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*Maintenance***REPAIR AND CALIBRATION OF TEST,
MEASUREMENT, AND DIAGNOSTIC
EQUIPMENT (TMDE)****COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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This instruction implements and defines the Test Measurement and Diagnostic Equipment (TMDE) program, and describes the control system used to ensure all TMDE used for measuring and testing government-owned systems and equipment are repaired, calibrated and certified at regularly scheduled intervals. Control and calibration of TMDE are essential to exact and repeatable systems alignment, and through the Air Force Primary Standards Laboratory (AFPSL), ensures measurements are traceable to National Institute of Standards and Technology (NIST) Standards. This instruction applies to all agencies that use or have custody of Government owned TMDE, and is not intended to replace requirements outlined in AFI 21-101, *Aerospace Equipment Maintenance Management*, AFI 21-113, *Air Force Metrology and Calibration (AFMETCAL) Program* or TO 00-20-14, *Air Force Metrology and Calibration Program*. Refer recommended changes and questions about this instruction to 30 RMS/RMO, 816 13th Street Suite 229 VAFB CA 93437-5212 using AF Form 847, *Recommendation for Change of Publications*. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with AFMAN 37-123 (will convert to AFMAN 33-363), *Management of Records*, and disposed of in accordance with the Air Force Records Disposition Schedule (RDS) located at <https://afirms.amc.af.mil/>.

SUMMARY OF CHANGES

This instruction has been substantially revised and must be completely reviewed. Organizational names and office symbols have been updated. Meters information has been deleted (paragraph 2.3.); TMDE Storage has been renumbered; TMDE Scheduling and Control has been substantially rewritten (paragraph 3.); user/customer responsibilities clarified (paragraph 5.2.13.) and (paragraph 5.2.14.).

1. Introduction

1.1. General. The 30th Space Wing provides TMDE calibration services at Vandenberg Air Force Base (VAFB). The Precision Measurement Equipment Laboratory (PMEL), 340 Airfield Road,

(Building 1737), Vandenberg AFB CA 93437-6118, repairs, calibrates, and certifies all TMDE. To have an effective calibration program, TMDE customers will:

- 1.1.1. Provide TMDE inventory information to PMEL.
 - 1.1.2. Make sure assigned TMDE is calibrated at periodic intervals.
 - 1.1.3. Furnish auxiliary equipment, such as cables, probes, and electrical cords, needed to calibrate TMDE.
 - 1.1.4. Ensure care and handling procedures are followed for TMDE in their custody.
 - 1.1.5. Perform preventive maintenance to include proper use, cleaning, preservation, servicing, and minor external repairs in accordance with (IAW) TO 33-1-27, *Logistic Support of Precision Measurement Equipment* (excluding any work needing adjustment or replacement of parts or components that affect calibration).
 - 1.1.6. Maintain technical data files of equipment owned. Provide technical data with TMDE when requested by PMEL. TMDE user will ensure adequate maintenance and technical data for each item of TMDE is available.
 - 1.1.7. Seek assistance from the ASSC program office (30 RMS/RMO) to resolve technical problems needing special consideration. Examples include system or subsystem calibration, on-site calibration, limited certifications, acceptance tests, and new test equipment purchases.
 - 1.1.8. Only use TMDE that was serviced by an authorized PMEL and has a valid TMDE certification label affixed.
 - 1.1.9. Consider the alternative of limited calibration, no periodical calibration (NPC) and Calibrate Before Use (CBU), when possible.
- 1.2. Traceability. Reference standards used at PMEL are traceable to the National Institute of Standards and Technology (NIST) directly through the Air Force Primary Standards Laboratory (AFPSL) or through the US Naval Observatory Precision Timing Reference Station (PTRS) for precise time.
- 1.3. Responsibilities.
- 1.3.1. The Commander, 30th Space Wing (30 SW/CC) has overall responsibility for the PMEL program at VAFB.
 - 1.3.2. The 30th Contracting Squadron (30 CONS) is responsible for overall compliance of the PMEL contract.
 - 1.3.3. The Quality Assurance Office (30 RMS/RMQ) assesses, documents, and reports contractor performance of the PMEL contract and statement of work requirements.
 - 1.3.4. The Program Office (30 RMS/RMO) is the office of primary responsibility (OPR) for cost, schedule and performance, as well as providing the technical guidance and monitoring of the PMEL's program compliancy.

2. Care, Handling, and Storage of TMDE.

2.1. General. The accuracy and useful life of TMDE are directly influenced by proper use, care, handling, and storage. Manufacturer operating and maintenance manuals describing specific items of TMDE are excellent references as they contain precautionary instructions related to use and operation.

Each item of TMDE is usually designed for a particular application. Therefore, the knowledge of assigned TMDE technical specifications is a basic requirement and all workcenter personnel are urged to read manufacturer's manual prior to using equipment.

2.2. Care and Handling. It is beyond the scope of this instruction to give detailed care and handling instructions for all contingencies that may be encountered at individual workcenters. Guidelines listed below are general procedures for the care and handling of test equipment.

2.2.1. Do not stack test equipment on the floor and do not place open liquid containers on or near test equipment.

2.2.2. Before lifting or carrying test equipment, disconnect and coil all cables and leads so they do not drag on the floor.

2.2.3. Get help when lifting or carrying heavy or bulky equipment. Heavy equipment is defined as weighing in excess of 50 pounds. A person carrying equipment is subject to tripping since the view of the floor is usually obstructed. Utilize wheeled carts to move equipment when practical.

2.2.4. Utilize carrier handles to move storage cells.

2.2.5. Avoid stacking test equipment more than two units high. When equipment must be stacked, always place smaller, lighter units on top.

2.2.6. Arrange TMDE used during testing to minimize possibility of tripping over test leads or cables. Cart-mounted equipment must be located adjacent to work benches.

2.2.7. Avoid blocking aisles, exits, or access to fire extinguishers with test equipment mounted on carts.

2.2.8. Avoid subjecting TMDE to any unnecessary mechanical shock. If an item is dropped, it must be removed from service immediately, tagged, and sent to PMEL for recalibration.

2.2.9. Wear special gloves to handle items, such as unplated precision iron weights, to protect them from moisture and/or oil from the skin.

2.2.10. Avoid putting fan-equipped TMDE in a position that will restrict or block air flow when in operation. Check rack-mounted test equipment to ensure cooling is adequate, fan filters are clean, and air flow is not restricted.

2.2.11. Do not use any item of TMDE suspected of malfunctioning or when certification date has expired and is due calibration.

2.3. TMDE Storage. To avoid mechanical damage and protect TMDE from dust and effects of moisture, the following storage instructions apply:

2.3.1. A definite storage area must be assigned for all TMDE when not in use. Shelves, work bench drawers, or cabinets may be used for storage purposes and will be identified as test equipment storage areas.

2.3.2. Test and measurement equipment having magnets (such as meters and waveguide isolators) must be kept away from degaussing fields. Keep these items separated by at least six inches to prevent magnetic coupling.

2.3.3. Mechanical test and measurement devices must be stored carefully avoiding nicks, burring, abrasion, corrosion and rust.

2.3.4. In areas where dust control is a problem, place test and measurement equipment in plastic bags prior to storage. Bags are available in a variety of shapes and sizes and may be ordered through logistics channels.

2.3.5. When physical size or weight of equipment renders shelf storage impractical, store in area where it is used.

2.3.6. Small portable items stored in drawers are protected from shock through generous use of vibration absorbent material. Two acceptable cushioning materials are urethane foam and sponge rubber.

2.3.7. Non-calibrated accessory items, such as adapters, probes, and cables (when not stored as part of the test and measurement equipment) should be in drawers, on racks, or on shelves. These storage areas are designated and marked to ensure individual items are properly stored. Coaxial cables and accessories damaged, dented, creased, or with faulty connectors, will be tagged listing the discrepancy and stored in an area designated as nonconforming equipment hold area. When repairs are completed, remove tags return item to service.

2.3.8. Minimize effects of moisture by storing equipment in a dry storage area. Equipment within cases is stored with the covers closed and latched. When test equipment has been exposed to moisture, remove from case, dry, and replace in case prior to application of power or storing.

2.3.9. Protective covers are installed on waveguide parts when test equipment is not in use.

2.3.10. All internal dry cell batteries must be removed from instruments placed in long-term or permanent storage to prevent damage from battery acid leakage. The custodian declaring an item excess will remove dry cell batteries from test equipment.

3. TMDE Scheduling and Control.

3.1. General. Periodic calibration and maintenance of test equipment are necessary to ensure equipment remains accurate to within designed limits. This chapter prescribes procedures for processing TMDE through PMEL Scheduling Section.

3.1.1. The master ID is used to produce reports and listings relative to scheduling and control of TMDE.

3.2. TMDE Schedule. PMEL will provide monthly schedules prior to start of the month for each owning work center (OWC). This schedule will include list of items overdue, items currently in PMEL, and forecast of items due for the month. PMEL will exclude any categories with no entries.

3.2.1. OWC will review work center schedules to ensure accuracy. OWC will notify PMEL Scheduling of required changes, additions or deletions. PMEL will update PMEL Automated Management System (PAMS) database accordingly, and a new schedule provided upon request.

3.2.2. The monthly schedule is also provided as an equipment hand receipt. The original or copy of the monthly schedule is provided when items are being processed. PMEL employee receiving TMDE will place initial and date next to each line item on the schedule for TMDE being processed. Each OWC will retain this listing as their record of receipt.

3.2.3. All items must be available to PMEL 10 calendar days prior to due date shown on the schedule or as established by PMEL Scheduler. TMDE received more than 10 calendar days past due date is considered overdue and will not be approved for priority calibration.

3.3. Scheduled Maintenance. TMDE scheduler will send OWC a due calibration listing for each calendar month. OWC's will ensure all TMDE due calibration is received by PMEL or delivered to PMEL for calibration within 10 calendar days of due date. Any TMDE scheduled for calibration that is no longer needed should be brought to the attention of PMEL Scheduler and eliminated from the master ID listing.

3.4. Unscheduled Maintenance. Unscheduled TMDE includes new items in inventory, items more than 10 calendar days overdue calibration, and items failed prior to calibration due date.

3.5. Initial Calibration; No Identification (ID) Number Assigned. OWC will notify TMDE Scheduler of model/part number and serial number of new items added to the inventory. Scheduler will update the master ID listing.

3.5.1. OWC will supply maintenance manuals when submitting new items to PMEL for initial calibration. This does not pertain to new like-items of TMDE already owned by the OWC and supported by PMEL.

3.6. Monthly TMDE Overdue Report. Status of overdue OWC (not updated) as of end of the reporting period will be included as part of TMDE monthly schedule. Workcenters must verify overdue items are submitted to PMEL immediately.

3.6.1. OWC will notify TMDE scheduler when a unit of equipment is removed from the master inventory for any reason (condemned, obsolete, excess to requirements, etc.).

3.6.2. When schedule or inventory requires a correction, addition, or deletion, OWC will note information in red on the monthly schedule or TMDE inventory document.

3.7. TMDE Maintenance. OWC will ensure cleanliness and completeness of equipment. Items, such as test leads and probes, must be replaced when lost or in need of repair. All equipment will be handled in the manner required for TMDE.

3.7.1. Equipment must be cleaned externally before pickup by PMEL. Incomplete equipment received by PMEL will be returned to OWC without repair or calibration-except in cases where PMEL help is necessary to replace defective items. Protective covers shall be installed on all unmated connectors (such as waveguide ports, BNC, etc.) prior to submitting equipment to PMEL. Equipment air filters are cleaned as necessary.

3.8. Adjustment of Calibration Cycle (Interval). The Air Force calibration cycle listed in TO 33K-1-100-2, *TMDE Interval, Calibration and Repair; Technical Order Guide and Work Unit Code Manual* is the period of time equipment will perform a function with a statistically derived end-of-period reliability of 85% or better (meet specification). These intervals are established and modified as necessary from data collected through maintenance data collection system on the total TMDE population. TMDE that has exceeded prescribed calibration interval will not be used. When no calibration interval is prescribed or listed in TO 33K-1-100-2, the interval must not exceed 12 months. For items not listed in TO 33K-1-100-2, calibration requirements and responsibilities will be determined by the 562d Combat Sustainment Group (562d CBSG) by submitting AFTO Form 45, *Request for Calibration Responsibility Determination*, via PMEL.

3.9. Torque Wrenches. Torque wrenches are considered TMDE and will be treated as such. No special considerations apply.

3.10. Seldom Used Items. TMDE that normally is not used at least once during calibration interval do not require periodic calibration. TMDE, designated CBU, will be calibrated at least once prior to being designated CBU. PMEL will not make an item CBU without user's direction or permission.

3.10.1. An AFTO Form 99, *Limited/Special TMDE Certification*, or AFTO Form 398, *Limited/Special TMDE Certification*, will be used as the certification label. Calibration block date will have the last date TMDE was calibrated. Date due block will have the date TMDE would normally be due calibration followed by "/CBU". The CBU designation will be entered in PMEL Master ID in place of frequency.

NOTE: OWCs can designate previously PMEL calibrated and certified TMDE as CBU by contacting PMEL scheduler to have calibration interval changed to CBU. OWC will annotate "/CBU" on certification sticker.

3.11. Removal of TMDE from Storage. OWC or custodian will ensure calibration is within the time frame of the PMEL certification label when TMDE is removed from storage. If certification time frame has expired, OWC or custodian will resubmit item for recalibration.

3.12. No Periodic Calibration Required (NPC). Based on application, TMDE may not require periodic calibration and may be designated NPC. TMDE will require an initial calibration and re-calibrated when repaired to ensure requirements of the applicable calibration technical order (T.O.) have been met. PMEL is not authorized to make or designate an item NPC without user direction or permission. However, there are a few exceptions where TO 33K-1-100-2 has directed items be designated NPC, in these instances PMEL will not require user permission.

3.12.1. Items designated NPC will carry an AFTO Form 99 or 398 as the certification label. Date calibrated block will have the last date item was calibrated. The letters "NPC" will be entered in the date due calibration block.

3.12.2. NPC items may be used provided its performance is verified, checked, or monitored by other certified TMDE. NPC items may also be used if usage does not affect safety, or if they are not used to make absolute measurements.

3.13. Limited Calibration. There are situations when PMEL may be authorized to perform a limited calibration. OWC supervisor will sign AFTO Form 99 or initial AFTO Form 398 when item is returned for use.

3.13.1. Limited PMEL Capability. PMEL supervisor will advise user of the extent of services available when PMEL does not have capability to calibrate a full range of TMDE. User will determine whether available service will meet mission requirements. If limited calibration service will not meet customer needs, action will be taken to obtain support IAW TO 00-20-14.

3.13.2. Limited User Requirements. User will specify desired calibration points or ranges to PMEL when user requires less than full capability of associated TMDE. PMEL will clearly identify certified points or ranges on certification label (AFTO 99 or 398).

3.13.3. Instrument Limitation. When a function, range, or specification on TMDE item cannot be economically restored to original specifications, the PMEL supervisor will advise using activity of the condition. Using activity will determine if the test instrument limited capability will support mission requirements or replacement is needed.

3.13.4. T.O. Directed Limitation. Calibration procedure can identify any limitations caused by lack of adequate reference standards available to PMEL.

4. TMDE Priority Service.

4.1. General. Normal day-to-day TMDE calibration and repair service will be provided on a routine basis. Priority calibration service will be provided by VAFB PMEL to meet nonroutine requirements.

4.2. Priority Categories. Priorities are generally classified Emergency or Mission Essential.

4.2.1. Emergency. Used for calibration/repair of TMDE that will render an operational weapons system out of commission. Included are Emergency War Operations (EWO) space launches and aircraft flying missions when failure to immediately process the item will cause a work stoppage. Emergency items will be processed into PMEL immediately and work will continue, including overtime (when approved by the program manager or contracting officer), until TMDE is serviceable/calibrated or awaiting parts (AWP).

4.2.2. Mission Essential. Used for TMDE that is urgently needed to support mission requirements, but does not require around the clock work. Included are items that create a work stoppage condition prior to a combat training launch (missile crew training) or a simulated test of flight/integrated systems and flight training missions. Mission Essential items will be processed on a first-in, first-out basis, ahead of routine work.

4.2.3. Routine. Used for all other non-prioritized TMDE work. Average turn-around time for routine calibrations, excluding items requiring repair, is 7 work days.

4.2.4. Special case. Considered when loss of test equipment causes a hardship work situation on using organization. Priority may be assigned to items by mutual agreement between PMEL and user. Items not in priority categories are considered routine and serviced in order received.

4.3. Procedure for Obtaining Priority Support. Each unit of TMDE requiring priority service may be delivered (or picked up by request) to PMEL, accompanied by 30 SW Form 50, Priority Request, justifying the requirement and including the following information: (1) Priority Request Date, (2) Owning Work Center, (3) Part/Model Number, (4) Noun, (5) PAMS Label Number, (6) Emergency or Mission Critical, (7) Date Needed, (8) Point of Contact with Phone Number, (9) Signature of Authorized Individual, and (10) Signature of TMDE Coordinator.

NOTE: TMDE more than 10-days overdue will not be approved for priority support.

4.4. After-Hours and Weekend PMEL Service. To obtain PMEL services after hours, customer will coordinate through Aerospace Maintenance Operations Center (AMOC) for PMEL support. AMOC will alert PMEL. Upon notification of PMEL authorization, customer will arrange delivery of equipment to the lab. PMEL personnel will also need approval from the program manager or contracting officer prior to accomplishing overtime work.

4.5. Upgrading Priorities. When operational demands justify upgrading priorities, OWC will prepare and deliver a letter of justification. OWC will promptly pick up equipment for which priority work is requested.

5. Support Responsibilities.

5.1. General. To be effective, TMDE program requires active support from various organizational elements. This section recaps support functions and outline responsibilities not previously discussed.

5.2. TMDE User. Care of TMDE is a shared responsibility between user and PMEL. Specific responsibilities assigned to user are outlined in TO 00-20-14 and TO 33-1-27. User responsibilities are as follows:

5.2.1. Appoint a PMEL account coordinator.

5.2.2. Calibrate, certify and repair TMDE not specified in TO 33K-1-100-2 as PMEL responsibility or obtain calibration and maintenance support from the lowest level having capability.

5.2.3. Use applicable forms, labels, and alternate methods of certification in accordance with TO 00-20-14.

5.2.4. Return all TMDE specified as PMEL responsibility in TO 33K-1-100-2 to PMEL when scheduled for calibration or when unscheduled maintenance is required.

5.2.5. Ensure TMDE sent to PMEL has all ancillary equipment (e.g., preamps, power supplies, adapters, cables, or probes) needed for calibration. PMEL personnel will advise user when item is not complete. PMEL may return item without action if the ancillary equipment and/or technical data is not available.

5.2.6. Provide proper care, handling, and cleanliness of all TMDE.

5.2.7. Provide technical data with the TMDE when requested.

5.2.8. Identify and/or coordinate any requirements for limited or special calibrations with the PMEL.

5.2.9. Perform organizational maintenance on assigned TMDE in accordance with TO 33-1-27.

5.2.10. Perform all periodic maintenance and inspections as directed by maintenance technical orders.

5.2.11. Ensure all forms, labels, and calibration charts received with TMDE from PMEL are complete. Place authorized signature on AFTO Form 99, or initials on AFTO Form 398, for TMDE receiving limited or special calibration, or for TMDE that is exempt from periodic calibration.

5.2.12. Return one (1) corrected TMDE Scheduling Report to PMEL prior to date indicated at the top of the listing. Corrections will be made in red ink using the same format and printed above data that corrected.

5.2.13. Coordinate local purchases of TMDE with PMEL to verify there is no existing TMDE that may be used to satisfy requirements listed in calibration measurement summary (CMS) or TO 33K-1-100-2.

5.2.14. Provide funding for resources necessary for support of locally procured TMDE not listed in CMS or TO 33K-1-100-2.

6. Prescribed and Adopted Forms:

6.1. Prescribed Form:

30 SW Form 50, *PMEL Priority Request*

6.2. Adopted Forms:

AFTO Form 45, *Request for Calibration Responsibility Determination*

AFTO Form 99, *Limited/special TMDE Certification (3 1/2 x 1 4/6)*

AFTO Form 108, *TMDE Certification (3 1/2 x 1 4/6)*

AFTO Form 255, *Notice Certification Void When Seal is Broken (Decal)*

AFTO Form 256, *No Calibration Required (NCR) (Issued by sheet)*

AFTO Form 398, *Limited TMDE Certification*

AFTO Form 394, *TMDE Certification (2 x 7/10)*

STEPHEN M. TANOUS, Colonel, USAF
Commander

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

AFI 21-101, *Aircraft and Equipment Maintenance Management*, 29 Jun 2006

AFI 21-113, *Air Force Metrology and Calibration (AFMETCAL) Program*, 1 Feb 2001

AFI 33-360, *Publications and Forms Management*, 18 May 2006

TO 00-20-14, *AF Metrology and Calibration Program*, 24 Jul 2006

TO 33K-1-100-1 and TO 33K-1-100-2, *TMDE Interval, Calibration and Repair, Technical Order Guide and Work Unit Code Manual*, 29 Nov 2006

TO 33-1-27, *Logistic Support of Precision Measurement Equipment*, 1 Oct 1994

PMEL Handbook, 6 Apr 2007

Abbreviations and Acronyms

AFMETCAL—Air Force Metrology and Calibration

AFPSL—Air Force Primary Standards Laboratory

AMOC—Aerospace Maintenance Operations Center

AWP—Awaiting Parts

CMS—Calibration Measurement Summary

CBU—Calibrate before use

EWO—Emergency War Operations

IAW—In accordance with

ID—Identification

NIST—National Institute of Standards and Technology

NCR—No Calibration Required

NPC—No Periodic Calibration Required

OPR—Office of Primary Responsibility

OWC—Owning Work Center

PAMS—PMEL Automated Management System

PMEL—Precision Measurement Equipment Laboratory

PTRS—Precision Timing Reference Station

RDS—Records Disposition Schedule

TMDE—Test, Measurement, and Diagnostic Equipment

TO—Technical Order

VAFB—Vandenberg Air Force Base

Terms

Accessories—Item of general adaptability or special-purpose items related to specific measurement or test equipment necessary to complete desired equipment connections or test configuration.

BNC—Type of connector.

Calibration—Comparison between instruments, one of which is a standard of known accuracy, to detect, correlate, or adjust, any variation in accuracy of instrument being compared.

Calibration Interval—Length of time between calibrations during which each item of test equipment is expected to retain reliable measurement capability.

Calibration Responsibility—Term used to identify agency responsible for doing calibration of equipment. Calibration responsibility, except for NCR items, will be listed as PMEL.

Certification—Act of stating that standards and test measurement and diagnostic equipment have been calibrated and meet established requirements.

Master ID Listing—Quarterly listing of TMDE owned by particular OWC supported by PMEL.

Owning Work Center—Work center having primary use of TMDE.

PMEL Automated Management System (PAMS)—Used for inventory control and tracking of items of TMDE.

Precision Measurement Equipment Laboratory—Standards-possessing activity responsible for calibration and certification of TMDE traceable to NIST.

Test, Measurement, and Diagnostic Equipment (TMDE)—Equipment used to maintain, measure, calibrate, test, inspect, diagnose, or otherwise examine materials, supplies, equipment, and systems to identify or isolate actual or potential malfunctions, or decide if operational specifications established in technical documents are met.