

Q6-O2 – Requisiti per l'accreditamento: comparazione ISO 17025:2005 e 15189:2007 per la validazione dei metodi analitici

Codifica di questo documento:

Flusso Operativo	Elementi fondamentali del sistema qualità
Pre-esame Richiesta di esame A	Documenti e Registri L
Raccolta del campione B	Organizzazione M
Trasporto del campione C	Personale N
Ricezione e trattamento del campione D	<u>Strumentazione O</u> X
Esame Analisi E	Acquisti e gestione scorte P
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	Impianti e sicurezza Z

Riferimenti

ISO 17025	ISO 16189
5.1 General	

Nota:

all'indirizzo <http://snipurl.com/commqua> si trova il modulo telematico per la raccolta del consenso sui documenti

Introduzione

EA, European Cooperation for Accreditation, è una associazione senza scopo di lucro istituita nel novembre 1997 e registrata in Olanda nel giugno 2000 (www.european-accreditation.org).

EA risulta dalla fusione di EAC, European Accreditation of Certification, e di EAL, European cooperation for Accreditation of Laboratories ed è la rete europea degli organismi di accreditamento riconosciuti a livello nazionale con sede nella zona geografica europea.

EA multilateral agreement (MLA) fornisce un mezzo per consentire a beni e servizi di varcare i confini nazionali in Europa e nel resto del mondo.

Con MLA una prova o una relazione di controllo o un certificato rilasciato da un organismo accreditato in un paese è riconosciuto come equivalente ad una relazione o un certificato rilasciato da un organismo

accreditato in uno qualsiasi dei paesi firmatari del MLA EA. Gli organismi di accreditamento ammettono di operare in un modo equivalente e che rilasciano equivalenti accreditamenti, fornendo lo stesso livello di competenza e di fiducia.

MLA trasforma l'accreditamento in un "passaporto" che facilita l'accesso alla UE ed ai mercati internazionali mediante la cooperazione con ILAC (International Laboratory Accreditation Co-operation) e IAF (International Accreditation Forum). [1]

Un rapporto sull'estensione degli accordi internazionali che sostengono l'attività di EA MLA si trova nel documento EA-01/08 EA Multi and bilateral Agreement Signatories [2]

Tra gli scopi di MLA si trova l'accreditamento dei laboratori con ISO 17025 e ISO 15189 [3].

Nell'ambito del Laboratory Committee di EA, LC WG sta terminando la "Guidance on accreditation scopes for medical laboratories" e produce anche una lista di domande frequenti disponibile nella sua intranet.

In questo contesto possiamo prevedere un probabile e vicino scenario in cui si realizzano due situazioni. Da una parte organizzazioni cresciute e consolidate nell'attività di accreditamento di laboratori di prova e calibrazione con ISO 17025 si troveranno ad accreditare laboratori medici in riferimento a ISO 15189. Dall'altra parte laboratori clinici maturati nell'esperienza con la certificazione del sistema qualità secondo ISO 9001 e con l'accreditamento professionale secondo schemi diversi riceveranno visite da ispettori formati almeno in parte in ambiente ISO 17025 che applicheranno criteri e liste di riscontro basati su ISO 15189.

Si rende così opportuno affrontare un percorso di studio comparativo tra ISO 17025 e ISO 15189, al fine di evidenziare gli elementi comuni e quelli differenziali, che consentano di orientare sia l'attività di ispezione che quella di preparazione dei laboratori.

Il percorso comparativo comprenderà tutte le singole parti delle due norme.

Vengono confrontati due documenti:

- UNI CEI EN ISO/IEC 17025 september 2005
- EN ISO 15189:2007 may 2007

Il confronto non sarà pedissequamente sequenziale. Vengono prese in esame le singole parti individualmente, in base alla priorità di interesse. In questo documento si estraggono i punti riferiti a gestione delle informazioni e infrastruttura informatica.

Dalla lettura delle due norme si evidenzia un primo elemento importante: ISO 17025 contiene "Requisiti generali per la competenza dei laboratori di prova e di taratura", mentre ISO 15189 "requisiti particolari" e si basa su ISO 9001 e ISO 17025. Ne conseguirebbe una sorta di gerarchia di riferimenti e la conseguenza pratica per i laboratori medici di dover considerare in sequenza ISO 9001, ISO 17025 e ISO 15189.

L'area dei metodi analitici presenta alcune differenze non trascurabili tra ISO 17025 e ISO 15189, dovute al fatto che i laboratori medici non utilizzano metodi normati e molto poco quelli sviluppati al loro interno, ma per lo più metodi non normati sviluppati e validati da strutture esterne (le aziende fornitrici). Ciò comporta l'espansione dei requisiti relativi alla documentazione. Inoltre, il riesame delle necessità degli utenti comprende in medicina la verifica degli intervalli di riferimento.

Il confronto dei requisiti è in questo settore particolarmente complicato, la sequenza numerica tra 17025 e 15189 presenta molte differenze.

<p>Società Italiana di Medicina di Laboratorio SIMeL Commissione Nazionale Qualità ed Accreditamento <i>Marco Pradella, Coordinatore</i></p>	<p>documento Q6-O2 – validazione dei metodi analitici</p>
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17025	15189
<p>5 TECHNICAL REQUIREMENTS 5.1 General 5.1.1 Many factors determine the correctness and reliability of the tests and/or calibrations performed by a laboratory. These factors include contributions from: - human factors (5.2); - accommodation and environmental conditions (5.3); - test and calibration methods and method validation (5.4); - equipment (5.5); - measurement traceability (5.6); - sampling (5.7); - the handling of test and calibration items (5.8).</p>	5 Technical requirements
<p>5.1.2 The extent to which the factors contribute to the total uncertainty of measurement differs considerably between (types of) tests and between (types of) calibrations. The laboratory shall take account of these factors in developing test and calibration methods and procedures, in the training and qualification of personnel, and in the selection and calibration of the equipment it uses.</p>	

15189 non contiene una introduzione ai requisiti tecnici. Senza motivazione evidente ed esplicita. Il punto 17025 5.1.2 è dedicato a chi sviluppa metodi in proprio.

17025	15189
5.4 Test and calibration methods and method validation	5.5 Examination procedures <i>NOTE Some of the following might not be applicable to all disciplines in the scope of laboratory medicine.</i>
<p>5.4.1 General. The laboratory shall use appropriate methods and procedures for all tests and/or calibrations within its scope. These include sampling, handling, transport, storage and preparation of items to be tested and/or calibrated, and, where appropriate, an estimation of the measurement uncertainty as well as statistical techniques for analysis of test and/or calibration data.</p> <p>The laboratory shall have instructions on the use and operation of all relevant equipment, and on the handling and preparation of items for testing and/or calibration, or both, where the absence of such instructions could jeopardize the results of tests and/or calibrations.</p> <p>All instructions, standards, manuals and reference data relevant to the work of the laboratory shall be kept up to date and shall be made readily available to personnel (see 4.3). Deviation from test and calibration methods shall occur only if the deviation has been documented, technically justified, authorized, and accepted by the customer.</p>	<p>5.5.3 All procedures shall be documented and be available at the workstation for relevant staff. Documented procedures and necessary instructions shall be available in a language commonly understood by the staff in the laboratory. ...</p> <p>The procedure shall be based on the instructions for use (e.g. package insert) written by the manufacturer, provided that they are in accordance with 5.5.1 and 5.5.2 and that they describe the procedure, as it is performed in the laboratory, and are written in the language commonly understood by the staff of the laboratory....</p> <p>Any deviation shall be reviewed and documented. Additional information that could be required to perform the examination shall also be documented. Each new version of examination kits with major changes in reagents or procedure shall be checked for performance and suitability for intended use. Any procedural changes shall be dated and authorized as for other procedures.</p>
<p>Note International, regional or national standards or other recognized specifications that contain sufficient and concise information on how to perform the tests and/or calibrations do not need to be supplemented or rewritten as internal procedures if these standards are written in a way that they can be used as published by the operating staff in a laboratory. It may be necessary to provide additional documentation for optional steps in the method or additional details.</p>	

15189 non contiene una introduzione alla validazione. Nel laboratorio medico spesso le istruzioni sono scritte dal fornitore, mentre negli altri laboratori sono spesso norme tecniche internazionali o nazionali.

17025	15189
<p>5.4.2 Selection of methods The laboratory shall use test and/or calibration methods, including methods for sampling, which meet the needs of the customer and which are appropriate for the tests and/or calibrations it undertakes. Methods published in international, regional or national standards shall preferably be used. The laboratory shall ensure that it uses the latest valid edition of a standard unless it is not appropriate or possible to do so. When necessary, the standard shall be supplemented with additional details to ensure consistent application. When the customer does not specify the method to be used, the laboratory shall select appropriate methods that have been published either in international, regional or national standards, or by reputable technical organizations, or in relevant scientific texts or journals, or as specified by the manufacturer of the equipment. Laboratory-developed methods or methods adopted by the laboratory may also be used if they are appropriate for the intended use and if they are validated.</p>	<p>5.5.1 The laboratory shall use examination procedures, including those for selecting/taking sample portions, which meet the needs of the users of laboratory services and are appropriate for the examinations. Preferred procedures are those that have been published in established/authoritative textbooks, peer-reviewed texts or journals, or in international, national or regional guidelines. If in-house procedures are used, they shall be appropriately validated for their intended use and fully documented.</p>
<p>The customer shall be informed as to the method chosen. The laboratory shall confirm that it can properly operate standard methods before introducing the tests or calibrations. If the standard method changes, the confirmation shall be repeated. The laboratory shall inform the customer when the method proposed by the customer is considered to be inappropriate or out of date.</p>	<p>5.5.6 Upon request, the laboratory shall make its list of current examination procedures, including primary sample requirements and relevant performance specifications and requirements, available to users of laboratory services.</p> <p>5.5.7 If the laboratory intends to change an examination procedure such that results or their interpretations could be significantly different, the implications shall be explained to users of the laboratory services in writing, prior to the introduction of the change.</p> <p>NOTE This requirement can be accomplished in any of several different ways, depending on local circumstances. Some methods include directed mailings, laboratory newsletters or part of the examination report itself.</p>
<p>5.4.3 Laboratory-developed methods The introduction of test and calibration methods developed by the laboratory for its own use shall be a planned activity and shall be assigned to qualified personnel equipped with adequate resources. Plans shall be updated as development proceeds and effective communication amongst all personnel involved shall be ensured.</p>	<p>5.5.1 ... If in-house procedures are used, they shall be appropriately validated for their intended use and fully documented.</p> <p>5.5.2 The laboratory shall use only validated procedures for confirming that the examination procedures are suitable for the intended use. The validations shall be as extensive as are necessary to meet the needs in the given application or field of application. ...</p>

Sia per 17025 che per 15189 i metodi sono collegabili a precisi riferimenti scientifici, possibilmente veri e propri standards. I metodi sviluppati “in casa” sono teoricamente possibili in tutti i laboratori, ma devono essere validati.

17025	15189
<p>5.4.4 Non-standard methods When it is necessary to use methods not covered by standard methods, these shall be subject to agreement with the customer and shall include a clear specification of the customer's requirements and the purpose of the test and/or calibration. The method developed shall have been validated appropriately before use.</p>	<p>5.5.2 The laboratory shall use only validated procedures for confirming that the examination procedures are suitable for the intended use. The validations shall be as extensive as are necessary to meet the needs in the given application or field of application. The laboratory shall record the results obtained and the procedure used for the validation. The methods and procedures selected for use shall be evaluated and found to give satisfactory results before being used for medical examinations. A review of procedures by the laboratory director or designated person shall be undertaken initially and at defined intervals. Such a review is normally carried out annually. These reviews shall be documented. 5.5.6 Upon request, the laboratory shall make its list of current examination procedures, including primary sample requirements and relevant performance specifications and requirements, available to users of laboratory services.</p>
	<p>5.3.13 Where calibrations give rise to a set of correction factors, the laboratory shall have procedures for ensuring that copies of prior correction factors are correctly updated.</p>
<p>Note For new test and/or calibration methods, procedures should be developed prior to the tests and/or calibrations being performed ...</p>	<p>5.5.3 All procedures shall be documented and be available at the workstation for relevant staff. Documented procedures and necessary instructions shall be available in a language commonly understood by the staff in the laboratory. Card files or similar systems that summarize key information are acceptable for use as a quick reference at the workbench, provided that a complete manual is available for reference. The card file or similar systems shall correspond to the complete manual. Any such abridged procedures shall be part of the document control system. The procedure shall be based on the instructions for use (e.g. package insert) written by the manufacturer, provided that they are in accordance with 5.5.1 and 5.5.2 and that they describe the procedure, as it is performed in the laboratory, and are written in the language commonly understood by the staff of the laboratory. Any deviation shall be reviewed and documented. Additional information that could be required to perform the examination shall also be documented. Each new version of examination kits with major changes in reagents or procedure shall be checked for performance and suitability for intended use. Any procedural changes shall be dated and authorized as for other procedures.</p>
<p>Note For new test and/or calibration methods, procedures should be developed prior to the tests and/or calibrations being performed and should contain at least the following information: a) appropriate identification; b) scope; c) description of the type of item to be tested or calibrated; d) parameters or quantities and ranges to be determined; e) apparatus and equipment,</p>	<p>In addition to document control identifiers, documentation should include, when applicable, the following: a) purpose of the examination; b) principle of the procedure used for examinations; c) performance specifications (e.g. linearity, precision, accuracy expressed as uncertainty of measurement, detection limit, measuring interval, trueness of measurement, analytical sensitivity and analytical specificity); d) primary sample system (e.g. plasma, serum, urine); e) type of container and additives; f) required equipment and reagents;</p>

including technical performance requirements; f) reference standards and reference materials required; g) environmental conditions required and any stabilization period needed; h) description of the procedure , including - affixing of identification marks, handling, transporting, storing and preparation of items, - checks to be made before the work is started, - checks that the equipment is working properly and, where required, calibration and adjustment of the equipment before each use, - the method of recording the observations and results, - any safety measures to be observed; i) criteria and/or requirements for approval/rejection ; j) data to be recorded and method of analysis and presentation ; k) the uncertainty or the procedure for estimating uncertainty.	g) calibration procedures (metrological traceability); h) procedural steps ; i) quality control procedures; j) interferences (e.g. lipaemia, haemolysis, bilirubinemia) and cross reactions; k) principle of procedure for calculating results, including measurement uncertainty ; l) biological reference intervals ; m) reportable interval of examination results; n) alert/critical values , where appropriate; o) laboratory interpretation ; p) safety precautions ; q) potential sources of variability . Electronic manuals are acceptable provided that the above-specified information is included. The same requirements for document control should also apply to electronic manuals. The laboratory director shall be responsible for ensuring that the contents of examination procedures are complete, current and have been thoroughly reviewed.
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La documentazione dei metodi contiene informazioni sulle modalità di esecuzione (17025 e 15189) e sui criteri di interpretazione dei risultati (15189).

17025	15189
5.4.5 Validation of methods	5.5 Examination procedures <i>NOTE Some of the following might not be applicable to all disciplines in the scope of laboratory medicine.</i>
5.4.5.1 Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.	5.5.4 Performance specifications for each procedure used in an examination shall relate to the intended use of that procedure.
5.4.5.2 The laboratory shall validate non-standard methods, laboratory-designed/developed methods, standard methods used outside their intended scope, and amplifications and modifications of standard methods to confirm that the methods are fit for the intended use. The validation shall be as extensive as is necessary to meet the needs of the given application or field of application. The laboratory shall record the results obtained, the procedure used for the validation, and a statement as to whether the method is fit for the intended use. Note 1 Validation may include procedures for sampling, handling and transportation.	5.5.1 The laboratory shall use examination procedures, including those for selecting/taking sample portions, which meet the needs of the users of laboratory services and are appropriate for the examinations. Preferred procedures are those that have been published in established/authoritative textbooks, peer-reviewed texts or journals, or in international, national or regional guidelines. If in-house procedures are used, they shall be appropriately validated for their intended use and fully documented.
Note 2 The techniques used for the determination of the performance of a method should be one of, or a combination of, the following: - calibration using reference standards or reference materials; - comparison of results achieved with other methods; - interlaboratory comparisons ; - systematic assessment of the factors influencing the result; - assessment of the uncertainty of the results based on scientific understanding of the theoretical principles of the method and practical experience.	5.5.2 The laboratory shall use only validated procedures for confirming that the examination procedures are suitable for the intended use . The validations shall be as extensive as are necessary to meet the needs in the given application or field of application. The laboratory shall record the results obtained and the procedure used for the validation. The methods and procedures selected for use shall be evaluated and found to give satisfactory results before being used for medical examinations. A review of procedures by the laboratory director or designated person shall be undertaken

	initially and at defined intervals. Such a review is normally carried out annually. These reviews shall be documented.
Note 3 When some changes are made in the validated non-standard methods, the influence of such changes should be documented and, if appropriate, a new validation should be carried out.	5.5.3 ... Any deviation shall be reviewed and documented. Additional information that could be required to perform the examination shall also be documented. Each new version of examination kits with major changes in reagents or procedure shall be checked for performance and suitability for intended use. Any procedural changes shall be dated and authorized as for other procedures.
5.4.5.3 The range and accuracy of the values obtainable from validated methods (e.g. The uncertainty of the results, detection limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences and/or cross-sensitivity against interference from the matrix of the sample/test object), as assessed for the intended use, shall be relevant to the customers' needs . Note 1 Validation includes specification of the requirements, determination of the characteristics of the methods, a check that the requirements can be fulfilled by using the method, and a statement on the validity.	5.5.1 The laboratory shall use examination procedures, including those for selecting/taking sample portions, which meet the needs of the users of laboratory services and are appropriate for the examinations. ...
Note 2 As method-development proceeds, regular review should be carried out to verify that the needs of the customer are still being fulfilled. Any change in requirements requiring modifications to the development plan should be approved and authorized.	5.5.5 Biological reference intervals shall be periodically reviewed. If the laboratory has reason to believe that a particular interval is no longer appropriate for the reference population, then an investigation shall be undertaken, followed, if necessary, by corrective action. A review of biological reference intervals shall also take place when the laboratory changes an examination procedure or pre-examination procedure, if appropriate.
Note 3 Validation is always a balance between costs, risks and technical possibilities . There are many cases in which the range and uncertainty of the values (e.g. accuracy, detection limit, selectivity, linearity, repeatability, reproducibility, robustness and cross-sensitivity) can only be given in a simplified way due to lack of information.	5.5.2 ... The validations shall be as extensive as are necessary to meet the needs in the given application or field of application.

Il laboratorio medico secondo 15189, più che validare il metodo, ne conferma l'utilità con procedure validate. Le caratteristiche dei metodi sono funzionali alle necessità degli utilizzatori. In medicina 15189 raccomanda l'inclusione degli intervalli di riferimento nelle attività di revisione della validazione.

17025	15189
5.4.6 Estimation of uncertainty of measurement 5.4.6.1 A calibration laboratory, or a testing laboratory performing its own calibrations, shall have and shall apply a procedure to estimate the uncertainty of measurement for all calibrations and types of calibrations. 5.4.6.2 Testing laboratories shall have and shall apply procedures for estimating uncertainty of measurement. In certain cases the nature of the test method may preclude rigorous, metrologically and	5.6.2 The laboratory shall determine the uncertainty of results, where relevant and possible. Uncertainty

<p>statistically valid, calculation of uncertainty of measurement. In these cases the laboratory shall at least attempt to identify all the components of uncertainty and make a reasonable estimation, and shall ensure that the form of reporting of the result does not give a wrong impression of the uncertainty. Reasonable estimation shall be based on knowledge of the performance of the method and on the measurement scope and shall make use of, for example, previous experience and validation data.</p> <p>Note 1 The degree of rigor needed in an estimation of uncertainty of measurement depends on factors such as: - the requirements of the test method; - the requirements of the customer; - the existence of narrow limits on which decisions on conformity to a specification are based.</p> <p>Note 2 In those cases where a well-recognized test method specifies limits to the values of the major sources of uncertainty of measurement and specifies the form of presentation of calculated results, the laboratory is considered to have satisfied this clause by following the test method and reporting instructions (see 5.10).</p> <p>5.4.6.3 When estimating the uncertainty of measurement, all uncertainty components which are of importance in the given situation shall be taken into account using appropriate methods of analysis.</p> <p>Note 1 Sources contributing to the uncertainty include, but are not necessarily limited to, the reference standards and reference materials used, methods and equipment used, environmental conditions, properties and condition of the item being tested or calibrated, and the operator.</p> <p>Note 2 The predicted long-term behaviour of the tested and/or calibrated item is not normally taken into account when estimating the measurement uncertainty.</p> <p>Note 3 For further information, see ISO 5725 and the Guide to the Expression of Uncertainty in Measurement (see Bibliography).</p>	<p>components which are of importance shall be taken into account. Sources that contribute to uncertainty may include sampling, sample preparation, sample portion selection, calibrators, reference materials, input quantities, equipment used, environmental conditions, condition of the sample and changes of operator.</p>
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L'incertezza del metodo è un parametro obbligatorio. 15189 ipotizza che nel laboratorio medico talvolta possa essere non rilevante o non misurabile. Probabilmente, la cautela deriva dalle critiche espresse in qualificati ambienti scientifici alla prassi di includere l'informazione di incertezza con i risultati, aggravando il sovraccarico informatico degli utilizzatori. In realtà, se i rapporti sono confezionati opportunamente (v. 15189 5.8), questo problema è superabile. Resta la difficoltà di immaginare metodi per i quali l'incertezza sia assolutamente irrilevante o che sia impossibile da misurare. Un ambito di potenziale difficoltà è quello dei risultati qualitativi, che però si può avvalere oggi di metodi appropriati, ancorché non sempre di semplice applicazione (v. documento Q5-O1).

Conclusioni

L'area dei metodi analitici presenta differenze tra ISO 17025 e ISO 15189, dovute al fatto che i laboratori medici per lo più metodi non normati sviluppati e validati da strutture esterne (le aziende fornitrici). A ciò è dovuta l'espansione dei requisiti relativi alla documentazione. Il confronto dei requisiti è in questo settore particolarmente complicato, perché la sequenza numerica tra 17025 e 15189 presenta un certo numero di differenze.

Ad un esame analitico dei requisiti, appare che i principi che ispirano le due norme sono sostanzialmente gli stessi. In testa alle priorità viene messa la tutela dell'utilizzatore-cliente, che nel caso dei metodi normati o di quelli sviluppati in casa viene messo al corrente delle caratteristiche, di eventuali varianti procedurali, e così via. Nel caso dei metodi non normati del laboratorio medico, non si segue la prassi di

informare gli utenti dei dettagli metodologici, le istruzioni non sono scritte dagli operatori ma dai fornitori di sistemi e reagenti. Ciò per ragioni multiple, non esplicitate nella norma ma facilmente intuibili. La principale è l'eterogeneità degli utenti, che possono essere sia lo specialista che il medico generico che il paziente o persino un soggetto terzo non sanitario. Per alcuni di questi i dettagli del metodo possono essere ovvii, oppure incomprensibili, o ancora confondenti, quasi sempre inutili e ridondanti rispetto alla massa di informazioni che questi soggetti devono costantemente gestire. Un'altra ragione è il fatto che nella quasi totalità dei casi i laboratori acquistano i materiali pronti e li usano così come sono senza modifiche, fidando nelle verifiche condotte dal produttore a vari livelli.

Comunque, anche se non mette gli utenti a conoscenza di questi dati, il laboratorio ha il dovere di valutare i metodi e di verificare che siano adatti all'uso previsto. Il laboratorio deve conoscere le fonti di variabilità e l'incertezza del metodo.

In definitiva, anche in questo settore le differenze tra 17025 e 15189 non coinvolgono i principi fondanti. 15189 contiene in generale la specificazione, espressa con parole di uso comune in medicina, di concetti già presenti in 17025, dove sono talvolta più estesi nella parte analitica.

Si può concludere che per ottenere un buon risultato nella preparazione all'accREDITAMENTO il laboratorio deve stabilire un rapporto di collaborazione molto stretto con i suoi fornitori di sistemi, reagenti e materiali di consumo. L'associazione dei due soggetti, con il produttore in posizione talvolta rilevante, ha la convenienza di considerare sia 15189 che 17025 per meglio comprendere la natura di alcuni singoli requisiti.

Riferimenti

1. CONFIDENCE IN COMPETENCE. www.european-accreditation.org/content/communication/EA_Brochures/Brochure_European%20co-operation_approved.pdf.
2. EA-01/08 EA Multi and bilateral Agreement Signatories. May 2008 – rev.23. www.european-accreditation.org/n1/doc/EA-1-08.pdf.
3. EA-2/11 - EA Policy for Conformity Assessment Schemes. January 2006 rev01. www.european-accreditation.org/Docs//0001_General/0002_Procedural%20and%20Policy%20Documents%20Series%202/01300_EA-2-11_rev01.pdf.
4. UNI CEI EN ISO/IEC 17025:2005. Requisiti generali per la competenza dei laboratori di prova e di taratura. General requirements for the competence of testing and calibration laboratories.
5. ISO 15189 august 2007. Medical Laboratories - Particular requirements for quality and competence.