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D-01-100-230/SF-001
1996-06-10
SUPERSEDES/REPLACE
D-01-100-230/SF-001
1994-05-03

**SPECIFICATION
FOR
PREPARATION OF
TEST EQUIPMENT CALIBRATION PROCEDURES (TECP)**

- 1. **SCOPE**
 - 1.1 **Scope.** This specification provides technical guidelines for the preparation of Canadian Forces (CF) Test Equipment Calibration Procedures (TECP) for use in CF Calibration Centres (Calcentres).
 - 1.2 **Purpose of Test Equipment Calibration Procedures (TECP).** TECP provide essential instructions that enable calibration personnel to determine whether a Test Instrument (TI) is operating within specified tolerances or other performance criteria. The instructions shall contain sufficient detail to be understood at the level where the procedure is to be used. Other purposes for calibration procedures are as follows:
 - (a) To guide the technician in the performance of various tests, including calibration equipment setup and connections, TI connections, control settings, interpretation of test results, etc; also to provide nominal and tolerance values or other appropriate test criteria, and in limited instances, calibration adjustment instructions.
 - (b) To establish and maintain uniformity of test methods, measurement techniques, and agreement of calibration results among the various Calcentres. Except for necessary differences due to design differences in TI and calibration equipment, test methods should remain the same and be described in the same way in all applicable procedures.
 - (c) To serve as training and reference material concerning the theory and practice of calibration.

OPI DECSS 2

Issued on Authority of the Chief of the Defence Staff



1.3 **Audience considerations.** Calibration procedures must be prepared using language, format, and instructions that will be understood by calibration personnel with broad variations in education, training, and experience. To accomplish this, procedures are prepared with the following audience considerations:

- (a) Users will have some high school education with technical training and experience in calibration techniques.
- (b) Users will have familiarity and knowledge with calibration standards and equipment, but may be totally unfamiliar with the instrument being calibrated.

2. **APPLICABLE DOCUMENTS**

2.1 **Government documents.** The following documents form part of this specification to the extent specified herein. Unless otherwise specified, the issue or amendment of documents effective for a particular TECP document that applies shall be those in effect on the date of the applicable TECP.

REFERENCES, SPECIFICATIONS AND STANDARDS

- C-01-100-100/AG-006 Writing, Format and Production of Technical Publications
- C-01-100-102/AG-000 National Defence Indexing of Documentation (NDID) System
- A-AD-100-100/AG-000 National Defence Publishing Policy and Administration Procedures

2.1.1 Copies of this specification and the above documents may be obtained at the following mailing address for National Defence Headquarters (NDHQ):

**Department of National Defence
National Defence Headquarters
MGen George R. Pearkes Building
Ottawa, Canada
K1A 0K2**

Attention: DPTDS CSC 6-4

2.2 **Other publications.** The publications listed below form part of this specification to the extent specified herein. The effective date of the publication shall be that in effect on the date of the drafting of the Test Calibration Procedure.

**Canadian Standards Association
178 Rexdale Boulevard
Rexdale, Ontario
M9W 1R3**

- CAN3-Z234.1-89 Canadian Metric Practice Guide

2.3 **Order of precedence.** In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 General information for procedure preparation

3.1.1 The calibration procedure shall include the following essential parts:

- (a) Front Matter (see C-01-100-100/AG-001).
- (b) Section 1 – Calibration Description (See Appendix 1 of this Specification).
- (c) Section 2 – Equipment Requirements (See Appendix 2 of this Specification).
- (d) Section 3 – Preliminary Operations (See Appendix 3 of this Specification).
- (e) Section 4 – Calibration Process (See Appendix 4 of this Specification).
- (f) Section 5 – Calibration Performance Table (See Appendix 5 of this Specification).

3.1.2 Additional information may be included in Annexes attached to the procedure following the Calibration Performance Chart.

3.1.3 In some cases it may be advantageous to prepare a Calibration Description before writing the procedure. But in other cases, the procedure text should be written before the Calibration Description is prepared, because it is easier to list and describe what has already been done than it is to project what will be done.

3.1.4 Available existing procedures on similar instruments are of value during the writing process. A comparison procedure should not be regarded as an authority, but it can provide useful guidelines. The Government-Industry Data Exchange Program (GIDEP) is a good source of comparison procedures.

3.1.5 To facilitate editing, it is preferred that procedures be prepared using the latest version of WORDPERFECT for WINDOWS. When developing a table for Figures 1 and 2 of the TECP (see Figures 2 and 3 of this Specifications) and any other required tables use the **Table** feature in WORDPERFECT. When developing diagrams and drawings for insertion into the text use AUTOCAD.

3.2 Style and format

3.2.1 Each calibration procedure shall adhere to the requirements for writing style, layout and composition of a P4 Short Format Layout as specified in C-01-100-100/AG-006 (especially at Figures 7-1-10 and 7-1-11 of that publication). The calibration procedure shall be typed on 8-1/2 inch by 11 inch bond in single-column manuscript page layout and page numbered.

3.2.2 **Paragraph numbering.** Paragraphs shall be numbered as specified in paragraphs 8 to 11 of Section 1, Part 4, of C-01-100-100/AG-006.

3.2.3 Prepare the procedure using a step-by-step sequence for each operation. Each step or instruction must be in the sequence that the technician will perform the operation. Each step or instruction shall not contain more than one task.

3.2.4 International system of units (see the NOTE following this paragraph) or SI measurement unit nomenclature shall be used with meticulous care. The use of SI units in presenting data shall conform to Canadian Metric Practice Guide CAN3-Z234. When non-SI units are encountered, as in some non-electronic equipment, they shall be written in a manner as consistent as possible with the SI units.

NOTE

International system of units or SI. The name "Système International d'Unités" (International System of Units), with the international abbreviation SI, was adopted by the 11th Conference of Weights and Measures in 1960.

3.2.5 Familiar terms and abbreviations shall be used. If an abbreviation or acronym must be originated, it shall be defined the first time it is used.

3.2.6 The direct form of instructions (imperative sentences) shall be used. The technician shall be addressed directly and instructed to do something. Short sentences shall be used. Short words shall be used. The instructions shall be simplified. For example, the three previous sentences, in calibration procedures, would be written in the following manner: "Use short sentences. Use short words. Simplify the instruction".

3.2.7 The following conventions in word usage shall be used:

(a) **Verify and ensure**

- (i) The verb "verify" shall be used when referring to a specification requirement, such as "verify that the OUTPUT meter indicates between 39.5 to 40.5 volts."
- (ii) The verb "ensure" shall be used when referring to operational steps that are not specification requirements, as "ensure that the equipment has warmed up for 30 minutes."
- (iii) The verb "ensure" shall also be used when referring to a condition that should be satisfied prior to performing the next procedure step or requirement.

(b) **Adjust and set**

- (i) The verb "adjust" shall be used when referring to continuously variable controls.
- (ii) The verb "set" shall be used when referring to controls with positive stops.
- (iii) The verb "set" shall also be used when referring to a **group of controls** even if some of them are continuously variable, such as "set the TI OUTPUT controls as follows."

(c) **"As follows" and "preceding" vice "below" and "above"**. Data that are "below" or "above" in the draft may be on another page when the calibration procedure is published. Therefore, "as follows", or "following", or "preceding" shall be used.

(d) **Read and indicate.** The verb "read" shall be used when referring to the technician and "indicate" when referring to an instrument.

(e) **Press and depress**

- (i) The verb "press" shall be used when referring to a spring-return or momentary pushbutton switch.
- (ii) The verb "depress" shall be used when referring to a pushbutton switch that does not have a spring-return switch but rather a switch that is maintained in a locked state.

3.2.8 The equipment shall be identified first, then the control, and then the control position.

3.2.9 The action required shall always be stated first in the instruction.

3.2.10 **WARNING, CAUTION and NOTE.**

3.2.10.1 **WARNING** and **CAUTION** and their accompanying comments shall be placed above, that is to say before, the paragraph or sub-paragraph where the instruction given could result (for **WARNING**) in injury or loss of life to personnel and which could result (for **CAUTION**) in damage to equipment.

NOTES

1. The **DANGER** notice shall also be used to draw attention to an extreme, violent and continuous hazard to life, should such a hazard be present before, during, or after the particular test equipment calibration procedure.
2. Although the comments of **NOTES** can be numerous and numbered, there shall be only one comment written under the hazard notices **DANGER, WARNING** and **CAUTION**. If more than one hazard exist the notice shall be repeated for each hazard comment.

3.2.10.2 Since **NOTES** provide clarification or further information to an instruction they shall be written after that instruction.

3.2.10.3 The following is an example of the three main comments and of their setup that will be used in the drafting of Text Equipment Calibration Procedure:

WARNING

The hazard heading is always in capital letters, but upper/lower cases shall be used for the text (comment) under the heading. A **WARNING** shall be used to emphasize correct operating procedures and practice, which if not followed could result in injury or loss of life.

●●●●●●●●●●
●CAUTION●
●●●●●●●●●●

The hazard heading is always in capital letters, but upper/lower cases shall be used for the text (comment) under the heading. A **CAUTION** shall be used to emphasize procedures and practices, which if not correctly followed could result in damage to equipment.

NOTE

The heading is in capital, but the text (comment) shall be in upper/lower cases. **NOTES** shall be used to inform the technician of special considerations or to clarify or advise on special techniques.

3.2.11 Each TECP shall be assigned a National Defence Index of Documentation (NDID) number in accordance with C-01-000-102/AG-000. The NDID number shall appear in the top right-hand corner of odd-numbered pages starting with the title page (although the number on the title page is slightly lower and in a different font), and on the top left corner of even numbered pages of the rest of the publication. The NDID for a TECP shall read something like "C-67-010-XXX/MR-001". The correct NDID number shall be obtained through DECSS 2-3.

3.2.12 Sections need not begin at the top of a page; however, section headings should not stand alone at the bottom of a page. If it is not possible to include a step or a note below the heading, the section heading shall be placed at the top of the next page.

3.2.13 The title page shall identify the TI being calibrated, its model number, the manufacturer and NSN if available.

3.3 **Technical content**

3.3.1 Maintenance, servicing, and repair instructions are not included in calibration procedures. However, in limited instances, an instruction that corrects an out-of-tolerance condition may be included.

3.3.2 Detailed instructions for removing cover plates or cases shall be omitted unless some special procedure is required.

3.3.3 When referring to a switch, control, connector, indicator, or light labelled on the **TI**, the exact term shall be used and it shall be written in capital letters (upper case), for example, TI OUTPUT. When a device is not labelled, a suitable name shall be assigned to said device and it shall be written with an initial capital letter only. For example, a pushbutton shall be called a "Pushbutton", rather than a "Momentary Contact Switch" or some other vague term; and, the terms "press" and when applicable "release" shall be used for said **Pushbuttons**. Once a name or nomenclature has been assigned, it shall be used consistently throughout the procedure.

3.3.4 Safety precautions shall be considered for each step or task, and the writer shall ensure that procedure steps do not call for unsafe moves. Use **CAUTION** and **WARNING** notices to notify the technician of appropriate hazards. (See NOTE of 3.2.9.1 if **DANGER** is applicable.)

3.3.5 If needed to clarify or simplify instructions, block diagram figures shall be provided in the text. All equipment and connections shall be labelled with capital letters. Equipment names shall be the same as described in **Section 2 Equipment Requirement**. Additional figures, diagrams, or pictures, if necessary, may be included in an annex. Working drawing and parts list of special fixtures to be constructed are also included in an annex.

3.3.6 Figures to show expected waveforms and to illustrate indications that may not be clearly understood shall be provided.

3.3.7 Except for the simplest calculations, an example of formulas shall be provided using typical normal values.

3.3.8 Detail instruction on the operation of equipment used to perform the calibration is not required and shall not be given, as it is assumed that the calibration technician is already knowledgeable on its operation.

3.4 **Adjustments**

3.4.1 Generally, instructions for performing adjustments are not included in a calibration procedure. They are contained in the maintenance and servicing manual. However, in some cases it may be beneficial to include the adjustment procedure in the calibration process to correct an out-of-tolerance test result under the following conditions:

- (a) Reasonable assurance exists that the out-of-tolerance condition can be corrected by the adjustment without need for other maintenance/repair action.
- (b) The adjustment instruction is compatible with the calibration equipment set-up being used and the test sequence being followed.
- (c) The adjustment instructions can be included without unduly increasing the length and complexity of the procedure.
- (d) The adjustment instructions correspond to instructions contained in the maintenance and servicing manual.

3.4.2 Considerations which make it impractical to include complete adjustment data in calibration procedures are as follows:

- (a) Out-of-tolerance conditions may be due to several possible causes, and further testing would be required to isolate the causes.
- (b) Adjustment requirements can vary for different serial numbers of the same model number.
- (c) Some adjustments require special alignment procedures requiring special alignment equipment.
- (d) Where adjustments interact, related adjustments would have to be covered causing the procedure to become unduly long and complex.

3.5 Calibration correction Table/Chart

3.5.1 If the TI is fabricated in such a manner that adjustments cannot be made, then the calibration procedure shall provide an instruction to produce a Correction Table/Chart. A correction table/chart is prepared to show corrections which must be added to indicated readings to obtain actual values. Refer to Figure 1 of this Specification for an example format for a correction chart.

CALIBRATION CORRECTION CHART																			
Model Number _____					Serial Number _____					Date _____									
Equipment Name _____										TEMMIS Number _____									
+1.0																			
+0.8																			
+0.6																			
+0.4																			
+0.2																			
-0.2																			
-0.4																			
-0.6																			
-0.8																			
-1.0																			
Calibration Technician _____																			

Figure 1 Example of a Calibration Correction Chart

4. **QUALITY CONTROL/INSPECTION**

4.1. When applicable, validation and verification of TECP produced by contractors and in-house shall be validated and verified in accordance with A-AD-100-100/AG-000 and this Specification by DECSS 2-3.

5. **PACKAGING**



It is imperative that the electronic copy of the TECP and of any accompanying electronic file(s) be checked for VIRUS prior to transmission through E-mail.



The electronic copy of the TECP and of any accompanying electronic file(s) put on diskette to be mailed shall also be checked for VIRUS.

5.1 **Packaging and delivery.** As requested in 3.1.5, TECP shall be prepared in the latest available WORDPERFECT version and sent to the Directorate of Electronics, Communications and Spectrum Services, that is, to DECSS 2-3 through electronic mail (E-mail); or, if E-mail not available, sent by mail on a diskette.

NOTE

If the electronic copy of the TECP and any accompanying electronic file(s) are sent by mail, they shall be put in an appropriately protected "Disk Mailer" envelop.

6. **NOTES**

6.1 **Enquiries.** Questions about this specification or suggestions on how to improve it may be addressed to the **Attention of DECSS 2-3**, at the NDHQ mailing address given at 2.1.

INSTRUCTIONS FOR THE PREPARATION OF TEST EQUIPMENT CALIBRATION PROCEDURES (TECP)

PREPARATION OF SECTION 1 (CALIBRATION DESCRIPTION)

10. SCOPE

10.1 **Scope.** This appendix covers the preparation of Section 1 (Calibration Description).

10.2 REQUIREMENT

10.2.1 The calibration description shall contain a table identifying, in columns, all of the characteristics of the instruments and their individual performance specifications as well as the test method used. Figure 2 of this Specification provides a Sample Format for Section 1, which should be suitable for most TI.

10.2.2 Generally, instruments are to be calibrated to the manufacturer's specifications unless the LCMM dictates calibration to actual use or system requirements.

10.2.3 List the TI characteristics in the sequence they are to be tested. This testing should be the best analysis of the logical testing order, so that something found in error in the TI will not invalidate previous tests. The following considerations are helpful in arriving at the best testing sequence:

- (a) **Dependence or Interaction.** Where the measurement of one parameter depends on the prior calibration of another, or where circuits or corrective adjustments interact, a test sequence should be adopted that satisfies the dependence or minimizes the effects of the interaction. An example of **dependence** is the calibration of oscilloscope vertical rise time, which depends on the time base accuracy. Therefore, the sweep time calibration must precede the rise time measurement. An example of **interaction** is oscilloscope horizontal gain, trace length, and sweep time which should be calibrated consecutively due to possible interaction of corrective adjustments.
- (b) **Test Efficiency.** After considering dependence and interaction, tests should be grouped so that the tests requiring the calibration equipment set-up are performed consecutively. For example, oscilloscope trace length, sweep time linearity, sweep magnifier accuracy, and delayed sweep tests should be performed consecutively since they all require a time-mark generator.
- (c) **Minimum Retesting.** Tests of parameters or functions whose corrective adjustment or repair adjustment or repair could affect a number of other tests, should be performed early to minimize the need for retesting. For example, line regulation should be tested early in the calibration since failure leading to repair or adjustment could affect several other tests.
- (d) **Logical Grouping.** After the preceding considerations, the remaining tests should be arranged in functionally related groups. For example, all tests relating to an oscilloscope vertical amplifier should be grouped as much as possible. Sometimes the nucleus of such a group occurs as the result of other considerations, such as the grouping of oscilloscope vertical gain and vertical attenuator accuracy, which are performed in that order because of dependence.

10.2.4 In the first column of Figure 2 of this Specification, the tests to be performed shall be listed in their proper order. It is possible that this order may have to be revised when Section 4 is prepared, as the sequence must match the listed order of **Figure 1 Table for Calibration Description** (internal sample Figure of Figure 2 of this specification).

10.2.5 Each characteristic listed in the first column must have a corresponding performance specification in the second column and a test method in the third column.

10.2.6 Generally the performance specifications are those claimed by the manufacturer. If the manufacturer lists several accuracies for a characteristic, corresponding to different time periods, the longest time period given shall be used, unless otherwise instructed. Each performance specification shall be described briefly without omitting any of the manufacturer's stipulations. The term "tolerance" shall be used rather than "accuracy" or "limit of error" for entries in **Figure 1 Table for Calibration Description** (internal sample Figure of Figure 2 of this specification).

10.2.7 If the TI includes accessories, list the accessories in the table and state whether calibration of each accessory is required or not.

10.2.8 When there is a choice of test methods, select the method that will produce the required result with the least expenditure of time for setting up and testing, but try to avoid tying up precision calibration equipment that is much more accurate than is needed for the test.

10.2.9 It is usually better to complete Section 1 as far as possible before going on to Sections 2, 3 and 4. Having in mind all the test methods that will be used shall be helpful in selecting calibration equipment that may be used for more than one test.

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CALIBRATION DESCRIPTION

1. Refer to the Calibration Description in the following table:

Test Instrument (TI) Characteristics	Performance Specifications	Test Method

Figure 1 Table for Calibration Description

Figure 2 Sample Format for Section 1 of a TECP

**INSTRUCTIONS FOR THE PREPARATION OF
TEST EQUIPMENT CALIBRATION PROCEDURES (TECP)**

PREPARATION OF SECTION 2 (EQUIPMENT REQUIREMENTS)

20. SCOPE

20.1 **Scope.** This appendix covers the preparation of Section 2 (Equipment Requirements).

20.2 REQUIREMENT

20.2.1 The equipment requirements shall contain a table identifying the equipment required to perform the calibration within the tolerance using the test methods identified in Section 1. The table shall be identified in columns headed "Noun", "Minimum Use Specifications" and "Calibration Equipment". Figure 3 of this Specification provides a sample format for Section 2.

20.2.2 The generic class of standards or instruments required to perform the tests identified in Section 1 of the procedure shall be determine; for example, Electronic Counter, Oscillator, Power Meter, etc. The generic name shall be listed in the first column. When listing the generic name in the standard, the initial capital letters for each word shall be used; for example, Signal Generator. But, when using abbreviations, all capital letters shall be used; for example, VHF Signal Generator, DVM.

20.2.3 Coaxial cables and/or test leads need not be listed unless the length, size, etc., are critical – in which case they shall be listed.

20.2.4 The required "Minimum Use Specifications" of the equipment or standards shall be listed in column 2 of Figure 2 Table for Equipment Procedure (Figure 3 of this Specification refers). The Minimum Use Specifications shall provide the least acceptable capabilities required of the calibration equipment. This specification will assist personnel to determine the adequacy of standards or equipment to be used as substitutes when necessary.

20.2.5 Calibration equipment must provide the minimum requirements required by the procedure, not the manufacturer's specifications. If a frequency of ± 1 per cent is to be measured, the electronic counter tolerance requirement is ± 0.25 per cent (a 4:1 ratio). The electronic counter listed may be specified as 0.01 ppm by the manufacture, but the only requirement is it must meet the procedure minimum use specification. NA (not applicable) shall be used if a tolerance specification is not required.

20.2.6 Only those characteristics which are the salient ones shall be used to serve as a guide in the selection of substitutes.

20.2.7 In listing the "Minimum Use Specifications" for the standards (see Figure 3 of this Specification),

20.2.8 **Selection of standards.** Calibration standards used by CF Calcentres shall be selected. Calibration activities usually have a variety of standards that can be used for a particular calibration procedure, so writing the calibration procedure specifically around a particular make or model reduces the flexibility of the procedure. Therefore, alternative standards capable of performing the required measurements shall be used, and the text instructions shall be generalized so that the instructions will apply to the various standard listed. There are exceptions. In some cases explicit instructions must be used to ensure proper use of a complex or unique standard. Also, in other cases the characteristics of the standard used are such, that other substitutes are not readily available. Whatever the case, the writer of the TECP shall advise the technician that he/she to ensure that all standards meet the "Minimum Use Specifications".

20.2.9 In the "Calibration Equipment" column of Figure 2 Table for Equipment Requirements of the TECP (Figure 3 of this Specification refers), the manufacturer and model number of the equipment to be used shall be provided. The manufacturer's name shall be spelled out. Codes or abbreviations shall not be used.

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EQUIPMENT REQUIREMENTS

1. Refer to the Equipment Requirement in the following table:

Noun	Minimum Use Specifications	Calibration Equipment

Figure 2 Table for Equipment Requirements

Figure 3 Sample Format for Section 2 of a TECP

**INSTRUCTIONS FOR THE PREPARATION OF
TEST EQUIPMENT CALIBRATION PROCEDURES (TECP)**

PREPARATION OF SECTION 3 (PRELIMINARY OPERATIONS)

30. SCOPE

30.1 **Scope.** This appendix covers the preparation of Section 3 (Preliminary Operations).

30.2 REQUIREMENT

30.2.1 The preliminary operations shall call to the technician's attention anything needed to know or do before starting the actual calibration process. Section 3 is the place to look at the calibration system as a whole in order to identify or located any equipment or operator hazards or special environmental requirements. **WARNING, CAUTION** and **NOTE(S)** belong in Section 3 if they are of general nature or apply to the system as a whole. (See NOTE of 3.2.9.1 if **DANGER** is applicable.) If these special notations apply to a specific operation, then they belong in Section 4 preceding the instruction for that operation. Some conditions that may call for a special notation in Section 3 are:

- (a) Voltages of 45 V or more from low impedance sources.
- (b) Compressed air or other gas.
- (c) High-level current.
- (d) High-temperature baths or ovens.
- (e) High-level microwave or RF radiation.
- (f) Ultraviolet or infrared radiation.
- (g) Toxic and flammable solvents.
- (h) Dry ice; liquified gases.
- (i) Bottled-gas cylinders.
- (k) Heavy objects.

30.2.2 When included, functional tests ensure that the TI is in satisfactory operating condition. For example, if the TI has a meter, a mechanical zero check and adjustment and perhaps also an electrical zero check and adjustment may be required. Visual inspection of the instrument for safety and serviceability may be in order. Batteries may require checking or replacement. Vernier controls may require checking for sufficient range, etc. Figures 5 and 6 are sample formats for Section 3. Included are some commonly used instructions that may or may not apply.

PRELIMINARY OPERATIONS

3. The following shall apply:
- a. Review and become familiar with the entire procedure before beginning the Calibration Process.

WARNING

Unless otherwise designated and prior to beginning the calibration process, ensure that all TI voltage and/or current outputs are set to zero (0) or turned off, where applicable.

WARNING

Ensure that all equipment switches are set to the proper position before making connections or applying power.

- b. Connect the auxiliary equipment, and the TI, to the (appropriate power source) power source.
- c. Set POWER switches to ON and allow a (state number of minutes) minutes warm-up period.
- d. Set the TI controls as follows:
(list controls and settings)
- e. Calibration process must be performed in the sequence as written.

Figure 4 Sample Format for Section 3 of a TECP concerning Electrical/Electronic Equipment

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PRELIMINARY OPERATIONS

3. The following shall apply:
 - a. Review and become familiar with the entire procedure before beginning the Calibration Process.
 - b. Ensure that the TI is clean and free of any defects that would impair its operation.
 - c. Bring the TI into the calibration area a minimum of (state number of hours) hours prior to beginning the calibration.
 - d. Calibration process must be performed in the sequence as written.

Figure 5 Sample Format for Section 3 of a TECP concerning Mechanical Instruments

**INSTRUCTIONS FOR THE PREPARATION OF
TEST EQUIPMENT CALIBRATION PROCEDURES (TECP)**

PREPARATION OF SECTION 4 (CALIBRATION PROCESS)

40. SCOPE

40.1 **Scope.** This appendix covers the preparation of Section 4 (Calibration Process).

40.2 REQUIREMENT

40.2.1 Reference shall be made to the completed Section 1. The test sequence in Section 4 must be in the same order as the characteristics listed in Section 1. Figure 6 is the sample format for Section 4 of a TECP.

40.2.2 The Section 3 draft shall be reviewed. When writing the first test operation, the writer shall ensure that there is no gap or omitted operation between the Section 3 operations and the first step in Section 4.

40.2.3 The writer of the TECP shall think through each action that the technician must perform to accomplish this calibration step. If the equipment is available, it is very helpful to actually work through the step. The writer shall remember that each step must not contain more than one task.

40.2.4 The writer of the test calibration procedure shall tailor the length and content of each step to be a complete operation, but shall make the step short enough for the technician to retain it in memory while the step is performed.

40.2.5 Illustrations shall be provided when necessary to located adjustments, controls or tests points.

40.2.6 For each test, it shall be decided whether to include instructions for adjusting the TI if that characteristic is out of tolerance. This decision requires some judgemental balancing with the following in mind:

- (a) A short, simple adjustment that saves the technician from having to refer to the instrument manual may be included in the calibration procedure.
- (b) A long, complex adjustment that interacts with other adjustments or affects other characteristics should not be included.
- (c) The clarity and contents of the instrument manual will influence the decision.

40.2.7 If the technician will be required to make calculations or manipulate data beyond the most elementary operations, sample calculations and sample work sheets shall be included in the procedure.

40.2.8 Any necessary calculations to establish the test tolerance limits shall be performed. For example, an instrument's tolerance may be stated by the manufacturer as a percentage of full scale, or as a percentage of reading plus a constant. When writing the required indications in the procedure, the maximum and minimum values shall be calculated and provided.

40.2.9 Where the calibration consists of several sets of calibration points, then a Calibration Performance Table should be used indicating the range, the applied values and the limits for each value. The text should be tied to the table in the following manner:

- (a) The first step shall be to set the TI to the applied value specified in the Calibration Performance Table. That is, the equipment should be set so that the standard and TI are able to compare the same calibration points.
- (b) The standard to the first applied value shall be set to the value stated in the Calibration Performance Table.
- (c) The TI reading shall be between the limits specified in the table.
- (d) Steps (b) and (c) shall be repeated for the remaining applied values in the Calibration Performance Table.

NOTE

This method may vary from procedure to procedure; however, this basic set-up should remain intact.

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CALIBRATION PROCESS

•••••
•CAUTION•
•••••

Unless otherwise specified, verify the results of each test and take corrective action before proceeding, whenever the test requirement is not met.

- 4. Proceed as follows:
 - a. Connect the equipment (name the equipment where applicable) so that the standard and TI are able to compare the same set of calibration points.
 - b. Set the standard to the first applied value as stated in the Calibration Performance Table.
 - c. The TI reading must be between the limits as specified in the Calibration Performance Table.
 - d. Repeat steps b and c for the remaining applied values in the Calibration Performance Table.

Range	Applied	Limits

Figure 3 Calibration Performance Table

Figure 6 Sample Format for Section 4 of a TECP (with a Calibration Performance Table)

**INSTRUCTIONS FOR THE PREPARATION OF
TEST EQUIPMENT CALIBRATION PROCEDURES (TECP)**

PREPARATION OF SECTION 5 (CALIBRATION TEST DATA TABLES)

50. SCOPE

50.1 **Scope.** This appendix covers the preparation of Section 5 (Calibration Test Data Tables).

50.2 REQUIREMENT

50.2.1 A calibration test data table shall be prepared to show the actual value of the parameter(s) certified.

50.2.2 The calibration test data table format shall specify the readings in each calibration process subsection; listing the range, applied signal, limits and reading in columns headed by "TI Range", "Applied", "Limits" and "Reading", as shown in Figure 7 of this Specification.

50.2.3 All calibration procedures require a data table format unless the adjustment procedure is part of the calibration process. An instruction shall be included in the calibration procedure stating that the calibration data table be compiled for all calcentre standards and for users when requested.

50.2.4 Section 5 of the TECP can be reproduced locally and forwarded to the user on demand and can become, in that sense, a separate entity. For that reason, it is requested that Calibration Test Data Tables not be identified or numbered as figures. This should avoid any confusions with the other tables of the TECP.

