



**I. COURSE DESCRIPTION:**

This course has been designed so as to introduce students to the topics of Weld Quality and Visual Inspection using the requirements of AC 43.13-1A as a reference and source of technical information. A basic understanding of Metallurgy, Mechanical Properties as well as familiarity with Oxy-Acetylene and Gas Metal Arc welding equipment and process will be developed in order to understand how they relate to the Aircraft Industry. Shop demonstrations and lectures will be used as the method of course delivery and will be further supported by means of written assignments, reports and theory testing.

**II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:**

Upon successful completion of this course, the student will demonstrate the ability to:

1. ***Demonstrate a sound working knowledge of both personal and shop safety.***

Potential Elements of the Performance:

- identify proper eye protection as well as the need to wear it at all times while in the welding shop
- identify and locate proper hand and face protection such as
  - face shields
  - welding helmets
  - filter lenses
- understand the need to wear the above protective equipment during any and all cutting, heating or welding operations and / or demonstrations
- identify proper types of footwear and clothing
- identify the dangers associated with
  - contact lenses
  - butane lighters
  - exposed metal jewelry
  - long hair and beards
  - synthetic materials
- identify the location of commonly used welding tools, face shields and leather jackets
- identify personal safety equipment that must be supplied by the student
- locate and identify shop lighting and ventilation controls
- locate and identify emergency shop exits
- understand emergency shop evacuation procedures locate and identify manifold shut-off valves for the shop gas system

2. ***Demonstrate an understanding of the basic theory and concepts related to the Heat Treatment and Mechanical Properties of Steel.***

Potential Elements of the Performance:

- review proper eye, hand and face protection equipment and procedures
- identify the following list of equipment and component parts:
  - oxygen and acetylene cylinders
  - welding and cutting tips
  - torch body and hoses
  - regulators
  - spark lighter
  - welding face shield / goggles
- observe fusion welding / flame heating operations
- define and describe the following heat treatment terms
  - solid solution
  - anneal
  - normalize
  - quench harden
  - temper
- observe and participate in demonstrations of the above heat treating operations on various steel samples
- observe and estimate the effects of the above heat treating operations on various steel samples
- define and describe the following mechanical properties
  - yield strength
  - ultimate tensile strength
  - hardness
  - brittleness
  - ductility
  - toughness
- observe and participate in demonstrations of the above list of mechanical properties
- estimate the presence of mechanical properties thru the use of standard shop tools and equipment

3. ***Demonstrate an understanding of the basic theory and concepts related to the Heat Treatment and Mechanical Properties of Aluminum.***

Potential Elements of the Performance:

- define and describe the following heat treatment terms
  - solution treat
  - anneal
  - normalize
  - precipitate harden
  - age harden

- observe and participate in demonstrations of the above heat treating operations on various steel samples
- observe and estimate the effects of the above heat treating operations on various steel samples
- define and describe the following mechanical properties
  - yield strength
  - ultimate tensile strength
  - hardness
  - brittleness
  - ductility
  - toughness
- observe and participate in demonstrations of the above list of mechanical properties
- estimate the presence of mechanical properties thru the use of standard shop tools and equipment

4. ***Demonstrate an understanding of the basic theory and concepts related to Weld Distortion and Heat Affected Zone.***

Potential Elements of the Performance:

- review proper eye, hand and face protection equipment and procedures
- identify the following list of equipment and settings:
  - welding machine and wire feeder
  - regulator / flow meter
  - shielding gas
  - voltage and WFS
  - welding gun
  - ground clamp
- observe and participate in demonstrations of typical GMAW operations
- identify and describe the appearance of a properly made weld
- identify and describe the appearance of an improperly made weld
- identify and define the following terms
  - distortion
  - neutral axis
- understand the effect of the location of the neutral axis upon the direction in which a metal bends
- identify and name the various types of distortion
- list common methods that can be used to control distortion
- identify the presence, location and size of a H.A.Z.
- list the various regions within a H.A.Z.
- describe the affect(s) of a H.A.Z. upon the over-all strength and reliability of a welded structure

5. ***Demonstrate an understanding of the basic concepts, techniques and responsibilities related to the process of Weld Inspection.***

Potential Elements of the Performance:

- observe and participate in demonstrations of both destructive and non-destructive inspection techniques.
- understand the basic differences between destructive and non-destructive testing
- understand the circumstances under which each of the above inspection techniques would be used
- identify methods of non-destructive testing as well as the ability of each method to detect the presence of defects
- identify and describe the following weld defects and discontinuities
  - distortion and warping
  - arc blow
  - weld cracks
  - base metal cracks
  - crater cracks
  - excessive weld metal penetration
  - excessive weld metal reinforcement
  - excessive weld width
  - weld spatter
  - porosity
  - lack of fusion
  - insufficient weld metal penetration
- state the cause(s) for each of the above defects
- list corrective actions that can be taken to reduce and / or eliminate weld defects and discontinuities
- identify criteria for acceptable vs non-acceptable welds
- perform a visual examination of welds to identify:
  - the presence of defects and discontinuities
  - acceptable levels of defects and discontinuities
- create written report(s) on visual inspections c/w reasons for
  - accepting welds
  - referring questionable welds to an engineer for evaluation

**III. TOPICS:**

1. Personal and Shop Safety
2. Mechanical Properties
3. Welding and Heating Equipment and Techniques
4. Distortion and Heat Affected Zone
5. Weld Testing and Inspection

**IV. REQUIRED RESOURCES/TEXTS/MATERIALS:**

- CSA Approved (Impact Resistant) Safety Glasses
- CSA Approved (Gauntlet Type) Welding Gloves
- 3 inch Diameter Magnifying Glass
- Technical Papers:
  - Ensuring Weld Quality in Structural Applications
  - Fabricators' and Erectors' Guide to Welded Steel Construction

**V. EVALUATION PROCESS/GRADING SYSTEM:**

The final course grade shall be determined by means of the following two criteria based upon their described weighted factors:

- Reading Assignments      25%
  - Lab Assignments            25 %
  - Theory Tests                50%
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- Total      100%

**IMPORTANT --- PLEASE NOTE !!!**

While the following semester grades are normally assigned to students in postsecondary courses, **Transport Canada** requires a minimum grade of 70% in order to be granted accreditation for this course. In keeping with their policy, a **minimum of 70 % is required in order to pass ASR114.**

<b>Grade</b>	<b><u>Definition</u></b>	<i>Grade Point Equivalent</i>
A+	90 – 100%	4.00
A	80 – 89%	3.00
B	70 - 79%	2.00
C	60 - 69%	1.00
D	50 – 59%	0.00
F (Fail)	49% and below	
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	

X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
NR	Grade not reported to Registrar's office.
W	Student has withdrawn from the course without academic penalty.

## VI. SPECIAL NOTES:

### Special Needs:

If you are a student with special needs (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Special Needs office. Visit Room E1101 or call Extension 703 so that support services can be arranged for you.

### Retention of Course Outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

### Plagiarism:

Students should refer to the definition of “academic dishonesty” in *Student Rights and Responsibilities*. Students who engage in “academic dishonesty” will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

### Course Outline Amendments:

The professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

## VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the professor. Credit for prior learning will be given upon successful completion of a challenge exam or portfolio.

**VIII. DIRECT CREDIT TRANSFERS:**

Students who wish to apply for direct credit transfer (advanced standing) should obtain a direct credit transfer form from the Dean's secretary. Students will be required to provide a transcript and course outline related to the course in question.