



## STRATEGIC BUSINESS PLAN – ISO/TC 164

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### Executive summary

The aim of TC 164 is to develop unique international standard testing methods that can provide rational and reliable mechanical property data in order to facilitate clear and easy technical judgement and business decision-making in international trade through the provision of a common international scale. In fact, generally speaking, the mechanical properties of metals cannot be obtained as simple fixed values applicable to all situations. Thus, the standard test procedures have been established according to the need for different material evaluations for different application purposes.

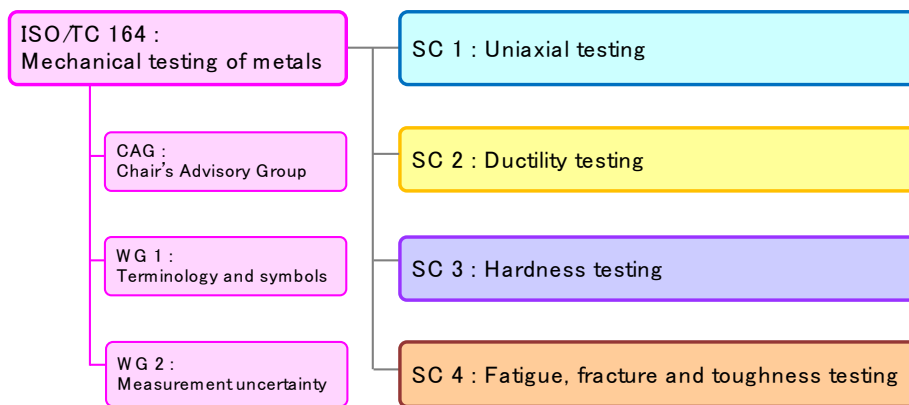
The standard test methods developed by TC 164 provide such user benefits as assurance of easy technical judgement and business decision-making based on reliable materials data that has been obtained through rational and common test methods. This prevents eventual complications of property data obtained from incompatible test standards, and hence provides systematic and correlated data for different mechanical properties evaluated by relevant methods of tests defined under the same philosophy.

Major manufacturers and consumers of metals and metallic products form the principle stakeholders of TC 164, and they work in co-operation with testing machine makers and researchers from academia.

Setting priorities for standards development by TC 164 shall reflect the following:

- the need to develop standards acceptable to the market of different nations;
- anticipated frequency of use (i.e. demand), relevance to international trade, and health/safety implications;
- issues of international dispute and trade barriers;
- special requests clearly and thoroughly enunciated by ISO Central Secretariat or other international standards organisations;
- consideration of money, time, labour, and other resources required and/or available to conduct standards development work by a given country;
- minimising duplication of standards, broadening applicability of a given and/or existing standard, and achieving simplicity in the application of a given and/or existing standard; and
- issues of environmental protection and conservation, living standards, and technology transfer, all interwoven in one way or another.

In order to maintain the published standards and develop new proposed standards, these documents are developed in four subcommittees under TC 164 (Figure 1).



**Figure 1 — Structure of ISO/TC 164**

## 1 Introduction

### 1.1 ISO technical committees and business planning

The extension of formal business planning to ISO Technical Committees (ISO/TCs) is an important measure which forms part of a major review of business. The aim is to align the ISO work programme with expressed business environment needs and trends and to allow ISO/TCs to prioritize among different projects, to identify the benefits expected from the availability of International Standards, and to ensure adequate resources for projects throughout their development.

### 1.2 International standardization and the role of ISO

The foremost aim of international standardization is to facilitate the exchange of goods and services through the elimination of technical barriers to trade.

Three bodies are responsible for the planning, development and adoption of International Standards: [ISO](#) (International Organization for Standardization) is responsible for all sectors excluding Electrotechnical, which is the responsibility of [IEC](#) (International Electrotechnical Committee), and most of the Telecommunications Technologies, which are largely the responsibility of [ITU](#) (International Telecommunication Union).

ISO is a legal association, the members of which are the National Standards Bodies (NSBs) of some 165 countries (organizations representing social and economic interests at the international level), supported by a Central Secretariat based in Geneva, Switzerland.

The principal deliverable of ISO is the [International Standard](#).

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 Technical Enquiry). ISO and its [Technical Committees](#) are also able to offer the ISO Technical Specification (ISO/TS), the ISO Public Available Specification (ISO/PAS) and the ISO Technical Report (ISO/TR) as solutions to market needs. These ISO products represent lower levels of consensus and have therefore not the same status as an International Standard.

ISO offers also the International Workshop Agreement (IWA) as a deliverable which aims to bridge the gap between the activities of consortia and the formal process of standardization represented by ISO and its national members. An important distinction is that the IWA is developed by ISO workshops and fora, comprising only participants with direct interest, and so it is not accorded the status of an International Standard.

## **2 Business Environment of the ISO/TC**

### **2.1 Description of the Business Environment**

The following political, economic, technical, regulatory, legal and social dynamics describe the business environment of the industry sector, products, materials, disciplines or practices related to the scope of this ISO/TC, and they may significantly influence how the relevant standards development processes are conducted and the content of the resulting standards:

#### **TC 164 "Mechanical Testing of Metals"**

The Technical Committee on Mechanical Testing of Metals (TC 164) develops standards on methods for testing the mechanical performance of metals by measuring responses to the application of testing force in order to determine fundamental property values, such as strength and durability of metals. It is clear that adequate testing and proper evaluation of mechanical properties of metallic materials are of prime importance for guaranteeing the reliable function and safe operation of machines and constructions, since metals are one of the most common and basic materials used by the modern industries throughout the world. Other mechanical properties of metallic materials such as hardness and ductility can strongly affect the formability of materials in production lines. Therefore, the standards developed by TC 164 can have very wide and important influence on various industries as well as regulatory systems in different societies.

The testing standards defined by TC 164 play an important role in the various industries that use metallic materials as they provide objective criteria for evaluating metallic products and their characteristics. This is particularly true in the manufacture of metals and metallic products, since the determination of whether these products meet the required strength or safety criteria can only be conducted by means of mechanical tests for those materials, before, during and/or after the fabrication process. Thus, in various industries such as construction, automobiles, energy, shipbuilding and railways, mechanical testing is widely conducted for this purpose on metallic materials, with most of these testing methods referring, to a greater or lesser extent, to the standards of TC 164. In terms of legislation, metallic materials and products are currently produced in a number of different countries, where certain specified materials and products may be officially controlled by national regulation. To prevent the rise of technical barriers to trade, these regulations need to be aligned and harmonised, and in this respect, reference to the relevant ISO standards is indispensable.

The TC 164 standards naturally have a direct influence on the manufacture of testing machines and equipment, supply testing machines, calibrating apparatuses, auxiliary devices and various measuring tools including small computers. Interest is not limited to the industrial sector, however, as researchers in academic fields utilise materials testing technology to pursue valuable scientific and technological research topics.

Mechanical testing is carried out on metals for three different reasons. First, it is carried out for quality control, to ensure that a material conforms to a specification or that it has been correctly processed. Second, it is carried out to provide information that can be used in the design of a component or structure. Third, it is carried out as part of investigations into the causes for failures in service. Thus, the results achieved from the mechanical testing of products that are made of or from metals are used to help guarantee the safety and reliability of metals, which in turn ensures the safety of those products.

At present, however, the testing methods used in these different industrial and regional sectors do not always rely on the relevant ISO standards, mainly due to different traditional backgrounds. The industries concerned are beginning to rely more and more on ISO standards as they recognise the benefits of using standards that can be considered truly unified across the global market.

### **SC 1 "Uniaxial testing"**

Among the uniaxial force tests appear the tensile test, which can be considered as the most common and often-used mechanical test and has been applied for a long time. The properties which can be derived from tensile tests can be directly used for the characterization and acceptance of metallic materials and the design of numerous structures and equipment used in different application fields for which the properties given by creep testing can also be taken into account. In this respect uniaxial testing, especially tensile testing, concerns a wide range of stakeholders (including manufacturers of products, users of metallic materials, testing laboratories, research institutes, and manufacturers of testing equipment).

It is essential to have International Standards applied all around the world for this type of testing and for relevant methods of verification and calibration of corresponding testing machines in order to avoid technical barriers to trade. This will be achieved by applying the procedures defined in the Vienna Agreement between CEN and ISO.

The International Standards developed by SC 1 shall also take into account the evolution of technology concerning testing machines with computer assistance. The uncertainty issues shall be addressed in the standards concerning testing methods and testing machines to get more accurate information about the metallic materials.

### **SC 2 "Ductility testing"**

The future orientation of ductility testing is concentrated on the revision of contemporary ISO standards with the aim of determining more precisely the conditions under which such testing is carried out. For example, through revision of ISO 10113 "Metallic materials – Sheet and strip – Determination of plastic strain ratio and ISO 10275 "Metallic materials – Sheet and strip – Determination of tensile strain hardening exponent", it is intended to extend the scope of these standards to materials with inhomogeneous plastic strain. Under previous standards, testing of these materials was not possible.

Attention is also paid to testing following new materials such as metallic superplastic materials and porous and cellular metals.

- ISO 20032:2013, Method for evaluation of tensile properties of metallic superplastic materials"
- ISO 13314:2011, Mechanical testing of metals – Ductility testing – Compression test for porous and cellular metals

The main stakeholders are manufacturers of metallic products, testing laboratories, research institutes, users of metallic products and manufacturers of testing equipment.

The majority of these tests are used as technological tests for the assessment of behaviour of metallic materials during forming. Therefore, uncertainty issues do not have such importance as for tensile and hardness tests.

### **SC 3 "Hardness testing"**

Hardness testing methods are the longest applied and most well-known test methods for metallic materials. In order to work with comparable measured values, standards of hardness testing methods have been developed. This work started in the early 1930s. The specifications of National, European and International Standards are not identical or fully aligned with each other. Meanwhile, it is generally accepted that the complete alignment of hardness standards at all standardisation levels should be sought. With the application of parallel voting within ISO and CEN according to the Vienna Agreement the duplication of work will be avoided.

Another purpose of standardisation work is to decrease the uncertainty of test methods. With this intention in mind the department of Materials Testing of DIN took over the secretariat of the ISO-Committee ISO/TC 164/SC 3 "Hardness testing of metallic materials" in 1994, aiming to achieve the identity of worldwide ISO-Standards with other national and regional standards.

A further objective of this standardisation work is the reduction of impediments to trade. In connection with the need for new and more precise test methods, there is a mutual influence of the development of measurement techniques and the development of test methods, especially for the characterisation of new advanced materials like advanced ceramics and for the characterisation of thin inorganic and organic coatings. Standards for new methods for testing in nano range not only hardness testing but also the estimation of moduli, stress strain behaviour, time depending behaviour and testing at higher temperatures are under development.

In the last 10 years all standards of SC 3 were revised according to the objective of the subcommittee given in clause 5.

### **SC 4 "Fatigue, Fracture and Toughness Testing"**

The durability performance of different materials under static and dynamic loading is important to a whole variety of commercial product designers and manufactures. Fatigue, fracture and toughness behaviors of certain materials are specified as part of the raw material procurement level by many aircraft and automotive component manufactures. The fatigue, fracture and toughness behaviour of most materials is critical to component designers. Without knowledge of these behaviours for specific materials, the designer cannot possibly design an adequate component. This is especially true in industries that use their materials in critical applications, such as the aircraft, automotive, electrical power, and medical implant industries.

Mathematical modelling of the mechanics involved is increasingly relied upon, but never to the exclusion of laboratory testing. It is to the speciality of laboratory testing that much of the work of this subcommittee is devoted. The standards developed in SC4 ensure consistency of procedure and of treatment of results. They eliminate barriers to trade, and ensure that subscription to the specified methods agreed to through the consensus process based on the user experiences of many people, can presume tests will be conducted, results generated, and reported in a unified way.

## **2.2 Quantitative Indicators of the Business Environment**

The following list of quantitative indicators describes the business environment in order to provide adequate information to support actions of the ISO/TC:

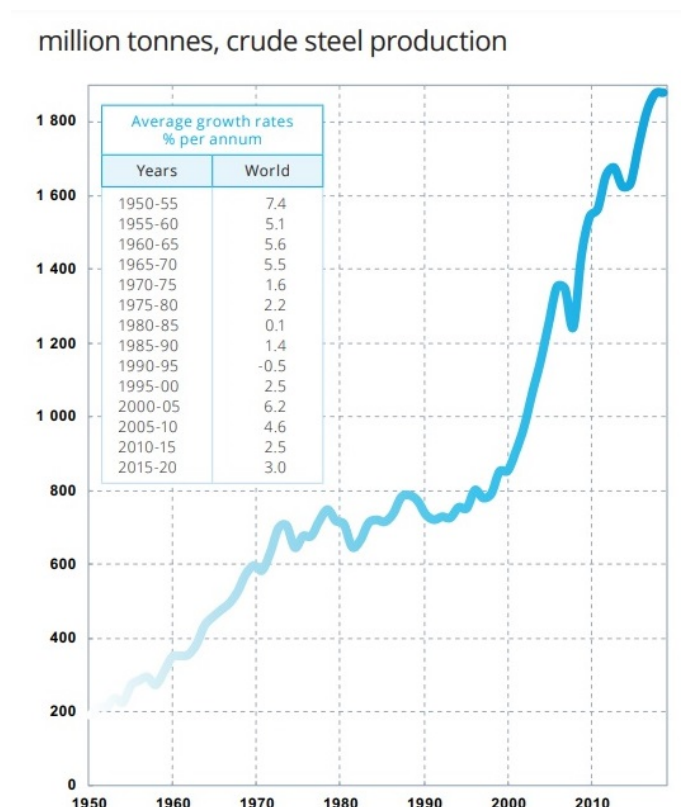
### TC 164 "Mechanical Testing of Metals"

It is not very easy to give quantitative indicators for the business environments that are likely to be influenced by TC 164, as the committee focuses on the development of standards of testing methods for mechanical properties of metals, rather than the evaluation or grading of metals themselves.

It is indisputable, however, those most manufacturing industries use metallic materials in one way or another. Further, manufacturers need to verify the mechanical properties of their materials during the production process, and accordingly have to refer to the standards for mechanical testing of metals in order to be able to do this. For this reason, the influence of standards prepared by TC 164 can be said to extend throughout the whole of the manufacturing industry sector.

If we attempt to show these terms of indicators by taking the steel industries as an example of major testing method standards users, we can see that

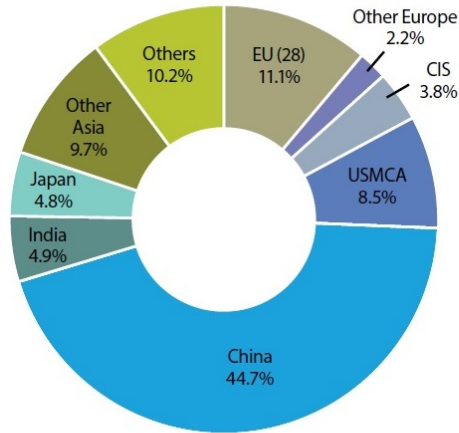
- the amount of crude steel production increase from approximately 200 million tonnes in 1950 to approximately 1 850 million tonnes in 2020 (Figure 2)
- the amount of finished steel products increase from approximately 1 300 million tonnes in 2010 to approximately 1 770 million tonnes in 2020 (Figure 3).



**Figure 2 — World crude steel production 1950 to 2020**  
 [SOURCE: 2021 World Steel in Figures, World Steel Association]

**Apparent steel use (finished steel products)**

World total: 1 315 million tonnes

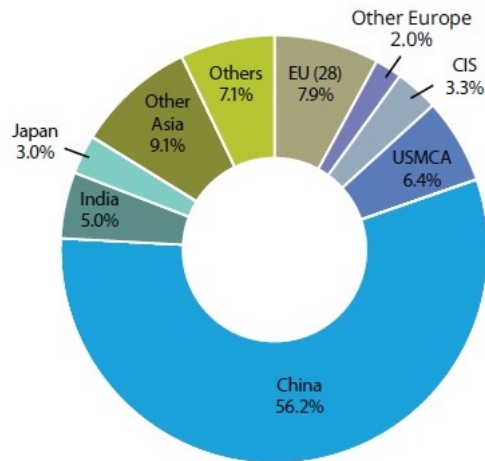


Others comprise:

Africa	2.4%	Central and South America	3.5%
Middle East	3.7%	Australia and New Zealand	0.6%

**Apparent steel use (finished steel products)**

World total: 1 772 million tonnes



Others comprise:

Africa	2.0%	Central and South America	2.2%
Middle East	2.6%	Australia and New Zealand	0.3%

**Figure 3 — Apparent steel use (finished steel products):  
 geographical distribution  
 (Upper) 2010 (Lower) 2020**

[SOURCE: 2021 World Steel in Figures, World Steel Association]

### **3 Benefits expected from the work of the ISO/TC**

The aim of TC 164 is to develop unique international standard testing methods that can provide rational and reliable mechanical property data in order to facilitate clear and easy technical judgement and business decision-making in international trade through the provision of a common international scale. In fact, generally speaking, the mechanical properties of metals cannot be obtained as simple fixed values applicable to all situations. Thus, the standard test procedures have been established according to the need for different material evaluations for different application purposes.

The standard test methods developed by TC 164 provide such user benefits as assurance of easy technical judgement and business decision-making based on reliable materials data that has been obtained through rational and common test methods. This prevents eventual complications of property data obtained from incompatible test standards, and hence provides systematic and correlated data for different mechanical properties evaluated by relevant methods of tests defined under the same philosophy.

Efforts to harmonise national standards to ISO standards are progressing within the committee. For instance, the secretariat of the Japanese Industrial Standards Committee (JISC), which serves as the secretariat of the TC 164, has been actively adopting ISO standards as national standards (JIS). Around 30 JIS standards are harmonised today with ISO standards and nearly half of these standards are identical and/or equivalent to the corresponding ISO standards, from a technical point of view.

#### **SC 1 "Uniaxial testing"**

The main benefit expected from SC 1 work is obtaining a unique and universal basis to be used for the characterization of metallic materials in tension or compression and then to be cited as a reference in International Standards specifying metallic materials and products and in the International design codes of structures and equipment. This unique and universal basis shall also apply to the testing machines used for the determination of the tensile properties that are more and more often computer assisted.

#### **SC 2 "Ductility testing"**

The standards are used for the assessment of formability of metallic products and for comparing these properties across various materials. They contribute to the better use of metallic structures and cost savings through more effective technological treatment and better use of metallic products. These standards do not influence the removal of technical barriers to trade, but help in harmonization of testing methods, in technological treatment of metallic products, and in international co-operation in this field. Some of these standards are published as EN ISO applying procedures defined by Vienna agreement.

#### **SC 3 "Hardness testing"**

Hardness is a property which is used in many materials and product standards for the characterisation of quality. Hardness testing has a special importance in the field of mechanical test methods, because it is a relatively cheap, easy to use and nearly non-destructive method for the characterisation of materials and products. An additional economic importance consists in the conversion of hardness values between different scales and of hardness values into tensile strength to gain information quickly. ISO 18265 "Metallic materials – Hardness conversion" was published in 2003 (The revised version was published in 2013.). With the rising interest in testing of thin coatings the new test method "Instrumented Indentation Testing" was

created to obtain, in addition to the conventional hardness values, more specific materials parameters like Martens Hardness, Indentation Hardness, Indentation Modulus, Creep and Relaxation. ISO 14577-1 "Metallic materials – Instrumented indentation test for hardness and other materials parameters — Part 1: Test method" was published in 2002. Standards for new methods for testing in nano range not only hardness testing but also the estimation of moduli, stress strain behaviour, time depending behaviour and testing at higher temperatures are under development.

Participation in the yearly meetings of SC 3 shows the increasing interest in the world.

#### **SC 4 "Fatigue, Fracture and Toughness Testing"**

By the use of standardized test methods for measuring fatigue, fracture and toughness behavior, substantial improvements in quality and safety are assured. Provided with the proper tools to conduct fatigue, fracture and toughness tests, the testing community is enabled to obtain reliable and repeatable test data that can be used in the design of structures and components. SC4 writes standards for fatigue, fracture and toughness tests of materials that often do not exist as standards in any country in the world. As these are completed, ISO acquires the most up-to-date and technically robust standards for conducting fatigue, fracture and toughness tests. The work of SC4 also helps to harmonize the various test procedures, specimen requirements, machine requirements, and machine calibrations/protocols that are currently used throughout the world. The benefit of this harmonization effort is a more transparent test for use by our industries and laboratories using the tests to produce higher quality, more reproducible, reliable and comparable data. This will help provide a more level playing field.

## 4 Representation and participation in the ISO/TC

### 4.1 Membership

#### Countries/ISO member bodies that are P and O members of the ISO committee

### 4.2 Analysis of the participation

Major manufacturers and consumers of metals and metallic products form the principle stakeholders of TC 164, and they work in co-operation with testing machine makers and researchers from academia. There are four Subcommittees (SCs) and two Working Groups (WGs) attached to TC 164 and the participants of each include specialists from nearly all the industrialised and industrialising countries.

The chairpersons and committee managers for the TC and SC are nominated from within the three regions, to ensure that the most experienced and qualified candidates are elected to the posts.

#### *Secretariats and chairs*

- TC: Japan - JISC (Japanese Industrial Standards Committee)
- SC 1: France - AFNOR (Association Francaise de Normalisation)
- SC 2: Japan - JISC (Japanese Industrial Standards Committee)
- SC 3: Germany - DIN (Deutsches Institut fur Normung)
- SC 4: United States - ANSI (American National Standards Institute)

Both developed and developing countries participate in TC 164 almost equally. However, developing countries are underrepresented as P members.

A TC plenary meeting is held once every three years. 16 countries out of 20 P member countries participated in the 2021 plenary meeting. For the liaison committees, see **Table 1**.

Participation in each SC is as described below.

**Table 1 — Liaison committees and organizations**

Date	TC/SC	Title of TC/SC
<b>Liaison Committee to ISO/TC 164</b>	ISO/TC 17	Steel
	ISO/TC 26	Copper and copper alloys
	ISO/TC 67	Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries
	ISO/TC 79	Light metals and their alloys
	ISO/TC 107	Metallic and other inorganic coatings
	ISO/TC 107/SC 8	Chemical conversion coatings
	ISO/TC 123	Plain bearings

	ISO/TC 156	Corrosion of metals and alloys
	ISO/TC 156/SC 1	Corrosion control engineering life cycle
<b>Liaison Committee from ISO/TC 164</b>	ISO/TC 17	Steel
	ISO/TC 18	Zinc and zinc alloys - STANDBY
	ISO/TC 26	Copper and copper alloys
	ISO/TC 44	Welding and allied processes
	ISO/TC 44/SC 5	Testing and inspection of welds
	ISO/TC 67	Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries
	ISO/TC 67/SC 5	Casing, tubing and drill pipe
	ISO/TC 79	Light metals and their alloys
	ISO/TC 107	Metallic and other inorganic coatings
	ISO/TC 119	Powder metallurgy
	ISO/TC 119/SC 2	Sampling and testing methods for powders (including powders for hardmetals)
	ISO/TC 119/SC 3	Sampling and testing methods for sintered metal materials (excluding hardmetals)
	ISO/TC 119/SC 4	Sampling and testing methods for hardmetals
	ISO/TC 123	Plain bearings
	ISO/TC 123/SC 2	Materials and lubricants, their properties, characteristics, test methods and testing conditions
	ISO/TC 155	Nickel and nickel alloys
	ISO/TC 206	Fine ceramics
ISO/TC 334	Reference materials	
<b>Liaison Organization with ISO/TC 164</b>	EC	European Commission
	OIML	International Organization of Legal Metrology
	European Aluminium	European Aluminium

### **SC 1 "Uniaxial testing"**

In 2021, 20 countries are participating (P members) and 20 countries are observing (O members). Most of them are well represented during the meetings (almost 40 delegates during ISO/TC 164/SC 1 October 2021 meeting from 15 countries).

The organizations in liaison with SC 1 are the following:

- ISO/TC 17/SC 17 “Steel - Steel wire rod and wire products”
- ISO/TC 17/SC 20 “Steel - General technical delivery conditions, sampling and mechanical testing methods”
- ISO/TC 123/SC 2 “Plain bearings - Materials and lubricants, their properties, characteristics, test methods and testing conditions”

### **SC 2 "Ductility testing"**

SC 2 consists of 20 P-members and 10 O-members, and the number of participants for this decade was between 10 and 20.

The delegates belong mainly to National Standards Organizations, scientific institutions, and manufacturers of metals and metallic products. In addition, technical experts from consumers of metals and producers of testing machines join the technical discussions.

Liaisons: ISO/TC 5/SC 1, ISO/TC 17/SC 20, ISO/TC 25, ISO/TC 79

### **SC 3 "Hardness testing"**

The participation of most of the 23 P-members and 11 O-members represents the great interest in the revision of the existing standards for hardness testing and the development of new test methods.

The delegates represent the different producers of metallic materials, the scientific field, the producers of hardness testing machines and the different testing laboratories.

In the last 10 years the number of participants was between 27 and 35.

Liaisons exist to: ISO/TC 2, ISO/TC 26, ISO/TC 17/SC 20, TC 35/SC 9, TC 61/SC 2, TC 79, TC 79, TC 107, TC 107/SC 9, TC 119, TC 119/SC 4, TC 123, TC 156, EC (European Commission) and OIML (International Organization of Legal Metrology).

### **SC 4 "Fatigue, Fracture and Toughness Testing"**

As a general observation, participation, especially presence at meetings, has increased significantly from Asian, Latin America and eastern European countries. This is a direct result of increased industrial activity in the facilities producing metals, alloys and subsequent fabrication of metallic products. This requires higher levels of producer/consumer quality that translates into more awareness of requirements and need for standards and the importance of being involved in their development.

Presently, the Secretariat for SC 4 is held by the United States, and has 21 P member nations, including: Austria (ASI), Belgium (NBN), Brazil (ABNT), China (SAC), Czech Republic (UNMZ), Egypt (EOS), France (AFNOR), Germany (DIN), India (BIS), Italy (UNI), Japan (JISC), Korea, Republic of (KATS), Netherlands (NEN), Poland (PKN), Russian Federation (GOST R), Slovenia (SIST), South Africa (SABS), Spain (UNE), Sweden (SIS), United Kingdom (BSI), and the United States (ANSI). O member nations number 12 at this time, and include: Argentina, Bulgaria, Czech Republic, Finland, Hungary, Iceland, Iran, Romania, Serbia, Slovakia, Switzerland, and Turkey.

Finally, SC4 Liaisons with TC 44, Fatigue of Weldments.

## **5 Objectives of the ISO/TC and strategies for their achievement**

### **5.1 Defined objectives of the ISO/TC**

#### **TC 164 "Mechanical Testing of Metals"**

The objective of the TC is to provide international-scale, unique test methods in the field of mechanical testing of metals through the unification and harmonization of existing standards, and to establish advanced international standards using state-of-art technologies for assessing modern metallic materials. The TC aims to contribute to the facilitation of smooth international business and trading of metallic products while ensuring their safety and reliability for consumers, by providing international standards in the fields of Uniaxial, Ductility, Hardness, Fatigue, Fracture and Toughness Testing that are relevant to the market and give consideration to the market trends.

#### **WG 1 "Terminology & Symbols"**

To develop terminology document in order to facilitate standards development within TC 164.

#### **WG 2 "Measurement Uncertainty"**

To develop guidance document regarding a vocabulary to assist users of TC 164 standards in the interpretation of terms and definitions applied to uncertainty calculation, and to give hints for application in decision rules and hints for determination of risk in applying a decision rule.

#### **SC 1 "Uniaxial testing"**

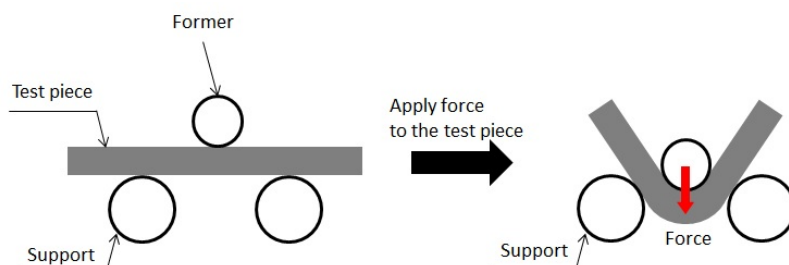
The main objectives for the future standardisation work within SC 1 are as follows:

- to ensure a continuous maintenance and updating of the existing standards (for testing methods and verification and calibration of testing machines) to take into account in particular the possible evolution in the technology of testing machines (computer assistance for testing and data acquisition and treatment) and the concepts in the field of measurement uncertainty on the basis of GUM (see ISO/IEC 17025);
- to try to proceed to the 5 years review of all documents related to a specific test (i.e. the test method and the verification and calibration of testing machines) at the same time. This procedure will ensure the continuous consistency of all documents related to a specific test;
- to think about a more user-friendly numbering of the ISO standards dealing with tensile testing methods;
- to avoid the development of different regional standards and to apply as much as possible the Vienna Agreement between ISO and CEN for the future revision of Uniaxial Testing Standards and all New Work Items; and
- to use available well-tried national standards as a basis for New Work Items.

#### **SC 2 "Ductility testing"**

SC 2 develops standards, technical specifications in the field of ductility testing of metals with the aim of unification, easier technological treatment of metallic materials and for the assessment of formability of metallic products.

The most basic test for measuring ductility is bend test. As shown in Figure 4, a metal material is bent to a specified angle by applying a forming tool to the top of the material to check for splits, cracks, or other defects on the outside of the curved portion of the material. This testing method is published as ISO 7438:2020 "Metallic materials — Bend test".



**Figure 4 — Bend test**

Since the ductility of metallic materials varies depending on the shape of the material, bending test methods are also specified for linear (wire rod) and tubular materials (wire rod: ISO 7801, tubular material: ISO 8491), in addition to the above-mentioned plate shapes.

### **SC 3 "Hardness testing"**

It has been decided that in the context of the ISO 5 years revision all documents related to a specific hardness test (test method, verification and calibration of testing machines, calibration of reference blocks and the tables for calculation of hardness values) are to be considered at the same time. This procedure will ensure the same revision date for all documents related to a specific hardness test.

It has been decided that for future revisions only one ISO Standard number will be assigned to a specific hardness test with the part numbers 1, 2, 3 and 4 assigned to the above-mentioned four parts.

Beside the continuous development of the conventional test methods, attention should be drawn to the use of automated testing and data acquisition and digitalisation of data handling for more objective measurement results.

It is a peculiarity that hardness is not a pure metrological value. For this reason hardness testing requires a combination of certified reference materials (reference blocks) and certified calibration machines to establish and maintain worldwide uniform hardness scales.

### **SC 4 "Fatigue, Fracture and Toughness Testing"**

In broad terms, the principal objective of the subcommittee is to standardize protocols for measuring the fatigue, fracture and toughness characteristics of metallic materials, with a view toward improving the quality and safety of structural designs and eliminating barriers to trade.

Harmonization of standards is an objective in this subcommittee. For example, consider the case of impact tests: for the most part, these are mature tests for which many national standards have been developed. A goal of the SC4 work is the harmonization of existing pendulum impact test standards, as well as to focus on the requirements for the verification of Charpy pendulum impact machines.

Identification of emerging standardization opportunities viewed to hold strategic benefit to industry sectors is another objective of this subcommittee. Toward this end, the subcommittee is organized in a manner that fosters the identification of strategic standardization opportunities. Those opportunities showing significant promise are selected for further work, often leading to the emergence of new standards where none previously existed.

Finally, assuring relevance of existing standards is another objective of this subcommittee. For example, technological developments in data processing, and especially sensor technologies continue to rapidly grow and evolve, presenting new opportunities for enabling capabilities in the modern materials testing laboratory. Standards under development as well as those already adopted are regularly reviewed and revised to embrace these emerging technologies.

## **5.2 Identified strategies to achieve the ISO/TC's defined objectives**

Setting priorities for standards development by TC 164 shall reflect the following:

- the need to develop standards acceptable to the market of different nations;
- anticipated frequency of use (i.e. demand), relevance to international trade, and health/safety implications;
- issues of international dispute and trade barriers;
- special requests clearly and thoroughly enunciated by ISO Central Secretariat or other international standards organisations;
- consideration of money, time, labour, and other resources required and/or available to conduct standards development work by a given country;
- minimising duplication of standards, broadening applicability of a given and/or existing standard, and achieving simplicity in the application of a given and/or existing standard; and
- issues of environmental protection and conservation, living standards, and technology transfer, all interwoven in one way or another.

ISO/TC 164 was formed in 1975 to consolidate the mechanical testing of metals standardisation activities of ISO/TC 17, TC 26, TC 79 and TC 119.

International standards prepared by TC 164 have broad application. Where applicable, other technical committees are expected to reference these standards. With this in mind, every attempt is made by TC 164 to stay abreast of current developments so as to be timely in meeting the needs of relevant technical committees.

The objectives will be achieved by two Working Groups and four SCs mentioned below.

### **WG 1 "Terminology & Symbol"**

Participation is obtained from SC chairpersons and committee managers as well as WG experts in order to develop common and consistent standards.

### **WG 2 "Measurement Uncertainty"**

In order to spread understanding of measurement uncertainty in testing method, it is important to communicate with the standards users. For achieving this, WG 2 will intend to communicate with the standard users, for example, the industrial sector of metals and other TC's experts as in the past.

### **SC 1 "Uniaxial testing"**

- To use available well-tried national standards as a basis for New Work Items
- Apply as much as possible the Vienna Agreement between ISO and CEN for the future revision of Uniaxial Testing Standards and all New Work Items
- The work is conducted by correspondence or web meetings when possible. ISO/TC 164/SC 1 meets once a year (with all other ISO/TC 164/SCs) in order to take decisions on the future of the projects. The meeting is held in English only.
- Liaisons exist to ISO/TC 17, TC 17/SC 20, ISO/TC 132/SC 2. ISO/TC 164/SC 1 works also closely with CEN/TC 459 (European committee)(for Vienna agreement).
- Depending on the items under revision, WGs are created under SC1. For each item a project leader is nominated and in charge of the progress of work.

### **SC 2 "Ductility testing"**

The defined objectives within ISO/TC 164/SC 2 are reached by using the results of the latest research in ductility testing and reflecting this development in the prepared standards and technical specifications. The revisions of present standards are oriented to widening the scope to other materials and other dimensions of products and to more exact specifying of the conditions of the tests.

### **SC 3 "Hardness testing"**

It has been decided to apply the Vienna Agreement between ISO and CEN for the future revision of the Hardness Testing Standards and all New Work Items.

The process of integration of details according to the measurement uncertainty on the basis of GUM in accordance with ISO/IEC 17025 will go on.

It is a further aim to determine whether no standardised test methods that have been tried nationally or internationally could be standardised in future.

Use of Technical Reports for new test methods in the field of pre-normative work is urged.

Use of available well-tried national standards for New Work Items is urged.

### **SC 4 "Fatigue, Fracture and Toughness Testing"**

Two principal strategies are followed in SC4: first, to develop harmonized standards in the fields of fatigue, fracture and toughness testing of metallic materials. Secondly, to continually seek out strategic opportunities for which new ISO standards will be crucially needed.

These strategies are supported by Working Groups organized and focused toward the following key concerns: impact toughness, fracture toughness, fatigue testing under general conditions, fatigue testing under elasto-plastic conditions, including crack growth, and advanced apparatus and analysis. Leadership and membership of the Working Groups is comprised of technical experts, each of whom are significantly involved with national standard organizations. Finally, SC 4 continues to actively pursue additional volunteer working group membership from other countries to enhance our ability to promote state-of-the-art fatigue, fracture and toughness testing technology and methodology world-wide.

## **6 Factors affecting completion and implementation of the ISO/TC work programme**

There are a variety of different standards, which are currently used by different professional groups in different countries. This is due to the fact that metallic materials have been utilised since ancient times all over the world and recognised as indispensable engineering materials. This fact explains why TC 164 is tackling the huge task of trying to unify standards. The testing and evaluation of metals to determine their physical and chemical properties is an important concern of engineers. They recognise the significance of a thorough understanding of mechanical property testing not least because it relates directly to the safety of users. This is the reason why diverse mechanical testing methods based on deviations in professional, technical, regional and historical customs have been developed and are still employed in different groups.

The ISO organisation needs to find ways to minimise the administrative work being asked of technical members of the TC and SCs, because they are typically all volunteering their time and energy to develop technically superior standards. The more administrative assistance ISO can provide, the faster the technical experts can develop standards. Rapid response of ISO to questions asked by committee members should be common. Attendance at TC 164 Plenary meeting by a responsible ISO staff member is preferable, so that face-to-face discussions can occur.

## **7 Structure, current projects and publications of the ISO/TC**

### **Information on ISO online**

The link below is to the TC's page on ISO's website:

[ISO TC 164 on ISO Online](#)

Click on the tabs and links on this page to find the following information:

- About (Secretariat, Committee Manager, Chair, Date of creation, Scope, etc.)
- Contact details
- Structure (Subcommittees and working groups)
- Liaisons
- Meetings
- Tools
- Work programme (published standards and standards under development)

### **Reference information**

[Glossary of terms and abbreviations used in ISO/TC Business Plans](#)

[General information on the principles of ISO's technical work](#)