

**MWI 3410.5**

**REVISION A**

**EFFECTIVE DATE: AUGUST 28, 2018**

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# **MARSHALL WORK INSTRUCTION**

**QD01**

## **PERSONNEL CERTIFICATION PROGRAM FOR SKILLS**

**COMPLIANCE IS MANDATORY**

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### DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Change/ Revalidation/ Canceled)	Document Revision/ Change	Effective Date	Description
Baseline		7/29/2015	This new MWI was developed to separate the requirements for "Skills" certifications from MWI 3410.1, "Personnel Certification Program." The MWI 3410.1 originally contained requirements for both "Safety" and "Skills" certifications. Due to the MWI 3410.1 becoming an increasingly large document, it was recommended and approved to develop a new MWI for the "Skills" requirements.
Revision	A	8/28/2018	Updated the "Applicable Documents" section and TABLE CH3-1, EPS TRAINING REQUIREMENTS (RQMT) (minimum hours), to comply with latest version of the Agency-level standard NASA-STD-8739.6, Implementation Requirements For NASA Workmanship Standards. Deleted CH3.4.4.4, "When necessary, the SMA Certifying Officer shall extend or limit the certification period based on recommendations of the individual's supervisor." and CH3.4.4.5, "Extensions shall not exceed 6 months."  Rationale for Change: The latest version of the Agency-level standard NASA-STD-8739.6, Implementation Requirements For NASA Workmanship Standards, has eliminated the option for certification extensions. This change is also necessary to close-out an April 2018 QAAR audit finding per Audit Card 026, NCR #1883.

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## **1. PURPOSE**

To describe the Personnel Certification Program process and provide instructions to implement the certification requirements for skills associated with approved standards or documents as specified per NPD 8730.5, NASA-STD-8739.6, NASA-STD-6016, QD-QA-022, as well as MPR 3410.1.

*NOTE: For personnel training/qualification which does not require certification, also reference MPR 3410.1.*

## **2. APPLICABILITY**

2.1 This MWI applies to Center personnel, programs, projects, and activities, including contractors and resident agencies to the extent specified in their respective contracts or agreements. (“Contractors,” for purposes of this paragraph, include contractors, grantees, Cooperative Agreement recipients, Space Act Agreement partners, or other agreement parties.)

2.2 This MWI applies to the MAF civil service personnel who perform skills identified in Chapters 1, 2, 3, and 4.

2.3 This MWI applies the following: all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms: “may” or “can” denote discretionary privilege or permission, “should” denotes a good practice and is recommended, but not required, “will” denotes expected outcome, and “are/is” denotes descriptive material.

2.4 This MWI applies the following: all document citations are assumed to be the latest version unless otherwise noted.

2.5 This MWI applies to MSFC civil service and Safety and Mission Assurance (SMA) contractor personnel who perform skills identified in Chapters 1, 2, 3, and 4.

*NOTE: The applicability of the MWI may be extended to other contractors who require personnel to perform skills identified in Chapters 1, 2, 3, and 4 if specified in their contract, or with prior agreement between the MSFC Contracting Officer (CO) and the SMA Safety and Quality Department. Specific contracts or projects may have additional requirements.*

## **3. AUTHORITY**

3.1 NPD 8730.5, NASA Quality Assurance Program Policy

3.2 NASA-STD-6016, Standard Materials and Processes Spacecraft

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#### **4. APPLICABLE DOCUMENTS AND FORMS**

- 4.1 NPR 8715.3, NASA General Safety Program Requirements
  - 4.2 NAS 410, NAS Certification and Qualification of Nondestructive Test Personnel
  - 4.3 NASA-STD-8739.1, Workmanship Standard for Polymeric Application on Electronic Assemblies
  - 4.4 NASA-STD-8739.4, Crimping, Interconnecting Cables, Harnesses, and Wiring
  - 4.5 NASA-STD-8739.6, Implementation Requirements for NASA Workmanship Standards
  - 4.6 MPR 3410.1, Training
  - 4.7 NRRS 1441.1, NASA Records Retention Schedules
  - 4.8 MSFC-RQMT-2918, Requirements for Electrostatic Discharge Control
  - 4.9 QD-QA-022, Visual Weld Inspection
  - 4.10 ASNT EN 473, Nondestructive Testing (NDT), Qualification and Certification of NDT Personnel, General Principles
  - 4.11 AWS B5.1, Specification for the Qualification of Welding Inspectors
  - 4.12 AWS QC1, Standard for AWS Certification of Welding Inspectors
  - 4.13 IPC J-STD-001, Requirements for Soldered Electrical and Electronic Assemblies
  - 4.14 IPC J-STD-001\*S, Space Applications Electronic Hardware Addendum to IPC J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies
- NOTE: The asterisk character (\*) is used in this citation as a placeholder to signify the latest revision of the basic document (J-STD-001). The "S" signifies that this is the Space Applications Addendum for that basic document.*
- 4.15 ISO 9712, Nondestructive Testing, Qualification and Certification on NDT Personnel
  - 4.16 ISO 18490, Non-destructive testing – Evaluation of vision acuity for NDT Personnel
  - 4.17 MSFC Form 4083, Personnel Certification
  - 4.18 MSFC Form 4293, Eye Exam Certification

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## 5. INSTRUCTIONS

### 5.1 Certification Process

5.1.1 Supervisors determine which skilled operations are necessary for their employees to perform required job functions. Employees selected by their supervisors shall successfully complete the associated training and meet the minimum scoring for the skills that require certification as specified within the appropriate Chapters of this MWI. Supervisors can use the Safety, Health & Environmental (SHE) Training Assessment Questionnaire within the CERTRAK webpage to assist with determining the skills certification training needed for their employees. Use the SHE Training Assessment website to access the questionnaire.

*NOTE: For access to the SHE Training Assessment website, use the following links: Starting from the Explornet Homepage, select the Search icon (i.e., magnifying glass on right side of screen) and type "SHE", select the Safety, Health & Environmental – SHE link, under the PLACES tab on the right side of screen, select Safety Tools & Apps, under the Available Tools tab launch CERTRAK (MSFC), once within the CERTRAK webpage select the "Jobs" drop-down menu, then select "Assessment", afterwards choose "Worker Type" (i.e., Office Worker or Non-Office Worker) then proceed through the training questions.*

5.1.2 For Skills certifications, the Center's Certifying Officer and Certification Administrator (CA) shall be identified by and reside in the Quality Assurance Branch.

5.1.3 The Center's CA, designated by the Quality Assurance Branch, shall perform the administrative functions for skills certifications.

5.1.4 The Center's Certifying Officer, designated by the Quality Assurance Branch, shall sign-off on the final approval for personnel requiring skills certifications.

### 5.2 Skills Certification

5.2.1 Skills certifications shall be required for, but not limited to, the skills identified in Chapters 1, 2, 3, and 4 of this MWI.

5.2.2 Certification for all skills/tasks shall meet the requirements of the process/workmanship specifications, or other certification instructions.

5.2.3 For Skills certifications, in the absence of established training, experience requirements, or certification intervals, the proficiency examiner or technical advisor shall recommend the appropriate requirements to the Center's Certifying Officer within the Quality Assurance Branch.

5.2.4 Other process/workmanship skills that require certification shall be identified to the Center's Certifying Officer within the Quality Assurance Branch.

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5.2.5 Supervisors of MSFC employees and SMA Contractor Certifying Officers shall submit the following documentation package to the Center’s Certifying Officer, within the Quality Assurance Branch, in order to complete the skills certification process: 1) MSFC Form 4083; 2) MSFC Form 4293; and 3) documented evidence (certificate of completion, test score results, etc.) of demonstrated proficiency per requirements of the governing standards for the skills identified in Chapters 1, 2, 3, and 4 of this MWI. An equivalent visual acuity record from a qualified eye examiner can be an acceptable substitute for the MSFC Form 4293.

5.2.6 MSFC Form 4293 or an equivalent visual acuity record from a qualified eye examiner shall not be required for electrostatic discharge (ESD) certifications per Chapter 3.

5.2.7 SMA Contractor Certifying Officers shall review and sign-off on the MSFC Form 4083 providing the initial approval of their personnel that require skills certifications while performing specific job assignments or tasks.

5.2.7.1 Afterwards, the documentation package shall be forwarded to the Center’s Certifying Officer within the Quality Assurance Branch for final approval.

5.2.8 Contractors, excluding SMA contractor personnel, shall establish and maintain their own database system as the official record for skills certifications of their employees.

5.2.9 Contractors shall maintain and track the official records for skills certifications of their employees to reflect current certification status.

5.2.10 Official records for skills certifications of contractor employees shall be available for review upon request.

### 5.3 Proficiency Test

5.3.1 Employees shall demonstrate proficiency per the requirements of the governing standards for the skills certifications identified in Chapters 1, 2, 3, and 4 of this MWI.

5.3.2 Employees who do not successfully pass all required proficiency tests/examinations (written, hands-on, or both) shall not be qualified, nor approved for skills certifications.

### 5.4 CERTRAK Access

5.4.1 Certified personnel, quality representatives, and supervisors who have been granted approval through IdMAX shall be able to access CERTRAK.

5.4.2 Employee certifications can be viewed from the SHE Web page with an IdMAX password.

*NOTE: For CERTRAK access, use the following web-site links: Starting from the Explornet Homepage, select the Search icon (i.e., magnifying glass on right side of*

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*screen) link, select the Safety, Health & Environmental link, Under the Safety tab on the right side of screen, select Safety Tools & Apps, Launch CERTRAK (MSFC).*

## 5.5 Employee Certification

5.5.1 Employees shall not be considered certified for skills certifications until all required proficiency tests/examinations have been completed with a minimum passing score as specified within the appropriate Chapters of this MWI.

5.5.2 Employees can be considered certified for skills certifications prior to being listed in CERTRAK. This applies to Electrical/Electronic certifications only.

5.5.3 Employee certification shall be verified by any of the following methods:

5.5.3.1 A printout from CERTRAK maintained by the employee, supervisor, or quality representative listing their certification as current.

5.5.3.2 Employee listed within the CERTRAK electronic database identifying current certifications, or a copy of the training certificate of completion can serve as objective evidence of certification as well. This applies to Electrical/Electronic certifications only.

5.5.4 Contractors, excluding SMA contractor personnel, shall establish the certification process for their own employees.

## 5.6 On-the-Job Training (OJT)

5.6.1 For Nondestructive Evaluation/Nondestructive Testing (NDE/NDT) certifications, documented evidence of OJT (i.e., work experience) shall be maintained in logbooks, which can be in hard copies or electronic formats.

5.6.2 The logbooks shall be maintained and stored within the cognizant NDT organization.

5.6.3 The logbooks shall be available for inspection upon request.

## 5.7 Medical Examinations

5.7.1 Medical examinations (i.e., visual acuity tests) shall be required for skills certifications identified in Chapter 1, 2, 3, and 4 of this MWI, excluding ESD certifications.

5.7.2 Medical examinations (i.e., visual acuity tests) required for skills certifications identified in Chapters 1, 2, 3, and 4 of this MWI shall be conducted at the MSFC Medical Center or by a qualified eye examiner.

5.7.3 Medical examinations (i.e., visual acuity tests) required for skills certifications identified in Chapters 1, 2, 3, and 4 of this MWI shall be performed annually.

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5.7.4 Employees that fail the medical examinations (i.e., visual acuity tests) required for skills certifications identified in Chapters 1, 2, 3, and 4 of this MWI shall not be approved until the visual acuity requirements have been met.

## **6. CANCELLATION**

None.

*Original signed by*

Jody Singer  
Acting Director

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## CHAPTER 1

### SKILLS THAT REQUIRE CERTIFICATION

CH1.1 Skills that require certification are identified in Table CH1-1 below.

<b>TABLE CH1-1: <u>SKILLS THAT REQUIRE CERTIFICATION</u></b>		
<b>SKILL/TASK</b>	<b>REQUIREMENTS</b>	<b>SHE COURSE NUMBERS</b>
Liquid Penetrant Testing	Chapter 2	SHE 401
Magnetic Particle Testing	Chapter 2	SHE 402
Eddy Current Testing	Chapter 2	SHE 403
Ultrasonic Testing	Chapter 2	SHE 404
Radiographic Testing (Film, NonFilm, or both)	Chapter 2	SHE 405
Thermal/Infrared Testing (Thermography)	Chapter 2	SHE 406
Visual Testing	Chapter 2	SHE 407
Certified Welding Inspectors	Chapter 4	SHE 408
Soldering including SMT	Chapter 3	SHE 410
Staking and Conformal Coating	Chapter 3	SHE 411
Cabling, Harnessing, and Wiring	Chapter 3	SHE 412
Crimping	Chapter 3	SHE 412
ESD Control	Chapter 3	SHE 413
Shearography	Chapter 2	SHE 421

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## CHAPTER 2

### **NAS CERTIFICATION AND QUALIFICATION OF NONDESTRUCTIVE TEST PERSONNEL**

#### **Written Practice in Accordance with *National Aerospace Standard (NAS) 410***

#### **CH2.1 Purpose**

This written practice establishes the minimum requirements for qualification and certification of MSFC personnel who perform nondestructive testing (NDT), nondestructive inspection (NDI), or nondestructive evaluation (NDE) while in the employment of NASA. These requirements cover education, training, experience level, qualification, examination, and certification of NDT personnel. This written practice establishes the qualification, maintenance of skill levels, and proficiency examination (test) requirements of individuals seeking initial certification or recertification to the following levels for each NDT method:

- Level 1
- Level 2
- Level 3

NOTE: Issuance of certifications for all levels of NDE/NDI/NDT personnel is the responsibility of the employer. Also for the purposes of this written practice, the term NDT will be used and will be considered equivalent to NDI and NDE.

This written practice addresses the procedural details necessary for the employer (MSFC) to implement an NDT qualification and certification program and incorporates the details of the NDT qualification and certification process, including:

- The levels of qualification and certification used by the employer
- Personnel duties and responsibilities
- Training and experience requirements
- Certification and recertification requirements
- Records and record keeping requirements
- Requirements for expiration, suspension, revocation and reinstatement of certifications
- Process for annual maintenance [This is a new requirement per NAS 410 (Revision 4)]

CH2.1.1 Applicability. This written practice applies to MSFC personnel performing NDT methods to test and/or accept materials, products, components, or systems related to flight hardware, flight-associated hardware, mission-essential or critical ground support equipment, piping, and pressure vessels. This also applies to NDT personnel who are responsible for offering technical assistance to contractors, other NASA Centers, and Project Offices. This written practice is not intended to apply to individuals who only have administrative duties, or

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supervisory authority over NDT personnel, or to individuals performing research and development of technology slated for subsequent implementation and approval by a certified Level 3. This written practice does not apply to personnel who perform radiographic inspection of electrical, electronic, and electromechanical parts.

CH2.1.2 Common Methods. The NDT methods covered by this written procedure are: Liquid Penetrant testing (PT), Magnetic particle testing (MT), Thermography Testing (IRT: both Thermal/Infrared), Shearography Testing (ST), Eddy current testing (ET), Ultrasonic testing (UT), Radiographic testing (RT; Film, NonFilm, or both), as used in accordance with the applicable codes, standards, specifications, and regulations for that method.

CH2.1.3 Other Methods. This written practice also applies to other NDT methods such as acoustic emission, computed tomography, terahertz imaging, backscatter x-ray, magnetic resonance imaging, microwave testing, or any other NDT method that can be used to determine the acceptability of materials, products, components, or systems related to flight hardware, flight-associated hardware, mission-essential or critical ground-support equipment, piping, and pressure vessels. The requirements for personnel education, training, experience, and examination for these other methods shall be established by the cognizant NDT organization. Guidelines established for the methods listed in CH2.1.2 are acceptable for use.

## **CH2.2 Delineation of NDT Responsibilities at MSFC**

The delineation of roles associated with the NDT responsibilities at MSFC between the organizations will be with Materials & Processes Lab (EM) being responsible for research and development of NDT techniques and hardware and establishing NDT requirements, and SMA being responsible for the implementation of established NDT requirements. Both organizations will procure and maintain equipment and facilities required to implement their responsibilities. Existing equipment and facilities will be shared with priority being given to certification or acceptance of hardware. The following further describes the responsibilities of each of these organizations:

CH2.2.1 The Material & Processes Lab organization shall be responsible for the following:

CH2.2.1.1 Establishing and defining NDT requirements, specifications, and instrumentation for inclusion in MSFC programs.

CH2.2.1.2 Planning, conducting, directing, and/or coordinating NDT methods research and development conducted on behalf of MSFC programs, including the supporting research and technology applications engineering conducted by contractors on behalf of MSFC programs.

CH2.2.1.3 Performance of diagnostic NDT in support of EM conducted processes, materials, hardware investigations, and development endeavors.

CH2.2.1.4 Assume lead role for technical assessment and approval of MSFC contractor's selection and specification of NDT methods and processes.

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CH2.2.1.5 As required by the results of paragraphs CH2.2.1.1 and CH2.2.1.2 above, special training will be conducted or coordinated by the Materials & Processes Lab.

CH2.2.2 The SMA organization shall be responsible for the following:

CH2.2.2.1 Witness the performance of NDT methods associated with the formal acceptance of hardware fabricated or processed within MSFC facilities.

CH2.2.2.2 Verification that NDT requirements are appropriately identified on hardware drawings.

CH2.2.2.3 Verifying the implementation of NDT requirements, methods and processes.

CH2.2.2.4 Monitoring of MSFC programs contractors implementation of NDT methods, assuring that those NDT methods, specifications, and procedures are effectively implemented.

CH2.2.2.5 Maintenance of a training and certification program for SMA and Materials & Processes Lab personnel engaged in formal implementation of NDT methods, and assurance that contractor personnel so engaged are also trained and certified.

### **CH2.3 Requirements of Qualification**

There are four basic levels of qualification that apply to NDT personnel employed by NASA at MSFC: Trainee, Level 1, Level 2, and Level 3. The requirements in section CH2.2 and CH2.3 shall be met before certification can be issued.

CH2.3.1 Trainees shall:

CH2.3.1.1 Obtain work experience under the guidance of a certified Level 2 or Level 3 in that same method.

CH2.3.1.2 Not independently conduct tests.

CH2.3.1.3 Not make acceptance or rejection decisions.

CH2.3.1.4 Not independently perform any other NDT function.

CH2.3.2 Level 1 individuals shall:

CH2.3.2.1 Have the skills and knowledge to process parts and perform equipment standardization in accordance with written procedures approved by the appropriate Level 3.

CH2.3.2.2 Have the skills and knowledge to carry out any necessary preparation of parts before or after inspection in accordance with written procedures approved by the appropriate Level 3.

CH2.3.2.3 Be able to follow written procedures and instructions in the methods for which certified.

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CH2.3.2.4 Receive guidance or supervision from Level 2 or Level 3 in that method when necessary.

CH2.3.2.5 Pass the Level 1 training course for the method in which certification is sought.

CH2.3.3 Level 2 individuals shall:

CH2.3.3.1 Have the skills and knowledge to set up and standardize equipment, conduct tests, interpret and evaluate for acceptance or rejection, and document results.

CH2.3.3.2 Be thoroughly familiar with the scope and limitations of the method in which they are certified.

CH2.3.3.3 Be capable of providing the necessary guidance and/or supervision to trainees and Level 1 personnel in the method in which they are certified.

CH2.3.3.4 Be familiar with the codes, standards, procedures, and other documents that control the method of inspection as utilized by NASA.

CH2.3.3.5 Be capable of developing written instructions from approved general procedures.

CH2.3.3.6 Have a basic knowledge of product manufacturing and inspection technology.

CH2.3.3.7 Pass the Level 2 training course for the method in which certification is sought.

CH2.3.4 Level 3 individuals shall:

CH2.3.4.1 Have the skills and knowledge to interpret codes, standards, and other governing documents that control the NDT method(s) as utilized by NASA.

CH2.3.4.2 Be capable of assuming technical responsibility for the NDT facilities related to a specific method of inspection.

CH2.3.4.3 Be capable of selecting the method and technique for a specific inspection.

CH2.3.4.4 Be capable of preparing and verifying the adequacy of procedures in the method certified.

CH2.3.4.5 Approve NDT procedures and other NDT related work instructions for technical adequacy in the method in which they are certified.

CH2.3.4.6 Approve written instructions developed by Level 2 personnel.

CH2.3.4.7 Have a general knowledge of other NDT methods and product technologies utilized by NASA.

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CH2.3.4.8 Be capable of providing or directing training, examination, and qualification of personnel in the method in which they are certified.

CH2.3.4.9 Conduct NDT for the acceptance or rejection of parts only when a demonstration of proficiency in this method was included in the practical examination.

CH2.3.4.10 When required, be capable of auditing contractors to ensure that NDT requirements of NAS 410, and other governing documents, are met.

CH2.3.4.11 Pass the Level 3 training course for the method in which certification is sought.

CH2.3.5 NDT Instructors or Examiners shall have the skills and knowledge to plan, organize, and present classroom training, practical exercises, or OJT in accordance with approved course outlines. This function is usually performed by an outside agency responsible for training. When necessary, Level 3 personnel may be designated in writing by the Responsible Level 3 to serve as NDT Examiners for applicable NDT method(s).

CH2.3.6 Responsible Level 3 individuals shall:

CH2.3.6.1 Be identified in writing by the employer.

CH2.3.6.2 Be certified as a Level 3 prior to receiving the “Responsible Level 3” designation by the employer.

CH2.3.6.3 Be responsible for the implementation of this written practice and the overall administration of the qualification and certification program per applicable NDT method(s).

CH2.3.6.4 Be knowledgeable of the specifications, standards, codes, techniques, and products associated with the aerospace industry and used by the employer.

## **CH2.4 Training and Experience**

CH2.4.1 Candidates for certification as Level 1, Level 2, or Level 3 shall complete sufficient organized classroom training, as administered by the outside agency, to become proficient with the principles and practices of the applicable inspection method(s).

CH2.4.2 Training shall be conducted in accordance with a detailed course outline approved by the cognizant NDT organization.

CH2.4.3 At a minimum, the training shall cover basic theory, test principles, products, equipment operation and calibration, safety, operating procedures, applicable techniques, applicable specifications, codes, and written instructions used by NASA.

CH2.4.4 The course outline shall include a list of references from which the training material is derived.

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CH2.4.5 General, Specific, and Practical examinations shall be administered by an outside organization or the responsible Level 3.

#### CH2.4.6 Outside Agency

CH2.4.6.1 If an outside agency is used to provide training, the Responsible Level 3 shall verify that the training meets the employer's requirements.

CH2.4.6.2 The outside agency shall provide the SMA Certifying Officer with the names, qualifications, and certifications held by the instructors and test administrators contracted in the examination and training process. This information can be documented on the composite examination/test report provided to the student after successfully passing NDT training courses.

CH2.4.6.3 The outside agency can qualify but not certify employer personnel.

#### CH2.4.7 Health and Safety Training

CH2.4.7.1 All regulations relating to hazardous substances, accident prevention and safe working practices shall be strictly adhered to.

CH2.4.7.2 Safety-related training requirements shall be determined in accordance with local codes and regulations, and NPR 8715.3 as applicable (e.g., ionizing radiation).

CH2.4.7.3 Prior to certification, all candidates seeking qualification for radiography testing shall have received instructions and classroom or on-line training on the hazards and safety requirements associated with ionizing radiation and be familiar with applicable regulations and laws.

CH2.4.7.4 The training on hazards and safety requirements associated with ionizing radiation shall be initially approved by the Radiation Safety Officer prior to use.

CH2.4.7.5 Safety-related training shall be provided by NASA.

#### CH2.4.8 Minimum Required Classroom Training Hours

CH2.4.8.1 Candidates for certification to all levels shall complete sufficient formal training to become proficient with the principles and practices of the applicable test method and technique(s) and be capable of carrying out the duties specified in Section CH2.3 titled Requirements of Qualification, as applicable for a Trainee, Level 1, Level 2, or Level 3.

CH2.4.8.2 Formal training shall be conducted prior to, or in conjunction with, OJT training.

CH2.4.8.3 All completed NDT training shall be documented. The minimum training hours for Level 1 and Level 2 are given in Tables CH2-1 and CH2-1A for the specified methods.

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CH2.4.8.4 Individuals shall not be certified to Level 3 without having prior certification to Level 2 in the method.

CH2.4.8.5 Forty (40) additional hours of training is required for current certified Level 3 radiography personnel transitioning to either film or non-film radiography.

CH2.4.8.6 General, specific and practical training may be obtained with the employer or outside agency but shall always be supplemented by practical OJT training with the employer.

<b>TABLE CH2-1: Minimum Formal Training Hours</b>			
METHOD	LEVEL 1	LEVEL 2 (with previous Level 1 experience)	LEVEL 2 (without previous Level 1 experience)
PT	16	16	32
MT	16	16	32
Thermal/Infrared (IRT)	20	40	60
ST	20	40	60
ET	40	40	80
UT	40	40	80
RT (Film or NonFilm)	40	40	80
RT (Film and NonFilm)	60	60	120

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<b>TABLE CH2-1A: RT Formal Training Hours for Transition to Film and NonFilm</b>		
<b>Additional Formal Training Hours</b>		
LEVEL 1	LEVEL 2 (with previous Level 1 experience)	LEVEL 2 (without previous Level 1 experience)
20	40	80

#### CH2.4.9 Minimum Work Experience

CH2.4.9.1 Candidates for Level 1, Level 2, or Level 3 certification shall have sufficient practical hands-on experience to assure they are capable of performing the duties of the level for which certification is sought.

CH2.4.9.2 The minimum experience requirements for Level 1 and Level 2 are provided in Table CH2-2, while the minimum requirements for Level 3 are provided in Table CH2-3.

<b>TABLE CH2-2: Minimum Practical Work Experience Hours</b>			
METHOD	EXPERIENCE TIME IN HOURS		
	LEVEL 1 (with Trainee experience)	LEVEL 2 (with previous Level 1 experience)	LEVEL 2 (without prior Level 1 experience)
PT	130	270	400
MT	130	400	530
Thermal/Infrared (IRT)	200	600	800
ST	200	600	800
ET	200	600	800
UT	200	600	800
RT (Film or NonFilm)	200	600	800
RT (Film and NonFilm)	220	780	1000

<b>TABLE CH2-2A: RT Experience Requirements for Transition to Film and NonFilm</b>		
<b>Additional Minimum Experience Time in Hours</b>		
LEVEL 1	LEVEL 2 (with previous Level 1 experience)	LEVEL 2 (without previous Level 1 experience)
20	200	800

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CH2.4.9.3 Additional experience requirements for current Level 3 radiography personnel transitioning to either film or non-film radiography are 240 hours with guidance or supervision from an examiner, instructor, or outside agency.

<b>TABLE CH2-3: Minimum Education and Work Experience Hours for Level 3 in Common Methods</b>	
EDUCATION	LEVEL 2 EXPERIENCE
High School	4 years
Two years of engineering or science study at an accredited technical school, college, or university	2 years
Graduate or at least successful completion of at least 3 years accredited science or engineering program	1 year

## **CH2.5 Examinations**

CH2.5.1 Examinations to verify near vision, color perception, and technical qualifications of candidates shall consist of a visual acuity examination, a general examination, a specific examination, and a practical (and/or written for Level 3) examination for each method in which the candidate is to be certified.

CH2.5.2 The requirements for the vision examination, the questions used for the general and specific examinations, and the checklist for the practical examination shall be available for review by the SMA Certifying Officer.

### **CH2.5.3 Visual Acuity**

CH2.5.3.1 All candidates for certification shall be given an annual vision examination by the MSFC Medical Center and meet the near vision and color perception requirements listed in Table CH2-4. Any of the near vision test options listed in Table CH2-4 will be acceptable.

CH2.5.3.2 Near vision and color perception tests shall be administered prior to certification or recertification.

CH2.5.3.3 The results shall be documented on MSFC Form 4293, "Eye Exam Certification" or an equivalent visual acuity record, and submitted to MSFC Safety and Quality Department.

CH2.5.3.4 Any limitations in color perception shall be evaluated by the Responsible Level 3 prior to certification and approved in writing.

CH2.5.3.5 For Ultrasonic and Eddy Current methods, this requirement can be relaxed to Jaeger No. 2, provided it is approved and documented by the responsible Level 3.

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<b>TABLE CH2-4: Vision Requirements</b>	
<b>EXAM</b>	<b>REQUIREMENTS</b>
Near Vision Options	<ul style="list-style-type: none"> <li>• Tumbling E in accordance with ISO 18490</li> <li>• 20/25 (Snellen) at 16 inches [40.64 centimeters (cm)] +/- 1 inch (2.54 cm) or equivalent in at least one eye, natural or corrected</li> <li>• Jaeger No. 1 at not less than 12 inches (30.48 cm) in at least one eye, natural or corrected</li> </ul>
Color Perception	Personnel shall be capable of distinguishing red, green, blue, and yellow colors as prescribed in Dvorine Charts, Ishihara Plates, or American Optical Hardy-Rand-Rittler (AO-HRR) Tests

#### CH2.5.4 General Examination

CH2.5.4.1 The general examination for all Levels shall be a closed-book examination consisting of questions that comprise a cross-section of the applicable method at the appropriate Level.

CH2.5.4.2 A minimum of 40 questions shall be administered for Level 1, Level 2, or Level 3.

CH2.5.4.3 For Level 3, the questions shall address the general knowledge of other NDT methods used by NASA, as well as the method in which certification is sought. Possession of a current ASNT, EN 473, or ISO 9712 Level 3 NDT certificate of completion can be satisfactory evidence that the General examination requirements have been met.

#### CH2.5.5 Specific Examination

CH2.5.5.1 The specific examination for all Levels shall consist of an examination containing questions that cover the requirements and use of the specifications, codes, operating procedures, equipment, science of the method, and test techniques that the candidate may use while employed by NASA.

CH2.5.5.2 A minimum of 30 questions shall be administered for Level 1, Level 2, or Level 3. Reference materials, such as specifications, tables, formulas, and other technical documents, can be used as needed.

#### CH2.5.6 Practical Examination

CH2.5.6.1 The practical examination shall consist of a demonstration of proficiency in performing tasks that are associated with the candidate's duties. Test samples used in the examination can be actual hardware or can be general test samples provided by the outside agency or the responsible Level 3.

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CH2.5.6.2 A checklist shall be developed by the outside agency or the responsible Level 3 administering the examinations to assist in the grading process.

CH2.5.6.3 Level 1 Practical

- a. At least two test samples shall be processed for each method.
- b. Test samples shall be representative of the products to be encountered by the candidate while performing their job duties with NASA.
- c. The checklist used for grading purposes shall address proficiency in the use and calibration of equipment and materials and adherence to procedural details.
- d. The results of the Practical examination shall be documented.

CH2.5.6.4 Level 2 Practical

- a. At least two test samples shall be inspected, evaluated, and the results interpreted and documented for each method.
- b. Test samples shall be representative of the products to be encountered by the candidate while performing their job duties with NASA.
- c. The checklist used for grading purposes shall address proficiency in the use and calibration of equipment and materials, adherence to procedural details, and the accuracy and completeness of interpretation and evaluation of indications, and, when applicable, the ability to develop written instructions.
- d. The results of the Practical examination shall be documented.

CH2.5.6.5 Level 3 Practical

- a. For a Level 3 candidate not performing actual inspections or evaluations of hardware, the candidate shall demonstrate proficiency by preparing a written procedure for the operation of equipment used to perform an inspection including setup, calibration, and acquisition of data.
- b. If the duties of a Level 3 candidate include the operation of inspection equipment and/or evaluation of hardware, the candidate shall demonstrate proficiency in performing such tasks to the degree as defined for a Level 2.
- c. The checklist used for grading purposes shall address the practical and technical adequacy of the procedures prepared by the candidate and, when applicable, the adequacy of the interpretation and evaluation of indications.

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d. The results of the practical examination shall be documented.

#### CH2.5.7 Administration of Examinations

CH2.5.7.1 The administration and grading of all examinations shall be the responsibility of the Responsible Level 3 or Examiner.

a. The Responsible Level 3 or Examiner may delegate in writing the administration and grading of examinations using multiple choice or true/false type questions to non-Examiner personnel.

b. All practical examinations shall be administered by the Responsible Level 3 or Examiner.

(1) Responses to essay and fill-in questions shall be evaluated by the Responsible Level 3 or Examiner to verify the candidate's adequate understanding of the subject matter.

c. In no case can an examination be administered by one's self or by a subordinate.

d. When an outside agency is used to administer examinations, the employer shall ensure that all individuals involved in the administration of the examinations meet the requirements of this standard (i.e., written practice).

e. In all cases, the ultimate responsibility for compliance to this standard (i.e., written practice) shall remain with the employer.

#### CH2.5.7.2 Grading

a. The candidates for certification shall achieve a minimum grade of 70 percent on the General and Specific examinations.

b. The candidate shall detect all discontinuities and/or meet the conditions specified in this document during the practical examination and achieve a minimum score of 70 percent.

c. The candidate shall have a composite score of no less than 80 percent in order to be qualified for certification.

d. All examination scores shall be of equal weight in determining the composite score.

e. If a certificate of qualification is accepted as fulfilling part of this examination process and grading was issued as "pass/fail," the value for "pass" used for the composite score shall be 80 percent.

#### CH2.5.7.3 Re-Examination

a. Candidates who fail any General, Specific, or Practical examination shall receive additional training prior to re-examination of the failed exam.

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b. The re-examination shall not use the same written test or test sample that was used in the initial examination.

c. The re-examination shall contain a minimum of 25 percent new questions.

## **CH2.6 Certification**

### CH2.6.1 General

CH2.6.1.1 Personnel who have demonstrated they possess the proper qualifications are eligible for NDT certification by NASA/MSFC, in accordance with this written practice.

CH2.6.1.2 Certification is not required for individuals who are trainees.

### CH2.6.2 Records

CH2.6.2.1 SMA shall maintain certification records for personnel for as long as their certifications are in effect.

CH2.6.2.2 Records shall be made available for review during audits.

CH2.6.2.3 The records shall include, as a minimum:

- a. Name of the individual certified.
- b. Level and method for which the individual is certified.
- c. The latest written and practical exams and scores, and scores from previous exams the individual has taken.
- d. If the Credit System per Section CH2.7 is used, documentation of credit points used for Level 3 recertification. Last written and practical examinations need not be maintained.
- e. Date and expiration of current certification(s).
  - (1) Suspended or revoked certification(s) shall be documented for reason and date.
  - (2) If applicable, date and action to reinstate certification(s) shall also be documented.
- f. A record of all previous NDT certifications (per each method) with NASA/MSFC.
- g. Training history which identifies source, type of training, dates of training, and course hours.
- h. Work experience history, including any previous certifications, both with current and previous employers sufficient to justify satisfaction of experience requirements for qualification

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in accordance with this written practice.

- i. Results of a current visual acuity and color perception examination.
- j. Extent and documentation of formal education, when used to meet qualification requirements.
- k. The name and signature of the SMA Certifying Officer issuing the certification.

CH2.6.3 Loss of Certification. NDT certification may expire, be suspended, or be revoked.

CH2.6.4 Expiration. Certifications shall expire when employment is terminated or when the certification interval has lapsed with no recertification issued. Certification, annual maintenance, and vision examinations are considered to expire at the end of the corresponding month in which the event began.

CH2.6.5 Suspension. Certification shall be suspended when the visual acuity examination is expired, the individual does not perform in the method certified for 12 consecutive months, the individual fails recertification examination, when the individual's performance is found to be deficient in any manner, or when annual maintenance is expired.

CH2.6.6 Revocation. Certification shall be revoked when the individual does not perform in the certified method for the employer for at least 24 consecutive months, when employment has been terminated, or when the individual's conduct is found to be unethical or incompetent. When an individual is re-hired by the same employer within 24 months, certification may be considered as reinstated.

CH2.6.7 Reinstatement of Certification. Certifications that have been suspended shall be reinstated when the cause for suspension has been corrected and the correction verified by NASA, or the individual's proficiency is verified by a Level 3.

CH2.6.7.1 Level 1 and Level 2 certifications that have expired or been revoked shall only be reinstated by recertification per paragraph CH2.6.7.

CH2.6.7.2 Level 3 certifications that have expired or been revoked shall only be reinstated by Specific and Practical re-examinations equivalent to initial certification.

CH2.6.8 Recertification for Levels 1, 2, and 3. Levels 1, 2, and 3 personnel shall be re-certified at intervals not to exceed 5 years. Certification is considered to expire at the end of the corresponding month in which certification began.

CH2.6.8.1 Recertification of Levels 1 and 2 personnel shall be accomplished by specific and practical examinations equivalent to the initial certification.

CH2.6.8.2 Recertification of Level 3 personnel shall be accomplished by specific and practical examinations equivalent to the initial certification or by the credit system option specified below.

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CH2.6.8.3 The Specific and Practical examinations shall be as described in section CH2.4.

CH2.7 Credit System for Recertification of Level 3 NDT Personnel (Optional)

CH2.7.1 The credit system option specifies the requirements for recertification of Level 3 NDT personnel without examination. It applies only to personnel holding a valid Level 3 NDT certification at the time of recertification.

CH2.7.2 Documentation for recertification shall be submitted to the Responsible Level 3 at least 14 days prior to the expiration date of the certification.

CH2.7.3 Application for recertification of the Responsible Level 3 shall be made directly to the applicable regulatory agency, or employer for review by the designated SMA Certifying Officer.

CH2.7.4 The candidate shall have been employed in a Level 3 function for a minimum of 36 months (at least 12 of which are in the last 24 months) within the previous 5 years in the method(s) for which recertification is sought. The number of months is cumulative and does not need to be consecutive months for validation purposes.

CH2.7.5 Continuity in the method shall be demonstrated.

The candidate shall provide a list of eight verifiable Level 3 tasks in each NDT method for which recertification is sought covering the 5-year period.

CH2.7.6 Candidates shall provide objective evidence that they have kept up to date with current NDT technology in the method(s) for which they are seeking recertification by obtaining a minimum of 24 points during the 5-year period of certification, irrespective of the number of certifications (methods) obtained, by engaging in one or more of the activities listed in Table CH2-5.

CH2.7.7 The approval of credit system activity documentation shall be determined and documented by the Responsible Level 3 as defined within the employer's written practice.

a. Using the credit system recertification option for the Responsible Level 3 shall be determined and documented by the employer.

b. A single event shall only be used for one award credit activity during a 5-year period.

CH2.7.8 Credits and points shall be recognized as being equivalent for recertification of Level 3 NDT personnel using the Credit System.

CH2.8 Annual Maintenance The employer shall develop and implement a documented annual process to verify technical proficiency for each method during the certification cycle for all levels of personnel processing or inspecting hardware.

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<b>TABLE CH2-5: Level 3 Awarded Credit Activity</b>			
ACTIVITY	CRITERIA	Point Allocation	Maximum Points per 5 years
Authoring or co-authoring technical NDT papers, presentations, or white papers	Sole-Author	8	8
	Co-Author	4	
Authoring or co-authoring for company or industry NDT specifications or standards	Each standard/specification	2	8
Attending NDT technical sessions, committee or panel meetings organized by: a) National or international technical societies, associations, and institutes b) Inter-company NDT teams comprised of members from several locations	1 day or 1 meeting	1	8
	2 days	2	
	3 or more days	4	
NDT instructor teaching academic courses, or courses designed to prepare students for NDT qualification	For each 8 hours of instruction	4	8
Participating in technical courses or seminars	For every 8 hours of documented instruction	2	8
Participating in technical courses or seminars for which academic credit is given	For actual CEUs or academic credit earned	Actual CEUs/ credit awarded	8
Obtaining an initial * Level 3 certificate from an recognized Industry source (applicable only to initial professional certification. * This does not apply to professional recertification)	For each method obtained	4	4
Nondestructive testing examiner	For each qualification examination	1	6
NDT related technical and/or scientific publications published either internally or externally	For each published paper	4	8
Documented NDT contributions to company, technical society, or industry committee projects	For each documented contribution	4	8
Documented participation in NDT-related studies, developments, or investigations	For each documented contribution	4	8
Documented continuous satisfactory performance as a Level 3	Written testament for each method in the certification period	1	4
Attend NDT equipment or trade show	For each show attended	1	4
Conduct external NDT audits	For each external audit conducted	2	6
Development on new NDT processes, facilities, or systems	For each documented contribution	4	8
Submitting and/or obtaining a patent for an NDT product or process.	Sole inventor	8	8
	Co-inventor	4	

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## **CHAPTER 3**

### **ELECTRICAL PROCESS SKILLS (EPS)**

#### **CH3.1 Purpose**

This Chapter establishes the minimum requirements for the certification and/or qualification of MSFC personnel who fabricate or inspect flight, flight-associated hardware, mission critical ground support equipment, and elements thereof, using EPS per the documents referenced herein.

CH3.1.1 Exceptions. Personnel developing technology and performing research shall not be required to be certified.

#### CH3.1.2 EPS Categories

CH3.1.2.1 Personnel performing EPS shall be certified as either operators or inspectors to the applicable electrical workmanship document in Table CH3-1.

CH3.1.2.2 Operators shall be authorized to perform work on flight, flight-associated hardware, mission critical ground support equipment, and elements thereof.

CH3.1.2.3 Inspectors shall be authorized to accept flight, flight-associated hardware, mission critical ground support equipment, and elements thereof.

CH3.1.2.4 Personnel evaluating EPS for certification shall be classified as technical advisors.

- a. Technical advisors shall complete the same training requirements as operators and inspectors or have equivalent experience.
- b. Technical advisors do not need to be certified; however, they shall be recognized as experts in their field.
- c. Technical advisors shall be recommended by their supervisors for approval by the SMA Certifying Officer.
- d. Beginning with technical advisors appointed after July 1999, supervisors shall submit to the SMA Certifying Officer their documented credentials.

#### **CH3.2 Training**

##### CH3.2.1 Training Organization

CH3.2.1.1 Training shall be obtained from a school approved by a technical advisor and the SMA Certifying Officer.

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CH3.2.1.2 Other agencies used for training shall be subject to review and approval by the technical advisor and the SMA Certifying Officer.

CH3.2.1.3 ESD Training shall be obtained by completing the System for Administration, Training, and Educational Resources for NASA (SATERN) course number SHE 413, Certification Training for Electrostatic Discharge (ESD) Control.

### CH3.2.2 Lesson Plans

CH3.2.2.1 Lesson plans shall be developed for each training course required.

CH3.2.2.2 The plans shall include topics to be addressed, practical test specifics, and examination examples.

CH3.2.2.3 Training contractor lesson plans shall be reviewed and approved by the technical advisor.

### CH3.2.3 Instructor Qualifications

CH3.2.3.1 Instructors shall be recognized experts in their field.

CH3.2.3.2 Instructors shall be evaluated to requirements of the EPS documents specified herein, as determined by the SMA Certifying Officer and technical advisor.

### CH3.2.4 Training Requirements for Initial Certification

CH3.2.4.1 Personnel who perform operator or inspector tasks for any of the electrical processes shall meet the initial certification/qualification requirements of Table CH3-1.

CH3.2.4.2 Documented previous training and experience are accepted for certification at the discretion of the technical advisor and SMA Certifying Officer.

CH3.2.4.3 Certification shall be required for all EPSs.

CH3.2.4.4 Operator certification for SMT may require additional training on the exact machine used for production at the supervisor's discretion.

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### **CH3.3 Examinations**

CH3.3.1 Written and practical examinations shall be administered and graded by the instructor or designated representative.

CH3.3.2 Copies of the examination shall be retained on file.

#### **CH3.3.3 Vision Examination**

CH3.3.3.1 Vision and color perception tests shall be administered by the MSFC Medical Center personnel or a qualified eye examiner, accepted by the procuring supplier, using standard instruments and techniques prior to certification.

CH3.3.3.2 The following vision requirements shall apply:

- a. Near Vision: Jaeger 1 at 14 inches, reduced Snellen 20/20, or equivalent.
- b. Color Vision: Ability to distinguish red, green, blue, and yellow colors as prescribed in Dvorine Charts, Ishihara Plates, or AO-HRR Tests.

CH3.3.3.3 Vision in at least one eye, natural or corrected, shall be required.

CH3.3.3.4 The vision tests shall be administered prior to certification/recertification documented on MSFC Form 4293, Eye Exam Certification or an equivalent visual acuity record from a qualified eye examiner, and submitted to the MSFC Safety and Quality Department.

#### **CH3.3.4 Written Examination**

CH3.3.4.1 For initial certification, each candidate shall score at least 80 percent on a written exam typically consisting of at least 25 questions.

#### **CH3.3.5 Practical Examination**

CH3.3.5.1 The candidate shall pass a practical exam which is a representative of the work to be performed and fully demonstrates proficiency in the skill (excluding ESD).

CH3.3.5.2 The minimum acceptable score for the practical exam shall be in accordance with the requirements of the governing document [e.g., a minimum score of 85 percent is now required for passing the practical (i.e., hands-on) examinations per the NASA 8739 Series standards]. For verification, reference NASA-STD-8739.6.

CH3.3.5.3 For inspectors, the practical exam shall include fabrication of samples and an inspection test.

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CH3.3.5.4 For operators, the practical exam can include an inspection test and shall include fabrication of samples.

CH3.3.5.5 As an option to the practical exam, proficiency demonstration can also be accomplished by a supervisor and SMA Certifying Officer audit of actual work performed provided the audit results are documented and included in the employee's personnel certification file.

### **CH3.4 Certification**

CH3.4.1 Candidate civil service personnel who meet the above criteria shall be certified by the SMA Certifying Officer upon the recommendations of their supervisors.

CH3.4.2 Contractor personnel shall be certified by the individual designated by their company.

CH3.4.3 Personnel who perform only limited operations or processes shall have the limitations documented in their certification records (e.g., certification card, certificate, or electronic records).

<b>TABLE CH3-1. EPS TRAINING REQUIREMENTS (RQMT) (minimum hours)</b>			
TASK	INITIAL CERTIFICATION	RECERTIFICATION	REQUIREMENT
Soldering (thru-hole and SMT)	40	20	IPC J-STD-001 and IPC J-STD-001*S
Cabling	28	8	NASA-STD-8739.4
Crimping	12	8	NASA-STD-8739.4
Conformal coating/staking	32	8	NASA-STD-8739.1
ESD control	2	2	MSFC-RQMT-2918

*NOTE: The asterisk character (\*) is used in this citation as a placeholder to signify the latest revision of the basic document (J-STD-001). The "S" signifies that this is the Space Applications Addendum for that basic document.*

#### **CH3.4.4 Recertification**

CH3.4.4.1 Training for recertification shall be required at the discretion of the individual's supervisor.

CH3.4.4.2 Recertification shall include a demonstration of proficiency in accordance with CH3.4.5.

CH3.4.4.3 Recertification of EPS operators and inspectors shall be required every 2 years.

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CH3.4.5 Demonstration of proficiency shall be required for recertification. This can be achieved by fabrication/inspection of samples, completion of a refresher training course approved by the technical advisor, or by an audit of an individual's actual work performed by the SMA Certifying Officer and their supervisor. Recertification can also include a written examination.

CH3.4.5.1 Each recertification method shall require documentation to substantiate compliance.

CH3.4.5.2 The method chosen for recertification shall be the responsibility of the individual's supervisor.

CH3.4.6 Loss of Certification. Certification shall be revoked under the following conditions:

- a. Evidence of deficient performance.
- b. Interruption of a work period for more than 6 months.
- c. New techniques have been developed which require different skills.
- d. Employment has been terminated.
- e. Job function has changed and new function does not require EPS.
- f. Failure to meet the vision requirements of paragraph CH3.3.3.

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## Chapter 4

### Certified Welding Inspector (CWI)

#### CH4.1 Purpose

This Chapter establishes the minimum requirements for the certification and/or qualification of MSFC personnel who perform visual weld inspections per the documents referenced herein.

CH4.1.1 MSFC organizational issuance QD-QA-022, requires that personnel who perform weld inspections shall be American Welding Society (AWS) certified.

CH4.1.2 Personnel who perform weld inspections shall be certified per the requirements of AWS QC1.

CH4.1.3 Personnel certified per AWS QC1 shall comply with requirements of AWS B5.1.

#### CH4.2 Levels of Certification and Qualification Requirements

There are three levels of AWS certification for welding inspection personnel. The certification levels and minimum qualification requirements shall be specified as follows:

CH4.2.1 Certified Associate Welding Inspector (CAWI) shall be an individual certified by AWS and meet the following minimum qualification requirements:

- a. Be a high school graduate, or hold a general educational development (GED) diploma.
- b. Have a minimum of two years' experience in an occupational function directly related to welded assemblies fabricated to national or international standards.
- c. Be able to provide verifiable documentation of acceptable qualifying experience.
- d. Pass the visual acuity requirements of section CH4.3 as specified herein.
- e. Achieve 60 percent correct as the minimum passing score on each component of the qualifying examination.

CH4.2.2 CWI shall be an individual certified by AWS and meet the following minimum qualification requirements:

- a. Be a high school graduate, or hold a GED diploma.
- b. Have a minimum of five years' experience in an occupational function directly related to welded assemblies fabricated to national or international standards.

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- c. Be able to provide verifiable documentation of acceptable qualifying experience.
- d. Pass the visual acuity requirements of section CH4.3 as specified herein.
- e. Achieve 72 percent correct as the minimum passing score on each component of the qualifying examination.

CH4.2.3 Senior Certified Welding Inspector (SCWI) shall be an individual certified by AWS and meet the following minimum qualification requirements:

- a. Be a high school graduate, or hold a GED diploma.
- b. Have a minimum of 15-years' experience in an occupational function directly related to welded assemblies fabricated to national or international standards.
- c. Have been certified as a CWI for a minimum of six years prior to being upgraded to the SCWI certification level.
- d. Be able to provide verifiable documentation of acceptable qualifying experience.
- e. Pass the visual acuity requirements of section CH4.3 as specified herein.
- f. Achieved 72 percent correct as the minimum passing score on each component of the qualifying examination.

#### CH4.3 Visual Acuity Requirements

CH4.3.1 Applicants for initial certification or recertification as SCWI, CWI, or CAWI shall satisfy the following visual acuity requirements:

- a. Near Vision Test: Jaeger 2 at not less than 12 inches, or Snellen 20/30 or equivalent in at least one eye, natural or with corrected lenses; and
- b. Color Perception Test: If needed, applicants shall demonstrate the ability to distinguish red, green, blue, and yellow as prescribed in Dvorine Charts, Ishihara Plates, or AO-HRR Tests. Color perception is desirable for some applications, but not mandatory for all examinations.

CH4.3.2 Any limitations in color perception shall be evaluated by the Responsible Level 3 prior to certification and approved in writing.

CH4.3.3 Annual vision examinations shall be administered by the MSFC Medical Center or a qualified eye examiner, accepted by the procuring supplier, using standard instruments and techniques.

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CH4.3.4 The results of the vision tests shall be documented on MSFC Form 4293, “Eye Exam Certification,” or an equivalent visual acuity record, and submitted to the MSFC Safety and Quality Department.

#### CH4.4 Certification

CH4.4.1 Certifications shall be valid for three years, unless suspended, refused renewal, or revoked by the Certification Committee of the AWS as a result unauthorized practices by the applicant.

CH4.4.2 The AWS shall issue to each SCWI, CWI, and CAWI applicant who complies with the applicable requirements of AWS B5.1, a serialized (unique number) certificate and a wallet card stating that the applicant has met the AWS certification requirements.

CH4.4.3 Documented evidence of certifications issued by AWS shall be provided to the MSFC certifying officer.

#### CH4.5 Recertification

CH4.5.1 CAWIs shall not be eligible for recertification.

CH4.5.1.1 CAWI certifications shall be valid for a single three-year period only.

CH4.5.1.2 CAWI personnel shall achieve a minimum passing score of 72 percent correct on the qualifying examination towards CWI certification before the third year of their CAWI certification period ends.

CH4.5.1.3 CAWI personnel shall be eligible to upgrade to the CWI certification level once the minimum five-year experience requirements has been met.

CH4.5.1.4 CAWI personnel also shall comply with the visual acuity requirements.

CH4.5.2 After the initial three-year certification period, SCWIs and CWIs shall be eligible for only two consecutive three-year recertification intervals.

CH4.5.2.1 This interval of time shall not exceed nine years from the initial SCWI and CWI certifications.

CH4.5.2.2 Before the end of the ninth year from the date of initial certification, and each nine-year period thereafter, SCWIs and CWIs shall attain recertification in accordance with the respective requirements of CH4.5.2.3 and CH4.5.2.4 below.

CH4.5.2.3 SCWIs shall satisfy the nine-year recertification requirements by complying with the visual acuity requirements and meeting either of the following options:

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- a. By achieving a minimum passing score of 72 percent correct on each component of the SCWI qualifying examination; or
- b. By accepting an AWS Certification Committee-approved endorsement; or
- c. By experience and completing a minimum of 80 professional development hours (PDH) of continuing education.
  - (1) The SCWI shall attest to having no period of continuous inactivity greater than two (2) years during the previous three years of certification.
  - (2) The PDH requirements shall be in accordance with AWS B5.1.

CH4.5.2.4 CWIs shall satisfy the 9-year recertification requirements by complying with the visual acuity requirements and meeting either of the following options:

- a. By achieving minimum passing score of 72 percent correct on the Part B Practical qualifying examination for CWIs; or
- b. By accepting an AWS Certification Committee-approved endorsement; or
- c. By experience and completing a minimum of 80 PDH of continuing education.
  - (1) The CWI shall attest to having no period of continuous inactivity greater than two years during the previous three years of certification.
  - (2) The PDH requirements shall be in accordance with AWS B5.1.

#### CH4.6 Loss of Certification

CH4.6.1 Loss of certifications shall result from either of the following conditions:

- a. Certifications are suspended, refused renewal, or revoked by the AWS Certification Committee as a result of unauthorized practices.
- b. Failure to meet the visual acuity requirements.
- c. Evidence of deficient performance.
- d. Certification interval has lapsed with no recertification issued.

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## **APPENDIX A. DEFINITIONS**

American Society for Nondestructive Testing (ASNT) Nondestructive Evaluation (NDE) Level 3 Certificate. A confirmation of qualification issued by ASNT.

Center. NASA owned property that has been designated as a NASA Center. In this MWI, the Center is MSFC or MAF.

Certifying Officer. The Quality Assurance Branch employee designated to sign-off on the final approval of personnel for skills certifications.

CERTRAK. The SMA software database for employee certification records used to access personnel certifications electronically and accessed via IdMAX.

Certification Administrator (CA). The Quality Assurance Branch employee designated to perform the administrative functions for skills certifications.

Closed-Book Examinations. An examination administered without access to reference material except that provided with or in the examination.

Contracting Officer (CO). A person, appointed in accordance with the Federal Acquisition Regulation (FAR)/NASA FAR Supplement (NFS), with the authority to enter into, administer, change, and/or terminate Government contracts and make related determinations and findings within the limits of their certificates of appointment.

Cognizant Nondestructive Testing (NDT) Organization. The NDE team located at NASA MSFC.

Committee or Panel Meetings. Meetings, conferences, symposia, seminars, trade association meetings, panels, etc., organized or sponsored by a regional, national, or international NDT organization or technical society. Foreign or international meetings qualify, if the sponsor(s) are national or international.

Contractor Certifying Officer. The contractor employee authorized by the SMA Directorate to approve safety and skills certifications for personnel employed on his or her contract.

Employer. An organization, whether Government, prime contractor, subcontractor, supplier, processor, or outside agency, employing individuals performing EPS, NDT, CWI, or safety operations. Self-employed individuals are included in this definition.

European (EN) 473 Certificate. A confirmation of qualification issued in accordance with the European Standard *General Principles for Qualification and Certification of NDT Personnel*

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indicating successful completion of the requirements of that document. Issuance of this certification is by the EN473 Certification Body.

Evaluation. A review, following interpretation of the indications noted during an NDT inspection, to determine whether specified acceptance criteria is met or to determine its significance.

Examination. Formal, controlled, documented testing conducted in accordance with a documented written practice to verify the candidate's knowledge of applicable NDT methods.

Experience. Work activities accomplished in a specific NDT method under the direction of qualified supervision including the actual performance and use of the equipment in that method. This does not include classroom training, but does include OJT.

Formal Education. Engineering or science studies at a technical school, college, or university.

Formal Training. An organized and documented program of learning activities designed to impart knowledge and skills necessary to be qualified to this written practice, NAS 410, or equivalent NDT standards. Formal training may be a mix of classroom, on-line, practical and programmed self-instruction, or OJT as approved by the Responsible Level 3 or Examiner.

General Examination. A written examination addressing the basic principles and theory of the applicable NDT method.

Indication. The response or evidence of a condition resulting from an NDT inspection that requires interpretation to determine its significance.

Interpretation. The determination of whether indications are relevant or nonrelevant.

ISO 9712 Certificate. A confirmation of qualification issued in accordance to the International Standard *Nondestructive Testing -- Qualification and Certification of Personnel* indicating successful completion of the requirements of that document. Issuance of this certification is by the employer.

Method. One of the disciplines of nondestructive inspection or testing (e.g., radiography) within which different techniques exist.

Non-Film Radiography. Radiographic imaging that does not use a film based recording medium. Non-Film radiography includes, but may not be limited to, Computed Radiography, Digital Radiography, Radioscopy, and Computed Tomography.

On-the-Job Training (OJT). Supervised training by a journeyman employee who is skilled and knowledgeable in the task/job of an apprentice employee while they perform a task/job. Also, per NDT applications, training in the work environment for learning instrument set-up,

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equipment operation, recognition of indications, and interpretation under appropriate technical guidance.

Operator. An employee who manually or remotely controls or directs the functioning of a system, process, or operation.

Outside Agency. An independent company or organization outside the employer who provides NDT services to implement the requirements of this standard, such as training and examination of NDT personnel. Consultants and self-employed individuals are included in this definition.

Practical Examination. The examination used to demonstrate an individual's ability to conduct the NDT method that will be performed for the employer.

Procedure. A general or detailed written instruction for conducting a given process applicable to a specific NDT method.

Proficiency Examiner. The qualified person(s) designated, by the SMA Directorate or outside agency, to develop and administer exams (written, hands-on, or both) necessary to achieve the desired proficiency required for skills certification training.

Qualification. Demonstration of skill and knowledge along with documented training and experience required for personnel to properly perform the duties of a specific job.

Recertification. The process of reconfirming the certification of an individual by training and/or proficiency test at the end of a predetermined period, or when lack of proficiency dictates.

Shearography. A nondestructive evaluation method similar to holographic interferometry that uses the interference pattern created by superimposing the laser speckle cast onto a surface from an un-deformed and deformed stress state to reveal information about internal material discontinuities or anomalies. The methods uses the test object itself as the known reference and the sensitivity is tuned by the amount of shear, double off-set imaging, used.

SMA Contractor Certifying Officer. The contractor employee authorized by the SMA Directorate to approve safety and skills certifications for SMA support contractor personnel.

Skilled Operations. Any necessary activities which are critical to the required quality level of a produced article or material.

Specific Examination. The written examination to determine an individual's understanding of operating procedures, codes, standards, product technology, test, techniques, equipment, and specifications for a given NDT method as used by the employer.

Supervisor. The person assigned supervisory functions for employee performing the job or tasks that require training and/or certification (e.g., organizational line manager, foreman, branch chief, or team lead).

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Technical Advisor. The person(s) recommended by their supervisor for approval by the SMA Certifying Officer to evaluate EPS requirements for certification. Technical advisors review consultant training courses to ensure technical adequacy, complete the same training requirements as EPS operators and inspectors, or have equivalent experience, but do not need to be certified; however, they are recognized as experts in their field.

Technique (as applicable to NDT methods). A category within a method (e.g., ultrasonic immersion testing, or ultrasonic contact testing). Specific techniques within a method are defined by the cognizant NDT organization.

Test Samples. Parts or images containing known discontinuities or defects used in the practical examination to demonstrate the candidate’s proficiency in using a particular method. Test samples can refer to images of actual hardware such as radiographs.

Trainee. An individual who is participating in a training program for an NDT method and is not certified.

Written Instruction. A procedure detailing the NDT technique and testing parameters used for the inspection of a specific component, group of parts (e.g., “aluminum extrusions,” “aluminum brackets”), or assembly. These are sometimes referred to as “technique sheets” or “data cards.”

Written Practice. A procedure that describes the control and administration of NDT personnel qualification and certification.

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## **APPENDIX B. ACRONYMS**

(AO-HRR) American Optical Hardy-Rand-Rittler

(ASNT) American Society for Nondestructive Testing

(AWS) American Welding Society

(CA) Certification Administrator

(CAWI) Certified Associate Welding Inspector

(CERTRAK) Certification Tracking

(CEUs) Continuing Education Units

(CO) Contracting Officer

(CWI) Certified Welding Inspector

(EN) European

(EPS) Electrical Process Skills

(ESD) Electrostatic Discharge

(ET) Eddy Current Testing

(GED) General Educational Development

(IdMAX) Identity and Access Management Tools

(IPC) formerly Institute of Printed Circuits

(IRT) Infrared Thermography

(ISO) International Organization for Standardization

(MAF) Michoud Assembly Facility

(MPR) Marshall Procedural Requirement

(MSFC) Marshall Space Flight Center

(MT) Magnetic Particle Testing

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(MWI) Marshall Work Instruction

(NAS) National Aerospace Standard

(NASA) National Aeronautic and Space Administration

(NDE) Nondestructive Evaluation

(NDI) Nondestructive Inspection

(NDT) Nondestructive Testing

(NPD) NASA Policy Directive

(NPR) NASA Procedural Requirements

(NRRS) NASA Records Retention Schedule

(OJT) On-the-Job Training

(PDH) Professional Development Hours

(PT) Liquid Penetrant Testing

(RQMT) Requirements

(RT) Radiographic Testing

(SATERN) System for Administration, Training, and Educational Resources for NASA

(SMA) Safety and Mission Assurance Directorate

(SCWI) Senior Certified Welding Inspector

(SHE) Safety, Health, and Environmental

(SMT) Surface Mount Technology

(ST) Shearography Testing

(STC) SHE Training Catalog

(STD) Standard

(UT) Ultrasonic Testing

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**APPENDIX C.  
VERIFICATION MATRIX**

<b>Section</b>	<b>Brief Description</b>	<b>Verification</b>			<b>Comments</b>
		<b>Inspect</b>	<b>Document</b>	<b>Test</b>	
5.1	Certification Process		x		
5.2	Skills Certification		x		
5.3	Proficiency Test		x		
5.4	CERTRAK Access		x		
5.5	Employee Certification		x		
5.6	OJT		x		
5.7	Medical Examinations		x		

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## **APPENDIX D. RECORDS**

D.1 The following records are maintained in accordance with NRRS 1441.1 by the assigned SMA CA. “Destroy/delete 5 years after separation of employee, or in accordance with the requirements of the governing standard or when no longer needed, whichever comes first.”

D.1.1 Evidence of personnel qualifications (e.g., MSFC Form 4083 used for skills certifications, training certificates of completion, or test results from training organizations).

D.1.2 CERTRAK records.

D.1.3 List of civil service and contractor certified personnel.

D.1.4 List of Proficiency Examiners and Certifying Officers.

D.1.5 NDT logbook when required to establish experience history (employee).

D.1.6 Equivalent NDT work experience. (See CH2.4.9)

D.2 OJT records are maintained by the supervisor (or designee) and documented in accordance with the requirements of the governing standard. “Destroy/delete 5 years after separation of employee, or in accordance with the requirements of the governing standard, or when no longer needed, whichever comes first.”

D.3 Completed MSFC Form 4083, and MSFC Form 4293 or equivalent visual acuity records from a qualified eye examiner.

D.4 Employee training records required for certifications contained in this MWI are maintained in accordance with MPR 3410.1.

D.4.1 Contractors retain training and skills certification records for their employees. (See MPR 3410.1)

*NOTE: The skills certification records of SMA support contractor personnel are maintained by the Center’s assigned quality representative.*

D.4.2 Contractors maintain employees OJT records as well.