



International Standards pertaining to Thermography Practices, Training and Certification

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Abstract

American, European and International societies establish standards for individuals and companies within the field of infrared thermography. Historically addressing non-destructive testing (NDT) applications and personnel, standards exist and are being developed within the fields of condition monitoring (CM) and building diagnostics. Incorrect reference to or application of standards and guidelines create widespread market confusion. What type of claim can be made against which standards? Does the standard apply to a company or an individual? To what or whom is the standard intended? Does reference to a standard guarantee compliance or imply quality? How does one become educated or involved in standards? A clear and factual overview of international standards within the field of thermography (with brief reference to recognizable standards such as ASNT SNT-TC-1A and CEN 473), their status and application will be presented. As an active member of the standards drafting committee and member body voting process for ISO during the past five years, the author will be prepared to answer open questions related to standards development, guidelines and procedures.

Keywords: Standards, ISO, Thermography, Training, Certification.

1. Introduction

An International Standard provides rules, guidelines or characteristics for activities or for their result, aimed at the achievement of the optimum degree of order in a given context. Apart from product standards, there are test methods, codes or practice and, increasingly, management standards. They are designed for common and repeated use. The foremost aim of international standardization is to facilitate the exchange of goods and service through the elimination of technical barriers to trade. The globalization of trade implies that standards based on a double level consensus – between countries and across stakeholders – are, more than ever, in demand.

2. The need for International Standards

The political context in which International Standards are developed has evolved drastically. With a collection of over 15,000 International Standards in a network of 156 national bodies and 580 organizations in liaison, the International Organization for Standardization (ISO) is the leader for the production of International Standards.

ISO considers its traditional role to keep the wheels of industry sectors rolling efficiently by supplying the technical standards they need, adapting them to the evolutions of technology, the increased concerns for the environment or security and the pervasiveness of information and communication technologies. But, technology, industry and business do not exist in a vacuum. ISO's mission has evolved to that of providing the crucible for developing globally relevant, consensus-based standards that assist organizations in meeting their challenges in all three dimensions of sustainable business.

2.1 ISO and world trade

The World Trade Organization's "Agreement on Technical Barriers to Trade" which includes practice for the preparation, adoption and application of standards, recognizes the important contribution that international standards and conformity assessment systems can make. ISO fully implements the six principles adopted by the committee that should be observed by international standardizing bodies: transparency; openness; impartiality and consensus; effectiveness and relevance; coherence; and development dimension.

ISO's global relevance policy details principles consistent with the WTO principles along with implementation guidelines to ensure that ISO standards

- respond effectively to global regulatory requirements, market needs and scientific/technical developments;
- do not distort markets nor have adverse effects on fair competition;
- do not stifle innovation or technological development;
- do not give preference to the requirements of specific countries or regions, and are performance-based rather than design-prescriptive.

2.2 Worldwide collaboration

ISO collaborates with its two sector based, international partners, the IEC (International Electrotechnical Commission) and ITU (International Telecommunication Union). These three organizations, all located in Geneva, Switzerland, have formed the World Standards Cooperation (WSC) as the focus for their combined strategic activity. ISO collaborates with the United Nations Organization and its specialized agencies and commissions, particularly those involved in the harmonization of regulations and policies. ISO's technical committees have formal liaison relations with some 580 international organizations, which complement

the network of its national members. Many of ISO's members also belong to regional standards organizations. This makes it easier for ISO to build bridges with standardization activities throughout the world.

2.3 ISO Membership

Those involved in committee work are designated as member bodies. A *member body* of ISO is the national body most representative of standardization in its country. Only one such body for each country is accepted for membership of ISO. Member bodies are entitled to participate and exercise full voting rights on any technical committee and policy committee of ISO. They can use ISO standards as the basis for their national standards.

All ISO member bodies are eligible for membership of any of the ISO committees. There are two types of active memberships: P-members (participating members) are ISO bodies which wish to play an active role in the work of a technical committee or subcommittee; O-members (observing members) include those who wish to follow the development of a standard, and possibly to make contributions to the work, without committing themselves to active participation.

2.4 Stages leading to new Standards

An International Standard is the result of an agreement between the member bodies of ISO. They are developed by ISO technical committees (TC) and subcommittees (SC) by a process each with its unique product name:

- Stage 0: Preliminary stage / PWI (Preliminary Work Item)
- Stage 1: Proposal stage / NP (New Proposal)
- Stage 2: Preparatory stage / WD (Working Draft)
- Stage 3: Committee stage / CD (Committee Draft)
- Stage 4: Enquiry stage / DIS (Draft International Standards)
- Stage 5: Approval stage / FDIS (Final Draft International Standard)
- Stage 6: Publication stage / IS (International Standards)

2.5 ISO Technical Committees

An International Standard embodies the essential principles of global openness and transparency, consensus and technical coherence. These are safeguarded through its development in an ISO Technical Committee (ISO/TC), representative of all interested parties, supported by a public comment phase. The ISO/TC's have a formal scope in consideration of market environment, strategies, and risk analysis outlined in a formal business plan. As of August 2007, the Technical Committees span from TC1 to TC 237, with titles from *screw threads* to *nanotechnologies*.

2.6 ISO Committee for Conformity (CASCO)

CASCO membership is open to interested member bodies as participating (P) or observer (O) members and to interested correspondent members as observer (O) members.

The committee is responsible

- to study means of assessing the conformity of products, processes, services and management systems to appropriate standards or other technical specifications;
- to prepare international guides and International Standards relating to the practice of testing, inspection and certification of products, processes and services, and to the assessment of management systems, testing laboratories, inspection bodies, certification bodies, accreditation bodies and their operation and acceptance;
- to promote mutual recognition and acceptance of national and regional conformity assessment systems, and the appropriate use of International Standards for testing, inspection, certification, assessment and related purposes.

There are 104 member bodies with 73 Participating countries and 31 Observing countries. This committee creates conformity assessment guidelines and requirements. For example, CASCO representatives advise ISO technical committees on the drafting of international standards.

3. Guidelines Regarding Thermography

It is beyond the scope this paper to examine and discuss the many published guidelines associated with the thermography industry such as: “Guidelines on the certification of thermographers,” *Confederation of Fire Protection Associations Europe*; or, “Guidelines to thermographic inspection of electrical installations,” *Centre National de la Recherche Scientifique*. Although there are numerous respected and at least a handful of well recognized country and/or market/application specific guidelines, the ASNT brand name is likely the most familiar to our industry.

3.1 ASNT (Recommended Practice No. SNT-TC-1A)

The American Society for Nondestructive Testing, Inc. (ASNT) is the world’s largest technical society for nondestructive testing (NDT) professionals. ASNT was founded in 1941 (under the name of The American Industrial Radium and X-Ray Society). The Society is structured into local Sections (or chapters) throughout the world. There are over 80 local Sections in the US and 14 internationally.

Through its organization and membership, ASNT provide a forum for exchange of NDT technical information; NDT educational materials and programs; and standards and services for the qualification and certification of NDT personnel. ASNT promotes the discipline of NDT as a profession and facilitates NDT research and technology applications.

ASNT is a nonprofit corporation governed by a board of directors and national officers. The Society is organized into councils which govern issues related to 1) Technical and Education, 2) Research, 3) Section Operations and 4) Certification. These councils meet regularly to achieve the goals and objectives of the overall organization. Day to day operations and activities are managed by the ASNT world headquarters staff in Columbus, Ohio.

ASNT serves the NDT professions and promotes NDT technologies, through publishing, certification, research and conferencing. In terms of specific activities, ASNT is the world leader in organizing and sponsoring conferences and meetings pertaining to NDT.

Their Autumn and Spring Conferences alone attract over 2,000 participants. The Society also maintains an extensive publications operation which produces and distributes NDT related books, standards, technical journals, and training materials. Well known in many American and Asian areas, ASNT *Recommended Practice No. SNT-TC-1A: Personnel Qualification and Certification in Nondestructive Testing* (2006) provides guidelines for employers to establish in-house certification programs for the qualification and certification of nondestructive testing personnel. Since 1966, employers have used this document as the general framework for their NDT programs.

The ASNT recommended practice document is used by employers to create a written practice, against which they are responsible to train, examine and certify their own employees. In contrast to International Standards, the written practice developed is unique to a company and can not be applied globally.

A valid certificate in accordance with SNT-TC-1A would be issued by an employer, not a certification (or training) body. It should be noted that an employer issued certificate is NOT however in conformance to ISO, which denotes that document as a “declaration.”

After (possibly unintentional) misrepresentation to this practice during the rapid expansion of the thermography market in primarily American and Asian countries, reference to ASNT certification has lost some reputation, while “central certification” by third-party bodies became more recognizable.

(ASNT does administer central certification for Level III practitioners only, which has included thermal infrared since the mid-1990’s.)

4. Standards Regarding Thermography

It is beyond the scope this paper to examine and discuss all published standards associated with the thermography industry such as: “Standards and Protocols in Clinical Thermographic Imaging,” *International Academy of Clinical Thermology*.

4.1 CEN (EN 473)

CEN, the European Committee for Standardization, was founded in 1961 and contributes to the objectives of the European Union and European Economic Area with technical standards to promote free trade, the safety of workers and consumers, interoperability of networks, environmental protection, exploitation of research and development programs, and public procurement.

CEN coordinates efforts of its members to develop standards drawn up in technical committees consisting of National Standards Bodies of the 27 European Union countries plus the National Standards Bodies of European Free Trade Area.

The European standard EN 473, “Qualification and certification of NDT personnel – General principles” was first issued in January 1993. It provides a uniform level of qualifications of the personnel, which is acknowledged and accepted and sometimes demanded by authorities and users of NDT in industrial areas in European countries such as Germany.

EN 473 defines levels of competence along with requirements for experience, training and examination. Certification bodies issue certificates to those demonstrating conformance to the standard. There have been approximately 600 certificates issued by the German Association for Applied Thermography and SECTOR Cert, a German certification body, between 1999 and 2006.

5. International Standards Pertaining to Thermography

5.1 ISO IS 9712: Personnel Certification in Nondestructive Testing

Developed by the NDT/Personnel Qualification/Performance based qualification and certification working group of ISO, International Standard 9712:2005 (first published in 1999) specifies the qualification and certification of personnel involved in non-destructive testing (NDT). It is applicable to proficiency in one or more of the following methods: acoustic emission testing; eddy current testing; infrared thermographic testing; leak testing (hydraulic pressure tests excluded); magnetic particle testing; penetrant testing; radiographic testing; strain testing and ultrasonic testing.

There are 42 member bodies with 30 Participating countries and 12 Observing countries in this committee. They work in liaison with the ISO committee for Technical delivery conditions for steel tubes for pressure purposes. The secretarial organization of this committee is the American National Standards Institute (ANSI).

5.2 ISO FDIS 18434: Thermography, Part 1: General Procedures

Developed by the Mechanical Vibration, Shock and Condition Monitoring/Condition Monitoring and Diagnostics of Machines/Thermal Imaging working group of ISO, Final Draft International Standard 18434 Part 1 provides an introduction for the application of infrared thermography (IRT). ISO 18434-1:2006 is intended to

- introduce the terminology of IRT as it pertains to condition monitoring and diagnostics of machines;
- describe the types of IRT procedure and their merits;
- provide guidance on establishing severity assessment criteria for anomalies identified by IRT;
- outline methods and requirements for carrying out thermography of machines, including safety recommendations;
- provide information on data interpretation, and assessment criteria and reporting requirements;
- provide procedures for determining and compensating for reflected apparent temperature, emissivity and attenuating media;
- encompasses the testing procedures for determining and compensating for reflected apparent temperature, emissivity and attenuating media when measuring the surface temperature of a target with a quantitative thermography camera.

There are 34 member bodies with 21 Participating countries and 13 Observing countries in this committee. They work in liaison with the ISO committee for Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries; Non-destructive testing; Industrial automation systems and integration and; Gas Turbines. The secretarial organization of this committee is the American National Standards Institute (ANSI).

5.3 ISO 18436-1: Requirements for training and certification of personnel – Part 1: Requirements for certifying bodies and the certification process

Developed by the Mechanical Vibration, Shock and Condition Monitoring/Condition Monitoring and Diagnostics of Machines/Training and Accreditation working group of ISO, International Standard 18436-1 defines the requirements for bodies operating certification systems for personnel who perform machinery condition monitoring, identify faults, and recommend corrective action. Procedures for the certification of condition monitoring and diagnostic personnel are specified.

There are 34 member bodies with 21 Participating countries and 13 Observing countries in this committee. They work in liaison with the ISO committee for Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries; Non-destructive testing; Industrial automation systems and integration and; Gas Turbines. The secretarial organization of this committee is the American National Standards Institute (ANSI).

5.4 ISO 6781: Thermal insulation – Qualitative detection of thermal irregularities in building envelopes – Infrared Method

Developed by the Thermal Insulation committee, International Standard 6781 Specifies a qualitative method, by thermographic examination (infrared method), for detecting thermal irregularities in building envelopes. The method is used to identify wide variations in the thermal properties, including air tightness, of the components constituting the external envelopes of buildings. It does not apply to the determination of the degree of thermal insulation and air tightness of a structure.

As this standard was published in 1983, there are no relevant member bodies and liaison committee statistics available; however, at the time it was circulated for vote in 1982, 14 member bodies approved the standard (Australia, Austria, Belgium, Canada, Denmark, Egypt, Finland, France, Italy, Japan, Norway, Spain, Sweden and the USA) while two member bodies objected (Germany and the Netherlands). A new ISO working group has been formed in the area of thermography of buildings and industrial installations with its first meeting scheduled 1 October 2007.

6. Emerging International Standards Pertaining to Thermography

6.1 ISO FDIS 18436-3: Requirements for training and certification of personnel -- Part 3: Requirements for training bodies and the training process.

Developed by the Mechanical Vibration, Shock and Condition Monitoring/Condition Monitoring and Diagnostics of Machines/Training and Accreditation working group of ISO, Final Draft International Standard 18436-3 is registered for formal approval with its member bodies.

6.2 ISO DIS 18436-8: Requirements for qualification of personnel -- Part 8: Thermography.

Developed by the Mechanical Vibration, Shock and Condition Monitoring/Condition Monitoring and Diagnostics of Machines/Thermal Imaging working group of ISO, Draft International Standard 18436-8 is circulated with a full report for a new DIS ballot.

Conclusion

By conservative estimate, there are at least 30 technical committees of ISO where thermography standards applying to the specified segment could be developed, with four major market oriented committees (NDT, CM, Building and Automation) and a major industry committee (optics and photonics) in existence. At the present, the most active and global thermography committee within ISO is TC 108: *Mechanical vibration, shock and condition monitoring*. In the author's opinion, it is not of strategic importance to debate over titles of committees and working group – what is of the utmost importance is to create applicable and open international standards to our industry and the practice/profession of thermography.

We are a global community, with even the most ferocious of competitors having common interests – everyone wants to (professionally) grow the market for thermography. International Standards to address the use of infrared thermal imaging and the science of thermal measurement is one way to prevent the “cowboy syndrome” that can and will limit market acceptance due to poor practice. Until we can establish a parallel endorsement to a PE (Professional Engineer), we as a society of professionals have much to consider and contribute to the unique vision of infrared.

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References

In an effort to properly represent the International Organization for Standardization (ISO), The American Society of Nondestructive Testing (ASNT) and the European Committee for Standardization (CEN), a number of mission and objective statements were copied from the organizations own literature.

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