



April 30, 2007

To: NRCan Acceptable training Organizations (NATOs)

Dear all,

This purpose of this letter is provide to you with information pertaining to prerequisite basic mathematical skills and knowledge of materials and processes (M&P). Effective July 1, 2007, all NRCan Acceptable training Organizations are required to implement tests and training courses for basic mathematical skills and knowledge of materials and processes.

Rational: The Canadian National Standard, CAN/CGSB-48.9712-2006/ISO 9712:2005, specifies minimum training but those “training hours are based upon candidates possessing basic mathematical skills and prior knowledge of materials and processes”.

Lack of basic math skills and knowledge of M&P:

1. Slows the progress of the instructor
2. Slows the progress of the rest of the students
3. Frustrates students who are unprepared
4. Frustrates students who are prepared
5. Raises the failure rate on examinations

Accordingly, students for NDT training and certification will be required to successfully pass (one time only) a prerequisite math test and a prerequisite M&P test before training/certification.

Basic Mathematic Skills – Prerequisite to Training (UT, RT, ET)

- Effective July 1, 2007, students for training in the NDT methods of UT, RT and ET will be required to pass a basic math-skills test prior to training in these NDT methods.
- Exemption: Students for training in PT and MT are exempt from having to pass the math-skills test.
- NRCan will provide a common math-skills test to all NATOs and NRCan examination centres.
- NRCan intends to replace the math-skills test every three months.
- The math-skills test consists of 15 questions and may be distributed to the students by the NATOs using various methods such as an on-line test, via mail, fax, email, etc.
- NATOs are responsible for grading the test. Passing grade is a minimum of 10 correct answers out of 15 questions. NATOs must send the successfully passed test to NRCan for retention and filing. If no test is on file at NRCan, the NDT training (UT, RT, ET) of an applicant seeking certification will not be accepted by NRCan.
- In the event that a student fails the math-skills test, a NATO may offer to the student a basic mathematical skills course of duration to be decided by the NATO.
- With or without a mathematical skills course, all students for UT, RT and ET must pass the math-skills test prior to commencement of training in these NDT methods.

Materials and Processes (M&P) – Prerequisite to NRCAN Examination

- Effective July 1, 2007, candidates applying for certification in any NDT method must pass an M&P test prior to NRCAN examinations.
- Exemption: NRCAN certified inspectors who hold at least two current NDT certifications are exempt from both M&P test and/or M&P training. (Such inspectors already passed examinations containing approximately 40 M&P questions.)
- Students for NDT method training are encouraged to pass the M&P test prior to training.
- NATOs are responsible for the preparation of an M&P test.
- The M&P test may be distributed to the students by the NATOs using various methods such as an on-line test, via mail, fax, email, etc.
- NATOs are responsible for grading the M&P test. Passing grade is a minimum of 70%.
- NATOs must send only the grade (not the entire test) obtained by the student on the M&P test to NRCAN for retention and filing.
- In the event that a student fails the M&P test or wishes not to take the NATO administered M&P test, the NATO may offer to the student a 40 hour M&P course – that follows the subject list in Appendix C6 of CAN/CGSB-48.9712-95 (reproduced below).
- With or without an M&P course, candidates applying for certification in any NDT method must pass a NATO administered M&P test prior to commencement of NRCAN examinations - except those NRCAN certified inspectors who already hold at least two current NDT certifications.

From CAN/CGSB-48.9712-95

**APPENDIX C6
INFORMATIVE**

TRAINING COURSE GUIDELINES FOR KNOWLEDGE IN MATERIALS AND MANUFACTURING PROCESSES - LEVEL 2

These guidelines give a breakdown of some of the background knowledge required to perform NDT and interpret NDT results correctly. Students are encouraged to place greater emphasis on those subject items listed below which are most relevant to the NDT method in which certification is desired.

- 1. General Material Properties**
 - 1.1 Physical, mechanical, electrical and magnetic properties
- 2. Basic Casting Technology**
 - 2.1 Casting metallurgy
 - a. Solidification of metals
 - 2.2 Pouring and feeding castings
 - a. Casting design
 - b. Pouring
 - c. Gating system
 - d. Risers
 - e. Chills

- 2.3 Sand moulding
 - a. Green sand moulds
 - b. Patterns
 - c. Flasks
 - d. Cores
 - e. Dry sand moulds

- 2.4 Special moulding processes
 - a. Shell moulds
 - b. Permanent mould casting
 - c. Die casting
 - d. Investment casting
 - e. Plaster mould casting
 - f. Centrifugal casting
 - g. Continuous casting

- 3. Basic Welding Technology**
- 3.1 Welding metallurgy
 - a. Metallic bonding
 - b. Effects of composition, grain size and grain structure on the properties of welded joints
 - c. Distortion and stresses

- 3.2 Welding processes
 - a. Shielded metal arc welding (SMAW)
 - b. Gas tungsten arc welding (GTAW)
 - c. Gas metal arc welding (GMAW)
 - d. Flux cored arc welding (FCAW)
 - e. Submerged arc welding
 - f. Electroslag welding
 - g. Spot and seam welding
 - h. Soldering and brazing

- 3.3 Welding designs
 - a. Joint configurations

- 4. Basic Metal Forming Technology**
- 4.1 Metallurgy of metal forming
 - a. Plastic deformation
 - b. Hot working and cold finishing
 - c. Work hardening and recrystallization
 - d. Direction effects

- 4.2 Metal forming processes
 - a. Rolling
 - b. Extrusion
 - c. Tube and pipe making
 - d. Forging, open and closed die

5. Improper Service Conditions

- 5.1 Loading, temperature and chemical environment

6. Flaws - Classification, Morphology, Location, Causes

- 6.1 In cast parts: cold shuts, blowholes, inclusions, hot tears, segregation, shrinkage, dross, cold shot, misrun, porosity, etc.
- 6.2 In welded parts: inclusions, undercutting, porosity, cracks, incomplete penetration, crater cracks, incomplete fusion, lamellar tearing, etc.
- 6.3 In rolled, extruded or forged parts: bursts, laminations, stringers, seams, laps, hydrogen flake cracks, etc.
- 6.4 Others: fatigue cracks, stress corrosion cracks, grinding cracks, and heat treating cracks, plating cracks, cavitation corrosion, corrosion fretting, etc.

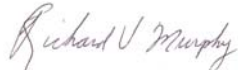
RECOMMENDED REFERENCES FOR STUDY OF MATERIALS AND MANUFACTURING PROCESSES

Publication	Selected Pages	Subject
1. CAN/CGSB-48.5-95, Manual on Industrial Radiography	Chapter 9	Some Aspects of Welding Technology
2. Materials and Processes for NDT Technology by ASNT	31 to 44	Nature of Materials & solid State Changes in Metals
	50 to 54	Ferrous Metals
	57 to 65	Nonferrous Metals
	79 to 93	Casting Processes
	95 to 103	Welding Processes
	121 to 135	Metal Forming Processes
3. Basic Metallurgy for Nondestructive Testing	1 to 5	Solidifications & Crystallinity
	22 to 28	Fusion Welding of Steel
	29 to 35	Defects in Fusion Welds
	36 to 43	Flaws in Steel Castings
	50 to 56	Defects in Steel Forgings
	69 to 74	Corrosion of Metals
4. Why Metals Fail R.D. Barer & B.F. Peters	9 to 16	Several Common Failure Mechanisms

Last Chapter in any of the General Dynamics Classroom training handbooks, usually Chapter 7: Flaws, their description and causes.

The publications referred to in items 2 to 4 may be obtained from Canadian Institute for NDE, 135 Fennell Avenue West, Hamilton, ON, L8N 3T2. Fax (905) 574-6080. Telephone (905) 387-1655 or 1-800-964-9488.

Respectfully,



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