*Union Electric*

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February 21, 2001

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
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Washington, DC 20555-0001

Gentlemen:

ULNRC-04393

**DOCKET NUMBER 50-483**
**UNION ELECTRIC COMPANY**
**CALLAWAY PLANT**
**"RESPONSE TO NRC REVIEWER TELECON QUESTIONS REGARDING INSTALLATION OF AUTOMATIC LOAD TAP CHANGING TRANSFORMERS TO PROVIDE OFFSITE POWER TO THE SAFETY RELATED ELECTRICAL BUSSES"**

(References: 1. ULNRC 04353, dated January 18, 2001
2. ULNRC-04239, (FSAR Update), dated May 1, 2000
3. ULNRC-04220, dated April 17, 1999)

This letter provides the responses to the reviewers' questions pertaining to Reference 1, as discussed via telecons with the reviewers on February 15 and February 21, 2001. Attachment 1 is the required affidavit, Attachment 2 provides the responses to the reviewers' questions, the enclosure is the transformer nameplate drawing provided in response to question number four of Attachment 2. Information on this drawing is typical for both transformers.

Union Electric has reviewed the No Significant Hazards Determination provided in Reference 1, Attachment 2, Section 5.1 and determined there is no impact or revision necessary. Therefore, the conclusion of the No Significant Hazards Determination is unchanged. The proposed FSAR and T/S Bases changes included in Reference 1, Attachments 3 and 4 respectively are also unchanged.

A001

If you should have further questions on the above, attached, or Reference 1 please contact Dave Shafer at (314) 554-3104 or Walter Muskopf at (573) 676-4327.

Very truly yours,

J. D. Blosser
Manager, Operations Support

JDB/WPM/mlo

Attachments: 1) Affidavit
2) Responses to Reviewer Questions

Enclosure: XNB02 LTC Transformer Nameplate Drawing (Typical for XNB01)

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STATE OF MISSOURI )
) S S
CITY OF ST. LOUIS )

John D. Blosser, of lawful age, being first duly sworn upon oath says that he is Manager, Operations Support for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By J Blosser
John D. Blosser
Manager, Operations Support

SUBSCRIBED and sworn to before me this 21st day of February, 2001.

Melissa L. Orr

MELISSA L. ORR
Notary Public - Notary Seal
STATE OF MISSOURI
City of St. Louis
My Commission Expires: June 23, 2003

## RESPONSES TO REVIEWER QUESTIONS

Reviewer Question 1:
Your amendment request states that only transformer XNB02 is required to be included in the SBO program. It further states that replacement transformer XNB01 is associated with train "A" and therefore does not support nor is required to be classified as SBO equipment. It also speaks to an "SBO classification" for replacement transformer XNB02 and its associated control equipment. Please clarify what distinguishes a train that is the "defined SBO train" (train "B") from one that is not the defined SBO train (train "A"). Also, what are the attributes of an "SBO classification;" and what does that mean in terms of replacement transformer XNB02 and its associated control equipment capabilities, versus the capabilities of replacement transformer XNB01 and its associated control equipment which do not have an SBO classification?

AmerenUE Response 1:
The following is a revised section 4.1.2 of Attachment 2 of the license amendment request dated January 18, 2001 (ULNRC - 04353) that clarifies the SBO information. It should be noted the original evaluations performed in support of 10 CFR 50.63 implementation did not identify any plant modifications as required by 10 CFR 50.63 (c)(2)(iii). The replacement of the ESF transformers does not include any specific equipment requirements to meet 10 CFR 50.63. The information is being submitted to demonstrate continued compliance with 10 CFR 50.63 with the new transformers as stated in Section 5.2 of the amendment request.

> The new replacement transformers for XNB01 and XNB02 are non-safety related and will be connected to non-safety related capacitor banks NB03 and NB04 using manual full load break switches. The ESF transformers provide the ability to restore the preferred offsite power sources (i.e., SBO AC Power Restoration). AmerenUE evaluations performed to establish compliance with 10CFR50.63 and Reg. Guide 1.155 Appendix A (QA Guidance for Non-Safety Systems and Equipment) determined that only transformer XNB02 was required to be included in the Graded QA SBO program. The new transformer and associated control equipment will retain this SBO classification. The additional small load placed on station blackout battery PK12 by XNB02 and NB04 will not adversely impact the battery's ability to fulfill its station blackout function.

The replacement XNB01 & XNB02 transformers and associated controls are identical and have the same capabilities. Either source is sufficient for restoration of off site power to terminate an SBO event. AmerenUE evaluations for the SBO Graded QA Program controls determined that only one of the two available independent sources of offsite power to the ESF transformers needed to be classified as SBO related. This was based upon not having to consider single failure criteria (ref. NUMARC 87-00 question and answer guidance for section 2 question # 8) for these available redundant sources of offsite power to the ESF transformers. Each ESF transformer has the capability to supply power to both safety train buses (NB01 and NB02). XNB01 and XNB02 transformers have the same preventative maintenance activities and schedules. Inclusion of only XNB02 transformer in the SBO Graded QA Program provides compliance with Reg. Guide 1.155 Appendix A while minimizing the implementation expense of this SBO Graded QA Program.

Reviewer Question 2:
The amendment request states that the additional load placed on station blackout battery PK12 by XNB02 and NB04 will not adversely impact the battery's ability to fulfill its station blackout function. What are the additional loads, and what is the additional current demand placed on the battery? Has the battery sizing calculation been recalculated to include the new loads? Will replacement transformer XNB01 and NB03 result in additional load placed on their associated battery? Explain.

AmerenUE Response 2:
The current load on PK12 from the existing transformer is listed as 0.27 amps. This load is from the annunciator and associated auxiliary relays. The new transformer will also use DC power for annunciators and auxiliary relays. The total new load with all annunciators and auxiliary relays actuated will be 0.48 amps. The PK12 battery has a 17% reserve capacity after allowing a 10% derate for temperature and a 25% derate for aging. The addition if 0.21 amps of load on the PK12 battery is insignificant and will have no adverse effects on the capacity of the battery to support SBO requirements. The load addition has been reviewed to be insignificant and will be incorporated into the next revision of the battery sizing calculation. The replacement of XNB01 will result in a similar increase in loading for the associated battery group.

Reviewer Question 3:
With regard to the fire protection design the amendment request states that the new transformer's size and oil volume affects the physical separation design. It states that the transformer oil volume is increasing approximately 2600 gallons and the physical outline is increasing. It states that the larger transformer outline requires a revision to the fire protection deluge system, but its not clear what those specific changes are. Therefore its not clear how the conclusion is drawn that the oil will be contained by the pit even with the additional water from two transformer water spray systems operating for ten minutes. Please provide some background on what properties of the deluge system are being changed, in order that we can verify your conclusion that the change does not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire, consistent with the Callaway Plant License Condition C(5)(d).

Ameren UE Response 3:
The new ESF transformers are substantially larger than the old transformers. The sprinkler system had to be redesigned to cover the full surface area of the new transformers. The new water spray system has a higher required flow rate in an effort to maintain the density of the water spray coverage on the new transformers. Due to the higher flow of firewater, the pit drainage system is being modified to drain off excess water. The pits under the transformers have piping in the bottom to allow water to drain to an additional pit. Since the oil is lighter than water, only water will drain through the piping at the bottom. The water then drains from the top of the additional pit to a "dry" pit. Once the "dry" pit is filled with water, it will overflow into the drainage ditch. The pits beneath the transformers will contain the entire volume of transformer oil and will drain the water at a rate that the pits will not overflow the top of the curb.

Reviewer Question 4:
The amendment request states that the new transformers meet the electrical design requirements of the original transformers. [1] Is the auto load tap changer portion of the new transformers capable of handling the same inrush currents while changing taps? [2] Is the tap changing portion of the design more limiting than the transformer portion in terms of load carrying and inrush capability while changing taps?

AmerenUE Response 4:
(1) Yes, the transformer equipment specification required that the transformer with tap changer is capable of switching a current of 4000 amps (at 4.16 kV) at a power factor of 0.5. This corresponds to the locked rotor current of the two largest motors (essential service water pump motors) plus two fully loaded safety divisions and design margin for load growth. Thus this provides for actual plant loading plus a design margin. The manufacturer stated that a series autotransformer is provided with the LTC. The load tap changer and regulated winding would see one third of the secondary load current. A drawing is provided (enclosure) to show the transformer windings and LTC configuration. For a 4000 amp inrush current the LTC would see 1333 amps.

(2) Yes, because the Reinhausen load tap changer is rated for 1500 amps continuous, 3000 amps short time and carries only a portion of the secondary load current.

Reviewer Question 5:
In Table 2 of the amendment request the note at the end of the table indicates that a single source line-up with one ESF transformer feeding two NB buses is allowed, but not considered OPERABLE under Line-up 4 (Auto LTCs with taps fixed, capacitor banks out of service, both ESF transformers in service). [1]Why is this the case?
[2] What indications are available to the operators to determine the functionality of the capacitor banks or LTCs?

Your amendment request states that Ameren Services Transmission Planning bi-annually calculates by load flow analysis the expected grid voltage range for peak conditions for Callaway's switchyard in accordance with 10CFR50 Appendix A GDC 17 criteria. [3] What is the current projected anticipated range of switchyard voltages and how does that compare to the voltage regulating capability of the capacitor banks and the new auto load tap changing transformers?

AmerenUE Response 5:
(1) The note pertaining to line-up 4 is clarifying that one ESF transformer feeding two safety divisions would not be allowed. Current load flow analysis shows that a line-up with one ESF transformer feeding two safety divisions without the use of the capacitor bank result in a corresponding switchyard voltage requirement that is too high to be met by the transmission system for most of the year. For this situation, it is more desirable not to enter a single source line-up.

(2) Annunciation in the Control Room is provided for functionality of the capacitor banks and load tap changing transformers. Procedures are being developed to respond to the annunciator. A general "XNB01(02) Transformer / Voltage Control Trouble" annunciator window is provided. Computer points and local annunciators provide for further identification of the trouble for the following:

Volt Control Trouble (capacitor bank PLC self test failure or capacitor protection relay unit trouble)
Cap Bank Lockout Tripped
Cap Bank Not In Auto
LTC Voltage Regulator Failure
LTC Backup Volt Regulator Operated
LTC Auto-Manual Switch Not In Auto
LTC Tank Gas Pressure High
LTC Vacuum Interrupter Failure
XNB01(2) Gas Pressure Hi
XNB01(2) Tank N2 Pressure Hi-Low
XNB01(2) Tank N2 Cylinder Pressure Low
XNB01(2) Oil Level Low
XNB01(2) Oil Level Low-Low
XNB01(2) Oil Level Temperature High
XNB01(2) Winding Temperature High
XNB01(2) Loss of Auxiliary AC power
LTC Tank Oil Level Low
LTC Tank Oil Level Critical-Low

A second main control board annunciator is provided to indicate a voltage control system freeze. This indicates that the automatic control systems are disabled and prevented from stepping on capacitor banks or changing LTC steps. This is normally used to prevent unwanted control system interaction when testing the emergency diesel generators.

(3) Line up 1 in Table 2 is verified to an established switchyard voltage range with the expected plant LOCA loading plus additional load margin. These values are specified in a Transmission Provider Agreement and are evaluated bi-annually by Ameren Services Transmission Planning. This is currently considered as the projected (anticipated) range of switchyard voltages. Transmission Planning confirms meeting the required range but does not provide the analyzed margin.

Table 2 Line-ups 2, 3 and 4 are based on additional failures of the non-safety related voltage regulation equipment that make-up the on-site portion of the off-site power sources. For planned equipment outages or identified failures, the affected off-site source(es) would be declared inoperable until a determination of operability is made. For these configurations, procedures are in place for the plant operators to revise alarm and operability limits on the control area operator's contingency analysis computer program. This program provides a load flow analysis that would predict the switchyard voltages that would occur for current grid conditions given that additional single contingencies were to occur. The control area operator would take actions as needed to provide adequate voltage or to recommend to the plant operators that the plant off-site source(es) be declared inoperable.

Reviewer Question 6:
The amendment request states that the voltage control systems function to ensure that the voltage at NB01 and NB02 is sufficient to reset the safety related degraded voltage relays and loss of voltage relays before time limits are exceeded. The degraded voltage relays have a time delay of 8 seconds. This time delay would appear to only allow the LTCs to correct a 3 % voltage change (2.5 secs first tap and 2 secs/each additional tap equates to 3 taps at 6.5 secs) before the relays time out. Is a maximum of 3% or less voltage change expected at the secondary of the replacement transformers following a plant emergency event involving the loss of the Callaway generator voltage support to the switchyard? Please describe how the transformer and capacitor control systems coordinate with the degraded voltage and loss of voltage relays during such a transient.

AmerenUE Response 6:
For the LOCA sequencer operation, the motors starting at TIME = 0 cause a voltage drop adequate to step the capacitor banks on in 120 milliseconds and in 0.5 seconds to provide a control signal to step the load tap changers. The physical movement of the tap change takes approximately two seconds. Thus, the first transformer tap change will occur at TIME = 2.5 seconds. Callaway's LTC design basis assumed a tap change every 3 seconds as a conservative assumption. At TIME = 4 seconds all motors starting at Time = 0 will be up to speed. At this time, we will have a 3% voltage correction from the capacitor banks and a 1% voltage correction from the LTC transformer. This voltage correction will be adequate to reset the degraded voltage relays prior to TIME = 5 seconds. At TIME = 5 seconds the next series of motors will start and voltage will again drop. A trip of the off-site sources from the degraded voltage relays would occur at 8 seconds if not reset. Given the conservative design assumption the tap changes will cause one percent voltage improvements at TIME = 3, 6, 9, 12, 15, 18, 21, 24 and 27 seconds as needed until voltage is recovered or the tap changer is at its maximum limit. The speed of the tap changer is determined by the LTC motor speed. This will change due to supply voltage and maintenance condition. Actual stepping should occur at TIME = 2.5, 4.5, 6.5, 8.5, 10.5, 12.5, 14.5, 16.5 and 18.5 seconds. The capacitor banks will remain on until TIME = 60 seconds. Given that the voltage is adequate the capacitors will start stepping off. The LTC transformers and capacitor banks are currently configured to provide a 12 % voltage correction that could be observed following the loss of the Callaway main generator and the addition of the accident loads.

**WAUKESHA ELECTRIC SYSTEMS** ISO 9001 CERTIFIED
P.O. BOX 268 GOLDSBORO, NC 27533

# LOAD TAP CHANGING POWER TRANSFORMER

| | | | | | |
|---|---|---|---|---|---|
| CLASS | OA/FA | 3-PHASE | 60 HZ SER. NO. | | |
| MVA | 12.00/16.00 | | CONT. TEMP. RISE | 65° C | |
| HV | 13800 DELTA | | VOLTS | BIL 110 | KV |
| LV | 4160 GrdY/2400 | | VOLTS | BIL 75 | KV |
| LV NEUTRAL | | | | BIL 75 | KV |
| IMPEDANCE [ ] % AT 13800-4160 VOLTS | | | | AND 12.00 | MVA |

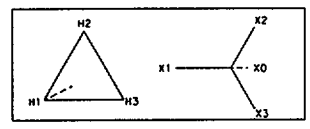
DESIGN SOUND LEVEL AT 12.00 MVA [69] db

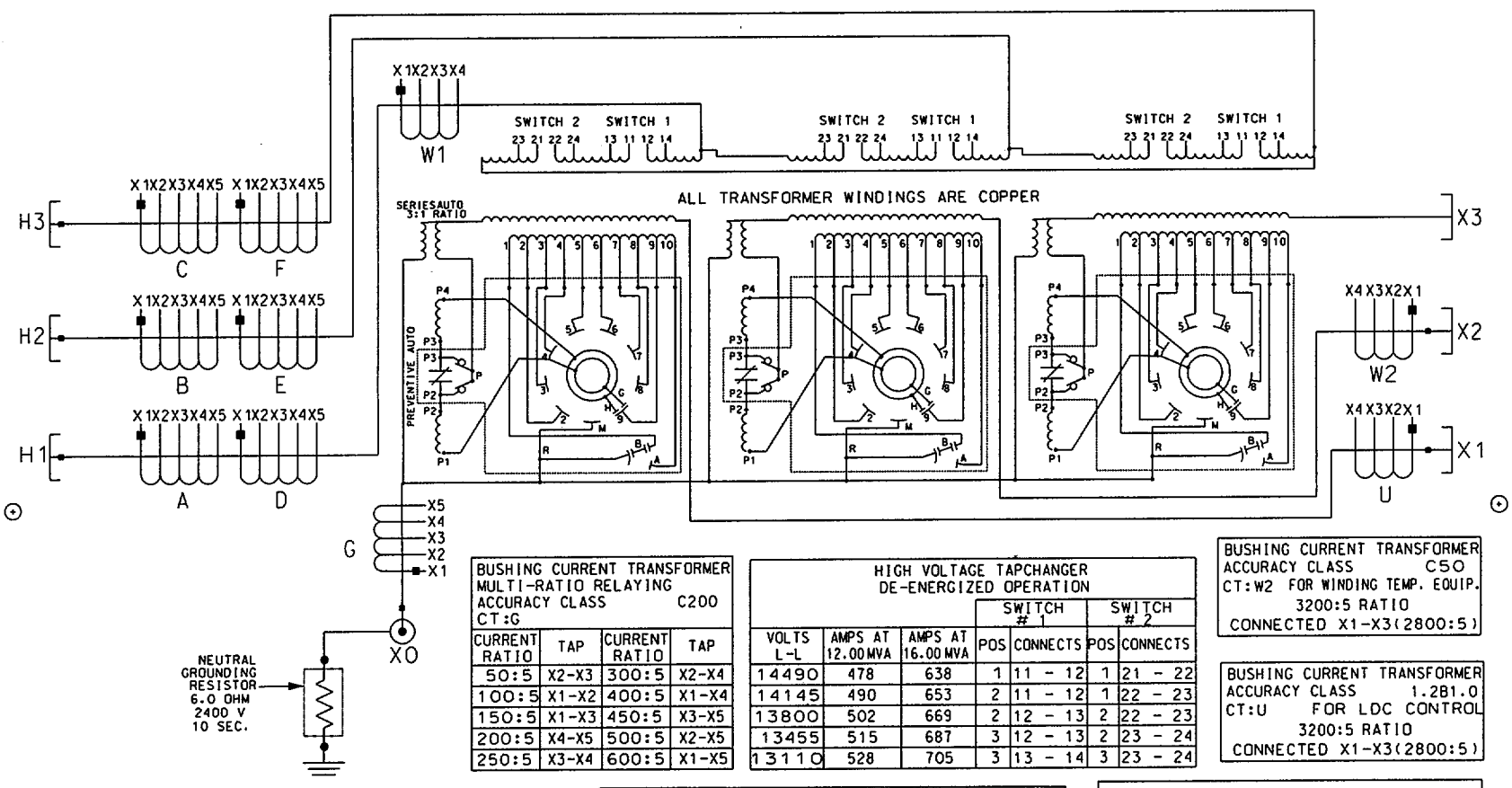
DESIGN SOUND LEVEL AT 16.00 MVA [71] db

BUSHING CURRENT TRANSFORMER
MULTI-RATIO RELAYING
ACCURACY CLASS C400
CT:A,B,C,D,E,F

| CURRENT RATIO | TAP | CURRENT RATIO | TAP |
|---|---|---|---|
| 100:5 | X2-X3 | 600:5 | X2-X4 |
| 200:5 | X1-X2 | 800:5 | X1-X4 |
| 300:5 | X1-X3 | 900:5 | X3-X5 |
| 400:5 | X4-X5 | 1000:5 | X2-X5 |
| 500:5 | X3-X4 | 1200:5 | X1-X5 |

BUSHING CURRENT TRANSFORMER
ACCURACY CLASS C50
CT:W1 FOR WINDING TEMP. EQUIP.
1300:5 RATIO
CONNECTED X2-X3(1000:5)




BUSHING CURRENT TRANSFORMER
MULTI-RATIO RELAYING
ACCURACY CLASS C200
CT:G

| CURRENT RATIO | TAP | CURRENT RATIO | TAP |
|---|---|---|---|
| 50:5 | X2-X3 | 300:5 | X2-X4 |
| 100:5 | X1-X2 | 400:5 | X1-X4 |
| 150:5 | X1-X3 | 450:5 | X3-X5 |
| 200:5 | X4-X5 | 500:5 | X2-X5 |
| 250:5 | X3-X4 | 600:5 | X1-X5 |

HIGH VOLTAGE TAPCHANGER
DE-ENERGIZED OPERATION

| VOLTS L-L | AMPS AT 12.00 MVA | AMPS AT 16.00 MVA | SWITCH #1 POS | SWITCH #1 CONNECTS | SWITCH #2 POS | SWITCH #2 CONNECTS |
|---|---|---|---|---|---|---|
| 14490 | 478 | 638 | 1 | 11 - 12 | 1 | 21 - 22 |
| 14145 | 490 | 653 | 2 | 11 - 12 | 1 | 22 - 23 |
| 13800 | 502 | 669 | 2 | 12 - 13 | 2 | 22 - 23 |
| 13455 | 515 | 687 | 3 | 12 - 13 | 2 | 23 - 24 |
| 13110 | 528 | 705 | 3 | 13 - 14 | 3 | 23 - 24 |

BUSHING CURRENT TRANSFORMER
ACCURACY CLASS C50
CT:W2 FOR WINDING TEMP. EQUIP.
3200:5 RATIO
CONNECTED X1-X3(2800:5)

BUSHING CURRENT TRANSFORMER
ACCURACY CLASS 1.2B1.0
CT:U FOR LDC CONTROL
3200:5 RATIO
CONNECTED X1-X3(2800:5)

| LOW VOLTAGE | LTC POS | TAPS CONN P4 | P1 | R | AMPS @ 12.00 MVA | AMPS @ 16.00 MVA |
|---|---|---|---|---|---|---|
| 3494 | 1 | 2 | 2 | A | 1665 | 2221 |
| 3536 | 2 | 3 | 2 | A | | |
| 3578 | 3 | 3 | 3 | A | | |
| 3619 | 4 | 4 | 3 | A | | |
| 3661 | 5 | 4 | 4 | A | | |
| 3702 | 6 | 5 | 4 | A | | |
| 3744 | 7 | 5 | 5 | A | | |
| 3786 | 8 | 6 | 5 | A | | |
| 3827 | 9 | 6 | 6 | A | | |
| 3869 | 10 | 7 | 6 | A | | |
| 3910 | 11 | 7 | 7 | A | | |
| 3952 | 12 | 8 | 7 | A | | |
| 3994 | 13 | 8 | 8 | A | | |
| 4035 | 14 | 9 | 8 | A | | |
| 4077 | 15 | 9 | 9 | A | | |
| 4118 | 16 | M | 9 | A | | |
| 4160 | 17 | M | M | B | | |

| LOW VOLTAGE | LTC POS | TAPS CONN P4 | P1 | R | AMPS @ 12.00 MVA | AMPS @ 16.00 MVA |
|---|---|---|---|---|---|---|
| 4160 | 17 | M | M | B | 1665 | 2221 |
| 4202 | 18 | 2 | M | B | 1649 | 2198 |
| 4243 | 19 | 2 | 2 | B | 1633 | 2177 |
| 4285 | 20 | 3 | 2 | B | 1617 | 2156 |
| 4326 | 21 | 3 | 3 | B | 1602 | 2135 |
| 4368 | 22 | 4 | 3 | B | 1586 | 2115 |
| 4410 | 23 | 4 | 4 | B | 1571 | 2095 |
| 4451 | 24 | 5 | 4 | B | 1557 | 2075 |
| 4493 | 25 | 5 | 5 | B | 1542 | 2056 |
| 4534 | 26 | 6 | 5 | B | 1528 | 2037 |
| 4576 | 27 | 6 | 6 | B | 1514 | 2019 |
| 4618 | 28 | 7 | 6 | B | 1500 | 2000 |
| 4659 | 29 | 7 | 7 | B | 1487 | 1983 |
| 4701 | 30 | 8 | 7 | B | 1474 | 1965 |
| 4742 | 31 | 8 | 8 | B | 1461 | 1948 |
| 4784 | 32 | 9 | 8 | B | 1448 | 1931 |
| 4826 | 33 | 9 | 9 | B | 1436 | 1914 |

OIL LEVEL BELOW TOP SURFACE OF THE HIGHEST POINT OF THE HIGHEST MANHOLE FLANGE AT 25°C IS 15.5 INCHES.

OIL LEVEL CHANGES 0.82 INCHES PER 10° C CHANGE IN OIL TEMPERATURE.

OPERATING PRESSURE OF OIL PRESERVATION SYSTEM IS 5 LBF/IN$^2$ POSITIVE TO 0.5 LBF/IN$^2$ POSITIVE.

TANK DESIGNED FOR 10 LBF/IN$^2$ POSITIVE AND FULL VACUUM FILLING.

ALTITUDE 3300 FEET ABOVE SEA LEVEL

INSTRUCTION BOOK NO.: V 2.2

| APPROXIMATE WEIGHTS | | LBS. |
|---|---|---|
| CORE & COIL (UNTANKING WEIGHT) | | 57000 |
| TANK, FITTINGS & RADIATORS | | 41280 |
| RADS. (BOLT ON) | 12684 LBS. | |
| OIL-MAIN TANK | 4145 GALS. | |
| OIL-TAPCHANGER COMPARTMENT | 345 GALS. | |
| OIL-RADIATORS | 543 GALS. | |
| OIL-TOTAL* | 4961 GALS. | 37210 |
| TOTAL WEIGHT | | 135490 |

*OIL MEETS ASTM D3487 TYPE II - INHIBITED CONTAINS NO DETECTABLE LEVEL OF PCB (LESS THAN 2PPM) AT TIME OF MANUFACTURE.

FOR STEP DOWN OPERATION

PURCHASE ORDER # [ ]

LTC TYPE [RMV-II 1500 AMP REACTIVE]

MANUFACTURER [REINHAUSEN] DESIGN NO. [5272312T00]

YEAR OF MANUFACTURE: [ ]

0.3150

21.00

0.3150

0.15625 DIA
6 HOLES

18.5000

10.25

| GM # | PO # |
|---|---|
| GM001986 | 331900 |
| GM001987 | 331900 |
| X | |
| X | |
| X | |

NOTE:
THE DESIGN IMPEDANCE IS:
5.1% @ 12.00 MVA
THE SERIAL NUMBER, YEAR OF MANUFACTURE, PO #, AND MEASURED IMPEDANCE OF EACH UNIT OF THIS DESIGN WILL BE STAMPED ON ITS NAMEPLATE PRIOR TO SHIPMENT.

MATERIAL: STAINLESS STEEL USS. STD. GA. NO. 22 (.0299)
LETTERING AND NUMERALS SUNKEN BLACK ON A POLISHED STAINLESS STEEL BACKGROUND
PAINT: SPRAYED BLACK ENAMEL
PADS: ALL RAISED PADS ARE 3/32 WIDE AND LENGTH SHOWN

| MOD. PKG. NO. | DRAWING NO. | REV. | SEQ. |
|---|---|---|---|
| 99-1038 | E-1044-00011 | N/A | 0 |

AS-BUILT

| DRAWING NO. | REV. |
|---|---|
| E-1044-00011 | N/A |

AMEREN UE
PO# 331900
CALLAWAY PLANT
GM001986

WAUKESHA ELECTRIC SYSTEMS
P.O. BOX 268 GOLDSBORO NC 27533

XNB02
LTC TRANSFORMER
NAMEPLATE DRAWING

SIZE D | FSCM NO | DWG NO A5272312P00 | SCALE 1.0 | SHEET

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

| | NAME | DATE |
|---|---|---|
| DRAWN | RON | |
| APPROVED | MBS | |

| ZONE | REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | 2 | XO CT ANNOTATION WAS CORRECTED TO G AND CT CHART ANNOTATION WAS CORRECTED TO D | 9/11/00 | MBS |
| | 1 | CT WAS ON BUSHING AND REVISED WEIGHTS 9/27/00 | | MBS |

| REV. | SEQ. | DATE |
|---|---|---|
| N/A | 0 | |
| DRAWN | CHKD. | APPD. |
| DJB | RAM | |

INITIAL ISSUE FOR CMP 99-1038C



Enclosure to: ULNRC-04393