

GETR SEISMIC TRIP REPLACEMENT  
INSTALLATION AND CHECKOUT PROCEDURE

The following procedure incorporates the changes described in Change Authorization GETR-694. While the reactor is defueled, the components will be installed and connected to the present seismic trip follower relays. The trip system then will be observed and tested for a period. When the test criteria have been satisfied and the test results reviewed by the assigned reviewers, the system will be ruled operable.

This procedure has been written with the best information available. There may be a requirement of necessity, better practice, or new information which demands a change on the spot. Any such change must be approved by the Project Engineer. The change must be documented on a master, uncontaminated copy.

APPROVALS:

P.W. Swartz /Date 4-20-81  
Manager, Plant Engineering & Maintenance

P.F. Kachel /Date 4-20-81  
Manager, GETR Operations

DR. Smith /Date 4-20-81  
Reactor Analyst

J.H. Chubb /Date 4-20-81  
Manager, Quality Assurance

W.H. E. /Date 4-20-81  
Manager, Nuclear Safety Technology

Dwight L. Gelliland /Date 4-20-81  
Manager, Reactor Irradiations

I. INSTALLATION AND CHECKOUT PROCEDURE

The purpose of this procedure is to specify the requirements for and document the results of installation and acceptance testing for the new Kinematics seismic trip switches.

A. Both seismic switches are to be located on the rod gallery wall in the containment vessel.

1. Equipment and Materials

2 each Mounting Bracket, Dwg. #153C4616

2 each Seismic Trigger, Kinematics Model TS-3

6 each  $\frac{1}{2}$ "x2 $\frac{1}{2}$ " (or longer) bolts, lock washers, anchors

2 each  $\frac{1}{4}$ "x2" bolts, seal washers, lock washers

2 each Junction Box

2 each Connector (supplied with TS-3 unit)

Cable, 4-conductor shielded (20AW6 Belden #8404).

Tools as required.

2. Mechanical

- a. Notify Shift Supervisor that work on the installation of the seismic triggers will begin. Contact QA for verification of 2.d. through 2.g.

Shift Supervisor \_\_\_\_\_ Date/Time \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

- b. Position each of the two mounting brackets, and mark mounting holes on wall (requestor to specify location).
- c. Drill holes in concrete wall and install anchors. If conduit or rebar is encountered in concrete, change hole pattern to miss conduit or rebar and redrill bracket.

2. Mechanical - continued

- d. Install mounting bracket and level as well as possible.  
Torque bolts to 20 ft-lb minimum.
- e. Install seismic trigger #1 on the (south) bracket. Level trigger to within 2° using shims under feet as required. Torque mounting bolt to 20 ft-lb minimum. Do not damage trigger during installation.
- f. Install seismic trigger #2 on the (north) bracket. Level trigger to within 2° using shims under feet as required. Torque mounting bolt to 20 ft-lb minimum.
- g. Place identification tag on brackets identifying them as:  
Seismic Trigger #1 (Caution: Will scram reactor.), and  
Seismic Trigger #2 (Caution: Will scram reactor.).

Installation Performed By \_\_\_\_\_

QA Verified By \_\_\_\_\_

Date/Time \_\_\_\_\_/\_\_\_\_\_

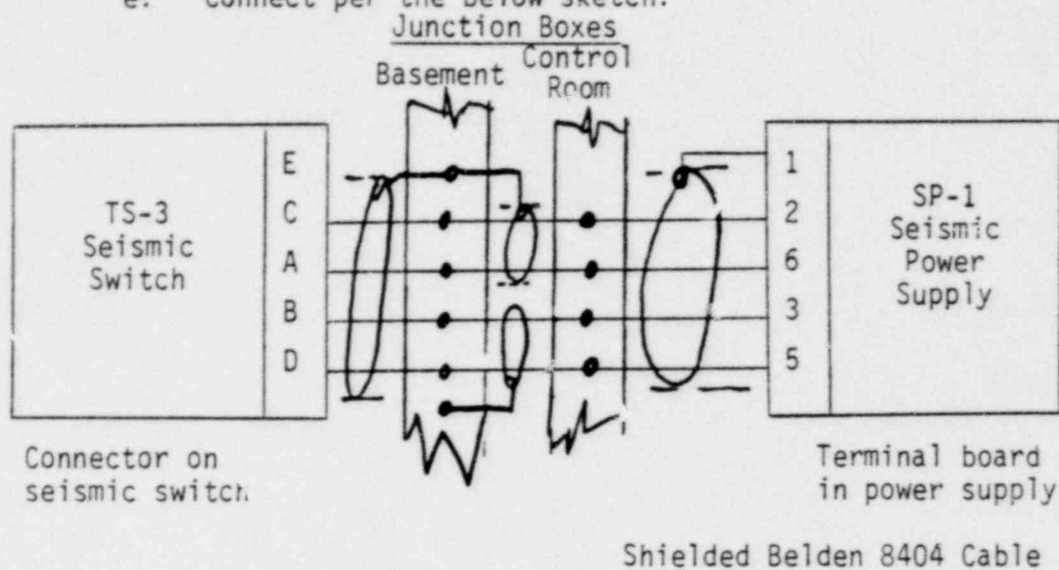
3. Electrical

- a. Install conduit and junction boxes by the two seismic triggers on the rod gallery wall per Drawing #153C4614.
- b. Run conduit from the junction box for seismic trigger #1 to junction box \_\_\_\_\_ for penetration \_\_\_\_\_. Terminals \_\_\_\_\_
- c. Run conduit from the junction box for seismic trigger #2 to junction box \_\_\_\_\_ for penetration \_\_\_\_\_. Terminals \_\_\_\_\_
- d. After the power supplies are mounted in the Control Room, connect a shielded 4-conductor cable between each of the power supplies and the Control Room junction box.

|                    | <u>J-Box</u> | <u>Terminals</u> |
|--------------------|--------------|------------------|
| Seismic Trigger #1 | _____        | _____            |
| Seismic Trigger #2 | _____        | _____            |

I. A. 3. Electrical - continued

e. Connect per the below sketch.



B. Seismic switch power supplies are to be mounted in the control room.

1. Equipment and Materials

2 each Seismic Power Supplies, Kinometrics SP-1

16 Awg 600-volt wire

Tools as required

2. Electrical

a. Notify Shift Supervisor that seismic equipment will be installed.

Shift Supervisor \_\_\_\_\_ Date/Time \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

b. Install (2 each) seismic power supplies (SP-1) in the control room.

Seismic power supply #1 will be rack mounted in the bottom of the Victoreen panel. Seismic power supply #2 will be mounted in one of the spare slots in the nuclear panel.

2. Electrical - continued

- c. Connect L21 to terminal 10 on both seismic power supplies.
- d. Connect terminal 11 on seismic switch power supply #1 to T27-2 (PP-2) after removing the lead that comes from R97 pin 5.
- e. Connect terminal 11 on seismic switch power supply #2 to T15-12 (PP-2) after removing the lead that comes from R97A pin 5.
- f. Disconnect and remove R97, seismic switch #1, R97A, and seismic switch #2.

Installation Performed By \_\_\_\_\_

Engineer Verified By \_\_\_\_\_

Date/Time \_\_\_\_\_/\_\_\_\_\_

C. Checkout

Checkout shall be performed by Instrument Technicians with the assistance of Operations personnel. QA shall verify that the subsystem requirements have been met.

1. Requirements

The requirements of the checkout period are to verify that the seismic trip system operates reliably within the set point limit of  $.01g \pm 5\%$  at 4 Hz while installed in the operating environment. In order to accomplish this, the following observations shall be made.

- a. Test the stability of the trip set point by measuring it with the field calibrator. These measurements shall be made at discrete times over a minimum of a four-week period.
- b. Operations shall note the presence of spurious trips from on-site occurrences.

I. C. 1. Requirements

- c. The effects of a power supply failure shall be tested.  
(The seismic trigger should operate on battery power, and the trip circuits should trip.)
- d. Observe the operation of the system with respect to voltage, frequency, and humidity conditions.

2. Drawings and Instructions

706E305 - Reactor Control.

Operating instructions for SP-1 Seismic Power Supply.

Operating instructions for TS-3 Triaxial Seismic Switch.

Operating instructions for Model FC-1 Field Calibrator.

3. Initial Turn-On

If the specified response on any of the following steps does not occur, correct the situation before continuing the checkout.

- a. Connect battery terminals inside seismic power supplies (SP-1).
- b. Apply 115 VAC power to SP-1 seismic power supplies. Pilot lights on front panel of seismic power supplies should be on.
- c. Push battery test switch down to test battery. Battery voltage should be at least 11.5 volts. If battery voltage is less than 11.5 volts, allow battery to charge.
- d. Push "Test" switch on each seismic power supply panel. Yellow light should come on and stay on.
- e. After 10 to 15 seconds, push "Reset" switch on each seismic power supply panel. Yellow light should go off.

3. Initial Turn-On - continued

- f. If the correct response for either step d. or e. does not occur, correct the problem and retest before proceeding.
- g. Relay 16-16 and relay 16-23 should be energized.
- h. Press the test switch on seismic switch power supply panel #1 and check to see that relay 16-16 is deenergized and relay 16-23 is still energized.
- i. Press the test switch on seismic power supply panel #2 and check to see that relay 16-23 is deenergized.
- j. Press reset switches on power supply #1 and power supply #2 and check that relay 16-16 and relay 16-23 are energized.
- k. Turn-On Tests Performed By \_\_\_\_\_

QA Verified By \_\_\_\_\_

Date/Time \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_



#### 4. System Calibration

System calibration shall be done by Instrument Technicians and verified by QA. Initial calibration data will be recorded below, and subsequent calibration checks will be recorded on the record data sheet.

Instruments and material required for calibration are:

FC-1 Field Calibrator

Digital Voltmeter

Operating Instructions for FC-1 Field Calibrator

Operating Instructions for TS-3 Triaxial Seismic Switch

Rod, 0.047" diameter x 2" long (or paper clip)

Small Screwdriver or Trimpot Tool

Stopwatch

The calibration procedure beginning with Trigger #1 located within the containment is as follows:

- a. On the two horizontal sensors, check to see that the moving coil mass is centered between the magnet pole and the coil stop. (Refer to Figure 2 in the TS-3 Operating Instructions.) If the mass is not centered, rotate the pivot rod with the 0.047 rod (or paper clip) until the mass is centered. Ensure the vertical moving coil is not on the bottom and is in the approximate center.
- b. Turn on switch of FC-1 field calibrator, and measure BATT voltage with digital voltmeter and record.

$E_b$  (BATT voltage) = \_\_\_\_\_



I. C. 4. System Calibration - continued

- c. Calculate sensor pot setting by:

$$R_s = (415)(E_b) \text{ where } (E_b = \text{BATT voltage})$$

$$R_s = \underline{\hspace{2cm}}$$

- d. Set sensor pot to value of  $R_s$  (first three digits).
- e. Set ACCELERATION pot to 0.
- f. Refer to sensor location sketch for steps i. through m.
- g. Connect digital voltmeter between terminals 5(+) and 4(-) on terminal board near vertical sensor. Reading should be approximately 12 VDC.
- h. Lightly move each of the coils in both directions and observe the voltmeter go to zero.
- i. Connect leads from output binding posts of FC-1 across the 82 ohm damping resistor on the vertical sensor of TS-3 trigger. (See sketch in FC-1 instructions.) Observe polarity shown in the sketch.
- j. Increase ACCELERATION pot slowly until digital voltmeter reading drops to a low value. Record pot reading.  $V_{11} = \underline{\hspace{2cm}}$ .  
(For 0.01g, reading on pot should be 1 in window and 0 on the dial.)
- k. Turn ACCELERATION pot to zero, and push the reset button on the SP-1 panel after approximately 10 seconds.
- l. Reverse leads across the 82 ohm resistor. Repeat steps j. and k., and record results.  $V_{11} (\text{Rev.}) = \underline{\hspace{2cm}}$ .
- m. Both readings should read  $0.01g \pm 5\%$ . If not, adjust proper sensitivity pot to obtain acceleration indication of  $0.01g \pm 5\%$ .

I. C. 4. System Calibration - continued

- n. Repeat steps i. through m. for H-1 (transverse) sensor and for H-2 (longitudinal) sensor. Record data.

H11 = \_\_\_\_\_. H12 = \_\_\_\_\_.

H11 (Rev.) = \_\_\_\_\_. H12 (Rev.) = \_\_\_\_\_.

- o. Check the reset delay time by pressing the test switch on the SP-1 panel, and begin timing the reset when the alarm light goes on. Within a few seconds, press the reset button and hold it down until the light goes off. The elapsed time is the reset time. Record T = \_\_\_\_\_. If the reset time does not fall between 8 and 12 seconds, adjust the time delay pots on the three sensors until it falls within the prescribed range.

- p. Repeat this procedure for seismic trigger #2. Record data.

Trigger #2

$E_b$  = \_\_\_\_\_.

$R_s$  = \_\_\_\_\_.

V21 = \_\_\_\_\_.

V21(Rev.) = \_\_\_\_\_.

H21 = \_\_\_\_\_.

H21(Rev.) = \_\_\_\_\_.

H22 = \_\_\_\_\_.

H22(Rev.) = \_\_\_\_\_.

T = \_\_\_\_\_.

Calibration Performed By \_\_\_\_\_

QA Verified By \_\_\_\_\_

Date/Time \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

I. C. 5. Periodic Check

During the operational verification period, the following checks shall be made.

a. Daily checks - by Operations.

On SP-1 panel - AC on light should be on.

- Press BATT switch and battery voltage should be at least 11.5 VDC.

Record spurious trips or unusual events on data sheet.

b. Weekly checks - by Operations and Instrumentation.

On SP-1 panel - Press test switches for channels 1 and 2.

A scram indicator should be obtained on each of the seismic switch power supplies.

On TS-3 triggers - Perform calibration test described in paragraph 4. above, except DO NOT CHANGE SETTINGS of any pots in the TS-3 switch. Record data on data sheet. Blow on each sensor mass and check that trigger trips.

WEEKLY DATA SHEET FOR  
SEISMIC TRIP OPERATIONAL TESTS

Fiscal Week \_\_\_\_\_

DAILY CHECKS

SP-1 Panel

AC On

BATT Volts

Operator's  
Initials

| Mon | Tues | Wed | Thur | Fri | Sat | Sun |
|-----|------|-----|------|-----|-----|-----|
|     |      |     |      |     |     |     |
|     |      |     |      |     |     |     |
|     |      |     |      |     |     |     |

Test Performed By: \_\_\_\_\_

COMMENTS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

WEEKLY CHECKS

TS-3 Triggers Calibration Check

Trigger #1

$E_b =$  \_\_\_\_\_

$R_s =$  \_\_\_\_\_

$V_{11} =$  \_\_\_\_\_

$V_{11} \text{ (Rev)} =$  \_\_\_\_\_

$H_{11} =$  \_\_\_\_\_

$H_{11} \text{ (Rev)} =$  \_\_\_\_\_

$H_{12} =$  \_\_\_\_\_

$H_{12} \text{ (Rev)} =$  \_\_\_\_\_

Mass Trip Check \_\_\_\_\_

Acceleration Pot Setting \_\_\_\_\_

Trigger #2

$E_b =$  \_\_\_\_\_

$R_s =$  \_\_\_\_\_

$V_{21} =$  \_\_\_\_\_

$V_{21} \text{ (Rev)} =$  \_\_\_\_\_

$H_{21} =$  \_\_\_\_\_

$H_{21} \text{ (Rev)} =$  \_\_\_\_\_

$H_{22} =$  \_\_\_\_\_

$H_{22} \text{ (Rev)} =$  \_\_\_\_\_

Mass Trip Check \_\_\_\_\_

Acceleration Pot Setting \_\_\_\_\_

Performed By: \_\_\_\_\_

Verified By: \_\_\_\_\_