

SUBJECT:	Fermilab Assessment Manual – Chapter 4 Independent QA Assessment Procedure – Form 2	NUMBER:	3902.1004 FORM 2
RESPONSIBILITY:	Quality Assurance Manager	REVISION:	001.3
APPROVED BY:	Head, Office of Quality and Best Practices	EFFECTIVE:	06/20/2011

Fermilab Independent QA Assessment Report	
Assessment Number & Title: 11-IA-QA-011 TD – Measurement and Test Equipment	Version: 1.0
Date(s) of Assessment: 6/20/11 – 6/23/11	
Performing Organization: Office of Quality & Best Practices	
Assessed Organization(s): Technical Division (TD) including the following departments: <ul style="list-style-type: none"> • Magnet Systems • SRF Development • Quality and Materials (Q&M) • Test and Instrumentation (T&I) • Headquarters (ES&H) 	
Assessment Activities & Scope: Implementation and effectiveness of controls for Measurement and Test Equipment (M&TE) relative to the requirements of Integrated Quality Assurance (IQA) were examined via interview, observation, and document & record review. These controls were examined across the TD departments listed in the “Assessed Organization(s)” section of this report.	
Scope Limitations: The scope of this assessment was limited to the five departments listed in the “Assessed Organization(s)” section of this report.	
Activities Reviewed Within this Assessment: <ul style="list-style-type: none"> • Magnet Production • Cable/Coil Production • Magnet Testing • Test & Instrumentation Electrical Support • Test & Instrumentation Mechanical Support • Quality & Materials Calibration • Cavity Cleaning • Cavity Assembly • Cavity Tuning • Cavity Test • SRF Materials Testing • Safety 	
Description of the Implementation & Effectiveness of Observed Activities: <u>Measurement and Test Equipment:</u> M&TE requirements found in IQA chapters five and eight have been implemented within the TD departments assessed, although some exceptions are identified in the Findings section of this report. M&TE used for inspection, test, process monitoring, and data collection are identified, calibrated,	

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maintained and controlled commensurate with their intended use. Effectiveness of the M&TE program implementation varies among the organizations assessed.

Identification and tracking of M&TE is done through electronic databases such as the GAGetrak® Database (File01) and the Instrumentation & Controls Inventory database, or through a spreadsheet. M&TE is identified through serial numbers, Fermi National Accelerator Laboratory (FNAL) property stickers, or bar code stickers attached to the equipment. Calibration information such as last date calibrated, next calibration due date, and calibration company is contained on calibration stickers attached to the equipment as well as in the calibration databases and spreadsheets.

The majority of the M&TE examined during the assessment was correctly identified and had been calibrated within the current calibration interval. A sample of M&TE was checked for calibration certificates (File02 – File06). 100% of the sample had valid certificates and all used calibration standards that are traceable to the National Institute of Standards and Technology. There were occurrences in all organizations and locations of M&TE that were either overdue for calibration, not correctly identified, or not listed in a calibration database or spreadsheet. A complete list of these occurrences can be found in Appendix one.

The overall TD quality management program, including the management of M&TE, is described in Technical Division Quality Management Program, TD-2010 Version 2. The assessment team also reviewed the recently revised Version 3 (draft) of this document. The T&I organization uses a documented T&I Calibration Program, TID-N-40. The assessment team used revision 1.1, but also reviewed revision 1.2, dated 6/21/11 that became available during the assessment. This program document provides detailed calibration information such as departmental calibration requirements, procedures, intervals, and standards. Improvements over the previous revision include removal of references to obsolete SQIP and MIL-STD-45662 requirements, addition of in-house calibration transfer standards, and the addition of a section on calibration improvement plans.

Conclusions:

The TD departments examined during this assessment have implemented the M&TE requirements found in IQA chapters five and eight. This includes identification, calibration, maintenance, and control of M&TE used for inspection, test, process monitoring, and data collection. The degree of effectiveness of implementation of the M&TE program varies across the organizations and locations assessed. Details of specific areas where improvements are needed are found below in the Findings section of this report.

Findings:

1. There is no evidence that four Network Analyzers belonging to SRF RF Design and Test Group, and used for RF measurement and tuning of cavities, are controlled in any calibration program. None of these analyzers is listed in any of the calibration databases or lists. Three of these Analyzers have exceeded their calibration intervals and there was no evidence they have ever been calibrated. IQA section 8.5 states: “The measuring and test equipment (M&TE) used for inspection and acceptance tests are identified, calibrated, maintained, and controlled commensurate with their intended use.” Also, Technical Division Quality Management Program Document, TID-2010 section 8.5 states: “Department Heads are also responsible for developing an effective program for the necessary calibration activities.” Appendix one contains identification details for this equipment.

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- There were many instances of M&TE that had exceeded their TD recommended calibration intervals. For example in the Magnet System Fabrication area more than 33% of sampled M&TE exceeded their intervals; in the Magnet Systems Superconductivity R&D area more than 50% of the sampled M&TE exceeded their intervals, and Standard Leaks (used for leak checking) were found in multiple areas that had exceeded their calibration interval. IQA section 8.5 states: “The measuring and test equipment (M&TE) used for inspection and acceptance tests are identified, calibrated, maintained, and controlled commensurate with their intended use.” Also, Technical Division Quality Management Program Document, TID-2010 section 8.5 states: “Department Heads are also responsible for developing an effective program for the necessary calibration activities.” Appendix one contains identification details for this equipment.

Observations and Recommendations:

- Observation:** There was no evidence of a procedure to evaluate the adequacy of the calibration system based on out of tolerance data generated from calibrating M&TE as required in section 7.6 of the T&I Calibration program Document

Recommendation: Use historical out of tolerance data to evaluate the calibration system in use in the T&I organization.

- Observation:** Although several interviewees described what they would do in case M&TE they had used was found to be out of calibration, there was no evidence of evaluations being performed to assess adverse impact on inspection, test, or data collected using out of tolerance M&TE as required by section 8.5 of the IQA. In general interviewees stated that this situation had not occurred to them and that no documented evaluation results existed.

Recommendation: When M&TE is returned from calibration with an indication that it was out of calibration, assess the adverse impact on inspection, test, or data collected.

- Observation:** ES&H M&TE are not tracked via a list or DB; but are segregated in a locked trailer

Recommendation: Utilize a list or database to track ES&H M&TE calibration status.

Commendable Practices:

- All superconducting magnet test stands log quench event summaries using e-logs.

Names of Person Interviewed:

T. Arkan
T. Beale
J. Blowers
D. Hicks
D. Howard
A. Kandziorski
T. Khabiboulline
O. Lira
F. Lewis

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W. Mumper
D. Orris
J. Ozelis
R. Riley
A. Rowe
A. Rusy
R. Ruthe
D. Smith
J. Szal
V. Yakovlev

Documents Reviewed:

- Midwest CMM Services Certificate of Calibration for Cordax RS-220
- LDS Vacuum Products, Inc. Certified Calibration Certificate for Gas Leak (6)
- Quest Technologies Certificate of Calibration for QC-10 Calibrator
- Quest Technologies Certificate of Calibration for 2700 SLM
- Technical Division Automatic External Defibrillator Inspection form for Lab 4 VMS
- Hexagon Metrology Calibration Test Report for CMM RS 220
- ACME Scale System Inc. Calibration Report for Allegany MP-Z 30,000 pound scale
- Hach Certificate of Calibration for Particle Counter 227B (3)
- Hach Certificate of Calibration for Particle Counter 3313 (3)
- Smartscope Service Agreement for Optical Gaging Products, Inc. Avant Video measuring System
- GAGetrak® Database
- Instrumentation & Controls Inventory Database

Standards, Regulations, and Other Program Requirements Applied:

The specific criteria applied to this assessment were:

1001 IQA section 5.4.2, Maintenance (relative to M&TE)
1001 IQA section 5.4.4, Calibration of Process Equipment
1001 IQA section 8.5, Control of Measuring & Test Equipment
TD-2010, Technical Division Quality Management Program
TID-N-40, Test and Instrumentation Calibration Program
TID-N-93, T&I Quality Assurance Program Description

Describe or List Any Other Assessment Methods Used:

None

Corrective Action Plans Issued: TD-20110708-01 M&TE
TD-20110708-02 M&TE

Assessors' Names (asterisk indicates team leader):

- Bakul Banerjee - CD

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- John Martzel* - OQBP

Submitted by: : John Martzel

Date: 7/14/11

Distribution (Distribute to assessed organizations' management, OQBP head, and other interested parties):

Giorgio Apollinari
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Romesh Sood
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Adam Bracero

Bob Grant
Ed Vokoun
Jed Heyes
Bakul Banerjee
John Martzel

Attachments:

- File01 – Gage Tracker Database
- File02 - Particle Counter Calibration Certificates
- File03 – Leak Tester Calibration Certificate
- File04 – CMM Calibration Certificate
- File05 – Preamplifier Calibration Certificate
- File06 – Calibrator Calibration Certificate

Appendix 1 – M&TE Calibration Issues

Gages Database

- 30,000 # ACME Crane scale S/N 123719P230 overdue for calibration as of 5/11/11. Will be scrapped.
- 70,000# ACME Crane scale S/N 13700 overdue for calibration 6/10/11. Waiting for replacement of 30,000# scale before sending out. Gage DB said calibration interval is 5 years, but it is really only 1.

QC Lab

- Giddins and Lewis CMM machine ES-220 – DCC, serial # 02930085 overdue for calibration 12/10/10. Observed calibration in progress later in the assessment.
- Micro - Hite scale overdue for calibration 2/22/11. It was calibrated when examined later in the assessment.
- Brown and Sharpe CMM machine serial # 0798-2449 overdue for calibration 10/20/06. This machine was not in use and was being assembled.
- Avant 800 ATS Optical Comparator Overdue for calibration 5/11/11. (If 6 month calibration interval is correct)
- LDJ Inc. Model 5500 Hysteresigraph, property ID 75899 had no calibration sticker nor indication of its calibration status. Interviewees indicated it has not been used in a couple of years
- None of the 4 CMM machines in the Quality Control (QC) lab, the optical comparator, nor the

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Hysteresigraph are tracked via a database or list.

SRF -Materials R&D IB3, MDTL

- Instron 1000# Model 4411 S/N C2623 overdue for calibration 7/31/07
- Instron 100000# Model 8503 S/N C0302 overdue for calibration 8/09; can calibrate using load cells which are not themselves calibrated.
- Eddy Current Scanner – custom built equipment that gets calibrated after every 100 uses. No records of calibration observed.
- Mettler scales AT 250 S/N 68926 and Toledo S/N 11283230771 did not contain calibration stickers or property tags; weights are available to calibrate the scales, but the weights have not been calibrated.
- Eagle HF Detector, S/N E06Z118, overdue for calibration 6/08; self-calibrate before every procedure.

SRF – IB4

- The following four Agilent Network Analyzers used for cavity measurements and tuning had no calibration or service stickers and could not be found in any database or equipment list. A calibration kit (85052D) for the analyzers was observed that was overdue for calibration 1/1/2002
 - Agilent 8720ES S/N 87928
 - Agilent E5062A S/N 108371
 - Agilent E5062A S/N 117885
 - Agilent 8722ES S/N 90224 (in MP9)

T&I – IB1

- Tektronix digital Photosphor DP07 Oscilloscope overdue for calibration 2008. Equipment owned by AD, had been used by TD; the assessment team was told that it was not used for test purposes.
- Rhodes and Schwarz Spectrum Analyzer reference number 180402007, Bar code 001408 was observed being used for testing prototype hardware, overdue for calibration 4/1/2008.
- 2 Standard leaks model 141430-008, bar code 4053, 3197, overdue for calibration 3/25/10.

Magnet Systems – IB2, IB3

- Associated Research Hipot AR0503 DC Withstand Voltage tester overdue for calibration 3/15/11.
- Oxford Intelligent Superconducting Magnet Power Supply IPS 120-10, ID 40113 overdue for calibration 8/27/09.
- Oxford Intelligent Superconducting Magnet Power Supply ID 097535 had no calibration sticker and could not be found in the calibration database.
- Oxford Power supply E503/70 overdue for calibration 8/27/09
- 2 Agilent DC Power supplies 90625 and 90754 overdue for calibration 8/27/09.
- Standard leak model 141430-008 S/N 4248 overdue for calibration 5/6/03

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- Could not locate Keithley Digital Multimeter 0552328 due for calibration 9/19/11