



EAC

No.145_2

TABLE of CONTENTS

ITEM	TITLE
<u>EAC145-2</u>	Welding Workshops And Quality Control
145_2.1	General requirements
145_2.3	Welding procedure
145_2.5	Welding equipment requirements
145_2.7	Weld quality
145_2.9	Inspection records
145_2.11	Identification, classification packing and storage
145_2.13	Qualification of inspection personnel
145_2.15	Welding classification and definitions

WELDING WORKSHOPS AND QUALITY CONTROL

145_2.1 General requirements

The purpose of this circular is to ensure that qualified procedures are used by properly trained and qualified personnel. It shall be the responsibility of the contractor to ensure that only qualified personnel, procedures, and nondestructive test equipment are used in fabrication and inspection necessary to comply with this document. Procedures and personnel previously qualified or approved shall not require qualification provided that qualifications are appropriate for the production of welding to be done and have not lapsed, and provided that qualification records are available to substantiate prior qualification or approval. For more precise details refer to :

- (a) ECAA will recognize and accept (as amended).
 - AWS D17.1/ D17.1M;2010 AMDI "Specification for Fusion Welding For Aerospace Applications" American Welding Society
 - ISO 24394:2008+A1:2002 " Welding For Aerospace Applications Qualification test for welders and welding operators. Fusion welding of metallic components"
 - CAAP 33-1:2011 " Aircraft Manual Welding-Approvals and Qualifications" Australian Government Civil Aviation Safety Authority
 - CAP 553 BCAR Section A Chapter A 8-10 'Approval of Welders ' UK Civil Aviation Authority
- (b) ECAA recognize and accepte the (Institut de Soudure) for personnel examination and qualification.

145_2.3 Welding procedure

Prior to engaging in production welding, the welding procedure for classes A and B shall be qualified (approved). In order to achieve that, the following requirements should be fulfilled.

- (a) Welding control (or work) sheet:

For each sub-assembly or welded assembly composed of many components, a worksheet (or control sheet) should be issued by the competent workshop or approved repair station containing at least:

 - (1) Name of assembly or subassembly, part number.
 - (2) Reference to design document or part manual and standards used.
 - (3) Materials to be assembled by this welding procedure and their treatment before welding, and weld configuration.
 - (4) Welding method and supporting material and filler metal.
 - (5) Welding thermal conditions requirements as (preheating, maintaining at certain temperatures during welding, cooling... etc.).
 - (6) Quality control required or qualified person to certify each welding step.
 - (7) List of control operations required before, during, and after welding, and after treatment as well, which should define:
 - (i) Form of adaptation sample and nature of destructive samples realized.
 - (ii) Nature and frequency of non-destructive control.
- (b) Welding drawings:

Welding drawings should contain the following information in addition to the drawing of subassemblies or parts to be welded:

 - (1) Welded materials and their treatment reference.
 - (2) Welding procedure or method used.
 - (3) Supporting materials and flux used.
 - (4) Number of worksheets or control sheets used for welding procedure.
- (c) Adaptation samples:

Before executing a welding procedure on a new piece or new series of pieces; a sample should be made and subjected to the same designed service operating conditions of the relevant part, and also subjected to destructive tests to determine internal defects. Adaptation sample reports should be kept by the contractor or repair station.

145_2.5 Welding equipment requirements

- (a) General: Welding equipment, such as welding machines, welding torches, regulators and filler metal feeders shall be capable of making satisfactory welds, when operated by a qualified welder or welding operator.
- (b) Welding apparatus capability: Where doubts about the capability of any welding apparatus to function satisfactorily exists, the equipment shall not be used until the necessary repairs, adjustments, or replacements have been made.
- (c) Furnace control equipment: Unless otherwise specified in the welding procedure documents, furnace control temperature tolerances shall be within + or - 50°F.
- (d) Cooling furnaces: Cooling furnaces shall be provided with suitable means for controlling the cooling rate.
- (e) Qualified weld settings: Qualified weld settings are required for machine welding of class A welds. Qualified weld settings are not required for machine welding of class B or C welds. Allowable variations from the established weld settings are acceptable if within + or (1) 10 %. If meter readings are used, the variation shall be based on the mean reading. Weld settings for manual welding are not required to be qualified.
- (f) Reproducibility of qualified machine weld settings:
 - (1) When a sample is required: A sample shall be made to demonstrate the reproducibility of the machine weld settings whenever one of the following situations occur:
 - (i) A change in the location of the welding equipment;
 - (ii) A change in the welding power supply;
 - (iii) The installation of electrical components which would affect welding parameters; and
 - (iv) A change in tooling which will affect heat dissipation rate from the weld area of the joint or which affect the shielding gas effectiveness.
 - (2) Sample preparation: The reproducibility sample shall consist of a simulated or actual production joint (if production joint will be less than 10 inches in length) or 10 inches of a simulated or actual joint (where the production item requires at least a 10 inch long weld). The reproducibility sample shall meet the quality requirements of the production item.
 - (3) Requalification of machine weld settings: Requalification of the affected machine settings shall be required when:
 - (i) The machine settings reproducibility sample is not able to meet the requirements of this Part.
 - (ii) The qualified weld settings will not provide acceptable product weld quality.

145_2.7 Weld quality

- (a) General: Cracks, incomplete fusion and overlap, are not acceptable in any class of weld. Two or more adjacent surface discontinuities shall be treated as one when the space between them is less than the dimension of the smallest discontinuity. The dimension of any discontinuity shall be defined by its largest dimension. Interconnecting discontinuities shall be considered as a single discontinuity. Limits of discontinuity when specified in terms of percentage of thickness "T" shall be based on thinner member of the joints. In the case of weldments with variations in cross section along the joint, "T" shall be considered to be the minimum thickness at the specific discontinuity location. Arc strikes, arc burns from loose electric connections and gauge marks on the base metal of the finished weldment are unacceptable for class A and B welds. Welds made from one side only under 0.125 inch thick may have the root surface faired in by using a cosmetic weld pass or by grinding, provided that complete penetration was obtained in the original weld.
- (b) Other visual inspection criteria: Welds of all classes should be visually inspected for discontinuity limits, minimum fillet weld sizes and discoloration according to the limitations specified for the particular welding configuration, material and technique used.
- (c) NDT: Whenever an NDT process is specified for a particular weld, inspections are not through until results of the NDT inspections prove its acceptance.

145_2.9 Inspection records

Each contractor shall ensure that the records, including radiographic films, compiled for his materials, components or weldments are retained for a period of five years for class A or B welds and one year for class C welds following acceptance of the weld. They shall be available for review by the cognizant engineering organization upon request.

145_2.11 Identification, classification, packing and storage

- (a) The quality assurance shall determine that a satisfactory system has been established to assure continuous maintenance of identification, classification, packing and storage of welding and brazing filler metal electrodes and fluxes in order to assure the use of proper filler metals for welding and brazing.
- (b) Marking of individual lengths of filler rod may be omitted provided that approved system of controls that assures positive segregation and identification of materials is adopted.
- (c) Packaging shall be labeled with the manufacturer's name, material specification and identified with a stamp, label or equivalent, indicating material acceptance, acceptance or test date and expiration date, if appropriate.
- (d) Each welded assembly, or the documentation accompanying each welded assembly, shall be marked with the date and the signature or individually assigned stamp or code of the welder who made the weld, and with the date and signature(s) or individually assigned code or stamp of the inspector(s) who accepted the weld.

145_2.13 Qualification of inspection personnel

- (a) Visual weld inspector: Personnel performing visual examinations shall be trained and qualified in accordance with Part 65. Visual weld inspector qualification criteria and training shall be documented in a written procedure.
- (b) Vision test: Inspection personnel shall be required to pass an annual vision test. The test shall be conducted by a trained technician using the standard test methods for determining visual acuity. The standard of acceptance for the vision test shall be natural or corrected near distance acuity such that the individual is capable of reading JI letters on the standard Jaeger type chart for near vision. Other equivalent visual tests may be substituted for the Jaeger Chart. Glasses or other corrective aids used to pass vision tests shall be worn when performing production work.
- (c) NDT personnel: Non destructive examination personnel shall be qualified in accordance with Part 65, to establish the quality of the personnel to perform the required examinations.

145_2.15 Welding classification and definitions

- (a) Class A: Are weldments whose fractures would cause injury to personnel, loss of a vehicle or system, failure to complete an assigned mission task, or welds considered highly stressed.
 - (b) Critical application: A weldment is critical where a failure of any portion would cause loss of system, loss of major component, loss of control, unintentional release of critical stores, or endangering personnel.
 - (c) Class B: Semi-critical application. A weldment is semi-critical when a failure would reduce overall efficiency of the system, but loss of the system or endangering of personnel would not be experienced.
 - (d) Class C: Non-critical application. A weldment is non-critical when a failure would not affect the efficiency of the system or endanger personnel.
- Note: When the class is not specified in the contract or on the drawing, class A shall apply.