STANDARDS NEWS: A NEW TITLE AND SCOPE FOR THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION / TECHNICAL COMMITTEE 108 (ISO/TC 108)

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In December 2006 the Technical Management Board of the International Organization for Standardization (ISO), headquartered in Geneva, Switzerland, approved a new title and scope for ISO/TC 108. The new title is "*Mechanical vibration, shock and condition monitoring*." This title change formally recognizes and brings to the forefront the growing field of condition monitoring of machines and structures and its importance in the agenda of ISO/TC 108.

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The new scope of ISO/TC 108 was approved as: Standardization in the fields of mechanical vibration and shock and the effects of vibration and shock on humans, machines, vehicles (air, sea, land and rail) and stationary structures, and of the condition monitoring of machines and structures, using multidisciplinary approaches.

Specific areas of current interest include the standardization of:

- terminology and nomenclature in the fields of mechanical vibration, mechanical shock, and condition monitoring;
- measurement, analysis and evaluation of vibration and shock, e.g., signal processing methods, structural dynamics analysis methods, transducer and vibration generator calibration methods, etc.;
- active and passive control methods for vibration and shock, e.g., balancing of machines, isolation and damping;
- evaluation of the effects of vibration and shock on humans, machines, vehicles (air, sea, land and rail), stationary structures, and sensitive equipment;
- vibration and shock measuring instrumentation, e.g., transducers, vibration generators, signal conditioners, signal analysis instrumentation and signal acquisition systems;
- measurement methods, instrumentation, data acquisition, processing, presentation; analysis, diagnostics and prognostics, using all measurement variables required for the condition monitoring of machines;
- training and certification of personnel in relevant areas.

This change of mission statement represents a much needed update. The previous scope, written in 1991, at the time that Subcommittee 5 (SC 5) was formed, added condition monitoring to the work program of the TC. The new title and scope reflects the growing importance and multi-disciplinary nature of condition monitoring in the work of the committee. These changes were made to reflect better the current program of work in TC 108 and for consistency with the ISO approved Business Plan.

ISO/TC 108 has been actively writing vibration and shock standards for over forty years. First proposed to ISO on 29 May 1962 by the United States of America Standards Institute, the predecessor organization to today's American National Standards Institute (ANSI), TC 108 held its initial plenary meeting in 1964. By the mid-1970's ANSI assigned the Acoustical Society of America the responsibility for the Secretariat for TC 108. (ASA was already administering the national parallel committee, S2.) When SC 5 was formed in the early 1990's, ASA again was tapped to provide the International Secretariat.

The need to make these current changes has its roots go back seven years ago when ISO/TC 108 was reorganized internally into a set of working groups directly under the chair of TC 108. These working groups dealt with the basic science of the TC 108 mission and subcommittees that are primarily concerned with the engineering aspects. Currently, the TC 108 working groups have been formed to standardize:

basic vocabulary and nomenclature issues (WG 1)
vibration and shock isolators (WG 23)
condition assessment of structural systems from dynamic response measurements including structural dynamics measurements methods, measurement parameters and structural condition monitoring (WG 24)
stationary and non-stationary signal processing involving vibration, shock and condition monitoring issues (WG 26)
viscoelastic material evaluation and structural damping (WG 28)
vibration power flow methods (WG 29)
rotor balancing (WG 31).

TC 108 subcommittees have been formed to standardize:
vibration of machines, vehicles (air, land and sea) and stationary structures (SC 2)
vibration and shock transducers and calibration methods (SC 3)
human response to vibration and shock (SC 4)

condition monitoring of machines (SC 5)
vibration and shock generators (SC 6).

Most technical committees within ISO are assigned along product lines and have a very strong manufacturing component in their constituency. TC 108 is somewhat unique in that it spans many constituencies. This is due to the fact that its standards directly impact human health and safety, the environment, as well as the design of vehicles, machines and national infrastructure, manufacturing, trade, jobs and the economy in general. Standards written by this Technical Committee can, and have, directly influenced who gets a shipbuilding contract or which machine tool gets to market, as well as which machine goes into a vehicle or building. These standards can even have a great impact on the preservation of cultural monuments and historical buildings, an issue of great current interest in Europe. The main impact of TC 108 standards is to broadly influence customers and markets by specifying acceptable vibration and shock levels and to mitigate downside risk of failure in machines and structures.

This is one of a few ISO Technical Committees that can be said to impact the overall quality of life of nations. As a result, the member countries send experts that reflect a wide range of experience. Government representatives provide expertise on the environment, the consumer, human health and human safety from the user perspective. Experts from the manufacturing and design communities are concerned with customers and the marketplace. Those from academia bring expertise in the basic sciences. This mix of experts tends to act more in the interest of society at large, since consensus building is a strong aspect to reaching the final stage of the process, an international standard. The diversity of opinion and perspective in generating a standard is its primary strength and measure of its quality since technical standards are voluntary and primarily reflect the wisdom and reputation of participating individuals and organizations.

Future directions of ISO/TC 108

As we enter the twenty-first century, the world is experiencing a revolution as profound as the industrial revolution before it—the high technology, information revolution. Like the industrial age, the high tech age is having a major impact on all aspects of society. However, our Achilles' heel is the inherent complexity in high tech advances and the law of unintended consequences. The technology behind many of these significant developments is understood only by a select few. The interactions between components of complex systems are often poorly understood and a need for robustness and real-time monitoring has become a critical concern as our reliance on such systems increases. This issue, more than any other, drives the need for condition monitoring standards and explains the ISO decision to upgrade the visibility of SC 5 within TC 108. As a result, the need to rapidly incorporate new technologies into the TC 108 work agenda has become a paramount concern in order to keep these standards meaningful and relevant to the user community.

The main challenge in TC 108 is to develop quality standards that are based on a solid scientific foundation and yet have met some test of time. These standards should be as inclusive as possible, thus encouraging product innovation. Good standards should account for the realities of life in a wide range of economic circumstances without being unduly complicated and burdensome to apply.

In the near future, ISO/TC 108 is going to re-examine standards associated with the basic physics of the mechanical vibration and shock response of complex systems and the art and science of vibration and shock measurement. By emphasizing these areas, it is hoped that this committee can provide tools that can be consistently applied to provide meaningful measurement methods, repeatable measurement results, and consistent databases with known uncertainty that are the backbone for setting performance and condition monitoring levels for acceptance, prognosis and assessment purposes.

In addition to measurement practices, this technical committee will undertake new initiatives in defining appropriate vocabulary and symbols used in the vibration and shock community. The proliferation of new technology in this area is proceeding at such a rapid rate that inconsistencies in technical language are starting to be a problem. Precise language usage is fundamental for both public law and contract compliance. It is a prerequisite for providing meaningful guidance to protect public safety, the environment and culture.

One working group has been established in the areas of signal processing of vibration and shock measurement time-histories. This group is charged with generating international standards to classify vibration and shock signals as well as analyze and identify feature sets from such measurements. It is anticipated that these standards will assist the machine condition monitoring community by improving the quality of the databases by allowing them to be used for detailed comparison purposes and precursor identification. For example, a recent standard, ISO 18431-2:2004 *Mechanical vibration and shock—Signal processing—Part 2: Time domain windows for Fourier Transform analysis*, generated by this working group standardizes the algorithm for time domain windows for Fourier Transform analysis. This standard, if widely applied, should result in data sets that can be compared more exactly for examining change in system dynamics over time, a critical issue for predicting failure.

Another working group is concerned with developing standards for vibration and shock data acquisition. Its scope is to identify a set of key parameters that adequately describe the basic conditions of a vibration measurement for the purposes of allowing the technical community to efficiently compare measurements and build meaningful databases. After completion of this task, its scope will broaden to shock measurements. These standards will serve as the anchor for a planned compendium of standards for making high-quality vibration measurements.

Two working groups have been formed to standardize structural dynamics analysis and measurement tools for assessing the dynamic behavior and state of complex structural systems. These tools are primarily based on the application of a known force and the subsequent measurement of the amplitude and phase response at critical points in the system. Future project areas might include measurement methods for mechanical mobility, modal analysis, structural intensity, wave-number analysis (spatial array processing) and structural damping evaluation. Current areas under study center include examining methods for assessing vibratory power flow in complex structures.

Two other working groups were established that are concerned with the measurement of the dynamic system behavior, dynamic modeling and condition assessment of stationary structures such as buildings, dams, bridges and towers. Specifically, these working groups will standardize the terminology, measurement procedures and analysis methods necessary to assess the dynamic state and condition of stationary structures and to establish criteria and procedures for the timely assessment of such structural systems. Structural systems under dynamic loading and under environmental stress exhibit fatigue damage and aging (e.g., oxidation) over time that, if not properly assessed, can result in structural failure with potential danger to public safety as well as economic dislocations. These dynamic stresses can be produced by vibration and shock loading whose impact may be direct or indirect. Previous assessment methods relied heavily on inspection. However, in recent decades, advances in structural dynamics evaluation/diagnostics methods have provided insights into the assessment, dynamic modeling and current condition of stationary structures that are both sensitive and quantitative. This working group will exploit these structural dynamics evaluation methods to develop standards of structural system condition assessment that can be used to protect the public safety. One new standard, ISO 16587:2004 *Mechanical vibration and shock—Performance parameters for condition monitoring of structures*, that has been generated by these experts should help the insurance industry assess risk better in insuring vehicles and structures.

The six subcommittees under the auspices of TC 108 each have dynamic programs of work, that are detailed in references 1 and 2, with information also available on the ISO website (www.iso.org). Examples include the work in SC 3 on transducer calibration. SC 3 is in the process of developing a series of standards, that specifies the methods for the primary and secondary calibration of shock and vibration transducers under a wide range of environmental conditions. This series of standards should serve as the basis for conducting vibration and shock measurements for all other ISO standards.

SC 5 is involved with machinery condition monitoring and is an example of standardization across major technologies. The ISO Technical Management Board agreed to establish this subcommittee under the auspices of TC 108 due to the predominance of mechanical vibration and rotor-dynamic diagnostic methods in this field. However, in addition to vibration sensors, sensors for thermal imaging, sensors to assess oil contamination, acoustic emission sensors and simple thermometers are widely used to provide clues to the state of a machine. To generate quality technical standards in this area requires in-depth expertise in all the above areas and an understanding of the interplay between different types of sensors.

The current portfolio of TC 108 consists of over 100 international standards. A compendium of many of the older standards can be found in the two ISO Standards Handbooks.[3,4]

Those readers interested in more information on TC 108 from an international perspective can contact Bruce Douglas, the Chairman, at bruce.douglas@att.net, or Susan Blaeser, the Secretariat. at sblaeser@aip.org. Those readers interested in more information on TC 108 from a national perspective can contact David Evans, the U.S. Technical Advisory Group (TAG) Chairman, at dje@nist.gov or Susan Blaeser in her capacity as the ASA Standards Manager.**AT**

References for further reading:

1 B. Douglas, "International Standardization of Mechanical Vibration and Shock, The Story of ISO/TC 108," ISO Bulletin (January 2001).

2 B. Douglas and E. Christ, "The Role of Mechanical Vibration and Shock Standards in Workplace Safety," ISO FOCUS (2005).

3 ISO Standards Handbook, Mechanical vibration and shock, Volume 1 Terminology and symbols, Tests and test equipment, Balancing and balancing equipment, Second edition 1995 (International Organization for Standardization, Geneva), ISBN 92-67-10219-2.

4 ISO Standards Handbook, Mechanical vibration and shock, Volume 2 Human exposure to vibration and shock, Vibration in relation to vehicles, specific equipment and machines, buildings, Second edition 1995 (International Organization for Standardization, Geneva), ISBN 92-67-10219-2.

Bruce E. Douglas is the current Chairman of ISO/TC 108, the international body charged with writing standards in the technical area of mechanical shock and vibration and the condition monitoring of machines and structures. He is also the owner of Resonance Technologies that specializes in the development of novel structural dynamics diagnostics and control methods and devices. From 1988 through 1999, he was the Director of Research at the David Taylor Research Center (DTRC), the U. S. Navy's lead laboratory in naval architecture and the maritime sciences. From 1985 to 1988 he served separately as Head of the Target Physics Branch and the Structural Acoustics Branch at DTRC and from 1965 to 1985 he was a bench scientist at the Marine Engineering Laboratory in Annapolis Maryland. In the area of basic science he isolated three inter-laminar damping mechanisms inherent in laminated composites, developing both the theory and experimental evidence to verify their existence and optimize their performance. He has contributed to over 100 technical publications, presentations, standards and patents over his career mostly in the areas of active and passive structural damping and vibration diagnostics and control. He received his Bachelors and Masters degrees in physics from Virginia Polytechnic Institute and State University and a Ph.D. degree in mechanical engineering from the University of Maryland.