IMPORTANT NOTICE: A printed copy of this document may not be the version currently in effect. The current official version is available via the Sandia National Laboratories Yucca Mountain Project Online Documents web site.

SANDIA NATIONAL LABORATORIES
CIVILIAN RADIOACTIVE WASTE MANAGEMENT
TECHNICAL PROCEDURE (TP)

TP-236

TAPE EXTENSOMETER MEASUREMENTS

Revision 03

Effective Date: 04/20/2004

Original signed by Ron S. Taylor	04/20/2004
Author: Ronnie S. Taylor	Date
Original signed by John W. Kelly	04/20/2004
Technical Reviewer: John W. Kelly	Date
Original signed by Leopoldo A. Buenviaje	04/20/2004
Quality Assurance Reviewer: James F. Graff	Date
Original signed by Ron S. Taylor	04/20/2004
Approval:	Date

(Reviewer signatures above serve to document the review and resolution of comments)

REVISION HISTORY

Rev.	Effective Date	Change Summary
00	8/7/95	Initial issue under title “Operation, Calibration, and Control of Tape Extensometers”
01	1/17/96	Complete rewrite to better represent process, focus on necessary steps, and improve documentation flow. Replaces former use of scientific notebook with records generated by this procedure, narrows scope to the measurement process, and clarifies baseline determination
02	1/31/97	Modified Section 4.2.3 to reflect current post-processing steps, updated Section 5.0 (Records) to identify records as lifetime records per YM-96-D-088.
03	4/20/04	Modified per QAIP20-1, Revision 09, to address issues raised in CR2036, 3/9/04

Table of Contents

Section Page

1.0 SCOPE 4

2.0 OBJECTIVES AND PRIMARY TASKS 4

3.0 PREREQUISITES 4

4.0 REQUIRED EQUIPMENT 4

5.0 DEFINITIONS/ACRONYMS 5

6.0 PROCESS 5
- 6.1 Relative Instrument Baseline Calculation 5
- 6.2 Performing Tape Extensometer Measurements 5
  - 6.2.1. Pre-Test/Post-Test Performance Check 5
  - 6.2.2. Conducting a Tape Extensometer Measurement 6

7.0 RECORDS 7

8.0 REFERENCES 7

APPENDIX - FORMS 8

1.0 SCOPE

Sandia National Laboratories (SNL) is responsible for rock mechanics field experiments to monitor and characterize the Exploratory Studies Facility (ESF) in support of the Yucca Mountain Project (YMP). These experiments include installing and monitoring instrumentation that measures the long-term in situ stability of rock units penetrated by ESF excavations.

This Technical Procedure (TP) applies to all SNL YMP personnel and contractors who shall be trained and qualified to measure the change in distance between points in the Exploratory Studies Facility (ESF) using a tape extensometer.

2.0 OBJECTIVES AND PRIMARY TASKS

The objective of this technical procedure is to describe the process for performing and documenting tape extensometer measurements in the ESF. The measurement process is based on ASTM D4403-84, "Standard Practice for Extensometers Used in Rock," and the Geokon Tape Extensometer Instruction Manual provided with the instrumentation. The process includes two primary tasks: (1) Setting Tape Extensometer Performance Criteria and (2) Performing Tape Extensometer Measurements

3.0 PREREQUISITES

The Principal Investigator (PI) or PI designee is responsible for assuring and documenting that individuals assigned to conduct tape extensometer measurements have read, are trained to and have demonstrated proficiency in the use of this procedure before these individuals initiate work. The PI/PI designee is also responsible for verifying instrument and instrumentation performance in accordance with the requirements defined in TP-249, *Maintenance, Verification, and Reject Criteria of Instrumentation*.

The following prerequisites are required when using this TP:

- A current version of this TP is available for use.
- Measuring and Test Equipment (M&TE) used will have a current calibration.

4.0 REQUIRED EQUIPMENT

The following items are required to perform this work:

- the current Convergence Pin Data Acquisition Form
- the current Baseline Average Uncertainty Range (BAUR)
- calibrated tape extensometer
- calibrated static frame
- calibrated digital thermometer
- connecting pole and light
- wristwatch, pen and spare batteries

5.0 DEFINITIONS/ACRONYMS

BAUR	Baseline Average Uncertainty Range
ESF	Exploratory Studies Facility
M&TE	Measuring and Test Equipment
PI	Principal Investigator
QA	Quality Assurance
QAIP	Quality Assurance Implementing Procedure
SNL	Sandia National Laboratories
TCO	Test Coordination Office
TP	Technical Procedure
YMP	Yucca Mountain Project

6.0 PROCESS

6.1 Relative Instrument Baseline Calculation

Whenever a new/alternate tape extensometer is used, a baseline value of the offset between the old instrument and the new/alternate instrument is needed to compensate for the difference between the absolute measurements. The relative instrument baseline calculation is determined by averaging the difference of a series of similar measurements made with both instruments at ten measurement stations in the ESF. The relative instrument baseline value is set to the average of the temperature-corrected length differences between measurements made with the different extensometer gages. This process is initially performed whenever a new instrument is acquired and repeated whenever an instrument's configuration is altered (e.g., a broken tape). The offset calculation shall be submitted with the data collected.

6.2 Performing Tape Extensometer Measurements

6.2.1 Pre-Test/Post-Test Performance Check

The Tape Extensometer Pre-Test / Post-Test Performance Check is performed before and after daily collection of data. A calibrated tape extensometer and a calibrated thermometer are utilized in this performance check to measure a calibrated static frame. The successful completion of the Tape Extensometer Pre-Test / Post-Test Performance Check demonstrates that the individual is trained and proficient in the use of the tape extensometer. The results of the Tape Extensometer Pre-Test / Post-Test Performance Check are recorded on the Convergence Pin Data Acquisition Form (Appendix A). The following steps describe the Tape Extensometer Pre-Test / Post-Test Performance Check process:

1. Record the current BAUR value on the Convergence Pin Data Form (Appendix A). The BAUR value can be found on the current tape extensometer calibration report.

2. Inspect the tape extensometer instrument for any visible damage prior to and after conducting measurements in the ESF. Report any suspect conditions to the PI before proceeding.

3. Use a calibrated thermometer to measure the temperature (±0.1°) and record the temperature value on the Convergence Pin Data Form (Appendix A).

4. Hook the tape end of the extensometer to the top center eyebolt of the static frame.

5. Reel the tape out until the other anchorage point is reached (bottom center eyebolt of static frame).

6. Take up the slack in the tape.

7. Insert the tape-holding pin in nearest hole in the tape. If the correct tape hole has been chosen, it will be possible to achieve correct tension on the tape while still being within the range of the dial indicator.

8. Hook the end of the extensometer to the bottom center eyebolt.

9. Align the index mark on the spring plunger so that it will move away from the window index mark in one direction only. It will coincide with the index mark in one position, but it will never cross over to the other side of the window index mark.

10. Read and record the tape and the dial indicator values on the Convergence Pin Data Form (Appendix A).

11. Compare the measurements to the current BAUR value. If the measurement falls outside the BAUR:

    - Allow the tape extensometer and the static frame to reach thermal equilibrium (at least fifteen minutes), then repeat the measurement and comparison.

    - If the measurement remains outside the BAUR value, report the suspect condition to the PI before proceeding.

12. Remove the tape extensometer from the static frame.

13. Complete the "Tape Extensometer Pre-Test/Post-Test Performance Check" section of the Convergence Pin Data Form (Appendix A).

6.2.2 Conducting a Tape Extensometer Measurement

1. Prior to taking any measurement over the conveyor belt, contact the ESF Test Coordination Office (TCO) to arrange the lockout/tag out of the conveyor belt.

2. Locate the appropriate station to be monitored.

3. Use the connecting pole as need to connect the tape end of the tape extensometer to the distant convergence pin eyebolt.

4. Take up the slack in the tape.

5. Engage the tape-locking pin in the nearest punched tape hole. If the correct tape hole has been chosen, it will be possible to achieve correct tension on the tape while still being within the range of the dial indicator.

6. Hook the end of the tape extensometer to the near convergence pin eyebolt.

7. Align the extensometer along the chord between the two convergence pin eyebolts, minimizing the effect of instrument weight on tape tension.

8. Align the index mark on the spring plunger so that it will move away from the window index mark in one direction only.

   - If the index marks do not align, select another tape-locking point.

   - Repeat Steps 4-8.

9. Complete the "Convergence Pin Field Data" section of the Convergence Pin Data Acquisition Form (Appendix A).

10. Disconnect the tape extensometer.

11. Repeat steps 2 through 11 for all stations to be measured.

12. At the completion of the day's data collection, return to section 6.2.1 and perform the Post-Test Performance Check process.

13. Turn in all records to the PI or designee for review and approval.

7.0 RECORDS

Records and record packages, including corrections and changes thereto, generated as a result of implementing this procedure shall be prepared and submitted as Quality Assurance (QA) records (QA:QA) in accordance with the requirements of AP-17.1Q.

QA records generated by this procedure include:

- Convergence Pin Data Form (which documents proficiency in the use of this procedure and records ESF data collection, including Tape Extensometer Pre-Test / Post-Test Performance Check)

8.0 REFERENCES

1. ASTM D4403-84, *Standard Practice for Extensometers Used in Rock*, American Society for Testing and Materials

2. *Geokon Tape Extensometer Instruction Manual*, Geokon, Inc., Lebanon, NH

3. AP-12.1Q, *Control of Measuring and Test Equipment and Calibration Standards*

4. AP-17.1Q, *Records Management*

5. AP-SIII.3Q, *Submittal and Incorporation of Data/Technical Information to the Technical Data Management System*

6. QAIP 20-1, *Technical Procedures*

7. TP-249, *Maintenance, Verification, and Rejection Criteria of Instrumentation*

The most current version of the reference procedures in place at the time of work performance shall apply.

Sandia National Laboratories

Convergence Pin Data Form

M&TE	SNL ID	Recall Date	BAUR Value
TAPE EXTENSOMETER			
STATIC FRAME			
THERMOMETER			

Tape Extensometer Pre-Test / Post-Test Performance Check

Performance Check	Date	Time	Tape Value	Dial Value	Temp °
Pre-Test Reading					
Post-Test Reading					

Convergence Pin Field Data

Station ID	Tape Value	Dial Value	Time	Temp°	*Reader Initials	Recorder Initials	Comments

H=SLL-SLR L=UL-F R=UR-F V=U-F **RF=UR-FR **LF=UL-FL
**Used at alcove entrances

***Reader Initials indicate that the individual has read and can demonstrate proficiency in the use of the latest version of TP-236**