Global Review of Qualification and Certification of Personnel for NDT & Condition Monitoring

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Abstract. Published and draft international and regional standards - and some significant national standards - covering the certification of competence of NDT and Condition Monitoring personnel are already in use at national, regional or international level.
Each of the standards referenced below aims to satisfy the needs of geo-political regions for independent third party or interested second party certification of NDT personnel (at least one, ISO 11484, addresses both 2nd and 3rd party systems) in general or specific industry sectors.

This paper:

- provides an overview of the status of national, regional and international standards related to qualification and certification of personnel engaged in non-destructive testing, condition monitoring, diagnostics and material evaluation;
- discusses problems and solutions concerning implementation of certain standards, particularly in respect of sectors covered by European regulations, and
- presents the current situation regarding global arrangements for mutual recognition and acceptance of personnel certification, including those activities of various supra-national bodies, such as ICNDT and EFNDT, to foster harmonization of qualification and certification.

STANDARDISATION

There are now a number of published international and regional standards - and some significant national standards that are used world-wide (see "references") - covering the certification of competence of personnel. Each of the standards referenced below aims to satisfy the needs of geo-political regions for independent third party or interested second party certification of personnel engaged in inspection and testing (at least one, ISO 11484, addresses both 2nd and 3rd party systems) in general or specific industry sectors. The following is a summary of relevant personnel qualification and certification standards:

- ISO 9712 (Non-Destructive Testing - Qualification and Certification of Personnel) was originally developed at the request of the ICNDT by ISO Technical Committee 135 Sub Committee 7 (ISO/TC135/SC7), and was issued in 1991 in order to provide an international standard, which would have the effect of harmonizing the certification of NDT personnel throughout the world. ISO 9712 was the first international standard specifying independent (central) certification. The second edition of the standard was published early in 2000, and a third edition was published in April 2005.
- EN 473 (Qualification and certification of NDT personnel - General Principles) was developed by a CEN Technical Committee (CEN/TC138) specifically for the European Union in order to provide a more stringent set of requirements than ISO 9712 (which allowed, in its first edition, up to fifteen years for countries adopting the standard to implement all of its provisions). The second edition of this standard was published in October 2000. EN473 is a *'harmonized standard'* in the context of the European Pressure Equipment Directive (97/23/EC), and is therefore enshrined within the law of the EU. EN 473:2000 is presently under review, and is likely to be published as a third edition in 2007.
- ISO 11484:1994 (Steel tubes for pressure purposes - qualification and certification of non-destructive testing (NDT) personnel) was developed specifically to provide for the needs of the manufacturers of steel tubes where testing is usually carried out using automated systems which, once set up, require minimal NDT skills to operate. It was not considered appropriate, by the ISO member representatives of the industry concerned, to apply the provisions of ISO 9712 to levels 1 and 2 personnel in this industry, but ISO 11484 does cater for both 2nd and 3rd party certification.
- ISO 20807: 2003 (Qualification of personnel for limited application of non-destructive testing). Limited NDT is defined within this standard as "the implementation of a test method for a particular application requiring specific training and experience, i.e., an application which is limited, repetitive or automated". Annex A of the standard serves to provide examples of syllabi for the training and examination of personnel seeking qualification to this International Standard.
- EN 10256:2000 (Non-destructive testing of steel tubes - qualification and competence of level 1 and 2 non-destructive testing personnel) was developed by the European Committee for Iron and Steel Standardization (ECISS) for similar reasons to those that led to the development of the international standard ISO 10256; the industry utilizes a high proportion of automated testing and it was considered that the application of EN 473 would lead to over qualification of operators.
- EN 4179:2005 (Aerospace series - qualification and approval of personnel for non-destructive testing). The original standard was developed by the Association of European Aerospace Manufacturers (AECMA) to suit the particular needs of their industry, which were not felt to be adequately served by EN 473. This industry sector

uses a range of sometimes very esoteric NDT techniques, often automated and computerised, which it was considered would be beyond the scope of independent certification examinations. Added to this, there was a need to harmonise the certification of personnel employed in the European aerospace industry with the requirements of MIL-STD-410 (now AIA-NAS-410) since this standard is often specified in contractual arrangements with US manufacturers. EN4179 and NAS410 are at this time partially merged into one specification, which is published as European standard EN 4179:2005. Work on a further revision, which will completely merge the European and North American standards, is ongoing, and is expected to be completed within 2 years.

- ISO/IEC 17024 (General requirements for bodies operating certification systems of persons) was published in 2003, and International Accreditation Forum (IAF) guidance on the implementation by certification and accreditation bodies of ISO/IEC 17024 was published as G24 in 2004. The standard replaces EN 45013 (1989 General criteria for certification bodies operating certification of personnel), which has been formally withdrawn. The requirements of the new standard are far more appropriate than those of the superseded EN 45013, which was originally based upon EN 45012 (General criteria for certification bodies operating *certification of quality systems*). All accredited certification bodies are now fully applying ISO/IEC 17024, and it is expected that this will become a major contributor to harmonization of qualification and certification of NDT personnel.

NDT PERSONNEL CERTIFICATION STATISTICS

The following table contains data collected from certification bodies during the first quarter of 2005.

Country	Certification Body	Certification Scheme	Certificates valid	Persons certified	Certificates issued	Standards	Date data provided
Canada	NRcan	CGSB	11,204	4,164	20,000	1,4	2005-01-14
UK	BINDT	PCN	17,080	7,733	50,000	2,3,4	2005-01-14
China	ChSNDT	ChSNDT	41,800	21,000	41,800		2005-01-25
Czech	APC	APC	1,780	959	2,150	1,4	2005-01-25
Spain	CERTIAEND	PC03	3,929	2,049	4,880	1,3	2005-02-02
Ukraine	UKREXPERT		1,473	971	5,117	1,3	2005-02-02
Croatia	CrSNDT		912	618	4,952	1,3	2005-02-02
Netherlands	SKO		2,164	1,351	5,202	2,3	2005-02-12
Denmark	Force Dantest Cert	Nordtest	1,800	750	5,000	2,3	2005-02-12
Sweden	NDT Training Center AB	Nordtest	2,400	800	3,300	2,3	2005-02-12
Japan	JSNDI	JIS Z 2305 and NDIS 0601	61,000	34,000	144,500	National standards only	2005-03-02
Israel	Israndt	Isracert	20	20	20	2,3,4	2005-03-02
Netherlands	SKO	SKNDO	2164	1351	5202	2,3	2005-03-02
Russia	MIA Spectrum	Rostechnadzor	47,384	39,308	79,149	1,3,4	2005-03-02
Russia	Testing & Diagnistics	Rostechnadzor	5,166	4,366	9,932	1,3,4	2005-03-02
Hungary	Association of welding and material testing	MHtE	3907	3319	5263	2	2005-02-28
		Totals:	204,183	122,759	386,467	= EN 45013 = ISO/IEC 17024 = EN 473 : 2000 = ISO 9712 : 1999	
		Data:	Certificates valid	Persons certified	Certificates issued		

The above data does not fully reflect the global position since the responses to the request for data were limited to those bodies listed. It nevertheless gives a good indication of the implementation of ISO 9712 and EN 73, and of compliance with EN 45013 and ISO/IEC 17024.

STANDARDS DEVELOPMENT

- **ISO/TC135/SC7/WG7** has been formed to develop an international standard covering qualification of NDT personnel through performance based assessment of competence. This project follows numerous round robin trials that have demonstrated a deficiency in the current approach to qualification and certification of NDT personnel.
- **ISO/TC135/SC7/WG8** has been formed to develop specifications for discontinuities in examination specimens. This follows on from a Technical report issued by CEN (prTS 15053 - Recommendations for discontinuity types in test specimens for examination) that covers the same scope. The resulting ISO document is intended to be a Technical Specification which, unlike a Technical Report, contains mandatory compliance criteria, and may be elevated to a standard.

PREN 473 : 2006 – NOTABLE CONTENT AND FEATURES

The process of reviewing and revising EN 473 to a third edition is in progress, and at the time of submission of this paper it is too early to report on likely changes. However, CEN/TC138 is undertaking this work with a view to submitting the resulting standard to ISO for adoption under the Vienna Agreement as an international standard.

CONDITION MONITORING PERSONNEL CERTIFICATION

ISO/TC 108/SC5 is developing a suite of standards covering the qualification and certification of personnel engaged in Condition Monitoring. Mainly concerned with monitoring machinery, the standard also embraces Infrared Thermography, and this also deals with civil engineering and electrical/electronic systems. ISO 18436 has a number of parts (some of which are already published, with others in various stages of drafting):

- Part 1: General requirements
- Part 2: Vibration analysis (published)
- Part 3: Accreditation of Certification Bodies (published)
- Part 4: Lubrication Management and Analysis
- Part 5: Thermography
- Part 6: Diagnostics and Prognostics
- Part 7: Condition Monitoring Specialists

NDT TRAINING

CEN/TC138 ad-hoc group 4 and ISO/TC135 WG2, both under the convenership of the CEN/TC138 Chairman, have drafted the following Technical Reports:

CEN ISO/TR 25108 : 2006, NON-destructive testing – Guidelines for NDT personnel training organisations.

This Technical Report provides guidance for training organizations in terms of Management, QMS, student induction and assessment, facilities, NDT equipment, technical library, training staff and records to be maintained. This is a useful publication, and is highly recommended for use by those certification bodies that assess

and approve training organizations preparing candidates for ISO 9712 qualification examinations.

CEN ISO/TR 25107 : 2006, Non destructive testing – Guidelines for NDT training syllabuses.

This Technical Report provides recommendations for detailed training syllabuses at three levels covering RT, UT, ET, MT, PT, LT, AT and VT.

These documents are the product of 2 years work in ISO/TC135 and CEN/TC138 working groups to promote harmonization of the minimum training requirements of the different existing certification schemes. The content of this first edition has been based on the experience of the participating experts and comments of the end-user industries. The time allotment for the different topics takes into account the latest developments in each method and consequently the total duration can be sometime greater than the minimum duration required by ISO 9712 and EN 473.

Also noteworthy is the fact that these two specifications are normative references in CD prEN473 : 2006, but that ISO 9712:2005 *does not* make reference to CEN ISO/TR 25107 : 2006. The ISO standard refers to IAEA-TECDOC-628/Rev.1:2002, *Training Guidelines in Non-destructive Testing Techniques*, published by INIS Clearinghouse, International Atomic Energy Agency.

ICNDT

ICNDT *"the World organization for NDT"*

INTERNATIONAL COMMITTEE FOR NON-DESTRUCTIVE TESTING

The International Committee on NDT is today seeking to establish for itself a wider and more meaningful role in the international NDT community, and it has recently set up the *ICNDT NDT Qualification and Certification Committee* with the following objectives:

(i) To provide a focal point for ICNDT's activities in Qualification and Certification of NDT, working in co-operation with the Regional NDT Committees;

(ii) To promote international harmonisation in compliance with International Standards (including nomination of ICNDT representation on ISO Committees);

(iii) To promote mutual recognition of Certification.

(iv) To organise information of NDT Qualification and Certification on the ICNDT Website.

(v) To oversee the preparation of documents/guidelines etc. (e.g. ICNDT Recommended Guidelines on NDT Qualification and Certification according to ISO 9712) for publication on the ICNDT Website.

The Committee Chairman is nominated by the ICNDT Executive Committee, and the members will be invited by the ICNDT Executive Committee, chosen to ensure a geographical spread of interested parties.

Meetings will be held as required, supplemented by e-mail correspondence.

EFNDT

The European Federation for NDT (EFNDT) was formed in 1999 from the members of the previous European Council for NDT (ECNDT).

The purpose of the Federation is to promote all aspects of non-destructive testing including the technology, research, development application, training and information in all countries within the geographical area of Europe, according to the UN definitions and to initiate any actions likely to improve its quality and reliability.

The EFNDT has established itself as a legal entity, thus creating the opportunity to raise funds from its members and activities in order to undertake various projects for the wider benefit of the NDT community at large (there are already over thirty members of the EFNDT). The EFNDT has two committees concerned with Qualification and Certification of NDT Personnel:

The EFNDT Certification Executive Committee (CEC) has have six members: one nominee from each of the three Founding Societies [BINDT, COFREND and DGZfP], and three further members appointed by the EFNDT Board of Directors. All CEC Members are appointed for a period of three years, and are eligible for re-appointment. The CEC is set up to:

- Execute the policy of the EFNDT in the field of certification.
- *Approve* certification bodies against the criteria set out in document EFNDT/P/05-001 (such approval being seen as an alternative to accreditation – where no national accreditation system exists).
- Monitor and direct the CEC Secretariat in processing applications for and awarding licenses for the use of the EFNDT examination question bank.
- Negotiate mutual recognition and acceptance of certification issued by approved certification bodies, including the management and administration of the EFNDT Multilateral Recognition Agreement (MRA).

The EFNDT Forum on NDT Accreditation, Qualification and Certification (FAQC), which was previously known as the Working Group on Qualification and Certification (referred to as WGC or Working Group 1), has been given new terms of reference in keeping with its new identity. The FAQC is set up to consider and formulate recommendations to the Board of Directors (BoD) on EFNDT policy and objectives the areas of:

- criteria for registration under the EFNDT Multilateral Recognition Agreement (MRA);
- liaison with other regional MRA for NDT personnel certification;
- promoting acceptance of the certificates of competence issued by accredited certification schemes registered under the EFNDT MRA.
- codes, standards and specifications related directly or indirectly to NDT;

- NDT laboratory assessment and accreditation;
- NDT personnel certification body assessment and accreditation;
- Co-operation with European Accreditation of Certification (EAC) and the International Accreditation Forum (IAF) on matters relating to non-destructive testing, including laboratory accreditation and accreditation of NDT personnel certification bodies;
- interpretation of ISO 9001 : 2000 criteria for NDT service vendors;
- qualification of NDT equipment, procedures and NDT personnel;
- Interfacing with established authorities and bodies involved with and having an interest in equipment and inspection qualification;
- promoting and improving quality and reliability in Non-Destructive Testing generally.

Participation in the FAQC is open to all Full and Associate Member NDT Societies of the EFNDT, and each Member of the EFNDT may nominate one official representative to attend an FAQC meeting. Other NDT Societies and Certification Bodies not in current membership of EFNDT may be invited by the FAQC Chairman to attend meetings with Observer status. The Chairman and Secretary of the FAQC are appointed by the Board of Directors of the EFNDT (for the time being, the Chairman and Secretary are provided by the British Institute of NDT).

ASME

ASME Code requirements for NDT personnel have been revised following recent code case enquiries to reference ASNT ACCP central certification specifically, and to ISO 9712 implicitly. Centrally certificated NDT personnel may now satisfy certain ASME code requirements, provided the employing organization operates a procedure or written practice that covers the employment and authorization of such personnel.

ASME has recently published Section V, Article 14 (qualification of personnel, equipment and NDT procedures). The methodology set out in this Article involves the evaluation of general, technical, and performance-based evidence presented within a documented technical justification, and when required, a blind or non-blind performance demonstration. It also provides good information on statistical analysis concerning Probability of Detection. A very useful document!

THE EUROPEAN PRESSURE EQUIPMENT DIRECTIVE (PED)

Within the Directive, Pressure Equipment is categorised at four levels (I to VI) according to degree of hazard: category III and IV equipment, with potentially the greatest hazard, will require conformity assessment by 'notified bodies' and 'recognised third party organisations'. The following extracts are relevant to this paper:

> 97/23/EC Article 13 clause 1: Members states shall notify the Commission and the other member states of the third party organizations which they have recognised for the purposes of the tasks referred to in Annex 1, sections 3.1.2 and 3.1.3.

97/23/EC Annex I clause 3.1.3: Non-Destructive Tests. For pressure equipment, non-destructive tests of permanent joints must be carried out by suitable qualified personnel. For pressure equipment in categories III and IV, the personnel must be approved by a third party organisation recognized by a member state pursuant to Article 13.

97/23/EC Annex IV: Criteria to be met when designating the notified bodies referred to in Article 12 and the recognised third party organizations referred to in Article 13.

PrEN 13480: part 5 - Inspection and testing - clause 8.4.3 (Personnel qualifications). Personnel performing tests shall be qualified and certified in accordance with EN 473 for the appropriate testing method (this requirement is repeated in clauses 8.5 to 8.9 which cover NDT methods VT, MT, PT, RT and UT).

PrEN13445 part 5 - Inspection and testing - clause 2 (Normative references) includes reference to EN 473.

PrEN13445 part 5 - Inspection and testing - clause 6.1.3.5.7 (Qualification of NDT personnel): NDT personnel shall be qualified and certified in accordance with EN 473 except for visual examination and leak testing (for which personnel shall be qualified but not certified). NDT personnel shall hold an appropriate certificate of competence at level 1, 2 or 3, as appropriate, which is delivered as described in tables H-1 and H-2 depending on the conformity assessment module (tables H-1 and H-2 state that for category III and IV equipment, qualification and certification of NDT personnel *may be* (is?) carried out by recognised third party organisation).

The NDT personnel approval requirements of the PED have been addressed quite differently at the national levels in Europe, where most (but not all!) Recognized Third Party Organisations (RTPO) have been appointed on the basis of compliance with EN45013 or ISO/IEC 17024.

NDT personnel holding EN 473 certification in relevant sectors (welds, castings, wrought products, forgings, pipes, pre and in-service inspection and metal manufacturing) are automatically *'approved'* under the PED – so long as the certification body that issued the certification has been 'notified' as a RTPO. However, except where EN 473 is invoked within the terms of a harmonized standard (e.g., EN 13480 or 13445), EN 473 certification is *not* mandatory to satisfy the provisions of the PED.

NDT personnel qualified within a 2nd party system, such as SNT-TC-1A, can be *'approved'* by a RTPO under a code of practice proposed by the EFNDT, which was taken up and modified by the EU Conformity Assessment Bodies Forum (CABF) before being passed to CEN TC 138 for publication as CEN/TR 00138123 : 2006, Non destructive testing – Code of practice for the approval of NDT personnel by recognised third party organisations under the provisions of Directive 97/23/EC.

The diagram at Annex 1 serves to illustrate the processes for approving NDT personnel under CEN/TR 00138123 : 2006, which has been incorporated as a normative reference in CD/prEN 473 : 2006.

EASA AND EN 4179 (AEROSPACE SECTOR NDT QUALIFICATION)

The European Aviation Safety Agency (EASA) superseded the Joint Aviation Agency in September 2003 and, as the new European civil aviation regulator, is taking over the roles

of the respective national aviation safety authorities of European Union member states. EASA publishes two regulations of interest to the NDT fraternity:

- EASA Part 21 regulation covers the provision of NDT in the civil aviation manufacturing sector, and recognizes the qualification and certification of NDT personnel in both second party, e.g., AIA-NAS-410, and third party arrangements, e.g., EN 473.
- EASA Part 145 regulation covers the provision of NDT in service and specifies compliance with EN 4179 for the qualification and 'approval' of NDT personnel.

Although EN 4179:2000 is specified by EASA part 145, this is almost universally ignored since industry has adopted AECMA standard prEN 4170:2003, which represents a fusion of EN 4179 with NAS-410, prEN 4179 places responsibility for controlling NDT qualification examinations upon National Aerospace NDT Boards.

National Aerospace NDT Boards (NANDTB) are presently being widely constituted throughout Europe to address the airworthiness requirements of EASA regulations (especially parts 21 and 145) and prEN 4179:2003. NANDTB have the responsibility of controlling all NDT qualification examinations, including those conducted by the employer and central certification bodies. The status of development of EU member states' Aerospace NDT Boards (believed correct at 31 May 2006) is shown in the following table:

Country	Status of Board	Country	Status of Board
Sweden-Denmark-Norway	active	Yugoslavia	Under development
Italy	active	Finland	active
Austria	active	Turkey	not established
Germany	active	Malta	unknown
United Kingdom	active	Czech	unknown
Switzerland	active	Poland	unknown
France	active	Ireland	unknown
Belgian	active	Slovenia	unknown
Greece	active	Latvia	unknown
Holland	Under development	Estonia	unknown
Luxemburg	unknown	Lithuania	unknown
Spain	Under development	Cyprus	unknown
Portugal	Under development	Iceland	not established
Australia	active	Slovakia	unknown

Footnote

It is proposed to hold a meeting of representatives of the various National Aerospace NDT Boards during the 9th European Conference on NDT. The conference organiser, DGZfP, has kindly arranged facilities, ECC Room 5 in the conference centre for such a meeting, which will commence at 14:00 on Friday 29th September.

Each Board wishing to participate has been requested to nominate not more that two representatives to attend the meeting. Countries which do not presently have a Board established have also been invited to attend. It is hoped that one or more representatives from EASA will attend the meeting as observers, though this status is not intended to limit their participation in any way.

The main purpose of the meeting will be to discuss whether to formally establish a Forum for NANDTB under the umbrella of the European Federation for NDT.

BIBLIOGRAPHY

Standards and guidelines covering qualification and certification of non-destructive testing and condition monitoring personnel

AIA-NAS-410	2002 Aerospace Industries Association national Aerospace Standard for qualification and certification of non-destructive testing personnel
ANSI-CP-189	1995 ANSI/ASNT standard for qualification and certification of non-destructive testing personnel
ANSI-CP-189	2006 (DRAFT for comment) standard for qualification and certification of non-destructive testing personnel
EN 10256	2000 (white draft) Non-destructive testing of steel tubes - qualification and competence of level 1 and 2 non-destructive testing personnel
EN 4179	2005 Aerospace series - qualification and approval of personnel for non-destructive testing
EN 45013	1989 General criteria for certification bodies operating certification of personnel (WITHDRAWN)
EN 473	2000 Qualification and certification of NDT personnel - General Principles (2nd edition)
PrEN 473	2006 Qualification and certification of NDT personnel - General Principles (Draft 3rd edition)
ISO 11484	1994 Steel tubes for pressure purposes - qualification and certification of non-destructive testing (NDT) personnel
ISO 9712	2005 (3rd edition) Non-Destructive Testing - Qualification and Certification of Personnel
ISO 18436	Condition monitoring and diagnostics of machines – Accreditation of organisations and training and certification of specialists
ISO 20807	2003 Qualification of personnel for limited application of non-destructive testing
ISO/IEC 17024	General requirements for bodies operating certification systems of persons
SNT-TC-1A	2001 ASNT recommended practice for the qualification and certification of non-destructive testing personnel (Periodically reviewed and republished by the American Society for NDT)

Codes and Regulations

97/23/EC	European Pressure Equipment Directive - published in the Official journal of the European Communities No. L181 of 9th July (ISBN 011 916 0927)
ASME Section V	(1998 edition A99) Article 1 : General Requirements, T-140 : Requirements (98 A99), sub paragraph *(b)* (Requirements for NDE Personnel)

ASME Section VIII Welded Vessels, UW-51 (98), sub paragraph *(a)* (2) (Qualification and Certification of NDE Personnel)

Training guidelines for the qualification of non-destructive testing personnel

TECDOC-628 : 1991 Training Guidelines in Non-destructive testing Techniques

Published by the International Atomic Energy Agency, Wagrammerstrasse 5, P. O. Box 100, A-1400 Vienna, Austria.

CR ISO TR 25107 Non-destructive testing - Guidelines for NDT training syllabuses

CR ISO TR 25108 Non destructive testing - Guidelines for NDT personnel training organisations

ANSIASNT-CP-105 2006 (DRAFT for comment) Topical outlines for qualification of NDT personnel

ANNEX 1 – ROUTES TO APPROVAL OF NDT PERSONNEL TO SATISFY THE EU PED