CHAPTER 57

PROCEDURES FOR EVALUATION AND APPROVAL SPECIALISED ACTIVITIES SUCH AS NDT, WELDING ETC.

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1.0 OBJECTIVE

The chapter provides guidance and information for inspectors for evaluation and approval of organizations for Specialized Services like Non-Destructive Testing and Inspections., Welding etc.

2.0 GENERAL

GENERAL INFORMATION

Internationally, NDT standards generated by other regulatory agencies and national certification programs have been, and are considered, acceptable to the NCAA. For example, individuals considered NDT qualified/certified under EN 4179 Aerospace Series – “Qualification and Approval of Personnel for Nondestructive Testing”, (EN 4179, as published, is technically equivalent to AIA NAS-410) are considered qualified by the NCAA. The following information discusses the generic elements of the standards considered acceptable to the NCAA and can be utilized as the basic requirements to determine that only qualified individuals perform NDT inspections. Any organization developing its own procedures to determine that only qualified personnel perform NDT, should minimally address the generic elements.

1. **Vision Examinations**: NDT personnel shall receive documented vision and color blindness testing at reasonable intervals (one year preferred). The NDT inspector shall have documented evidence of satisfactory vision in accordance with accepted medical standards to be considered a qualified NDT inspector. Vision examinations can either precede or accompany the initial determination of qualification to perform NDT. Vision examinations shall be administered by personnel in accordance with the standard to determine qualification.

(a) Near Distance Vision Requirements: The NDT inspector shall have natural or corrected near distance acuity in at least one eye capable of 20/25 (Snellen) at 14" to 18" or equivalent. Near vision acuity shall permit reading a minimum of Jaeger number 1 or Times Roman N 4.5 or equivalent letters (having a height of 1,6 mm) at not less than 30 cm with one or both eyes, either corrected or uncorrected;

(b) Color Vision Requirements: The NDT inspector shall be capable of adequately distinguishing and differentiating colors used in the process involved. Colour vision shall be sufficient that the candidate can distinguish and differentiate contrast between the colours or shades of grey used in the NDT method concerned as specified by the employer

(c) Vision Examination Documentation Requirements: Following initial qualification, the documented near distance and color vision examinations shall be administered as required above, and records will be retained by the employer.

2. **Levels of Qualification:** NDT personnel can be categorized at different levels of competence (e.g., Trainee, Limited, Level 1, 2, or 3). They can also be categorized for different functional areas, such as inspector, trainer, or auditor. NDT personnel should perform only at the level(s) or function(s) to which they have been qualified.

(a) An NDT Level I individual should be qualified to properly perform specific calibrations, specific NDT and specific evaluations for acceptance or rejection determinations according to written instructions and to record results. The NDT Level I should receive the necessary instruction and supervision from a certified NDT Level II or III individual.

(b) An NDT Level II individual should be qualified to set up and calibrate equipment and to interpret and evaluate results with respect to applicable codes, standards and specifications. The NDT Level II should be thoroughly familiar with the scope and limitations of the methods for which he is qualified and should exercise assigned responsibility for on-the-job training and guidance of trainees and NDT Level I personnel. The NDT Level II should be able to organize and report the results of NDT tests.

(c) An NDT Level III individual should be capable of developing, qualifying and approving procedures, establishing and approving techniques, interpreting codes, standards, specifications and procedures, as well as designating the particular NDT methods, techniques and procedures to be used. The NDT Level III should be responsible for the NDT operations for which he is qualified and assigned and should be capable of interpreting and evaluating results in terms of existing codes, standards and specifications. The NDT Level III should have sufficient practical background in applicable materials, fabrication and product technology to establish techniques and to assist in establishing acceptance criteria when none are otherwise available. The NDT Level III should have general familiarity with other appropriate NDT methods, as demonstrated by an ASNT Level III Basic examination or other means. The NDT Level III, in the methods in which he is certified, should be capable of training and examining NDT Level I and II personnel for certification in those methods.

(d) Trainee: Though not a certification level, a trainee is a person who is in the process of being initially trained, qualified and certified, and should work with a certified individual. A trainee may not independently conduct, interpret, evaluate or report the results of any NDT test.

(e) NDT Instructor: The term “NDT Instructor” is used in the ANSI/ASNT standard CP-189, ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel, to describe an individual with the skills and knowledge to plan, organize and present classroom, laboratory, demonstration, and/or on-the-job NDT instruction, training and/or education programs.

3. **Training:** NDT personnel should receive documented initial and recurrent training in the standards, methods, and levels they utilize. This should be a mix of classroom, practical, and on-the-job training. The frequency and content of recurrent training will be specified by the standard under which the NDT personnel have been qualified.

The minimum duration of training undertaken by the candidate for certification may be as defined in Table 1 (below)

Table 1: Minimum Duration of Training (hours)			
NDT Methods	Level 1 hours	Level 2 hours	Level 3 hours
ET	40	48	48
PT	16	24	24
MT	16	24	32
RT	40	80	40
UT	40	80	40
Basic knowledge	(direct access to Level 3 examination parts A, B and C)		80

4. **Testing:** NDT personnel should demonstrate documented proficiency, both in classroom knowledge and practical application of test method(s). NDT personnel shall have a combination of 3 education, training, and experience as determined by the specific standard under which they are determined qualified. NDT inspectors must understand the principles and procedures of applicable NDT methods. Personal information including education, training, and experience must be documented and validated against the standard under which the NDT inspector is considered qualified.

5. **Experience:** NDT personnel require experience in a test method to be considered qualified to perform that test method. Recent (within the last 6-12 months, shorter period preferred) utilization of the inspection method being performed is necessary in order to maintain a qualified NDT inspector status. Inspectors not meeting this recent experience level would need to be requalified.

6. **Disqualification:** A procedure needs to be in place to allow an organization to disqualify a NDT individual from performing inspections when the inspector doesn't meet current standards.

7. **Documentation:** Sufficient documentation must be available and retained to demonstrate that only qualified personnel are engaged in the NDT process. Records shall be maintained for each qualified individual, and for each individual who has been disqualified to perform NDT. Records shall include all education, experience, vision examination, and training documentation.

8. **Recertification Requirements:** Level I-limited personnel shall be re-certified at intervals not to exceed one year for each certification held;
Levels II and III personnel must recertify at intervals not to exceed five years and must successfully complete practical and specific examinations equivalent to those required for initial certification.
The period of validity of the certification is five years from the date of certification indicated on the certificate.

Any maintenance organisation approved under Nig. CARs Part 6 that carries out NDT should establish NDT specialist qualification procedures detailed in the MPM and accepted by the NCAA.

Boroscoping and other techniques such as delamination coin tapping are nondestructive inspections rather than non-destructive testing. Notwithstanding such differentiation, the maintenance organisation should establish an exposition procedure accepted by the NCAA to ensure that personnel who carry out and
interpret such inspections are properly trained and assessed for their competence with the process. Non-destructive inspections, not being considered as NDT by Nig. CARs Part 6.

The referenced standards, methods, training and procedures should be specified in the maintenance organisation MPM.

A. PROCEDURES FOR APPROVAL OF ORGANISATIONS CONCERNED WITH RADIOGRAPHIC INSPECTION OF AIRCRAFT DURING MAINTENANCE AND OVERHAUL

1. **INTRODUCTION:** Organisation engaged in inspection of Radiographic inspection of aircraft during overhauls, repairs, replacements, modifications and inspection may be approved to provide reports and certify compliance in respect of this work on aircraft structure, structural components, and welded structural components, subject to compliance with the procedures set down in this Chapter 57 and the supplement.

   NOTE: Safety and protection procedures are not included in this Chapter and Supplement. It is incumbent on the operator to comply with the Radioactive Substance Act and other relevant Regulations.

2. **APPLICATION:** Organisations seeking approval, or the extension of an existing approval, for the radiographic work described in paragraph 1, shall make written application to the NCAA Directorate of Airworthiness Standards.

3. REQUIREMENTS FOR GRANT OF APPROVAL

3.1 The radiographic department shall be organised under the direction of a radiographer who has satisfied the appropriate requirements of the Supplement to this Chapter.

3.2 All radiographic inspections shall be directly supervised and the final certification made by a Radiographer who has satisfied the appropriate requirements of the Supplement. Certification shall be in a form agreed by the NCAA.

3.3. Radiographic inspection concerned with the inspection required in approved Manuals, approved Maintenance schedules, the NCAA Mandatory Aircraft Modifications and Inspection procedures summary and the Foreign Airworthiness Directives Volumes, shall be in accordance with techniques approved by the manufacturer, or an appropriately approved Organisation unless an alternative technique has been accepted by the NCAA.

4. REQUIREMENTS FOR THE RADIOGRAPHER

4.1 The following shall be satisfied by the person(s) required under paragraph 3.1. and 3.2. above:-

4.1.1 For aircraft structure and structural components (other than welds)

(a) Be able to read, write and converse in the English language.

(b) Have experience, acceptable to the NCAA of a minimum of one year dealing with practical inspection of aircraft structure, or alternative training experience acceptable to the NCAA.

(c) Have satisfactorily completed a course for course for instruction in radiography acceptable to the NCAA.

(d) Produce evidence, satisfactory standard, acceptable to the NCAA, of at least six months recent work in the radiographic inspection of the aircraft structures and structural components, including processing and interpretation of radiographs.

(e) Have achieved a satisfactory standard, acceptable to the NCAA in the appropriate parts of the examination in accordance with paragraph 2 of the Supplement.

4.1.2 For flight alloy and dense metal welded structural component

(a) Be able to read, write and converse in English Language

(b) Have satisfactorily completed a course of instruction in radiography acceptable to the NCAA.

(c) Produce evidence, satisfactory standard, acceptable to the NCAA, of at least six months recent work in the radiographic inspection of both (or either if required separately) light alloy and dense metal welded aircraft structural components.

(d) Have achieved a satisfactory standard, acceptable to the NCAA, in the examination detail in paragraph 2 of this Supplement.

5. EXAMINATION SYLLABUS

5.1 **Written Examination:** The written examination will include questions on the following:

(a) The elementary principles of Radiographic theory and how these principles are related to the practical techniques of radiography.

(b) The photographic aspects of radiography

(c) Safety and protection against radiation hazards.

5.2 **Practical Test:** The practical test will consist of the following:

(a) The development and recording of techniques for the inspection of typical aircraft structures including structural components.

(b) The development and recording techniques for the inspection of welded structure components.

(c) The practical application of the technique

(d) Processing of Radiographs

5.3 **Interpretation Test:** The interpretation test will consist of the following:

(a) The co-relation of the radiographs with the report

(b) Identification of the various features in the radiographs

5.4 **Appropriate parts of the Examination:**The following parts are appropriate to the approval sought:

(a) The written examination (paragraph 2.1) shall be undertaken by all radiographers.

(b) Practical Test: Paragraphs 2.2 (a), (c) and (d) are applicable where approval is sought for inspection of aircraft structures and structural component. Paragraph 2.2 (b), (c) and (d) and applicable where approval is sought for inspection of welded structural components.

(c) An interpretation test (paragraph 2.3) shall be undertaken by all radiographers.

6. **RE-EXAMINATION:** The NCAA may require re-examination of a radiographer at times which will be notified in writing to the approved Organisation .

B. PROCEDURES FOR APPROVAL OF ORGANISATIONS CONCERNED WITH ULTRASONIC INSPECTION OF AIRCRAFT DURING MAINTENANCE AND OVERHAUL

1. **Introduction:** Organisations engaged in ultrasonic inspection of aircraft during overhauls, repairs, replacement, modifications and inspection may be approved to be approved to provide reports and certify compliance in respect of this works, subject to compliance with the procedures set down in this Chapter 57 and the supplement.

2. Application: Organisation seeking approval, or the extension of an existing approval, for the ultrasonic work described in paragraph 1, shall make written application to the NCAA Directorate of Airworthiness Standards.

3. Requirements for Grant of Approval

3.1 The Ultrasonic Inspection Department shall be organised under the direction of a person who has satisfied the requirements of the Supplement to this Chapter.

3.2 All ultrasonic inspections shall be directly supervised, and the final certification made by a person who has satisfied the requirements of the supplement to this Chapter. Certification shall be in a form agreed by the NCAA.

Ultrasonic inspections concerned with the inspections required in approved Manuals, approved Maintenance Schedules, the NCAA Mandatory Aircraft Modifications and Inspections procedures and the Foreign Airworthiness Directives Volumes, shall be made in accordance with techniques approved by the manufacturers, or an appropriately approved Organisation unless an alternatives techniques has been accepted by the NCAA.

4. REQUIREMENTS FOR THE ULTRASONIC TECHNICIAN

1. The following shall be satisfied by the person(s) required under paragraph 3.1 and 3.2 above.

(a) Be able to read, write and converse in the English language.

(b) Have experience, acceptable to the NCAA, of a minimum of one year dealing with practical inspection or aircraft, or alternative training or experience acceptable to the NCAA.

(c) Have satisfactory completed a course of instruction in ultrasonic flaw detection acceptable to the NCAA.

(d) Produce evidence, satisfactory to the NCAA, of at least six months recent work in ultrasonic inspection 2 of this supplement.

(e) Have achieved a satisfactory standards, acceptable to the NCAA in the examination detailed in paragraph 2 of this supplement.

5. EXAMINATION SYLLABUS

5.1 **Written Examination:** The written examination will include questions on the following:

(a) Modes of ultrasonic propagation in solids and liquids

(b) Reflection, refraction, absorption and scattering of ultrasonic waves.

(c) Piezo-electric crystrals: basic essential of the construction and mode of operation of ultrasonic probes.

(d) Methods of coupling ultrasonic probes to the work piece

(e) Functions of the externally accessible controls normally fitted to ultrasonic flaw detection equipment.

(f) Scope and limitations of ultrasonic flaw detection

(g) Application of the reflection and transmission method of testing aluminium alloy and steel work piece, including welds.

(h) The use of standards reference blocks for checking sensitivity of equipment and estimation of defect size and depth.

(i) The recognition of defect indications and the interpretation of these.

(j) Definition of the term “decibel” as applied to a unit of voltage (or amplitude) difference: the use of attenuators.

(k) Recognition of false indications.

Note: The approach to the above subject should be practical rather than mathematical.

5.2 **Practical Test:** Ultrasonic flaw detection shall be carried out on a given number of specimens using contact scan techniques. The test on one specimen will include the estimation of defect size by means of standard reference blocks (flat bottom hole type) and suitable ettenuators.

5.3 **Technical Preparations:** Ultrasonic flaw detection contact scan techniques, shall be prepared in respect of a number of specimens as follows:

(a) Comprehensive inspection of one specimen

(b) Inspection for a particular defect in the remaining specimens including the design of suitable test pieces.

6. **RE-EXAMINATION:** The NCAA may require re-examination of an ultrasonic technician at times which will be notified in writing to the approved Organisation.

C. PROCEDURES FOR APPROVAL OF ORGANISATION CONCERNED WITH MAGNETIC PARTICLE

1. Inspection of aircraft during overhauls, repairs, replacements, modification and inspections may be approved to provide reports and certify compliance in respect of this work subject to compliance with the procedures set down in this Chapter 57.

2. Application organsiations seeking approval or the extension of an existing approval, for the magnetic particle work described in paragraph 1, shall make written application to the NCAA Directorate of Airworthiness Standards.

3. **Requirement for Grant of approval.**

3.1 The magnetic particle inspection Department shall be organized under the direction of a person who has satisfied the requirement of the supplement to this Chapter.

3.2 All magnetic particle inspections shall be directly supervised and the final certification made by a person who has satisfied the requirements of the supplement to this Chapter. Certification shall be in a form agreed by the NCAA.

3.3 Magnetic particle inspections concerned with the inspection required in approved manuals, approved maintenance programme, the NCAA Mandatory Aircraft Modification and inspections summary and the Foreign Airworthiness Directives volumes, shall be made in accordance with techniques approved by the manufacturer or an appropriately approved organization unless an alternative technique has been accepted by the NCAA.

4 Requirement for the magnetic particle technician.

4.1 The following shall be satisfied by the persons required under paragraph 3.1 and 3.2 above.

(a) Be able to read, write and converse in the English language.
(b) Have experience acceptable to the NCAA of a minimum of one year dealing with practical inspection of aircraft, or alternative training or experience acceptable to NCAA.
(c) Have satisfactorily completed a course of instruction in magnetic particle flaw Detection acceptable to the NCAA.
(d) Produce Evidence, satisfactory to the NCAA of at least six months recent work in magnetic particle inspection of aircraft.
(e) Have achieved a satisfactory standard equivalent (BINDT) to the British Institute of Non-destructive Testing (BINDT) or the American Standard of Non-destructive Testing (AMSNDT) in the examination detailed in paragraph 2 to this supplement.

5. EXAMINIATION SYLLABUS

5.1 Written Examination. The written examination will included question on the following:
(a) Characteristics of Aircraft materials
(b) Heat treatment
(c) Material Hardness
(d) Magnetic field/strength/Flux Density
(e) Electrics
(f) Magnetic INDUCTION
(g) Magnetic Particle machine
(h) Blade Light
(i) Optional Particle method/materials
(j) The recognition of defect indications and the interpretation of these.
(k) Recognition of false indications.

5.2 Practical Test magnetic particle flaw detection technique shall be prepared in respect of a number of specimens as follows.

(a) Comprehensive inspection of one specimen
(b) Inspection for a particular defect in the remaining specimens including the design of suitable test pieces.

6. Examination: The NCAA may require re-examination of a magnetic particle technician at times which will be notified in writing to the approved organization.

D. PROCEDURES FOR APPROVAL OF ORGANISATIONS CONCERNED WITH EDDY CURRENT INSPECTION OF AIRCRAFT DURING MAINTENANCE AND OVERHAUL.

1. **Introduction:** Organisations engaged in Eddy current inspection of aircraft during overhauls, repairs, replacement modifications and I inspections may be approved to provide reports and certify compliance in respect of this work, subject to compliance with the procedures set down in this chapter 57.

2. **Application:** Organisation seeking approval, or extension of an existing approval, for the Eddy current work described in paragraph 1, shall make written application to the NCAA Directorate of Airworthiness Standards.

3. Requirements for Grant of Approval

3.1 The Eddy current department shall be organized wide the direction of a person who satisfied the requirements of the supplement to this chapter.

3.2 All Eddy current inspection shall be directly supervised, and the final certification made by a person who has satisfied the requirement of the supplement to this chapter. Certification shall be in a form agreed by the NCAA.

3.3 Eddy current inspections concerted with the inspection required in approved manuals, approved maintenance programme the NCAA Mandatory Aircraft Modifications and inspections Summary and Foreign Airworthiness Directives volumes shall be made in accordance with techniques approved by the manufacturer or an appropriately approved organization unless an alternative technique has been accepted by the NCAA.

4. Requirement for Eddy current technician.

4.1 (a) Be able to read, write and converse in the English Language.

(b) Have experience, acceptable to the NCAA of a minimum of 1 year dealing with practical inspection of aircraft, or alternative training or experience acceptable to the NCAA.

(c) Have satisfactorily completed a course of instruction in Eddy current flow detection to any level of the British institute of Non destructive testing standard or any level of the American standard of Non destructive testing standards or any other requirement standards acceptable to the NCAA.

(d) Produce evidence, satisfactory to the NCAA of at least six months recent work in Eddy current inspection of aircraft.

(e) Have achieved a satisfaction standard, acceptable to the CAA, in the examination detailed in paragraph 2 to this supplement.

5. Examination Syllabus

5.1 Written Examination: The written examination will include questions on the following:

(a) Different types of crocks found on A/C
(b) Alternating Current
(c) Magnetic Folds
(d) Rejection Criteria
(e) Law Frequency Eddy Current Inspection
(f) Medium Frequency Eddy Current Inspection
(g) Heat Treatment
(h) Heat Damage
(i) Electrical Conductively
(j) Eddy Current Flaw Detection Equipments/Set up
(k) High frequency Eddy Current inspection
(l) The recognition of defect indications and the interpretation of these.
(m) Recognition of false indications.

5.2 Practical Test. Eddy Current flaw detection shall be carried out on a given number of specimens. The tests on the specimen will include the estimation of defect size.

5.3 Technical preparation. Eddy Current flaw detection technique shall be prepared in respect of a number of specimens as follows:

(a) Comprehensive inspection of one specimen

(b) Inspection for a particular defect in the remaining specimens including the design of suitable test pieces.

6. Re-examination. The NCAA may require re-examination of an Eddy Current technician at times which will be notified in writing to the approved organization.

E. APPROVAL OF WELDERS

1. **INTRODUCTION** This Chapter is applicable to persons who weld metallic parts which are essential to the airworthiness of an aircraft where the making of a sound joint by oxy-acetylene or arc-fusion welding techniques depends largely on the competency of the operator. Welders will be approved in accordance with the requirements of this Chapter and its Supplement.

NOTE: For the purposes of this Chapter 57, the term arc-fusion welding includes:

(a) Manual metal-arc (MMA) welding,
(b) Metal inert gas (MIG) welding, and
(c) Tungsten inert gas (TIG) welding.

2. **GRANT OF APPROVAL** The procedures for the issue and control of welding approval are dependent upon the circumstances of employment of the welder. For welders not employed by an NCAA approved Organisation the provisions of paragraph 2.1 (c) shall apply. Where a welder is in the employ of an Organisation approved by the NCAA, the NCAA will not undertake direct approval of the welder. The Organisation is required to establish its own effective system for the control. They system shall, as a minimum, include records of all sample tests (and results) and a ready means of establishing the current qualification status of all welders employed. All records shall be available to the NCAA upon request, including details relating to welders who have since left the employ of the Organisation. No essential records, e.g Approval Cards and Test Reports shall be destroyed without the permission of the NCAA. A description of the control system shall be included in the Company Exposition required by the relevant NCAR Chapter and NCAA approval of the system will be indicated by inclusion of the control of welders in the Schedule of Approval.

2.1 The procedures for obtaining welder's approval are as follows:

(a) Where the welder is employed by NCAA approved Organisation, that Organisation shall make arrangements for the welder to prepare and weld an appropriate test sample(s). The Organisation shall submit the test sample(s) to NCAA approved Test House for examination together with full particulars of the welder concerned, materials used, details of any post-welding treatment (e.g. heat treatment for stress relief) and identification marks on the test sample(s). Upon receipt of an Approved Test Certificate from the test house, indicating successful test results for the sample(s), the Organisation may grant approval to the welder. Only then may the welder be employed on work of significance to airworthiness.

(b) In the event of a welder leaving the employ of an Organisation approved by the NCAA, the welder may request the NCAA to grant a Welder's Approval Certificate for the welding approvals held while in the employ of that Organisation. It should be noted that grant of such an approval, is conditional upon the availability of evidence of prior qualification status, the NCAA cannot accept responsibility for a previous employer's failure or inability to provide evidence.

(c) Welders not employed by NCAA approved organisation shall, under the supervision of a responsible person acceptable to the NCAA (see Notes 1 and 2), prepare and weld appropriate test sample(s) in accordance with these requirements and also complete NCAA relevant form. The test sample(s) shall be submitted to NCAA approved Test House for examination together with full particulars of the welder concerned, materials used , details of any post welding treatment (e.g. heat treatment for stress relief) and identification marks on the test sample(s). Upon receiving from the Test House an Approved Test Certificate indicating successful test results on the sample(s) the welder shall forward the original copy of the Approved Test Certificate and the complete

NCAA relevant forms. Grant of approval will be notified by issue of an NCAA Welder's Approval Certificate and Check Test Record Card to the welder. Both documents must be maintained in a legible condition by the welder and produced or surrendered to the NCAA upon request. Test House charges and any other costs associated with the process of meeting these requirements are the responsibility of the welder.

NOTES: (1) An Approved welder is not permitted to certify welded parts unless separately qualified as a person competent to issue a Certificate of Release to service e.g. holder of an appropriate Maintenance Engineer's Licence or equivalent approval.

(2) A responsible person in the context of paragraph 2.1 (c) is either:

(a) A person who holds an Aircraft Maintenance Engineer's Licence with a Type Rating.

or

(b) A person who is currently authorised as a Signatory within the NCAA approved Organisation. (The consent of the Approved Organisation responsible for granting such authorisation should be obtained by the Signatory before agreeing to supervise the preparation of weld test sample)

or

(c) Such other person specifically authorised in writing by the NCAA.

(3) Welders' Approval Certificate issued prior to the May 1988 Revision of Chapter 4 may make reference to Sketches 3 and/or 4. All such references shall be interpreted as being equivalent to Figure 3 of the Supplement to this issue of Chapter 4.

(4) Paragraphs 2.1 (a) and 2.1 (c) refer to identification marks on test samples. These shall be made permanent i.e. stamp, vibro-etch, or indelible marking medium and they shall identify the welder and material specification. When preparing and welding the sample, care should be taken not to obliterate any markings thereon.

3. MAINTENANCE OF APPROVAL

3.1 The validity of a welder's approval may be maintained by the procedures detailed in paragraphs 3.1.1. or 3.1.2 as appropriate. Should approval be sought in a different combination (see Supplement) than that shown on the Welder's Approval Certificate or documents, the procedure for the grant of approval as prescribed in paragraph 2.1. must be followed.

3.1.1 Where the welder is employed by an Organisation approved by the NCAA, the approved Organisation shall arrange for periodic check examinations of the welder’s competency. At each periodic check examination an appropriate standard test sample (see Supplement) or such other test samples to be decided by the approved Organisation shall be completed by the welder using techniques and materials detailed in the Supplement, or by using techniques and material used in standard work practices appropriate to the maintenance of approval. For welders holding approval for more than one configuration (i.e. sheet to sheet, sheet to tube or tube to tube) it will normally only be necessary to provide a single test sample provided that the NCAA is satisfied it is representative of the welder’s main day-to-day work. However, a separate initial test sample will be required for each technique and material group specified in the welder’s approval.

Test samples shall be sent to NCAA approved Test House under arrangements made by the approved Organisation. If the test results of this examination are satisfactory the Welder’s Approval document shall be endorsed by the approved Organisation. Complete records of the periodical check examinations shall be kept at the Organisation. The check test records for each welder must indicate the date for the next check test in advance so that the test can be completed and the results known within the period of approval of the welder. All records shall be held available to the NCAA.

3.1.2 The maximum period between check examinations shall be 12 months. Organisations shall arrange for the relevant test within the period of validity of the previous test period to ensure continuity of approval.

3.1.3 If the test results are unsatisfactory, the approved Organisation shall arrange for the check examinations to be repeated immediately and the samples sent to an approved Test House for examination. During the period between any check test which proved unsatisfactory and the result of the next check test, the welder shall not weld parts which are essential to the airworthiness of an aircraft. If the test results are again unsatisfactory, the welder’s approval shall be suspended until further training and/or experience has been gained to the satisfaction of the approved Organisation and a further test has been satisfactorily completed.

3.1.4 Welders who are not employed in accordance with the conditions of paragraph 3.1.1 shall arrange for a check examination to be carried out at periods not exceeding 12 months. The same procedure as for the issue of Welder's Approval Certificate in paragraph 2.1 (c) shall apply except that, for welders holding approval for more than one configuration (i.e. sheet to sheet, sheet to tube, tube to tube) it will normally only be necessary to provide a single test sample, provided that the NCAA is satisfied it is representative of the welder's main day-to-day work. However, a separate initial test sample will be required for each technique and material group specified in the welder's approval.

3.1.5 If the test results are unsatisfactory the applicant shall prepare new test samples and arrange for the check examination to be repeated immediately at NCAA approved Test House. During the period between any check which proves unsatisfactory and the result of the next check test, the welder shall not weld parts which are essential to the airworthiness of an aircraft. If the result of the re-test is again unsatisfactory, the welder shall notify the NCAA. The approval will be suspended from the date of the first unsatisfactory examination and remain so until further training and/or experience has been gained and a further test has been satisfactorily completed.

3.1.6 A check test record must be kept to indicate the date for the next check test in advance so that the test can be completed and the result know within the period of approval of the welder. All records shall be made available to the CAA.

3.2 The NCAA may select samples of an approved welder's work at any time for additional check examination purpose.

SUPPLEMENT TO CHAPTER 57

APPROVAL OF WELDERS

1. **INTRODUCTION** Welders shall be approved in accordance with the technical requirements of this Supplement to Chapter 57.

2. **MATERIAL GROUPS** Approval may be granted in any of the following groups:

Group 1	-	Aluminium Alloys
Group 2	-	Magnesium Alloys
Group 3	-	Carbon Steels
Group 4	-	Corrosion and Heat-Resisting Steels
Group 5	-	Nickel Alloys
Group 6	-	Copper Base Alloys
Group 7	-	Titanium Alloys

2.1 For the purpose of this Supplement to Chapter 57 the following Definitions shall apply:

Combination	-	Material group, configuration and technique
Configuration	-	A sample produced to Figure 1, 2 or 3
Technique	-	The welding method e.g. oxy-acteylene or arc-fusion
Test Sample (Standard)	-	As detailed in Figure 1, 2 and 3
Test Sample (Special)	-	As dictated by the nature of work being undertaken (e.g. repair or rebuild fan blades e.t.c.)

2.2 Approval, when granted to the welder, shall be restricted to the combinations for which satisfactory examination reports from an approved Test House are available to the NCAA or the Approved Organisation, in accordance with the procedure under which the welder is to be approved, Nig. CARs Part 6 refers.

Alternatively, special test sample, agreed by the CAA or the Approved Organisation, should be prepared if required for a specific application and the approval, when granted will be restricted accordingly.

3. **TEST SAMPLES AND SPECIMENS** Standard test samples for oxy-acetylene and arc-fusion welding shall be prepared by the welder using the techniques and materials appropriate to the approval sought. The specifications of the material used for test samples must meet the requirements of the material groups defined in paragraph 2 and be representative of materials likely to be encountered by the welder in the course of his normal work. NCAA approved certificates are not necessary and material of good commercial quality may be appropriate. However, if the material used is not a British Standards or other generally recognised aerospace specification a typical aircraft application must be quoted to the NCAA approved Test House as part of the material specification. The NCAA or the Approved Organisation may decide that special test samples are required appropriate to the work to the undertaken by the welder. The preparation of test samples shall be supervised as defined in Chapter 4(E) paragraph 3.1.

3.1 **Standard Test Samples.** The standard test samples for oxy-acetylene and arc-fusion welding shall be prepared to Figure 1, 2 and 3 as appropriate.

3.1.1 The welds of test samples shall not be hammered or dressed unless specifically required.

3.1.2 The test samples shall be submitted complete and suitably identified (see Chapter 4 paragraph 2.1 Note (4) to NCAA approved Test House.

3.1.3 Where appropriate, e.g. for light aircraft structural applications, tube wall thickness may be reduced. In certain cases, where the nature of a welder's activities regularly involve welding thin wall tube, the controlling organisation or authority may require test specimen to be prepared from material of reduced wall thickness.

3.2 **Cutting Test Specimens.** Test specimens shall be cut by the approved Test House.

3.2.2 Test specimens in magnesium must be sawn from samples and filed to final shape to prevent the possibility of cracking.

4. MECHANICAL TESTING

4.1 **Tensile Test Specimens.** Tensile test specimens shall be tested to destruction in direct tension. The minimum acceptable tensile strength of the weld test specimen shall be determine by reference to public-domain DEF STAN 00-932 or by reference to NCAA recognised Design Authority who can judge the acceptable levels of weld strength required for typical applications of the weld technique in question.

4.1.1 **Sheet to Sheet Butt Weld (Figure 1)** If a tensile specimen prepared in accordance with Figure 1 should break through the weld, it is considered satisfactory only if the ultimate stress is found to be equal to, or greater than, the minimum value given in the appropriate specification.

4.1.2 **Tube to Tube Weld.** Tensile specimens prepared in accordance with Figure 3 shall be broken in a tensile test machine fitted with suitable shackles and pins, the pins being passed through the top and bottom cross tubes of the specimen so that the end load may be applied without bending.

4.2 **Bend Test Specimens (Figure 1).** Bend specimens shall be tested in bending so that the weld lies along the centre line of the bend and the base of weld 'V' is on the inner side (unless otherwise stated) over the radius of bend appropriate to the test.

4.2.1 To ensure close contact of the specimen to the bar about which it is bent, the side of the specimen remote from the weld face must be dressed by filling or grinding until the weld is level with the parent metal. It may also be necessary to dress the other face to facilitate bending. The edge of the specimen in the vicinity of the weld must be given reasonable radii.

4.2.2 Bend test specimens of austenitic steel must be given the 'weld decay' pickling test prescribed with in the relevant specification or in accordance with British Standard 5903, and must be bent through 90^0 over a radius equal to three times the normal thickness of the parent metal.

4.2.3 Magnesium alloy specimens must be bent through 180^0 over a radius equal to ten times the nominal thickness of the parent metal.

4..2.4 Aluminium alloy specimens must be bent through 180^0 over a radius equal to five times the nominal thickness of the parent metal.

4.2.5 Boron-containing steels must be bent through 180^0 over a radius equal to three times the nominal thickness of the parent metal.

4.2.6 Titanium alloy specimens must be bent through 180^0 over a radius equal to five times the nominal thickness of the parent metal.

4.2.7 Specimens of all other materials must be bent through 180^0 over a radius equal to twice the nominal thickness of the parent metal.

4.2.8 the bend tests may be considered satisfactory if the test specimen withstands the bending without showing cracks which are apparent to nominal vision.

NOTE: If interpretation of the bend results in doubt, comparison may be made with the bend test performance of a separate sample of the parent material from which the test specimens were fabricated.

5. SPECIMEN EXAMINATION

5.1 Final assessment of the weld shall be based on consideration of the sample weld as a whole, including the result obtained by visual, microscopical and where applicable, mechanical testing. If any doubt exists regarding the quality of the weld, or any defect revealed is thought to be of a local character, further sections may, if available, be examined and final assessment shall be based on all the specimens examined.

5.2 The micro specimen shall be examined at suitable magnification in the unetched and the etched condition.

5.3 the presence of intergranular oxide film is considered to be detrimental to the weld due to the embrittling effect, but the extent of these film is very difficult to determine in etched specimens. If the area of intergranular oxide is only very slight and satisfactory results are obtained by mechanical testing, further sections of the weld shall be examined before a decision is reached.

5.4 Where fillet welds are concerned, unless complete fusion is required by the drawing, a certain degree of lack of fusion is permissible at the roots:

(a) For fillet welds of 45^0 or more, the maximum lack of fusion which can normally be accepted is that revealed by a line of oxide extending from the root of the weld for a distance not greater than one-third of that between the root and the toes of the weld. Provided the amount of weld material used has been adequate, this method of assessment should ensure that the effective throat thickness of the weld is not less than the thickness of the sheets or tubes used for the specimens.

(b) For fillet welds at acute angle, full root in tubular sections can be difficult to achieve and there is a danger of collapse of the tube walls if excessive penetration is attempted. The presence of a fairly large cavity, or corresponding lack of fusion, is permissible at the root of such welds but there should be a bridge of weld metal of a reasonable throat depth, showing satisfactory fusion to the basic metal.

5.5. **Sheet to Sheet But Welds.** The section must be free from excess oxidation, burning, cracks, cavitations, porosity, scale and slag. The specimen must show adequate penetration and with specimens welded from one side only, there should be evidence of adequate penetration when underside of the weld is examined. If excessive penetration has occurred along the majority of the weld the specimen must be rejected, but isolation excrescence on the underside are permissible, provided the weld itself is free from cavities, oxide films and other defects.

F. PROCEDURE FOR APPROVAL OF ORGANISATION CONCERNED WITH DYE PENETRANT INSPECTION OF AIRCRAFT DURING MAINTEENANCE AND OVERHAUL

1. INTRODUCTION

Organisation engaged in dye penetrant inspection of aircraft during overhaul, repairs, replacement modifications and inspections may be approved to provide reports and certify compliance in respect of this work, subject to compliance with the procedures set down in this Chapter 57 and the Supplement.

2. APPLICATION: Organisation seeking approval or extension of existing approval for the dye penetrant work described in paragraph 1 shall make written application to NCAA Directorate of Airworthiness Standards.

3. Requirement for Grant of Approval

3.1 The dye penetrant inspection Department shall be organised under the direction of a person who has satisfied the requirements of the Supplement to this Chapter.

3.2 All dye penetrant inspection shall be directly supervised and final certification made by a person who has satisfied the requirements of the Supplement to this Chapter. Certification shall be in a form agreed by the NCAA.

3.3 Dye penetrant inspections concerned with the inspection required in approval manuals, approved maintenance programme, the NCAA Mandatory Aircraft Modifications and inspections summary and Foreign Airworthiness Directives volumes shall be made in accordance to techniques approved by the manufacturer or on appropriately approved organisation unless an alternative technique has been accepted by the NCAA.

SUPPLEMENT TO CHAPTER 57 (F)

PROCEDURE FOR APPROVAL OF ORGANISATION CONCERNED WITH DYE PENETRANT INSPECTION OF AIRCRAFT DURING MAINTEENANCE AND OVERHAUL

Requirement for the Dye Penetrant Technician

The following shall be satisfied by the person(s) required under paragraph 3.1 and 3.2 of Chapter 57 (F) above.

(a) Be able to read, write and converse in the English Language
(b) Have experience, acceptable to NCAA of a minimum of 6 months dealing with practical inspection of aircraft or alternative training or experience acceptable to the NCAA.
(c) Have satisfactorily completed a course of instruction in Dye Penetrant Inspection acceptable to the NCAA.
(d) Produce evidence, satisfactory to the NCAA of at least six months recent work in Dye penetrant inspection of aircraft.

(f) Having achieved a satisfactory standard, acceptable to the NCAA in the examination detailed in paragraph 2 of this Supplement.

2. EXAMINATION SYLLABUS

2.1 (a) Types of dye penetrant
(b) Types of penetant indications and the interpretation of those
(c) Capillary actions
(d) A/C Materials
(e) Dye penetrant Equipments/set-up[
(f) Scope and limitations of dye penetrant inspection
(g) Methods of administering dye penetrant inspection on aircraft surfaces.
(h) Recognition of false indications.

NOTE: Approach to the above subject should be practical

2.2 **Practical Test**: Dye penetrant flaw detection shall be carried out on a given number of specimens.

2.3 **Technical Preparation:** Dye penetrant inspection techniques shall be prepared in respect of a number of specimens as follows:
(a) Comprehensive inspection of one specimen
(b) Inspection for a particular defect in the remaining specimens including the design of suitable test pieces.

3. **Re-Examination:** The NCAA may require re-examination of an dye penetrant technician at times which will be notified in writing to the approved organisation.