Ministry of Defence

Defence Standard 05-055 Part 01

Issue 4 **Date: 14 April 2024**

Measurement and Calibration System Requirements for Ministry of Defence Test and Measurement Equipment

Part 01: Ministry of Defence Calibration Laboratories Operation and Management

Section 1
Foreword

Defence Standard Structure

Section 1 (Generated by the StanMIS toolset)

- Revision Note
- Historical Record
- Warning
- Standard Clauses

Section 2 (Technical information provided by Subject Matter Expert)

- Title
- Introduction (optional)
- Table of Contents
- Scope
- Technical Information to include Tables and Figures
- Annexes (as required)

Section 3 (Generated by StanMIS toolset)

- Normative References
- Definitions
- Abbreviation
- Changes Since Previous Issue

REVISION NOTE

Routine review of Part 1 but after initial review Parts 2 and Parts 4 have been merged.

HISTORICAL RECORD

This standard supersedes the following:

Def Stan 05-055 Part 1 Issue 3

WARNING

The Ministry of Defence (MOD), like its contractors, is subject both to United Kingdom law and any EU-derived law that has been retained under the European Union (Withdrawal) Act 2018 regarding Health and Safety at Work. Many Defence Standards set out processes and procedures that could be injurious to health if adequate precautions are not taken. Adherence to those processes and procedures in no way absolves users from complying with legal requirements relating to Health and Safety at Work.

STANDARD CLAUSES

a) This standard has been published on behalf of the Ministry of Defence (MOD) by UK Defence Standardization (DStan).

b) This standard has been reached following broad consensus amongst the authorities concerned with its use and is intended to be used whenever relevant in all future designs, contracts, orders etc. and whenever practicable by amendment to those already in existence. If any difficulty arises which prevents application of the Defence Standard, DStan shall be informed so that a remedy may be sought.

c) Please address any enquiries regarding the use of this standard in relation to an invitation to tender or to a contract in which it is incorporated, to the responsible technical or supervising authority named in the invitation to tender or contract.

d) Compliance with this Defence Standard shall not in itself relieve any person from any legal obligations imposed upon them.

e) This standard has been devised solely for the use of the MOD and its contractors in the execution of contracts for the MOD. To the extent permitted by law, the MOD hereby excludes all liability whatsoever

and howsoever arising (including, but without limitation, liability resulting from negligence) for any loss or damage however caused when the standard is used for any other purpose.

Measurement and Calibration System Requirements for Ministry of Defence Test and Measurement Equipment

The Operation and Management Requirements for Calibration Laboratories and Units undertaking Unit Level Tests

Contents

Annexes

Figures

Tables

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1 Scope

This Defence Standard is based on the requirements of BS EN ISO 9001 and BS EN ISO 10012 and covers:

a) The requirements for the management and calibration of Test and Measurement Equipment (TME) items and requirements for Calibration Laboratories. It applies to TME sent to a contractor for:

1) Calibration,
2) Repair,
3) Calibration after repair, and
4) when the contractor is required to travel to the TME to conduct the work.

Note: It also applies to those contracts, which include a combination of TME, and other equipment such as parts of a main system; in such contracts it is important that the requirements for the TME are identified and listed in the contract.

b) The Management and Control of Test and Measurement Equipment (TME) tested using Unit Level Tests.

Note: This is equipment which, because of its simplicity or mode of use, does not require periodic calibration but should be regularly checked against a working standard using an approved Unit Level Test Procedure (ULTP), under pre-defined and controlled conditions.

2 Requirements for Calibration Laboratories

2.1 Calibration laboratories shall demonstrate competency for the scope of calibration being undertaken. This competency can be demonstrated by:

a) Accreditation by a national accreditation body, e.g., United Kingdom Accreditation Service (UKAS)

1) It is not necessary to contractually require the supplier to employ an ISO/IEC 17025 accredited test laboratory if the contractor can demonstrate, and the delivery team is confident, that the laboratory chosen to conduct the testing is competent and impartial.
2) Specifying that testing will be conducted by an ISO/IEC 17025 accredited body is only appropriate if it will assist in the management of identified risks.
3) Accreditation is for specific measurements and for the smallest uncertainties that can be achieved in the respective calibration laboratory. For more information on the uncertainty of measurement, refer to JCGM 100:2008 Evaluation of measurement data - Guide to the expression of uncertainty of measurement (also known as 'The GUM') or UKAS Publication M3003

b) Proving traceability of the calibration data reported to meet the requirements of BS EN ISO/IEC 17025.

Note: For additional information refer to Knowledge in Defence (KiD) Managing Quality > Quality in Acquisition [GQA] > Requirements Preparation > Appropriate Certification.

2.2 Calibration Laboratories fulfilling the requirements of BS EN ISO/IEC 17025 are considered competent for their scope.

2.2.1 A calibration certificate bearing an accreditation body logo from a calibration laboratory accredited to BS EN ISO/IEC 17025, for the calibration concerned, is sufficient evidence of the traceability of the calibration data reported.

2.2.2 Calibration certificates that do not bear an accreditation mark will not be regarded by the MOD as providing evidence of traceability.

2.3 For some specialist personnel protection and safety related TME, the MOD has initiated specific requirements for the calibration and support of this TME which may require demonstration of quality management, standards and traceability other than those demonstrated for accreditation to BS EN ISO/IEC 17025.

2.3.1 Ionising Radiation Detection and Monitoring Equipment (RDME) is governed by policy and procedures outlined in Joint Service Publication (JSP) 425 Part 1, Examination and Testing of Ionising Radiation Detection and Monitoring Equipment (RDME). JSP425 Part 1 sponsors the minimum specific requirements for MOD approved radiation calibration laboratories which are detailed in DEF STAN 05-055 Part 3.

Note: Activities are currently in place to merge the content of JSP425 in to JSP392.

2.4 Calibration laboratories shall maintain an appropriate Quality Management System (QMS) to ensure standards within the facility are maintained and that equipment is correctly tested / calibrated with test procedures subsequently controlled in an effective manner.

2.4.1 This shall be demonstrated by BS EN ISO 9001 certification.

2.4.2 Those who do not have certification shall agree with Delivery Team (DT) / Support Authority (SA) an appropriate process to demonstrate that their QMS meets the requirements of BS EN ISO 9001; or meets contractual requirements.

Note: For additional information refer to Knowledge in Defence (KiD) Managing Quality > Quality in Acquisition [GQA] > Requirements Preparation > Appropriate Certification

2.5 Calibration laboratories are required to confirm periodically that each of their calibration standards is continuing to perform at its declared accuracy level. The aim of confirmation is to prevent deterioration in accuracy producing erroneous results in subsequent calibration of TME. Such confirmation is to be conducted at intervals determined by the stability, purpose and usage of the standards.

Note: Guidance on Calibration assessment of TME is detailed in the MOD document 'The Management of Test and Measurement Equipment Handbook'. Calibration Requirements and Assessment are to be applied to assessing the confirmation requirements of calibration standards. Confirmation techniques and periodicities will be checked during technical audits.

2.6 All TME shall be calibrated and be traceable to National or International Standards, see **Clause 3**. Calibration laboratories must maintain documented evidence to support that traceability, **Clause 4**.

2.7 All TME shall be appropriately marked or labelled, see **Clause 6**.

Note: The means of establishing traceability of measurement to the appropriate standards will vary between different items of TME depending on several factors such as complexity of the measurement, accuracy of the measurement, and the capability of the laboratory.

2.8 Each Instrument Under Calibration (IUC) shall satisfy the published performance specification and is to be calibrated over the ranges and cardinal points as specified in the following documents:

a) MOD Calibration Statement of Requirement (CSOR).

Note: A CSOR is a document that defines the minimum accuracy requirements of the TME for service use. These will generally, but not exclusively, reflect the procurement or manufacturers claimed accuracy specification, and may be varied to reflect the accuracy and safety requirements for service use. It specifies the range of calibration, uncertainty required and number of points to be measured.

b) Legacy MOD Sponsored Instrument Calibration Procedure (ICP).

Note: An ICP is a document that defines the minimum accuracy requirements of the TME and the method that the calibration laboratory is to use to conduct the calibration. ICP's are generally used to define the calibration of Special Purpose Test Equipment, where special equipment or methods are needed to conduct the calibration and the equipment is not available to a commercial specification. These can be found in single service legacy documents i.e., Laboratory Calibration Procedures (LCP's), Test Equipment Support Manuals (TESM's), Army Equipment Support Procedures (AESP's) subcategory 5.4 level 2.

2.9 In the absence of **2.8 a)** and **2.8 b)** above, the Calibration laboratory shall develop a Calibration Method that will ensure that the collective uncertainty of the measurement standards shall not exceed 25% of the acceptable tolerance for each characteristic being calibrated. This collective uncertainty may also be referred to as the 'Test Uncertainty Ratio' (TUR) which based on this 25% limit would be represented as 4:1. In either case, the measurement standards shall meet the needs of the client based upon the appropriate:

a) Cardinal point specification / checklist which are appropriate for the tests and / or calibrations it undertakes based on the appropriate International Organisation for Standardisation (ISO) or British Standard (BS).

b) Manufacturer's recommended calibration procedure. This should be assumed to be the minimum required to ensure the equipment is operating correctly and within the limits of the manufacturer's published specification. However, this may not cover the calibration need when the equipment is operating in-service, therefore calibration periodicity may change. Any functions, ranges and points which are of importance to the MOD shall be specified by the equipment DT/SA.

c) Cardinal point specification / checklist which are appropriate for the tests and / or calibrations it undertakes based on the manufacturer's calibration procedure.

3 Requirements for Measurement and Traceability of Calibration Standards

3.1 All TME shall be calibrated using standards traceable to national or international standards except where the standards have been derived from accepted values of natural physical constants or derived by the ratio of type of self-calibration techniques.

Note: TME need not be referred directly to national standards but may be calibrated against intermediate standards, providing it can be demonstrated that traceability to national standards with an appropriate uncertainty is satisfied. All standards used in the measurement and calibration system shall be supported by certificates, uncertainty budgets, reports or data sheets attesting to the date, accuracy and conditions under which the results were valid.

3.2 Routes for Measurement Traceability

3.2.1 The calibration of MOD TME shall be carried out by one of the following:

a) National Metrology Institutes (NMI).

b) An appropriate service or ISO/IEC 17025 accredited laboratory (e.g., UKAS).

c) Approved MOD calibration laboratory.

d) The Original Equipment Manufacturer (OEM) of the TME.

e) Third party calibration laboratory.

3.2.2 If it is not possible or appropriate to achieve traceable calibration, the equipment DT/SA may agree for the calibration laboratory to demonstrate traceability to a widely used standard which is clearly specified and mutually agreeable to all parties concerned. There is therefore a calibration hierarchy, as shown in **Figure 1**.

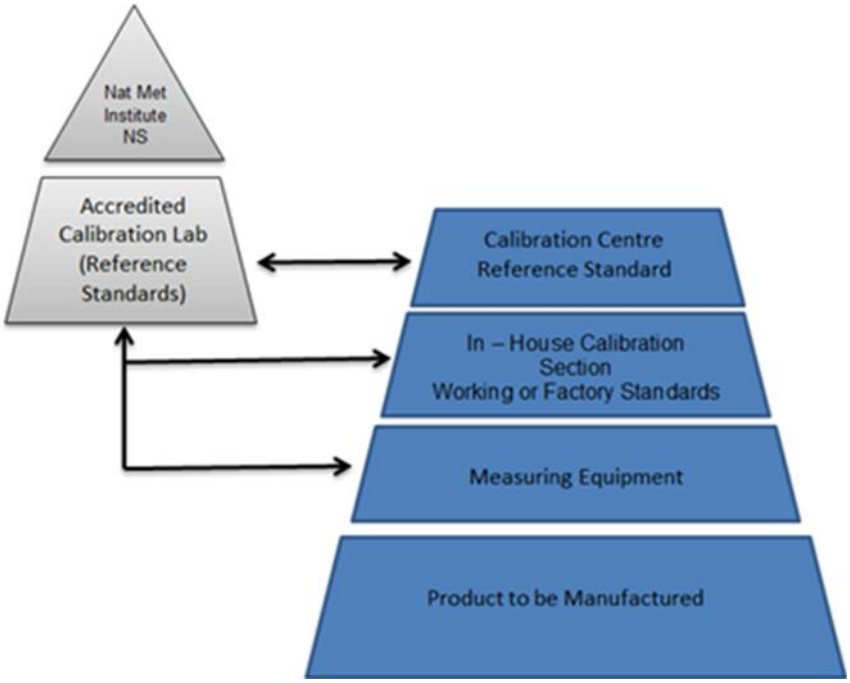


Figure 1 - Calibration Hierarchy

Note: In each of these stages, a calibration has been performed using a standard with a metrological quality already determined by calibration with a higher-level standard. The figure illustrates in particular how an in-house calibration system (right hand side of the diagram) may interact with the existing metrological infrastructure (left hand side of the diagram).

3.3 Measurement Traceability levels

3.3.1 Calibrations carried out on TME may be classified into one of three levels:

a) **Level 1** A calibration carried out by a laboratory accredited to ISO/IEC 17025 for the measurements concerned for which an ISO/IEC 17025 calibration certificate is issued. Certificates from other calibration bodies may be acceptable provided that full traceability to national standards is demonstrated.

b) **Level 2** A calibration which may be performed to a documented method by competent staff using appropriate reference standards and equipment. The reference equipment used need to be calibrated by a laboratory that can demonstrate competence, measurement capability and traceability, e.g., a UKAS accredited calibration laboratory.

Note: See https://ilac.org/signatory-search/ to confirm if an accreditation body is accredited for calibration to ISO/IEC 17025

c) **Level 3** A certificate of conformance issued by the manufacturer of the equipment or an appropriate organisation. The specified level of traceability is the minimum considered appropriate.

3.4 Traceability Levels Summary

3.4.1 It is acceptable for an organisation to calibrate to achieve a higher level of traceability for calibration, e.g., Level 2 rather than Level 3. However, a lower level than specified is not considered acceptable without full justification. In this case, it is the equipment DT/SA, who will agree or not.

3.4.2 If the equipment DT/SA has established that the associated uncertainty from a calibration makes an insignificant contribution to the total uncertainty of the measurement activity, then less stringent requirements for traceability, (e.g., a manufacturer's certificate) may be acceptable. In all cases the equipment DT/SA needs to ensure that the equipment used provides the uncertainty of measurement needed.

3.4.3 Following assessment of a laboratory's equipment calibration and check system, a higher level of traceability may be necessary than that undertaken by the laboratory to achieve the accuracy required. This situation may arise where the capabilities required to perform the calibration in-house, e.g., environment, equipment, or staff are not available to the laboratory.

3.4.4 In general terms a single uncertainty contribution may be relatively small, however, the inclusion of individual contributions to the overall uncertainty budget should be based on the guidance provide by National and International Standards, BIPM, JCGM 100:2008 – Evaluation of measurement data – Guide to the expression of uncertainty in measurement and UK Measurement Good Practice Guides.

Note 1: It is possible that a single uncertainty contribution can be 5% or less, particularly in an instance where this contribution is related to a calibration coefficient or similar factor. Where such a contribution appears, it is acceptable for this value to be removed from the overall uncertainty budget provided a statement to this effect is made on the calibration certificate.

Note 2: Alternatively, the contribution can be included in the budget provided, again, a suitable statement is made on the calibration certificate such that the end user is aware of the reason for, and justification of, a high value of overall uncertainty.

4 Requirements for Certification of Calibration Standards

4.1 All approved calibration laboratories shall maintain documented evidence to support traceability of their standards back to the appropriate national level. This certification is to comprise reports or data sheets which attest to the date, accuracy and conditions under which the calibration results are valid. The only exceptions to this requirement are:

a) Standards based on nationally accepted physical constants (e.g., Caesium beam frequency standard).

b) Standards which can have their accuracy checked by self-calibration ratio method.

4.2 Calibration laboratories shall establish and maintain a system which records the below for each standard:

a) The method of calibration employed.

b) The influence quantities, i.e., environmental or any special conditions of measurement.

c) The date of calibration.

d) The calibration interval.

e) Any adjustments or repairs performed.

f) The associated measurement uncertainty.

g) The signature or initials of the calibrator.

h) Care of Calibration Standards.

4.3 Reference measurement standards could deteriorate due to handling and in transit. Therefore, calibration laboratories shall:

a) Minimise the movement of primary, secondary and reference standards.

b) Check the performance of these standards against travelling standards to ensure they have not deteriorated.

4.4 Calibration laboratories shall ensure that:

a) Standards are properly packed and protected against mechanical damage and shock before shipment to another location.

Note: They should seek the advice of both the manufacturer and Logistic packaging specialists on the methods and transit cases to be used.

b) A system for receiving, handling, transporting, storing and installing any standard received is established and maintained.

Note: The system employed should aim to prevent abuse, misuse, damage and changes in dimensional and functional characteristics and prevent confusion between similar items.

c) The systems employed shall be documented with entries to record each transaction.

5 Requirements for Certificates of Calibration

5.1 The results of each calibration carried out shall be reported accurately, clearly and unambiguously to the MOD.

5.2 When a receipted test or calibration item is found to be out of specification the detail of the non-conformance shall be reported to the MOD before any adjustment or repair action is taken.

5.3 On completion of the calibration work a certificate of calibration shall be provided and signed by the authorised representative. It should contain a statement confirming that the calibration can be demonstrated to be traceable to National or International Standards.

5.4 The certificate of calibration shall contain a statement of the full compliance of the equipment under calibration with its performance specifications. It shall include the information required by BS EN ISO/IEC 17025 Clauses 7.8.2 and 7.8.4.

5.5 Before declaring IUC compliance, the measured value shall be extended by the uncertainty of measurement, with the results lying within the specified limits. All measurement uncertainty shall be at a confidence level of 95% or better.

5.6 Any omissions from the full calibration are to be notified to MOD and shall be agreed in writing before a certificate, clearly annotated “Limited Calibration” is issued.

5.7 Where full compliance cannot be achieved then the IUC is to be rejected. An out of tolerance (OOT) report is required detailing both before and after adjustment measured values.

5.8 A calibration may be restricted to cover certain parameters, at the MODs request, to meet a special calibration requirement. The instrument shall be labelled to identify its restricted use.

5.9 Laboratories shall apply calibration labels to measuring instruments (or, if not practicable, to the container) that they have been calibrated under their scope of measurement and shall indelibly inscribe on the label:

a) Instrument identification

b) Date of calibration (with the month stated as a word)

c) Certificate number

d) The date when calibration is again due e.g., Recalibration date where this has been agreed with the MOD or Space for the date when calibration is again due

e) If desired, the name of the calibration laboratory

5.10 STANAG 4704 contains the Northern Atlantic Treaty Organisation (NATO) requirements for calibration support of TME and a standard calibration documentation system which shall be used for reporting calibration at participating countries.

5.11 All calibration results shall be maintained by the Contractor for a minimum of three years or two calibration intervals from the date of calibration whichever is longer, even if the contracted period has expired. Such results shall remain the property of the equipment DT/SA and may be requested at any time by MOD.

6 Requirements for Labels

6.1 MOD policy details the requirements for the reporting of calibration results and stipulates that the calibration status and serviceability of all TME shall be identified by means of a recognised calibration label. Details of labels and colour coding can be found in **Annex A**.

6.2 **Annex A** provides guidance for the format, presentation and wording of calibration labels. In-house MOD approved calibration laboratories following this guidance will be able to produce documentation that is easily identified as produced by a MOD approved calibration laboratory and thus minimise the risks of Units and readers being misled. Further guidance is contained within the Management of Test and Measurement Handbook sponsored by Operational Infrastructure Workshops (OI Wksp) DT.

7 Requirements for Unit Level Test

7.1 General Requirements

7.1.1 The availability of an appropriately approved ULTP ultimately determines the calibration level for equipment and the facilities required. Where ULT (Unit Level Testing) is adopted then the requirements of Clause **7** shall be observed.

7.1.2 Details of equipment that can be tested by the user and the procedures to do so are specified within 'The Management of Test and Measurement Equipment Handbook', which is sponsored by Operational Infrastructure (OI) Delivery Team (DT).

7.1.3 By its definition ULT is less stringent than a laboratory level calibration. Some items can have various uses, which could require different levels of calibration. In these instances, the items will be calibrated to the higher level of measurement traceability. For example, unit level test can be used to calibrate weighing scales used for weighing purposes in medical, sports or postal services, etc. It is clearly the users' responsibility to ensure that all TME is calibrated to cover its use. It is the use of TME that determines calibration requirements.

7.1.4 Unit level testing shall be carried out by:

a) Suitably Qualified and Experienced Personnel (SQEP), and

Note: SQEP in this scenario shall be a person who can demonstrate familiarity with the TME. This competence should be assessed by the UNIT.

b) Using a calibrated artefact or equipment, which has been calibrated and is traceable to a National Standard.

7.2 Management Responsibility

7.2.1 Field Unit Commanders or Delivery Duty Holders (DDH) shall decide whether their unit carries out any of the appropriate unit level test procedures. Items not tested at unit level are to be back loaded to an approved calibration facility, which has the technical competence to carry out the requirements.

7.2.2 The Unit Commander or Delivery Duty Holders (DDH) are responsible for ensuring that all TME in use in their unit is within its calibration period by ensuring:

a) That the management of all TME held on the unit is co-ordinated by a TME Controller and tested in accordance with Defence Standards. Centralised co-ordination is recommended but not mandatory.

b) That adequate facilities are allocated to enable ULT of lower accuracy TME.

c) TME Controllers of units supporting ULT facilities are to use appropriate labels on the Instrument Under Test (IUT) after ULT has been conducted, see **Annex A**.

7.3 Unit Responsibilities

7.3.1 The work described in ULTPs shall be carried out by a user, who is SQEP, of the TME items that require testing.

7.3.2 Units are to make all reasonable efforts to conduct the ULT and the officer in charge of conducting the TME work shall:

a) Ensure that SQEP are employed.

b) Perform the work correctly IAW the ULTP.

c) Perform the work in the correct environment.

Note: The officer in charge may arrange for the TME ULT to be carried out elsewhere.

7.3.3 Units are not expected to establish permanent dedicated facilities for ULTP tasks and should not seek long-term manpower, equipment or works services purely for this purpose.

7.4 Procedures

7.4.1 Each IUT shall satisfy the published performance specification and is to be tested over the ranges and cardinal points as specified in the manufacturer's documentation.

7.5 Traceability

7.5.1 All MOD TME shall have its measurement capability traceable to National or approved International Measurement Standards except where the accuracy of the measuring standard is derived by approved self-calibration ratio techniques or based on nationally accepted physical constants. All Laboratory reference and working standards are to be supported by a calibration certificate attesting to the date, accuracy and conditions under which the results were valid.

7.6 Equipment used as Standards

7.6.1 Measurement standards used in the ULTP shall be designated as working standards and are to be clearly shown as such using label Working Standard (MOD 1786).

7.6.2 Working standard calibration certificates shall be requested from the calibration authority and are to be kept by the user for a minimum of two years or for the duration of two intervals of calibration, whichever is the longer.

Note: The individual equipment can be demanded through normal procedures.

7.6.3 Reference Standards are to be submitted to one of the primary standard laboratories which may or may not be a MOD laboratory for calibration.

7.7 Software

7.7.1 A ULTP may include, or refer, to the use of software. This software shall be treated as an intrinsic part of the associated ULTP and should be derived and managed for configuration control, data protection and documentation.

7.8 Sub-Contracting

7.8.1 Sub-contracting is permitted when the relevant facilities and resources are not available, and it is not cost effective to provide them.

7.9 Environment

7.9.1 Normally, environmental requirements will be stated in the ULTPs. ULT areas are to be environmentally stable, i.e., limited in fluctuation of temperature within the range and humidity over short time periods. Working areas are to be clean and tidy. The area is not to be shared with other activities. It should be sufficient for the work being undertaken and the safety of personnel involved. The consumption of food, drink, vaping and smoking within the specified area should be prohibited.

7.10 Training

7.10.1 The prime obligation for correctness of a measurement during a ULTP lies with the person making it. Therefore, staff employed in this area are to have experience or training on the type of work undertaken. Training requirements will vary, and the following steps are to be taken:

a) Identification of the individual training needs against those required for satisfactory performance of the task.

b) Planning and carrying our appropriate training.

c) Planning and organising general quality awareness programme.

d) Recording training and achievement in an easily retrievable form so that records can be updated and gaps in training can be identified.

7.11 Intervals of Calibration cross-check

7.11.1 The test interval is set and usually reflects the manufacturers recommended interval. This interval may change to reflect in service requirements and will be notified normally via The Management of Test and Measurement Handbook equipment list.

7.12 Results

7.12.1 Testing of the IUT to the required performance specification should be attempted in the "as received" condition without adjustment or repair action being taken. The results shall include both the measurements made upon the equipment prior to adjustment of parameters and those obtained after adjustment.

7.12.2 Test measurements are to be recorded on a result sheet. A result sheet should be completed for each ULT performed.

7.12.3 The result sheet is the record of test and should be kept by the unit for a minimum of two years, or for the duration of two intervals of calibration, whichever is the longer.

7.12.4 A suitable result sheet is generally supplied with the with the ULTP. Where result sheets do not exist, the list below provides minimum information that should be recorded:

a) The description of the equipment.

b) The NATO Stock Number (NSN), maker's part number and serial number.

c) Details of the inspection procedure used.

d) The date of the ULT.

e) The unit job number.

f) The results of each measurement performed, cross-referenced to the relative paragraph in the test procedure.

g) A list of the working standards used and their serial numbers.

h) The identity of the technician performing the ULTP.

7.13 Feedback of Test Results

7.13.1 Where the IUT is found to be out of tolerance an out of tolerance report should be maintained and provided to the customer using MOD Form 731 detailing measured values before adjustment or minor repairs. Adjustment or minor repairs may then be made to bring the IUT into tolerance; however, a full second test is not required where the adjustment to specification made effects only that specific measurement parameter. This does not apply to RDME.

7.14 Calibration Failures – Conditioning

7.14.1 TME which cannot be brought within the performance specification by using the appropriate ULTP or by local repair action should be marked as defective or scrapped, whichever is appropriate.

7.15 Labels

7.15.1 After completing ULT, the appropriate label (see **Annex A**) should be placed on the IUT. Items of TME which are too small to permit the attachment of a label are to be individually packaged and a label affixed to the packaging/ container. The ULT label annotated with the serial number of the equipment should be prominently positioned on the packaging/ container.

7.16 Integrity seals

7.16.1 An integrity seal is not required for unit level tested TME. It is only to be used by MOD calibration laboratories on higher accuracy TME.

7.17 Storage, handling and delivery

7.17.1 All TME should be handled carefully. TME should be stored and transported under conditions compatible with its vulnerability.

7.17.2 Performance of measuring instruments or working Standards will be impaired by:

a) Careless use (e.g., damaging the anvil of a micrometre).

b) Poor storage conditions (e.g., extremes of temperature, humidity causing rust and/or mould growth or direct sunlight causing degrading of plastics).

c) Poor transportation.

7.17.3 The workshop should introduce and monitor procedures for storage and indication of TME status. Such procedures are to allow for identification of:

a) Calibration/Test status

b) TME awaiting test

c) TME awaiting disposal post test

d) Workshop standards

e) Workshop standards awaiting calibration

7.17.4 Procedures are to be introduced and maintained for handling TME to prevent abuse, misuse, damage or deterioration.

7.17.5 TME should be adequately packaged prior to transportation to prevent damage.

7.17.6 Areas used for ULT are to be always kept clean and tidy. A cleaning routine should be established to always maintain cleanliness of the area.

7.18 Audits

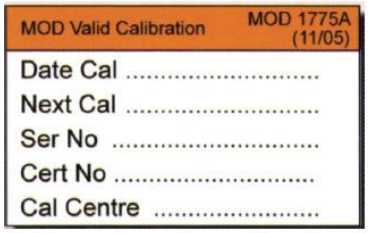
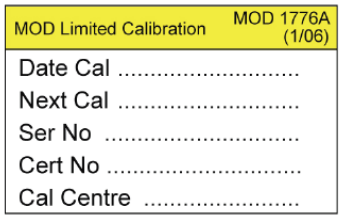
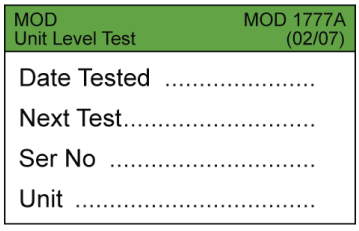
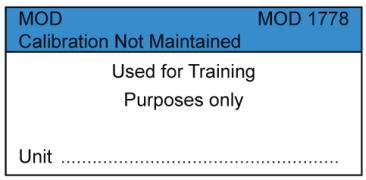
7.18.1 The calibration/test system and operation of a ULT facility should be regularly and systematically audited by the unit Quality Assurance Manager (or nominated member of staff); to ensure quality of operating procedures is managed effectively. A review and evaluation of the findings of the audit programme should be conducted at least annually as part of the management review.

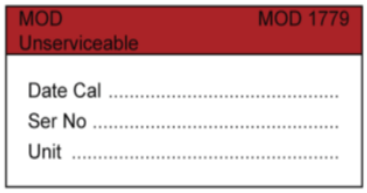
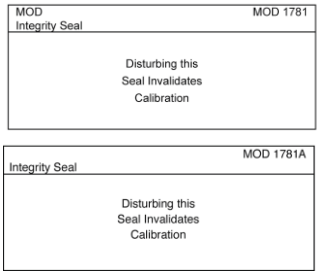
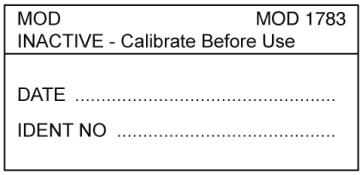
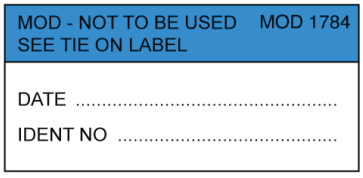
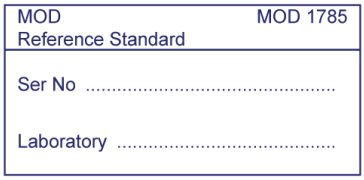
7.18.2 Typical questions useful to the reviewing officer in the evaluation of a calibration/test system are given in **Annex C**.

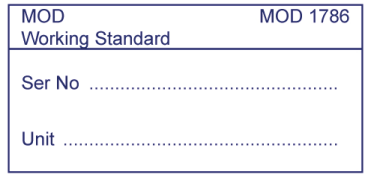
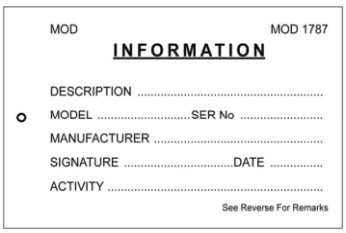
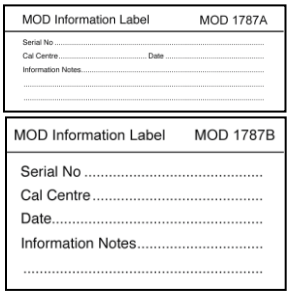
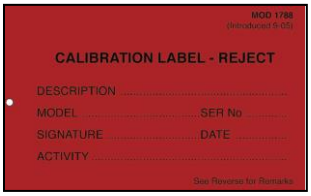
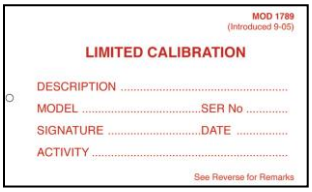
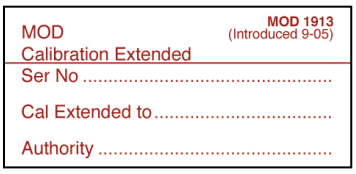
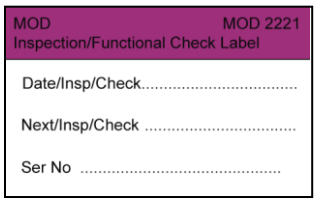
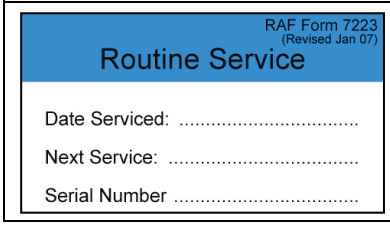
Annex A

Standard system of colour coded calibration labels used on TME

Table A1 - MOD Approved Calibration and Integrity Seals

Label Type	Details
	**MOD 1775A/B/C Valid Calibration (orange stripe)** This label is used to indicate compliance with an agreed specification on the date calibrated by the named MOD approved calibration laboratory. It is to be accepted in lieu of a Certificate of Calibration. When originated in a MOD approved calibration laboratory It is to be accompanied by a tie-on label MOD Form 731 SERVICEABLE, which is to be accepted in lieu of a Certificate of Calibration. Indicates compliance with an agreed specification on the date calibrated by the MOD sponsored calibration laboratory. All results when extended by the uncertainty of measurement are within specification The following information should be indelibly inscribed on the label by the laboratory that has undertaken the calibration: • Date Cal: date of calibration (with the month stated as a word). • Next Cal: date when next calibration is again due e.g. Recalibration due (with the month stated as a word). • Ser No. instrument identification. • Cert No. certification number (if applicable). • Cal Centre: the name of the calibration laboratory. Under normal conditions of use the calibrated instrument may be used to the next calibration due date.
	**MOD 1776A/B/C Limited Calibration (yellow stripe).** This label is used by the named MOD approved calibration laboratory to indicate that complete compliance with an agreed specification has not been verified or cannot be achieved. The results when uncertainty of measurements is considered may be within or outside of specification. It is important that the label is not misleading, and the adhesive label is therefore to be accompanied by a tie-on label MOD Form 731 SERVICEABLE (MOD 1789 for SWS use) attached to the item of TME and detailing the limitations. The limitations usually take one of the following forms: • The item of TME has only been calibrated over a limited portion of its specification. • During calibration, the equipment fails to meet all requirements specified. • Limited calibration may restrict the use of the instrument for other measurement purposes.
	**MOD 1777A/B/C Unit Level Test (green stripe).** This label is used to indicate TME tested at Unit level to an agreed specification, which because of its simplicity or mode of use is to be regularly checked against a working standard using approved procedures. This is not a full calibration. It is to be accompanied by a tie-on label MOD Form 731 SERVICEABLE. The following information should be indelibly inscribed on the label by the Unit that has undertaken the unit level test: • Date tested: date of Unit level test (with the month stated as a word). • Next test: date when next Unit level test is again due (with the month stated as a word). • Ser No. instrument identification. • Unit: the name of the Unit that has undertaken the test. Where full compliance is not achieved, then the TME is to be sent to a MOD approved calibration laboratory.
	**MOD 1778 Calibration Not Maintained (blue stripe).** This label is used to indicate TME used for training purposes only where measurement accuracy does not need to be maintained. TME that is held as for training purposes only but is also allocated for War Maintenance Reserve (WMR) purposes, requires its calibration status to be maintained. **Note:** TME in this category requires regular maintenance and safety checks.

Label Type	Details
	**MOD 1779 Unserviceable (red stripe).** This label is used to indicate that the serviceability of the item is suspect or to indicate non-compliance with an agreed specification on the date calibrated by the approved MOD Calibration Laboratory. When originated in an approved MOD Calibration Laboratory it is to be accompanied by a tie-on label MF731 UNSERVICEABLE (MOD 1788 for SWS use) and accepted in lieu of a Calibration Report. The measured result falls completely outside of the specification / drawing requirement even when extended by the uncertainty of measurement. The following information should be indelibly inscribed on the label by the laboratory that has undertaken the calibration: • Date Cal: date of calibration (with the month stated as a word). • Ser No: instrument identification. • Unit: the name of the calibration laboratory.
	**MOD 1780 Calibration Not Required (all white with red lettering)** This label is used to indicate TME that would normally be subject to calibration but which because of their use or nature does not require calibration (they indicate but do not measure). The authority for its use on a particular equipment or system is to be stated on each label.
	**MOD 1781 and MOD 1781A Integrity Seal (all white with black lettering).** This label functions as a seal. It is used to deter access and prevent adjustments that could affect the instrument's accuracy. The label is attached so that breakage in the seal will indicate interference and it is to be stamped by the originating calibration laboratory or authority. The MOD 1781 is for general use and the MOD 1781A is made of a material used for specific applications only.
	**MOD 1782 Integrity Seal (all white with black lettering).** This label is used where label MOD 1781 is too large for the item of TME. The centre space is to be stamped by the originating calibration laboratory or authority. The MOD 1782 is for general use and the MOD 1782A is made of a material used for specific applications only.
	**MOD 1783 INACTIVE - Calibrate Before Use (all white with black lettering).** This label is used when it is known that an item of TME will be out of use for a long period and calibration is not justified. Prior to being labelled 'Inactive' the item of TME is to be verified as being in good condition and fully calibrated. The label is to show the date of calibration.
	**MOD 1784 NOT TO BE USED (blue stripe).** This label is to be attached by the user when an item of TME is not to be used. It is to be attached adjacent to the calibration label and is to be accompanied by an 'Information' tie-on label (MOD 1787) stating reasons, such as: a) The item of TME bears a valid calibration label but the performance is considered suspect by the user. b) The item has sustained damage or has been dropped. c) The item is overdue for calibration, but because of logistic problems, it cannot be returned immediately to a calibration laboratory.
	**MOD 1785 Reference Standard (all white with blue lettering)** This label is used to indicate TME, which because of their use or nature are treated as a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.

Label Type	Details
	**MOD 1786 Working Standard (all white with blue lettering).** This label is used to indicate TME, which because of their use or nature are treated as a standard, and which is used routinely to calibrate or check other items of TME.
	**MOD 1787 INFORMATION (all white with black lettering).** This tie-on label is used in conjunction with other labels to provide information to the user or to the calibration laboratory, for example: a) The user would request that the calibration laboratory pay particular attention to a parameter, control or other matter giving cause for concern. b) The calibration laboratory would advise the user of a temporary repair using substitute components, and that the correct parts would be a future fitment.
	**MOD 1787A/B Information (all white with black lettering).** These are self-adhesive labels that are direct alternatives to the MOD 1787, used for specific applications in conjunction with other labels to provide information.
	**MOD 1788 REJECT (all red with black lettering).** This tie-on label is used in conjunction with label MOD 1779 in the SWS environment.
	**MOD 1789 LIMITED CALIBRATION (all white with red lettering)** This tie-on label is used in conjunction with label MOD 1776 in the SWS environment.
	**MOD 1913 Calibration Extended (all white with red lettering).** This label is used to indicate that due to operational requirements, an extension has been agreed to use the item of TME beyond its due date and that it is to be used with MOD Form 1914 Extensions Proforma. A MOD 1787 Information label is to be attached to the item of TME detailing the criteria for its continued use.
	**MOD 2221 Inspection/Functional Check (Pantone 246C stripe).** This label is used to indicate TME, which because of their use or nature requires periodic inspections or functional checks. The inspections / checks are performed to a MOD calibration laboratory agreed specification and periodicity, and they are normally carried out by the user Unit. On successful completion of each inspection/check, where practicable, a completed MOD 2221 Inspection / Functional Check Label is to be affixed to the equipment.
	**RAF Form 7223 Routine Service (blue stripe).** This label is used by RAF units to indicate TME, which because of their use or nature, requires periodic routine service in accordance with an agreed maintenance schedule. The routine service is normally carried out by the user unit. On successful completion of the routine maintenance task, where practicable, a completed RAF Form 7223 Routine Service label is to be affixed to the equipment. All old routine maintenance labels are to be removed.

Annex B

Informative References

Reference Number	Title	Issue Number	Issue Date
JSP 425	Examination and Testing of Ionising Radiation Detection and Monitoring Equipment (RDME)	8.1	01/05/2016
M3003	The Expression of Uncertainty and Confidence in Measurement	Edition 4	31/10/2019
TME Handbook	The Measurement of Test and Measurement Equipment Handbook	V1.0	01/01/2016
SI Brochure	The International System of Units (SI)	9th Edition	01/01/2019
JCGM 100:2008	Evaluation of measurement data — Guide to the expression of uncertainty in measurement	First Edition	01/09/2008

Note: It should be noted that the ownership of JSP 425 has moved from LSOC to HSEP and it is planned to be incorporated in JSP 392.

Annex C

Typical Quality Review Check / Questions

Quality Review Requirements	Review Checks – Requirement Questions
Calibration of Test System	1. Are there prescribed procedures for the control and calibration/test of all measurement standards and measuring equipment? 2. Are the procedures effective and complied with? 3. Are the appropriate management responsibilities documented? 4. Does the system provide for the prompt detection of deficiencies to prevent subsequent inaccuracies? 5. Is there a procedure to ensure corrective action? 6. Is there an appropriate area allocated for carrying out all calibration work?
Environment	7. Are controlled environments provided where necessary? 8. Are controlled environment areas properly laid out, monitored and controlled? 9. Are environmental monitoring devices properly maintained and calibrated? 10. Have instructions been issued detailing actions to be taken when environmental conditions are not being met? 11. Has the level of skill and training required by the test and measurement personnel been determined?
Training Documented Calibration Procedures	12. Are there prescribed procedures for controlling the calibration/test of measurement standards and measuring equipment? 13. Are the latest issues of procedures identified and available? 14. Is a check carried out to ensure that written procedures are adhered to? 15. Do records include details of calibration controls environmental data, error limits and information to establish traceability? 16. Does the system include the retention of calibration certificates or data used in support of all calibration/test of measuring equipment?
Calibration Labelling	17. Is there a prescribed system of labelling that identifies the calibration/test status of measurement standards and measuring equipment? 18. Is equipment that is not fully calibrated or has limited use, fully identified?
Invalidation of Calibration	19. Do prescribed procedures ensure the immediate removal from use, or conspicuous identification of any measurement standard or measuring equipment that: a. Has not been calibrated/tested in accordance with the established time period? b. Has failed in operation in any measurement parameter? c. Shows evidence of physical damage? d. Is suspect for any reason? 20. Are procedures for segregation of TME effective and complied with? 21. Do the procedures provide for immediate notification to owners of TME failures or damage likely to have compromised their product quality?
Storage and Handling	22. Is there an adequate system for the handling, transportation and storage of measurement standards and measuring equipment? 23. Is the system under the control of the calibration department? 24. Do the procedures include a requirement for reporting damage, or deterioration? 25. Are storage and handling arrangements reviewed particularly in respect of increased equipment sophistication?
Training	26. Have all personnel performing ULT functions the appropriate experience or training? Are training records maintained? 27. Is the experience or training applicable to the type of test work undertaken? 28. Are ULT personnel sent on training courses? 29. Is the competence of staff reviewed at the planning stage?

Section 3

Normative References

1 The publications shown below are referred to in the text of this standard. Publications are grouped and listed in alpha-numeric order.

Note: Def Stan's can be downloaded free of charge from the DStan web site by visiting **<**http://dstan.gateway.isg-r.r.mil.uk/index.html**>** for those with RLI access or **<https://www.dstan.mod.uk>** for all other users. All referenced standards were correct at the time of publication of this standard (see 2, 3 & 4 below for further guidance), if you are having difficulty obtaining any referenced standard please contact the UK Defence Standardization Help Centre in the first instance.

Def Stans

Number	Title

STANAGs

Number	Title
4704 Edition 2	NATO REQUIREMENTS FOR CALIBRATION SUPPORT OF TEST & MEASUREMENT EQUIPMENT - ALogP-33 EDITION A

Allied Publications

Number	Title
ALogP-33 Edition A Version 1	NATO REQUIREMENTS FOR CALIBRATION SUPPORT OF TEST & MEASUREMENT EQUIPMENT

Other References

Standard Type	Standard Name
BS / BS EN / BS ISO Standards	BS EN ISO 10012: Measurement management systems. Requirements for measurement processes and measuring equipment
BS / BS EN / BS ISO Standards	ISO 9001: Quality management systems - Requirements
BS / BS EN / BS ISO Standards	ISO/IEC 17025: General Requirements for the Competence of Calibration and Testing Laboratories.

2 Reference in this Standard to any normative references means in any Invitation to Tender or contract the edition and all amendments current at the date of such tender or contract unless a specific edition is indicated. Care should be taken when referring out to specific portions of other standards to ensure that they remain easily identifiable where subsequent amendments and supersession's might be made. For some standards the most recent editions shall always apply due to safety and regulatory requirements.

3 In consideration of clause 2 above, users shall be fully aware of the issue, amendment status and application of all normative references, particularly when forming part of an Invitation to Tender or contract. Correct identification of standards is as defined in the ITT or contract.

4 DStan can advise regarding where to obtain normative referenced documents. Requests for such information can be made to the UK Defence Standardization Help Centre. Details of how to contact the Help Centre are shown on the outside rear cover of Defence Standards.

Definitions

For the purpose of this standard, ISO/IEC Guide 2 ‘Standardization and Related Activities – General Vocabulary’ and the definitions shown below apply.

Definition	Description
Accreditation	the procedure by which an authoritative body gives formal recognition that a body or person is competent to carry out specific tasks.
Calibration Standard	A calibration standard, otherwise known as a measurement standard, is defined as a material measure, measuring instrument, reference material or system intended to define, realise, conserve or reproduce a unit of one or more values of a quantity in order to transmit them to other measuring instruments by comparison.
Calibration Statement of Requirement (CSOR)	a document that defines the minimum accuracy requirements of the TME for service use. These will generally, but not exclusively, reflect the procurement or manufacturers claimed accuracy specification, and may be varied in order to reflect the accuracy and safety requirements for service use. It specifies the range of calibration, uncertainty required and number of points to be measured.
Certification	the procedure by which a third party gives written assurance (certificate of conformity) that a product, process or service conforms to specified requirements.
Instrument Calibration Procedure (ICP)	a document that defines the minimum accuracy requirements of the TME and also the method that the calibration laboratory is to use to conduct the calibration. ICPs are generally used to define the calibration of SPTME, where special equipment or methods are needed to conduct the calibration and the equipment is not available to a commercial specification. These can be found in single service legacy documents i.e. Laboratory Calibration Procedures (LCPs), Test Equipment Support Manuals (TESM) and Army Equipment Support Publications (AESPs).
International Laboratory Accreditation Cooperation	The International Laboratory Accreditation Cooperation (ILAC) is the international cooperation between the various laboratory accreditation schemes operated throughout the world. This arrangement facilitates the international acceptance of test data, and the elimination of technical barriers to trade.
National Metrology Institutes (NMI)	The NMI is the highest authority in metrology in almost all countries. NMI ensures that the primary standards are internationally comparable and are responsible for disseminating the units of measurement to users.
National Standard	A national standard, otherwise known as a primary standard, is that which is recognised nationally as having the highest metrological qualities in a specified field.
Secondary Standard	A secondary standard is a standard established to be of similar accuracy to the appropriate national standard, but which is used, in preference to the national standard, for the routine and regular confirmation of other lesser standards.
Travelling Standard	A travelling standard is that which is used to transport units of measurement from a laboratory of higher standing to local facilities elsewhere. Invariably, travelling standards may be of special and rugged construction and of fixed, rather than variable value. Such standards will be used to verify measurement techniques and measurement quality amongst calibration laboratories.

Working Standard	A working standard is that which is normally calibrated against a reference standard and used routinely to calibrate or check material measures or measuring instruments.

Abbreviations

Abbreviation	Description
AESP	Army Equipment Support Publication
BS	British Standard
BS EN ISO	British Standard European Norm International Standards Organisation
CSOR	Calibration Statement of Requirement
DDH	Delivery Duty Holders
DT	Delivery Team
ICP	Instrument Calibration Procedure
ISO	International Organisation for Standardisation
IUC	Instrument Under Calibration
IUT	Instrument Under Test
JSP	Joint Service Publication
KiD	Knowledge in Defence
LCP	Local Calibration Procedure
MOD	Ministry of Defence
NATO	North Atlantic Treaty Organisation
NMI	National Metrology Institution (The NMI of the UK is NPL).
NSN	NATO Stock Number
OEM	Original Equipment Manufacturer
OOT	Out of Tolerance
QMS	Quality Management System
RDME	Radiation Detection and Monitoring Equipment
SA	Support Authority
SQEP	Suitably Qualified and Experienced Person
TESM	Test Equipment Support Manual
TME	Test and Measurement Equipment

TUR	Test Uncertainty Ratio
UKAS	United Kingdom Accreditation Service
ULT	Unit Level Testing
ULTP	Unit level Test Procedure

Changes since previous issue

The changes incorporated in this issue are shown below. For more information, please contact DStan through the UK Defence Standardization Help Centre. Details of how to contact the Help Centre are shown on the outside rear cover of Defence Standards.

Clause	Page	Change	Change Reason
title	2-1	Title changed	Required due to Part 02 being merged in Part 01
1	2-2	Scope reworded to include Unit Level Test	Reworded due to the merge of 05-055 Part 02
2.1 a)	2-3	i.e changed to e.g.	Accreditation to a national body does not need to be a UK national body. The UK national body is an example not "that is".
2.1 a) 1) & 2.1 a) 2)	2-3	A UKAS changed to an ISO/IEC 17025.	Accredited ISO/IEC 17025 calibrations can be to other national accreditation bodies other than UKAS.
2.1 a) 3)	2-3	Added additional information - JCGM 100:2008 Evaluation of measurement data - Guide to the expression of uncertainty of measurement (also known as 'The GUM') or	To improve clarity for the reader
2.3.1	2-3	Note added of future merge of JSP425 into JSP 392.	To improve clarity for the reader
2.8 a)	2-4	Note added from Part 04 Subcontract of calibration	To add additional information for the reader regarding CSOR from Part 04 as it is planned to be withdrawn.
2.8 b)	2-4	Note added from Part 04 Subcontract of calibration	To add additional information for the reader regarding ICP from Part 04 as it is planned to be withdrawn.
3 Note		Note amended to include appropriate uncertainty.	To improve clarity for the reader
3.1.1 b) & 3.2.1 a)	2-5	Reworded.	Accredited ISO/IEC 17025 calibrations can be to other national accreditation bodies other than UKAS.
3.2.1 b)	2-5	Note added.	To provide additional information for the reader.
3.3.4 Note	2-6	Note amended	A range was provided for excluding an uncertainty contribution from an uncertainty budget. The range has

			been removed and replaced with a maximum value.
4.2	2-6	Clause reworded.	To improve clarity for the reader.
7 (old)	2-8	Clause 7 content taken from Def Stan 05-055 Part 02 Unit Level Test.	To support the merge of Part 01 & 02.
7.2.1 & 7.2.2	2-8	Delivery Duty Holders (DDH) included within clause.	To remove ambiguity across domains.
7.3.2	2-9	Clause reworded and Note added.	To improve clarity for the reader.
7.5	2-9	Clause amended adding or based on nationally accepted physical constants.	To include standards based on nationally accepted physical constants.
7.6.1	2-9	Clause split into 2 clauses and note added.	To improve clarity for the reader.
7.9	2-9	Vaping added to clause.	To future proof.
Annex B	2-15	Created for informative references	To improve clarity for the reader
Annex C	2-16	Def Stan 05-055 Part 02 Table 1 moved into Annex.	Relocated to aid in the merge of 05-055 Part 02.
Various	Various	Dates removed from BS EN ISO standards listed within the standard. Minor grammatical changes. Standardised language through the standard i.e., are to, must, is to and should amended to shall.	To improve clarity for the reader.

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Defence Standards are published by and obtainable from:

Defence Equipment and Support

UK Defence Standardization

Kentigern House

65 Brown Street

GLASGOW

G2 8EX

UK Defence Standardization Help Centre
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To access the StanMIS Help Centre please select either http://stanmis.gateway.isg-r.r.mil.uk/ (for MOD and industry users with MOD Core Network (MCN) access) or https://www.dstan.mod.uk/StanMIS/ (for all other users), and, after logging in, please follow the link to the Help Centre. If required, users can also register for an account from the login screen.

File Reference

The DStan file reference relating to work on this standard is 01706/2023.

Contract Requirements

When Defence Standards are incorporated into contracts, users are responsible for their correct application and for complying with contractual and statutory requirements. Compliance with a Defence Standard does not in itself confer immunity from legal obligations.

Revision of Defence Standards

Defence Standards are revised as necessary by an up-issue or amendment. It is important that users of Defence Standards ensure that they are in possession of the latest issue or amendment. Information on all Defence Standards can be found on the DStan Websites https://www.dstan.mod.uk and http://dstan.gateway.isg-r.r.mil.uk/index.html, updated weekly. Any person who, when making use of a Defence Standard, encounters an inaccuracy or ambiguity is encouraged to notify UK Defence Standardization (DStan) without delay in order that the matter may be investigated, and appropriate action taken.