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SANDIA NATIONAL LABORATORIES
CIVILIAN RADIOACTIVE WASTE MANAGEMENT
TECHNICAL PROCEDURE

TP-238
Revision 02

Installation of Convergence Pins

Effective Date: 04/27/2004

Original Signed by Ron S. Taylor	04/27/2004
Author: Ron S. Taylor	Date
Original Signed by John W. Kelly	04/27/2004
Technical Reviewer: John W. Kelly	Date
Original Signed by Leopoldo A. Buenviaje for	04/27/2004
Quality Assurance Reviewer: James F. Graff	Date
Original Signed by Ron S. Taylor	04/27/2004
Approval: Ron S. Taylor	Date

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

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REVISION HISTORY

Rev.	Effective Date	Change Summary
00	8/7/95	Initial issue
01	9/10/98	Minor editorial corrections and update to current requirements.
02	04/27/04	Modified per QAIP20-1, Revision 09, to address issues raised in CR2035, 3/9/04

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1.0 SCOPE

Sandia National Laboratories (SNL) is responsible for field experiments to monitor and characterize activities in 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. Deformation of rock surfaces in the excavation is one of the parameters used to monitor stability and is measured using a tape extensometer (TE) attached to convergence pins (CPs) that are anchored in the rock or to a steel set.

This Technical Procedure (TP) applies to all YMP SNL personnel and contractors who will be trained and qualified to install CPs on rock surfaces and steel sets in the ESF.

2.0 ACTIVITY OBJECTIVE

The objective of the activity described in this TP is to define the methods used to install CPs in ESF excavations.

3.0 RESPONSIBILITIES

The Principal Investigator (PI) or PI designee is responsible for ensuring and documenting that all individuals installing CPs have read and are properly trained to this procedure before initiating their 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 Rejection Criteria of Instrumentation*.

4.0 QUALIFICATION PREREQUISITES

The following prerequisites are required when using this TP:

- A current version of this TP is available for use.
- Demonstration to the PI/PI designee that proficiency requirements of the TP are met.

5.0 ACRONYMS

CP	Convergence Pins
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
TE	Tape Extensometer
TP	Technical Procedure
YMP	Yucca Mountain Project

6.0 PROCESS

CPs shall be installed by qualified SNL field personnel and contractors involved in the YMP. The PI/PI designee is responsible to ensure that CPs are properly installed and that their as-built information is properly documented. The following steps shall be performed for each CP instrumented station:

1. Pre-Installation Activities
2. Installation of CPs
3. Documentation of As-Built

6.1 Pre-Installation Activities

The PI/PI designee will perform the following pre-installation activities:

1. Establish the CP installation location.
2. Inventory CP materials (including CP eyebolts, lock washers, nuts, grout, epoxy) and restock as required.
3. Notify the TCO of the CP installation location, identifying the type of CP installation -- anchored in rock or anchored on a steel set.
4. Establish the materials and work schedule.
5. Request lockout/tag out status from the TCO of the conveyor belt.

6.1.1 Pre-Installation Activities for CPs Anchored in Rock

The PI/PI designee will perform the following pre-installation activities for CPs anchored in rock:

1. Locate the sites for the CP array boreholes (1 ½-inch diameter nominal).

2. Request drilling CP boreholes 12-inches deep nominal.
3. Inspect and accept the drilled boreholes.
4. Provide the TCO with the dimensions for the CP rebar/rockbolt segment that will be cut to length, drilled and tapped, usually:
   - a ¼ - 20 tap into ½-inch diameter rebar stock for the crown, upper right, upper left or springline segment; and
   - a 3/8 - 16 tap into 1-inch diameter rockbolt stock for the invert segment.
5. Screw the CP eyebolt into the rebar segment and insure that the CP eyebolt is seated firmly against the lock nut (see Appendix-A, Exploded View of CP Anchor Assembly).

   Note: Alternatively, the CP eyebolt can be inserted into a slightly larger drilled hole and welded into place.
6. Generously apply a hard setting thread sealant (Loc-Tite Type N or equivalent) to the eyebolt threads.
7. Inspect and accept each CP rebar/rockbolt assembly.

6.1.2 Pre-Installation Activities for CPs Anchored on Steel Set

The PI/PI designee will perform the following pre-installation activities for CPs anchored on a steel set:

1. Drill 4 to 6 inch diameter hole through the precast invert section at the station location.
2. Drill 1 ½-inch diameter borehole 12-inches deep nominal into invert.
3. Inspect and accept drilled borehole.
4. Provide the TCO with the dimensions for the rockbolt segment that will be cut to length, drilled and tapped (a 3/8 - 16 tap into 1-inch diameter rockbolt stock for the invert segment).
5. Screw the CP eyebolt (3/8 - 16) into the rockbolt segment and insure that the CP eyebolt is seated firmly against the lock nut (see Appendix-A, Exploded View of CP Anchor Assembly).

   Note: Alternatively, the CP eyebolt can be inserted into a slightly larger drilled hole and welded into place.
6. Generously apply a hard setting thread sealant (Loc-Tite Type N or equivalent) to the eye bolt threads .
7. Inspect and accept the CP rockbolt assembly.
8. Drill 9/32-inch holes for the ¼-inch CP eyebolts at the crown, upper left, upper right, springline left and springline right on the steel set, as directed by the PI/PI designee

6.2 Installation of CPs

6.2.1 Installation of CPs Anchored in Rock

The PI/PI designee will perform the following steps to anchor each CP in rock:

1. Inspect and clean each borehole as necessary.
2. Insert the CP rebar assembly into the borehole and align the CP eyebolt opening to the position that will allow measurements to all other anchors of interest, yet allow the CP to remain as protected as possible.
3. Fill borehole around the CP rebar assembly with quick setting epoxy cement or cement grout and allow to cure according to manufacturer's instructions.

6.2.2 Installation of CP Anchored to Steel Set

The PI/PI designee will perform the following steps to anchor each CP to a steel set:

1. Insert the invert CP rebar assembly into the borehole and align the CP eyebolt opening to the position that will allow measurements to all other anchors of interest, yet allow the CP to remain as protected as possible.
2. Fill borehole around the invert CP rebar assembly with quick setting epoxy cement or cement grout and allow to cure according to manufacturer's instructions.
3. Insert the ¼-inch CP eyebolt into the drilled 9/32-inch hole, align the CP eyebolt opening to the position that will allow measurements to all other anchors of interest.
4. Firmly attach the eyebolt to the steel set with a lock-washer and double lock nuts.
5. Generously apply a hard setting thread sealant (Loc-Tite Type N or equivalent) to the eye bolt threads.

6.3 Documentation of As-Built

The PI/PI designee will perform the following steps to document the As-Built:

1. Complete the Convergence Pin As-Built Documentation Form (Appendix-B).
2. Make the initial CP readings using TP-236, *Tape Extensometer Measurements*. Record two reading at each CP location to establish the initial reference reading and indicate 'Initial CP Reading' in the comments column.
3. Request the TCO to have a survey done for each CP location.

7.0 RECORDS

Records and record packages, including corrections and changes thereto, generated as a result of implementing this procedure will be prepared and submitted as QA records

(QA:QA) to the RPC in accordance with AP-17.1Q, *Records Management*, and AP-SIII.3Q, *Submittal and Incorporation of Data to the Technical Data Management System*

QA records generated by this procedure include:

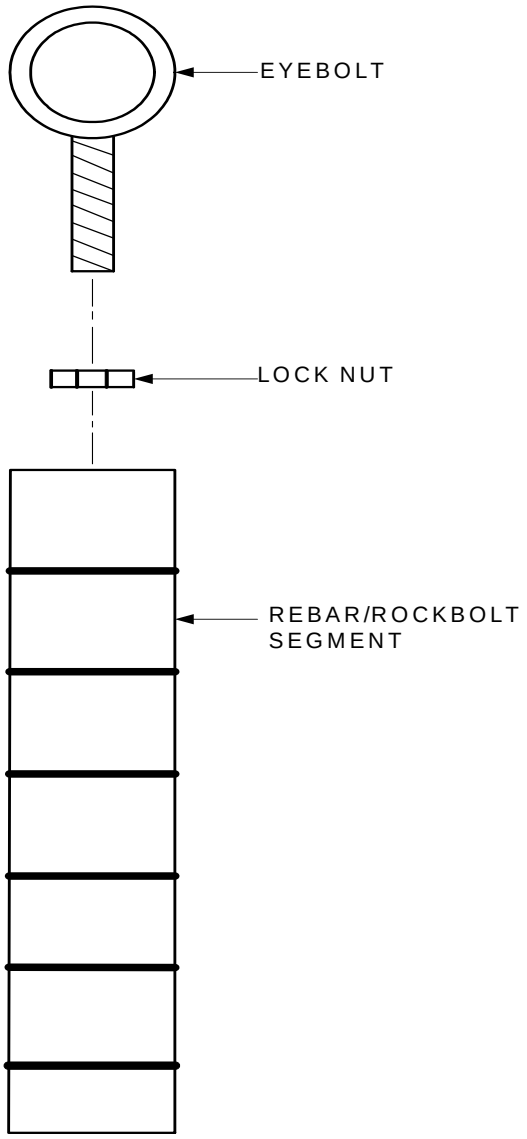
- Convergence Pin As-Built Documentation Form (Appendix B)

8.0 REFERENCES

1. AP-17.1Q, *Records Management*
2. AP-SIII.3Q, *Submittal and Incorporation of Data to the Technical Data Management System*
3. QAIP 20-1, *Technical Procedures*
4. TP-236, *Tape Extensometer Measurements*
5. TP-249, *Maintenance, Verification, and Rejection Criteria of Instrumentation*
6. LP-OM-001-BSC, *Lockout/Tagout Process*

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

Exploded View of CP Anchor Assembly



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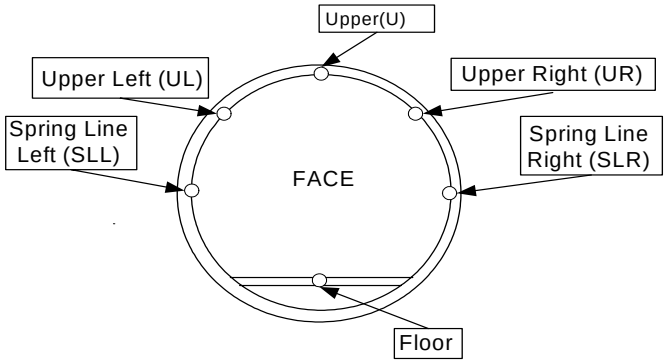
Convergence Pin As-Built Documentation Form

General Specification:	Verification:
	Yes No
a) Drill all holes to within ± 2 ft of a common plane oriented perpendicular to tunnel axis.	Required specifications have been met: ☐ ☐
b) Drill 4-6in diameter access hole through precast invert.	If No, Describe Deviations:
c) Drill boreholes 1 ½ - inch diameter nominal, minimum of 12-inches deep.	
	Station is accepted as built: Yes ☐ No ☐
*Installer	
Print:	If No, Describe acction required:
Signature:	

General Layout
Convergence Pins
(6 per Station)



*Installer's signature above indicates that the individual has read and can demonstrate proficiency in the use of the latest version of TP-238