr>
<tr>
<td>P3.2.6 Explain function of air bleed in simple carburetor</td>
<td></td>
</tr>
<tr>
<td>P3.3 Characteristics of Gasoline</td>
<td></td>
</tr>
<tr>
<td>P3.3.3 Identify range of fuel/air mixture ratios within which gasoline will burn</td>
<td></td>
</tr>
<tr>
<td>P3.3.4 Define &quot;stoichiometric mixture&quot;</td>
<td></td>
</tr>
<tr>
<td>P3.3.5 Differentiate between mixture ranges</td>
<td>Best power</td>
</tr>
<tr>
<td></td>
<td>Lean best power</td>
</tr>
<tr>
<td></td>
<td>Rich best power</td>
</tr>
<tr>
<td></td>
<td>Best economy</td>
</tr>
</tbody>
</table>
P3.3.6 Explain effect of fuel/air mixture
- Exhaust gas temperature
- Flame propagation
- Detonation
- Afterfiring
- Backfiring
- Specific fuel consumption
  - Effects of altitude

P3.4 Carburetors

P3.4.1 Differentiate between types of carburetor floats

P3.4.2 Identify fuel strainer

P3.4.3 List components which make up main metering system

P3.4.4 Identify components of idle system

P3.4.5 Describe different types of accelerating systems
- Accelerating well
- Accelerating pumps

P3.4.6 Identify types of main mixture controls
- Needle type
- Disc type
- Backsuction type
- Variable orifice
- AMC

P3.4.7 Identify types of economizer systems
- Needle valve
- Air bleed
- Manifold pressure

P3.4.8 Explain function of components in float carburetor
- Venturi
- Metering jets
- Discharge nozzle
- Idle circuit
- Main metering circuit
- Float
- Needle valve
- Accelerator pump
Program Content
Level 2

- Accelerator well
- Main mixture controls
- Idle mixture control
- Economizers

P3.5 Pressure Injection Carburetors

P3.5.1 State advantages of pressure injection carburetors over float carburetors

P3.5.2 Explain operation of fuel pressure regulator

P3.5.3 Identify major components in pressure injection carburetor

P3.5.4 Define “air metering force” and “fuel metering force”.

P3.5.5 Explain operation of sub-systems
  - Mixture control system
    - Automatic mixture control system
  - Idle system
  - Acceleration system
  - Manual power enrichment valve
  - Airflow power enrichment valve

P3.6 Anti-detonation Injection (ADI)

P3.6.1 State purpose of anti-detonation injection (ADI)

P3.6.2 Describe components in ADI system

P3.6.3 Describe principles of operation of ADI system.

P3.7.3 Describe adjustments of idle speed

P3.7.4 List items to be inspected, on carburetor, during routine inspection
P3.7.5 Describe removal and installation procedures of aircraft carburetor

P3.7.6 Describe possible causes and corrective action for carburetor problems
- Carburetor leaks when engine stopped
- Mixture too lean at idle
- Mixture too lean at cruise
- Mixture too lean at full power
- Mixture too rich at idle
- Mixture too rich at high power
- Poor acceleration
- Poor idling
- Engine stalls during
  - Acceleration
  - Idle
- Engine “hunting”

P3.7.7 Describe independent check for carburetor controls
Line (GAC): 11 Reciprocating Engines
Competency: 11.05 Introduction to Fuel Systems

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

LEARNING TASKS

P4.1 Introduction to Fuel Injection

P4.1.1 Review disadvantages of carburation
- Uneven fuel/air distribution
- Carburetor icing
- Incomplete vaporization
- Loss of fuel in abrupt, or prolonged

P4.1.2 Describe basic concepts of continuous flow fuel injection system
- Positive delivery
- Delivers it to intake port of each cylinder
- Continuous flow

P4.2 Introduction to Fuel Injection

P4.2.1 Describe fuel control unit
- Fuel inlet strainer
- Mixture control valve
  - Idle cut-off
  - Manual mixture control
  - Cockpit linkage
- Main metering jet
- Throttle fuel valve
  - Idle valve lever connection to throttle lever linkage

P4.2.2 Describe regulator unit
- Fuel regulator
  - Air diaphragm
    - Inlet air pressure
    - Venturi air pressure
  - Fuel diaphragm
    - Metered fuel pressure
    - Unmetered fuel pressure
    - Ball valve
- Throttle valve
  - Cockpit linkage
P4.2.3 Explain interaction of air metering force and fuel metering force to regulate fuel flow

P4.2.4 Describe function of flow divider
- Divides fuel flow
- Idle downstream fuel pressure
- Positive fuel cutoff
- Fuel flow indication

P4.2.5 Describe function of fuel injection nozzles
- Calibration
- Air bleed system
- Installation

P4.2.6 Describe idle system
- Constant head spring
- Constant effort spring

P4.2.7 Describe manual mixture control system

P4.2.8 Describe automatic mixture control
- Bellows
- Bleed across air diaphragm

P4.2.9 Describe starting procedures
- Cold engine
- Hot engine

P4.2.10 Describe system maintenance
- Nozzle cleaning
- Injector body

P4.2.11 Describe system adjustments
- Idle mixture
- Idle speed

P4.2.12 Discuss typical problems that occur and troubleshooting techniques to pinpoint fault and determine corrective action.

P4.2.13 Describe typical repairs and/or refractions for these faults

P4.2.14 Trace a Bendix fuel injection system flow diagram.

P4.3 Teledyne Continental System

P4.3.1 Describe function of fuel pump
- Vapor chamber
- Vane pump
- Adjustable orifice
P4.3.2 Describe fuel control unit
- Relief valve
- Jet pump/venturi
- Bypass check valve
- Variable restrictor controlled by aneroid valve for turbocharging

P4.3.3 Describe function of fuel manifold valve
- Manual mixture control valve
  - Linkage to cockpit
- Throttle fuel valve
  - Air valve linkage
  - Cockpit linkage

P4.3.4 Describe function of injector lines

P4.3.5 Describe function of fuel injection nozzles
- Calibration
- Air bleed system
- Nozzle length
- Turbocharged application

P4.3.6 Describe starting procedures
- Cold engine
- Hot engine

P4.3.7 Describe system maintenance
- Nozzle cleaning
- Inspection

P4.3.8 Describe system adjustments
- Low unmetered fuel pressure
- High unmetered fuel pressure
- Idle mixture
- Idle speed

P4.3.9 Describe typical problems that occur and troubleshooting techniques to pinpoint fault and determine corrective action

P4.3.10 Describe typical repairs and/or rectifications for these faults

P4.3.11 Trace a Continental fuel injection flow diagram
Line (GAC): 11 Reciprocating Engines
Competency: 11.06 Fuel Injection Systems

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

LEARNING TASKS

CONTENT

P5.1 Reciprocating Engine Ignition Systems

P5.1.1 Explain battery ignition systems
- Components and their function
  - Coil
  - Battery
  - Distributor
    - Points
    - Capacitor
    - Distributor cap
  - Ignition harness
  - Spark plugs
  - Ignition switch
- Advantages of battery ignition system over magneto system

P5.1.2 Explain low tension magneto ignition systems
- Components and their function
  - Magneto
    - Coil
    - Distributor
    - Points
    - Capacitor
  - Ignition harness
  - Spark plugs
  - Ignition switch
- Advantages and disadvantages of low tension magneto system

P5.1.3 Explain high tension magneto ignition systems
- Single and dual magnetos
- Components and their function
  - Magneto mechanical system
    - Rotating magnets
      - Bearing
      - Seal
    - Methods of mounting
Program Content
Level 2

- Base mount
- Vernier coupling
- Flange mount
  - Magneto magnetic circuit
    - Two pole magnet
    - Pole shoes
    - Core of coil
    - Flux flow
      - Full register
      - Null
  - Primary circuit
    - Windings
    - Points
    - Cam
    - Capacitor
      - Feed through
      - Axial capacitor
      - Radio noise suppression
  - Collapsing of primary field
    - E-gap
  - Secondary circuit
    - Windings
    - Carbon brush contact
    - Distributor gear
    - Distributor block

P5.1.4 Describe electronic ignition systems

P5.1.5 Describe magneto maintenance procedures

P5.1.6 Inspect, service, and test magneto ignition system components (Practical)

P5.2 Ignition Harnesses

P5.2.1 Explain purpose of ignition harnesses

- Carry high voltage
- Noise shielding

P5.2.2 Describe construction of ignition harnesses

- Centre conductor
  - ‘Slick/Electro’
  - ‘Bendix’
P5.2.3 Describe installation of ignition harnesses

- ‘Bendix’ type
  - Crimp style
  - Distributor block end
  - Spark plug end
- ‘Slick’
  - Pin style
  - Distributor block end
  - Spark plug end

P5.2.4 Describe testing of ignition harnesses

- Continuity test
- Insulation test
- Resistance test

P5.2.5 Install and test ignition harness

P5.3 Spark Plugs

P5.3.1 Describe spark plugs

- Size of plugs
  - Shell thread
  - Terminal thread
- Electrode types
  - Massive
  - Fine wire
- Reach
  - Short
  - Long
  - Gasket
- Part number information
- Heat range
  - Selectable range as per Type
  - Certificate
- Resistor type

- Insulator
- Shield
  - Outer covering
- Terminal ends
  - 5/8”-24 shielded
  - ¾”-20 all weather
  - Angled leads
  - Insulators
P5.3.2 Describe maintenance of spark plugs

- Inspection intervals
- Removal
- Visual inspection
  - Types of fouling
  - Wear limits
- Cleaning
  - Electrode
    - Abrasive blast
    - Vibrator type
    - Terminal end
    - Threads
- Gapping
  - Fine wire
  - Massive
- Testing
- Installation
  - Rotation
  - Lubrication
  - Torque
  - Spark plug
  - Terminal end
- Care and handling

P5.3.3 Remove, clean, inspect, test, and install spark plugs

P5.4 Ignition Systems for Engine Starting

P5.4.1 Explain reasons for ignition systems for engine starting

P5.4.2 Explain booster magneto

- Theory of operation
- Booster coil
  - Power source
- Trailing finger
  - Firing order

P5.4.3 Explain induction vibrators

- Theory of operation
### P5.4.4 Explain ‘Shower of Sparks’ ignition
- Theory of operation
- Starting vibrator
- Ignition switch
- Magnetos condition on start
  - Left
  - Right
- Left magneto breaker points
  - Retard
  - Advance

### P5.4.5 Explain impulse couplings
- Theory of operation
- Lag angle
- Spring loaded coupling
- Coming in speed

### P5.4.6 Describe maintenance of ignition systems for engine starting

### P5.4.7 Inspect and test ignition systems for engine starting (Practical)

### P5.5 Magneto Timing

#### P5.5.1 Explain conditions that must occur for proper ignition timing

#### P5.5.2 Describe internal timing of magnetos
- Locating E-gap
- Adjusting point opening
  - Advance points
  - Retard points (if applicable)
  - Gear meshing

#### P5.5.3 Describe magneto-to-engine timing (external timing)
- Locate advance firing location on compression stroke of #1 cylinder
  - Timing hat
  - Time-rite
  - Engine markings
- Set magneto to fire#1 ignition lead (Explain various methods)
- Engage magneto to engine (Explain various methods)
- Do final adjustment using magneto timer
P5.5.4 Internally time magnetos
- Single
- Dual
- Radial engine

P5.5.5 Install magnetos on any of the following
- Single
- Dual
- Radial engine

P5.6 Ignition Systems Maintenance

P5.6.1 Describe field-inspection of installed ignition-system.

P5.6.2 Explain testing of magneto system
- Magneto RPM drop test
- Live magneto test

P5.6.3 Explain drift of magneto timing
- Cam follower wear
- Breaker point wear

P5.6.4 Describe use of engine ignition analyzer
Line (GAC): 11 Reciprocating Engines
Competency: 11.07 Induction, Supercharging, Exhaust

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

LEARNING TASKS

<table>
<thead>
<tr>
<th>P10.1</th>
<th>Related Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>P10.1.2</td>
<td>Define</td>
</tr>
<tr>
<td>P10.1.3</td>
<td>Explain effect of density-altitude on engine performance</td>
</tr>
<tr>
<td>P10.1.4</td>
<td>Explain how Gas Laws relate to engine performance</td>
</tr>
<tr>
<td>P10.2</td>
<td></td>
</tr>
<tr>
<td>P10.2.1</td>
<td>Describe reciprocating engine induction system components</td>
</tr>
<tr>
<td>P10.2.2</td>
<td>Explain purpose of supercharging</td>
</tr>
</tbody>
</table>

CONTENT

- Manifold pressure
- Induction
- Boost
- Supercharging
- Turbocharging
- ISA (International Standard Atmosphere)
- Critical altitude
- Absolute altitude
- Engine rated power

- Air intakes
- System filtering
- Dust removal
- Ice control
- Intake manifold
- Alternate air intake
- Fuel metering systems

- Relationship between manifold pressure and horsepower
- Density altitude
- Supercharging limitations
P10.2.3 Compare induction systems of opposed engines with that of radial engines

P10.2.4 Perform inspection of aircraft engine induction system (Practical)

P10.3 Classification of Superchargers

P10.3.1 Describe aircraft superchargers

- Internally driven superchargers
- Single stage, one speed
- Single stage, two speed
- Externally driven superchargers (turbochargers)
- Discuss turbocompound engines

P10.3.2 Describe sea level supercharger and altitude supercharger

P10.4 Internally driven Superchargers

P10.4.1 Describe internal supercharger system

- Impeller
- Diffuser
- Carburetor
- Single speed/two speed

P10.4.2 Explain operation of two-speed supercharger

P10.4.3 Explain Changes in temperature and pressure within internal supercharger

P10.5 Turbocharger Systems

P10.5.1 Describe configurations and operation of turbocharger systems

P10.5.2 Describe components of turbocharger system

- Ground adjustable waste gate
- Automatic waste gate
- Absolute pressure controller
- Ratio controller
- Rate controller
- Variable absolute pressure controller
P10.5.3 Describe turbocharger oil system

- Pressure relief valve
- Alternate air door
- Density controller
- Differential pressure controller
- Heat exchanger

- Lubrication
- Cooling
- Turbocharging control

P10.5.4 Describe adjustments

- Density controller
- Absolute pressure controller
- Ratio controller
- Variable absolute pressure controller
- Waste gate

P10.5.5 Describe typical turbocharger faults

P10.5.6 Describe turbocharging systems troubleshooting methods

P10.6 Exhaust Systems

P10.6.1 Describe types of exhaust systems

- Short stack
- Collector ring
- Opposed type exhaust manifold

- Cabin heat
- Carburetor heat

P10.6.2 Explain purpose of mufflers and heat exchangers

- Inspection and repair critical areas
  - Welds
  - Expansion joints
  - Bends
  - Internal baffles
  - Heat muffs

- Pressure testing
  - Vacuum cleaner
  - Soap and water

P10.6.4 Describe exhaust system maintenance

- Gaskets and seals
- “V” band couplings
- Heat shrouds and shields

P10.6.5 Describe turbocharged exhaust system
Program Content
Level 2

- Expansion joints

P10.7 Turbocharged Engines

P10.7.1 Describe operation of turbocharged engines

- Warm up procedures
- Limitations
- Cool down procedures
- Safety procedures
Line (GAC): 11 Reciprocating Engines
Competency: 11.08 Engine Starting Systems

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

LEARNING TASKS

P12.1 Reciprocating Engines Starting Systems

P12.1.1 Discuss starting systems

P12.1.2 Describe starting systems operation

P12.1.3 Describe starting systems operating procedures

CONTENT

• Hand propping (Hand Cranking)
  – Hazards and safety
• Bungee cord
• Direct hand cranking
• Inertia starters
  – Hand inertia
  – Combination inertia
• Cartridge
• Direct cranking electric

• Sources of energy
  – Mechanical
  – Combustion
  – Electrical
• Methods of engagement and disengagement
  – Clutches
  – Over running
  – Torque overload release
  – Helical spline
  – Spring clutch
• Drive configurations
  – 90 degree drive
  – Planetary gear drive
  – Direct drive
  – Pinion and starter gear
## Program Content

**Level 2**

### Line (GAC): 11 Reciprocating Engines

### Competency: 11.09 Lubricants and Lubrication

#### 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>
<tbody>
<tr>
<td>P13.1 Function and Characteristics of Lubricants</td>
<td></td>
</tr>
<tr>
<td>P13.1.1 Describe functions of lubricants</td>
<td>• Friction</td>
</tr>
<tr>
<td></td>
<td>• Cooling</td>
</tr>
<tr>
<td></td>
<td>• Corrosion</td>
</tr>
<tr>
<td></td>
<td>• Cleaning</td>
</tr>
<tr>
<td></td>
<td>• Cushioning</td>
</tr>
<tr>
<td></td>
<td>• Sealing</td>
</tr>
<tr>
<td>P13.1.2 Describe characteristics of engine lubricants</td>
<td>• Viscosity and Index</td>
</tr>
<tr>
<td></td>
<td>• Specific Gravity</td>
</tr>
<tr>
<td></td>
<td>• Colour</td>
</tr>
<tr>
<td></td>
<td>• Cloud and pour point</td>
</tr>
<tr>
<td></td>
<td>• Flash and fire point</td>
</tr>
<tr>
<td></td>
<td>• Carbon residue</td>
</tr>
<tr>
<td></td>
<td>• Ant-forming quality</td>
</tr>
<tr>
<td></td>
<td>• Operating range</td>
</tr>
<tr>
<td></td>
<td>• Resistance to oxidation</td>
</tr>
<tr>
<td></td>
<td>• Non-corrosive</td>
</tr>
<tr>
<td>P13.2 Types and Classifications of Lubricants</td>
<td></td>
</tr>
<tr>
<td>P13.2.1 Describe common standards and specification for lubricants</td>
<td>• SAE system</td>
</tr>
<tr>
<td></td>
<td>• Commercial aviation grade number</td>
</tr>
<tr>
<td></td>
<td>• Military specifications</td>
</tr>
<tr>
<td>P13.2.2 Explain advantages and disadvantages of</td>
<td>• Mineral oils</td>
</tr>
<tr>
<td></td>
<td>• Ashless dispersant oils</td>
</tr>
<tr>
<td></td>
<td>• Synthetic oils</td>
</tr>
<tr>
<td></td>
<td>• Greases</td>
</tr>
<tr>
<td>P13.2.3 Explain precautions when inter-mixing oil types</td>
<td></td>
</tr>
</tbody>
</table>
P13.3 Reciprocating Engine Lubricating Systems

P13.3.1 Describe types of lubrication systems
- Dry-sump
- Wet-sump

P13.3.2 Describe external components of reciprocating engine oil lubrication system
- Tanks
  - Capacity
- Pumps
  - Scavange
- Filters
  - Types of filters
    - Pressure and scavange
    - Full-flow and partial-flow
    - Edge
    - Depth
    - Surface
    - Semi-depth
- Pressure relief valve
- Pressure indication
- Temperature regulator
- Temperature indication
- Quantity indication
- Temperature switches
- Cooler
- Flow control valves
- Surge protection valves
- Air flow control valves
- Oil/Air separators
- Oil dilution

P13.3.3 Describe methods for internal lubrication of reciprocating engines
- Pressure
- Splash
- Pressure/splash combination

P13.3.4 Describe maintenance practices for reciprocating engine oil lubrication systems
- Analysis
  - Magnetic plugs
  - Filter inspection
  - Spectrometric
- Maintenance
  - Tanks
  - Coolers
  - Screens and strainers
- Filters
- Bypass valves
- Relief valve
  - Adjustment
- Frequency of servicing

P13.3.5 Service reciprocating engine lubricating system (Practical)

P13.3.6 Inspect engine oil-system
Line (GAC): 11 Reciprocating Engines
Competency: 11.10 Aircraft Engine: Operation and Installation

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

LEARNING TASKS

<table>
<thead>
<tr>
<th>Learning Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P14.1</td>
<td>Removal and Installation – Reciprocating Engines</td>
</tr>
<tr>
<td>P14.1.1</td>
<td>Discuss reasons for removal of reciprocating engines</td>
</tr>
</tbody>
</table>

CONTENT

- Defects requiring removal
  - Cracked crankcase
  - Defective mounts
  - Access to firewall
- Engine has reached Time Between Overhaul (TBO)
  - Engine fails to meet standards
    - Excessive internal wear
    - High oil consumption
    - High operating temperatures
    - Poor performance
    - Sudden stoppage
  - Sudden speed reduction (engine detuned)
  - Overspeed
  - Foreign Object Damage (FOD) ingestion
    - Metal particles in oil
    - Immersion in water (cold engine, hot engine, salt water)
  - When run using incorrect fuel
  - Excessive vibration
  - Exposure to volcanic ash
  - Lack of pre-oiling
P14.1.2 Describe procedures for preparation of engine removal/installation
- Magneto “off” or grounded
- Fuel shut-off
- Battery disconnected
- Wheels chocked
- Tail supported
- Human resources required
- Fire safety procedures
- Hoisting requirements and safety

P14.1.3 Describe disconnection/reconnection of
- Engine controls
- Electrical components
- Fuel, oil, hydraulic, air, and other lines
  (Note: stress importance of capping lines)
- Engine mounts

P14.1.4 Describe removal of other components necessary to facilitate engine removal
- Cowlings
- Baffles

P14.1.5 Describe procedure for hoisting and removing/installing engine
- Use of slings and hooks
- Use of hoists
- Placement of engine receiving stands

P14.1.6 Describe transfer of components to replacement engine (as necessary)
- Starter motor
- Propeller governor
- Fuel pumps
- Magnetos
- Vacuum pump
- Engine mounts

P14.1.7 Describe engine installation procedures
- Inspections required
  - Pre-installation
  - Functional
  - Independent inspections
  - Leak checks
- De-preservation
- Pre-oiling

P14.1.8 Describe required log book entries, maintenance certifications, and records

P14.1.9 Describe preservation and crating procedures for storage/transportation of engines.
P14.3 Reciprocating Engines Operation

P14.3.1 Describe preparation of engines for ground running

- Pre-run inspection
  - Points to look for
- Pre-oiling
  - Reasons
  - Equipment
  - Procedure
- Fuel system bleeding
- Propeller checks
- Cowlings in position
- Check the operation of engine and propeller controls
- Fire precautions
- F.O.D.
- Operating area clear of personnel and equipment
- Pre-heat
  - Heat blanket
  - Oil heat
  - Herman Nelson
- Radial engine propeller pull-through

P14.3.2 Describe run-up procedures

- Starting using external power sources
- Starting using aircraft battery
- Hand starting
- Starting procedure
  - Position of controls
  - Idle rpm
  - Mixture position
- Check engine rpm
- Check fuel flow
- Check temperatures and pressures
- Observance of other indication and warning systems
- Magneto checks
- Avoidance of critical rpm range

P14.3.3 Describe factors that affect engine starting

- Starter systems
- Ignition faults
- Fuel system faults
<table>
<thead>
<tr>
<th>P14.3.4</th>
<th>Describe engine shut-down procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Idle mixture shut-off</td>
<td></td>
</tr>
<tr>
<td>• Danger of shut-down using magneto</td>
<td></td>
</tr>
<tr>
<td>switch</td>
<td></td>
</tr>
<tr>
<td>• Cool down period</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P14.3.5</th>
<th>Describe typical engine adjustments for reciprocating engines</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Carburetor</td>
<td></td>
</tr>
<tr>
<td>• Fuel injection system</td>
<td></td>
</tr>
<tr>
<td>• Oil pressure</td>
<td></td>
</tr>
<tr>
<td>• Fuel pressure and flow</td>
<td></td>
</tr>
<tr>
<td>• Magneto</td>
<td></td>
</tr>
<tr>
<td>• Timing</td>
<td></td>
</tr>
<tr>
<td>• Turbocharger</td>
<td></td>
</tr>
<tr>
<td>• Propeller governor</td>
<td></td>
</tr>
<tr>
<td>• Propeller synchronizer</td>
<td></td>
</tr>
<tr>
<td>• Generator/alternator</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P14.3.6</th>
<th>Describe emergency procedures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Oil leak</td>
<td></td>
</tr>
<tr>
<td>• Fuel leak</td>
<td></td>
</tr>
<tr>
<td>• Fire</td>
<td></td>
</tr>
<tr>
<td>• Over-speed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P14.3.7</th>
<th>Ground run reciprocating engine (Practical)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>P14.5</th>
<th>Troubleshooting Reciprocating Engines</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>P14.5.1</th>
<th>Review troubleshooting techniques and principles</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>P14.5.2</th>
<th>Describe operating problems and their probable causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Backfiring</td>
<td></td>
</tr>
<tr>
<td>• Engine fails to start</td>
<td></td>
</tr>
<tr>
<td>• Low power/uneven running</td>
<td></td>
</tr>
<tr>
<td>• Failure to develop full power</td>
<td></td>
</tr>
<tr>
<td>• Rough running</td>
<td></td>
</tr>
<tr>
<td>• Failure to shut down</td>
<td></td>
</tr>
<tr>
<td>• Low/high operating temperatures</td>
<td></td>
</tr>
<tr>
<td>• Low/high operating pressures</td>
<td></td>
</tr>
<tr>
<td>• Low/high fuel flow</td>
<td></td>
</tr>
<tr>
<td>• Vibration</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P14.5.3</th>
<th>Describe probable remedial action for the above problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Manufacturers’ recommended procedures</td>
<td></td>
</tr>
</tbody>
</table>
P14.5.4 Review log book entries and maintenance records required prior to and following remedial action.
Line (GAC): 12 Propellers
Competency: 12.01 Propellers

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P11.1 Basic Applications</td>
<td></td>
</tr>
</tbody>
</table>
| P11.1.1 Describe sources of power to drive propellers | • Piston engines  
• Turbine engines |
| P11.2 Nomenclature | |
| P11.2.1 Identify areas of propeller blade | |
| P11.2.2 Identify components of propeller | |
| P11.3 Propeller Theory | |
| P11.3.1 Explain propeller operating variables | • Blade element theory  
• Blade stations  
• Blade angle  
• Pitch distribution  
• Propeller angle of attack with respect to change in relative wind at different airspeeds and aircraft attitudes (fixed pitch prop)  
• P-factor or propeller factor  
• Geometric pitch  
• Slip  
• Effective pitch  
• Changeable pitch props  
  – Two-position  
  – Multiposition  
  – Automatic  
  – Constant speed  
• Forces acting on a propeller in flight |
• Relationship of propeller tip speed to speed of sound
• Ratio of forward velocity to rotational velocity
• Propeller load
• Propeller efficiency
• Propeller feathering
• Reverse thrust
• Newton’s laws
• Airfoil design
• Angle of attack
• Airspeed
• Density

P11.4 Propeller Classifications and Types

P11.4.1 Describe classifications of propellers
• Tractor
• Pusher

P11.4.2 Describe types of propellers
• Fixed pitch
• Ground-adjustable
• Controllable-pitch
• Two-position pitch
• Constant speed
• Automatic pitch

P11.4.3 Describe feathering capability of controllable pitch propeller

P11.4.4 Describe reverse pitch capability of controllable pitch propeller

P11.5 Fixed Pitch and Variable Pitch Propellers

P11.5.1 Describe construction of wooden propellers
• Materials used
• Fabrication techniques
• Shielding to prevent abrasion
• Mounting assemblies
• Identification

P11.5.2 Describe construction of metal propellers
• Materials used
• Fabrication techniques
• Mounting
P11.5.3 Describe construction of composite propellers

- Identification
- Materials used
- Fabrication techniques
- Mounting
- Identification

P11.5.4 State advantages and disadvantages of different types of propellers

- Wood
- Metal
- Composite

P11.5.5 Describe construction of ground adjustable propellers

- Blade design
- Hub design
- Method of changing pitch

P11.5.6 State advantages of being able to adjust blade pitch on ground

P11.6 Propellers Governors

P11.6.1 Explain advantages of being able to change and control propeller pitch in flight.

P11.6.2 Discuss two-position propeller system

- Basic pitch-change mechanism of propeller (oil pressure and counterweights)
- Valve system for selecting high or low pitch

P11.6.3 Discuss constant-speed propeller system

- Review concept of constant speeding
- State mechanisms that may be used for pitch change
- Describe basic concept of how oil flows through governor to control blade angle of propeller

P11.6.4 Describe propeller governors

- Internal parts
- Oil flow through governor and crankshaft
- Relationship between speeder spring pressure and flyweight forces due to engine rpm
- On-speed condition and resultant oil flow
- Under-speed condition and resultant oil flow
- Over-speed condition and resultant oil flow
Program Content
Level 2

flow

- Linkage between propeller control in cockpit and governor speeder spring adjustment
- Feathering capability of governor

P11.7 Constant-Speed and Feathering Propellers

P11.7.1 Describe construction and internal operation

- Non-feathering
- Feathering
- Counterweight
- Reversible

P11.7.2 Describe operation of feathering propeller installation

- Cockpit controls
- Cockpit instrumentation

P11.7.3 Explain

- Shaft horsepower (SHP)
- Equivalent shaft horsepower (ESHP)
- Torquemeter readings compared to horsepower output

P11.7.4 Describe construction and internal operation of reversing propeller

P11.7.5 Describe operation of turbo-prop (PT-6 System) control systems

- Cockpit controls
- Engine reversing linkage
- Propeller governor during
  - On-speed
  - Under-speed
  - Over-speed
  - Feathering
  - Reversing
- Propeller over-speed governor
- Topping governor

P11.7.8 Disassemble and Reassemble Propeller (Practical)

P11.8 Synchronizing and Synchrophasing Systems

P11.8.1 Explain

- Synchronized propeller operation
- Synchrophased propeller operation
P11.8.2 Define terminology for systems
- Master engine
- Slave engine

P11.8.3 Describe components and operation
- Synchronizing system
- Synchrophasing system

P11.9 Autofeather Systems

P11.9.1 Explain autofeather system

P11.10 Propellers Installation and Removal

P11.10.1 Describe basic types and components of propeller mounting configurations
- Tapered shaft
- Splined shaft
- Flanged shaft

P11.10.2 Describe basic steps for removal and installation for each shaft configuration
- How puller part of hub works
- How to check and improve interference fit
- Inspection of crankshaft
- Installation and making safe

P11.10.3 Describe steps for removal and installation on splined shaft
- Removal procedure
- Master spline
- Spline inspection
- Installation procedure
- Front-cone bottoming and how to fix the problem
- Rear cone bottoming and how to fix the problem
- Torqing and making safe

P11.10.4 Describe parts of flanged hub

P11.10.5 Describe basic steps for removal and installation on a flanged hub
- Removal procedure
- Replacing bushings
- Mating surface inspection
- Dowel position
- Propeller positioning in absence of dowels
- Installation and making safe
P11.10.6 Remove, inspect reinstall and adjust propeller on piston or turbine engine (Practical)

P11.11 Inspection, Maintenance and Repair

P.11.11.1 Discuss propeller vibrations
- Correctable vibrations
- Uncorrectable vibrations
- Purpose for checking propeller track and balance
- Method for checking track and balance
- Static balance
  - Horizontal imbalance
  - Vertical imbalance
  - Method for correcting
- Dynamic imbalance

P11.11.2 Discuss propeller repairs
- General causes of propeller damage
- Results of not repairing damage
- General inspection or maintenance operations
- Repairs that AME is authorised to accomplish
- Repairs that must be done by specialized shops

P11.11.3 Discuss wooden propeller inspection
- Defects that may occur on all parts of propeller
- Defects that are cause for rejection
- Basic repairs of minor damage
- Major damage

P11.11.4 Discuss hollow and solid metal propellers
- Major damage
- Techniques used for inspection
- Basic repairs allowed for minor damage

P11.11.5 Discuss aluminum-alloy propellers
- Major damage
  - Bent in face alignment
  - Bent in edge alignment
  - Fatigue failure
- Prevention and treatment of minor surface defects
- Repair of pitted leading edges
- Inspection and treatment of scratches and suspected cracks
Program Content
Level 2

- Local etching
- Purpose
- Procedure
- Shortening of blades to remove defects
- Causes for rejection of aluminum blades
- Terms used for blade damage
- Minor damage of
  - Erosion shield
  - Blade cuff
  - Blade
- Major damage
- Methods of recording repairs (major or minor)
- Check blade angles using propeller protractor
- Scheduled inspection
- Dynamic balance
- Static RPM check
- Constant speed propeller adjustments
- Prop-strike inspection
- Typical inspections for responding to troubleshooting problems
- Five year inspection

P11.11.6 Discuss composite propeller blades

P11.11.7 Describe special inspections

P11.11.8 Inspect minor damage to propeller blade (Practical)

P11.12 Troubleshooting

P11.12.1 Identify

- Common faults
- Probable causes
- Proper corrective actions
Line (GAC): 13 Aircraft Structural Materials  
Competency: 13.01 Non-Metallic Materials  

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A12.5</td>
<td>Plastics and Glass</td>
</tr>
<tr>
<td>A12.5.2</td>
<td>Describe methods for storing and protecting plastics</td>
</tr>
<tr>
<td>A12.5.3</td>
<td>Describe procedures for cleaning machining and cementing plastics</td>
</tr>
<tr>
<td>A12.5.4</td>
<td>Explain installation and repair of plastic transparencies</td>
</tr>
<tr>
<td>A12.5.5</td>
<td>Explain procedures for inspection and installation of glass windows.</td>
</tr>
</tbody>
</table>
Program Content
Level 2

Line (GAC): 13 Aircraft Structural Materials
Competency: 13.02 Materials and Processes

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| **G12.1** Aircraft Development and Materials | • Steel  
• Aluminum  
• Magnesium  
• Titanium  
• Plastic/rubber  
• Glass  
• Composite materials |
| **G12.1.2** Discuss materials used in aircraft construction |  |
| **G12.2** Properties of Materials |  |
| **G12.2.1** Define metallurgical terms | • Force  
• Load  
• Stress  
• Strain  
  – Forms of stress  
  – Tension  
  – Torsion  
  – Compression  
  – Shear  
  – Bending  
• Deformation  
• Elasticity  
• Plasticity  
  – Malleability  
  – Ductility  
• Hardness  
• Tensile strength  
• Brittleness |
| **G12.2.2** Explain Common metallurgical expressions | • Strength to weight ratio  
• Ultimate tensile strength |
• Proof stress
• Design limits
• Service life
• Fail-safe
• Cyclic stresses

G12.2.3 Describe general properties of metals
• Crystalline structures
• Slip planes
• Grain size
• Alloys

G12.3 Ferrous Metals

G12.3.1 Describe iron
• Characteristics
• Production process
• Properties
• Forms
• Advantages/disadvantages/limitations

G12.3.2 Describe steel
• Characteristics
• Production process
• Forming
• Alloys and properties
  – For example
    o Reasons for alloying
    o Carbon
    o Chromium
    o Aluminum
    o Lead
    o Manganese
    o Vanadium
    o Silicon
    o Nickel
    o Molybdenum
    o Tungsten
    o Titanium
• Control of impurities
  – Sulphur
  – Phosphorous

G12.3.3 Explain steel alloy identification systems
• SAE identification system
• AISI system
• Colour coding
- Spark characteristics

G12.3.4 Describe steel heat treatment
- Reasons for heat treatment
  - Softening
  - Hardening
  - Surface hardening
- Heat treatment process
  - Austenite
  - Ferrite
  - Cementite
  - Pearlite
  - Martensite
- Types of heat treatment
  - Annealing
  - Case-hardening
  - Cyaniding
  - Nitriding
  - Normalizing
  - Tempering

G12.3.5 Describe stainless steels
- Characteristics
- Identification by AISI number
- Uses
- Advantages and disadvantages

G12.4 Non-ferrous metals

G12.4.1 Describe aluminum
- Characteristics
- Production and manufacturing processes
- Forms
  - Cast
  - Wrought
- Properties
- Advantages/disadvantages
- Methods of strengthening aluminum
  - Alloying
  - Cold working
  - Heat treatment

G12.4.2 Describe aluminum alloys
- Reasons for alloying
- Alloying elements and their properties
G12.4.3 Explain aluminum and alloy identification systems

- Aluminum association designation system for wrought alloys
  - 1st digit: main alloy element
  - 2nd digit: modification of alloy
  - 3rd and 4th digit: alloy designator (% of alloy)
- Temper designation system
  - F: as fabricated
  - O: annealed
  - H: strain hardened (for NHT alloys)
  - W: unstable condition (temporary while material ages after SHT)
  - T: thermally heat treated
- Heat treatable and non-heat treatable alloys
- Forms of wrought metal
  - Sheet
  - Plate
  - Extrusions
  - Bar and rod stock
- Federal Specifications (QQ#)
- Identification markings for sheet
  - Manufacturer
  - Alloy temper
  - Thickness
  - Production lot #

G12.4.4 Describe heat treatment

- Reasons for heat treatment
- Annealing
  - Reasons
  - Process
  - Natural aging
  - Retarding aging – icebox rivets
- Precipitation heat treatment (artificial aging)
  - Reasons
G12.4.5 Describe magnesium
- Properties and uses
- Heat treatment
- Identification
- Safety

G12.4.6 Describe titanium
- Properties and uses
- Heat treatment
- Identification

G12.4.7 Describe copper and its alloys
- Properties and uses

G12.4.8 Describe monel and its alloys
- Properties and uses

G12.4.9 Describe high-temperature alloys
- Hastelloy
- Haynes
- Inconel

G12.5 Material Testing

G12.5.1 Recall hardness and strength characteristics

G12.5.2 Explain purpose of hardness testing
- To determine hardness of material
- To identify metals and alloy

G12.5.3 Describe various hardness testing processes
- Brinell
  - For ferrous, non-ferrous and soft metals before machining
  - Steel ball, pressure, measure depression, 15s press for ferrous, 30s press for others
- Rockwell
  - For depth of penetration
  - Steel ball or diamond spherocical penetrator

G12.6 Glass and Plastics
G12.6.1 Define “plastics”

G12.6.2 Describe

G12.6.3 Describe aircraft transparencies

- Thermosetting plastics
- Thermoplastics resins

G12.6.4 Describe storing, protecting, and handling of plastic and glass materials, windows and lenses

- Materials
- Construction
- Care and handling
- Cleaning
- Repair
- Inspection
- Installation
- Damage Assessment

G12.6.5 Describe types and uses of glass in aircraft

G12.6.6 Describe windshields

- Types
- Construction
- Coatings

G12.6.7 Handle plastics: clean a transparency (Practical)
### Objectives
To be competent in this area the individual must be able to:

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>G14.1 Formation and Types of Corrosion</td>
<td>• Definition of corrosion</td>
</tr>
<tr>
<td></td>
<td>• Chemistry</td>
</tr>
<tr>
<td></td>
<td>- Requirements for corrosion</td>
</tr>
<tr>
<td></td>
<td>- Potential difference table</td>
</tr>
<tr>
<td>G14.1.1 Describe elements of corrosion</td>
<td>• Direct chemical attack</td>
</tr>
<tr>
<td></td>
<td>• Electrochemical attack</td>
</tr>
<tr>
<td></td>
<td>• Uniform</td>
</tr>
<tr>
<td></td>
<td>• Localized</td>
</tr>
<tr>
<td>G14.1.2 Classify corrosion</td>
<td>• Galvanic</td>
</tr>
<tr>
<td></td>
<td>• Oxidation</td>
</tr>
<tr>
<td></td>
<td>• Uniform surface</td>
</tr>
<tr>
<td></td>
<td>• Pitting</td>
</tr>
<tr>
<td></td>
<td>• Intergranular</td>
</tr>
<tr>
<td></td>
<td>• Exfoliation</td>
</tr>
<tr>
<td></td>
<td>• Fatigue</td>
</tr>
<tr>
<td></td>
<td>• Oxygen cell</td>
</tr>
<tr>
<td></td>
<td>• Metallic ion cell concentration</td>
</tr>
<tr>
<td></td>
<td>• Internal stress</td>
</tr>
<tr>
<td></td>
<td>• Crevice</td>
</tr>
<tr>
<td></td>
<td>• Fretting</td>
</tr>
<tr>
<td></td>
<td>• Microbiological</td>
</tr>
<tr>
<td></td>
<td>• Filiform</td>
</tr>
<tr>
<td>G14.1.3 Describe types of corrosion</td>
<td>• Magnesium</td>
</tr>
<tr>
<td></td>
<td>• Certain aluminium alloys</td>
</tr>
<tr>
<td></td>
<td>• Ferrous and non-ferrous</td>
</tr>
<tr>
<td>G14.1.4 Recall corrosion-prone materials used in</td>
<td>• Metals in contract</td>
</tr>
<tr>
<td>aircraft construction</td>
<td>• Water</td>
</tr>
<tr>
<td></td>
<td>• Air</td>
</tr>
</tbody>
</table>
- Salts
- Organic growths
- Acids
- Alkalis
- Mercury
- Paint strippers
- Toilet and galley contaminants
- Blood
- Chemicals
- Rain

G14.1.6 Identify types of corrosion on samples (Practical)

G14.2 Corrosion Detection

G14.2.1 Describe corrosion-prone areas
- Exhaust areas
- Battery compartments and vents
- Lavatories and galleys
- Wheel wells and landing gear
- Skin seams and lap joints
- Engine inlet areas
- Fuel tanks
- Piano hinges
- Control surface recesses
- Bilges
- Landing-gear boxes
- Engine mount/structure
- Control cables
- Welded areas
- Avionics equipment
- Rotating components (helicopter)
- Leading edge of wings and rotors erosion leading to corrosion

G14.3 Corrosion Removal and Control

G14.3.1 Explain mechanical removal of corrosion in aluminum alloys
- Abrasive materials
- Removal limits
- Safety precautions
- Procedure cautions
G14.3.2 Explain chemical control of corrosion in aluminum alloys
- Alodine
- Alachrom
- Do not use steel-wire brush

G14.3.3 Explain mechanical removal of corrosion in magnesium alloys
- Abrasive materials
- Removal limits
- Safety precautions

G14.3.4 Explain chemical control of corrosion in magnesium alloys
- Chromic acid + sulphuric
- Pickling

G14.3.5 Explain mechanical removal of corrosion in ferrous metals
- Abrasive materials
- Removal limits
- Safety precautions

G14.3.6 Explain chemical treatment of corrosion in ferrous metals
- Safety precautions

G14.4 Corrosion Prevention and Protection

G14.4.1 Describe corrosion protection measures
- Seam sealing
- Aircraft cleaning
- Anodizing and related processes
- Plating
- Chrome-pickling
- Dichromate treatment
- Stannate immersion
- Galvanizing
- Cladding
- Metal spraying
- Sacrificial node
- Organic coatings
- Dope proofing
- Internal treatments
- Painting

G14.4.2 Describe methods of constructing corrosion-resistant structure
- Use of close galvanic metals in proximity
- Insulation of dissimilar metals
- Treating and painting of cut edges
- Alodining
- Sealing methods
- Use of drain holes
- Use of water dispersant
Program Content
Level 2

Line (GAC): 14 Wood and Fabric
Competency: 14.01 Non-Metallic Structures

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

LEARNING TASKS

A12.1 Wood Structures

A12.1.1 Review use of wood in aircraft structures
- Classification of wood
- Acceptability and considerations when selecting or ordering wood.

A12.1.3 Describe types of glues

A12.1.4 Describe procedures for wood preparation

A12.1.5 Describe inspection and repair procedures

A12.2 Fabric Coverings

A12.2.1 Describe materials and nomenclature used for fabric covering
- Types
- Tape
- Threads and cords
- Grommets
- Inspection rings
- Miscellaneous

A12.2.2 Describe nitrate and butyrate dopes and dope additives
- Rejuvenators
- Solvents
- Retarders

A12.2.3 Discuss facilities and equipment required for doing fabric work
- Tools
- Safety
- Environment
A12.2.4 Discuss application process for fabric covering
- Structure preparation
- Fabric seams
- Covering methods
- Installation of fabric
- Rib lacing and attachment
- Surface tape application
- Finishing process

A12.2.5 Discuss fabric inspection
- Examine Seybolt and Maule “punch” tester
- Determine criteria for serviceability of fabric material

A12.2.6 Discuss methods of repairing fabric covering
- Sewing and doping tears
- Doped repair
- Sewn-in panels
- Doped-in panels
- Application of rejuvenators
Line (GAC): 14 Wood and Fabric  
Competency: 14.02 Materials and Processes

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>G12.7 Wood</td>
<td></td>
</tr>
</tbody>
</table>
| G12.7.1 Describe the uses of wood in aircraft construction | • Advantages  
• Disadvantages  
• Examples of aircraft using wood  
• Types of structures using wood |
| G12.7.2 List three forms of wood commonly used in aircraft | • Solid wood  
• Plywood  
• Laminated wood |
| G12.7.3 Describe solid wood | • Types of approved species  
• Spring wood  
• Grain pattern  
• Density  
• Defects  
  – Checks  
  – Shakes  
  – Splits  
  – Knots  
  – Decay |
| G12.7.4 Describe laminated wood |         |
| G12.7.5 Describe plywood |         |
| G12.7.6 Describe testing procedures for wood and adhesives |         |
| G12.8 Fabric Coverings |         |
G12.8.1 Describe uses of fabric coverings and materials
- Covering of wings, control surfaces and fuselage
- Reinforcing tape
- Surface tape
- Lacing cord
- Machine thread
- Hand-sewn thread
- Rib stitching

G12.8.2 Describe fabric coverings
- Nomenclature
  - Bias
  - Bleaching
  - Calenderizing
  - Fill/woof
  - Mercerizing
  - Selvedge
  - Sizing
  - Thread count
  - Weight
- Organic fabrics
  - Cotton fabrics
  - Linen
  - Thread count
  - Grades
- Discuss SAE numbers
- Inorganic fabrics
  - Polyeseters
  - Fiberglass
- List advantages and disadvantages of each material

G12.8.3 Describe tapes and their uses
- Surface
- Reinforcing
- Chaffing

G12.8.4 Describe sewing threads and lacing cords
- Machine thread
- Hand-sewn thread
- Lacing cord

G12.8.5 Describe use of fabric covering accessories and hardware
- Grommets
- Inspection rings
- Special fasteners
- Tacks
Program Content
Level 2

- Beeswax

G12.8.6 Describe testing of fabric
Aircraft Maintenance Technician Industry Training Authority

Line (GAC): 16 Dynamic Drive Systems
Competency: 16.01 Dynamic Drivetrains

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

LEARNING TASKS
A1.1. Driveshafts and Transmission Accessories

A1.1.1 Describe aircraft power transmission

- Driveshafts
  - Reasons for use
  - Types
    - Solid
    - Hollow
    - Flexible
- Materials
  - Steel
  - Aluminum
  - Combination
- Belts and pulleys
  - Types of belts
    - Flat vee
    - Cogged
- Types of pulleys
  - Flat
  - Vee

A1.1.2 Describe types of driveshaft couplings

- Grease lubricated
  - Internal/External crown tooth gear and splined housing
- Laminated flex
- Curvic
- Elastomeric
  - Combination rubber and steel
- Splined

A1.1.3 Describe driveshaft support systems

- Hangers and bearings
- Floating supports
- Dampeners
A1.1.4 Describe maintenance of driveshafts

- Lubrication and servicing
- Removal and installation
- Balance
- Temperature indicators

A1.1.6 Remove, inspect and install helicopter tail rotor driveshaft (Practical)

A1.2 Freewheel Units

A1.2.1 Explain purpose of freewheel units on helicopter drive systems

A1.2.2 Describe different types of freewheel units

- Sprag
  - Components
  - Operating principle

A1.2.3 Describe location of freewheel units

- Engine output-Bell 206
- Output driveshafts-AS 350
- Combining gearboxes-Bell 212
- Main transmission inputs-Bell 204
- Planetary system-Bell 47

A1.3 Clutches

A1.3.1 Describe clutches and their operation

- Unloading engine during start sequence
- Difference between clutches and freewheel units

A1.3.2 Identify types of clutches

- Centrifugal
- Mercury
- Shoe
- Maintenance and adjustments
- Belt tensioners
- Manual
- Electric
- Maintenance and adjustments

A1.4 Gear Systems
A1.4.1 Describe gear nomenclature
- Tooth description
  - Heel
  - Toe
  - Face
  - Profiles
    - Gear (crown)
    - Pinion

A1.4.2 Describe types of gears
- Straight cut
- Helical
- Bevel
- Spiral bevel
- Worm

A1.4.3 Describe types of gear sets and their uses
- Types
  - Spur gears
  - Gear (crown) and pinion
  - Planetary
  - Worm and wheel
- Uses
  - Transmitting motion
  - Changing speed
  - Changing direction

A1.4.4 Describe methods for determining gear mesh relationships
- Lash measurement
- Checking visual pattern
- Lubrication
  - Tooth loading
  - Shimming
  - Positioning of bearings and housings

A1.4.5 Describe methods for determining gear wear
- Visual pattern
- Gauge pins
- Straight edge and feeler gauge
- Backlash measurements

A1.5 Aircraft Gearboxes

A1.5.1 Describe gearbox construction
- Material
  - Aluminum
  - Magnesium
1.5.2 Describe gearbox components

- Seals
- Packings
- Bearings
- Oil system components
  - Pumps
  - Pressure regulators
  - Filters
    - Cartridge
    - Element
    - Bypass valves
  - Chip detectors
  - Temperature transmitters
    - Switches
  - Pressure transmitters
    - Switches
- Quantity indicators
  - Sight glasses
  - Dip sticks
  - Floats
- Filler caps
  - Vents
- Coolers
  - Thermobypass valves

A1.5.3 Describe gearbox accessories

- Mounts
  - Torsional loads
  - Lift loads
  - Vibration isolation
- Accessory drives
  - Hydraulic pumps
  - Tachometer
  - Clutches
  - Drive adapters
Program Content
Level 2

- Rotor brakes
- Motor generators
- Blowers
- Tail rotor

A1.5.4 Describe types of gearboxes and their applications
- Helicopter main transmissions
- Intermediate
- Tail rotor
- Accessory
- Flap extension
- Engine
- Propeller reduction

A1.5.5 Maintain aircraft gearboxes
- Replace/clean filters
- Check chip detectors
- Determine type quantity of lubrication
- Adjust oil pressure regulator
- Determine security and condition of fasteners and mounts
- Inspect for corrosion
- Check gear backlash
Line (GAC): 17  Vibration Analysis
Competency: 17.01  Vibration Analysis and Rectification

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

LEARNING TASKS  CONTENT

A10.1  Transmission of Sound  
A10.1.1  Explain and discuss transmission of sound  
- Frequency, amplitude and displacement  
- Wave motion  
- Transmission of sound in different mediums  
- Measurement of intensity against time (inches per sec.)  
- Resonance  
- Doppler effect

A10.2  Vibrations in Rotating and Non-Rotating Devices  
A10.2.1  Explain vibrations  
- Amplitude  
- Frequency  
- Centre of mass  
- Centre of gravity  
- Centre of rotation  
- Direction of vibration (vertical and lateral)

A10.2.2  Demonstrate low and medium frequency vibration (Practical)

A10.3  Nodes, Anti-Nodes, Inherent Vibrations, Masking and Harmonics  
A10.3.1  Explain vibration characteristics and properties  
- Nodes and anti-nodes  
- Harmonics and inherent vibrations  
- Nodamatic suspensions  
- Pendulum absorbers  
- Bifilars  
- Mass weight and springs  
- Isolation mounts  
- Noise canceling systems
A10.4  Detection and Isolation

A10.4.1  Explain vibration troubleshooting techniques
- Low-, medium-, and high-frequency vibrations and their sources
- Vertical and lateral vibrations and their causes
- Blade phase angles
- Acquisition of information
- Seat of the pants track and balance
- Importance of communication with pilot
- Equipment used
- Frequency
- Direction
- Differences of track in a hover versus speed-sensitive track
- How track affects phase
- Proper sequence of adjustments

A10.4.2  Balance vibration simulator (Practical)

A10.4.3  Identify direction of vibration

A10.4.4  Determine source of vibration

A10.5  Test Equipment

A10.5.1  Explain function of and demonstrate use of test equipment
- Accelerometers, piezoelectric, velocimeters and veiocimeters
- Pickups
  - Magnetic
- Interrupters
- Phasors
- Strobe lights
- IPS meters
- Charts
- Vibration analysers

A10.5.2  Install test equipment on vibration simulator or helicopter (Practical)
A10.6 Static Balance

A10.6.1 Explain static balance
- Alignment and phasing of rotors and blades
- Telescope gunsight alignment
- Knife-edge balancer
- Marvel balancer
- Bullseye and bubble levels
- Methods of weight change

A10.7 Dynamic Balance

A10.7.1 Explain dynamic balance
- Reading charts
- Chart correction
- Interpretation of results
- Building chart from scratch
- Predicting move line directions

A10.7.2 Perform dynamic balance (Practical)
- Equipment installation
- Tuning
- Sequence of corrections
- Chart building and use
- Adjustments to track
- Adjustments to balance
- Fine-tuning
Level 3

Aircraft Maintenance Technician
Line (GAC): 20 Drawings
Competency: 20.01 Aircraft Drawings

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

LEARNING TASKS

G5.1 Types of Drawings

G5.1.1 Explain Drawings and Sketches

- Production drawings
  - Detail
  - Assembly
  - Pictorial
  - Installation
- Block diagrams
- Schematic diagrams
- Shop sketches
- Electrical/electronic drawings
  - Wiring diagrams
  - Schematic diagrams
  - Logic circuit diagrams

G5.1.2 Explain drawing production processes.

G5.2 Drawing Techniques

G5.2.1 Explain Projections

- Perspective view
- Oblique view
- Isometric projection
- Orthographic projection

G5.2.2 Explain Lines

- Widths
  - Wide
  - Medium
  - Narrow
- Object
- Hidden
G5.2.3 Recognize and explain machining and finishing symbols

- Phantom
- Dimension
- Extension
- Cutting-plane
- Break
- Adjacent part
- Short
- Long

- Countersinking
- Boring
- Surface finish

G5.2.4 Explain Views

- Single
- Two
- Three
- Multiple
- Phantom
- Sectional
  - Full section
  - Half section
- Detail

G5.2.5 Explain Dimensions

- Basic dimensions
  - Limits
  - Permissible dimensions
  - Tolerance
  - Allowance
  - Tight fit
  - Loose fit

G5.2.6 Explain numbering and lettering format

- Block
- Upper case
- Gothic
- Zoning

G5.2.7 Explain basic sketching techniques
G5.2.8  Explain title block layout and purpose
- Drawing number
- Materials list
  - Quantity
  - Part number
  - Description
  - Material
  - Size
  - Specifications
- Left-hand and right-hand parts
  - Scale
  - Title
  - Revisions
  - Dimensions and limits

G5.2.9  Explain drawing revisions/changes/modifications
- Engineering orders
- Production changes
- Ballooning

G.5.2.10 Explain care and storage of drawings

G5.2.11 Using a variety of line types, views, and levels of complexity, draw/sketch examples of each of the projections. (Practical)

G5.2.12 Given a damage scenario, produce sketch/drawing to evaluate repair (Practical)

G5.3 Interpretation of Aircraft Drawings

G5.3.1 Explain Station numbers
- Datum
- Fuselage stations
- Wing stations
- Water line
- Butt line
- Component stations

G5.3.2 Explain zoning
- ATA 100 zoning system
- Major zoning areas
G5.3.3 Explain symbols and abbreviations
- Materials symbols
- Process codes
- Flag notes
- Caution tags

G5.3.4 Locate specific information from a variety of aircraft drawings and blueprints (Practical)
- Serial numbers
- Aircraft applicability
- Location on aircraft
- Scale

G5.3.5 While performing various tasks interpret blueprints and drawings (Practical)
- Locating components on aircraft
- Wiring components on aircraft
- Configuring aircraft from floats, skis or wheels
Line (GAC): 21 Metallic Structures  
Competency: 21.01 Metallic Structures

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A11.3 Aircraft Sheet Metal</td>
<td></td>
</tr>
</tbody>
</table>
| A11.3.1 Describe handling procedures and storage of sheet metal | - Safety  
- Documentation and identification |
| A11.3.2 Review identification of sheet Aluminum alloy | - Markings  
- Thickness  
- Aluminum Association Identification system |
| A11.3.3 Describe sheet metal documentation |  |
| A11.3.4 Obtain sheet of specified aluminum alloy from sheet metal rack. Handle and move it. Replace it in rack (practical) |  |
| A11.4 Lay Out, Cutting and Drilling of Sheet Metal |  |
| A11.4.1 Describe layout procedures | - Constructing a  
  - Square  
  - Triangle  
  - Circle  
  - Bisect above constructions |
| A11.4.2 Describe use of lay-out tools and instruments |  |
| A11.4.3 Describe process for marking and drilling holes in sheet metal |  |
| A11.5 Installation of Rivets |  |
| A11.5.1 Describe solid rivets | - Rivet codes (AN and MS)  
  - Head shape |
A11.5.2 Describe riveting process

- Material
- Shank diameter
- Shank length
- Head styles
- Ice box rivets
- Lay out
  - Pitch
  - Min and max
  - Edge distance
  - Single row
  - Staggered row
  - Grip length
- Riveting tools
  - Rivet guns
  - Bucking bars
  - Clecos and clamps
  - Set-up and "drawing" tools
  - Countersinking and dimpling tools
  - Rivet cutting tools
  - Rivet gauges
- Rivet sizing
  - Length
  - Diameter
  - Tail length
  - Formed head size
- Forming upset heads (bucking)
- "Wet " installation
- Prepare faying surfaces
- Safety precautions

A11.5.3 Describe inspection of formed rivets

- Rivet replacement rules
- Shear strength
- Bearing failure
- Riveting faults
  - Manufactured head damage
  - Formed head under/oversized
  - Cracks
  - Offset head
  - Loose rivet
  - Clearance under heads
  - Marked skin
A11.5.4 Describe removal of rivets (Practical)
- Tools
- Procedure
  - Centre punch head
  - Drill size
  - Depth of drilling
  - Head removal
  - Use of pin punch
- Safety precautions

A11.5.5 Lay out pieces of metal, cut to size using both hand shears and mechanical shears. Note safety
- Single row
- Double row
- Staggered row
- One row for countersunk rivets

A11.5.6 Lay out and drill rivet pattern on two pieces of metal
- Lap joint
- Butt joint

A11.5.7 Rivet together two pieces of metal using both hand-riveting and pneumatic-riveting procedures
- Lap joint
- Butt joint

A11.5.8 Inspect rivets for correct installation, mark poor or damaged rivets

A11.5.9 Remove poor or damaged rivets or select several rivets for removal

A11.6 Forming and Bending Sheet Metal

A11.6.1 Describe calculation of bend allowance
- Definition
  - Bend radius
  - Metal thickness
  - Degrees of bend
  - Hardness of metal
- Bend allowance formula
- Bend allowance chart
- Sight line
- Bend line
- Bends smaller than 90°
- K-factor
A11.6.2  Describe bend allowance

- 90° bend
- Bends less than 90° (open angle)
  - Use K-factor
- Bends greater than 90°
  - Use K-factor
  - Without K-factor

A11.6.3  Describe formation of joggle

- Manual method
- Brake method

A11.6.4  Form a bend (Practical)

- Brake
- Bars
- Radius

A11.6.5  Calculate bend allowance and lay out selection of one or more forms

- Simple 90° bend
- Bend greater than 90°
- Bend less than 90°
- U channel
- Hat section
- V section
- Z section

A11.6.6  Produce selection of one or more of following forms

- Simple 90° bend
- Bend greater than 90°
- Bend less than 90°
- U channel
- Hat section
- V section
- Z section

A11.6.7  Form joggle

A11.6.8  Fabricate joggled joint (join two joggled pieces)

A11.7  Sheet Metal Repairs

A11.7.1  Explain damaged area inspection

- Scratch inspection
- Assess type and extent of damage
- Draw or make rubbing of damaged area
- Write up damage report
- Plan repair
A11.7.2 Explain damage removal process
- Support damaged area
- Remove rivets
- Dress out damage
- Inspect for further damage

A11.7.3 Explain fabrication of surface and flush patches
- Blind hole finding

A11.7.4 Explain rivet formulas

A11.7.5 Describe repair to pressurized structure

A11.7.6 Explain use of sealants in structural repair
- Types of sealant
- Application and curing

A11.7.7 Practice dimpling and countersinking

A11.7.8 Perform sheet metal repair in accordance approved data
- Stressed skin

A11.8 Installation of Special Fasteners

A11.8.1 Describe sheet metal fasteners
- Hi-Shear rivets
- Blind Hi-Shear rivets
- Hi-Lok Hi-Tigue fasteners
- Hi-Lites
- Lockbolts
- Blind Lockbolts
- Huckbolt
- Taperlocks
- Blind Rivets:
  - Pop rivets
  - Rivnuts
  - Cherrylock rivets
  - Cherrymax rivets
  - Huck

A11.8.2 Describe special fasteners for panels and cowlings
- Dzus
- Camloc
- Airloc
A11.8.3 Install special fasteners (practical)

A11.9 Inspection of Tubular Structures

A11.9.1 Review types of tubular construction

A11.9.2 Discuss inspection of tubular structures for damage

- Visual
- NDT
- Areas of likely damage
  - Primary
  - Secondary
- Hazardous incidents such as:
  - Heavy/overweight landings
  - Flight through severe turbulence
  - Lightning strikes
  - Immersion in water

A11.9.3 Discuss type of repairs

- Weld alignment
- Cluster repairs
- Dent repairs
- Welded sleeve
- Bolted sleeve
- Welded patch
  - Dents
  - Punctures
- Splicing
  - Inner sleeve
  - Outer sleeve
  - Larger diameter replacement tubes

A11.9.4 Discuss inspection of welds

- Appearance of good weld
- Weld faults

A11.9.5 Explain regulatory requirements for repairs to tubular structures

- Qualifications
- Regulations
  - Transport Canada
  - FAA
- Documentation
  - Logbooks
A11.9.6 Discuss process of preparing aircraft for repair

- Survey damage
- Support structure
- Jury braces
- Alignment and geometry checks
- Cleaning
- Internal inspection

A11.9.7 Inspect and assess welded areas on tubular construction samples

A11.10 Inspection and Repair of Bonded Structures

A11.10.1 Describe inspection techniques

- Tap test
- Obvious damage
- NDI

A11.10.2 Describe metal-bonding materials

A11.10.3 Describe repair techniques

- Remove bonding material
- Re-bond
- Cut away damaged area
- Splice in and rivet repair
### Program Content
#### Level 3

**Line (GAC):** 21  Metallic Structures  
**Competency:** 21.02  Hand and Machine Tools

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

### LEARNING TASKS

<table>
<thead>
<tr>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>G6.5  Sheet Metal Tools</strong></td>
</tr>
<tr>
<td><strong>G6.5.1 Discuss hand tools employed for sheet metal work</strong></td>
</tr>
<tr>
<td>• Hammers and mallets</td>
</tr>
<tr>
<td>• Hand snips and shears</td>
</tr>
<tr>
<td>• Nibblers</td>
</tr>
<tr>
<td>• Rivet squeezers</td>
</tr>
<tr>
<td>• Punches</td>
</tr>
<tr>
<td>• Wire and sheet metal gauge</td>
</tr>
<tr>
<td>• Rivet guns and sets</td>
</tr>
<tr>
<td>• Bucking bars</td>
</tr>
<tr>
<td>• Sheet fasteners (clecos) and pliers</td>
</tr>
<tr>
<td>• Hole finder</td>
</tr>
<tr>
<td>• Rivet cutter</td>
</tr>
<tr>
<td>• Rivet mandrel grinder</td>
</tr>
<tr>
<td>• Dimpling tool</td>
</tr>
<tr>
<td>• Flanging tools</td>
</tr>
<tr>
<td>• Hand drills</td>
</tr>
<tr>
<td>• Rivet shavers</td>
</tr>
<tr>
<td>• Die grinders</td>
</tr>
<tr>
<td>• Blind fastener installing tools</td>
</tr>
<tr>
<td>• Air tools</td>
</tr>
<tr>
<td>• Battery powered tools</td>
</tr>
<tr>
<td><strong>G6.5.2 Discuss safe use of floor and bench tools employed in sheet metal work</strong></td>
</tr>
<tr>
<td>• Shears</td>
</tr>
<tr>
<td>• Brakes</td>
</tr>
<tr>
<td>• Forming machines</td>
</tr>
</tbody>
</table>
Program Content
Level 3

Line (GAC): 22 Maintenance Procedures
Competency: 22.01 Principles of Aircraft Maintenance Management

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

LEARNING TASKS CONTENT
G1.1 Quality Assurance within the workplace

G1.1.1 Define quality assurance as it relates to aircraft maintenance
• A program for systematically monitoring and evaluating all elements of a maintenance operation to ensure that standards for quality are being met.
• Finding and permanently eliminating the source of failures in quality
Program Content
Level 3

Line (GAC): 23  Turbine Engines
Competency: 23.01  Fire Protection and Detection

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2.3 Fire-Detection Systems</td>
<td></td>
</tr>
<tr>
<td>A2.3.1 List design requirements for fire-detection systems</td>
<td></td>
</tr>
</tbody>
</table>
| A2.3.2 Explain fire zone classification | • Class A  
  • Class B  
  • Class C  
  • Class D  
  • Class X |
| A2.3.3 Discuss types of detection systems available | • Fire  
  • Overheat  
  • Smoke |
| A2.3.4 Discuss types of detectors | • Fire/overheat detectors  
  – Thermocouples  
  – Pneumatic system  
  – Systron-Donner gas filled tube  
  • Bi-metallic thermal switches  
  • Smoke detectors  
  • Toxic gas detectors |
| A2.3.5 Explain function of thermal switches | • Principles of operation  
  • Description of system  
  – Materials  
  • Spot detectors (Fenwell) |
| A2.3.6 Explain function of thermocouples | • Principles of operation  
  • Description of system  
  – Materials  
  • Three circuits  
  – Detector  
  – Alarm  
  – Test |
A2.3.7 Explain function of continuous loop fire-detection systems (fire wire)

- Principles of operation
  - Materials
- Description of systems
  - Fenwell system
  - Kiddie system

A2.3.8 Explain function of pressure type fire-detection systems

- Principles of operation
  - Materials
  - Overheat function
  - Discrete function
- Description of systems
  - Lindberg
  - Systron-Donner

A2.3.9 Describe types of smoke and toxic gas detectors

- Principles of operation
- Toxic gas detection
  - Carbon monoxide detectors
- Smoke detectors
  - Light refraction type
  - Ionization type
  - Solid state type

A2.3.10

A2.3.11 Discuss flame detectors

- Principles of operation
- Types of detectors

A2.3.12 Describe routing, installation and inspection of sensors

A2.4 Fire-Suppression Systems

A2.4.1 Discuss types of fire-suppression systems

- Installed systems
- Portable extinguishers
- Where installed on aircraft

A2.4.2 Describe fire-suppression systems

- Principles of operation
- Requirements of systems
A2.4.3 Describe aircraft fire extinguishers

- Spherical
- Cylindrical
- Bottle
- Hand-held

A2.4.5 Describe spray pipe and spray nozzle installation

- Inspection
  - Hydrostatic life
- Safety
- Container pressure checks
- Discharge indication
  - Blow-out discs
  - Pressure gauges
  - Crew-initiated discharge indication
  - Automatic or thermal discharge indication
- Fitting and testing of discharge cartridges
- Identification of system pipelines and markings

A2.4.6 Describe inspection and maintenance of fire suppression systems

- Extinguishant containers
  - Cylinders under px
  - Types of bottles
  - How fired
- Explosive cartridges
  - Electrically operated
  - Safety/dangers
  - Installing
  - Testing
- Conventional system
  - Gradual release
- High rate of discharge (HRD)
- One-shot
- Two-shot
- Cross feed
- Process (warning to extinguishing)
  - Operator’s actions
  - Automatic functions
  - Follow up
  - Clean up
  - Inspection
A2.4.7 Describe typical fire protection and detection equipment installations

- Light aircraft
- Large aircraft
- Helicopters
- Powerplant installations
Line (GAC): 23 Turbine Engines
Competency: 23.02 Ignition Systems

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

LEARNING TASKS                  CONTENT

P5.7   Turbine Ignition Systems

P5.7.1 Explain types of turbine ignition systems

- Igniters
- Low tension
  - DC input
- High tension
  - AC input
- Glow plug

P5.7.2 Explain maintenance of turbine ignition systems

- Igniter plugs and units
  - Low voltage
    - Semiconductor
    - Inspection
    - Cleaning and servicing
    - Testing
    - Safety
  - High voltage
    - Inspection
    - Cleaning and servicing
    - Testing
    - Safety
- Glow plugs and ballast tubes
  - Inspection
  - Cleaning and servicing
  - Testing
  - Safety
- Ignition leads
  - Inspection
  - Cleaning and servicing
  - Testing

P5.7.3 Describe continuous, auto and manual ignition control systems
P5.7.4 Perform ignition systems servicing and inspection procedures (practical)
**Program Content**  
**Level 3**

**Line (GAC):** 23  **Turbine Engines**  
**Competency:** 23.03  **Engine Indicating and Warning Systems**

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P6.2 Gas Turbine Engine Instrumentation</td>
<td></td>
</tr>
<tr>
<td>P6.2.1 Discuss instrumentation that is common to both reciprocating and gas turbine engine installations</td>
<td></td>
</tr>
<tr>
<td>P6.2.2 Describe engine power measurement</td>
<td>Description, Uses, Operating principles, Engine Pressure Ratio (EPR)</td>
</tr>
<tr>
<td>P6.2.3 Describe engine speed indicating systems</td>
<td>Terminology, Description, Uses, Types, Operating principles</td>
</tr>
<tr>
<td>P6.2.4 Describe gas temperature indicating systems and terminology</td>
<td>Types, Description, Uses, Operating principles</td>
</tr>
<tr>
<td>P6.2.5 Describe torquemeter indicator</td>
<td>Description, Types, Uses, Operating principles</td>
</tr>
<tr>
<td>P6.2.6 Describe fault indicating and isolating systems</td>
<td>Chip lights, Temperature monitors</td>
</tr>
</tbody>
</table>
### Line (GAC): 23  Turbine Engines
Competency: 23.04  Gas Turbine Engine Theory

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P7.1 History and Development</td>
<td>P7.1.1 Describe jet propulsion</td>
</tr>
<tr>
<td>P7.1.2 Describe examples of natural jet propulsion</td>
<td>• Water creatures</td>
</tr>
<tr>
<td>P7.1.3 Describe common examples of jet propulsion</td>
<td>• Water hose, balloon releasing air, air hose</td>
</tr>
<tr>
<td>P7.1.4 Describe early jet propulsion inventions</td>
<td>• Hero’s Aelopile</td>
</tr>
<tr>
<td>P7.1.5 Describe gas turbine development</td>
<td>• Chinese Rocket</td>
</tr>
<tr>
<td></td>
<td>• Branca’s Turbine Stamping Mill</td>
</tr>
<tr>
<td></td>
<td>• Da Vinci’s “chimney jack”</td>
</tr>
<tr>
<td></td>
<td>• Newton’s Horseless Carriage</td>
</tr>
<tr>
<td>P7.1.6 Describe gas turbine applications</td>
<td>• Moss Turbo-supercharger</td>
</tr>
<tr>
<td></td>
<td>• Whittle’s Cranwell gas turbine thesis</td>
</tr>
<tr>
<td></td>
<td>• Description</td>
</tr>
<tr>
<td></td>
<td>• Development</td>
</tr>
<tr>
<td></td>
<td>• Problems</td>
</tr>
<tr>
<td></td>
<td>• Successes</td>
</tr>
<tr>
<td></td>
<td>• Aircraft in which flown</td>
</tr>
<tr>
<td>P7.2 Types of Gas Turbine Engines</td>
<td>P7.1.6 Describe gas turbine applications</td>
</tr>
<tr>
<td></td>
<td>• Large engines</td>
</tr>
<tr>
<td></td>
<td>• Helicopter (turbo-shaft)</td>
</tr>
<tr>
<td></td>
<td>• Turbo-prop</td>
</tr>
<tr>
<td></td>
<td>• Ducted fan</td>
</tr>
<tr>
<td></td>
<td>• Unducted fan</td>
</tr>
<tr>
<td></td>
<td>• Auxiliary Power Units (APU)</td>
</tr>
</tbody>
</table>
P7.2.1 Describe types of reaction engines
- Rockets
- Ram jet engines
- Pulse jet engines

P7.2.2 Describe types of gas turbine engines
- Turbofan
- Turboprop
- Turbo-shaft
- Turbo-Jet

P7.2.3 Describe advantages and disadvantages of each type of gas turbine engine

P7.3 Basic Science

P7.3.1 Review temperature scales and temperature conversion
- Celsius
- Kelvin
- Fahrenheit
- Rankine

P7.3.2 Review effects of atmospheric conditions
- Standard Day
  - Temperature
  - Pressure
  - Density
  - Humidity
  - Altitude

P7.3.3 Review Gas Laws

P7.3.4 Explain thrust formula

P7.3.5 Define the following physics terms
- Force
- Work
- Power
- Thrust
- Speed
- Velocity
- Acceleration
- Mass
- Momentum
- Kinetic energy
Potential energy

P7.3.6 Review Newton’s Laws of Motion

P7.3.7 Review Bernoulli’s Theorem

P7.4 Propulsion Principles

P7.4.1 Describe jet propulsion

P7.4.2 Describe gas turbine engine operation

- Main sections of engine
  - Compressor
  - Combustor
  - Turbine

P7.4.3 Describe Brayton Cycle (constant-pressure engine)

P7.4.4 Compare Brayton Cycle to Otto Cycle

P7.4.5 Describe flow of air through an engine (pressure and temperature changes)

P7.4.6 Describe behavior of air at varying velocities

- Low speed
- High speed
- How to vary air velocity
- Effects of compressibility
- Mach number
- Shock waves

P7.4.7 Describe gas turbine engine performance

- Effects of
  - Velocity
  - Altitude
  - Ram
  - Rpm
  - Temperature
  - Humidity
P7.4.8 Describe gas turbine engine efficiencies

- Thrust specific fuel consumption (tsfc)
- Propulsive efficiency
- Combustion efficiency
- Thermal efficiency

P7.4.9 Interpret engine performance graph (practical)

P7.5 Engine Inlet Construction and Design

P7.5.1 Describe function of engine air inlet

- Deliver airflow to compressor
- Convert kinetic energy of airstream into ram pressure
- Control air velocity

P7.5.2 Describe types of air inlet ducts, and state their function

- Subsonic
- Supersonic

P7.5.3 Describe airflow through air duct

- Subsonic
- Supersonic
- Variable geometry

P7.5.4 Explain purpose of inlet guide vanes

P7.5.5 Describe air inlet icing and icing control

- Anti-icing

P7.5.6 Describe

- Converging duct
- Diverging duct
- Subsonic diffuser
- Supersonic diffuser

P7.5.7 Define duct pressure efficiency and ram recovery point

P7.6 Compressor Construction and Design

P7.6.1 Explain purpose of compressors

P7.6.2 Describe centrifugal flow compressor

- Components
  - Impeller
  - Diffuser
Program Content
Level 3

- Compressor casing
- Compressor stages
- Bearings
- Seals

- Principles of operation
- Materials

P7.6.3 Describe axial flow compressors

- Components
  - Guide vanes, fixed, variable
  - Compressor blades
  - Stators
  - Diffuser
  - Compressor casing
  - Compressor stages
  - Bearings
  - Seals
  - Low pressure (I.P.) compressor (N1)
  - High pressure (h.p) compressor (N2)

- Principles of operation
- Materials

P7.6.4 Compare two types of compressors

- Advantages
- Disadvantages
- Engines using both types

P7.6.5 Explain compressor theory

- Temperature change
- Pressure change
- Velocity change
- Compressor efficiency
- Compressor stall
  - Causes
  - Indications
  - Effects
  - How corrected

P7.6.6 Describe air flow through compressor stages

- Vector diagrams

P7.6.7 Describe air-bleed and air supply systems

- Ice prevention
- Air conditioning
- Heating
- Pressurization
P7.7 Combustion Chamber Construction and Design

P7.7.1 Explain function of combustors
- Combustion process
- Air supply/flow
- Fuel supply
- Ignition

P7.7.2 Describe types of combustors
- Can type
- Annular type
- Can-annular type
- Reverse flow
- Advantages/disadvantages
- Materials

P7.7.3 Describe combustion chamber efficiency and performance
- Performance requirements
- Combustion efficiency
- Temperature distribution
- Combustion stability
- Emission control

P7.7.4 Describe fuel nozzle/igniter locations

P7.8 Turbine Construction and Design

P7.8.1 Explain function of turbine

P7.8.2 Describe types of turbine blades
- Impulse
- Reaction
- Reaction-impulse

P7.8.3 Describe nozzle guide vanes
- Construction
- Function

P7.8.4 Describe turbine construction
- Turbine disks
- Turbine blades
- Materials
- Balancing
P7.8.5 Discuss turbine blade cooling

P7.8.6

P7.8.7 Explain various turbine configurations

P7.8.8 Explain gas-flow through turbine stages

P7.9 Exhaust System Construction and Design

P7.9.1 Describe exhaust ducts
   • Function
   • Construction

P7.9.2 Describe gas-flow through exhaust system

P7.9.3 Describe exhaust nozzles
   • Function
   • Convergent nozzle
   • Divergent nozzle
   • Convergent-divergent nozzle
   • Variable-area nozzle for afterburners.
   • Materials
   • Thrust vectoring

P7.9.4 Describe thrust augmentation
   • Water injection
   • Afterburning

P7.9.5 Describe thrust reversers
   • Purpose
   • Types
     - Hot
     - Cold

P7.9.6 Discuss methods of noise suppression on gas turbines
   • Hush kits
   • Noise categories
   • Reason for

P7.10 Internal Air Systems
P7.10.1 Describe gas turbine internal air systems
- Cooling
- Seals
- Hot air control
- Control of tip clearance

P7.10.3 Describe airflow through engine

P7.10.4 Describe cooling
- Turbine
- Bearing chamber
- Accessory
- Case

P7.11 Components and Accessories

P7.11.1 Describe gear trains
- Internal gearbox
- Drive shafts
- Intermediate gearbox
- External gearboxes
- Auxiliary gearbox
- Direct drive

P7.11.2 Identify components driven by gear trains
- Oil pumps
- Fuel pumps
- Hydraulic pumps
- Starter/generators
- Fuel control units
- Governor
- Constant speed drive (CSD)
- Tach generators

P7.11.3 Discuss accessory drive configurations

P7.11.4 Discuss torque systems

P7.11.5 Discuss ignition systems
- Automatic ignition systems
Program Content
Level 3

Line (GAC): 23  Turbine Engines
Competency: 23.05  Turbine Engine Maintenance

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

LEARNING TASKS

P8.1  Inspection

P8.1.1  Describe turbine engine scheduled inspection requirements

• Lubrication
  − Spectrometric oil analysis program
• Oil filters
• Fuel filters
• Air filters
• Chip detectors
• Cleaning of gas pathways, e.g.:
  − Compressor wash
  − Desalination wash
• Thermocouple
• Vibration analysis
• Trend monitoring
  − Power checks
  − Internal inspection
• Rigging
• Inspection after storage

P8.1.2  Explain inspection of turbine engines after an unusual occurrence

• Sudden stoppage
  − Stalls
• Foreign object damage (FOD)
• Over limit
  − Temp
  − Rpm
  − Torque
• Immersion
• Lightning strike

P8.1.3  Explain why turbine engine inspection must comply with special inspection requirements due to engine operating environment

P8.1.4  Perform procedures for calculating engine cycle counts (practical)
P8.2 Modules and Parts Replacement

P8.2.1 Describe turbine engine module replacement
- Compressor section
- Bypass fans
- Gearbox section
  - Accessory
  - Reduction
- Combustion section
- Turbine section
- Fuel metering system components
  - Main fuel control units
  - Governors
  - Fuel pumps
  - Nozzles
- Generators
  - Tach
  - Starter generators
- Bleed valves
- Use of special tools

P8.2.2 Describe engine removal and replacement
- Engine mounts
- Disconnecting fuel lines and electrical harness
- Engine alignment
- Control rigging
- Use of special tools

P8.3 Hot Section Inspection

P8.3.1 Explain inspection procedures for turbine engine hot section components
- Engine parameter checks
- Determine inspection periodicity
- Combustion cans
- Combustion liners
- Heat shields
- Nozzle vanes
- Turbine discs and blades
- Tip clearances
- Exhaust diffusers and ducts
- Fuel nozzles
- Igniters
- Glow plugs
Program Content
Level 3

- Thermocouples
- Burner can drain valves
  - Bearings
  - Oilways
  - Use of borescopes and guides

P8.3.2 Describe types of damage

- Burning
- Blistering
- Cracks
- Discolouration
- Erosion
- Corrosion
- Stretching
- Rubbing

P8.3.3 Discuss manufacturers' tolerances/limits

P8.3.4 Describe disassembly and reassembly procedures

- Use of special tools
- Markings of parts
  - Approved means of marking
- Leak checks

P8.3.5 Perform hot section inspection (practical)

P8.4 Cold Section Inspection and Repair

P8.4.1 Explain inspection procedures for turbine engine cold section components

- Compressor inlet guide vanes
- Fan blades
- Compressor case halves
  - Abradable coatings
- Rotor blades and stator vanes
- Rotors
- Impellers
- Bleed valves
- Anti-ice valves
- Diffusers and vanes
- Scrolls
- Ducts
- Use of borescopes and guides
P8.4.2 Describe types of damage

- Nicks
- Dents
- Curls
- Erosion
- Corrosion
- Cracks
- Dirt, oil and contaminants

P8.4.3 Discuss manufacturers ‘tolerance/limits

P8.4.4 Discuss field repairs

- Fan blade replacement
- Blade repair
- Fan blade balancing

P8.4.5 Perform cold section inspection
Program Content
Level 3

Line (GAC): 23  Turbine Engines
Competency: 23.06  Gas Turbine Engine Fuel Systems

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P9.1  Turbine Fuel</td>
<td></td>
</tr>
</tbody>
</table>
| P9.1.1  State gas turbine fuel properties | • BTUs  
|                                                 | • Lubricity  
|                                                 | • Specifications  |
| P9.1.2  Describe characteristics of turbine fuel | • Calorific value  
|                                                 | • Freezing range  
|                                                 | • Combustion characteristics  
|                                                 | • Volatility  
|                                                 | • Specific gravity  |
| P9.1.3  Describe types of turbine fuels | • Kerosene  
|                                                 | • Wide cut gasolines  
|                                                 | • Advantages of each type  |
| P9.1.4  Describe entrained water in fuels, and methods used to prevent or limit its occurrence | • Tendency to absorb moisture  
|                                                 | • Water dispersants  |
| P9.1.5  Describe problems of fuel icing and methods used to prevent or limit its occurrence | • Additives  
|                                                 | • Fuel heating  |
| P9.1.6  Describe problems of micro-organisms and other contaminants in fuel | • Conditions for occurrence  
|                                                 | • Additives  
|                                                 | • Corrosion problems  |
| P9.1.7  Determine correct fuel and grade, and types of additives for certain conditions |                                                                         |
| P9.1.8  Describe problem of intermixed fuel, and danger of fuelling with incorrect fuel grade | • Type Certificates  
|                                                 | • Journey log  
|                                                 | • Flight Manual  
|                                                 | • Maintenance Manual  |
| P9.2  Fuel System Components     |                                                                         |
P9.2.1 Describe fuel system components
- Fuel pumps
- Filters
  - By-pass indicators
- Fuel control units
- Fuel nozzles
- Fuel control
- Governors
- Fuel –oil heat exchanger
- Fuel pressurizing valve
- Fuel manifolds
- Manifold drain valve and purge systems
- Fuel heater
- Fuel flow meter
- Fuel system instruments
- Pressure switch

P9.2.2 State purpose of fuel system

P9.2.3 Explain the purpose and operation of water methanol injection systems

P9.2.4 Describe fuel control systems
- General operation
- Hydro-mechanical
- Electronic
- Speed control
- Full authority digital engine control system (FADEC)

P9.2.5 Perform fuel nozzle inspection
- Inspection
- Servicing
- Safety

P9.3 Fuel Control Units

P9.3.1 Explain operation of fuel control
- Purpose
- Components
- Terminology

P9.3.2 Explain fuel control systems
- Hydro-mechanical
- Electro-mechanical
- Hydro-pneumatic
- Electronic
P9.3.3 Explain function and maintenance of fuel nozzles

- Description
- Components
- Types
  - Simplex
  - Duplex
  - Vapourizing
  - Atomizing
- Maintenance of nozzles
  - Handling and storage
  - Cleaning
  - Spray pattern checks
  - Inspection and testing

P9.3.4 Describe fuel system operation problems

P9.3.5 Describe maintenance of fuel control units

- Inspection
- Rigging of controls
- Troubleshooting
- Adjustments. Including but not limited to:
  - Trimming

P9.3.6 Inspect fuel control system (practical)

P9.3.7 Remove and install fuel system component

P9.3.8 Locate and identify components of gas turbine fuel system
Program Content
Level 3

Line (GAC): 23 Turbine Engines
Competency: 23.07 Engine Starting Systems

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

LEARNING TASKS

P12.2 Gas Turbine Engines Starting Systems

P12.2.1 Identify types of starting systems for turbine engines
  - Direct electric
  - Starter-generator
  - Air turbine starter
  - Cartridge starter
  - Gas turbine starter
  - Air-impingement starter

P12.2.2 Describe various starting systems for turbine engines
  - Sources of energy
    - Mechanical
    - Combustion
    - Electrical
    - Bleed air
  - Starter duty cycle
  - Start-up sequence of events
  - Methods of engagement and disengagement
    - Clutches
    - Ratchet and pawl over running clutch
    - Overload release clutch

P12.2.3 Describe supporting components for starters in turbine engines
  - Dual voltage starting systems
  - Various engagement and disengagement speed sensors
  - Bleed air systems
  - Pressure regulating and shut off valve
  - Starter/generator internal circuit

P12.2.4 Describe turbine engine starting procedures

P12.3 Inspection and Maintenance
P12.3.1 Describe inspection and maintenance of starting systems

- Security and condition
  - Magnetic chip plugs
  - Air ducts
  - Various attaching hardware
    - Clamps
    - QAD flange
  - Splines
  - Various drive couplings
  - Lubricants
  - Cooling fans
  - Electrical conductors
    - Brushes
- Installation and removal of starters

P12.3.2 Perform the inspection and servicing of an electrical turbine engine starter (practical)

- Remove
- Inspect
- Install
Program Content
Level 3

Line (GAC):  23  Turbine Engines
Competency:  23.08  Lubricants and Lubrications - Turbine

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

LEARNING TASKS                           CONTENT

P13.4  Turbine Engine Lubricating Systems
P13.4.1 Describe turbine engine lubrication systems  • Dry sump
P13.4.2 Describe turbine engine oil lubrication system components  • Tanks
                                                                 • Pumps
                                                                     − Vane
                                                                     − Gerotor
                                                                     − Gear
                                                    • Filters
                                                              − Ratings
                                                              − Types
                                                    • Air-oil separator
                                                    • Pressure relief valves
                                                    • Thermal relief valves
                                                    • Coolers
                                                              − Heat exchangers
                                                    • Internal system components
                                                              − Jets, vents
                                                              − Seals
                                                              − Labyrinth
                                                              − Check valves
                                                    • Pressure and temperature indicating
                                                    • Servicing and oil changes
                                                              − Intervals
                                                              − Consumption rates
                                                              − Flow checks
                                                    • Pressure adjustment
                                                    • Filters
                                                              − Cleaning
                                                              − Inspection
                                                    • Scavenge systems

P13.4.3 Explain turbine engine oil lubrication system maintenance
Program Content
Level 3

- Chip plugs
- Oil analysis
Program Content
Level 3

Line (GAC): 23 Turbine Engines
Competency: 23.09 Lubricants and Lubrications - Function

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

LEARNING TASKS

P13.1 Function and Characteristics of Lubricants

P13.1.1 Review functions of lubricants
- Friction
- Cooling
- Corrosion
- Cleaning
- Cushioning
- Sealing

P13.1.2 Review characteristics of engine lubricants
- Viscosity and Index
- Specific Gravity
- Colour
- Cloud and pour point
- Flash and fire point
- Carbon residue
- Ant-forming quality
- Operating range
- Resistance to oxidation
- Non-corrosive

P13.2 Types and Classifications of Lubricants

P13.2.1 Review common standards and specification for lubricants
- SAE system
- Commercial aviation grade number
- Military specifications

P13.2.2 Review advantages and disadvantages
- Synthetic oils

P13.2.3 Explain precautions when inter-mixing oil types

P13.2.4 Explain the types and requirements of turbine engine oil
Line (GAC): 23  Turbine Engines
Competency: 23.10  Aircraft Engine: Operation and Installation

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

LEARNING TASKS

CONTENT

P14.6 Troubleshooting Gas Turbine Engines

P14.6.1. Review troubleshooting techniques and principles

P14.6.2 Describe operating problems and their probable causes

- Engine fails to turn over
- Engine fails to start
- Hung start
- Wet start
- Compressor stall
- Failure to develop full power
- Engine vibration
- Acceleration temperature too high
- High rpm
- Low/high operating temperatures
- Low/high operating pressures
- Low/high fuel flow
- Over-torque

P14.6.3 Describe probable remedial action for the above problems
Objectives

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

**LEARNING TASKS**

**P14.2** Removal and Installation – Gas Turbine Engines

**P14.2.1** Explain reasons for removal of gas turbine engines

**CONTENT**

- Defects requiring removal, e.g.;
- Engine has reached Time Between Overhaul (TBO), or component has reached finite life
- Engine fails to meet standards by exhibiting
  - Excessive internal wear
  - High oil consumption
  - High operating temperatures
  - Poor performance
  - Failed “hot-end” inspection
  - Failed “cold-end” inspection
  - Other
- Sudden stoppage
- Over-speed
- Over-torque
- Fire damage
- Foreign Object Damage (FOD) ingestion
- Metal particles in oil
- Immersion in water (when cold, hot, running)
- When run using incorrect fuel
- Excessive vibration
- Exposure to volcanic ash

**P14.2.2** Describe procedures for preparation of engine removal/installations

**CONTENT**

- Load monitoring
- Fuel shut-off
- Battery disconnected
- Wheels chocked
- Tail supported
- Manpower requirements
Program Content
Level 3

- Fire safety procedures
- Hoisting requirements and safety

P14.2.3 Describe disconnection/reconnection

- Engine controls
- Electrical components
- Fuel, oil, hydraulic, air, and other lines
  (Note: stress importance of capping lines)
- Torquing, alignment and proper clamping of pipe lines
- Engine mounts
- Tail pipe

P14.2.4 Describe removal of other components necessary to facilitate engine removal

- Cowlings
- Particle separators

P14.2.5 Describe procedure for hoisting and removing/installing engine

- Use of slings and hooks
- Use of hoists
- Placement of engine receiving stands
- Use of engine dolly
- Safety procedures

P14.2.6 Discuss transfer of components to the replacement engine (as necessary):

- Starter/generator
- Propeller governor
- Fuel pumps
- Vacuum pump
- Engine mounts

P14.2.7 Describe gas turbine Quick Engine Change (QEC) installation

P14.2.8 Describe engine installation procedures

- Inspections
  - Pre-installation
  - Functional
  - Independent inspections
  - Leak checks

P14.2.9 Describe preservation and crating procedures for storage/transportation of an engine

P14.4 Gas Turbine Engines Operation

P14.4.1 Describe preparation of engines for ground running

- Pre-run inspection
  - Points to look for
• Propeller checks
• Cowlings in position
• Check operation of engine and propeller controls
• Fire precautions
• F.O.D.
• Operating area clear of personnel and equipment

P14.4.2 Describe typical run-up procedures
• Starting using external power source
• Starting using aircraft battery
• APU starting
• Air starting
• Starting procedure
  – Position of controls
  – Idle rpm
• Check engine RPM
• Check fuel flow
• Check temperatures and pressures
• Observance of other indication and warning systems
• Avoidance of critical rpm range

P14.4.3 Describe types of engine runs
• Dry run (motoring) check
• Wet run check
• Idle check
• Trimming check
• Power assurance check
  – Use of power check charts
  – Trend monitoring
  – Parameters to be monitored
  – OAT
  – Pressure Altitude
  – EGT, TOT, ITT etc
  – Fuel flow, pressure
• Engine control lever positions
• Acceleration check
• Deceleration check

P14.4.4 Describe factors that affect engine starting
• Starting systems
• Hung start
• Hot start
• Ignition faults
P14.4.5 Describe engine running adjustments for gas turbine engine

- Fuel system faults
- Compressor stall
- Wind direction/aircraft position
- Atmospheric conditions

P14.4.6 Describe engine shut-down procedures

- Fuel control system trimming
- Power turbine governor
- Exhaust temperature
- Inlet temperature
- Variable inlet guide vanes
- Turboprop governor

P14.4.7 Describe emergency procedures

- Cool down period
- Fuel shut-off

P14.4.8 Perform engine ground run (practical)

P14.4.9 Calculate engine performance from manufacturer's charts and interpret data (practical)

P14.6 Troubleshooting Gas Turbine Engines

P14.6.1 Review troubleshooting techniques and principles

P14.6.2 Describe operating problems and their probable causes

- Engine fails to turn over
- Hung start
- Compressor stall
- Failure to develop full power
- Engine vibration
- Acceleration temperature too high
- High rpm
- Low/high operating temperatures
- Low/high operating pressures
- Low/high fuel flow
- Over-torque
Objectives
To be competent in this area the individual must be able to:

LEARNING TASKS

A4.1 Aircraft Air Conditioning Systems

A4.1.1 Outline need for conditioned air in aircraft

A4.1.2 Describe vapour-cycle air conditioning

- Refrigeration theory
  - Heat transfer
  - Vapour cycle
- System components
  - Refrigerant
  - Refrigeration oil
  - Receiver – dryer
  - Thermal expansion valve
    - Internally equalized
    - Externally equalized
  - Evaporator
  - Compressor
  - Condenser
  - Service valves
  - Schrader type
  - Compressor isolation valve

A4.1.3 Describe vapour-cycle servicing procedures

- Servicing equipment
  - Manifold set
  - Charging hoses
  - Refrigerant source
  - Vacuum pump
  - Leak detector
- Servicing tasks
  - Visual inspection
  - Leak test
  - Performance test
  - Feel test
A4.1.4 Describe air-cycle air conditioning

- Operating principle
- Components
  - Primary heat exchanger and by-pass valve
  - Air conditioning shut-off valve
  - Refrigeration bypass valve
  - Secondary heat exchanger
  - Expansion turbine
  - Water separator
  - Ram air valve
- Cabin temperature control
  - Sensor
  - Selector
  - Regulator

A4.1.5 Describe air-cycle servicing procedures

A4.2 Aircraft Heating and Ventilation

A4.2.1 Identify aircraft heating systems

- Exhaust type cabin heaters
- Electric heaters
- Combustion heaters
- Compressor bleed air

A4.2.2 Describe operating principles of heating systems

- Exhaust type cabin heaters
  - Advantages
  - Disadvantages
- Combustion heaters
  - ‘Janitrol’ type
  - ‘South Wind’ type
- Bleed air

A4.2.3 Describe components of combustion heater systems

- Combustion air system
- Fuel system
- Ventilation air system
- Controls
- Safety features
  - Switches
    - Duct limit
    - Overheat
    - Etc.
- Combustion air pressure, cycling, purge
- Carbon monoxide detector

A4.2.4 Discuss basic system inspection and troubleshooting

A4.2.5 Describe aircraft ventilation systems

A4.2.6 Inspect exhaust type cabin heater components (practical)

A4.2.7 Examine, handle, and identify components of combustion heater systems (practical)

A4.2.8 Perform pressure decay test (practical)

A4.3 Aircraft Pressurization Systems and Components

A4.3.1 Identify need for aircraft pressurization systems

A4.3.2 Identify sources for pressurizing air

- Review of atmosphere
  - Pressure
  - Temperature
  - Altitude
  - Aircraft
  - Cabin

- Review encountered with flight at altitude
  - Aircraft construction
  - Passenger requirements
  - Engine performances

- Source
  - Roots type compressor
  - Turbocharging
- Superchargers
- Centrifugal cabin compressor
- Compressor bleed air
- Advantages and disadvantages of each source

A4.3.3 Describe maintenance of pressurization systems

A4.3.4 Describe pressurization theory
- Controlled air leakage
  - Components
    - Orifice theory
- Uncontrolled air leakage
  - Factors affecting
    - Penetration through pressurized structure

A4.3.5 Describe operation and control of pressurization system components
- Outflow and safety valves
- Negative pressure relief valves
- Pressure controllers
  - Manual
  - Automatic
- Altitude limiting devices

A4.3.6 Describe operation of small aircraft/turboprop/airliner/business jet pressurization system operation

A4.3.7 Identify and handle pressurization system components (practical)

A4.4 Aircraft Oxygen Systems

A4.4.1 Review physiology of flight
- Atmosphere
- Human respiration and circulation
- Medical conditions
  - Hypoxia/anoxia
  - Hyperventilation
  - Carbon monoxide poisoning

A4.4.2 Identify properties of oxygen
- Forms
  - Gaseous oxygen
  - Liquid oxygen
A4.4.3 Identify oxygen system components

- Chemical

- Gaseous oxygen systems
  - Storage bottles
  - Low/high pressure
  - Regulators
    - Continuous flow
    - Diluter demand
    - Pressure demand

- Masks
  - Continuous flow
  - Demand type
  - Liquid oxygen-Military
  - Chemical oxygen systems

A4.4.4 Describe operation and servicing of oxygen systems

- Gaseous oxygen systems
  - Leak testing
  - Hydrostatic test
  - Draining the system
  - Replenishing the system
  - Purging the system
  - Mask and tubing inspection

- Chemical oxygen systems
  - Mask extraction system
    - Manual
    - Automatic

A4.4.5 State safety precautions when working with oxygen systems

- Prevention of oxygen fires and explosions
- Cleanliness
- Tools
- Transportation & storage of components

A4.4.6 Examine oxygen systems (practical)
Level 4

Aircraft Maintenance Technician
**Program Content**  
**Level 4**

**Line (GAC):** 25  
**Canadian Aviation Regulations**

**Competency:** 25.01  
**Introductions to CAR**

**Objectives**

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.1 Introduction to CARs</td>
<td></td>
</tr>
<tr>
<td>25.1.1 Explain the function of the Aeronautics Act</td>
<td></td>
</tr>
</tbody>
</table>
| 25.1.2 Briefly summarize the basic regulatory structure from the manufacture of an aircraft to a Certificate of Airworthiness | • Aircraft Manufacturer  
• Transport Canada Type Certification  
• Aircraft owner  
• Aircraft Maintenance Engineers  
• Approved Maintenance Organizations |
| 25.1.3 Explain the CARs numbering system, including the differences in numbering for CARs Part V | |
| 25.1.4 Explain the difference between regulations, standards, and advisory material | |
**Line (GAC):** 25  Canadian Aviation Regulations  
**Competency:** 25.02  CAR Part 1 - General Provisions

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

**LEARNING TASKS**  
**CONTENT**

25.2  CAR Part I - General Provisions

25.2.1 Define Specific terminology from CAR 101
- Aeronautical Product
- Aeroplane
- Air Time
- Airworthiness Limitation
- Airworthy
- Elementary Work
- Flight Authority
- Flight Time
- Hard Time
- Large Aeroplane
- Life-Limited Part
- Owner
- Maintenance
- Maintenance Release
- Major Modification
- Major Repair
- Serviceable
- Small Aircraft

25.2.2 Explain the application of CAR, (who CARs apply to) according to CAR 102

25.2.3 Discuss regulations in CAR 103, Administration and Compliance
- 103.02 Inspection of Aircraft, Requests for Production of Documents and Prohibitions
- 103.03 Return of Canadian Aviation Documents

25.2.4 Explain the function of CAR 104 Charges
### Program Content

#### Level 4

**Line (GAC):** 25  Canadian Aviation Regulations  
**Competency:** 25.03  CAR Part 2 - Identification and Registration

#### Objectives

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

#### LEARNING TASKS

<table>
<thead>
<tr>
<th>25</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2</td>
<td>CARs Part II Identification and Registration</td>
</tr>
<tr>
<td>25.3.1</td>
<td>Discuss the regulations and standards for aircraft identification plates in CAR 201 and 221</td>
</tr>
<tr>
<td>25.3.2</td>
<td>Discuss the regulations and standards in CAR 201 and 221 for identification plates on aeronautical products other than aircraft</td>
</tr>
<tr>
<td>25.3.3</td>
<td>Discuss the regulations and standards for aircraft nationality and registration marks in CAR 202 and 222</td>
</tr>
<tr>
<td>25.3.4</td>
<td>Discuss regulations and standards for aircraft registration in CAR 202 and 222</td>
</tr>
</tbody>
</table>

#### CONTENT

- Location
- Required information
- Modification of an aircraft resulting in the alteration of aircraft identification plates data
- Alterations to information
- Removal and replacement of aircraft identification plates
- Engines
- Propellers
- Appliances
- Balloon basket and burner assemblies
- Requirement for marks
- Display of marks, including, size, style, and location for fixed and rotary wing aircraft.
- Removal or change of marks
- Application
- Qualifications to be a registered owner
- Types of registration
  - Private
  - State
  - Commercial
- Registration status
  - Provisional
  - Interim
  - Temporary
  - Continuing
25.3.5 Explain the requirements for carrying a certificate of registration on board the aircraft.

25.3.6 Explain the requirements for removing the marks of an aircraft being exported.

25.3.7 Describe the Canadian Civil Aircraft Register.

25.3.8 Search the Canadian Civil Aircraft Register through the transport Canada internet site for a specific aircraft or aircraft type (practical).
Line (GAC): 25 Canadian Aviation Regulations
Competency: 25.04 CAR Part IV Subpart 3 Chapter 566- AME Licences and Ratings

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

LEARNING TASKS

25.4 CAR Part IV Subpart 3 and AWM Chapter 566 – AME Licenses and Ratings

25.4.1 Explain the regulations and standards related to the issuance and endorsement of an AME license

CONTENT

- Citizenship
- Age
- Training
  - Approved training
  - Acceptable training
  - Basic training
  - Type training
- Knowledge
- Experience
- Skill

25.4.2 Explain the categories of AME licences

25.4.3 State the validity period of an AME licence

25.4.4 Explain AME licence recent requirements

25.4.5 Explain how currency is regained

25.4.6 Explain the application process for an AME licence

25.4.7 Define an Approved Training Organization from CAR 403.08 and explain their purpose
Line (GAC): 25 Canadian Aviation Regulations
Competency: 25.05 CAR 501, AWM 501-Annual Airworthiness Information Report (AAIR)

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

LEARNING TASKS

25.5 CAR 501, AWM 501-Annual Airworthiness Information Report (AAIR)

25.5.1 Discuss the requirements of an AAIR, including

- Requirement to report
- Consolidated fleet reports
- Out of service exemption
- Reporting schedule and alternate dates
- Reportable information
Objectives

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

LEARNING TASKS | CONTENT
--- | ---
25.6 | CAR 507, AWM 507 - Flight Authority
25.6.1 | Explain the application of flight authority
| • Exemption for ultralights
25.6.2 | Explain Certificates of Airworthiness (C of A)
| • Eligibility of aircraft
| • Transfer of a C of A
25.6.3 | Explain Special Certificates of Airworthiness
| • Provisional
| • Restricted
| • Amateur-built
| • Limited
25.6.4 | Explain Flight Permits
| • Experimental
| • Specific purpose
25.6.5 | Discuss the validation of a foreign flight authority
25.6.6 | Explain the application for a flight authority
| • Application for a C of A
| • Application for a special C of A
| • Application for a flight permit
| • Validation of a foreign flight authority
| • Application in respect of an imported aircraft
| • Persons who may attest to condition and conformity
25.6.7 | Explain the issuance of additional flight authorities
25.6.8 | Explain Operating Conditions
25.6.9  Explain the duration of flight authorities

- C of A
- Special C of A
- Flight Permits

25.6.10 Explain the requirements for the alteration of a flight authority
Line (GAC): 25  Canadian Aviation Regulations
Competency: 25.07  CAR 509, AWM 509 - Export Airworthiness Certificates

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

**LEARNING TASKS**

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.7</td>
<td>CAR 509, AWM 509 - Export Airworthiness Certificates</td>
</tr>
<tr>
<td>25.7.1</td>
<td>Describe Export Airworthiness Certificates (EAC)</td>
</tr>
</tbody>
</table>

**CONTENT**

- Application (eligibility for an EAC)
- Application procedures for an EAC
- Authority for export
- Persons who may attest to condition and conformity
- Responsibilities of the exporter
Line (GAC): 25 Canadian Aviation Regulations
Competency: 25.08 CAR 521 Division II Type Certificates

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.8 CAR 521 Division II Type Certificates</td>
<td>Normal, utility, aerobatic</td>
</tr>
<tr>
<td>25.8.1 State the categories of type certificates</td>
<td>Transport category aeroplane</td>
</tr>
<tr>
<td></td>
<td>Transport category rotorcraft</td>
</tr>
<tr>
<td></td>
<td>Normal category rotorcraft</td>
</tr>
<tr>
<td></td>
<td>Glider</td>
</tr>
<tr>
<td></td>
<td>Powered glider</td>
</tr>
<tr>
<td></td>
<td>Airship</td>
</tr>
<tr>
<td></td>
<td>Manned free balloon</td>
</tr>
<tr>
<td></td>
<td>Delete</td>
</tr>
<tr>
<td></td>
<td>Restricted</td>
</tr>
<tr>
<td>25.8.2 Explain restricted category special purpose operations</td>
<td>Agricultural</td>
</tr>
<tr>
<td></td>
<td>Fire prevention and suppression</td>
</tr>
<tr>
<td></td>
<td>Aerial surveying</td>
</tr>
<tr>
<td></td>
<td>Patrolling</td>
</tr>
<tr>
<td></td>
<td>Weather control</td>
</tr>
<tr>
<td></td>
<td>Aerial advertising</td>
</tr>
<tr>
<td></td>
<td>Wildlife conservation</td>
</tr>
<tr>
<td></td>
<td>Other specialized roles</td>
</tr>
<tr>
<td>25.8.3 Describe conditions for the issuance of a type certificate</td>
<td></td>
</tr>
<tr>
<td>25.8.4 Describe the types of information found in a type certificate data sheet</td>
<td></td>
</tr>
<tr>
<td>25.8.5 Discuss the aeronautical products requiring a type certificate</td>
<td></td>
</tr>
<tr>
<td>25.8.6 Using the Transport Canada Internet Site, find the type certificate data sheet for a specified aircraft (Practical)</td>
<td></td>
</tr>
</tbody>
</table>
Line (GAC):  25  Canadian Aviation Regulations  
Competency:  25.09  CAR 521 Division IV Changes to a Type Design  

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.9  CAR 521 Division IV Changes to a Type Design</td>
<td></td>
</tr>
</tbody>
</table>
| 25.9.1 Discuss means of creating approved data for modifications and repairs to aeronautical products | • Supplemental Type Certificates  
• Repair Design Certificates |
**Line (GAC):** 25  **Canadian Aviation Regulations**  
**Competency:** 25.10  **AWM 561 - Manufacture of Aeronautical Products**  

### 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>
<tbody>
<tr>
<td>25.10 AWM 561 - Manufacture of Aeronautical Products</td>
<td>• Right to manufacture</td>
</tr>
<tr>
<td></td>
<td>• Facilities</td>
</tr>
<tr>
<td>25.10.1 Discuss the requirements to be eligible for a manufacturing approval</td>
<td>• Quality program</td>
</tr>
<tr>
<td></td>
<td>• Inspectors</td>
</tr>
<tr>
<td>25.10.2 Discuss the responsibilities of the manufacturer</td>
<td>• Product conformity</td>
</tr>
<tr>
<td></td>
<td>• Subcontract activity</td>
</tr>
<tr>
<td></td>
<td>• Record retention</td>
</tr>
<tr>
<td></td>
<td>• Airworthiness certification</td>
</tr>
</tbody>
</table>
Line (GAC): 25  Canadian Aviation Regulations
Competency: 25.11  AWM 563 - Distribution of Aeronautical Products

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

LEARNING TASKS

<table>
<thead>
<tr>
<th>Learning Task</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.11 AWM 563 - Distribution of Aeronautical Products</td>
<td></td>
</tr>
</tbody>
</table>
| 25.11.1 Discuss the requirements to be eligible for a distributor approval | • Product sources  
• Facilities  
• Product control system |
| 25.11.2 Discuss the responsibilities of the distributor | • Product proof of conformity  
• Record retention |
Program Content
Level 4

Line (GAC): 25 Canadian Aviation Regulations

Competency: 25.12 CAR 571, AWM 571 - Aircraft Maintenance Requirements

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.12</td>
<td>CAR 571, AWM 571 - Aircraft Maintenance Requirements</td>
</tr>
<tr>
<td>25.12.1</td>
<td>Explain the application of CAR 571</td>
</tr>
<tr>
<td></td>
<td>• Exemption to hang gliders</td>
</tr>
<tr>
<td></td>
<td>• Exemption to ultralights</td>
</tr>
<tr>
<td>25.12.2</td>
<td>Explain the requirements of maintenance performance rules</td>
</tr>
<tr>
<td>25.12.3</td>
<td>Explain the requirements for the recording of maintenance and elementary work</td>
</tr>
<tr>
<td>25.12.4</td>
<td>Explain specialized maintenance, including Schedule II, CAR 571</td>
</tr>
<tr>
<td>25.12.5</td>
<td>Explain the maintenance requirements of aeroplanes or helicopters operated under Part IV and aircraft operated under Part VII</td>
</tr>
<tr>
<td>25.12.6</td>
<td>Explain the requirements of major modification and major repairs</td>
</tr>
<tr>
<td></td>
<td>• Requirements for reporting by the completion of a 24-004 conformity certificate</td>
</tr>
<tr>
<td></td>
<td>• Types of data required for carrying out major modifications and major repairs</td>
</tr>
<tr>
<td></td>
<td>• Criteria for the classification of modifications and repairs</td>
</tr>
<tr>
<td>25.12.7</td>
<td>Explain the requirements for the installation of new parts</td>
</tr>
<tr>
<td>25.12.8</td>
<td>Explain the requirements for the installation of used parts</td>
</tr>
<tr>
<td>25.12.9</td>
<td>Explain the requirements for the installation of life-limited parts</td>
</tr>
<tr>
<td>25.12.10</td>
<td>Explain the requirements for a maintenance release</td>
</tr>
<tr>
<td></td>
<td>• Information required</td>
</tr>
<tr>
<td></td>
<td>• Suggested wording</td>
</tr>
</tbody>
</table>
25.12.11 Explain who may sign a maintenance release for different types of maintenance

- Conditional maintenance release
- Specialized maintenance
- Maintenance on aircraft
- Maintenance on aeronautical products other than aircraft
- Maintenance on amateur-built aircraft
- Maintenance on flight training aircraft and commercial aircraft, and for parts used on either

25.12.12 Explain the general requirements for the installation of parts

25.12.13 Discuss personnel certification for non-destructive testing (NDT) from Schedule I CAR 571

25.12.14 Discuss additional maintenance standards, including standards

- Work that disturbs engine or flight controls
- Work affecting the pitot-static system
- Work affecting pitot static ports, pitot tubes, and flight control surfaces
- When ELT’s may be tested
- Changes to the empty weight or centre of gravity of an aircraft
### LEARNING TASKS

<table>
<thead>
<tr>
<th>25.13</th>
<th>Car 573, AWM 573 - Approved Maintenance Organizations (AMO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.13.1</td>
<td>Discuss the requirements for application for an Approved Maintenance Organization</td>
</tr>
<tr>
<td>25.13.2</td>
<td>Discuss the categories and ratings for AMOs</td>
</tr>
<tr>
<td>25.13.3</td>
<td>Explain the requirements for the Person Responsible for Maintenance</td>
</tr>
<tr>
<td>25.13.4</td>
<td>Discuss the options and requirements for assignment of management functions</td>
</tr>
<tr>
<td>25.13.5</td>
<td>Explain the authorization to sign a maintenance release</td>
</tr>
<tr>
<td>25.13.6</td>
<td>Explain the requirements for a training program</td>
</tr>
<tr>
<td>25.13.7</td>
<td>Discuss the requirements for the keeping of personnel records</td>
</tr>
<tr>
<td>25.13.8</td>
<td>Discuss the requirements for facilities, equipment, standards, and procedures</td>
</tr>
<tr>
<td>25.13.9</td>
<td>Explain the function and requirements of the Quality Assurance Program</td>
</tr>
<tr>
<td>25.13.10</td>
<td>Discuss the requirements for the Maintenance Policy Manual</td>
</tr>
</tbody>
</table>

### CONTENT

- **Qualifications**
- **Responsibilities**
- **Responsibility for quality assurance**
- **Responsibility for production**
- **Aircraft Certification Authority (ACA)**
- **Shop Certification Authority**
- **Initial training**
- **Additional training**
- **Update training**
- **Content**
- **Amendments**
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.13.11</td>
<td>Discuss the requirements for maintenance arrangements</td>
</tr>
<tr>
<td>25.13.12</td>
<td>Explain the requirement for the filing of service difficulty reports</td>
</tr>
<tr>
<td>25.13.13</td>
<td>Discuss the requirements for foreign AMO approvals</td>
</tr>
<tr>
<td>25.13.14</td>
<td>Discuss the requirements for AMO identification</td>
</tr>
</tbody>
</table>
Line (GAC): 25  Canadian Aviation Regulations
Competency: 25.14  CAR 521 Division IX Service Difficulty Reporting

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.14</td>
<td>Car 521 Division IX Service Difficulty Reporting</td>
</tr>
<tr>
<td>25.14.1</td>
<td>Define a reportable service difficulty</td>
</tr>
<tr>
<td>25.14.2</td>
<td>State the purpose of the SDR system</td>
</tr>
<tr>
<td>25.14.3</td>
<td>State the requirement to report</td>
</tr>
<tr>
<td>25.14.4</td>
<td>Discuss the organizations required to report</td>
</tr>
<tr>
<td></td>
<td>SDRs</td>
</tr>
<tr>
<td>25.14.5</td>
<td>State the time limits for reporting SDRs</td>
</tr>
</tbody>
</table>
Objectives
To be competent in this area the individual must be able to:

LEARNING TASKS

<table>
<thead>
<tr>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.15 CAR 521 Division X Airworthiness Directives (AD)</td>
</tr>
<tr>
<td>25.15.1 Explain the purpose of Airworthiness Directives</td>
</tr>
<tr>
<td>25.15.2 Explain the conditions under which an AD may be issued</td>
</tr>
<tr>
<td>25.15.3 State the application of ADs</td>
</tr>
<tr>
<td>25.15.4 Discuss who is responsible for ensuring that all applicable ADs are carried out</td>
</tr>
<tr>
<td>25.15.5 Discuss the applicability of foreign ADs or equivalent notices</td>
</tr>
<tr>
<td>25.15.6 Using the Transport Canada Internet Site, carry out a search for applicable ADs on a specified aircraft (practical)</td>
</tr>
</tbody>
</table>

- Compliance with ADs
- The consequences of non-compliance
- Alternative means of compliance
Objectives
To be competent in this area the individual must be able to:

LEARNING TASKS CONTENT

25.16 Car 604 – Private Operator Passenger Transportation

25.16.1 Define a Private Operator involved in passenger transportation

25.16.2 State the function of the maintenance control system

25.16.3 Discuss the information in the operations manual that forms the maintenance control system

25.16.4 Discuss the requirements for a person responsible for the maintenance control system

25.16.5 Discuss the requirements for maintenance personnel and facilities

25.16.6 Discuss the requirements for the reporting and rectification of defects
   - Recording defects
   - Defect rectification
   - Recurring defects

25.16.7 Discuss the requirements for service difficulty reporting

25.16.8 Discuss the requirements for technical dispatch instructions

25.16.9 Discuss the requirements for service information reviews

25.16.10 Discuss the requirements for maintenance agreements

25.16.11 Discuss the requirements for maintenance training
### Program Content

**Line (GAC):** 25  **Canadian Aviation Regulations**

**Competency:** 25.17  **Car 605 – Aircraft requirements and CARs 625 – Aircraft Equipment and Maintenance Standard**

### Objectives

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

### LEARNING TASKS

| 25.17 | Car 605 – Aircraft requirements and CARs 625 – Aircraft Equipment and Maintenance Standard |
| 25.17.1 | Explain the applicability of CAR 605 |
| 25.17.2 | State the requirements for carrying a flight authority on board the aircraft |
| 25.17.3 | State the requirement for making the flight manual available to crew members at their stations |
| 25.17.4 | State the requirement for aircraft to display all required markings and placards |
| 25.17.5 | State the requirements for aircraft equipment to meet the standards of airworthiness |
| 25.17.6 | Define Minimum equipment lists and state their purpose |
| 25.17.7 | Explain the requirements and criteria for operating an aircraft with unserviceable and removed equipment |
| 25.17.8 | Explain the requirement for having the appropriate maintenance performed before operating an aircraft |
| 25.17.9 | Explain the requirements for the certification of maintenance before an aircraft takes off |
| 25.17.10 | Explain the requirement for aircraft to be maintained according to an approved maintenance schedule |

---

### CONTENT

- **Operating conditions**
- **Exemptions**
- **General requirements**
- **Aircraft with a minimum equipment list**
- **Aircraft without a minimum equipment list**
- **The signing of a maintenance release**
- **Conditional maintenance releases and test flights**
- **No requirement for a maintenance release in the case of elementary work**
- **Applicability of the appropriate schedule for the type of aircraft and the type of operation**
• Locate and interpret approved maintenance schedules for:
  – Private piston powered small aeroplanes
  – Commercial aircraft
  – Large aircraft
  – Turbine powered pressurized aircraft

25.17.11 Discuss the requirements for the transfer of aeronautical products between maintenance schedules

25.17.12 Explain the requirement for inspection after abnormal occurrences

25.17.13 Discuss the requirements to keep technical records

• Identify abnormal occurrences
• Locate inspection standards in Appendix G, CAR 625
• Specify who may carry out the inspection
• Explain entries into the technical record after an abnormal inspection

• General requirements for making entries
• Requirements for journey logs, including
  – Identification
  – Required maintenance entries
  – Retention
  – Transfer of entries to the technical logs
  – Carrying on board
  – New volumes
• Requirements for separate technical records for airframes, engines, variable pitch props
  – Identification
  – Required maintenance entries
  – Retention
  – Transcribing of entries from the journey log
  – New volumes
  – Transfer of technical records
• Requirements for the component technical records
• Empty weight and balance reports
Objectives
To be competent in this area the individual must be able to:

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.18 Car 625 – Appendix A – Elementary Work</td>
<td></td>
</tr>
<tr>
<td>25.18.1 Define Elementary work</td>
<td></td>
</tr>
<tr>
<td>25.18.2 Locate and interpret elementary work tasks in CAR 625, Appendix A</td>
<td></td>
</tr>
<tr>
<td>25.18.3 Explain the requirements for persons performing elementary work</td>
<td>• Private aircraft</td>
</tr>
<tr>
<td></td>
<td>• Commercial and flight training unit aircraft</td>
</tr>
<tr>
<td>25.18.4 Explain the requirements for recording elementary work</td>
<td></td>
</tr>
</tbody>
</table>
Program Content
Level 4

Line (GAC): 25 Canadian Aviation Regulations
Competency: 25.19 CAR 625 – Appendix C – Out of Phase Tasks

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.19 Car 625 – Appendix C – Out of Phase Tasks</td>
<td>• Rotorcraft Dynamic Components</td>
</tr>
<tr>
<td>25.19.1 Locate and interpret hard time intervals for</td>
<td>• Engines</td>
</tr>
<tr>
<td>aircraft equipment from CAR 625, Appendix C,</td>
<td>• Variable pitch propellers</td>
</tr>
<tr>
<td>including requirements</td>
<td>• Fixed pitch and ground adjustable propellers</td>
</tr>
<tr>
<td></td>
<td>• Tachometers</td>
</tr>
<tr>
<td></td>
<td>• Weight and balance</td>
</tr>
<tr>
<td></td>
<td>• Magnetic compasses</td>
</tr>
<tr>
<td></td>
<td>• Emergency locator transmitters</td>
</tr>
<tr>
<td></td>
<td>• Altimetry devices</td>
</tr>
<tr>
<td></td>
<td>• Transponders</td>
</tr>
<tr>
<td></td>
<td>• Survival and emergency equipment</td>
</tr>
<tr>
<td></td>
<td>• Cockpit voice recorders</td>
</tr>
<tr>
<td></td>
<td>• Flight data recorders</td>
</tr>
<tr>
<td></td>
<td>• Underwater locating devices</td>
</tr>
</tbody>
</table>
Objectives

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

LEARNING TASKS

<table>
<thead>
<tr>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of lights</td>
</tr>
<tr>
<td>Required colours and fields of visibility</td>
</tr>
<tr>
<td>Use of lights</td>
</tr>
</tbody>
</table>

25.20 Car 625 - Appendix I Specification Tables – Schedule 1 Position and Anti-Collision Light Systems

25.20.1 Explain the requirements for position and anti-collision light systems
Line (GAC): 25 Canadian Aviation Regulations

Competency: 25.21 CAR 706 - Maintenance Requirements for Commercial Air Operators and CAR 726 – Commercial Air Service Standards

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.21 CAR 706 - Maintenance Requirements for Commercial Air Operators and CAR 726 – Commercial Air Service Standards</td>
<td></td>
</tr>
<tr>
<td>25.21.1 Explain the application of CARs Part VII</td>
<td></td>
</tr>
<tr>
<td>25.21.2 Explain the purpose of the Maintenance Control System</td>
<td></td>
</tr>
<tr>
<td>25.21.3 Discuss the Person Responsible for the Maintenance Control System</td>
<td></td>
</tr>
<tr>
<td>25.21.4 Discuss the responsibilities of maintenance personnel</td>
<td></td>
</tr>
<tr>
<td>25.21.5 Describe the standards that the maintenance facility must meet</td>
<td></td>
</tr>
<tr>
<td>25.21.6 State the purpose of defect rectification and control procedures</td>
<td></td>
</tr>
<tr>
<td>25.21.7 State the purpose of technical dispatch procedures</td>
<td></td>
</tr>
<tr>
<td>25.21.8 Describe the function of the evaluation program</td>
<td></td>
</tr>
</tbody>
</table>

- Qualifications
- Authorization to remove aircraft from service
- Combined AMO/ Air Operator
- Assignment of management functions
- Recording aircraft defects
- Ensuring that defects are rectified in accordance with regulations
- Detecting recurring defects
- Scheduling the rectification of deferred defects
- Purpose
- Updating of maintenance schedules
- Compliance with regulations
- Record keeping
25.21.9 Describe the requirements for the Maintenance Control Manual

- Purpose
- Incorporation by reference
- Compliance with MCM policies and procedures
- Approval and amendments
- Availability to staff
- Content

25.21.10 Explain Maintenance Arrangements

25.21.11 Explain the training requirements for persons performing elementary work

25.21.12 Discuss the training requirements for aircraft servicing

25.21.13 Discuss the requirements for training personnel

- Initial training
- Update training
- Additional training
- Combined Air Operator/AMO training
- Records of training

25.21.14 Discuss the requirements for keeping personnel records

25.21.15 State the requirement for reporting service difficulties
Program Content
Level 4

Line (GAC): 25 Canadian Aviation Regulations
Competency: 25.22 CAR on the Internet

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

LEARNING TASKS CONTENT

25.22 CARs on the Internet

25.22.1 Answer specific CARs questions by searching the Transport Canada internet website
Line (GAC): 25  Canadian Aviation Regulations
Competency: 25.23  AME Publications

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| 25.23 AME publications | - Service difficulty alerts  
| 25.23.1 Describe the purpose and content Transport Canada Publications sent to AMEs | - Service difficulty advisories  
|                      | - Feedback  
|                      | - Maintainer  
|                      | - Airworthiness notices |
Line (GAC): 27 Instruments
Competency: 27.01 Engine Indicating and Warning Systems

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

LEARNING TASKS                               CONTENT
P6.3 Engine Indicating and Warning Systems

P6.3.1 Describe types of displays
• Direct
• Servo
• Electronic (CAT)

P6.3.2 Describe handling and installation of instruments

P6.3.3 Describe serviceability checks

P6.3.4 Describe testing and calibration of instruments
• Test equipment
  – ‘Barfield’
  – ‘Jetcal’
  – Deadweight
Line (GAC):  27  Instruments  
Competency:  27.02  Aircraft Instrumentation

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| E4.1 Aircraft Instruments and Instruments | • Monitoring systems  
• Diagnostic purposes  
• Navigation  
• Allows IFR flight |
| E4.1.1 Explain reasons for using instrumentation |  |
| E4.1.2 Categorize instruments according to function | • Powerplant  
• Flight and navigation  
• Systems monitoring |
| E4.1.3 Identify applications of mechanically and electrically/electronically operated instruments (practical) |  |
| E4.2 Pressure Measuring Instruments |  |
| E4.2.1 Explain principles of absolute pressure measurement | • Atmospheric pressure  
• Standard day  
• Mercury barometer  
• Aneroid barometer |
| E4.2.2 Explain principles of gauge pressure measurement | • Bellows/diaphragms for low pressure  
  • Types of instrument  
    • Altimeter  
    • Air speed indicator (ASI)  
    • Manifold pressure  
  • Bourdon tubes for high pressure  
  • Types of instrument |
E4.2.3 Explain principles of differential pressure measurement

- Differential bellows type
  - Types of instrument
    - Pitot/static

- Rate of climb indicator
  - Engine pressure ratio indicator
  - Pressure switches

- Description and operation

E4.2.4 Explain altimeters

- Purpose
  - Types of altitude measurement
    - Indicated altitude
    - Pressure altitude
  - Effects of density changes

- Description of instrument
  - Face/scale
  - Pointers
  - Digital scale

- Operation
  - Temperature compensation
  - Components

- Encoding altimeter

E4.2.5 Explain airspeed indicators

- Differential pressure gauge
- Compares pitot-static pressures

- Purpose
  - Determine airspeed
  - Compute ground speed
  - Indicate to pilot warning speeds
  
  For example:
E4.2.6 Describe vertical- and instantaneous- vertical speed indicators

- Purpose
- Mechanism

E4.2.7 Explain air data computers

E4.2.8 Explain electrically driven instruments

- Servoed altimeters

E4.3 Temperature Measuring Instruments

E4.3.1 Explain temperature measuring instruments

- Principles of operation
  - Liquid expansion
  - Solid expansion
  - Gas expansion
  - Electrical

- Types of:
  - A.S.I. and altimeter temperature correction function
  - Outside air temperature gauges (OAT)
  - Engine temperature
  - Oil temperature

E4.4 Gyroscopic Instruments

E4.4.1 Explain gyroscopic principles

- Laser gyros principles
- Description of gyroscope
- Rigidity in space
- Increases as mass at rim increases
- Increases as speed of rotation
- Increases
- Effects of friction

- Precession
  - Definition
  - Advantages
  - Disadvantages

- Why used in aircraft instrumentation

- Instruments using gyroscopes for example:
  - Direction indicator
  - Artificial horizon indicator
  - Attitude director indicator
  - Turn and slip indicator
  - Turn coordinator
  - Horizontal situation indicator
  - Slaved gyro compass

**E4.4.2 Explain sources of power for gyroscopes**

- Electrical
  - Built-in motor

- Pressure
  - Vacuum pump discharge air
  - Reasons for use

- Vacuum
  - Vacuum pump
  - Venturi
  - Principles of operation

**E4.4.3 Describe vacuum pump system**

**E4.4.4 Explain gyro attitude instruments**

- Directional gyro indicator
  - Compare to magnetic compass, and reason why used
  - Relationship to HIS/RMI
  - Description
  - Purpose
  - Principles of operation
  - Mechanism
Program Content
Level 4

- Flux valves
- Compass amplifier
- Compensators
- Artificial horizon indicator
  - Description
  - Purpose
  - Principles of operation
  - Mechanism
- Attitude director indicator
  - Description
  - Purpose
  - Principles of operation
  - Mechanism
- Slave Gyro Compass system
  - Description
  - Purpose
  - Principles of operation
  - Mechanism
  - Flux valves
  - Compass amplifier
  - Compensators
- Laser Gyros
- Strap down gyros
- Slip turn and indicator (turn and bank)
  - Description
  - Purpose
  - Principles of operation
  - Mechanism
- Turn coordinator
  - Description
  - Purpose
  - Principles of operation
  - Mechanism
- Precautions
  - Recently powered down

E4.5.5 Explain rate gyro instruments

E4.4.6 Explain safety and handling of gyro instruments

E4.5 Direct Linkage and Drive systems

E4.5.1 Describe types of instruments using direct linkage and drives

- Mechanical tachometer
- Flap position indicator
- Cowl flap position indicator
- Fuel level indicator (on some older aircraft)
- Trim tab position indicator
E4.5.2 Describe installation of direct linkage and drive mechanisms
   - Installation, lubrication and cleaning

E4.6 Magnetic Compasses

E4.6.1 Describe magnetic compasses
   - Construction
     - Case
     - Compass fluid
     - Pivot bearings
     - Face markings
     - Corrector card
     - Illumination
   - Position
   - Purpose
   - Operation

E4.6.2 Explain principles of navigation
   - Meridians
     - Longitude
     - Latitude
   - Poles
     - Magnetic north
     - True north
   - Magnetic variation
     - Isogonic lines
     - Accounting for
   - Magnetic deviation
     - Causes

E4.6.3 Explain procedures for correcting errors (compass swing)
   - When required
   - The compass rose
   - Equipment required
   - Taxiing and swinging procedures
   - Compass adjustments
   - Documentation
     - Log book
     - Correction card
   - Compass swing
     - Magnetic
     - Slaved

E4.6.4 Conduct compass swing (real or simulated)(practical)
E4.7 Electronic Display and Indication Instruments

E4.7.1 Describe various display types
- Cathode-ray tubes
  - EFIS
  - ECAM
  - EICAS
- Light emitting diodes
- Liquid crystal displays
- Gas discharge

E4.7.2 Describe various methods of display
- Dial type
- Vertical type
- Numerical
- Analogue
- Digital
- Heads up displays (HUD)

E4.8 Electrical Flight Instruments

E4.8.1 Describe electrical flight instruments
- Angle of attack detection
- Control indication
  - Flaps
  - Rudder
  - Aileron
  - Elevator
  - Trim systems
- EADI
- Stall warning systems

E4.9 Engine Electrical Instruments

E4.9.1 Describe engine electrical indicating instruments
- Meter movements
  - D’Arsonval or Weston
  - Galvanometer
  - Dynamometer
- Types of instruments
  - Ammeter
  - Voltmeter
  - Magnesyn
  - Autosyn
  - Tachometers
E4.9.2 Describe engine instrument installation and marking
- Panel layout
- Instrument mounting
- Power requirements
- Range markings

E4.9.3 Describe testing of engine electrical indicating instrument systems
- Barfield EGT tester
- Multimeter

E4.10 Systems Instruments

E4.10.1 Describe systems that employ electrical indicating instruments
- Landing gear
  - Position indication
- Fuel systems
  - Quantity
  - Flow
- Environmental control
  - Pressurization
  - Air conditioning
- Flight controls

E4.10.2 Describe maintenance of systems electrical indicating instruments

E4.11 Instrument Installation and Maintenance

E4.11.1 Describe location of instruments in instrument panel

E4.11.2 Describe maintenance of flight instruments
- Handling and storage
- Types of mount
- Hardware
- Size of openings
- Capping of open lines
- Marking of lines
- Instrument face markings
- Witness marks
- Installation
- Removal
E4.11.3 Explain procedures for testing

- Shipping
  - Caging of gyros

- When to test
  - After installation
  - On defect
  - Periodically

- Types of test
  - Pitot/static tests for pressurized and non-pressurized aircraft
  - Compass swing
  - Dead weight checks
  - Functional tests

- Test equipment
  - Pitot/static
  - Vacuum/pressure test kit (air pressure/vacuum)
  - Land compass (compass swing)
  - Dead weight test kit (oil pressure)

- Calibration of fuel quantity indicating systems

E4.11.4 Describe servicing of pitot/static systems

E4.11.5 Carry out instrument section of periodic inspection (practical)

E4.11.6 Carry out pitot/static check (practical)

E4.11.7 Drain pitot/static system (practical)

E4.11.8 Inspect instruments for correct installation and markings (practical)

E4.11.9 Carry out check on liquid pressure instrument system (practical)
E4.11.10 Check aircraft instruments for correct function (practical)

E4.11.11 Test exhaust gas temperature system employing suitable testing instrument (practical)

E4.11.12 Package instrument for shipping (practical)
Line (GAC): 28 Avionics  
Competency: 28.01 Controls and Rigging

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A7.4 Electrical/Electronic Flight Control Systems</td>
<td></td>
</tr>
<tr>
<td>A7.4.1 Describe electrically operated controls</td>
<td>• Flaps</td>
</tr>
</tbody>
</table>
| A7.4.2 Describe electrically controlled trim systems | • Fixed-wing  
| | • Rotary-wing |
| A7.4.3 Trace electrically operated control systems by reference to circuit diagrams (practical) | |
| A7.4.4 Locate electrically operated control system components (practical) | |
| A7.4.5 Operate electrical control systems (practical) | |
| A7.5 Automatic Flight Control Systems [Refer to E5 Avionics] | |
| A7.5.1 List purposes of automatic flight control systems | |
| A7.5.2 Explain autopilot operation | • Stabilization  
| | • Full flight control |
| A7.5.3 Describe features of autopilot system | • Basic autopilot  
| | • Directed autopilot |
| A7.5.4 Describe autopilot flight control system | • List of components |
A7.5.5 Describe automatic flight and landing systems

- Purpose
- Types of systems

A7.5.6 Describe Stabilization Augmentation Systems (SAS)

- Purpose
- Components
  - Sensors
  - Processing units

A7.5.7 Describe electronic flight control systems

A7.5.8 Describe other forms of electronic flight control

- Fly-by-wire
- Fly-by-light
Line (GAC): 28 Avionics
Competency: 28.02 Avionics

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

LEARNING TASKS

E5.1 Introduction to Avionics
E5.1.1 Explain Frequency spectrum
- Frequency ranges
- Use in avionics systems
E5.1.2 Explain IFR versus VFR
E5.2 Communications
E5.2.1 Explain audio and communication systems
E5.2.2 Explain maximum power transfer theorem
- Definition
- MPT theory
E5.2.3 Describe audio components
- Headsets
  - Noise cancelling
  - Stere/mono
- Carbon microphone
- Dynamic microphone
- Electret microphone
- Aircraft microphone interconnects
- Speakers
- Impedance
  - Maximum power transfer
E5.2.4 Explain functions of audio control panels
E5.2.5 Explain functions of communication controls
- Flight interphone
- Service interphone
- Crew call
- Passenger address system
Program Content
Level 4

- General audio control
- Passenger entertainment system

E5.3 Antennas, Transmission Lines and Basic Radio

E5.3.1 Explain antenna fundamentals
- Wavelengths
- Frequency relationships
- Polarization
- Ground planes

E5.3.2 Describe transmission lines
- Coaxial cable
- Shielding
- Impedance line
- Diplex-triplex splitters

E5.3.3 Explain aircraft communications
- Wave propagation
- Information transfer
- RF Communication
- Amplitude modulation
- Frequency modulation
- Radio Theory
  - Transmitters
  - Superheterodyne receivers
  - Oscillators
  - Amplifiers

E5.4 Very High Frequency (VHF) Communication Systems

E5.4.1 Explain VHF communication systems
- Receivers
- Transmitters
- Controls
- Antenna and location
- Speakers
- Integrated system
- Aircraft components
- Location
- Frequency usage

E5.5 High Frequency (HF) Communication Systems
E5.5.1 Explain HF communication systems

- Propagation
- Short-wave
- Transmission modes
- Single sideband
- Advantages
- Components
- Antenna types and tuning
- Use of HF systems
- Safety

E5.6 Selective Calling

E5.6.1 Explain selective calling

- VHF system
- HF system
- Frequency
- Designation

E5.7 Cockpit Voice Recorders (CVR)

E5.7.1 Describe cockpit voice recorders

- Voice recorder
- Activation circuit
- G switch
- Recorder control head
- Acoustic Beacon
- Component location
- Testing procedures

E5.8 Flight Data Recorders and Health Usage Monitoring System (HUMS)

E5.8.1 Explain flight data recorders

- Typical recording parameters
- G switch
- Activation circuit
- Acoustic beacon
  - ULB/ULD
- Component location
E5.8.2 Explain Health and Usage Monitoring System (HUMS).

E5.9 Emergency Locator Transmitter (ELT)

E5.9.1 Explain ELTs

- ELT usage
- Characteristics
- Test procedures
- Operational test considerations
- Battery replacement
- Types of ELTs
- ELT installation
  - Antenna installation
  - Coax length
  - TSO C91A
- Frequencies
  - 121.5 Mhz
  - 406.025 Mhz
  - 243 Mhz

E5.10 Satellite Communications (SAT/COM)

E5.10.1 Satellite Communications (SAT/COM)

- Advantages
- Use
- Basic principles
- System operation
- Components

E5.11 Automatic Direction Finding (ADF)

E5.11.1 Explain ADF

- Purpose
- Theory of operation
- Components
- Indication
E5.12 Global Positioning Systems (GPS)

E5.12.1 Explain GPS

- Purpose
- Theory of operation
- Components
- Indication

E5.13 VHF Omni-Range Navigator (VOR)

E5.13.1 Explain VHF omni-range

- Purpose
- Theory of operation
- Components
- Indication
  - HSI
  - CDI
  - RMI

E5.14 Instrument Landing System (ILS)

E5.14.1 Explain instrument landing systems

- Purpose
- Theory of operation
- Components
- Indication

E5.14.2 Explain localizer

- Purpose
- Theory of operation
- Components
- Indication

E5.14.3 Explain glide slope

- Purpose
- Theory of operation
- Components
- Indication

E5.14.4 Explain marker beacon

- Purpose
- Theory of operation
- Components
E5.15 Distance Measuring Equipment (DME)

E5.15.1 Explain DME

E5.16 Secondary Surveillance Radar Transponder

E5.16.1 Explain transponder

E5.17 Traffic Collision Avoidance Systems (TCAS)

E5.17.1 Explain TCAS

E5.18 Radio Altimeter

E5.18.1 Explain radio altimeters

E5.19 Weather Radar
E5.19.1 Explain weather radar

- Purpose
- Theory of operation
- Components
- Indication
- Operational test precautions
- Radome
- Wave guide

E5.20 Autopilot

E5.20.1 Explain auto-pilot

- Purpose
- Theory of operation
- Components
- Indication
- Operational test precautions
- Yaw damper
- Mach trim

E5.20.2 Explain flight director system

E5.20.3 Explain auto throttle/auto thrust

E5.21 Flight Management Systems (FMS)

E5.21.1 Describe flight management systems (FMS)

- Relationship to autopilot
- Database
- Inputs
  - V.O.R.
  - D.M.E.
  - G.P.S.

E5.22 Ground Proximity Warning System (GPWS)

E5.22.1 Explain GPWS

- Purpose
- Theory
- Components
E5.23    Electronic Display Systems

E5.23.1   Explain EICAS
          • Purpose
          • Theory of operation
          • Components
          • Indication
          • Operational test precautions
          • BITE functions

E5.23.2   Explain EFIS
          • Purpose
          • Theory of operation
          • Components
            - Cathod-ray tube
          • Indication
          • Operational test precautions
          • BITE functions

E5.24    E5.24  Avionics Systems Installation

E5.24.1   Explain avionics systems installation
          • Cooling
          • Contamination
            - Moisture
            - Swarf
          • Vibration
          • Noise reduction
          • Bonding
          • Antenna installation
          • EMI
          • RFI
          • Documentation

E5.25    Avionics Maintenance Inspections
E5.25.1 Explain avionics maintenance inspections
- Visual
- Security
- Environment
- Ramp test equipment

E5.26 System Troubleshooting

E5.26.1 Explain Troubleshooting
- Cost of poor fault analysis
- Logic approach
- Planning
- Visual
- Components
- Interconnect
- Resources and references

E5.27 Systems Interconnection

E5.27.1 Discuss interconnection of avionics systems
- GPS
- Autopilot
- ILS
- Flight director
- Transponder
- FMS

E5.28 System Troubleshooting

E5.28.1 Explain System Troubleshooting
- Cost of poor fault analysis
- Logic approach
- Planning
- Visual
- Components
- Interconnect
- Resources and references
Line (GAC): 28 Avionics
Competency: 28.03 Data Bus and Logic

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>E6.1 Number Systems</td>
<td></td>
</tr>
<tr>
<td>E6.1.1 Describe number systems</td>
<td>• BCD</td>
</tr>
<tr>
<td></td>
<td>• Decimal</td>
</tr>
<tr>
<td></td>
<td>• Binary</td>
</tr>
<tr>
<td></td>
<td>• Octal</td>
</tr>
<tr>
<td></td>
<td>• Hexadecimal</td>
</tr>
<tr>
<td>E6.1.2 Explain analogue and digital systems</td>
<td>• Advantages and disadvantages</td>
</tr>
<tr>
<td>E6.1.3 Given several decimal numbers convert to binary and octal notations (practical)</td>
<td>• BCD</td>
</tr>
<tr>
<td></td>
<td>• Decimal</td>
</tr>
<tr>
<td></td>
<td>• Binary</td>
</tr>
<tr>
<td></td>
<td>• Octal</td>
</tr>
<tr>
<td></td>
<td>• Hexadecimal</td>
</tr>
<tr>
<td>E6.2 Logic Gates Functions</td>
<td></td>
</tr>
<tr>
<td>E6.2.1 Explain logic gates using truth tables</td>
<td>• AND</td>
</tr>
<tr>
<td></td>
<td>• OR</td>
</tr>
<tr>
<td></td>
<td>• NOT (Inverter)</td>
</tr>
<tr>
<td></td>
<td>• Buffer</td>
</tr>
<tr>
<td></td>
<td>• NAND</td>
</tr>
<tr>
<td></td>
<td>• NOR</td>
</tr>
<tr>
<td></td>
<td>• EXCLUSIVE OR</td>
</tr>
<tr>
<td></td>
<td>• Logic switch</td>
</tr>
</tbody>
</table>
E6.2.2 Use electrical circuit representations to explain logic gates
- AND
- OR
- NOT (Inverter)
- Buffer
- NAND
- NOR
- EXCLUSIVE OR

E6.2.3 BRIEFLY discuss boolean equations

E6.2.4 Describe display of digital data
- Voltage waveforms and levels

E6.3 Integrated Circuits

E6.3.1 Describe characteristics of integrated circuits
- IC connection arrangement
- DIP
  - IC
  - Switch
- OP AMPS (briefly discuss)

E6.3.2 Describe some applications of integrated circuits

E6.3.3 Given logic diagram with digital inputs, determine correct digital output (practical)

E6.4 Systems, Controls and Displays

E6.4.1 Describe functions of computer operations
- Central processing unit
- Central control unit
- Memory
  - RAM
  - ROM
- Arithmetic logic unit
- Data transmission
  - Serial
    - Multiplexers
    - Demultiplexers
  - Parallel
  - Data bus types including ARINC 429
E6.4.2 Describe flight management systems

E6.4.3 Describe air data computers

E6.4.4 Describe thrust management systems

E6.4.5 Describe aircraft digital systems
- Line replaceable units (LRU)
- Built in test equipment (BITE)
- Electronic flight instrument systems (EFIS)
- Engine indicating and crew alerting system (EICAS)

E6.5 Digital Systems

E6.5.1 Describe systems testing and troubleshooting
- Logic diagrams
- Flow charts
- Built in test equipment (BITE)

E6.5.2 Describe safety procedures
- Static
  - Static dischargers
  - Electrostatic discharge system
Objectives
To be competent in this area the individual must be able to:

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A8.1 Ice Formation and Effects on Aircraft Operation</td>
<td>A8.1.1 Explain conditions leading to ice formation</td>
</tr>
</tbody>
</table>
| A8.1.2 Describe types of ice and icing | • Rime ice  
• (Opaque or glaze) ice/Clear ice  
• Frost  
• Packed snow  
• Induction icing/Carburetor icing  
• Impact icing |
| A8.1.3 Explain dangers of airframe icing | • Loss of lift  
• Control surfaces  
• Loss of control  
• Weight  
• Linkages  
• Drains  
• Windshields (visibility)  
• Pitot tubes  
• Fuel system  
• Antennae |
| A8.1.4 Explain dangers of powerplant icing | • Props  
• Intake  
• Carbs  
• Oil system  
• Linkages  
• Vent blockages  
• Loss of power  
• Ice throw-off damage |
A8.1.5 Explain dangers of rotary-wing airframe and powerplant icing

- Engine indicating
- Main and tail rotor
- Powerplant intakes

A8.2 Ice Detection Systems

A8.2.1 Explain electronic ice-detection

- Leading edge build-up
- Wiper ice
- Wing lights
- Externally mounted indicators-ice accretion meters

A8.2.2

- O.A.T. gauge
- Probes

A8.2.3 Explain electro-mechanical ice-detection.

A8.3 Airframe and Powerplant De-icing

A8.3.1 Discuss differences in ground and airborne de-icing/anti-icing

A8.3.2 Describe ground de-icing of aircraft

- Anti-icing fluids
- Physical removal
  - Heated mixture of ethylene glycol, isopropyl alcohol, and water
  - Importance of time factor
  - Safety precautions
- Type I and Type II de-ice fluids

- Thermal types
  - Heated air ducted to leading edges and control surfaces and antenna
  - Windshield hot air anti-ice
  - Sources of heat
    - Engine bleed air
    - Combustion heaters
    - Exhaust augmenters

- Electric anti-icing
  - Pitot heads
  - Static ports

A8.3.3 Explain airframe anti-icing systems and components
A8.3.4 Explain airframe de-icing systems and component

A8.3.5 Explain powerplant anti-icing

A8.3.6 Explain propeller ice control systems and components

A8.3.7 Locate and identify components of ice control systems (practical)

A8.3.8 Operate ice control system (practical)

A8.3.9 Troubleshoot ice control system (practical)
A8.3.10 Clean and carry out basic maintenance of ice control systems (practical)

A8.4 Rain Removal

A8.4.1 Discuss rain control methods
- Waxed and cleaned windshields
- Windshield wipers
- Rain repellant
- Pneumatic systems

A8.4.2 Describe windshield wiper systems
- Electrically operated
  - System operation
  - Components
- Hydraulically operated
  - System operation
  - Components
- Pneumatically operated systems
  - System operation
  - Components
- Installation and rigging
  - Range of movement
  - Park
  - Tension
  - Speed control
  - Precautions, e.g., do not operate when windshield is dry
- Operating limitations, e.g., aircraft speed

A8.4.3 Describe rain repellent systems
- Types of chemicals
  - Environmental concerns
- Application methods
  - Ground applied
  - Pilot operated
- System operation
  - Components

A8.4.4 Describe pneumatic rain removal systems
- System operation
  - Components
  - Sources of air
A8.4.5 Describe inspection and maintenance of rain removal system
Objectives

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

**LEARNING TASKS**

E1.1 Atomic Theory and Static Electricity

**CONTENT**

- Molecules and atoms
- Elements and compounds
- Electrons, protons and neutrons
  - Positive and negative ions
  - Free electrons, valence electrons
  - Conductors, insulators
  - Semiconductors
- Direction of current flow

E1.1.1 Explain electron theory

E1.1.2 Explain electrostatics

E1.1.3 Explain voltage sources

E1.2 Electrical Circuits

**CONTENT**

- Chemical
- Magnetism
- Friction
- Pressure
- Light
- Thermal

E1.2.1 Explain units of electricity

- Current
  - Ampere (A)
- Voltage
  - Volt (V)
- Resistance
  - Ohm (Ω)
E1.2.2 Explain Ohm’s Law
- Electrical power and work
  - Watts
  - Horsepower
- Voltage drop
- Series circuits
- Parallel circuits
- Series-parallel circuits
- Kirchhoff’s laws
- Resistance bridge

E1.2.3 Discuss resistors
- Types of resistors
  - Fixed
  - Variable
- Construction Materials

E1.2.4 Use Ohm’s Law to solve a variety of series and parallel circuit problems. Use examples both taken from the text and provided by the instructor (Practical)

E1.3 Electrical Measuring Devices

E1.3.1 Explain meter movements
- Galvanometer

E1.3.2 Explain measuring devices
- Ammeter
  - Shunts
- Voltmeter DC
  - Multiplier (series) resistor
- Voltmeter AC
- Ohmmeter

E1.3.3 Explain meter types and uses
- Multimeter
  - Analogue meter
  - Digital meter
- Oscilloscope

E1.3.4 Use a variety of multimeters to measure current, voltage, and resistance
E1.3.5 Construct circuits from components that are the same as those previously solved mathematically. Components will be provided.

E1.3.6 Measure values to substantiate theories of Ohm’s Law and Kirchhoff’s Law.

E1.4 Batteries

E1.4.1 Explain voltaic cells
- Primary cells and secondary cells
- Dry cells and wet cells

E1.4.2 Explain cell types
- Alkaline, mercury
- Lead-acid
- Nickel-cadmium
- Gel cell

E1.4.3 Explain batteries
- Capacity (rating)
  - Volts
  - Ampere-hours
- Rate
- Open-circuit and closed-circuit voltage
- Internal resistance

E1.4.4 Explain lead-acid batteries
- Theory
- Construction of
  - Plates
  - Cell container
  - Vent caps
  - Case and paints
  - Maintenance free
- Voltage and capacity
- Testing
  - Hydrometer/specific gravity
  - Temperature effects
  - High-rate discharge test and load testers
- Charging lead-acid batteries
  - Constant-current charging
E1.4.5 Explain nickel-cadmium batteries

- Constant-voltage charging
- New batteries
- Safety precautions

- Theory and construction of:
  - Plates and cell case
  - Thermal runaway
  - Vents
  - Outer case and paints

- Capacity of nickel-cadmium batteries
  - Constant voltage charging
  - Foaming of electrolyte

- Maintenance of ni-cad batteries
  - Inspection
  - Deep cycling (reconditioning)
  - Discharge
  - Disassembly and cleaning
  - Reassembled
  - Recharged
  - Electrical lead check

- Battery storage
- Battery installation
- Temperature monitor
- Safety
  - Thermal runaway
- Segregation of lead acid and ni-cad operation

- Personal safety (WHMIS)

E1.4.6 Describe installation procedures for aircraft batteries

- Temperature of location
- Venting of gasses/overflow of electrolyte
- Battery connections and leads

E1.4.7 Describe maintenance of lead acid batteries

- Battery box
- Neutralizing electrolyte spillage
E1.4.8 Describe temperature effects on battery performance.

E1.4.9 Measure different battery types under load and no-load conditions (Practical)

E1.5 Electromagnetic Induction

E1.5.1 Explain magnetism
- Magnets
  - Residual magnetism
  - Permeability
- Properties of magnetism
  - Magnetic field
  - Lines of flux
  - Magnetic circuit
  - Reluctance

E1.5.2 Explain magnetic devices
- Electromagnets
- Solenoids and relays
  - Coils
  - Contact points

E1.5.3 Explain electromagnetic induction
- Generator action
- Explain the three requirements to make electricity
  - Magnetic field
  - Conductor
  - Relative motion

E1.6 DC Generators and Controls

E1.6.1 Explain DC generator theory
- DC generator
  - Commutator
  - Ripple
  - Residual magnetism
  - Armature reaction
    - Cross magnetism
    - Interpoles
    - Compensating winding
- Starter-generators

E1.6.2 Explain DC generator construction
- Armature assembly
- Field-frame assembly
- Brush assembly
- End frame
- Cooling
E1.6.3 Explain DC generator maintenance
- Inspection
  - Terminals
  - Flange mount
  - Brushes and holders
  - Commutator and windings
    - Growler
  - Aircraft mounting structure
  - Installation in aircraft
  - Drive spline inspection and lubrication

E1.6.4 Explain voltage regulation
- Vibrating type
- Solid state
- Carbon pile

E1.7 DC Motor Principles

E1.7.1 Explain magnetic attraction and repulsion
- Counter EMF and net EMF
- Types and characteristics of DC motors
  - Series
  - Shunt
  - Compound
  - Continuous duty
  - Intermittent duty
  - Reversible

E1.8 Aircraft Alternator

E1.8.1 Explain DC generation, using alternators
- Identify components
  - Stator
    - Wye-wound
    - Delta wound
  - Rotor
  - Slip rings
  - Rectifiers
- Aircraft alternators

E1.8.2 Service a DC alternator (Practical)
E1.8.3 Inspect and test rectifier assembly (Practical)

E1.9 Electrical Control Devices and Semiconductors

E1.9.1 Explain switches
- De-rating factors
- Manually operated
- Electrically operated
  - Solenoids

E1.9.2 Explain circuit protection
- Fuses
- Current limiters
- Circuit breakers
- Remote control circuit breakers

E1.9.3 Briefly describe electron tubes including cathod-ray tubes

E1.9.4 Explain semiconductors
- Construction
  - Materials
    - Germanium & silicon
    - P & N type
  - Doping
  - Junction
    - Potential barrier
- Diodes
  - Anode and cathode
  - Biasing
  - Rectifiers
    - Halfwave
    - Fullwave
  - Heat sinks
  - Testing
- Transistors
  - Base, collector, emitter
  - Npn, pnp
  - Uses
    - Switching
    - Amplification
  - Characteristics
  - Testing
- Other semiconductor devices
  - Thyristor family
  - Zener diode
    - Avalanche effect
  - LEDs
  - Photodiodes
E1.9.5 Operate and test switches, relays, circuit breakers, and

E1.9.6 Forward bias and reverse bias a diode

E1.9.7 Test diodes for serviceability

E1.9.8 Operate a transistor

   • Switch
   • Amplifier

E1.9.9 Test a transistor for serviceability

E1.10 Electrical Devices Safety

E1.10.1 Explain safe operation of

   • Measuring devices
     – Ohmmeter
     – Voltmeter
     – Ammeter
    (See Measuring Devices)
   • Batteries
     – Ni-cad
     – Lead-acid
    (See Batteries)
   • Electrical generation devices
     – Generators
     – Alternators
    (See Principles of Generation, and DC Alternator Principles)
   • Electrical motor
    (See DC Motor Principles)

E1.10.2 Demonstrate (Practical)

   • Safe use of a multimeter
Objectives
To be competent in this area the individual must be able to:

LEARNING TASKS

E2.1 Principles of Alternating Current (AC)
E2.1.1 Define alternating current
- Sine curve/wave
- Other wave forms

E2.1.2 Explain “root mean square (RMS)” values

E2.1.3 Explain frequency
- Hertz
- Domestic and aircraft industrial frequencies
- Effect of frequency on electrical equipment

E2.1.4 Explain phase
- Phase angle
- Three-phase
- Current/voltage; out of phase

E2.1.5 Explain use of oscilloscope

E2.2 AC Measuring Devices

E2.2.1 Explain AC measuring devices

E2.2.2 Describe inductive pickups

E2.2.3 Explain use of multimeters and oscilloscopes

E2.2.4 Perform the following
- Identify required lab equipment
- Measure AC voltages
  - Oscilloscope
  - AC voltmeter
E2.3 Capacitance

E2.3.1 Define capacitance

E2.3.2 Explain capacitors
- Types of capacitors
  - Fixed
  - Variable
- Materials
- Multiple capacitor circuits
  - Parallel
  - Series
- Time constant

E2.3.3 Describe effects of capacitors in electrical circuits

E2.3.4 Describe uses for capacitors
- Purpose
- In parallel in DC circuit-eliminate voltage pulsations
- Reduce arcing at points
- Reduce radio interference

E2.3.5 Explain capacitance in AC circuits
- Farads/micro-farads/pico farads
- Reactance
- Measured in ohms
- Formula
- Phase shift

E2.3.6 Explain polyphase AC circuits
- Description
- Uses
- Advantages
- Three-phase
- Single-phase

E2.3.7 Explain uses of AC electricity in aircraft

E2.3.8 Measure capacitance (Practical)
E2.4   Inductance

E2.4.1 Explain inductance
- Definition
- Measured in henries (h)

E2.4.2 Explain inductance coil

E2.4.3 Explain inductance in AC circuits
- Inductive reactance
  - Formula
- Phase shift

E2.4.4 Explain transformers
- Purpose
- Components
- Theory
- Step-up
- Step-down
- Phasing

E2.5   Resonance and Impedance

E2.5.1 Briefly explain resonance
- RLC circuits

E2.5.2 Define impedance

E2.5.3 Explain phase angle and power factor
- Phase angle (Ø)
  - True power
  - Apparent power
- Power factor
  - Definition

E2.6   AC Generators

E2.6.1 Describe use of AC generators in aircraft
E2.6.2 Explain AC generator theory

- AC generator
  - Sine wave generators
  - Parts of a generator
    - Field poles
    - Armature/rotor
    - Slip rings
    - Brushes

E2.6.3 Explain aircraft generators

- Construction
  - Wye configuration
  - Delta configuration
  - Regulator

- Differences between alternator and generator
  - Advantages/disadvantages
  - Rotor
  - Stator

- Principles
  - High power brushless alternator

E2.6.4 Explain transformer rectifiers

- Purpose
- Function

E2.7 Generator and Alternator Control

E2.7.1 Explain voltage regulation

- Purpose

- Generator and alternator voltage regulators in generators (DC)

E2.7.2 Describe generator control units

- AC

E2.8 Power Conversion

E2.8.1 Discuss conversion methods

- DC to AC
- AC to DC and
- AC to AC (voltage change)

E2.8.2 Explain inverters

- Function
- Cooling
- Input voltage
- Output voltage
- Single-phase
- Three-phase
- Rotary
- Static
E2.8.3 Explain variable-speed, constant-frequency power systems

- Purpose
- Description
- Advantages
- Types
  - CSD
  - IDG
- Servicing

E2.8.4 Describe transformer characteristics

E2.8.5 Describe semi-conductor diode

E2.8.6 Convert AC to DC (Practical)

E2.9 AC Motors

E2.9.1 Compare AC and DC motors

E2.9.2 Explain AC motors

- Theory
- Types
  - Universal
  - Induction
  - Synchronous
  - Combinations
- Components
  - Rotors
  - Stators
- Function

E2.9.3 Explain improvement of starting qualities

E2.9.4 Explain repulsion motors

E2.9.5 Explain synchronous motors

- Uses
E2.9.6 Explain motor losses

- Friction loss
- Resistance or copper loss
- Hysteresis loss

E2.9.7 Describe single-phase AC actuator motors

- Limit switches

E2.9.8 Describe three-phase AC motors

E2.9.9 Describe inspection and servicing of motors
## Program Content

### Level 4

**Line (GAC):**  30  **Electrical**  
**Competency:**  30.03  **Electrical Systems**

### Objectives

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

### LEARNING TASKS

#### E3.1 Circuit Installation and Wiring Practices

**E3.1.1** Describe types of wiring diagrams

- Block diagrams
- Pictorial diagrams
- Schematic diagrams

**E3.1.2** Describe basic circuit components

- Wire types and gauges
  - Continuous/intermittent
- Clamping, lacing and support devices
- Terminal strips including matrix blocks
- Connectors
  - BNC
  - Plugs and receptacles, for example:
    - AN
    - MS
    - MIL specs
- Junction boxes

**E3.1.3** Describe maintenance of electrical wiring systems

- Wiring and cable integrity
- Protection from fluids
- Wiring cable clamps and supports
- Conduits
- Plastic wire sleeving
- Crimping, stripping and splicing tools e.g. Daniels Manufacturing (deutch connectors, cannon plugs)
- Soldering
- Wire marking
- Heat shrink
E3.1.4 Identify proper crimping tools for pins and lugs

E3.1.5 Construct basic wiring harness using acceptable methods, techniques and practices (practical)

E3.2 Circuit Control and Protection Devices

E3.2.1 Describe types of electrical control devices

- Switches
  - Toggle and rocker
  - Rotary (wafer)
  - Micro
  - Transistor
  - Pushbutton
  - Slide type
  - Thermal
  - Inertia
  - Proximity
  - Frangible
  - Mercury
  - Specifications
    o Current capacity
    o Voltage and power
    o Derating
- Relays and solenoids
  - Specifications
    o Current capacity
    o Voltage and power
    o Derating

E3.2.2 Describe types of electrical circuit protection devices

- Fuses
- Circuit breakers
- Current limiters
- RCCB

E3.2.3 Identify electrical diagram symbols for control and protection devices

- Switches
- Relays
**Program Content**

**Level 4**

- Circuit breakers
- Fuses
- Transistors
- Warning lamps (press to test)

**E3.2.4** Troubleshoot various control and protection devices using schematic diagrams (practical)

**E3.3** Power Supply and Generation Systems

**E3.3.1** Describe electrical supply and generation components
- Batteries
  - Lead acid
  - Nickel-cadmium
- Alternators
- Generators
- Starter generators
- External power
- Voltage regulators
  - Vibrator
  - Carbon pile
  - Solid state
  - Paralleling
- Reverse current relays
- Current limiters

**E3.3.2** Read electrical supply and power generation systems’ wiring diagrams
- Alternator and battery bus supply
- Generator bus supply
- Starter generator bus supply
- External power supply
- Control devices
  - Voltage regulators
  - Paralleling
  - Reverse current relays
  - Current limiters

**E3.3.3** Describe maintenance of electrical power supply and generation systems
- Battery systems
  - Cooling and venting
- Alternator systems
  - Cooling
  - Bearings
  - Belts and alignment
  - Drive
- Generator systems
  - Cooling
  - Bearings
  - Drive
• Starter generator systems
• External power supply systems
• Control devices
  – Voltage regulators
  – Paralleling
  – Reverse current relays
  – Current limiters

E3.3.4 Service and test
• Alternator
• Generator

E3.3.5 Connect and test components to simulate aircraft generation system (practical)

E3.4 Monitoring and Troubleshooting Warning and Lighting Circuits

E3.4.1 Describe aircraft indication, monitoring and lighting circuits
• Components
  – Sockets
  – Bulbs
• Diagram symbols
• Relationships of components in circuits
• Functions of circuits

E3.4.2 Describe troubleshooting techniques
• Observation of circuit functions
• Use of multimeters
• Circuit and schematic analysis

E3.4.3 Students will determine causes of defect in electrical system using circuit diagram and appropriate test equipment (practical)

E3.5 Electrical Motor Systems

E3.5.1 Describe electrical motor theory
• DC motors
  – Series
  – Shunt
  – Compound
  – Reversing
• Brakes and clutches for motors
E3.5.2 Describe components which make up aircraft electrical motor circuits

- Diagram symbols
- Motors
  - AC
  - DC
- Control devices
  - Limit switches
  - Thermal switches
  - Relays
  - Rheostats
  - Field polarity resistors
  - Proximity switches

E3.5.3 Describe maintenance and repair of aircraft electrical motor systems

- AC
- DC

E3.5.4 Inspect and test aircraft motor system (practical)

E3.6 Landing Gear Electrical Systems

E3.6.1 Describe electrical components of landing gear system

- Diagram symbols
- Switches
  - Limit
  - Pressure
  - Squat
  - Weight on wheel
  - Various manufacturers' terminology
  - Throttle
- Warning horn
  - Proximity
  - Reed
- Lighting/indication
- Motors
  - Hydraulic
  - Geared
  - Electric

E3.6.2 Describe servicing and inspection of electrical landing gear system components

- Rigging and adjustment of switches
- Lighting/indication functions
- Motors

E3.7 Distribution Systems
E3.7.1 Describe light aircraft distribution systems:
- DC alternator
  - Single/multi engine
    - Paralleling
    - Buses
- DC generator
  - Single/multi engine
    - Paralleling
    - Buses
    - RCR
    - Over-voltage control
- GPU
- APU

E3.7.2 Describe large aircraft distribution systems
- Generation systems
  - GCU
  - TRUs
  - Inverters
- Bus
  - Split
  - Parallel
  - Control
  - Transfer bus
  - Load shed
- GPU
- APU
- ATM

E3.8 Safety

E3.8.1 Describe safety procedures for maintenance of electrical systems
- Connecting and disconnecting power supplies
- Correct meter connections
  - Voltage
  - Polarity
- Clothing
- Jewelry and tools
- Eye protection
- Circuit lockout and tagging

E3.8.2 Connect/disconnect power supply (practical)
# Program Content
## Level 4

**Line (GAC):** 31 Non Destructive Testing  
**Competency:** 31.01 Non-Destructive Inspection

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

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| **G11.1** Inspection Procedures | • Contains maintenance information and procedures common to manufacture’s aircraft, engine or components.  
• Typical information in cleaning, nondestructive inspection materials and procedures.  
• A standard practice is a single process that is required for maintenance of numerous parts included in product.  
• Each process has a defined area of application for accomplishing a specific task. |
| **G11.1.1** Explain purpose of and type of information found in Standard Practices manuals related to NDI processes | |
| **G11.1.2** Describe types of inspection procedures and standards required as per CGSB, MIL-410 and AECL | • Visual  
• Tap test  
• Prism check  
• Liquid Penetrant Inspection  
• Magnetic Particle Inspection  
• Eddy Current  
• Ultrasonic  
• Radiography |
| **G11.1.4** Describe documentation requirements for NDI | • Recording log entries for defects and rectification |
| **G11.2** Visual Inspection | |
| **G11.2.1** Describe visual inspection techniques | |
| **G11.2.2** Explain equipment used in visual inspection | |
G11.2.3 Describe cleaning processes and equipment for visual inspection

G11.2.4 Carry out visual inspection using related equipment
- Boroscope
- Prism check

G11.2.5 Demonstrate visual inspection using the following procedures
- Cleaning parts
- Looking for defects
- Confirming cracks with magnifying glass
- Confirming cracks using NDI methods
- Cleaning after inspection
- Reference to records (logs)
- Reference to manuals
- Recording log entries for defects and rectification
  - Track defects using maintenance records

G11.3 Tap Test

G11.3.1 Explain Tap Test
- Sound/tone changes
- Tool
- Mapping
- Precautions

G11.4 Prism Check

G11.4.1 Explain Prism Check
- Light refraction
- Prism material

G11.5 Liquid Penetrant

G11.5.1 Describe LPI
- Procedure
- Materials
- Limitations

G11.5.2 Explain application of dye penetrant
- Preparation
- Methods
- Interpretation of defects
- Final cleaning and precautions
G11.5.3 Explain use of fluorescent penetrant
- Process
- Safety precautions

G11.5.4 Demonstrate both procedures on sample components with and without known defects and, list advantages and disadvantages of dye penetrant and fluorescent penetrant (practical)

G11.6 Magnetic Particle

G11.6.1 Describe magnetic particle inspection (MPI)
- Description of process
- Principle of magnetic flaw detection
- Methods of magnetization
- Limitations

G11.6.2 Explain magnetic particle inspection procedure
- Prepare
- Magnetize
- Apply magnetic ink or powder
- Interpret indications
- Record defects
- Demagnetize after test
- Clean
- Field applications
- Precautions

G11.6.3 List advantages and disadvantages of magnetic particle inspection

G11.7 Ultrasonic Inspection

G11.7.1 Describe ultrasonic inspection
- Principles
- Types of sound waves
- Limitations

G11.7.2 Explain ultrasonic inspection procedures:
- Aircraft or part preparation
- Processes

G11.7.3 List advantages and disadvantages of UT

G11.8 Eddy Current
G11.8.1 Describe eddy current inspection

G11.8.2 Describe eddy current inspection procedures for fastener holes

G11.8.3 Describe eddy current inspection procedures for surface applications

G11.8.4 List advantages and disadvantages of eddy current inspection

G11.9 Radiography

G11.9.1 Describe radiography inspection procedures
- Principles of radiography
- Hazards and safety procedures
- Aircraft preparation
- Limitations

G11.9.2 List advantages and disadvantages of radiography inspection.

G11.10 Advanced Inspection Methods

G11.10.1 Describe advanced forms of NDI
- Acoustic emission
- Ultrasound
- Holographic imagery
- Shearography
- Thermography
Section 4

TRAINING PROVIDER STANDARDS
Facility Requirements

Classroom Area
- Recommended 2.5 Sq. meters per student
- Projection screen, multimedia projector, whiteboard or similar
- Seating and tables suitable for lecturing
- Compliance with all safety codes

Shop Area
- Recommended 25 Sq. meters per student
- Meet all safety and fire, and environmental codes
- Good lighting
- Appropriate lifting cranes as required to move industry equipment
- Approved ventilation systems

Lab Requirements
- Recommended 10 Sq. meters per student
- Computer labs on-site

Student Facilities
- 1 locker per student, study areas, computer labs, food facility, hand wash facility, washroom facility.

Instructor’s Office Space
- Recommended 3.5 Sq. Meters

Other
- Storage space for classroom and shop props.
Tools and Equipment

Shop (Facility) Tools

Standard Tools

- Abrasives
- Air blowers
- Air drills
- Air ratchets
- Aircraft snips
- Alignment tools
- Bevel protractors
- Blades
- Block sanders
- Bucking bars
- Buffing pads
- Burnishing tools
- Burnishing wheels
- Calipers
- Centre punches
- Chalk lines
- Chassis punches
- Chisels
- Clamps
- Cleco pliers
- Combination sets
- Compasses
- Countersinks
- Cutters
- Cutting bits
- Cutting blades
- Cutting discs
- Cutting shears
- Cutting tools
- Cutting wheels
- Deburring tools
- Depth gauges
- Dial indicators
- Die grinders
- Dimpling dies
- Disc sanders
- Discs
- Dividers
- Drift punches
- Drill jigs
- Drill motors
- Drill presses
- Drill size charts
- Extractor fans
- File cards
- Files
- Grip-length gauges
- Gun applicators
- Hacksaws
- Hammers
- Hand applicators
- Hand presses
- Hand punches
- Hand saws
- Hand shears
- Hand squeezers
- Heat guns
- Heat lamps
- Height gauges
- Hex keys
- Irons
- Jigsaws
- Knives
- Layout tools
- Levelling equipment
- Lights
- Line-up punches
- Magnets
- Mallets
- Mandrills
- Markers
- Measuring scales
- Measuring tape
- Mechanical files
- Microstop countersinks
- Micrometers
- Mirrors
- Needles
- Nibblers
- Pliers
- Plumb bobs
- Pneumatic applicators
- Pop riveters
- Portable circular saws
- Protractors
- Pry bars
- Punches
- Putty knives
- Rasp
- Ratchets
- Razors
- Reamers
- Rivet guns
- Rivet sets (snaps)
- Rollers
- Rotary files
- Rotary knives
- Rotary shears
- Router bits
- Routers
- Routing equipment
- Routing templates
- Scissors
- Scrapers
- Screwdrivers
- Scribes
- Socket ratchets
- Socket wrenches
- Sockets
- Spatulas
- Spot facers
- Squares
- Squeegees
- Squeeze riveters
- Straight edges
- Stretching tools
- Tap hammers
- Tape measures
- Temporary fasteners
- Thermometers
- Twist drills
- Vacuum cleaners
- Ventilation fans
- Vices
- Weights
- Wrenches
**Specialty Tools**

<table>
<thead>
<tr>
<th>Aircraft Maintenance Technician Industry Training Authority 312</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specialty Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>10X magnifying glass</td>
</tr>
<tr>
<td>Air compressors</td>
</tr>
<tr>
<td>Air extractors</td>
</tr>
<tr>
<td>Aircraft levelling equipment</td>
</tr>
<tr>
<td>Applicator guns</td>
</tr>
<tr>
<td>Arbour presses</td>
</tr>
<tr>
<td>Autoclaves</td>
</tr>
<tr>
<td>Band saws</td>
</tr>
<tr>
<td>Bead blasters</td>
</tr>
<tr>
<td>Bending equipment</td>
</tr>
<tr>
<td>Bending brakes</td>
</tr>
<tr>
<td>Blind fastener pulling heads</td>
</tr>
<tr>
<td>Blind riveters</td>
</tr>
<tr>
<td>Blind riveting equipment</td>
</tr>
<tr>
<td>Borescopes</td>
</tr>
<tr>
<td>Coin dimplers</td>
</tr>
<tr>
<td>Cold working tools</td>
</tr>
<tr>
<td>Contour blocks</td>
</tr>
<tr>
<td>Contour gauges</td>
</tr>
<tr>
<td>Cooling baths/tanks</td>
</tr>
<tr>
<td>Cranes</td>
</tr>
<tr>
<td>Crown rollers</td>
</tr>
<tr>
<td>Curing equipment</td>
</tr>
<tr>
<td>Curing ovens</td>
</tr>
<tr>
<td>Dust removal equipment</td>
</tr>
<tr>
<td>Explosion proof lighting</td>
</tr>
<tr>
<td>Fixtures</td>
</tr>
<tr>
<td>Flanging dies</td>
</tr>
<tr>
<td>Flanging machines</td>
</tr>
<tr>
<td>Flap-peening equipment</td>
</tr>
<tr>
<td>Flaring tools</td>
</tr>
<tr>
<td>Form blocks</td>
</tr>
<tr>
<td>Forming dies</td>
</tr>
<tr>
<td>Grinders</td>
</tr>
<tr>
<td>Hardness testers</td>
</tr>
<tr>
<td>Heat blankets</td>
</tr>
<tr>
<td>Heat-teat ovens</td>
</tr>
<tr>
<td>Hot bonders</td>
</tr>
<tr>
<td>Hot bonding control unit</td>
</tr>
<tr>
<td>Hot dimplers</td>
</tr>
<tr>
<td>Hydraulic brakes</td>
</tr>
<tr>
<td>Hydraulic presses</td>
</tr>
<tr>
<td>Hydroform presses</td>
</tr>
<tr>
<td>Ice boxes</td>
</tr>
<tr>
<td>Injection filling equipment</td>
</tr>
<tr>
<td>Jacks</td>
</tr>
<tr>
<td>Jigs</td>
</tr>
<tr>
<td>Joggling rollers</td>
</tr>
<tr>
<td>Machine mixers</td>
</tr>
<tr>
<td>Maule testers</td>
</tr>
<tr>
<td>Mechanical polishers</td>
</tr>
<tr>
<td>Mechanical presses</td>
</tr>
<tr>
<td>Mechanical shears</td>
</tr>
<tr>
<td>Media blasting equipment</td>
</tr>
<tr>
<td>Mixing equipment</td>
</tr>
<tr>
<td>Optical micrometers</td>
</tr>
<tr>
<td>Painting equipment</td>
</tr>
<tr>
<td>Pinking shears</td>
</tr>
<tr>
<td>Planers</td>
</tr>
<tr>
<td>Planes</td>
</tr>
<tr>
<td>Planishing hammers</td>
</tr>
<tr>
<td>Plastic weld guns</td>
</tr>
<tr>
<td>Pneumatic squeezers</td>
</tr>
<tr>
<td>Power shears</td>
</tr>
<tr>
<td>Precision measuring devices</td>
</tr>
<tr>
<td>Press brakes</td>
</tr>
<tr>
<td>Press punches</td>
</tr>
<tr>
<td>Pressure gauges</td>
</tr>
<tr>
<td>Prisms</td>
</tr>
<tr>
<td>Pyrometers</td>
</tr>
<tr>
<td>Reciprocating saws</td>
</tr>
<tr>
<td>Recording equipment</td>
</tr>
<tr>
<td>Salt baths</td>
</tr>
<tr>
<td>Sandbags</td>
</tr>
<tr>
<td>Sewing machines</td>
</tr>
<tr>
<td>Sewing needles</td>
</tr>
<tr>
<td>Seyboth testers</td>
</tr>
<tr>
<td>Sheet metal testers</td>
</tr>
<tr>
<td>Shoring and lifting tools</td>
</tr>
<tr>
<td>Skin peeling tools</td>
</tr>
<tr>
<td>Slip rollers</td>
</tr>
<tr>
<td>Spot welders</td>
</tr>
<tr>
<td>Spray booths</td>
</tr>
<tr>
<td>Spray equipment</td>
</tr>
<tr>
<td>Spray guns</td>
</tr>
<tr>
<td>Stirring/agitating equipment</td>
</tr>
<tr>
<td>Swagers</td>
</tr>
<tr>
<td>Swaging tools</td>
</tr>
<tr>
<td>Table saws</td>
</tr>
<tr>
<td>Tack hammers</td>
</tr>
<tr>
<td>Telescoping gauges</td>
</tr>
<tr>
<td>Thimbles</td>
</tr>
<tr>
<td>Timers</td>
</tr>
<tr>
<td>Torque wrenches</td>
</tr>
<tr>
<td>Trammels</td>
</tr>
<tr>
<td>Transits</td>
</tr>
<tr>
<td>Tube benders</td>
</tr>
<tr>
<td>Tube bending tools</td>
</tr>
<tr>
<td>Tube cutters</td>
</tr>
<tr>
<td>Vacuum gauges</td>
</tr>
<tr>
<td>Vacuum sniffers</td>
</tr>
<tr>
<td>Vacuum sources</td>
</tr>
<tr>
<td>Valve-stem cutters</td>
</tr>
<tr>
<td>Vernier scale</td>
</tr>
<tr>
<td>Verniers</td>
</tr>
<tr>
<td>Weigh scales</td>
</tr>
<tr>
<td>Wire twisters</td>
</tr>
</tbody>
</table>
Reference Materials

Required Reference Materials
- www.ccaa.ca

Recommended Resources
- www.ccaa.ca

Suggested Texts
- Aircraft Basic Science, 7th Edition by Kroes and Radon, Glencoe Publishing
Instructor Requirements

Occupation Qualification
The instructor must possess:
• AME-M licence

Work Experience
A minimum of 10 years' experience working in the industry as a journeyperson.

Instructional Experience and Education
It is preferred that the instructor also possesses:
• Instructor Diploma