



9250 Brown Deer Road ■ San Diego, California 92121 ■ 619-450-0085 ■ Telex: 211063

via fax 817-897-6482

15 July 1992

Texas Utilities Electric  
Comanche Peak Steam Electric Station  
P.M. Road 56  
Glen Rose, Texas 76043  
Attn: Ron Tomlinson

Subject: Deviation in Elgar Inverters

- Reference:
- 1) Docket Nos. ~~50-445~~ and 50-446
  - 2) Stone & Webster letter WBS-BFC5C, dated 08 January 1992
  - 3) Elgar letter dated 20 March 1992
  - 4) Elgar letter dated 13 January 1992
  - 5) Elgar letter dated 25 March 1992
  - 6) Elgar ECN 8208, dated 10 April 1992
  - 7) Elgar Quality Alert

92 AUG -6 10:18

Dear Mr. Tomlinson,

After extensive review of the Elgar participation in the bring up of the Elgar Inverters, Model 103-1-132 for Unit 2, the following is the summation of causes and corrective actions taken for the specific deviations noted. It should be first noted that the Inverters were first supplied to Texas Utilities in the 1981 time frame. All of the noted deviations of operation were recorded in the fall of 1991 and subsequent. It should also be noted that none of the deviations (ref. 1) caused a safety related concern, as the units are not currently in operation, in a safety related application.

The first noted deviation was the blowing of the F1, fuse during start up of the Inverters. This was due to improper operation of the timing circuit for SCR firing on card J7, Elgar Part Number 628-126-42. This was first reported in September 1991, and the root cause not determined until Elgar went to TUE in February 1992. It was determined that the U103, C101/C102 circuit had a tolerance band issue. It was only evident on spare PCB's supplied after delivery of the Inverters, presumably to replace PCB's taken out to assist in the start up of Unit 1. This was corrected by Elgar ECN 8162, bringing the PCB up to revision L. The failure analysis was submitted and approved by Stone & Webster on behalf of TUE (ref. 2). This appears to be a generic problem with current production of these PCB's, so all affected sites have been notified by letter from Elgar (ref. 3). All PCB's made available to Elgar were reworked and fully tested at Elgar then returned to TUE.

The second noted deviation was lack of record of notification of TUE of a change to card J3 Elgar P/N 643-119-40. No record is retrievable at Elgar or TUE of the notification, and it is unclear

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PDR ADOCK 05000445  
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Fax Numbers

619-458-0267 (Sales) ■ 619-458-0257 (Admin.) ■ 619-458-0225 (Purch) ■ 619-458-0231 (Finance)

whether notification was required. Elgar did issue a notification to all affected sites currently holding the subject PCB (ref. 4). Current events and notifications show the systems are in place to inform all required sites of any deviations. All PCB's were reworked on site.

The next noted deviation was the high inrush current to the Inverter. This was traced to the Charger Gate Drive PCB. The PCB in question was supplied as a spare board. All the originally supplied boards of this type functioned correctly. The root cause was the transformers on the PCB were not wound in a fashion which eliminated the noise from one secondary winding to the other. The secondaries were wound bifilar (on top of each other, at the same time) rather than concentric (one after the other, separated by insulation). This caused noise between the secondaries and allowed the SCR's to fire prematurely. A quality Alert (ref 7) was issued to the Transformer Department reminding them not to wind transformers bifilar, unless specifically required by the drawing. Also, all affected sites were notified to have any PCB's which were not original equipment be verified by test or returned to Elgar, for test and rework if necessary. All PCB's on site which were made available to Elgar were reworked to the latest revision.

The next noted deficiency was that the J2 PCB, Elgar part number 628-134-40, was noted as missing a resistor, R144. An Elgar ECN number 1899 added the resistor, but when the ECN was incorporated into the drawing the R144 was left off the parts list. This allowed Elgar to build and inspect the PCB without noticing the missing resistor. This again was the result of an ECN after shipment of the original units. This has been corrected by a later ECN bringing the revision of a correct PCB to revision H. All applicable sites were notified of the error (example ref. 5). All PCB's on site available to Elgar were reworked to the latest revision.

A workmanship error was noted on the crimps of four (4) pins in Inverter CP2-ECIVEC-04. It is unclear when the discrepancy happened, as the units had been delivered in 1981 and many parts were removed by TUE personnel to get Unit 1 power supplies up and running. There was no documentation available to Elgar to determine what was removed or replaced from the time of delivery from Elgar. This was verified to be the only unit, of all the Inverters on site, inspected by Elgar, where crimps were found to be discrepant. Proper tooling and new parts were provided to the Elgar representatives on site and the crimps properly were reworked.

The next noted deficiency was the requirement to 'field select' a value for resistors R3 and R4 on Elgar assemblies 628-432-41, 644-

305-40 and 644-311-40. The resistor installed at Elgar worked for the load used to test the operation of the circuit at Elgar, but with the TUE load, a different value was required. The correct values were calculated and added by Elgar ECN 8208 (ref 6) to the noted assemblies, to be the Elgar installed values. This will assure that any spare PCB's supplied to TUE will have the correct value for the TUE's load installed, at Elgar prior to delivery.

During current start up testing, a wiring error to transformer A2-T3 was noted. Again Elgar believes that the wiring error may have been caused by rework performed at TUE after delivery from Elgar. The units passed all tests at Elgar, including a 100 hour burn in test prior to delivery to TUE in 1981. This testing would have caught this type of wiring error. This wiring error was corrected and the unit operated per specification.

The last noted deficiency was cracked solder joint on a terminal block on PCB 634-105-40. After further investigation two other PCB's of a similar design had cracked solder joints, Elgar part numbers 643-124-41 and 643-125-40. These PCB's are single sided without plated thru holes. When the terminal block screws are tightened beyond a certain torque, the solder is subjected to an adverse stress. This over time will crack the solder joint. It was recommended to TUE, and accomplished by the Elgar representatives on site, to check all three PCB's and resolder any joints, showing sign of stress or cracking after the screws have been tightened. This would alleviate the residual stress left on the solder joint due to the tightening. This was the design which went through all the environmental and seismic testing without failure. Due to this information, a letter has been generated to all sites which have this type of PCB design, requesting them to inspect all of the noted types of PCB's. Any sites with concerns have been told that the current Elgar design utilizes a feed thru hole with pads on both sides, and they can procure new PCB's, if they desire. This will provide additional support to the terminal block pin.

While Elgar was on site assisting TUE/Bechtel in the start up effort from December 1991 to February 1992, many deficiencies were noted in the trouble shooting techniques utilized during start up of the Unit 2 Inverters.


One of the specific cases was the use of a piece of aluminum as a fuse, to replace a fuse which kept blowing. This allowed the continued trouble shooting, while possibly adversely affecting the unit. The fuse blowing problem should have been addressed technically, not by replacing the fuse with the aluminum block and possibly damaging the unit. Other areas of concern were the lack of proper ESD practices, and the inability of the Elgar Technicians to contribute to the trouble shooting, due to the inability to be

hands on. This was all brought up to the attention of TUE management. This resulted in a much more cooperative effort between Elgar and TUE, resulting in the completion of returning the units to an operational state.

Also the lack of documentation of what was removed and replaced in the units over the 10 years TUE had the units prior to this start up effort is of concern. It is therefore Elgar's position that we will only warrant the work we performed and documented, and not the units as a whole. All of Elgar's work is documented and available on site at TUE, and at Elgar.

Elgar will continue to support Texas Utilities in their effort to complete the start-up of Unit 2 in any way we can. Feel free to contact me at (619) 458-0247 if we can be of assistance.

Sincerely,



Timothy Roth  
Manager Quality Assurance/Customer Service

attachments

cc R. Daniel  
NRC - Document Control Desk

# STONE & WEBSTER ENGINEERING CORPORATION

## COMANCHE PEAK STEAM ELECTRIC STATION

P.O. BOX 1002, FARM ROAD 56

GLEN ROSE, TEXAS 76043



BOSTON  
CHERRY HILL, N.J.  
DENVER  
HOUSTON  
NEW YORK  
DALLAS  
PORTLAND, OR  
RICHLAND, WA  
WASHINGTON, D.C.

CPSES- 9200592

2SWEC- 9200025

WBS-BF05C

Date: January 8, 1992

No Response Required

↓ Mr. Timothy Roth  
Elgar Corp.  
9250 Brown Deer Road  
California 92121

SUBJECT: NOTIFICATION OF DOCUMENT STATUS

- REFERENCE:
1. Purchase Order No. S0026853 7S2
  2. Specification No. 2323-ES-009, Rev. 1
  3. VL No. 7594, vendor letter for failure analysis of PCB 628-126-42 dated 01-06-92
  4. SWFC Letter #CPSES-9130470, dated 12-02-91
  5. SWEC Letter #CPSES-9200457, dated 01-06-92

Dear Mr. Roth:

By copy of this letter please be advised of the status of the following document which was submitted in accordance with the referenced purchase order.

<u>ITEM</u>	<u>VENDOR DOCUMENT NUMBER</u>	<u>SHEET</u>	<u>REV.</u>	<u>DOCUMENT TITLE DESCRIPTION</u>	<u>STATUS</u>
1	Elgar letter dated Jan. 06, 92	N/A	N/A	Vendor letter for Failure analysis of PCB 628-126-42.	1

Key to the status of documents:

1. Approved
2. Approved with Comments
3. Not Approved
4. For Information Only

2SWEC - 9200592  
CPSES - 9200025

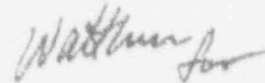
2

IMPORTANT

It is understood that the approval of the Contractor's documents whether general or detailed is a general approval only. Such approval shall not relieve the Contractor of errors, discrepancies, or omissions of detailed requirements; nor shall such approval relieve the contractor of any responsibility for the proper execution of the work or performance in accordance with the Contract Specification and Contractor Drawings.

If you have any questions, please contact Bharat Tailor at (817) 897-8500, ext. 7574. All written correspondence including document resubmittal must be addressed to:

DCC Vendor Document Group  
TU Electric  
P.O. Box 1002  
Glen Rose, Texas 76043-9990



J.E. Woods C28  
SWEC Project Engineer  
Unit 2

JLH/vw

cc:

E. Lavigne	C28
F.A. Garcia	CO7A
F.D. Stobaugh	CO7A
W. Lisneck	AP3
B.T. Thompson	CO7A
B. Tailor	AP3
CGS	EO6
VETIP Coordinator	FO4
Job Book #10-1	C28
Chrono File	C28



**ELGAR**

9250 Brown Deer Road  
 San Diego, California 92121  
 Telephone (619) 450-0085  
 Telex: 211063

20 March 1992

via fax 817-897-6482

Texas Utilities  
 Comanche Peak Steam Electric Station  
 F.M. Road 56  
 Glen Rose, Texas 76043

Subject: 10CFR21 Notification for Elgar PCB 628-126-42

Reference: Start Up of Unit 2 at Comanche Peak SES

Dear Ronnie Tomlinson:

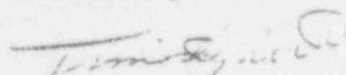
During the Start Up sequence of a unit at the referenced subject site it was determined that the subject PCB did not operate as require. This problem is only evident during Start-up sequence of the unit from an Inverter off status. If the Equipment is operating the problem does not occur.

After conclusion of a Failure Analysis on the subject PCB, it has been determined that three components on the PCB were inadequately toleranced, capacitors C101, 102 and Integrated Circuit (IC) Z103. This could allow pulse widths outside the original design intent, thus not allowing sufficient time for capacitor precharge. This could cause the Inverter fuse to fail at turn on.

Elgar has initiated ECN 8162 to change the above noted components. Elgar is recommending that all PCB's delivered after original delivery and start up be returned to Elgar for verification to Elgar Acceptance Test Procedure T28-126-42. The PCB's installed in operating units should also be verified. If they do not meet the units timing requirement, we recommend that the PCB's be brought up to the current revision level, revision L, per Elgar ECN 8162.

If you require any further information feel free to contact me at (619) 458-0247.

Sincerely,



Timothy Roth  
 Manager Quality Assurance/Customer Service

**ELGAR**

9250 Brown Deer Road  
San Diego, California 92121  
Telephone (619) 450-0085  
Telex: 211063

TECHNICAL BULLETIN

13 January 1992

Mr. Mike Cook  
TU Electric Company  
5 Miles N.W. of Glen Rose  
TX off FM 56  
Glen Rose, TX 76043

Subject: Technical Bulletin No. 2, PCB. P/N 643-119-40

Dear Mr. Cook:

The subject PCB had a change done to resistor R124 which decreased the sensitivity of the 'out of sinc' detect circuit. This change reduces the amount of false 'out of sinc' alarms. Integrated Circuit (IC) Z107 was also changed to another IC which is less sensitive to small frequency changes, thus eliminating some static transfers for units which use pin 15 of this board.

The resistor changed from Elgar part number 801-473-05 to 801-153-05. The IC went from Elgar part number 849-C40-11 to 849-C40-93. Elgar recommends that during the next service of the unit, these resistor and IC be changed. This will bring the PCB revision up to revision H or higher. Any spare PCB's should be returned to Elgar for changing of the capacitors. This can be done at a minimal charge of \$450.00 per PCB.

If you require any further information feel free to contact me at (619) 458-0247.

Sincerely,



Timothy Roth  
Manager Quality Assurance



**ELGAR**

9250 Brown Deer Road  
San Diego, California 92121  
Telephone (619) 450-0085  
Telex 211063

25 March 1992

via fax 817-897-6482

Texas Utilities  
Comanche Peak Steam Electric Station  
F.M. Road 56  
Glen Rose, Texas 76043

Subject: TUE 10CFR21 notification of assembly error on  
Elgar PCB 628-134-40

Reference: Elgar trip to TUE Comanche Peak SES, 9 March 1992

Dear Mr. Tomlinson,

After review of the trip report concerning the referenced trip, Elgar has evaluated the missing R144 and determined that it is reportable under 10CFR21. It was found that some of the subject PCB's were missing the resistor R144. It was found that ECN 1899 to the subject print was not fully incorporated. This change added resistor R144. The resistor was never added to the parts list or the assembly print. Therefore the resistor was not put on the last PCB's delivered to TUE.

Testing at Elgar utilizes a voltage source, like the actual unit, to set the low AC current set point. This will not verify the presence of R144. The error in the process was the incorrect incorporation of the above noted ECN.

The print has been corrected, and forwarded to TUE site personnel.

Elgar recommends that all of the subject PCB's be verified for the presence of this resistor. Any found without the resistor need to have them added.

If you require any further information feel free to contact me at (619) 458-0247

Sincerely,



Timothy Roth  
Manager Quality Assurance/Customer Service

**ELGAR**

**ENGINEERING CHANGE NOTICE**

ECN NO. **8208**

PREPARED BY *Rob FARRIS*

DATE *3/27/92*

SHT. 1 OF 14

ECN TITLE *IN UP CURRENT CT BURDEN RESISTOR*

DIV *NUCLEAR*

PRODUCTS AFFECTED				PRODUCTS AFFECTED			
MODEL	SERIAL	MODEL	SERIAL	TYPE	DOCUMENT NUMBER	REVISION	INCORPORATED
						WAS IS	INIT DATE
<i>UPS 103-1-132</i>	<i>176, 177</i>			<i>ASV</i>	<i>628-432-31</i>	<i>B C</i>	
				<i>"</i>	<i>644-305-40</i>	<i>C D</i>	
				<i>"</i>	<i>644-311-40</i>	<i>C D</i>	
CHANGE TYPE		ECSRS RESOLVED					
<input type="checkbox"/> PROD. IMPROVEMENT <input type="checkbox"/> RELIABILITY <input type="checkbox"/> COST REDUCTION <input type="checkbox"/> SAFETY/UL <input checked="" type="checkbox"/> REFLECT AS BUILT <input checked="" type="checkbox"/> DOC ERROR <input type="checkbox"/> DESIGN ERROR <input type="checkbox"/> OTHER _____		CHANGE CATEGORY		<i>SLH</i>	<i>528-428-61</i>	<i>F G</i>	
		<input type="checkbox"/> MANDATORY IMPROVEMENT <input type="checkbox"/> DOCUMENT ONLY <input type="checkbox"/> COMPUTER ONLY <input type="checkbox"/> NUCLEAR		<i>"</i>	<i>544-315-60</i>	<i>D E</i>	
				<i>"</i>	<i>544-306-60</i>	<i>E F</i>	

STOCK DISPOSITION  USE  REWORK  SCRAP  SEE ATTACHED

REQUESTED BY *CUSTOMER* DATE *3/27/92* RESP. ENGR *R. Farris* DATE *4/1/92* DEPT. HEAD *Tom [Signature]* DATE *4/10/92* CONF. CONT. *[Signature]* DATE *4/10/92*

DESCRIPTION OF PROBLEM

*CURRENT RESISTOR SUPPLIED FOR CT DOES NOT ADEQUATELY LIMIT CIRCUIT VOLTAGE OR AMPS REQUIRED TO BE DISAPPAITED FROM LOAD*

**CONTROLLED PRODUCT**  
**NUCLEAR**

DESCRIPTION OF CHANGE

*REVISE RESISTOR VALUE AND WATTAGE FROM:*

*R3 804-430-05 43Ω, 2W TO: 807-201-05 200Ω, 5W*  
*R4 NO LISTING TO: 807-152-05 1.5KΩ, 5W*

*NOTE: DRAWING TO REMAIN A "FSV" WITH PART SPECIFIED AS A PART LIST COMPONENT SUBJECT TO CHANGE AS REQUIRED.*  
*REMARKS: DRAWINGS PER REDLINES (TYPICAL)*

EVALUATION

*170:214 [Redacted] 170AIN = .170AOUT 1000:1 5VOLTS*  
*R3-MAX CURRENT @ 100AMPS, MAX VOLTAGE @ 15VOLTS DC ON PCB TRIP @ 200% LOAD OR 238 ADC (80% EFF) ≈ .238AMPS @ 5VOLTS = 1.2W*  
*R4-MAX CURRENT @ 140AMPS, MAX VOLTAGE @ 15VOLTS DC ON PCB TRIP @ 165% LOAD ≈ .140AMPS @ 5VOLTS = .7W*

CCS APPROVALS  APPROVE  REJECT  ON HOLD PENDING

MAKP.	DATE	QA	DATE	CONF. CONT.	DATE	EFFECTIVITY
<i>Rob Farris</i>	<i>4-10-92</i>	<i>[Signature]</i>	<i>4/10/92</i>	<i>[Signature]</i>	<i>4/10/92</i>	
MATERIALS	DATE	CUST SERV	DATE	NUCLEAR ENG.	DATE	
<i>[Signature]</i>	<i>4/10/92</i>	<i>[Signature]</i>	<i>4/10/92</i>	<i>[Signature]</i>	<i>4/10/92</i>	

# Quality Alert

No. 62A

\*\*CORRECTED COPY\*\*

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**ELGAR** Internal  
Correspondence

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To: N. Nguyen, S. Doa

From: T. Roth *TR*

Subject: 991-052-90 transformer

Date: 03/19/92

Problem : Some of these transformers have been found to have the secondaries wound bifilar. The print requires them to be wound concentric. It was found out that the practice in the magnetics department was to wind multiple secondaries bifilar, if the turns ratio/inductance are the same. This may induce noise in the output from the secondary.

Action:

Production: Build in accordance with the print, and do not wind any multiple secondary windings bifilar.

In-Process Inspection: Verify all subject and other transformer secondaries are wound concentric. This can be accomplished by a simple capacitance check between the secondary windings.

cc: P. Kelly (Supervisor Magnetics)  
J. Yee (Manager Production)  
QA Personnel