



**CONTRACT: 34303**

**SUBSTATION CONSTRUCTION SERVICES,  
AFTON SUBSTATION**

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**REQUIREMENTS FOR PROPOSAL, REQUIREMENTS FOR BIDDING,  
AND INSTRUCTIONS TO BIDDERS**

**CONTRACT: 34303  
SUBSTATION CONSTRUCTION SERVICES,  
AFTON SUBSTATION**

**SPECIFIC REQUIREMENTS**

1. Receipt and Opening of Bids:

The Grand River Dam Authority (herein called "GRDA"), invites sealed bids on the form attached hereto. Sealed Bids for the **Contract Number 34303** will be opened at **2:00 p.m. Central Daylight Time, June 29, 2012**. Bids received more than ninety-six (96) hours excluding Saturday, Sunday and holidays before the time set for the opening of the Bids, or any Bid so received after the time set for opening of bids, shall not be considered and shall be returned unopened. **Bids shall be submitted in a sealed envelope and marked "Sealed Bid – Contract 34303 - Substation Construction Services, Afton Substation"**. Sealed bids shall be submitted to the following address:

Nita Wade; Purchasing Superintendent  
Grand River Dam Authority  
Administration Headquarters  
226 W Dwain Willis Ave.  
P.O. Box 409  
Vinita, Oklahoma 74301-0409

All bids that have been correctly submitted and duly received shall be publicly opened and read aloud at the GRDA Administration Headquarters, Vinita, Oklahoma, at the time and date of bid closing shown above.

GRDA may waive any informalities or reject any and all Bids. Bids cannot be submitted by telephone, fax machine, telegram or electronic transfer. Any Bid may be withdrawn prior to the above scheduled time for the opening of Bids or authorized postponement thereof. No Bidder may withdraw a Bid within sixty (60) days after the actual date of the opening thereof.

2. Qualifications of Bidder:

The Bidder is required to be experienced and an expert in the supply of the construction services described in the attached hereto. GRDA may make such investigations as necessary to determine the ability of the Bidder to perform the work and the Bidder shall furnish to GRDA all such information and data for this purpose as GRDA may request. GRDA reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy GRDA that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the work specified therein.

3. Addenda and Interpretations and Substitutions:

No interpretation of the meaning of the plans, specifications, or other pre-bid documents will be made to any bidder orally.

***Every request for such interpretation should be in writing addressed to Nita Wade at [nwade@grda.com](mailto:nwade@grda.com)*** To be considered, the request for interpretation must be received no later than **June 21, 2012 at 5:00 P.M.** Central Time. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be e-mailed to all prospective Bidders (at the respective addresses furnished for such purposes) not later than five (5) days prior to the date fixed for the opening of Bids. Failure of any Bidder to receive any such addendum or interpretation shall not relieve such Bidder from any obligation under this Bid as submitted. All addenda so issued shall become part of the Contract Documents.

4. Mandatory Pre-bid Conference and Job Site Examination:

***A mandatory pre-bid conference will be held at 09:00 a.m. on June 15, 2012*** at GRDA's Ecosystems & Education Center, 420 Hwy 28, Langley, Oklahoma. A job site examination will follow at the substation location in Ottawa County, Oklahoma. ***All bidders who plan to submit bids must attend the pre-bid meeting. Any additional questions concerning the bid will be accepted during the meeting.***

5. Tax Exempt Status: GRDA itself is exempt from the payment of any Sales or Use Taxes, and pursuant to 68 O.S. Sec. 1350, *et seq.*, and Sec. 1401, *et seq.*, direct vendors to the Authority are also exempt from those taxes.

6. Contract Execution: The Contract to be entered into between GRDA and the Bidder awarded the Contract is attached. The Bidder to whom the Contract is awarded will be required to execute the Contract and deliver the same, together with the required bonds, within sixty (60) days from the date that the notice of the award is given the Bidder in writing by certified mail with return receipt requested addressed to the Bidder at its place of business as stated in the Bid; and, in case of failure or neglect to do so, the Bidder will be deemed to have abandoned the Contract and thereupon the amount of the check or bond accompanying the Bid shall be due and payable thereunto to GRDA as liquidated damages for such failure or neglect and not as a forfeiture.

All Bidders must distinctly understand that all work is to be done in strict accordance with the Contract and specifications hereto attached. Intending Bidders shall examine thoroughly the form of Contract under which the work is to be done. Exceptions taken to the Contract and specifications may be cause for rejection of a bid.

7. Bid Proposal Requirements: The Bidder's proposal must provide sufficient details for GRDA to perform a complete Bid evaluation. The Bidder shall comply with all requirements in the Request for Proposal. Incomplete proposals may be cause for rejection of a Bid. GRDA shall consider Bidders' Proposal as incomplete if the Bidder submits another form of Contract in lieu of GRDA's attached contract. Bid Proposals shall become the property of the Grand River Dam Authority.

8. Bid Comparisons: In comparing bids, GRDA will take into consideration not only the prices Bid but also items such as but not limited to efficiency, reliability, durability, economy of operation and maintenance, accessibility for repairs, cost of special construction made necessary by the equipment offered, and any guarantees. GRDA reserves the right to reject any or all Bids, to waive any and all informalities, to evaluate Bids, and to disregard all nonconforming, nonresponsive, or conditional bids.
9. Applicable Laws: The Bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.
10. Site Inspection: At the time of the opening of Bids, each Bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and Contract Documents (including all addenda). The failure or omission of any Bidder to examine any form, instrument, or documents shall in no way relieve any Bidder from any obligation in respect to their Bid.
11. Submittal Documents: Any Bid submitted must contain complete and executed originals of the following documents contained in the **REQUEST FOR PROPOSAL**:
  - *PROPOSAL TO THE GRAND RIVER DAM AUTHORITY FOR CONTRACT #34303 for Substation Construction Services, Afton Substation.*

NOTE: The Bidder shall include the required Bid security (5% of bid amount).

  - *LIST OF SUBCONTRACTORS*
  - *EXCEPTION STATEMENT*
  - *CREW SCHEDULE INCLUDING RESUMES FOR PROJECT SUPERINTENDENT AND PROJECT MANAGER*
  - *UNIT AND TASK PRICE SCHEDULE*
  - *NON-COLLUSION AFFIDAVIT*
  - *BUSINESS REATIONSHIPS AFFIDAVIT*
12. Equal Opportunity Employer Statement: Any Bid submitted must include a written acknowledgement that Bidder is an Equal Opportunity Employer.
13. Bid Bond: Any Bid submitted must be accompanied by a certified check or cashiers check of the Bidder, or a bid bond duly executed by the Bidder as principal and having as surety thereon a surety company authorized and registered to do business in Oklahoma and the surety company must also be listed in Federal Circular 570. The Federal Circular may be found at [http://www.fms.treas.gov/C570/c570\\_a-z.html](http://www.fms.treas.gov/C570/c570_a-z.html). The bid bond shall be in the

amount equal to five percent (5%) of the total Bid including alternates which shall be deposited with GRDA as a guarantee. Such checks or bid bonds will be returned to all except the three lowest Bidders within three (3) days after the opening of Bids and the remaining checks, or bid bonds will be returned promptly after GRDA and the accepted Bidder have executed the Contract, or if no award has been made within sixty (60) days after the date of the opening of Bids, upon demand of the Bidder at any time thereafter so long as they have not been notified of the acceptance of their Bid.

14. Contract Bonds: The selected Bidder shall be required to provide performance, defect, and payment bonds, or irrevocable letters of credit, with terms approved by GRDA, as described in the Pro Forma Contract. Such bonds shall have surety thereon a surety company authorized and registered to do business in Oklahoma and must also be listed in Federal Circular 570. In the event Bidder proposes to use an irrevocable letter of credit, the enclosed form shall be the basis for the letter of credit.
15. Vendor Protest: Vendor protests must be submitted in writing to the Central Purchasing Unit of GRDA within 36 hours of award of contract or purchase order. Contract award is expected to be made on *July 11, 2012*.
16. Prior Experience: Any Bid submitted must contain the following documentation and demonstration of technical competence:
  - a. The Contractor must demonstrate a proven record of successfully providing electrical transmission line and/or substation construction services.
  - b. Provide a list of three recent projects with names and phone numbers of reference contacts.
17. Price Schedule: All proposals shall include a completed copy of the attached Unit and Task Price Schedule with all prices and other information inserted. This schedule is for accounting purposes only.
18. Lump Sum Bid: This project is to be a LUMP SUM bid. All work is to be performed by one Contractor unless otherwise noted. Work to be done by subcontractors should be so noted on the proposal.
19. Proposal Copies: Bidder shall submit the original proposal and three (3) complete copies of the proposal for evaluation by the GRDA evaluation committee.
20. Schedule: Time is of the essence with this Contract. Contractor shall have three-hundred sixty-five (365) calendar days, to complete the construction of the substation after receiving the official Notice to Proceed. Liquidated damages charges in the amount of \$1,000 per calendar day shall be imposed beginning at 00:01 a.m. on day number 366 and extending until the official acceptance of the completed project by GRDA, defined as the Final Completion of the Work.

## **GENERAL REQUIREMENTS**

### **Definitions used in the *Requirements for Bidding and Instructions to Bidders*:**

**“Alternate bid” (or “Alternate”)** means an amount stated in the Bid to be added to or deducted from the amount of the Base bid if the corresponding change in the work, as described in the Bidding Documents, is accepted.

**“Assistant General Manager” (or “AGM”)** means that GRDA employee who has direct supervisory responsibility over the facility or land upon which the project will be completed.

**“Base bid”** means the sum stated in the Bid for which the Bidder offers to perform the work described in the Bidding Documents as the base. Work may be added or deleted from this Base bid value for sums stated in the Alternate bids.

**“Bid”** means the cost proposal submitted by a vendor in response to a request or solicitation from the GRDA for a project described in plans and/or specification provided by GRDA.

**“Bidding Documents”** includes the Request for Proposal, the Requirements for Bidding and Instructions to bidders, the Bid forms, the Specifications, the Pro Forma Contract, and any Addenda issued prior to receipt of Bids.

**“Board of Directors”** means the rule-making authority and governing body of the Grand River Dam Authority as defined by 82 O.S. § 863.2.

**“General Manager/Chief Executive Officer”** means the GRDA employee who has oversight and managerial responsibility over all GRDA functions and is selected by the Board of Directors of the Grand River Dam Authority as authorized by 82 O.S. § 864.A.2.

**“Contract”** means any Contract, exceeding Fifty Thousand Dollars \$50,000 in amount, awarded by the GRDA for the purpose of improving, constructing, repairing, or performing maintenance on GRDA land, buildings, facilities, and equipment which is permanently affixed to the same.

**“Design consultant”** means either the architectural/engineering firm under Contract to the GRDA or an engineer employed by GRDA who is responsible for the design and construction monitoring of the construction project.

**“GRDA” or “Authority”** means the Grand River Dam Authority, a governmental agency of the State of Oklahoma, as defined by 82 O.S. § 861, *et seq.*

**“Procurement Administrator”** means the GRDA employee with direct supervisory capacity of the Procurement Unit.

**“Procurement Unit”** means the unit or department within GRDA that is responsible for administering procurement policies and procedures.

**“Retainage”** means the difference between the amount earned by the Contractor on a GRDA contract, with the work being accepted by the GRDA, and the amount paid on said Contract by the GRDA.



**“Treasurer”** means the GRDA employee who is selected by the Board of Directors of the Grand River Dam Authority as authorized by 82 O.S. § 864.A.2 to oversee and manage all fiscal and procurement functions.

**“Unit Price”** is an amount stated in the Bid as a price per unit of measurement of materials or services as described in the Bidding Documents or in the proposed Contract Documents.

### **Bid Submission**

1. **Advertised projects.** Bids must be prepared on forms provided by GRDA and in accordance with the instructions provided in the Bid package. Instructions on obtaining the Bid packages shall be in the solicitation notice. Bids cannot be submitted by telephone, fax machine, telegram, or e-mail. Bids may be delivered in person, by the U.S. Mail, or by any of the express/delivery services available during regular business hours, 8:00 AM to 4:45 PM weekdays and shall be received during a period which does not exceed ninety-six (96) hours (excluding weekends or holidays) before the scheduled Bid opening at the time and day specified in the Bid Documents. Any Bid received by GRDA or an officer or employee thereof, more than ninety-six (96) hours excluding Saturdays, Sundays and holidays before the time set for the opening of bids, or any bid so received after the time set for opening of Bids, shall not be considered by GRDA and shall be returned unopened to the bidder submitting same. **The following information should be placed on the outside of each sealed bid envelope:**
  - a. **Bidder’s name and address.**
  - b. **The notation “Sealed Bid”**
  - c. **Contract #34303**
2. **Bid envelopes.** Each envelope shall contain only one (1) Bid. Bids received after the time specified in the Bid Documents cannot be accepted. The time shall be determined by the stamp-clock on the desk of the Procurement Administrator, or designee, where all bids must be received and stamped. GRDA cannot be responsible for delay of receipt of Bids due to factors beyond the control of GRDA employees.
3. **Equal opportunity employment requirements.** GRDA is an Equal Opportunity Employer. GRDA does not discriminate in its hiring practices and expects its contractors to abide by all Federal rules and regulations on non-discrimination. All Bidders shall acknowledge in the Bidding Documents they are Equal Employment Opportunity employers. GRDA adheres to a policy which provides a drug free workplace to all of its employees. All contractors working on a GRDA facility shall comply with the policies of GRDA.
4. Each bidder shall accompany its Bid with a written statement under oath disclosing the following information:
  - a. The nature of any partnership, joint venture or other business relationships then in effect or which existed within one (1) year prior to the date of such statement with any architect, engineer or other party to the project;

- b. Any such business relationship then in effect or which existed within one (1) year prior to the date of such statement between any officer or director of the Bidding company and any officer or director of any architectural or engineering firm or other party to the project; and
  - c. The names of all persons having any such business relationships and the positions they hold with their respective companies or firms. If none of the business relationships hereinabove mentioned exist, then a statement to that effect shall accompany the Bid.
5. Each Bidder, by making a Bid, represents that:
  - a. The bidder has read and understands the Bidding Documents and the Bid is made in accordance therewith.
  - b. The Bidder has had the opportunity to visit the site, is familiar with the local conditions under which the Work is to be performed and has correlated observations with the requirements of the proposed Contract Documents.
  - c. The submitted Bid is based upon the materials, systems and equipment required by the Bidding Documents without exception.

#### **Modifications/withdrawal of Bids**

1. A Bid may not be modified, withdrawn or canceled by the Bidder after the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.
2. Withdrawn Bids may be resubmitted up to the time designated for the receipt of Bids provided they are in complete conformance with these Instructions to Bidders.
3. Bidders may withdraw, change and resubmit their Bids by appearing in person prior to the time set for the closing of the Bid period. Upon presenting proper picture identification to the Procurement Administrator or an authorized representative, the sealed Bid will be returned to the Bidder. The withdrawn Bid shall not be opened or otherwise disclosed to GRDA. A new or changed sealed Bid will be accepted until the time designated for the closing of the Bid period.
4. Bid security shall be in an amount of five percent (5%) of the total Bid including alternates as modified.

#### **Bid openings**

The Bid openings shall be open to the public and shall be held as specified in the solicitation notice. The Bids shall be opened by the Procurement Administrator or designee in the following manner and recorded by an assistant. Bids may be examined by the public after the Bid opening on request to the Procurement Administrator.

1. The Bidder's name, city, and price shall be announced.

2. The Bid shall be initially reviewed for completeness and correctness. Any of these deficiencies shall be grounds for disqualifying the bid:
  - a. Addenda must be acknowledged. This may be waived in those cases where the addendum has no direct effect on the proposal cost.
  - b. The Bid must be signed.
  - c. The affidavits required by the Bid Documents must be present, signed and properly notarized.
3. The Bidder shall accompany the Bid with:
  - a. A certified check, cashier's check or bid bond equal to five percent (5%) of the bid, which shall be deposited with the GRDA as a guaranty; or
  - b. An irrevocable letter of credit containing terms the GRDA prescribes, issued by a financial institution insured by the Federal Deposit Insurance Corporation or the Federal Savings and Loan Insurance Corporation for the benefit of the GRDA in an amount equal to five percent (5%) of the total Bid including Alternates. The GRDA shall deposit the irrevocable letter of credit as prescribed by the GRDA Treasurer.
  - c. All equipment lists, selected materials, or other information when required by the specifications must be present.
4. The cost of republication of the notice to Bidders, actual expenses incurred by reason of the Bidder's default and the difference between the low Bid of the defaulting Bidder and the amount of the Bid of the Bidder to whom the Contract is subsequently awarded, but not to exceed the amount of the certified check, cashier's check, bid bond or irrevocable letter of credit may, at the discretion of GRDA, be forfeited to the GRDA in the event the apparently successful Bidder fails to execute the Contract or fails to provide the required bonds or irrevocable letters of credit and insurance to the GRDA.
5. The GRDA Treasurer shall return a certified or cashier's check, bid bond, or irrevocable letter of credit to the successful Bidder on execution and delivery of the Contract and required bonds or irrevocable letters of credit and insurance. Checks of unsuccessful Bidders shall be returned to them in accordance with the terms of the Bid solicitation.
6. Nothing contained herein shall be construed so as to prevent the GRDA or the courts from exonerating the Bidder and other parties to the Bid security document from liability upon a timely showing that the Bidder committed what the courts have determined under the common law to be an excusable Bidding error and for that reason it would not be equitable to enforce the Bid security.

### **Bid Review and Evaluation**

1. At the conclusion of the Bid opening, the Bids will be reviewed and considered by a designee from the Procurement Unit and designee(s) of the appropriate Assistant General Manager. The following items shall be reviewed:
  - a. **Surety companies.** If a surety company is used to issue bonds, the company must be registered to do business in Oklahoma and listed in Federal Circular 570. When a bond is required and the bond submitted is from a company not registered in Oklahoma or prequalified by GRDA or Oklahoma Department of Central Services as good and sufficient, or if the company is not listed in Federal Circular 570, the Bid shall be disqualified.
  - b. **Verification of Bid contents.**
    - i. Extensions on unit price calculations shall be recomputed. In case of an error, the Unit Price shall govern.

- ii. When there is a variance between the amount in words and the figures, the amount in words shall govern.
  - iii. Bid forms containing omissions, alteration of form, additions, or conditions not called for, or containing a clause in which the Bidder reserves the right to accept or reject a Contract, shall be disqualified.
  - iv. GRDA may reject a Bid as nonresponsive if the prices Bid are materially unbalanced between line items or sub line items. A Bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work; and, if there is reasonable doubt that the Bid will result in the lowest overall cost to GRDA even though it may be the low evaluated Bid; or, if it is so unbalanced as to be tantamount to allowing an advance payment.
  - v. Failure to submit unit prices for any requested work item shall cause the Bid to be disqualified.
- c. Before a Contract may be awarded to a Bidder, the Bidder's ability to perform the required work is considered. Any of the following may be grounds for disqualifying the Bidder.
  - i. More than one (1) Bid for the same work from an individual, firm, partnership, joint venture, or corporation under the same or different names.
  - ii. Evidence of collusion among Bidders, subcontractors, or material suppliers.
  - iii. Lack of responsibility as shown by past work for GRDA judged from the standpoint of workmanship and progress.
  - iv. Uncompleted work under any Contract with GRDA or any party which might hinder or prevent the prompt completion of the Contract, if awarded.
  - v. For being in arrears on existing Contracts with the State or GRDA or having defaulted on a previous Contract or failure to comply with any other just and reasonable cause.
  - vi. Certificate by the Oklahoma Human Rights Commission that the Bidder has engaged or is engaging in a discriminatory practice.
  - vii. Any violation of GRDA or Oklahoma Department of Central Services rules or other information indicating that the Bidder is no longer responsible nor qualified to do business with the State.
- d. The review/evaluation shall be completed within the greater of fifteen (15) days or the next regularly scheduled meeting of the GRDA Board of Directors after the Bid opening. The General Manager may extend the evaluation period.
- e. Decisions leading to the Contract award may be appealed in writing within five (5) working days of notice of the decision to the Procurement Administrator.
- f. All opened Bids, both successful and unsuccessful, and all Contracts and required bonds shall be placed on file and maintained in the main office of the GRDA for a period of five (5) years from the date of opening of Bids or for a period of three (3) years from the date of completion of the Contract, whichever is longer, shall be open to public inspection and shall be a matter of public record.

## **Rejection of Bids**

1. GRDA has the right to reject any or all Bids and to reject a Bid not accompanied by any required Bid security, or accompanied by other information as required by the Bidding Documents. GRDA may reject a Bid which is in any way incomplete or irregular.
2. GRDA will reject any Bid that is not signed by the authorized representative of the Bidder or does not contain the affidavit(s) included in the Bidding Documents. The affidavit must be properly signed by the Bidder, notarized and stamped by a Notary Public.
3. GRDA reserves the right to reject any or all Bids, to waive any and all informalities, to evaluate Bids, and to disregard all nonconforming, nonresponsive, or conditional Bids. GRDA reserves the right to accept or reject any Bid which, in its judgment, in is the best interest of GRDA. GRDA may consider any exceptions to the Bidding Documents as nonresponsive and cause for rejection of a Bid.

## **Contract Award**

1. Bids are normally awarded to the lowest, best, and responsible Bidder as determined by the review of the Bids. Within (5) five business days after approval by the GRDA Board of Directors, the successful Bidder shall be notified by GRDA of its selection and shall be provided copies of the Contract to execute. The GRDA Board of Directors may grant a reasonable extension of the awarding period, by formal recorded action and good cause shown. The Contractor shall be given a specific period of time, not to exceed sixty (60) days, in which to execute the Contract and obtain the necessary bonds and insurance. No Bidder shall obtain any property right in a Contract awarded under these provisions until the Contract has been fully executed by both the Bidder and the GRDA.
2. The notice to proceed, or work order, shall not be issued until the Contract has been executed by all parties. Work shall not commence until the Notice to Proceed has been received by the Contractor.
3. All bonds required herein must be issued by certified companies as identified in the U.S. Department of Treasury Federal Circular 570. This circular can be found at [http://www.fms.treas.gov/C570/c570\\_a-z.html](http://www.fms.treas.gov/C570/c570_a-z.html). The following surety bonds or Letters of Credit shall be required as provided in the Pro Forma Contract:
  - a) Performance Bond for 100% of the value of the Contract to insure completion of the Work;
  - b) Defect Bond for 100% of the value of the Contract to provide correction of defects in the construction and equipment for one year after acceptance of the Work; and
  - c) Payment Bond for 100% of the Contract to assure that GRDA is protected from the action of subcontractors, suppliers and employees for unpaid debts of the Contractor.

d) All bond submittals shall contain all terms and conditions of the bonds or applicable to the bonds.

e) Irrevocable Letters of Credit may be used as a substitute for the bond(s) required in the Pro Forma Contract and shall be in a form and with terms acceptable to GRDA.

f) Such bonds or irrevocable letters of credit shall be valid to the end of the Base Warranty Period as defined in Article 5 of the Pro Forma Contract, whichever is sooner.

4. Insurance shall be provided as required by the Pro Forma Contract.

- End of Section -

**PROPOSAL  
TO THE  
GRAND RIVER DAM AUTHORITY  
FOR CONTRACT 34303  
SUBSTATION CONSTRUCTION SERVICES  
AFTON SUBSTATION**

MADE BY: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Business Address: Street No: \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

Telephone Number \_\_\_\_\_

Fax Number \_\_\_\_\_

E-Mail \_\_\_\_\_

The Bidder named above hereby tenders his Bid and declares that the only person or persons interested in this proposal is or are named above; that the Bid is made without collusion with any other Bidder and is in all respects without collusion or fraud. The Bidder further declares he has examined the "***Pro Forma Contract 34303 - Substation Construction Services, Afton Substation,***" the specifications and the Contract drawings referred to, and has read the REQUEST FOR PROPOSAL REQUIREMENTS FOR BIDDING AND INSTRUCTIONS TO BIDDERS; included herein and agrees to furnish all the materials, equipment, and services necessary or proper to carry out such Contract in the manner, on the terms, and under the conditions set forth therein and in the specifications, **and to accept in full payment the firm lump sum Base bid of: \$ \_\_\_\_\_.**

*(Base bid price in writing)* \_\_\_\_\_

Bid Price, including 100% of the bond coverage required under Section 5 of the Pro Forma Contract.

Accompanying this proposal is a certified check, cashier's check or bid bond in the amount of five percent (5%) of bidder's lump sum Bid Price; in the amount of: \_\_\_\_\_ Dollars (\$ \_\_\_\_\_) payable to the Grand River Dam Authority, all as called for in the REQUEST FOR PROPOSAL, and it is hereby agreed that in case of failure on the part of the undersigned to execute the Contract including delivery to GRDA of the required bond or irrevocable letter of credit for performance and warranty guarantees, within sixty (60) days from the date that notice of the acceptance of this proposal is given the undersigned in writing by certified mail with return receipt requested, the undersigned will be deemed to have abandoned the Contract, and thereupon the above five percent (5%) Bid security shall be due and payable thereunder to GRDA as liquidated damages for such failure and not as a forfeiture.

In case this proposal is accepted by GRDA, the following surety company, or bank, namely,  
\_\_\_\_\_

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has agreed to provide the required bonds or irrevocable letter of credit for performance, warranty and payment guarantees.

Note: If this Bid is made by an individual, it shall be signed with his/her usual business signature, with his/her business address and place of residence; if by a firm, the co-partnership name shall be signed by a member of the firm and the name and address of each member shall be given; if by a corporation, it shall be signed by a duly authorized officer, with the corporate name attested by the corporate seal, and the business address of the corporation shall be given.

Signed: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Date: \_\_\_\_\_

(Seal)



**SUBCONTRACTORS**

In case this proposal is accepted by GRDA, the following subcontractors will be used (if no work will be subcontracted, state "NONE"):

Subcontractor identification is for information only and award of Contract does not constitute approval of identified subcontractors nor relieve the Bidder of the responsibility for providing qualified subcontractors. If any other subcontractors are used, Contractor must obtain GRDA advanced approval in writing. Subcontractors listed for relay or hotline work shall have their capabilities and experience listed in the proposal.

Work Subcontracted

Firm Name and Address

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

**EXCEPTION STATEMENT**

This part of the proposal must be completed even if no exceptions are stated.

EXCEPTIONS (Attach additional pages if required. If no exceptions, state "NONE".)

THE OKLAHOMA SUPREME COURT HAS PROHIBITED THE INCLUSION OF ANY CLAUSE WHICH INDEMNIFIES THE CONTRACTOR. BIDS CONTAINING EXCEPTIONS RELATED TO INDEMNITY CLAUSES MAY BE REJECTED AS NON-RESPONSIVE.

_____
_____
_____
_____

## **CREW SCHEDULE**

Crew Foreman (attach experience description): \_\_\_\_\_

Crew Size: \_\_\_\_\_

Equipment: \_\_\_\_\_

Planned Work Schedule: \_\_\_\_\_ Days/Week; \_\_\_\_\_ a.m. to \_\_\_\_\_ p.m.

## **CONTRACTOR EXPERIENCE**

The Contractor shall explain and enumerate his experience in this kind of construction, including hot line work and relay work in his proposal. The evaluation of the bids will include these criteria.

The contractor shall provide information on the experience of all subcontractors in this kind of work in his proposal.

## **RATES FOR ADDITIONAL WORK**

Bidders shall submit a schedule of hourly rates for all labor and equipment anticipated for this contract to be used as a basis for pricing any additional work that may be required.

## UNIT AND TASK PRICE SCHEDULE

Task	Unit	Unit Bid Price	Total
Mobilization	LS	-	\$
Material Hauling (new)	LS	-	\$
Substation Grading	LS	-	\$
Fence Installation	FT	\$	\$
Transformer Foundations and Oil Containment Installation	LS	-	\$
Foundation Installation 161kV yard	LS	-	\$
Foundation Installation 69kV yard	LS	-	\$
Grounding Installation	LS	-	\$
New 69kV Steel Erection	LS	-	\$
New 161kV Steel Erection	LS	-	\$
Station Service steel, conduit, cable, transformers, and foundation installation	LS	-	\$
69kV Bus Installation	LS	-	\$
161kV Bus Installation	LS	-	\$
Lighting installation (including fixture, pole, conduit and cable)	LS	-	\$
Installation of Instrument Transformers (CCVT) and wave traps	LS	-	\$
Install Lightning Arresters	LS	-	\$
161kV Switch Erection and Setting	EA	\$	\$
69kV and lower Switch Erection and Setting	EA	\$	\$
Conduit and Duct installation	LS	-	\$
Control & Power Cable Installation	LS	-	\$
69kV Breaker Installation	EA	\$	\$
161kV Breaker Installation	EA	\$	\$
Relay Panel Installation	LS	-	\$
Control House repair and clean-up	LS	-	\$
Fiber relocation and installation	LS	-	\$
SWPPP activities	LS	-	\$
Installation and energizing temporary line work	LS	-	\$
Removal of temporary line work	LS	-	\$
Cut-in and Terminate 161kV and 69kV T-Lines	LS	-	\$
Material Hauling (removed)	LS	-	\$
Surface Rock	YD	\$	\$
Site Finish	LS	-	\$
Demobilization	LS	-	\$
<b>REMOVALS</b>			
Existing 69kV yard Steel and Foundation removal	LS	-	\$
Existing 161kV yard Steel and Foundation removal	LS	-	\$
Abandon conduit removal	LS	-	\$
Control & Power Cable Removal	LS	-	\$
Removal of old control panels and other control house equipment	LS	-	\$

			Total \$
			Cost of Bonds
			Lump Sum Price Including Bonds

Bidder: \_\_\_\_\_

Date: \_\_\_\_\_

By: \_\_\_\_\_  
(Signature)

Title: \_\_\_\_\_

**NON-COLLUSION AFFIDAVIT**

A. For purposes of competitive bid or contract, being of lawful age and first duly sworn on oath, I certify:

1. I am the duly authorized agent of \_\_\_\_\_,  
(Company Name)

the bidder submitting the competitive bid which is attached to this statement, for the purpose of certifying the facts pertaining to the existence of collusion among bidders and between bidders and state officials or employees, as well as facts pertaining to the giving or offering of things of value to government personnel in return for special consideration in the letting of any contract pursuant to said bid;

2. I am fully aware of the facts and circumstances surrounding the making of the bid to which this statement is attached and have been personally and directly involved in the proceedings leading to the submission of such bid; and

3. Neither the bidder, nor contractor, nor anyone subject to the bidder's or contractor's direction or control, has been a party:

- a. to any collusion among bidders in restraint of freedom of competition by agreement to bid at a fixed price or to refrain from bidding,
- b. to any collusion with any state official or employee as to quantity, quality or price in the prospective contract, or as to any other terms of such prospective contract, nor
- c. in any discussions between bidders and any state official concerning exchange of money or other thing of value for special consideration in the letting of a contract, nor, whether competitively bid or not, has paid, given or donated or agreed to pay, give or donate to any officer or employee of the State of Oklahoma any money or other thing of value, either directly or indirectly, in procuring this contract herein.

B. The contractor further certifies that no person who has been involved in any manner in the development of said contract while employed by the State of Oklahoma shall be employed to fulfill any of the services provided for under said contract.

C. If any contract pursuant to this bid is for professional services as defined in 74 O.S. § 85.2.25, and if the final product is a written proposal, report or study, the contractor further certifies that (s)he has not previously provided the state agency or any other state agency with a final product that is a substantial duplication of the final product of the proposed contract.

\_\_\_\_\_  
*Authorized Signature*

\_\_\_\_\_  
*Certified this Date*

\_\_\_\_\_  
*Printed Name*

\_\_\_\_\_  
*Title*

State of \_\_\_\_\_ County of \_\_\_\_\_

Subscribed and sworn to me this \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_\_\_\_

**Notary Seal:**

\_\_\_\_\_  
*Notary Public Signature*

My commission expires: \_\_\_\_\_

My commission number: \_\_\_\_\_





**PRO FORMA CONTRACT**

**for AFTON SUBSTATION**

**CONSTRUCTION SERVICES**

**CONTRACT # 34303**

**LAST REVISED 4-24-12**

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## APPENDIX

ATTACHMENT A – AFFIDAVIT OF NON-COLLUSION FOR PROCUREMENT OF CONTRACT  
ATTACHMENT B - CERTIFICATE OF CONTRACT COMPLETION  
ATTACHMENT C - CHANGE ORDER REQUEST



THIS CONTRACT, made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, 2012, by and between the **GRAND RIVER DAM AUTHORITY**, an agency of the State of Oklahoma, organized and existing pursuant to 82 O.S. § 861 *et seq.*, as amended, (herein "GRDA") and \_\_\_\_\_, (herein "Contractor"), incorporated in the state of \_\_\_\_\_.

WITNESSETH:

That in consideration of the mutual terms, covenants and conditions set forth, the parties agree as follows:

1. RECITALS.

1.1 GRDA has called for bids for:

**Contract No. 34303  
Afton Substation Construction Services**

called the "Project," which is to be in accordance with the plans and specifications therefor prepared by GRDA, and is further identified as all the Specifications, Contract Documents, blueprints, drawings and any addenda made a part of this Contract. Contractor's bid is incorporated into and made a part of this Contract by reference, as fully as if copied at length.

1.2 This Contract together with GRDA's Request for Proposal contains the entire agreement between the parties as to the terms and conditions governing this Contract. This Contract shall supersede any and all additional or conflicting terms and conditions submitted in the Contractor's bid, all prior agreements, warranties, commitments, representations, writings and discussions between the parties. This Contract together with all plans, and the general and technical specifications contained in GRDA's Request for Proposal and Contractor's bid shall be the entire agreement and understanding between the parties as to the technical aspects of this Contract. This Contract shall be amended or modified only by a Change Order. A copy of GRDA's Request for Proposal, including all modifications and addenda, is attached hereto, and made a part hereof. Likewise, a copy of Contractor's Bid Proposal, including all modifications, is attached hereto, and made a part hereof. In the event of inconsistency or conflict between anything contained within the provisions of this Contract, GRDA's Request for Proposal, and the Contractor's Bid Proposal, the order of precedence for interpretation of the terms and conditions of this Contract shall be as follows: (1) Contract; (2) GRDA's Request for Proposal; and (3) Contractor's Bid Proposal.

1.3 By executing the Contract, Contractor represents that he has carefully examined the project site and has informed himself as to the facilities for delivery and placing of all equipment and materials. Contractor further agrees that it is his responsibility to evaluate the local economy, available labor, weather and other conditions which will influence his productivity in performing the Work. Contractor understands that no plea of ignorance of conditions that exist or difficulties that may be encountered in the execution of the work as a result of the failure to make necessary examinations will be accepted as an excuse for any failure or omission on the part of Contractor to fulfill all requirements in the Contract or will be accepted as the basis of any claim for extra compensation.

1.4 GRDA and Contractor agree that the following definitions shall be applicable to this Contract:

AGM – Assistant General Manager of the Grand River Dam Authority.

Base Warranty Period – shall mean the period commencing with the execution by both parties of the "*Certificate of Contract Completion*" and ending one (1) year thereafter.

Change Order – is a modification of the Contract signed by both parties. A Change Order is necessary for any change in the Work, any change or adjustment in the amount of the Contract Price, or any change or adjustment in the Contract time or schedule. Change Orders are subject to approval by the GRDA Board of Directors and any limitations set forth in Oklahoma law and regulations.

Completion of the Work - shall mean the date when GRDA issues a final certificate stating that the Work specified in the Contract has been completed and is ready for acceptance under the terms and conditions contained therein.

Contract Documents - shall mean: (1) GRDA's Request for Proposal, and any modifications thereto; (2) Contractor's Bid Proposal, and any modifications thereto; (3) plans, drawings or Specifications; (4) this Contract; (5) Change Orders issued after execution of the Contract; and (6) any other document to which both parties have agreed in writing.

Contract Term - shall mean the date set forth in this Contract. If no specific term is set forth in this Contract, GRDA's Request for Proposal shall govern regarding the Contract Term. If no specific term is set forth, the Contract expires by its own terms upon satisfactory completion of the Work. However, Contractor's contractual obligations pertaining to warranty, indemnification, confidentiality, insurance, and audit rights shall survive termination.

Contractor - shall mean the party entering into this Contract for the performance of the required work and/or any designated representatives of said Contractor.

Designated GRDA Representative – shall mean the person authorized to represent GRDA and who shall be appointed by an Assistant General Manager of GRDA. Such appointment shall be in writing and shall be provided to Contractor. Contractor shall only perform work hereunder as authorized in writing by the Designated GRDA Representative or by an Assistant General Manager of GRDA.

Final Acceptance Certificate - shall mean the certificate issued by GRDA to Contractor stating that the Work specified in the Work Authorization has been completed according to the terms and conditions of the Contract Documents.

GRDA - shall mean the Grand River Dam Authority, an agency of the State of Oklahoma, as defined by 82 O.S. § 861 *et seq.*

Procurement Administrator – shall mean the GRDA employee with direct supervisory capacity of the procurement unit.

Site - shall mean GRDA's facility where the Work is to be performed.

Specifications - shall mean, collectively, all of the terms and stipulations contained in the specifications appended to this Contract and includes all written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

Subcontractor - shall mean a person, firm or corporation to whom any part of this work has been sublet by or supplied to Contractor. This term includes, but is not limited to, a person or entity who has a direct contract with the Contractor to perform a portion of the Work or to provide materials or equipment.

Work - shall mean the construction and services required by the Contract Documents whether completed or partially completed, and includes all labor, materials, equipment, and services provided or to be provided by the contractor to fulfill the Contractor's obligations.

## 2. SCOPE OF WORK.

Contractor shall furnish all personnel, material and equipment, except as otherwise provided, for the Work to be performed, as described in GRDA's Request for Proposal and at the prices agreed to in Contractor's attached Bid Proposal.

## 3. CONTRACT PRICE, ACCEPTANCE, FINAL PAYMENT, ALTERATIONS AND CHANGE ORDERS.

3.1 The Contract Price as contained in Contractor's Bid Proposal, shall be

\_\_\_\_\_ Dollars (\$\_\_\_\_\_) and payable as set forth:

3.2 At times, partial payments on projects may be necessary by GRDA, before GRDA takes possession of the project. Partial payments for work completed and materials stored on site may be made once each month. In such instances, the following procedure applies:

- a) The Contractor shall be required to complete a detailed breakdown of costs, arranged according to sections of the specifications, and submit it to the Designated GRDA Representative, for approval by the Procurement Administrator and responsible AGM. This breakdown shall be used throughout the job and cannot be changed without approval from the GRDA Procurement Administrator and responsible AGM.
- b) The Contractor shall meet with the appropriate AGM or designee when the rough draft of the pay request is prepared. At such time, the parties shall agree on percentages of work completed prior to typing the final form. The Contractor should furnish the AGM or designee with (5) five copies of the pay request and all supporting documents.
- c) An itemized listing of materials stored on site at the end of the period covered in the pay request shall be prepared on the Contractor's letterhead. Copies of paid invoices are to be attached. The date on the listing must agree with the date on the pay request. The materials must be stored at the site and cannot be removed after the payment has been made. The detailed description of stored materials should show quantities and sizes of materials. The usual terms of reference such as tons of steel and types of

windows shall be acceptable. If the Contractor deems it necessary, and it is recommended by both the appropriate AGM and the General Manager, the Contractor may store material off-site if there is a written agreement between GRDA and the Contractor. This agreement must provide the following:

- i. Proof of acceptable insurance.
  - ii. A written guarantee of delivery to the job site.
  - iii. A written title to all materials covered by the request for payment, which shall pass to GRDA.
  - iv. An on-site inspection of facilities by an authorized GRDA representative to verify the authenticity of quantities of stored materials.
  - v. All pay requests shall be submitted to GRDA.
- d) If partial payments are made hereunder, ten percent (10%) of all partial payments made shall be withheld as retainage. At any time the Contractor has completed in excess of fifty percent (50%) of the total contract price, the retainage shall be reduced to five percent (5%) of the amount earned to date if GRDA has determined that satisfactory progress is being made, and upon approval by the surety. If satisfactory progress is not maintained, the retainage may be increased back to ten percent (10%) of the total contract price.
- e) The *Certificate of Contract Completion, Consent of Surety* and the *Contractor's Warranties* must be submitted with the final request for pay to GRDA.

3.3 Upon completion of the Work, Contractor shall give written notice to GRDA that the Work is ready for final inspection and acceptance, and shall at the same time submit evidence satisfactory to GRDA that all payrolls, material bills, sums due subcontractors and any or all other indebtedness connected with the Work have been fully paid. GRDA shall promptly make an inspection of the Work. In the event any portion of the Work is not in accordance with the plans and specifications or is faulty, whether such defect be latent or patent, discovered or undiscovered, before the final acceptance under this provision, Contractor shall at its expense remedy such deficiencies or defaults and correct any improper construction or workmanship in accordance with the Contract and warranty article herein, and shall then complete performance of this Contract in accordance with the plans and specifications and these contract documents.

3.4 When, upon inspection, GRDA finds that the Work has been fully completed and the Contract fully performed, Contractor and GRDA shall complete on six (6) copies, the applicable portions of the attached "*Certificate of Contract Completion*" form, including release of all claims and liens. The Contractor shall complete the sworn affidavit on this certificate, thus certifying all Work is complete in accordance with all terms of this Contract, and releasing GRDA from all claims and liens. GRDA agrees not to unreasonably withhold issuance of this certificate for minor inconsistencies that Contractor has agreed in writing to remedy in accordance with the Contract. Upon receipt of the final certificate from GRDA that said Work has been completed according to the terms and conditions of the Contract documents, Contractor shall invoice GRDA for payment in full, including retainage amounts, in accordance with the prices shown in Contractor's Bid Proposal, along with the sum of the change orders, and GRDA shall, within thirty (30) days, pay to Contractor the entire balance then due and payable unless otherwise agreed to in writing signed by both parties. No interest or penalty shall be

charged by Contractor for late payment until forty-five (45) days after receipt of the invoice at GRDA's office. If there are apparent billing errors, or amounts in dispute, payment will be delayed for those specific items until such errors or disputes are resolved satisfactorily between the parties. All submittals, operating manuals, brochures, as-built drawings, receipts for keys given to GRDA, warranties, and all other requirements of the contract shall have been submitted to GRDA for the items received by them, before final payment is made.

3.5 It is specifically understood that GRDA's approval of the "*Certificate of Contract Completion*", shall not of itself constitute an approval or acceptance of any faulty Work or defective materials, whether latent or patent, nor shall any payment, whether progress payment or final payment by GRDA, constitute a waiver and/or acceptance of any defective or faulty workmanship or materials. On such final completion, Contractor shall furnish to GRDA a release of all claims and right of lien and a sworn statement as required by law, and Contractor acknowledges receipt of statutory notice to furnish the same before final payment shall be due under this Contract.

3.6 Contractor shall not be entitled to any claim for extras in any amount, whether performed or not, unless before their commencement such extras shall have been approved and authorized in writing by the responsible AGM of GRDA.

3.7 The following procedure shall apply to changes to the Work outside the original scope of the Contract:

- a) When it has been determined that a change is needed in the work and prior to the issuance of any Change Order, the GRDA Representative and the Contractor shall complete applicable portions of the "*Change Order Request*" form attached to this Contract. The "*Change Order Request*" shall fully describe the scope of work explaining completely what each item entails and the cost, credit, and time extension involved. The Contractor shall provide a detailed breakdown of cost, showing quantities and sizes of materials, unit cost, labor, equipment, profit and overhead, and other expense items. The Designated GRDA Representative shall transmit the completed "*Change Order Request*" to the Procurement Administrator and appropriate GRDA officials. The change in work scope described in the Change Order Request is not authorized until it has been approved in writing by the GRDA Board of Directors.
- b) Change Orders or addenda to contracts of One Million Dollars (\$1,000,000.00) or less shall not exceed a fifteen percent (15%) cumulative increase in the original contract amount.
- c) Change Orders or addenda to contracts of over One Million Dollars (\$1,000,000.00) shall not exceed the greater of One Hundred Fifty Thousand Dollars (\$150,000.00) or a ten percent (10%) cumulative increase in the original contract amount.
- d) Change Orders or cumulative Change Orders which exceed the limits of b) or c) shall require a re-advertising for bids on the incomplete portions of the contract.
- e) All Change Orders shall require formal approval by the GRDA Board of Directors and the reasons for approval shall be recorded in the permanent records of GRDA. The GRDA Board of Directors must accept the additional adjusted amount prior to GRDA

being responsible for payment thereof. The approval by the GRDA Board of Directors and the reasons for approval of the Change Order shall be reflected in the formal minutes thereof.

4. CONTRACTOR'S OBLIGATIONS.

4.1 Contractor shall, unless otherwise specified, provide all supervision, materials, labor, tools, equipment, and other facilities necessary for the execution and completion of the specified Work. All materials, unless otherwise specified, shall be new. Contractor shall, if required, furnish satisfactory evidence as to kind and quality of materials to the Designated GRDA Representative who shall approve or reject them. Contractor shall diligently perform the specified Work in accordance with good industry practices and in a workmanlike manner, and shall use such methods, appliances, supervision and inspection for the performance of the specified Work as will assure satisfactory quality conforming to the provisions of this Contract. GRDA may provide equipment to be used by Contractor for performing authorized Work. GRDA equipment may include, but is not limited to, construction equipment, motor vehicles, boiler air bags, forklifts, and manlifts. Contractor shall take full responsibility for the safe operation of such equipment by its employees. Contractor shall assume all risk of loss or damage to such equipment.

4.2 Contractor shall commence Work only after receiving a written authorization from the Designated GRDA Representative. Contractor shall furnish sufficient trained and experienced personnel, materials, and equipment, and shall work such hours and shall furnish such other necessities so as to assure the completion of the authorized Work in accordance with the work scope and schedule specified by the Designated GRDA Representative. Contractor agrees to utilize his best skill and judgment, and to cooperate with GRDA in every way. Contractor agrees to provide highly competent supervision and direction and to maintain at the Site the necessary material, equipment and skilled workmen to properly prosecute the Work to completion. Prior to entering onto GRDA property and the work Site, Contractor shall supply to GRDA for approval a list of names of those Contractor staff, employees, staff and employees of any approved subcontractors, and other personnel who will be present at the Site to perform the Work. If personnel changes are required, the Contractor shall obtain approval from the Designated GRDA Representative and then update the list. The Contractor shall only provide the number of personnel authorized by the Designated GRDA Representative. Within one working day, Contractor shall remove from the Site any specific personnel designated by the Designated GRDA Representative. Only those persons approved in writing by the Designated GRDA Representative may enter onto the Site.

4.3 Contractor shall do no Work without drawings and specifications approved by the Designated GRDA Representative. Where Contractor proposes to deviate from the drawings or specifications, he must have approval in writing from the Designated GRDA Representative before commencing the Work. All Work done under this Contract shall be done to the satisfaction of the Designated GRDA Representative, who shall, in all cases, determine the amount, quality acceptability, and fitness of the completed Work. The Designated GRDA Representative shall decide all matters which may arise as to the Contractor's fulfillment of the Contract specifications. The decision of the Designated GRDA Representative thereon shall be final and conclusive.

4.4 Contractor shall obtain all permits, certificates and licenses which are requirements in existence on the date of Contract award, except for those specifically required or normally furnished by GRDA, and Contractor agrees to fully comply with such permits. Further, Contractor shall, where applicable, comply with all applicable codes, including, but not limited to, ASME, ANSI and manufacturer's specifications relating to stress, clearances, pressure and precision measurements, all as provided in manufacturer's plans and drawings for assembly and disassembly of equipment.

4.5 Contractor shall, in a good and workmanlike manner, perform all Work and furnish all labor, materials, supplies, machinery, equipment, facilities and means, except as otherwise provided, necessary or proper to perform and complete all the Work required by this Contract, within the time specified, which time is considered to be of the essence to GRDA, in accordance with the provisions of this Contract and the specifications. It is expressly understood and agreed by the parties that the specified times for completion of the Work are reasonable times for its completion, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

4.6 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the GRDA Representative immediately.

4.7 Contractor agrees to perform all Work and complete the construction of the substation within three-hundred sixty-five (365) calendar days after receiving the official Notice to Proceed. Should Contractor neglect, fail or refuse to complete the new facility within three-hundred sixty-five (365) days after receiving the official Notice to Proceed, then Contractor agrees, as part consideration for the awarding of this Contract, to pay to GRDA, ONE THOUSAND DOLLARS (\$1,000.00) not as a penalty, but as liquidated damages for each such breach of contract, for each and every calendar day, after the time set forth as provided that Contractor shall be in default in completing the Work. In the computation of the time actually taken to complete the Work, the length of time (expressed in days or parts of days) during which the Work or any part of it has been delayed in consequence of any act or omission of GRDA, (which shall be determined by GRDA who shall certify to the same in writing, and whose determination and certificate shall be binding and conclusive upon Contractor), or any force majeure event, shall be allowed to Contractor and excluded from the computation.

Notwithstanding the above, the total liquidated damages for delay in completion of the Work as a result of causes that are deemed to be within the reasonable control of Contractor are limited to a maximum of twenty percent (20%) of the total price of the Work covered by this Contract.

4.8 The liquidated damages described above are fixed and agreed upon by the parties because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages GRDA would in such event sustain. The said amount is agreed by the parties as liquidated damages and not as a penalty. The parties hereto have computed, estimated and agreed upon the sum as an attempt to make a reasonable forecast of probable actual loss because of the difficulty of estimating with exactness the damages which will result.

4.9 IT IS FURTHER AGREED THAT TIME IS OF THE ESSENCE OF EACH AND EVERY PORTION OF THIS CONTRACT AND OF THE SPECIFICATIONS IN WHICH A DEFINITE AND CERTAIN LENGTH OF TIME IS FIXED FOR THE PERFORMANCE OF ANY ACT WHATSOEVER; and where under the Contract an additional time is allowed for the completion of any Work, the new time limit fixed by such extension shall be of the essence of this Contract. A request for extension of time shall be filed with the GRDA Procurement Administrator within twenty (20) days from the date when any alleged cause for delay shall occur. No extension shall be deemed to be a waiver by GRDA of any of its rights under this Contract.

4.10 Contractor agrees that the Work shall be prosecuted regularly, diligently and uninterruptedly as far as possible, but it is expressly understood and agreed that the rate of progress and the time for completing the Work is subject to extension and revision in the event that Contractor is delayed in performance due to unforeseeable causes beyond its control and without its fault.

4.11 Contractor agrees to provide a criminal background history for each of its employees, agents or representatives (including subcontractors and any of subcontractor's employees) within five (5) days after GRDA requests such history.

## 5. BONDS AND INSURANCE.

5.1 Upon execution of the Contract, Contractor shall furnish three bonds for Contracts exceeding Fifty Thousand Dollars (\$50,000.00):

a) Performance Bond for 100% of the value of the Contract to insure completion of the Work;

b) Defect Bond for 100% of the value of the contract to provide correction of defects in the construction and equipment for one (1) year after acceptance of the Work; and

c) Payment Bond for 100% of the contract to assure that GRDA is protected from the action of Subcontractors, suppliers and employees for unpaid debts of the Contractor.

5.2 All bonds shall be in a form approved by GRDA with terms acceptable to GRDA. All bond submittals shall contain all terms and conditions of the bonds or applicable to the bonds. The surety company is registered to do business in Oklahoma and is listed in Federal Circular 570.

5.3 Irrevocable Letters of Credit may be used as a substitute for the bond required in 5.1 above and shall be in a form approved by GRDA and with terms acceptable to GRDA.

5.4 Such bonds or irrevocable letters of credit shall be valid for a period of one (1) year after acceptance of the Work, or to the end of the Base Warranty Period as defined in Article 1.4 herein, whichever is sooner.



5.5 Contractor, at its own expense, shall carry, with reliable insurance companies licensed to do business in the State of Oklahoma and acceptable to GRDA, the following types of insurance with limits not less than shown in the respective amounts:

- a) Workers' Compensation Insurance complying with all statutory benefits to the statutory limits, including coverage as necessary for the benefits provided under the U. S. Long Shoremen's and Harbor Worker's Act and the Jones Act, and employer's liability insurance to cover operations of the party required to furnish same performed in connection with the Work of no less than: (i) a combined single limit per occurrence of One Hundred Thousand Dollars (\$100,000) for each accident; (ii) Five Hundred Thousand Dollars (\$500,000) disease policy limit; and (iii) One Hundred Thousand Dollars (\$100,000) disease coverage per each employee.
- b) Liability Insurance in form providing coverage not less than that of Standard Comprehensive General Liability Insurance policy covering operations of the party required to furnish same, including Hazards of Premises/Operations (including explosion, collapse and underground coverage), Independent Contractors, Products and Completed Operations for two (2) years after completion of the Work, Contractual Liability coverage (for any contracts related to the Work), and Personal Injury Liability coverage for claims arising out of the Work hereunder for Personal Injury "occurrence" of Bodily Injury (including death) and Property Damage (Broad Form, including Completed Operations) in policy or policies of insurance such that the total available limits combined shall not be less than One Million Dollars (\$1,000,000).
- c) Automobile Liability Insurance with coverage for owned vehicles, non-owned vehicles and hired vehicles, with a combined single limit per occurrence of not less than One Million Dollars (\$1,000,000).
- d) The Contractor shall provide Excess/Umbrella insurance coverage of not less than Three Million Dollars (\$3,000,000) to follow form on the employer's liability, general liability and auto insurance heretofore described in this Section.

5.6 Contractor hereby waives and agrees to have its insurers waive any rights of subrogation they may have against GRDA, and any and all of its Directors, officers, agents and employees and their insurers. Contractor also waives any rights of subrogation as respect to deductibles under such policies and as respect to damage to its equipment, including loss of use thereof, whether insured or not. Deductibles on insurance policies shall be for the account of Contractor. Contractor's insurance shall be primary and insurance policies carried by GRDA shall not be called upon for contribution. Contractor further agrees to name GRDA as an additional named insured under its applicable insurance policies to the extent the coverage provided relates to the Work to be performed hereunder, but in no event shall such additional insured status extend coverage beyond the indemnification contained herein.

5.7 A certificate of such insurance shall be forwarded to the Legal Department, Grand River Dam Authority, P. O. Box 409, Vinita, Oklahoma 74301. The certificate must show the name and address of the insured, particular work covered, limits of coverage, policy number, effective and expiration dates and cancellation requirements. The cancellation clause must provide for thirty (30) days prior written notice to GRDA of cancellation or the making of any material change.

## 6. CONTRACT TERM AND TERMINATION.

6.1 The period of performance under this Contract shall be as provided herein from the effective date of this Contract unless sooner terminated as provided for herein.

6.2 GRDA may terminate this Contract for convenience upon fourteen (14) days prior written notice to Contractor or immediately in the event the Work is delayed for a period in excess of ninety (90) days due to a force majeure condition. Termination charges in either event will include a portion of the purchase price reflecting the amount of work performed, man hours expended and materials acquired at the time of termination. These charges will also include the expenses associated with the termination, including, but not limited to, any additional expense incurred by reason of termination or cancellation of agreements between Contractor and its suppliers, and any applicable costs allocated in contemplation of performance, including profit and overhead costs associated with the work performed, but not including any consequential damages. Contractor will make every reasonable effort to minimize such termination charges. Upon receipt of written notice from GRDA of termination, the Contractor shall cease operations as directed by GRDA, take actions necessary or that GRDA may direct, for the protection and preservation of the Work, and except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders. All termination charges shall be due and payable thirty (30) days from the date of receipt of Contractor's invoice. No interest or penalty shall be charged by Contractor for late payment until forty-five (45) days after receipt of the invoice at GRDA's office.

6.3 GRDA may terminate this Contract for cause if Contractor shall fail, at any time during the performance hereof, to provide the necessary crews, tools and equipment for the performance of the work hereunder; shall fail to make payment to Subcontractors for materials or labor; persistently disregards laws, ordinances, or regulations; or shall fail to perform any of its obligations as herein expressed. In such event, and if Contractor fails to substantially cure the non-conforming action within five (5) days of receiving notice, GRDA may, at its election, and without prejudice to other remedies it may have, either (i) cancel this Contract in its entirety and pay to Contractor the reasonable value of the work completed to date of cancellation; or (ii) relet the work to another Contractor. In such event, Contractor shall not be entitled to any consequential damages. If the nature of the remedial action is such that reasonable efforts are taken in a timely manner by Contractor, then GRDA will continue to allow Contractor to complete the remedial action without declaring Contractor to be in default. Following completion of the work under (ii) above, Contractor shall be entitled to receive the balance of the amount owed Contractor as specified in this Contract, less the cost to GRDA for completion of the work; provided, however, if the cost of completion, plus any payments previously made to Contractor, exceeds the amount specified, Contractor shall promptly pay GRDA the amount of such excess. Any remedy hereinabove provided for GRDA in the event of default by Contractor shall not be construed as a waiver of other rights or remedies to which GRDA may be entitled by virtue of such default.

6.4 Upon termination of the Contract by GRDA, GRDA shall be released from further liability to the Contractor or Surety Company. If the Contractor cannot be located, the payment for any amount owed to the Contractor for work performed, shall be held in GRDA funds for the Contractor for a period not to exceed thirty-six (36) months at which time the

payment shall be deposited in the GRDA Revenue Fund. This shall release GRDA from any further liability to the Contractor or Surety Company.

## 7. SUBCONTRACTING.

7.1 Except as provided in Contractor's Bid Proposal, Contractor shall not subcontract any portion of the Work without first obtaining GRDA's written consent. Approval of any subcontractor by GRDA shall not constitute a waiver of any right of GRDA to reject work not in conformance with the Contract. This right of subcontractor and subcontract approval does not extend to individuals or entities providing services to Contractor under personal or professional service contracts or subcontracts.

7.2 The requirements in this Contract shall also apply to each succeeding tier of Contractor's subcontractors.

7.3 Contractor shall be fully responsible for acts and omissions of its subcontractors. Nothing in this Contract shall be construed to create any contractual relationship between GRDA and any subcontractor, nor any obligations on the part of GRDA to pay or to see to the payment of any money due any subcontractor of Contractor, except as may be otherwise required by law.

7.4 Contractor shall be responsible for the management and performance of its subcontractors in the performance of the Work to be performed hereunder.

7.5 Contractor shall inspect and promptly report to GRDA any and all defects of such other work as would render it unsuitable for proper performance under this Contract. Failure by Contractor to inspect and report any such deficiency by any Subcontractor shall constitute its acceptance of the work of such Subcontractor as being fit, adequate and proper for the reception of the required work, but this clause shall not be construed or interpreted as relieving Contractor of the primary responsibility of due performance of this Contract in a good and workmanlike manner which shall extend to and encompass any and all work done under this Contract.

## 8. INDEMNITY AND LIABILITY.

8.1 The Parties intend that each shall be responsible for its own intentional and negligent acts or omissions to act. GRDA shall be responsible for the acts and omissions to act of its officers and employees while acting within the scope of their employment according to the Governmental Tort Claims Act, Title 51 O.S. § 151 *et seq.* The Contractor shall be responsible for any damages or personal injury caused by the negligent acts or omissions to act by its officers, employees, or agents. The Contractor agrees to hold harmless GRDA of any claims, demands and liabilities resulting from any act or omission on the part of the Contractor and/or its agents, servants, and employees in the performance of the contract. It is the express intention of the parties hereto that this agreement shall not be construed as, or given the effect of, creating a joint venture, partnership or affiliation or association that would otherwise render the parties liable as partners, agents, employer-employee or otherwise create any joint and several liability.

8.2 GRDA does not waive any protection it has under the Governmental Tort Claims Act (51 O.S. § 151 *et seq.*).

9. WARRANTIES.

9.1 Contractor warrants that the equipment and Work to be provided will conform to all specifications which are part of this Contract, will be free of defects in workmanship or material, and will be designed for the purposes stated in the specifications for a Base Warranty Period of one (1) year commencing from the date of completion of the installation, or eighteen (18) months from the date of delivery, whichever should occur first.

9.2 If any failure to conform to the foregoing warranties is discovered before one (1) year after completion of installation, or eighteen (18) months from the date of delivery, whichever should occur first, and GRDA gives Contractor written notice after its discovery of such nonconformity within thirty (30) days of such warranty period, then Contractor shall promptly correct such nonconformity at its sole cost and expense.

9.3 The warranty on the repaired or replaced equipment, or the correction of defective workmanship, provided by Contractor pursuant to the provisions of this warranty, will be on the same terms and conditions as set forth herein commencing from the date of such repair, replacement and/or rework.

9.4 If under the provisions of the Contract, Contractor is notified by GRDA to correct defective or non-conforming Work, and Contractor states or by its actions indicates that it is unable or unwilling to proceed with corrective action in a reasonable time, GRDA may, upon written notice, proceed to accomplish the redesign, repair, rework or replacement of non-conforming Work by the most expeditious means available and back-charge Contractor for the costs incurred. Furthermore, if GRDA agrees or is required to perform Work for Contractor, such as cleanup, off-loading or completion of incomplete Work, GRDA may, upon written notice, perform such Work by the most expeditious means available and back-charge Contractor for the costs incurred. The cost of back-charge Work shall include labor, materials, and other direct costs. The back-charge notice will request Contractor's concurrence for GRDA to proceed with the required Work. However, failure of Contractor to grant such concurrence shall not impair GRDA's right to proceed with Work under this or any other provision of the Contract.

9.5 GRDA shall separately invoice or deduct from payments otherwise due to Contractor the costs as provided herein. GRDA's right to back-charge is in addition to any and all other rights and remedies provided in this Contract. The performance of back-charge Work by GRDA shall not relieve Contractor of any of its responsibilities under this Contract including but not limited to express warranties, specified standards for quality, contractual liabilities and indemnifications.

10. FORCE MAJEURE.

10.1 Contractor will not be liable for failure to perform any obligation or delay in performance resulting from or contributed to by any cause beyond the control of Contractor or its suppliers if such cause was not reasonably foreseeable, or from any act of God; act of civil or military authority; act of war, whether declared or undeclared; act (including delay, failure to act

or priority) of any governmental authority or GRDA; civil disturbance; insurrection or riot; sabotage; terrorist activities; fire; earthquake; flood; strike, work stoppage or other labor difficulty; embargo; car shortage; fuel or energy shortage; major equipment breakdown; delay or accident in shipping or transportation; or failure or delay beyond its reasonable control in obtaining necessary manufacturing facilities, labor or materials from usual sources.

10.2 In the event of a delay in performance excusable under this Article, the date of delivery or time for performance of the Work will be extended by a period of time reasonably necessary to overcome the effect of the delay.

11. TITLE. Title to all materials and Work furnished by the Contractor hereunder shall pass to GRDA upon Contractor's receipt of payment as provided in Article 3.1 herein. Notwithstanding the terms of any agency appointment agreement entered into by the parties, Contractor shall retain all liability for, and risk of loss or injury to all materials and Work to be furnished by Contractor until final approval and acceptance of complete performance of this Contract.

12. ASSIGNMENT. Contractor shall not assign or transfer any work under this Contract without the prior written consent of GRDA. Any assignment by Contractor agreed to by GRDA shall not relieve Contractor of its obligations hereunder.

13. AMENDMENT. This Contract may be amended only by a written instrument signed by both Contractor and GRDA.

14. TAXES. The prices herein are exclusive of any present or future federal, state or municipal sales, use, property, gross receipts, gross income, excise, value added or other similar taxes with respect to the work performed herein. If Contractor is required by applicable law or regulation to pay or collect such taxes on the work performed herein, then GRDA shall pay such tax or reimburse Contractor for any payment of any such tax made by Contractor which is in addition to the Contract Price.

15. PATENTS.

15.1 Contractor will, at its own expense, defend, or, at its option, settle any suit or proceeding brought against GRDA so far as based on an allegation that any equipment furnished and used by Contractor in furtherance of the Work, work on GRDA's material, or process performed by Contractor in connection with the equipment/service or use thereof for its intended purpose constitutes an infringement of any United States patent, copyright or trade secret, if Contractor is notified promptly in writing and given authority, information and assistance in a timely manner for the defense of said suit or proceeding. Contractor will pay the damages and costs awarded in any suit or proceeding so defended. Contractor will not be responsible for any settlement of such suit or proceeding made without its prior written consent. In case the process, as a result of any suit or proceeding so defended, is held to constitute infringement of any patent, copyright or trade secret, or its use by GRDA is enjoined, Contractor will, at its option and its own expense, either (i) procure for GRDA the right to continue using said equipment, GRDA's material or process; (ii) replace it with a substantially equivalent non-infringing equipment, GRDA's material or process; or (iii) modify the equipment, GRDA's material or process so it becomes non-infringing.

15.2 Contractor will have no duty or obligation to GRDA under this Section to the extent that the equipment, work on GRDA's material or process is supplied according to GRDA's instructions wherein compliance therewith has caused Contractor to deviate from its normal course of performance, and by reason of said instruction, a suit is brought against GRDA.

16. COMPLIANCE WITH LAWS.

16.1 In the performance of any work under this Contract, Contractor and its suppliers shall comply with all applicable provisions and requirements of the Civil Rights Act of 1991 and any amendments thereto, the Fair Labor Standards Act of 1938 and amendments thereto, the Occupational Safety and Health Act of 1970 and all other federal, state and local laws, including but not limited to environmental laws. The Contract Price, as contained in Contractor's Bid Proposal for the work hereunder, is based on compliance by Contractor with these laws and requirements as they are in effect on the date of the offer prepared by Contractor. If any failure by Contractor or any subcontractor to comply with such laws, regulations or enactment shall result in any fine, penalty, cost or charge or expense being assessed or levied against GRDA, Contractor agrees to indemnify GRDA for such expenses.

16.2 The Contractor certifies that it and all proposed subcontractors, whether known or unknown at the time this Contract is executed or awarded, are in compliance with 25 O.S. Section 1313 and participate in the Status Verification System. The Status Verification System is defined in 25 O.S. Section 1312 and includes, but is not limited to the free Employee Verification Program (E-Verify) available at [www.dhs.gov/E-Verify](http://www.dhs.gov/E-Verify).

17. ACCESS TO WORK AND RIGHT OF INSPECTION BY GRDA. GRDA shall have reasonable access to the areas of Contractor plants where the work under this Contract is being performed to enable GRDA to observe tests on the work. Contractor, if requested, will inform GRDA of those tests and procedures which can be witnessed. Should GRDA elect to witness specific tests, GRDA must so specify such requirement in ample time to permit Contractor to include said witness tests in the schedule. Contractor, if requested, will advise GRDA of the schedule of such tests. However, no rescheduling of tests or delays in manufacturing or shipment will be made to accommodate such inspection. Contractor will exercise reasonable efforts to secure similar rights with respect to the inspection of the work at Supplier's premises. Any tests conducted at the Project Site shall likewise contain the same rights.

18. ACCOUNTING AND AUDIT RIGHTS.

18.1 For all contracts other than those on a fixed price basis, Contractor agrees to furnish GRDA, in such form as will be reasonably satisfactory to GRDA, such detailed statements pertaining to the cost of material and labor as may be necessary for GRDA to comply with the requirements of its internal purchasing and accounting policies or any governmental regulatory authority having jurisdiction over GRDA with the understanding that any such requests by GRDA for such information will comply with and be in accordance with generally accepted accounting principles and practices. In determining the amount of compensation payable to Contractor, Contractor shall, during the period of performance of Work invoiced on a time and material basis, maintain books, records, documents and other supporting data relating to the amounts invoiced, in accordance with generally accepted accounting principles and practices.

18.2 During the performance of Work invoiced on a time and material basis, GRDA having given reasonable prior notice, shall have the right to request to examine and audit such books, records, documents and other supporting data of Contractor which are reasonably necessary to substantiate the amounts and items invoiced. Such audit shall be conducted in accordance with a mutually agreed time schedule, on the account of GRDA, and in accordance with generally accepted auditing standards. The right to audit extends for a period of one year from the date of the invoice or from one year following the completion of the Work whichever occurs last. Such audits will be conducted at the Contractor's place of business during normal business hours, on a periodic basis not to exceed one audit per year, with such audit not exceeding three consecutive working days, unless otherwise mutually agreed.

19. WAIVERS. The failure of either party to enforce, at any time, any of the provisions of this Contract or to require, at any time, performance by the other party of any of such provisions, shall in no way be construed to be a waiver of such provision, nor in any way to affect the validity of this Contract, or any parts thereof, or the right of either party thereafter to enforce each and every provision.

20. ENVIRONMENTAL COMPLIANCE.

20.1 Contractor recognizes that the performance of the work at the Project Site may involve the generation of hazardous waste as such term is defined in the Resource Conservation and Recovery Act (42 U.S.C. § 6901, *et seq.*), the laws of the State of Oklahoma and the rules or regulations issued thereunder as are now in effect or hereafter amended from time to time. GRDA shall designate an area for hazardous waste storage at the Project Site where waste containers are to be placed by Contractor. Contractor shall, at its expense, furnish containers appropriate for hazardous waste storage and be responsible for the transportation and disposal of such waste. Contractor agrees to store, transport, and dispose of such hazardous waste in accordance with all applicable federal, state and local laws, rules, regulations and ordinances. GRDA shall pre-approve any waste contractor and disposal facility proposed to be utilized by Contractor prior to the waste leaving the GRDA job site. Further, Contractor shall employ procedures to minimize the generation of hazardous waste during the performance of its work hereunder.

20.2 Contractor further recognizes that the performance of the work at the Project Site may involve the generation of non-hazardous waste as such term is defined in the Resource Conservation and Recovery Act (42 U.S.C. § 6901, *et seq.*), the laws of the State of Oklahoma and the rules or regulations issued thereunder as are now in effect or hereafter amended from time to time. GRDA shall designate an area for non-hazardous waste storage at the Project Site where waste containers are to be placed by Contractor. Contractor shall, at its expense, furnish containers appropriate for non-hazardous waste storage and be responsible for the transportation and disposal of such waste. Contractor agrees to store, transport, and dispose of such non-hazardous waste in accordance with all applicable federal, state and local laws, rules, regulations and ordinances. GRDA shall pre-approve any waste contractor and disposal facility proposed to be utilized by Contractor prior to the waste leaving the GRDA job site. Further, Contractor shall employ procedures to minimize the generation of non-hazardous waste during the performance of its work hereunder.

21. SOFTWARE LICENSING.

21.1 Contractor hereby grants to GRDA a nonexclusive, nonsublicensable license to use any computer program(s) identified in the Bill of Materials or elsewhere including, but not limited to, machine readable object code, flow Charts, logic diagrams, listings, and any listing generated therefrom (referred to herein as the "Software"), for use by GRDA in operating or in connection with the equipment. Contractor, at its sole option and discretion, may provide GRDA with updates and improvements for the software for an additional cost and these shall also be covered by the provisions of this Agreement.

21.2 GRDA shall maintain the software confidential by affording access to the software only to those of its employees, agents, or consultants having a need to know. In addition, GRDA shall employ reasonable measures to prevent any unauthorized use, copying, publishing, reproducing, or disclosing of the software and shall treat such with no lesser care than its own confidential information.

## 22. CONFIDENTIALITY.

22.1 Contractor agrees to accept and hold drawings, specifications, identified computer software, materials and information furnished by GRDA hereunder in complete confidence, and further agrees not to divulge such to any third party or use the same for its own benefit, except to the extent of performing the work hereunder. Contractor agrees to return all originals and copies of such data and all ancillary information derived therefrom to GRDA promptly upon its request or termination of this Contract, whichever occurs first.

22.2 Contractor may have a proprietary interest in information that may be furnished pursuant to the Contract. GRDA will keep in confidence and will not disclose any such information which is specifically designated in writing as being proprietary to Contractor without the prior written permission of Contractor or use any such information for other than the purpose for which it is supplied. The provisions of this paragraph shall not apply to information, notwithstanding any confidential designation thereof, which is known to GRDA without any restriction as to disclosure or use at the time it is furnished, which is or becomes generally available to the public without breach of any agreement, or which is received from a third party without limitation or restriction on said third party or GRDA at the time of disclosure. Contractor also has a proprietary interest in the quotation and the Contract. Accordingly, neither document will be disclosed in whole or in part to third parties without the prior written permission of Contractor. Recording of training programs by video or audio devices is prohibited.

22.3 When required by appropriate governmental authority, including governmental regulations, applicable law or regulation, by order of a court of competent jurisdiction or lawful subpoena (hereinafter collectively referred to as "Governmental Authority"), GRDA may disclose such proprietary information to such Governmental Authority; provided, however, that prior to making any such disclosure, GRDA will: (a) provide Contractor with timely advance written notice of the proprietary information requested by such Governmental Authority and GRDA's intent to so disclose; (b) minimize the amount of proprietary information to be provided consonant with the interests of Contractor and its Suppliers and the Requirements of the Governmental Authority involved; and (c) make every reasonable effort (which shall include participation by Contractor in discussions with the Governmental Authority involved) to secure confidential treatment and minimization of the proprietary information to be provided. In the event that efforts to secure confidential treatment



are unsuccessful, Contractor shall have the prior right to revise such information to minimize the disclosure of such information in a manner consonant with its interests and the requirements of the Governmental Authority involved.

23. APPLICABLE LAW. The words and phrases of this Contract shall be given their ordinary English meaning and this Contract shall be interpreted and construed in accordance with the laws of the State of Oklahoma and venue shall be in Craig County, Oklahoma.

24. NOTICES. Except as otherwise provided, all notices required or permitted to be given shall be in writing and shall be deemed properly given when delivered in person to the other party to be notified or when mailed by registered or certified United States mail, postage prepaid to the proper individual(s), or when sent by facsimile to the party to be notified at its address set forth below, or such other address as the party to be notified may have previously designated by written notice to the other:

Designated GRDA Representative:

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GRDA Procurement Administrator:

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GRDA Assistant General Manager:

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Contractor:

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This Agreement entered into as of the day and year first above written.

**GRAND RIVER DAM AUTHORITY**

ATTEST:

(Seal)

By \_\_\_\_\_  
Daniel S. Sullivan, General Manager/CEO  
Director of Investments

\_\_\_\_\_  
Donna M. Jones, Secretary

**(CONTRACTOR)**

ATTEST:

(Seal)

By \_\_\_\_\_

\_\_\_\_\_  
Secretary

**Attachment A**

**AFFIDAVIT OF NON-COLLUSION FOR PROCUREMENT OF CONTRACT**  
(Attached to and a Part of the Contract)

STATE OF \_\_\_\_\_ )  
  ) ss  
COUNTY OF \_\_\_\_\_ )

\_\_\_\_\_, of lawful age, being first duly sworn, on oath says that (s)he is the agent authorized by \_\_\_\_\_, to execute the Contract of which this affidavit is a part. Affiant further states that the Contractor has not paid, given or donated or agreed to pay, give or donate to any officer or employee of the GRAND RIVER DAM AUTHORITY, any money or other thing of value, either directly or indirectly, in the procuring of this Contract.

\_\_\_\_\_  
(Agent Authorized by Contractor)

\_\_\_\_\_  
(Complete Legal Name of Contractor)

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 201\_\_\_\_.

\_\_\_\_\_  
(Notary Public)

My Commission Expires:

\_\_\_\_\_  
(Date)

Commission No.:  
\_\_\_\_\_

**Attachment B**

**State of Oklahoma  
Grand River Dam Authority**

**Certificate of Contract Completion**

Project Name	
Contract Number	
Contractor	
Contract Date	
Contract Amount	

**CONTRACTOR'S AFFIDAVIT**

**I DO SOLEMNLY SWEAR AND AFFIRM:** That the work under the above named contract and all amendments thereto have been completed in accordance with the requirements of said contract; that all costs incurred for equipment, materials, labor, and services against the project have been paid; that no liens have been attached against the project; that all Workmen's Compensation claims are covered by Workmen's Compensation Insurance as required by law; that all public liability claims are adequately covered by insurance; that I, acting for the Contractor, shall save, protect, defend, indemnify, and hold the Grand River Dam Authority harmless from and against all claims which arise as a direct or indirect result of any transaction, event or occurrence related to performance of the work included under said contract.

Contractor: \_\_\_\_\_  
By: \_\_\_\_\_  
Title: \_\_\_\_\_  
Date: \_\_\_\_\_

State of Oklahoma, County of \_\_\_\_\_.

Personally appeared before me this \_\_\_\_\_ day of \_\_\_\_\_, 201\_\_\_\_.

\_\_\_\_\_, known (or made known) to me to be the \_\_\_\_\_

[Owner, partner, title] of the above named Contractor, who being by me duly sworn, subscribed in the foregoing affidavit in my presence.

Notary Officer: \_\_\_\_\_  
Typed Name: \_\_\_\_\_  
My Commission expires: \_\_\_\_\_  
Commission No: \_\_\_\_\_

**Certificate of Acceptance**

**THIS IS TO CERTIFY:** That the work under the above described contract has been completed under the terms of the contract; that based on inspection and upon the statements made in the above affidavit, the project is hereby accepted as completed.

FOR GRAND RIVER DAM AUTHORITY

By: \_\_\_\_\_  
Title: \_\_\_\_\_

Date: \_\_\_\_\_

Distribution:

- GRDA Legal Department
- GRDA Finance Department
- Responsible GRDA Assistant Manager
- Contractor

**Attachment C**

**State of Oklahoma  
Grand River Dam Authority**

**Change Order Request**

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**DO NOT PROCEED WITH WORK DESCRIBED HEREIN UNTIL ALL ENTITIES LISTED BELOW HAVE SIGNED THIS DOCUMENT.**  
This request for modification shall be prepared by the Contractor. This form is required to be submitted. All costs must be broken down.  
**THIS WORK IS NOT AUTHORIZED UNTIL ALL ENTITIES HAVE SIGNED THIS DOCUMENT.**

---

Date of Request	
Project Name	
Contractor Number	
Contractor	
Contract Date	

**DESCRIPTION OF CHANGE** (Write a description of scope and reasons for change):

**BREAKDOWN OF ADDITIONAL CONTRACT COSTS FOR CHANGE ORDER REQUEST** (Show details of materials, labor, equipment, subcontractors, overhead, and profit:

\_\_\_\_\_  
Contractor Representative (Printed)

\_\_\_\_\_  
Signature of Contractor Representative

\_\_\_\_\_  
Date

---

*Change Order Reviewed and Recommended By:*

Designated GRDA Representative \_\_\_\_\_ Date \_\_\_\_\_

GRDA Procurement Administrator \_\_\_\_\_ Date \_\_\_\_\_

Responsible GRDA AGM \_\_\_\_\_ Date \_\_\_\_\_

*Change Order Approved By:*

GRDA General Manager \_\_\_\_\_ Date \_\_\_\_\_

ATTEST:

(Seal) \_\_\_\_\_ Date \_\_\_\_\_

Secretary

GRDA Board of Directors \_\_\_\_\_ Date \_\_\_\_\_

## Attachment D

### GENERAL SPECIFICATIONS

#### SEC. 1 MISCELLANEOUS

The Contractor shall abide and follow the attached “Technical Requirements” to perform the work described in the “Construction Specifications”.

- 1.1 Water: Water is not available at the job site.
- 1.2 Electricity: Electric power will NOT be provided for this construction by GRDA. All temporary connections for electricity shall be subject to approval of GRDA. All temporary lines necessary for Contractor’s execution of the work will be furnished, installed, connected and maintained by the Contractor in a workmanlike manner satisfactory to GRDA and shall be removed by Contractor in like manner at his expense prior to completion of the construction. Contractor’s temporary electrical power, if furnished by GRDA, will be 60 Hz, single phase, 240/120 volt AC.
- 1.3 Sanitary Facilities: Contractor shall provide an adequate number of portable toilets at each construction site for use by workers at the site during the duration of the contract. Portable toilets shall be maintained and cleaned on a regular basis. Rental costs for the toilets and maintenance services shall be included in the contract price.
- 1.4 Telephone: Contractor shall provide his own telephone lines, if needed.
- 1.5 Contacts: The GRDA Assistant General Manager has assigned the following Designated GRDA Representatives for purposes of this Contract.
  - a. The **Construction Coordinator/Inspector** for the project is Mike Waddell at 918-824-7847 (O), 918-521-6218 (C)
  - b. The **Design Engineer** for this project is Edwin Averill at 918-824-7843.
- 1.6 Correspondence:
  - a. A copy of all correspondence and letters of transmittal shall be sent to:  
Grand River Dam Authority  
P.O. Box 1128  
Pryor, OK 74362-1128  
  
Attention: Edwin Averill, Project Engineer  
E-mail: baverill@grda.com
  - b. In addition, a copy of all correspondence and letters of transmittal shall be sent to:  
Grand River Dam Authority

P.O. Box 1128  
Pryor, OK 74362-1128

Attention: Jeff Tullis, Chief Engineer  
E-mail: jtullis@grda.com

- 1.7 Invoices: Invoices for this work shall include the task order number, work order and work step, name of project, and a listing of the percentage of the units on the bid that have been completed as of the time period claimed in the invoice. Invoices shall be mailed to:

Nita Wade; Purchasing Superintendent  
Grand River Dam Authority  
Administration Headquarters  
226 W Dwain Willis Ave.  
P.O. Box 409  
Vinita, Oklahoma 74301-0409

A copy of each invoice shall be sent to the GRDA Chief Engineer, Jeff Tullis.

- 1.8 Safety: The Contractor and his subcontractors shall follow all applicable OSHA and GRDA Safety Manual rules. In addition, the Contractor shall have in place a safety program. The details of the program shall be included in the proposal.

All Contractor and Subcontractor employees, while at the work site, shall wear appropriate clothing and protective equipment for the work being done.

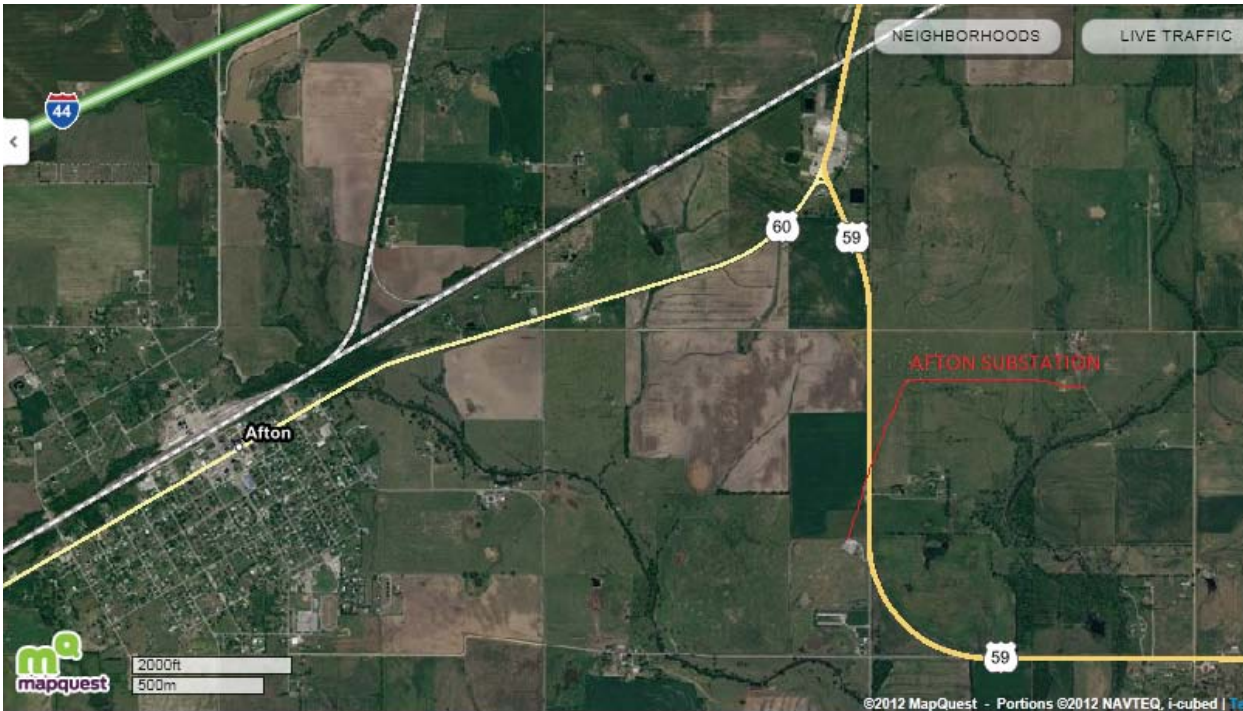
All accidents shall be reported to the GRDA Construction Coordinator/inspector immediately.

Contractor and Subcontractor personnel, who are not following the safety rules, will be immediately removed from the site by the contractor, and be banned from returning.

No pets shall be allowed at the jobsite.

## **SEC. 2 SCOPE OF WORK**

- 2.1 Location: This project is to extensively modify the Afton 161/69 kV substation. The location for the substation is listed below:



The Afton Substation is located near the town of Afton, Oklahoma on US 59, east of Afton, in Ottawa County, Oklahoma.

## 2.2 Project Description

The project shall consist of modifying the existing substation to add a 161kV ring bus, add an additional transformer, construct a 69kV breaker and one-half bus system. The construction shall include, but not limited to, removal of much of the existing substation, relocating the existing transformer, installing a new transformer, site grading, the installation of foundations, steel, instrument transformers, bus, switches, breakers, grounding, fence, control house modifications, changing all control panels, underground conduit, cable, termination of cables, transmission terminations, fiber cable installation and other items, as listed here and on the drawings. The construction shall be done in such a way to continue to allow the existing transmission lines to stay in service as much as possible, thus eliminating any customer outages. Temporary transmission bypass lines will need to be constructed. The temporary work is discussed in some detail in the attachments and drawings.

Contractor shall provide all materials except those materials specifically listed as to be furnished by GRDA. Contractor shall provide all installation and construction services necessary for and reasonably incidental to the proper completion of all work shown on the drawings and herein specified, excepting only such items as are specified or noted as being done or furnished by others.



All construction shall be performed in strict accordance with these specifications and the attached applicable drawings and shall be subject to the terms and conditions of the contract. See the attachments for a complete listing of the drawings.

Preceding each phase of work, the Contractor shall verify the availability of the material for that particular phase. Material lists for the complete project will be available at the time of construction. The Construction Coordinator/Inspector shall be advised immediately of any material discrepancies or problems.

The Contractor shall work with GRDA to determine planned outage dates for specific transmission lines. NOTE: actual outages are scheduled through the ECC and may be subject to SPP approval. The order of the work must be coordinated through the Construction Inspector. These outage dates will be mutually established; however, once established the Contractor shall perform all outage related work during these planned outage timeframes.

a. FOUNDATIONS

Contractor shall install the following foundations in accordance with the referenced drawings. Refer to the drawings for the count and details of each foundation. All abandoned foundations shall be removed completely or to a depth of 3' of surface. Because of the tight schedule of much of the work, 'high-early' concrete shall be used. The contractor is to submit the batch mix for this, for GRDA approval. When 'high-early' is used, the number and timing of the concrete breaks shall be adjusted for the work. A three (3) day break will be required. The ultimate strength shall be as listed in the Technical Specification section.

- (1) Foundations for 161 kV Switches
- (2) Foundations for 161 kV Dead End Structures
- (3) Foundations for 161kV Bus Support Structures
- (4) Foundations for 161 kV Circuit Breakers
- (5) Foundations for Lighting Masts
- (6) Foundations for Station Service Feeds
- (7) Foundations for CCVTs
- (8) Foundations for Station Service transformers
- (9) Foundations for 69kV Circuit Breakers
- (10) Foundations for 69kV dead ends and bus supports
- (11) Foundations for 69kV Switch Stands
- (12) Foundations for Transformers and oil containment

Drawings:

S875PG30	161kV Foundation Plan
S875PG31	69kV Foundation Plan
S294PG32	Station Centerline Control Points
S294PG33	Typical Foundation Details
S294PG34	Typical Foundation Details

b. STRUCTURAL STEEL ERECTION

Contractor shall remove existing steel as required, and assemble and erect the following galvanized steel structures provided by GRDA in accordance with the referenced drawings.

- (1) 2 – 161 kV Three Phase, two feeder, Dead End Structure
- (2) 6 – 161 kV Single Phase CCVT Structure
- (3) 8 – 161 kV Three Phase Switch stand
- (4) 24 – 161 kV Single Phase Bus Support
- (5) 2 – 161 kV Single Phase Station Power Structure
- (6) 2 – 69kV switch stands
- (7) 10 – 69kV bus supports
- (8) 1 – Integrated 69kV Dead End – Bus Support Structure

c. ELECTRICAL EQUIPMENT

Contractor shall remove the abandoned or retired equipment, and install the following electrical equipment per drawings. The following items will be provided by GRDA.

- (1) 161 kV Vee-Break Switches
- (2) 161 kV Circuit Breakers
- (3) 161 kV CCVTs (2 with Wave Trap mounted on top)
- (4) 161 kV Surge Arresters
- (5) 15kV-250/125 V Station Service Transformers
- (6) Power Transformers
- (7) 69kV Breakers
- (8) 69kV CCVTs
- (9) Control Panels
- (10) 69kV Surge Arresters
- (11) 69kV Switches

d. BUS WORK

Contractor shall remove and install the 161/69 kV buses per drawings.

e. STATION GROUNDING:

Contractor shall install station grounding in accordance with drawings. The contractor shall furnish all ground material.

S294PG20          Grounding Plan & Details

S294PG21            Grounding Details

f. CONDUIT AND CABLE:

Contractor shall furnish and install all raceway and cables in accordance with drawings. The cable schedule lists approximate distances for the cable lengths. The contractor shall make his own takeoff for cable lengths.

S294PG41	69kV Cable and Conduits
S294PG45	161kV Cable and Conduits
S294PG50	Trench Layout Plan
S294PG51	Trench Details
S294PG52	Conduit Details

g.            GRADING AND SUBSTATION ROCK

The Contractor shall modify the grading as indicated on the drawings and install rock over the substation areas in accordance with the drawings. The Contractor shall seed areas around the substation that do not receive rock but have been disturbed during project construction.

S294PG02	Existing Topographic Survey
S294PG11	Site Grading Plan
S294PG12	Erosion Control and Site Details

h.            FENCE

The Contractor shall provide, assemble, and erect the fence in accordance with the drawings and specifications. Also, the contractor shall erect any needed temporary fencing to secure the site.

S294PG11	Site Grading Plan
S294PG30	Fence Details

i.            CONTROL & POWER CABLE TERMINATION

The Contractor shall terminate both ends of the control and power cables listed in the Cable Schedule/Cable drawings (dwg. #s S294DT--- Series) and as specified in the specifications and drawings. Connection drawings will be furnished on award of Contract.

j.            CONTROL HOUSE

The contractor shall clean the house, and seal the cable entries (to prevent weather and vermin from entering). The floor shall be cleaned and made level. The tile does not have to be

removed, but may need to be repaired. The interior walls and ceiling shall be painted white.

k. TEMPORARY TRANSMISSION SYSTEM

In order to construct the substation there will be several go-arounds, jumpers, and other temporary transmission items installed and removed. The contractor is responsible for the installation and removal of these items. In the attachments is a proposed method and schedule for this activity. It must be noted that the times listed are tentative and are subject to change as the project progresses.

l. SWPPP ACTIVITIES

The contractor shall install, maintain, and remove the items needed for the site SWPPP. The contractor shall assist the GRDA site inspector in the fulfillment of the requirements of the plan.

m. PROJECT CONSTRUCTION MEETINGS

During the course of the construction, there will be weekly construction coordination meetings held at the site. The contractor site superintendent (or his representative) shall attend and share those items of information as needed for the proper coordination of the activities at the site.

2.3 Construction Schedule

Note that the in-service date is critical to customer operation. Contractor shall allocate crews and equipment as necessary to meet this date and those costs should be included in the bid. Contractor may be required to work around other crews: example, while others are dressing and processing any transformers. GRDA Utility crews may also be on the worksite during the construction period. Because of the nature of the work, and the fact that much of the substation will need to be kept in service during the construction, ALL phases of the construction shall be coordinated with the GRDA inspector.

a. This project shall begin work on or before: 15 days after official Notice to Proceed

b. This project shall be completed on or before: 365 days after official Notice to Proceed

The Contractor shall provide a schedule of work to the Design Engineer at the beginning of construction. This schedule is to be up-dated every two weeks, reflecting the actual work completed and the expected time line of the work remaining, and resubmitted to the Design Engineer.

2.4 Work to be performed by others

The following items of electrical equipment and systems will be furnished, delivered, and installed by others. The contractor shall schedule his construction activities to coordinate with the installation activities of others and install the associated electrical connections as required to

complete the installation and ready for operation. Such items of electrical equipment and systems include, but are not limited to, the following.

- a. Testing of control panels and relays.
- b. Final inspection of all three phase switches.
- c. Test and checkout all equipment.

## 2.5 Examination of Site

Prior to submitting a quotation Contractor should carefully examine the work site and adjacent premises and should conduct necessary investigations to inform himself thoroughly of any difficulties involved in the completion of all work in accordance with the specifications and drawings. No plea of ignorance of conditions that exist or of difficulties that may be encountered in the execution of the work (due to failure in making the necessary preliminary examination and investigations) will be accepted as an excuse for any failure or omission on part of the Contractor to fulfill in every detail all of the requirements of the specifications and/or drawings.

## 2.6 Material Furnished By GRDA

The attached material list is the complete list of material to be furnished by GRDA.

All work of unloading, sorting, bundling, storing, and caring for GRDA furnished materials shall be performed by the Contractor and the costs are to be included in the bid price. Material furnished by GRDA (except as noted) shall be picked up at the Transmission & Engineering Storeroom, 4.5 miles East of HWY 69 on HWY 69A, Pryor, OK by the contractor and transported to the job site. Costs associated with this material hauling shall be included in contractor's bid. All material may or may not be available at the start of the job.

## 2.7 Receiving of Material

a. All material will be checked out with written forms signed by both the Contractor and GRDA personnel, and charged to the proper work order and account. After the Contractor has accepted the materials furnished by GRDA as being in good condition and the correct quantity at the time of issuance, the Contractor is responsible for loss or damage of any nature until the finished structure and surplus materials are accounted for and accepted by GRDA.

b. Contractor shall be charged the replacement cost for any materials lost or damaged after delivery.

c. GRDA will periodically furnish Material Status Reports to Contractor indicating GRDA furnished materials on hand and materials on order but not delivered.

d. Contractor shall accept delivery of the materials provided by GRDA at job site or at the warehouse and shall provide the Construction Coordinator/Inspector with an accurate record of all materials received, condition of material received, and of the disposition and use of such

materials.

e. Contractor shall furnish Supervision, manpower and equipment to unload at the site, handle, haul, sort, store, block, and protect the received materials. Contractor shall reload and re-haul GRDA-furnished materials as required to transport all previously delivered materials from the existing marshaling yards to the work site or storage sites, the cost of which shall be included in the various unit prices where such materials are used.

f. Hardware shall be handled in such a manner as to protect the finish, and shall be clean and bright and free from nicks, chips, or other marks when installed on the structures.

g. Materials received in damaged condition shall be processed as directed by GRDA. Contractor shall report any shortage or damaged materials, in writing, to GRDA within forty-eight (48) hours of receipt of materials. If any damage is so encountered, the damaged materials may be replaced by GRDA, or it may be repaired by Contractor, if so directed by GRDA. Contractor shall cooperate with GRDA in the event claims for damage against the transportation company are required. If shortage and/or damage reports are not furnished to GRDA within forty-eight (48) hours after receipt of materials by Contractor, the cost of the shortage and/or damage shall be borne by Contractor, if not otherwise collectable.

h. Delivery schedules will be established with various suppliers by GRDA to provide materials in sufficient quantities for orderly and timely incorporation in the work.

## 2.8 Surplus and Junk Material

a. Contractor shall separate surplus material and junk material as required by the Construction Coordinator/Inspector and GRDA Warehouse personnel.

b. Surplus and Junk Material shall be taken to the GRDA facility designated by the Construction Coordinator/Inspector and placed in a manner that will facilitate the return of the Surplus Material to the GRDA Warehouse for the disposal of the material that has been determined to be Junk Material.

c. An inventory of returned Surplus Material, in units will be kept by Contractor. Construction Coordinator/Inspector will initial the inventory when acceptable as accurate and complete. The inventory shall be provided to GRDA Stores Personnel when the Surplus Material is returned.

d. All returned conductor and shield wire shall be rolled onto wood reels, or coiled and banded.

e. GRDA will furnish bins at the site for selected recyclable material. The contractor shall make efforts to keep the material separated correctly. At present the bins will be for copper, aluminum, and small steel items.

## 2.9 Material Furnished By the Contractor

Contractor shall furnish all material (not specifically furnished by GRDA) needed to make this a complete Substation. Below is a list (not inclusive) of items to be furnished by the Contractor.

- a. Crushed rock
- b. Fill dirt, if required
- c. Conduit and fittings
- d. Concrete
- e. Exothermic shots and molds
- f. Equipment mounting bolts and miscellaneous fasteners
- g. Contractor shall furnish all expendable tools, supplies, and services that are not provided by GRDA.
- h. Fence and fence materials
- i. Grounding material (cable, wire, and fittings)
- j. control cable

#### 2.10 Contractor's Responsibility

- a. The Contractor shall provide all machinery, tools, equipment, conveyances, permits, materials, supervision, and labor for construction. The only exceptions are GRDA furnished materials as defined in this specification.
- b. Any material furnished by the Contractor shall be shown as "Material Provided" on the Contractor's billing. Copies of backup invoices from the vendors shall be provided to GRDA.
- c. Contractor shall bring any discrepancy or error found on GRDA drawings to the attention of the Construction Coordinator/Inspector immediately.
- d. The Contractor shall provide a qualified on-site Supervisor who is experienced and familiar with all the aspects of construction of this type substation and foundations. The Supervisor shall be knowledgeable of the safety considerations and rules involved in performing construction work within an energized high voltage substation. The supervisor shall be present at all times that the contractor's crews are at the site and whenever any subcontractor(s) is at the site. This supervision shall be at the Contractor's expense and included in the bid price.
- e. The work under this contract may be in progress concurrent with other construction activities. The Contractor shall coordinate his activities and cooperate with the other Contractors or GRDA crews in the best interests of the project.
- f. The Contractor shall make provisions for an area for storage of materials at or near the site. The Contractor shall use mats, dunnage, pallets, or other approved items on which the materials shall be stored, and shall keep the area clean. Equipment should be stored in a manner to prevent damage, and allow easy access for removal of material as required.
- g. The Contractor shall keep the site graded smooth and the yard clean of excess material to

the satisfaction of GRDA's Coordinator/Inspector at all times.

- h. All work shall be done and completed in a skillful and workmanlike manner using GRDA standards and manufacturer or GRDA drawings.
- i. Should the Contractor desire a field office, telephone, or water at the substation, it shall be at the Contractor's expense.
- j. If, during spreading of substation rock, mechanical equipment used by the Contractor comes in contact with a foundation in such a manner that causes chips, broken corners, or cracks in the concrete, the foundation shall be repaired or replaced at the Contractor's expense.
- k. The contractor shall be responsible for prompt unloading of any materials delivered to the job site (required for the work scope defined herein) during a regular 5-day work-week and shall pay any demurrage resulting from delays in unloading.
- l. Contractor shall collect all surplus material and return it to GRDA's designated warehouse. Loading and transporting this material shall be at the Contractor's expense and included in the bid price.
- m. Upon completion of work, the Contractor shall dispose of any and all non-usable excess materials (less surplus material). All usable materials are to be returned to GRDA.
- n. Any additional work and/or changes to the scope of work described herein (after award of the contract) and/or considered to be an extra cost to the contract price shall be brought to the attention of the GRDA's Coordinator/Inspector and Design Engineer prior to initiation of said work for additional payments to be considered. Extra payments will be made only when authorized by GRDA and pre-approved according to the Change Order process defined in Section 3.7 of the Contract. The value of any work not covered by the unit prices will be negotiated between contractor and GRDA.
- o. If work is to be performed in an energized substation, Contractor is responsible for maintaining safe working clearances.
- p. No employee of Contractor shall have firearms, alcohol, or illegal drugs on his/her person or in any vehicle while on site, or while crossing the adjacent lands going to and from said rights-of-way or site. No employee of the Contractor who is under the influence of alcohol or illegal drugs shall be allowed on the work site.
- q. The GRDA shall provide corner pins (iron pins) depicting the substation site boundaries as shown and described on GRDA's Plot Plan Drawings. The Contractor shall familiarize himself with the corner pins and shall be responsible for the accuracy of dimensions with the substation site when laying out the work based upon GRDA's substation engineering drawings.



- r. Contractor shall use due care to minimize all construction damages. GRDA will be responsible for construction damages to crops, furrows, lands, or personal property which GRDA deems normal and reasonably necessary, provided Contractor has complied with specifications and Contract provisions. Contractor shall pay for all other construction damages.
- s. Contractor will not leave holes open overnight. Open holes are to be properly covered and/or fenced, if required, to avoid property damage or injury to personnel. All holes left by the Contractor shall be filled with native soils and machine tamped to surrounding grade.
- t. Contractor will be responsible for restoring the surrounding area, disturbed by the construction, to the conditions found at the time construction began as near as reasonably possible.
- u. Contractor shall be responsible for the maintenance of existing roads, drainage ditches, and levees, including construction easements if any, from the date any work is begun on the job to the date of its final acceptance.
- v. Contractor shall be responsible for the accuracy of all dimensions within the various sections of work according to the figured dimensions of the drawings. Figured dimensions shall, in all cases, be taken in preference to scale measurements, and detailed drawings consistent with general drawings, in preference to general drawings of the same part of the work.
- w. Contractor shall exercise care with its operations near existing roads, drainage ditches, and levees. It is a requirement that Contractor maintain the roads, levees, and waterways in such condition that damage to the roads, levees, ditches, or to abutting property shall not result from his operations. Obstruction of natural flow in waterways by stockpiling or storing materials or by placement of equipment or supplies will not be permitted. Collections of debris that prohibit or inhibit normal functioning of drainage facilities shall be removed.
- x. Contractor shall make all necessary provisions and do all work required by its operations under the Contract to prevent any interference with power or communications lines, with their operation or maintenance or services thereon, all in a manner satisfactory to GRDA or operator thereof and all costs incidental thereto shall be included in the bid price.
- y. Permanent relocation of communication and power lines, if any, made necessary by this construction work will be the responsibility of GRDA. Any damage done by Contractor to power lines or communication lines shall be Contractor's responsibility and may be settled and paid for by GRDA and charged to Contractor.
- z. Contractor and sub-contractor(s) personnel shall not be permitted to enter substation property without prior arrangement and approval from the Construction Coordinator/Inspector.

- aa. Contractor shall not use the control building for storage or use its sanitation facilities. Contractor shall enter control building only when necessary to perform work as described in Contract.
- ab. No mechanical diggers may be used for the installation of new conduits or grounding in areas where existing active conduits, direct-buried conductors, and/or grounding are located. This work must be done by hand.
- ac. Contractor shall take proper means to protect the adjacent areas, structures, and apparatus in any way encountered. The Contractor or sub-contractor(s) shall cooperate with the Construction Coordinator/Inspector and do its work in such a manner as to make as little annoyance as possible to the adjacent property owners and residents.
- ad. Contractor's employees will properly conduct themselves at all times, keeping in mind the good customer relations which GRDA maintains.
- ae. Contractor is to keep personnel, material, and vehicles on the designated landowner roads or rights-of way.
- af. It is Contractor's responsibility to ensure the base line stakes are intact, and if not, to notify GRDA 48 hours before re-staking is required.
- ag. Contractor shall install all GRDA furnished signs, switch numbers, feeder numbers, and phase letters. Contractor shall furnish bolts, nuts, washers, and conduit clamps necessary for mounting.
- ah. Contractor shall make minor modifications required to manufacture, assemble, or mount GRDA furnished material (i.e. making small straps or brackets, drilling, re-drilling, or tapping holes, etc.). All minor modifications requiring ten man-hours or fewer shall be at Contractor's expense and included in bid price. Any modifications requiring more than ten man-hours and any additional cost shall be mutually agreed to with the Construction Coordinator/Inspector and authorized by GRDA using the procedure outlined for Change Orders in Section 3.7 of the Contract in advance of performing the work.
- ai. Contractor shall field assemble all equipment (except transformer(s)) per manufacturer's instructions and connect it per GRDA's drawings and specifications.
- aj. Contractor shall, at all times, have at least two crewmembers who speak fluent English. In addition, the site supervisor shall be fluent in English.
- ak. The Contractor shall provide temporary fencing, as required, such that the energized substation equipment is never accessible to the general public or grazing animals on the properties.
- al. Contractor shall provide only qualified journeymen workers for each task, with no more

than 1 apprentice per 2 journeymen, and all workers shall perform their work in a safe manner at all times. In this sub-paragraph, a journeyman shall mean a person who has had a minimum of 4 years of relevant on-the-job experience in all aspects of the work to be performed, under the guidance of a qualified journeyman, or as defined by Oklahoma State Statutes.

- am. Contractor shall use only Oklahoma licensed electrical journeymen (industrial, commercial) for the work consisting of conduit installation, cable pulling, and control cable terminations.
- an. The contractor shall install and maintain a silt fence or other SWPPP items around the site, if required by the drawings and other parts of this specification.

## 2.11 Construction Coordinator/Inspector's Responsibility

- a. The GRDA's Construction Coordinator/Inspector shall:
  - 1. Assist Contractor in coordinating and issuing of material.
  - 2. Maintain a schedule of the project with information provided by Contractor.
  - 3. Inspect Contractor's work for conformance to specifications.
  - 4. Collect and maintain foundation logs and other construction documentation.
  - 5. Coordinate any electrical switching clearances required for construction.
  - 6. Prepare regular weekly reports of construction progress as required for the Design Engineer and others.
  - 7. Assist in resolving any material delivery problems.
  - 8. Assist Contractor in the preparation of field-initiated Contract Change Order Requests as required for approval through the Change Order process defined in Section 3.7 of the Contract.
  - 9. Be responsible for "As Built" drawings and Equipment Capabilities Drawings.
  - 10. Document and submit design adjustments and technical questions to Design Engineer.
  - 11. Record any changes during construction that would improve future designs.
  - 12. Assist in preparation of completion reports for work orders.
  - 13. Other tasks as required to complete the project correctly and safely.
  - 14. Require the removal from the site (in the view of GRDA) of any unqualified or unsafe contractor worker.
- b. In no event shall the Construction Coordinator/Inspector's actions excuse the Contractor from its responsibility under the contract (1) to meet all technical specifications and (2) provide all safety precautions necessary in the performance of the work.

## 2.12 Design Engineer's Responsibility

- a. The GRDA Design Engineer shall:
  - 1. Review and approve payment invoices prior to forwarding them to the AGM.
  - 2. Review and, if acceptable, approve the engineering and technical changes proposed

- by the Contractor within any Contractor-initiated Change Order Requests.
3. Initiate and prepare and GRDA-initiated Change Order Requests.
  4. Act as the GRDA resource to provide decisions to the Contractor concerning technical and engineering questions that may arise during the construction project.
- b. In no event shall the Design Engineer's actions excuse the Contractor from its responsibility under the contract (1) to meet all technical specifications and (2) provide all safety precautions necessary in the performance of the work.

### **SEC. 3 EXCEPTIONS AND BID SCHEDULE**

- 3.1 Any and all exceptions to the requirements of these specifications shall be clearly documented by bidder in bidder's proposal.
- 3.2 Contractor shall begin work promptly after receipt of official Notice to Proceed. Before start of work, Contractor shall update the schedule provided to GRDA on the bid proposal with a written work schedule or a Gantt Chart, relating the sequence, approximate duration, and approximate start/end dates for each phase of the required work.
- 3.3 The successful contractor shall be required to attend a pre-construction meeting at the engineering office in Pryor. The meeting will be held within two weeks after the award of the contract.

## TECHNICAL REQUIREMENTS

### TR- 1 SURVEYING

1. GRDA shall provide a permanent benchmark whose elevation shall be described on GRDA's Grading Layout Drawing. All horizontal and vertical control points used by the Contractor shall always be referenced to the benchmark.
2. All work shall be done to the lines, grades, and elevations indicated on the drawings. The Contractor shall provide suitable equipment and competent workmen who shall locate and layout the work.
3. The Contractor shall preserve all monuments, benchmarks, reference points, and stakes. The Contractor will be charged with the expense of replacement of any such items destroyed, and shall be responsible for any error or loss of time that he may have caused. Permanent monuments or benchmarks, which must be removed or disturbed, shall be protected until they can be properly relocated. The Contractor shall furnish materials and assistance for the proper replacement of such monuments or benchmarks.
4. The Contractor is to protect and not disturb any of the centerline hubs, which are set or will be set.

### TR- 2 EARTHWORK

1. The Contractor shall make efforts to locate all underground utilities such as direct burial electrical and communication cables, fluid-carrying pipelines whether they be gas or liquid drainage lines such as storm sewer or sanitary sewage, and any other obstructions. Should an underground utility interfere with the site work, it shall be the Contractor's responsibility to contact the owners and have the exact location of the underground utility made known. GRDA does not guarantee their location by GRDA's plot plan dimensions or guarantee that all underground items have been found.
2. Ground surfaces within the construction areas shall be cleared of all trees, brush, debris, surface vegetation, topsoil, and humus materials down to the subsoil. Stumps and roots larger than two inches in diameter shall be completely grubbed and removed. Matted roots shall be removed regardless of size. Surface vegetation shall be removed complete with roots to a depth of not less than four (4) inches below the ground surface.

The Contractor shall remove all topsoil from the substation-fenced area, including the 3' – 5' perimeter apron, and replace with suitable fill.

The Contractor shall remove all combustible and other waste materials from the construction areas and dispose of it at the Contractor's expense.

Organic topsoil that is free of trash, vegetation, rocks, and roots, shall be stockpiled for later use under these specifications. Other topsoil shall be removed at Contractor's expense.

3. Trees outside the construction area shall be preserved and protected. Unless specifically authorized by GRDA, trees shall be removed from only those areas which will be cut or filled. Consideration will be given to the removal of additional trees only where deemed essential by GRDA, for the safe, effective execution of the work. Trees left standing shall be adequately protected from permanent damage by construction operations. Trimming of standing trees, where required, shall be directed by GRDA's Construction Coordinator/Inspector.
4. All materials necessary for the construction of fills and embankments shall be obtained from CONTRACTOR PROCURED borrow areas if soil on site is determined to be inadequate by GRDA.

The fill material shall be classified by ASTM D2487 as GW, GP, GM, GC, SW, SP, SW, SC or other material approved by the GRDA Project Engineer with a maximum liquid limit of 35, a maximum plasticity index of 12 and a maximum of 25 percent by weight passing a No. 200 sieve.

All material placed in fills and embankments shall be free from rocks or stones larger than six (6) inches at their greatest dimension, brush, stumps, logs, roots, debris, and organic or other deleterious materials. No rock or stones shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the allowable size limit may be incorporated in the remainder of fills and embankments provided they are distributed so that they do not interfere with proper compaction.

5. After preparation of the fill or embankment site, the subgrade shall be leveled and rolled so surface materials of the subgrade will be as compact and well bonded with the first layer of the fill or embankment as specified for subsequent layers.
6. All fill and embankment materials shall be placed in 2 or more horizontal layers not to exceed eight (8) inches in uncompacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction. Each layer of material being compacted shall have the best practicable uniform moisture content to ensure satisfactory compaction. The Contractor shall add water, and harrow, disc, blade, or otherwise work the material in each layer as required to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted by rolling and or by sheep footing. The compacted density of each layer shall be at least 95 percent of the maximum density at optimum moisture content as determined by ASTM D698 when that test is appropriate or 70 percent of relative density as determined by ASTM D2049 when that test is

appropriate. If the material fails to meet the density specified, compaction methods shall be altered.

7. After all construction work under these specifications has been completed; all ground surface areas shall be graded. The grading shall be finished to the contours and elevations indicated on the drawings, or, if not indicated, to the matching contours and elevations of the original, undisturbed ground surface. In any event, the final grading shall provide smooth, uniform surfacing and effective drainage of the ground areas.
8. Materials, which are not suitable for fills and embankments, shall be disposed of in a manner and location as approved by GRDA's Construction Coordinator/Inspector. Materials shall be deposited in the disposal areas and leveled and compacted in 12-inch maximum layers. Compaction shall be by not less than three passes by appropriate equipment.
9. Fills and embankments that settle or erode and facilities damaged by such settlement or erosion, shall be repaired, as set out in the general conditions to the contract. The settled or eroded areas shall be refilled, compacted, and graded to conform to the elevation indicated on the drawings or to the elevation of the adjacent ground surface. Damaged facilities shall be repaired in a manner acceptable to GRDA.
10. All field and laboratory testing required to determine compliance with the requirements of this section will be provided by the Contractor. One density test shall be conducted per 10,000 square feet of each lift of fill material placed or fraction thereof. A minimum of one density test per lift of fill material shall be performed. Density tests may be conducted using either ASTM D1556 "Density and Unit Weight of Soil in Place by the Sand Cone Method" or ASTM D2922 "Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)". The Contractor will furnish two (2) copies of the test results to the GRDA's Construction Coordinator/Inspector within 2 working days of the test.
11. Maximum density for cohesive compacted materials placed under this section will be determined in accordance with ASTM D698. The term "relative maximum density" shall be as defined in ASTM D698.
12. Relative density for noncohesive compacted materials placed under this section will be determined in accordance with ASTM D2049. The term "relative density" shall be as defined in ASTM D2049.
13. If silt fences are required for the project, the contractor shall install and maintain them for the project duration. At the end of the project they are to be removed. If these are required, see the Storm Water Discharge Plan, as furnished by GRDA for details.
14. After subgrade preparation and prior to applying the final aggregate layer, areas to receive aggregate surfacing shall be treated with a weed eradicator and soil fumigant.

Weed eradicant and soil fumigant shall be applied in strict accordance with the manufacturer's instructions. The weed eradicant and soil fumigant shall be Allied Chemical "UROX" or "URAB"; Du Pont "Hyvar-X" or "Hyvar XL"; or U.S. Borax "Ureabor".

## TR- 3 SEEDING

### 1. General

This section covers the seeding of disturbed earth and sloped areas created by the construction covered by this specification. All areas disturbed during site preparation, shall be seeded except for finished driveway areas, the area inside the substation fence, and the 3' – 5' substation perimeter apron.

This work shall include the furnishing of all labor and materials including fertilizer, seed, and all equipment necessary for the preparation of the seedbed, planting of seed, the application of fertilizer, rolling, watering and maintenance. Eroded areas shall be repaired prior to preparation of the seedbed. Additional material shall be added and compacted as required to provide uniform slopes with effective drainage.

The seeding contractor shall furnish equipment manufactured expressly for the work.

### 2. Materials for seeding

Fertilizer. Fertilizer shall be applied in appropriate portions if required to ensure adequate establishment of grass to prevent erosion of finished grade.

Commercial fertilizer shall be uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer shall be stored in a weatherproof storage place in such a manner that it will be kept dry and its effectiveness will not be impaired.

Seed. Rye grass seed (or approved substitute) in appropriate quantity to establish growth sufficient to prevent erosion of finished grades, shall be applied to all required areas.

### 3. Seed Application

Topsoil. The Contractor shall be responsible for the procurement and distribution of suitable topsoil, as approved by the GRDA Construction Coordinator/Inspector. The topsoil, as specified, may be obtained from stockpiles on GRDA's property, if available. If GRDA has no available topsoil, the Contractor shall locate and furnish suitable topsoil.



Topsoil for planting operations shall be fertile friable, natural loam containing a liberal amount of humus, and shall be capable of sustaining vigorous plant growth. Topsoil shall be free of subsoil and shall be reasonably free to stone, lumps, clods of hard earth, plants or their roots, stalks, and other extraneous matter.

4. Watering. Watering will be required over the entire seeded area if rainfall is not sufficient to germinate the seed immediately. Water shall be applied to penetrate three inches into the soil immediately after compaction is completed. Watering should be sufficient to establish a complete cover of green before the weather retards growth.

It shall be the responsibility of the Contractor to furnish all pipes, pumps, hose, sprinklers, water, and all other necessary materials to apply water as necessary for maximum growth.

5. Guarantee. The Contractor shall guarantee all work and materials for a period of one year after completion of seeding work. During the guarantee period, all seed that dies shall be replaced by and at the expense of the Contractor.

#### TR- 4 FOUNDATION EXCAVATION AND BACKFILL

The specific type of foundation to be used at each structure location shall be shown on the drawings.

The foundation concrete shall cure a minimum of seven (7) days before erecting steel or applying any loads, except the transformer foundation, which requires twenty-one (21) days minimum.

Mat foundations and grade beams should be neatly excavated. Excavation should be accomplished with a smooth-mouthed bucket. If a toothed bucket is used, excavation with this bucket should stop 6-inches above bottom (invert) grade and the excavation completed with a smooth-mouth bucket or by hand labor. Steel should be placed and the foundation concrete placed the same day as excavation. Debris in the bottom of the excavation should be removed prior to steel placement. If for some reason the foundation concrete cannot be placed the same day as excavation, the Construction Coordinator/Inspector may require it be sealed to protect the exposed foundation site.

The excavation should be sloped sufficiently to create an internal sump for the runoff collection and removal. Surface runoff water accumulating at the bottom of the excavation should be pumped out prior to concrete placement.

Under no circumstances should accumulated water be allowed to affect the quality of the bearing surface adversely.

Drilled piers should be dry augered and constructed in an expeditious manner. Concrete should be placed in the footing excavations immediately following drilling, under-reaming, and inspection. Under no circumstances should the excavation remain open more than eight (8) hours unless permitted by GRDA's Construction Coordinator/Inspector. Surface runoff or ground water influx accumulating in the excavation should be pumped out prior to placing concrete in drilled pier.

No concrete shall be placed in water except with the written permission of GRDA, and the method of depositing the concrete shall be approved by GRDA. If more than one placement is required to complete a foundation, the Contractor shall chip the top of the piers, remove dirt and debris, and apply concrete epoxy bonding agent before starting the second placement. The Contractor shall furnish the concrete epoxy bonding agent.

Top surfaces of substation foundations shall be steel trowel finish with a permissible variation of elevation shown of plus or minus 1/16 inch. Edges of slab type foundations, shall have a 3/4 inch chamfer, unless otherwise shown on the drawings.

Pier type foundations with round caps shall be formed using "Sonotube" or reusable round metal forms. The top edge of all round cap foundations shall have a 3/4" chamfer. A "bolt-on" chamfer strip shall be used to obtain the necessary 3/4" chamfer. Sides of all substation foundations, including round caps and chamfers (above finished grade to a minimum of six (6) inches below finished grade) shall be rubbed with carborundum stones. That portion of forms covering the concrete to be rubbed may be removed as soon as concrete has set a minimum of twelve (12) hours. All other forms must be allowed to remain in place a minimum of seven (7) days. Concrete work is not to proceed without authorization of the Construction Coordinator/Inspector.

**EXCESS EXCAVATION SOIL AND DEBRIS SHALL BE REMOVED FROM THE PROPERTY AND PROPERLY DISPOSED OF BY THE CONTRACTOR.**

All reinforcement bar must have 3" (minimum) clearance on all sides, top and bottom.

The Contractor shall furnish all concrete, reinforcing steel, chamfer strips, and other form material.

For concrete cast-in-place foundation piers, the volume of over excavation shall be filled with concrete. Concrete shall not be placed against backfill or disturbed earth.

The cost of additional concrete used in the foundation (due to over excavation) shall be borne by the Contractor, unless otherwise approved in writing by GRDA.

The quality of the hole will be approved by GRDA before any concrete is placed in the excavation. Where water is encountered, the hole shall be kept dry by pumping during the installation of the foundation.

If unsuitable material is encountered at the bottom of cast-in-place concrete piers, GRDA may direct that a deeper cylinder be installed and the basis of payment will be the Contract unit price for the depth of circular pier actually installed.

GRDA will furnish all anchor bolts unless otherwise specified in the Drawings.

The Contractor shall maintain accurate records which shall contain the following information for each pier:

Contractor's name  
Drill rig operator's name  
Pier number and location  
Shaft diameter  
Ground elevation  
Top elevation of shaft  
Top elevation of rock, when applicable  
Bottom elevation of shaft  
Ground water elevation  
Caving or sloughing of excavation  
Drilling difficulties  
Casing insertion, size and length, and whether or not removed  
Date and time of start and finish excavation  
Length and diameter of reinforcing bar cage  
Date and time concrete placed  
Calculated volume of excavation based on diameter of shaft and bell  
Total quantity of concrete placed

## TR- 5      CONCRETE

5.1. General. This section covers all cast-in-place concrete and includes reinforcing steel, forms, finishing, curing and other appurtenant work. The Contractor shall notify GRDA 24 hours prior to concrete placement. No concrete shall be placed without the approval of GRDA's Construction Coordinator/Inspector.

5.2. Materials. Where the use of the following material is specified herein, such material shall be in accordance with these requirements:

Cement - ASTM C150, Type I, II

Fine Aggregate - Clean natural sand, ASTM C33. Artificial or manufactured sand will not be used unless specific prior approval of the GRDA is obtained.

Coarse Aggregate - Crushed stone, washed gravel, or other approved inert granular material conforming to ASTM C33. The size of the aggregate shall conform to be ASTM 57 unless otherwise required or permitted by GRDA.

Water - Fresh, clean and free from injurious amounts of oils, acids, alkalis, salts, organize materials or other substances that may be deleterious to concrete or steel.

Admixtures - Admixtures to be used in concrete, when required or permitted, shall conform to the listed specifications.

Air-Entraining Agent - Shall conform to ASTM C260

Water Reducing Agent - Shall conform to ASTM C494, Type A (water reducing)

Water Reducing Retarder - Shall conform to ASTM C494, Type D (water reducing and retarding)

Water Reducing Accel. - Shall conform to ASTM C484, Type E (water reducing and accelerating)

Reinforcing Steel ASTM 615, Grade 60 - Rebar yield strength should match the yield strength used for design

### Forms

Pier Form - Sonatube, Sonoco Products, Co., Hartsville, S.C., or approved equal.

Lumber - Straight, uniform width and thickness.

Form Oil - Light colored paraffin oil or other approved non-staining material.

Polyethylene Film - Fed. Spec. L-P-378, Type I; 6 mil

Membrane Curing - Fed. Spec. TT-C-800, chlorinated rubber, compound minimum 18 percent solids.

5.3. Limiting Requirements - Concrete shall be controlled within the following limiting requirements:

a. Specified compressive strength @ 28 days shall be 4,000 psi.

(1) Average strength shall exceed specified compressive strength as required in accordance with ACI 318.

b. Concrete shall be air-entrained. Total air content required (air-entrained and entrapped air) shall be:

Normal Max Size Coarse Aggregate	Total Air Content	
3/4"	6%	±1
1"	5%	±1
1-1/2"	4.5%	±1

Air content shall be measured by ASTM C231, "Test for air content of freshly mixed concrete by pressure method".

c. Concrete shall be proportioned and produced to have a slump between 3" and 5". No concrete shall be placed with a slump greater than 5".

Slump shall be determined by ASTM C143, "Standard Method of Test for Slump of Portland Cement Concrete".

d. Maximum size of coarse aggregate shall not exceed:

- (1) One-fifth narrowest dimension between forms.
- (2) Three-fourths minimum clear spacing between reinforcing bars.
- (3) One-third thickness of slabs.

e. Concrete may be adjusted to produce the required rate of hardening for varied climatic and job site conditions by incorporation of appropriate admixtures. Prior approval by GRDA is required before these adjustments may be made.

Concrete mix proportions shall be determined on the basis of field experience of trial mixtures in accordance with the provisions of ACI 318. All concrete mix designs shall be approved by GRDA prior to their use on this project.

5.4. Batching and Mixing. Batching and mixing shall conform to ASTM C94, except as otherwise specified herein.

Before unloading the concrete at the site, a copy of the delivery ticket shall be furnished to both the purchaser and the GRDA's Construction Coordinator/Inspector.

When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be complete within 1-1/2 hours, or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates, unless a longer time is specifically

authorized by the GRDA's Construction Coordinator/Inspector. In hot weather, or under conditions contributing to quick stiffening of the concrete, a time less than 1-1/2 hours may be required by GRDA.

- 5.5. Placement. Concrete shall be conveyed to the point of final deposit and placed by methods which will prevent the separation or loss of the ingredients. During and immediately after depositing, all concrete shall be thoroughly compacted, worked around all reinforcements and embedments, and worked into the corners of the forms. Unless otherwise authorized, compaction shall be by immersion-type vibrators only.
- 5.6. Hot Weather Concreting. Except as modified herein, hot weather concreting shall comply with ACI 605. At air temperatures of 90 degrees F or above, special procedures shall be adopted to keep the concrete as cool as possible during placement and curing. The temperature of the concrete shall not exceed 90 degrees F when it is placed in the work.

Whenever the air temperature exceeds 95 degrees F, membrane cured slabs shall be kept wet to promote cooling of the concrete during the curing periods.

- 5.7. Cold Weather Concreting. Except as modified herein, cold weather concreting shall comply with ACI 306. The temperature of concrete at the time of mixing shall be not less than that shown in the following table for corresponding outdoor temperature (in shade) existing at the time of placement:

<u>Outdoor Temperature</u>	<u>Concrete Temperature</u>
Below 30°F	70°F
Between 30°F & 45°F	60°F
Above 45°F	45°F (50° F if temperatures are expected to decrease during curing period)

When deposited, the temperature of heated concrete shall not be over 80° F.

When freezing temperatures may be expected during the curing periods, suitable means shall be provided for maintaining the concrete at a temperature of not less than 50 degrees F for five days or 70 degrees F for three days after the concrete is placed. Concrete and adjacent form surfaces shall be kept moist at all times. Sudden cooling of concrete shall not be permitted.

The use of calcium chloride, will be permitted PROVIDED justification for its use is provided to GRDA and the use of it is approved by GRDA prior to its use.

- 5.8. Reinforcement.

Reinforcing bars shall conform to ASTM Standard Specification for Deformed Billet Steel Bars for Concrete Reinforcement, Designation A615,  $F_y = 60$  ksi.

Steel reinforcing bars shall be supplied by the contractor. Bars shall be placed in the concrete where shown on the drawings. Unless otherwise shown on the drawings or directed, measurements made in placing the bars shall be to the centerlines of the bars. Reinforcement drawings show bar placement details and bar bending details, including bar lists and bending schedules. Before the reinforcing bars are placed, the surfaces of bars and the surfaces of any metal bar supports shall be cleaned of heavy flaky rusts, loose mill scale, dirt, grease or other foreign substances. After being placed, the reinforcing bars shall be maintained in a clean condition until they are completely embedded in concrete. Main reinforcement shall have a minimum clear protective cover to the face of concrete as shown on the drawings. Reinforcing bars shall be accurately placed and secured in position so that they will not be displaced during the placing of concrete, and special care shall be exercised to prevent any disturbance of the reinforcing bars in the concrete that has already been placed. Precast concrete blocks may be used for supporting reinforcing bars.

Rustproof metal chairs, metal hangers, metal spacers, or other satisfactory metal supports may be used for supporting reinforcing bars.

Welding on reinforcing bars in lieu of tie wire will not be permitted. A minimum of 50% of the rebar in rebar cages shall be tied with wire.

Reinforcing cages outside their final position in the foundation shall be of sufficient rigidity to permit lifting and handling without deformation.

Lap splices in reinforcing bars shall be a minimum length as calculated for Class B splices in accordance with ACI 318 latest revision, unless otherwise shown on the drawings or approved in writing by GRDA. Welded splices shall not be used for reinforcing bars.

- 5.9. Forms. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions shown on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment. Forms shall be thoroughly cleaned and oiled before concrete is placed and shall not be removed until the concrete has hardened sufficiently to support all loads without damage.

Where concrete is placed against dry or porous surfaces, such surfaces shall be covered with polyethylene film to protect the concrete from loss of water. Joints in the film shall be sealed with waterproof sealing tape. Unless otherwise permitted by GRDA, all concrete except pier concrete which is in contact with earth or granular fill shall be placed against 10 mil polyethylene film.

Vertical concrete surfaces above extended footings shall be formed.

Form ties shall be of the removable end, permanently embedded body type. Outer ends of the permanently embedded portions of form ties shall be at least one inch back from adjacent outer concrete faces.

Chamfer strips shall be placed in forms to bevel all foundation edges and corners except where otherwise noted. Bevel dimensions shall be 3/4 inch by 3/4 inch unless otherwise shown on the drawings.

- 5.10. Embedments. Materials that are to be embedded in the concrete shall be accurately positioned and securely anchored. Embedments shall be clean of all concrete spatter and other foreign substances.
- 5.11. Finishing Formed Surfaces. All fins and other surface projections shall be removed from all formed surfaces from which the forms are stripped except exterior surfaces that will be in contact with earth backfill. The surfaces shall be rubbed down using a mortar mix made from the same cement the foundation concrete is made of. This will assure color blending.

The removable ends of all form ties shall be removed and the recesses resulting from such removal shall be filled with mortar.

- 5.12. Finishing Unformed Surfaces. The unformed surfaces of concrete shall be screeded and given an initial float finish followed by a second floating at the time of initial set.
- 5.13. Curing. Concrete shall be protected from loss of moisture for at least seven (7) days by polyethylene film or membrane curing compound. Membrane curing compound shall be applied as recommended by the manufacturer. Concrete shall not be permitted to freeze for at least seven (7) days following placement.
- 5.14. Repairing Defective Concrete. Defects in formed concrete surfaces shall be repaired to the satisfaction of GRDA within 24 hours, and defective concrete shall be replaced within 48 hours after the adjacent forms have been removed. All concrete which is porous, honey combed, and otherwise defective to a depth in excess of one inch shall be cut out and removed.

Concrete repair work shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Mortar and concrete used in repair work shall be adequately cured and rubbed out.

- 5.15. Concrete Testing – The contractor shall provide an A.C.I. certified concrete testing company, acceptable to the owner, to conduct quality control testing of the concrete used on this project. Quality control tests for concrete shall be performed on each truckload of concrete (or fewer, at the discretion of GRDA)



and shall consist of a slump test per ASTM C 143, and entrained air test per ASTM C 231 and a concrete temperature test per ASTM C 1064. Each test shall include making four (4) 6 inch diameter x 12 inch long test cylinders per ASTM C 31. The test cylinders shall be tested in accordance with ASTM C 39. One cylinder is to be tested at 7 days, two cylinders are to be tested at 28 days and the remaining cylinder is to be saved for possible testing at a later date. The concrete samples are to be taken in accordance with ASTM C 172. Failure of the concrete to meet the requirements defined in this specification shall be cause for foundation replacement at the contractor's expense. Concrete testing shall be at the contractor's expense and the test results shall be provided to GRDA's Construction Coordinator/Inspector within 24 hours of the completion of each test.

TR- 6      ROADS

1. GRDA assumes no responsibility for securing right to use or the condition of maintenance of any road or structure that may be used by the Contractor in performing the work under this Contract or in the transferring of materials to and from the site of the work. Roads must be returned to their original condition.
2. GRDA will make no payment to the Contractor for any work done in constructing, improving, repairing, or maintaining any road or structure for use in the performance of work under this Contract, unless the road construction is part of the contract and included as a pay item.
3. Roads subject to interference by the work shall be kept open. The Contractor shall provide, erect and maintain, at its own expense, effective barricades on which shall be placed acceptable warning and/or detour signs at each side of any road obstruction caused by the operations of the Contractor and shall comply with Federal, State, and Local regulations.

TR- 7      CULVERTS

1. GRDA's Grading Layout and/or Plot Plan drawing will show culverts that will be required for the project.
2. Culverts and associated materials shall conform to the following requirements:

Reinforced concrete pipe:	ASTM C-76 - Size, shape, gage, and lengths as indicated on the GRDA drawings.
Steel pipe:	16 gauge corrugated hot dipped galvanized, round, lengths and sizes as directed by the GRDA.
3. Culvert trenches shall be carefully graded to the required slopes then carefully tamped to receive and fit the lower part of the pipe. If rock is encountered in the excavation it

shall be removed and replaced with suitable earth or granular fill material to a minimum depth of six (6) inches below the bottom of the pipe.

4. Culvert pipe shall be laid on the prepared bed starting at the outlet end with sections firmly joined, and with the outside laps of circumferential joints (if any) pointing upstream. Longitudinal seams shall be placed at the side of the trench.
5. Backfill shall be placed adjacent to and over the pipe in six (6) inch lifts, with each layer thoroughly compacted (minimum 12 inch covering).

TR- 8      CRUSHED ROCK SURFACING

1. Subgrade preparation: Immediately prior to surfacing, the subgrade shall be shaped to the grade and cross-section indicated on the drawings.
2. Crushed rock surfacing materials are given on the Grading Details.
3. The surface course shall be six (6) inches compacted thickness per attached drawings. Initially spread to (7) inches before compaction.
4. The compacted surfaces shall be free of ruts, depressions, and other surface disturbances and shall be finished to the lines and grades indicated on the drawings.
5. Surfaced areas shall be maintained by the Contractor until final acceptance of the work under these specifications.

Material shall conform to the following:

Crushed Stone. Crushed stone surface for the substation surface shall conform to Type 'A', of Oklahoma Department of Transportation Section 703.01 – Mineral Aggregate, Miscellaneous Use. Any sub base stone specified on the drawings shall be Type 'C' of the Oklahoma Department of Transportation Section 703.01 – Mineral Aggregate, Miscellaneous Use.

Crushed stone shall consist of fragments of hard, durable particles of stone showing an abrasion loss of not more than 40%, containing not more than 5% soft, friable material (No Fines), and shall be free from an excess of flat or elongated pieces. Below, for reference, is the gradation requirements (refer to the ODT standard for the most current standard and the complete requirements):

<u>Sieve Size</u>	<u>Percent Passing (By Weight)</u>	
	<u>TYPE A</u>	<u>TYPE C</u>
2 inch		100
1 1/2"	100	90 - 100
1"		80 - 100
3/4 "	40 - 100	
1/2 "		60 - 80
3/8 "	30 - 75	
No. 4	25 - 60	40 - 60
No. 10	20 - 43	25 - 45
No. 40	8 - 26	15 - 30
No 200	4 - 12	0 - 5

The material passing the 40 sieve shall conform to the following requirements:

Liquid Limit (Max)	25
Plasticity Index (Max)	6

Measurement. The stone will be measured by the ton, the weight determined by weighing the transporting vehicle loaded and empty.

Stone Revetments. Shall be hard, durable stone that will not disintegrate upon exposure to the elements or be easily broken from handling. Stone shall be well mixed and reasonably free from earth, dust, and other objectionable materials. Stone used for erosion control or for retention ponds, shall be as specified in the Grading Detail.

Placing. The stone revetment shall be dumped or rolled into place in such a manner that the smaller stones will be uniformly distributed through the mass. Sufficient handwork shall be done to procure a neat and uniform surface.

Measurement. The stone revetment will be measured by the ton, the weight determined by weighing the transporting vehicle loaded and empty. The quantity, installed and accepted, will be paid for at the contract unit price.

Payment will be made under:

<u>Pay Item:</u>	<u>Pay Unit:</u>
Stone Revetment for Erosion Control (12" thick)	Square Yard
Stone Revetment for Pond (4" thick)	Square Yard

Surface Rock  
(6" thick)

Cubic Yard

TR- 9      GROUNDING

1. The station grounding system consists of a buried main grid, which is interconnected with driven ground rods and/or ground wells. The grounding system shall be connected to all structures and noncurrent carrying metal parts of electrical equipment such as tanks, switch mats, switch handles, frames, bases, cabinets, and connections from equipment neutrals.
2. The main below-grade ground grid shall consist of soft-drawn copper cable buried a minimum of 24" below dirt grade arranged in the pattern shown on the plan view, above grade ground connections to be constructed with Copper Weld conductor. Each structure is to be connected to a minimum of two (2) #4/0 cables (unless noted otherwise on the drawings).
3. Ground rods shall be  $\frac{5}{8}$ " or  $\frac{3}{4}$ " diameter, 10' minimum, copper-clad steel rods furnished for this purpose. Connections between the rod and the ground grid shall be copper wire, size as per GRDA Drawings.
4. All below grade grounding system connections shall be made using the exothermic process as shown on GRDA drawings. Connections shall include all cable-to-cable splices, T's, X's, etc.; all cable to ground rods; and cable lug terminations to steel unless otherwise shown.
5. Once the grounding system is complete, GRDA shall test the designed ground system and if additional ground rods and/or grounding materials are required, these shall be installed in accordance with GRDA's directions.
6. Grounding of all equipment frames, tanks, switch handles, switch mats, or bases shall be connected to the main ground grid as shown on GRDA drawings by copper cable. The ground connections, when bolted, shall be bolted to the equipment with 1/2" S.S. bolts, (2) flat and (1) Belleville washer with silicon bronze nuts. Bolt length shall not exceed four threads showing past nut, after nut is torqued. All bolts to point north, east, or down when feasible. When other methods of grounding are used, such as a single groove clamp, these shall be used as shown on the drawings.
7. Group operated switch mechanism shafts shall be grounded to the operating handle with approved grounding (Braid) devices.
8. All grounding shall be performed as shown on GRDA Construction drawings and details. All nut and bolt connections shall be made with bolts long enough to have at

least one full thread of the bolt past the nut, and no more than 5 full threads past the nut.

9. Electrical equipment mounted by bolts to a well-grounded steel structure shall be considered adequately grounded. A copper bus is not required between equipment and structure unless specified in drawings.
10. Switch ground mats shall be installed being held down with rebar stakes. Switch ground plates shall be installed by being placed on the final rock grade and held in place with rebar stakes. The Contractor shall furnish rebar stakes.
11. All exothermic ground grid connections shall not be buried until inspected and approved by GRDA's Construction Coordinator/Inspector.

11.1 Exothermic Welds:

The Contractor shall supply all shots required. All shots and molds shall either be Cadweld or Thremoweld brand. The shots must be from the same manufacturer. The exothermic welds shall be installed as per the following specifications:

A. Conductor General

1. Clean and dry the conductor removing any contaminants (oil, insulation, water, etc.) present in conductors.
2. Use a safety solvent to wash the conductor, and then dry it.
3. Remove oxides with a wire brush.
4. Dry conductors with a torch.
5. If slag deposits cover more than 20% of the connection surface, or any strands are exposed after slag has been removed, the connection must be rejected.
6. The connection should be essentially free from porosity.

B. Mold, General

1. A mold is designed to last for an average of 50 connections. This will vary according to the care given the mold during use.
2. If the mold is excessively worn, replace it with a new mold.
3. Molds shall not be altered in the field.

4. Heat mold with torch (to above 212°) to dry the mold after each use.
5. Remove any mold packing material or contaminants in weld cavity of the mold.
6. Clean the mold with a soft brush, cloth, or newspaper. DO NOT USE A WIRE BRUSH.
7. Apply Cadweld / or equal “mold sealer” external to the mold around the conductor or rod to retard leakage of the weld metal.

C. Welding to Steel and/or Ground Rods

1. Clean the steel and/or ground rod with a rasp or grinder to bright metal. All scale, paint, and/or other coating must be removed. Wire brush will NOT suffice. Grease must be removed with safety solvent before cleaning.
2. Clean galvanized surfaces with a wire brush or emery cloth. Extra heavy-galvanized steel must be cleaned with a rasp.
3. If the steel and/or ground rod is moist, heat with a torch (from the back side if possible). Any carbon deposit from the flame must be removed.

12. Ground Wells

1. The construction of the ground wells shall be as detailed on the drawings.
2. The backfill material shall be BENTONITE.
3. The bentonite shall be mixed with water to form a slurry mixture with the consistency of pancake batter. The water mixture shall be between 14 and 18 gallons of water to 50 pounds of bentonite.
4. The copper electrode shall be installed, with a weight on the end, extending to the bottom of the well before the bentonite is installed.
5. The well shall be filled with bentonite to within 6” of the horizontal run of ground cable (within 2’-6” of the surface).
6. All wells shall be filled with the electrode and bentonite on the same day as the well is drilled. If this becomes impossible and is approved by the GRDA Construction Coordinator/Inspector, the filling may be delayed. However, the well must be cleaned out just before the electrode and bentonite is installed, using a method approved by the GRDA Construction Coordinator/Inspector.

TR-10     STATION POST INSULATOR ASSEMBLY

1. General

GRDA will supply insulators in quantities and strengths required for use in the assemblies. The insulators shall be assembled in accordance with the drawings.

The strength of insulator to be used on each structure is shown on the drawings furnished by GRDA. The Contractor shall exercise care that the correct strength of insulator is used at each structure.

Suspension insulator strings on tangent structures and in jumper assemblies shall not be more than one inch out of plumb after conductors are clipped in.

Hardware shall be handled in such a manner as to prevent contacting the ground. All hardware items shall be clean when installed.

Horizontal bolts or pins shall have the nut and/or cotter on the structure side of the connection. In the case of the horizontal conductor configurations, horizontal bolts or pins of center-phase connections shall have the nut and/or cotter consistently on one side or the other of the connections. On steel towers, these nuts and/or cotters shall face the ladder leg side. Vertical bolts or pins shall have the nut and/or cotter on the underside of the connection.

Ball and socket connections in a horizontal or semi-horizontal plan, as in dead-end or vee string configurations, shall have the cotter pins installed with the eyes on top so that the spread portions may be viewed from the ground. Ball and socket connections in a vertical plan shall have the eyes of the cotter pins on the tower side with the long axis of the pins perpendicular to the conductor.

Humpback cotters shall not be spread. Straight cotters shall have the ends spread and turned back to an opening of 180 degrees. Cotter pins in the suspension insulators must not be spread.

Heat-treated "U" bolts of suspension and dead-end clamps shall be properly seated and nuts uniformly tightened, as indicated on an approved torque wrench, to the following torque limits.

<u>"U" Bolt Size (in.)</u>	<u>Minimum (ft. – lbs.)</u>	<u>Maximum (ft. – lbs.)</u>
1/2	45	50
9/16	65	70
5/8	80	85
3/4	95	100

After the initial tightening of dead-end clamps, the “U” bolt shall be further seated by firmly driving them down with a hammer. The nuts shall then be fully retightened to the proper torque.

All other bolted fittings shall be installed with bolts properly seated, and nuts securely and uniformly tightened.

Bolted electrical contact surfaces of jumper terminals, paralleled groove clamps, terminal lugs, tee connectors, etc., shall be cleaned, coated with Alcoa No. 2 electrical joint compound, abraded through the grease with emery cloth or wire brush, and then bolted together with grease in place. All bolted electrical connections shall be torqued in accordance with the manufacturer’s recommendations.

## 2. Handling of Insulators

All insulators shall be handled carefully during transportation, assembly and installation on the structures or equipment to avoid chipping or damage of any kind.

All insulators shall be clean when installed and all other parts free from dirt.

Only clean rags, or other methods acceptable to GRDA, free from any abrasive material, shall be used for cleaning insulators.

Wire brushes shall not be used for the cleaning of any parts, metal or otherwise.

Workmen shall not climb on insulators at any time.

In the completed substation, all insulators and insulator assemblies shall be clean.

## 3. Damaged Insulators

Damaged insulators shall not be installed.

All damaged or defective insulators shall be returned to GRDA’s designated yard for inspection and disposition by GRDA.

## TR-11 DISCONNECT SWITCHES

Disconnecting switches shall be field assembled by the Contractor on station post insulators and installed on structures intended for these purposes. The control mechanism for the switch shall be installed and the switches shall be aligned for perfect and free operation in accordance with the manufacturer’s instructions or recommendations. Switches shall be connected to the station bus per the GRDA drawings and manufacturer specifications.



Motor operated switches should have 180° degree CCW rotation to open, as viewed from the top.

SET SCREWS SHALL NOT BE SET UNTIL THE SWITCHES HAVE BEEN INSPECTED BY THE GRDA'S CONSTRUCTION COORDINATOR / INSPECTOR OR GRDA SUBSTATION PERSONNEL.

## TR-12 CONDUIT AND RACEWAY

### A. General

All wiring is to be inspected by GRDA for adherence to practices and GRDA standards and all devices used for installing the control cable will be checked for proper operation.

Contractor shall install all cables in accordance with drawings and the Cable Schedule included in this specification under separate division.

All control cable is to be supplied by Contractor.

Immediately after cables are cut from the reels, they shall be identified at both ends with cable markers. The cable markers shall be securely fastened to the cables to make certain that they will not become separated from the cables during the training and termination process. Where more than one cable is installed in a conduit there shall be a tag for each cable. The cables shall be identified individually where they enter into the conduit. The cable tags shall be located at convenient locations for inspection and shall not be concealed by equipment or other material.

The Contractor shall store reels in an area reserved only for that purpose and shall protect them from damage by construction activities or the handling of other material in storage. Wire in coils, and any wiring accessories, which can be damaged by moisture or rough handling, shall be kept in a storeroom or suitable trailer.

In handling reels, proper precaution shall be taken by the Contractor to prevent any damage to the cable or any reel that is returnable for reel credit. Reels shall be rolled only in the direction indicated by the manufacturer and no reel containing cable shall be dropped from a truck or from any other comparable height, under any circumstances. In turning reels, particularly after the lagging has been removed, bars shall be used in such a manner that they will not bear against the cable. Reels shall not be rolled over rocks or other projecting objects that are liable to damage the cable, and when it is necessary to roll unlagged reels over soft ground, plank tracks shall be provided by the Contractor to keep the reel from sinking causing possible damage to the cable.

## B. Direct Buried

Where new cable trench is required, a trench with a minimum 12" width shall be excavated to a depth of 18" below finished grade. A 3" layer of sand shall be placed in the trench and cables, then laid in place in the center of the ditch. An additional 3" layer of sand shall be placed over the cables, then covered with the 2" X 8" pressure treated timbers.

Cable shall be installed in the trenches or raceways in accordance with GRDA's Substation Cable Tabulation and Drawings. Allowances should be made for proper lead length to all equipment. Under no circumstances shall a cable be spliced in the substation.

## C. Conduit and Cable

Conduit runs shall be installed a minimum of 18" below final yard grade. The Contractor shall leave sufficient length of cable at each end of the conduits so that connections can be made to all electrical equipment. The Contractor shall identify each cable at both ends with T&B Ty – Raps and T&B markers provided by the Contractor.

All rigid PVC conduits, condulets, and conduit fittings will be supplied by the Contractor. All material should be of the same type (manufacturer) and color when feasible. (Minimize mix and match for appearance and consistency). Conduit and connectors shall be Electrical Grade Schedule 40. Minimum conduit size in the yard shall be 1 1/2" in inside diameter, except as noted on the drawings. When three or more conduits are installed in one trench, the conduits shall be held in place with spacers (of the proper size) to assure that the spacing between the conduits is held in a uniform manner. Spacers shall be installed at least every three (3) feet along the conduit run.

All field cut conduits shall be cut square, and then reamed to remove any sharp edges. Conduit bends shall be made so that the internal diameter of the conduit will not be effectively reduced and the protective coating on the inside and outside of the conduit is not injured.

Conduit mounting brackets must adequately anchor and support the weight of the conduit and the contents without visible deflection. Whenever such brackets are not adequate to withstand the tensions incurred during the cable pulling operation, the Contractor shall temporarily brace such conduits and supports.

Conduit terminations shall be provided by the Contractor with a bushing or suitable protector to guard against damage to the insulation or outside covering of the cables.

Any cable pulled in a manner resulting in damage to the shielding shall be removed and replaced at the direction of the Construction Coordinator/Inspector and at the Contractor's expense. The Contractor shall utilize non-hardening cable pulling lubricant at all times.

Openings beneath equipment shall be closed with Carboline Pyrofoam 700 or acceptable equal where the cables are in conduits and the conduits project through the openings.

Where the cables entering the equipment are not in enclosing raceways, the openings shall be closed with Dow Corning 3-6548 silicone RTV foam, Manville Type 103 Cera Form board, or acceptable equal flame retardant materials. The Cera Form boards shall be not less than 1 inch thick and shall be cut to fit closely around the outside surfaces of the cable where the cable passes through the boards. The boards shall be securely placed in the floor opening and all openings around the cables and the boards shall be sealed with Manville Cerablanket or acceptable equal and all exposed surfaces of the board and Cerablanket shall be covered with a 1/8 inch thick coating of Carboline Intumastic 285.

Openings shall not be closed until all the cables through the openings have been installed and tested.

Unused openings beneath equipment shall be closed with Carboline Pyrofoam 700, Manville Cera Form board coated with a 1/8 inch thick coating of Carboline Intumastic 285, Dow Corning 3-6548 silicone RTV foam, or acceptable equal flame retardant materials.

Installation of materials shall be in accordance with the manufacturer's recommendations. The materials shall be finished to provide a smooth, neat appearance.

Liquid tight flexible conduits shall be installed with sufficient slack and with large enough radius bends to prevent kinking or straining that might damage the conduit joints or jacket. In terminating such conduit, the Contractor shall not remove any of the jacket material from the flexible steel edges. No flexible conduit or fittings shall extend below the finished rock surface. Flexible conduit shall not exceed 4' in length with out expressed permission from GRDA. All flexible conduits longer than 6' shall be secured with conduit clamps at a maximum of every 4'.

The Contractor shall install pull-tape or pull-rope in all spare conduits.

Contractor shall repair driveways cut during control cable installation. Repairs shall be completed in accordance with the requirements outlined in Earthwork section.

1. The GRDA will furnish all aluminum bus, bus bar, bus connectors, and bus support fittings.
2. The Contractor shall install aluminum tubular bus, welded (or Deutsch, whichever is provided) connections and joints, including any "A" frames, flexible risers and runs to switches and other equipment in the yard. Install 336 MCM ACSR in 2" or 2½" runs over 19 feet in length and 795 MCM ACSR in 4" or 6" aluminum bus runs over 23 feet in length.
3. To minimize corona loss, any roughness of welds shall be stainless steel wire brushed and sanded with emery paper or crocus cloth to present a smooth finish.
4. All bolted and compression connectors and equipment terminals which join aluminum to aluminum shall have Contractor provided oxide inhibitor such as "NO-OX-ID A Special" compound liberally applied to such contact surfaces in accordance with the manufacturer's instructions. Bus connections shall be bolted with ½" S.S. bolts, (2) flat and (1) Belleville washer with silicon bronze nuts with maximum four threads showing past nut once torqued. All bolts to point North, East, down or to the outside of equipment frames (i.e. breakers, transformers, etc.).
5. All connections involving aluminum and copper shall be buffered by aluminum-copper bi-metal transition pad furnished by the GRDA.
6. All bus connections to terminal connectors shall be completed by the Contractor either by welding, bolting, compression, or all, as may be required. The Contractor shall complete the attachment and connection of all aluminum or copper wire to equipment connectors and bus supports, as required for a complete installation ready for service.
7. Production welds shall be examined visually. Any weld with a linear crackline indication shall be rejected. All welds shall be to the satisfaction of the Construction Coordinator. Any weld deemed not satisfactory by the GRDA Construction Coordinator/Inspector shall be removed and replaced at the Contractor's expense.
8. All tubing lengths used in connections to equipment shall be formed from one continuous piece, whenever feasible. All tubular bus shall be installed straight, level and/or plumb. Installation, support, or alignment of bus components which does not produce these conditions will not be accepted. The Contractor shall use particular care in the storage, handling, and installation of the tubular bus, fittings, and connectors to avoid indentations and/or abrasions of any kind. Prior to installation, the Contractor shall inspect the tubular bus, fittings, and connectors for indentations, abrasions, pits, burs, and defects of any kind, which shall be repaired by hand rubbing with a fine emery cloth. Upon completing the tubular bus installation, the Construction Coordinator/Inspector will inspect the work to assure compliance with the above requirements. Improperly installed and/or damaged tubular bus, fittings,

- and connectors, shall be repaired or replaced to the satisfaction of GRDA's Construction Coordinator/Inspector by the Contractor at no additional cost to GRDA.
9. All bends in tubing shall be made in a neat manner, without damage to the tubing, and shall be free of kinks, indentations, or flattened surfaces. All bends shall be made at normal temperature and the use of heat in making bends will not be permitted.
  10. All tube cutting shall be done with an approved pipe cutter. No flame cutting will be permitted.
  11. The Contractor shall furnish all welding rods or wire, as necessary, for completing any welded electrical installations required by this specification. For compression type fittings (Deutsch/or similar), the Contractor shall supply the necessary equipment to install the connectors properly.
  12. Expansion connectors shall be installed per manufacturer's instructions and properly adjusted for ambient temperature.
  13. The Contractor shall cut, drill, and bend aluminum bus bar as needed to complete the aluminum bus installation, as per the GRDA Drawings. Bus bar shall be furnished by GRDA.
  14. The Contractor shall be responsible for the aluminum alloy 4043 welding wire, consumable gases, tools, machinery, safety, equipment and manpower to clean, weld and fabricate, erect or install the bus, drill a minimum of two (2), ¼" weep holes per each run, and make all connections to the equipment in accordance with GRDA Drawings and in a manner satisfactory to GRDA.
  15. Welder Qualifications - The Contractor is responsible for the quality of welding. ASME Section IX, "Welding Qualifications", shall be used as a guide for the qualification of welding procedures and operators. The welder must be a certified welder of aluminum and show evidence of proficiency by welding a series of samples as a prerequisite to making the final weld. If GRDA desires, the samples are to be tested in the field by bending to the fatigue point or taking a cross section of the joint and inspecting it visually. Welders, after qualifying, shall not be replaced on this welding duty unless such action is acceptable to GRDA. All welds shall be made by reversed-polarity direct current, gas metal-arc (MIG) or alternating current gas tungsten-arc (TIG) welding process. The shielding gas shall be welding grade argon, helium, or a mixture of the two.
  16. Welds - All joints to be welded shall be free of moisture and hydrocarbon. Degreasing shall be done with a non-toxic solvent (naphtha, mineral spirits, alcohol, or acetone) to leave a minimum of residual on the parts. Sufficient time must be allowed for evaporation of the solvent prior to welding. Wire brushing with a stainless steel wire brush should be employed after solvent cleaning to remove any oxide films, water stains, etc. and to permit optimum fusion and soundness of the

weld. The working area shall be shielded from winds and drafts by barriers and covers and protected from atmospheric contamination. All welds shall be made with clean metal and the completed weld shall have a smooth finish and shall indicate good fusion with parent metal. Defective areas must be entirely removed by chipping or machinery prior to application of subsequent weld passes. The cross sectional area of the weld should not be less than that of the smallest member being joined. Members being joined should be tack welded in place to prevent misalignment during the welding process. Support and alignment shall be as required to provide a finished bus arrangement with correct centerlines to adjacent sections.

17. Torque Values - If the equipment manufacturer's erection instructions do not include recommended torque values for bolt tightening or specify an alternate method for tightening bolted electrical connections, torque values shall be in accordance with those listed in the table which follows. This table is not to be used when Belleville washers are used.

**Torque Values For Dry, Unplated, Nonlubricated Bolts**

Bolt Size	18-8 Stainless Steel	Brass	Silicon Bronze	Aluminum 24ST-4	316 Stainless Steel
	ft.-lb.	ft.-lb.	ft.-lb.	ft.-lb.	ft.-lb.
1/4"-20	6	5	6	4	7
1/4"-28	8	6	7	5	8
5/16"-18	11	9	10	7	12
5/16"-24	12	10	11	7	12
3/8"-16	20	16	18	12	21
3/8"-24	22	18	20	13	23
7/16"-14	31	26	29	19	33
7/16"-20	33	27	31	20	35
1/2"-13	43	35	40	26	45
1/2"-20	45	37	42	27	47
9/16"-12	57	47	53	34	59
9/16"-18	63	51	58	38	66
5/8"-11	93	76	86	60	97

<b>Bolt Size</b>	<b>18-8 Stainless Steel</b>	<b>Brass</b>	<b>Silicon Bronze</b>	<b>Aluminum 24ST-4</b>	<b>316 Stainless Steel</b>
	<b>ft.-lb.</b>	<b>ft.-lb.</b>	<b>ft.-lb.</b>	<b>ft.-lb.</b>	<b>ft.-lb.</b>
5/8"-18	104	85	96	67	108
3/4"-10	128	104	118	82	132
3/4"-16	124	102	115	80	130
7/8"-9	194	159	178	125	202
7/8"-14	193	158	178	124	202
1"-8	287	235	265	184	300
1"-14	259	212	240	166	271

TR-14     STRUCTURES AND STEEL

1. General

Each separate component of the structure will be distinctly marked (by mfg.) with letters and numbers to identify the position of the component in the structure.

Bolts, nuts, washers, plates, brackets and other small parts will be bundled in packages convenient for handling and marked for identification (by mfg.).

Any shipping lists prepared by the fabricator will be furnished to the Contractor.

There may be some redrilling or adjustment needed to the structures, in order to make the components correctly fit. The contractor shall plan on 5% redrill of mounting holes.

2. Unloading and Handling Structure Components

When unloading the structures, the Contractor shall note the condition of all components and report any damage to the galvanizing or the structure components to GRDA's Construction Coordinator/Inspector and confirm such damage on the carrier's shipping papers at the time of delivery.

If damaged components are encountered, GRDA shall direct whether the component is to be repaired or replaced.

Stored structures shall be placed on adequate blocking to prevent dirt, mud, and other foreign materials from adhering to the structures.

Care shall be exercised during unloading and handling to avoid the bending of the components, damaging the galvanizing, or otherwise damaging the structure.

Structure components shall not be dragged. Slings for picking up the structures shall be of such material or protected in such a way as not to cut into the steel components or otherwise damage the galvanizing.

Components bent, twisted, or damaged during unloading or in transit from the point of delivery to the structure site, or at the structure site, shall not be erected, but shall be reported immediately to GRDA's Construction Coordinator/Inspector. Such damaged components shall be replaced or repaired at the direction of GRDA's Construction Coordinator/Inspector, and at the expense of the Contractor.

When approved by GRDA, materials on which galvanizing has been broken or otherwise damaged may be cleaned by wiping with clean rags saturated in mineral spirits or xylene and then painted with Galvanox or other equivalent protection as approved by GRDA.

### 3. Erection Procedures

The Contractor shall assemble and erect the structures in accordance with the fabricator's erection drawings, bills of material, bolt lists, and other drawings furnished by GRDA.

The structure type, pole heights, location, and orientation shall be in accordance with the construction Drawings furnished by GRDA.

The weight of each component of the structure will be shown on the fabricator's erection drawings. The erection drawings will also show the center of gravity of each component and the lifting points for one or two point erection lifting of each component.

The method of structure assembly and erection by the Contractor is subject to review and approval by GRDA. However, the Contractor shall remain fully responsible for the erection operation regardless of such review and approval by GRDA.

The structures shall be erected square and plumb, or in the correct cambered position if required.

The method of assembling and erecting shall be such that no component is subjected to an erection stress greater than that for which it is designed.

All erection limitations or procedures shown on the fabricator's erection drawings shall be strictly observed.



Extreme care shall be taken to establish and maintain the true geometric shape of the component or complete structure being assembled and erected.

Misalignment or misfit of adjacent sections or members due to the method of assembly or erection shall be corrected by adjusting the assembly or erection method as required to eliminate the problem.

Bolts shall be of the type, length, and diameter shown on the drawings. Only wrenches of proper size, which will not deform the nuts nor cut the protective coating, shall be used.

Bolts shall be installed in the orientation shown on the erection drawings and included in these specifications.

All components shall be clean at the joints before being bolted together.

Nuts shall be installed with the flat surfaces against the face of the component being bolted, and torqued to the specified value.

After the structure is completely erected, the structure shall be inspected by the Contractor to verify that all bolts are installed correctly.

Any bolts of incorrect diameter and length shall be replaced.

A standard nut and jam nut shall be used at each bolt unless otherwise shown or directed by GRDA or the fabricator's drawings.

After all bolting is completed on an erected structure; GRDA will make spot checks to verify bolt tightness.

#### 4. Ground Assembly

When portions of structures are being pre-assembled on the ground before erection, such assembly shall be on surfaces or blocking which will provide support to prevent distortion of the components and prevent dirt, mud and other foreign materials from adhering to the component.

All bolts shall be installed in all connections of pre-assembled structures and bolts shall be at least finger tight.

Poles, components and complete structures shall be handled and erected with slings and other equipment of such materials and suitably protected so as not to cut, bend or otherwise damage the structure components or finish.

All necessary measures shall be taken by the Contractor during handling and erection to prevent damage to the structure and its finish

Components of structures shall be erected in such a manner that no dragging against other components already connected shall occur.

A reasonable amount of drifting will be permitted with suitable measures taken to minimize or eliminate damage to the finish coating.

Re-drilling, reaming, or other corrective measures, if required, shall be undertaken only as directed by GRDA.

5. Misfabrication Correction

The Contractor shall notify GRDA's Construction Coordinator/Inspector of any fabrication errors or damaged components.

No correction, repair, or replacement of misfabricated or damaged components shall be undertaken without the approval of GRDA.

No drilling, welding or other modification will be allowed on the steel poles without the approval of GRDA.

6. Structure Identification

Any structure number signs shall be mounted on the arm of steel pole structures.

The signs and attachment devices for these signs will be furnished by the Contractor and are to be mounted according to instructions.

The Contractor shall drill pilot holes in the face of the structure arm and attach signs with self-tapping screws.

TR-15 ROCK EXCAVATION

Rock excavation shall consist of boulders exceeding one-half cubic yard in volume or solid ledge rock which in the opinion of GRDA, requires its removal, drilling, wedging, sledging, or barring.

No soft or disintegrated rock which can be removed with a pick or digging machine, no loose, shaken or previously blasted rock, no broken stones, and no rock which may fall into the opened excavation from outside the limits of excavation will be considered as rock excavation.

When solid rock is encountered in the excavation, it shall be stripped of earth, and GRDA notified and given proper time to measure the same before removal; all rock

removed which has not been measured by GRDA will not be estimated as rock excavation.

Blasting shall not be allowed unless authorized by GRDA and shall be subject to all landowner's within a three-quarter mile radius, signed approval.

Explosives shall be stored, handled and used as prescribed by the laws and regulations of the United States and the political subdivisions thereof. Special attention shall be given to the immediate disposal of paper wrappings from explosives, which are poisonous to livestock.

All permits for the use of explosives required by Federal, State, and Local authorities shall be obtained by the Contractor.

The use of explosives will be considered as incidental, included in the unit price and not as a separate work unit.

The Contractor is responsible for, and hereby indemnifies GRDA from any and all damage resulting from the use of explosives.

After rock has been measured, a cylindrical excavation shall be cut by drilling, sledging or such other means as may be necessary to the normal foundation depth and of a diameter equal to the normal foundation diameter.

In estimating the number of cubic yards of rock excavation, the radius squared of the foundation excavated will be multiplied by the average depth from the surface of the rock to the normal depth of the foundation. This result, multiplied by the number "pi" and recorded in cubic feet and divided by 27 will give the number of cubic yards allowed.

In general, the natural earth at each structure site shall be disturbed as little as possible during construction.

In all cases, the ground surface at each structure site shall be graded to provide drainage away from structure legs and completed reasonably smooth and compact.

No additional payment shall be made for rock excavation. The Contractor shall include the cost of rock excavation in the unit price for the concrete installation.

TR-16 TEMPORARY CASINGS

Temporary casings, if required to maintain the dimensions of the excavation, shall be of sufficient strength and rigidity to maintain the excavation lines against the soil and water pressures present in the excavation.

The temporary casing shall fit the augured hole tightly and be one inch greater than the diameter of the caisson.

Preferably, the casings shall follow the excavation without driving; but if the site conditions prevent this, driving or jacking will be permissible.

All casings shall be removed from the excavation as the concrete is being placed to prevent soil or other matter from sloughing into the excavation. Permanent casings will be used only with the written permission of GRDA.

The Contractor shall furnish the temporary casings and shall bear all costs associated with the installation and removal of the casings, unless otherwise stated by GRDA.

TR-17     SHIELD WIRE INSTALLATION

The Contractor shall install the shield wires in accordance with the drawings, specifications and data furnished by GRDA.

The method proposed by the Contractor for stringing the shield wires shall be reviewed by GRDA prior to commencement of stringing.

Particular care shall be taken to ensure that the shield wire does not become kinked, twisted, abraded, or damaged in any manner.

The shield wire shall be attached to the hardware assembly by bolted suspension clamps or compression connections as shown on the drawings. All assemblies shall be installed to the recommendations of the manufacturer.

Shield wire jumper loops shall be of sufficient length and formed to provide a uniform curving transition from dead-end assembly to dead-end assembly. The minimum distance from the jumper loop to the structure shall be 3”.

TR-18     BARBED WIRE FENCE

A. SCOPE: This specification covers the material and construction of a five (5) strand barbed wire fence to stand 4’ –2” above surface grade when erected.

B. MATERIALS:

Barbed Wire (manufactured in U.S.A.) shall consist of two #12 ½ gauge, class 3 twisted galvanized steel line wires with four point hardened #14 gauge barbs. Barbs shall be spaced no more than 5” apart. Gaucho wire is unacceptable.

Corner/Gate Posts shall be 8” dia. X 8’ –0” long ACA or CCA treated southern pine set 3’ – 6” deep, and shall be plumb in appearance.

Pull Post/Braces shall be 4" dia. X 8' -0" long ACA or CCA treated southern pine set 3' -6" deep, and shall be plumb in appearance.

Line Posts shall be 6' -6" long heavy-duty steel "T" posts with anchor plate and tie wire notches. Posts shall be hot-dip galvanized or painted with an anti-corrosive paint. Posts shall be set 2' -0" deep, and be plumb in appearance.

Gates with materials for locking will be provided by the GRDA.

Staples shall be 1 1/2" long galvanized cut point type.

Wire Ties shall be #9 gauge galvanized steel.

C. INSTALLATION: All materials shall be new and both materials and workmanship be first quality. The fence shall be erected true to the established lines shown on the fence site plan drawing. Fence wire shall be taut.

1. At grade depressions where stresses tend to pull the line posts out of the ground, a corner post shall be installed at the critical point. In situations where a corner post is not adequate, the project engineer will determine an alternate method of construction.
2. An intermediate brace (pull post assembly) shall be installed at intervals in the fence span as follows:

<u>FENCE SPAN ( FT.)</u>	<u>NUMBER OF BRACES REQUIRED</u>
400 - 600	One at center of span
600 - 1000	Two at equal intervals
1000 - 1400	Three at equal intervals
1400 - 1800	Four at equal intervals
1800 - 2200	Five at equal intervals

3. All wood posts are to be set in concrete.

TR-19 CHAIN LINK SUBSTATION FENCE

A. SCOPE: Fence shall consist of one of the following alternatives. The specific option shall be detailed on the project drawings. In all cases the bottom of the fabric shall be installed such that it is 6" above the soil to allow for the station rock to pass under the fence and allow for future changes in grading.

1. New eight-foot high fence

The Contractor shall furnish the material and perform the labor for erecting a seven-foot high (7') galvanized chain-link fence topped with three strands of barbed wire one-foot high (1'), complete with gates, as shown on the drawings and specified herein. The overall height of the fence, with barbed wire is eight feet – six inches (8'-6") above soil.

## 2. Fencing with razor wire

If fencing is to be topped with razor wire, the specifications below apply as applicable for providing and installing the razor wire on an existing fence. Existing fencing will usually be eighty-four inches (84") high and above that will be a combination of the three strands of barbed wire. The Contractor will remove the existing extension arms and barbed wire, supply and install 90° V-shaped extension arms, and supply and install new barbed wire and razor wire as shown on the drawings and specified herein. The overall fence height will remain at eight feet (8').

## 3. Drawings

Vendor shall submit drawings on all component parts. Samples and test certificates on materials will be furnished as requested by GRDA.

# B MATERIAL:

## 1. Fabric

The fabric shall be eighty-four inches (84") high, woven in a two-inch (2") diamond shaped "chain link" mesh. Top selvage shall have a twisted and barbed finish and the bottom selvage to have a knuckle finish. Fabric shall be constructed from zinc coated steel (hot-dip galvanized after weaving). Wire shall be nine-gauge (9 ga.) with tensile strength of 80,000 pounds per square inch. Fabric shall be true and even, so that when installed the weave will not be irregular or uneven but will be free of "waves" and will present a neat appearance.

The fabric shall be zinc coated in accordance with the latest ASTM A392 for Class II, two ounces (2.0 oz.) of zinc per square foot of wire surface.

## 2. Bottom Tension Wire

One (1) strand of nine-gauge (9 ga.) galvanized steel spring coil wire, with fasteners, shall be furnished for entire length of fence by fence supplier, installed at the bottom of fabric when fence is erected, and fastened with eleven-gauge (11 ga.) hog rings on twenty-four inch (24") centers. The coating shall be same type as fabric.

## 3. Barbed Wire

Barbed wire shall consist of three (3) strands each (6 strands required for razor wire installations) of galvanized #12-1/2 gauge wire, twisted, with large four (4) point hardened aluminum #14 gauge barbs or steel barbs, with complete barbed wire assembly galvanized after fabrication. Barbs shall be spaced no more than five inches (5") apart.

#### 4. Razor Wire

Razor wire shall be manufactured with a continuous one-inch (1") wide by 0.020" thick stainless steel tape containing clusters of four (4), needle-sharp barbs located on four-inch (4") centers. Sharpened blades in the clusters are in an elongated "H" pattern with each leg being approximately 1.2" long measured from the center of the cluster. The stainless steel tape is cold pressed around a high tensile spring steel core wire and formed into a coil to produce eighteen-inch (18") diameter loops.

#### 5. Fabric Ties

Fabric ties shall be furnished for attaching fence fabric to line posts every fourteen (14") inches and for attaching fabric to top rail every twenty-four (24") inches. The fabric ties for the top rail and the line posts; nine-gauge (9 ga.) galvanized steel tie wires shall be used.

#### 6. Extension Arms

All line and corner posts shall be fitted with galvanized 45° extension arms (90° extension arms required for razor wire installations). Arms to carry the three (3) barbed wires (6 wires for razor wire installations) shall be securely fastened to the line posts. Top most barbed wire shall be twelve inches (12") above fabric and twelve inches (12") out from top rail. Extension arms on intermediate posts shall be made of heavy duty pressed steel or malleable iron and those on all corner posts shall be made of eleven-gauge (11 ga.) heavy pressed steel or heavy malleable iron. Arms having projections that bend down over the barbed wires are not acceptable. Wires must fit in slot on the arm and be locked in place. Arms are to be riveted or welded to base before galvanizing. Arms shall withstand a minimum weight of 250 pounds from end of arm.

#### 7. Line Post

Line posts shall be pipe, two (2") Nominal Pipe Size, Schedule 40 or greater, minimum yield strength 25,000 PSI. Posts are to be hot-dip galvanized 2 oz. per sq. ft. Posts shall be of sufficient length to be set in two-feet, six-inches (2'- 6") deep concrete foundation.

#### 8. End, Corner Post

Corner posts shall be constructed of three-inch (3") Nominal Pipe Size, hot-dip galvanized pipe, Schedule 40 or greater. Used, re-rolled, or open seam posts are not permitted. Posts shall be of sufficient length to be set in a three-foot, six-inch (3'-6") deep concrete foundation.

#### 9. Gate Posts

Gate Post Size	Wt Per Foot	Gate Opening Dimension
3"	Nominal Pipe Size - 7.58 Lbs.	Single to 7' or double 14'
3-1/2"	Nominal Pipe Size - 9.11 Lbs.	Single 8' or double to 20'
6"	Nominal Pipe Size - 18.97 Lbs.	Single to 18' or double to 36'
8"	Nominal Pipe Size - 28.55 Lbs.	Over 36'

#### 10. Gate Frames

Gate frames shall be constructed of hot-dip galvanized pipe. Corner fittings are to be heavy pressed steel or heavy malleable iron ells with four rivets per corner. Barbed wire and fittings shall be included. For gates fourteen-feet (14') and larger, the contractor shall furnish one and one-quarter inch (1-1/4") Nominal Size Pipe, Schedule 40 or greater, for internal bracing. Pipe bracing shall be in the pattern shown on the drawings. Gate fabric shall be the same as that used for the fence.

#### 11. Walk-in Gates

Walk-in gates shall be single-hung gates normally for a four-foot (4') wide opening, constructed in accordance with items in this specification.

#### 12. Drive-in Gates

Drive-in gates shall be double-hung gates, width as specified, constructed in accordance with items in this specification.

#### 13. Locking

All gates shall have provision for padlocking. Latch and locking hardware is to be heavy malleable iron or heavy duty pressed steel and must be hot dipped galvanized after fabrication.

#### 14. Miscellaneous Gate Fittings

Hinges shall be heavy pattern with large bearing surfaces of adequate strength for the gate and shall not turn under the action of the gate. Hinge action shall be such that gates may be easily opened and closed by one person. Hinges shall provide for full 120-degree inward swing of gate leaf.



Latches shall be plunger bar type and arranged to engage the gate stop as shown on the drawings. Single gates less than ten-feet (10') wide may be provided with a forked latch. Latches shall be arranged for padlocking with the padlock accessible from both sides of the gate.

Stops shall consist of a roadway plate with anchor set in concrete and arranged to engage the plunger.

Keepers shall consist of mechanical devices for securing and supporting the free end of gates when in the full-open position.

Gates shall be installed so that they cannot be removed without disassembly of the hardware.

#### 15. Top Rail

Top rail shall be constructed of one and one-quarter inch (1-1/4") Nominal Size Pipe, hot-dip galvanized, Schedule 40 or greater, provided with outside sleeve type couplings not less than seven inches (7") long. Couplings must fit top rail snugly to prevent sagging of top rail at joints. Top rail to pass through base of line post tops and form a continuous brace from end to end of each stretch of fence. Top rail to be securely fastened to end, gate, or corner posts by heavy duty pressed steel connections. Top rail is to be provided in random lengths averaging not less than twenty (20') feet in length. The Contractor shall provide expansion couplings in straight sections longer than 100 feet.

#### 16. Braces

Horizontal braces are to be used on end gate and corner posts. Braces are to be one-piece, constructed of same material as top rail, to be spaced midway between top rail and ground, and to extend from end, gate, or corner post to first adjacent line post.

#### 17. Tension Bars and Bands

Tension bars for attaching fabric to terminal posts shall be one-quarter inch (1/4") by three-quarter inch (3/4") high carbon steel. Bands for attaching tension bar to terminal posts shall be eleven-gauge (11 ga.), one-inch (1") wide with three-eighths inch (3/8") carriage bolts and nuts spaced on fourteen-inch (14") centers. Banding for braces at ends and corners is to be eleven-gauge (11 ga.), one and one-quarter inch (1-1/4") wide.

#### 18. Miscellaneous Fittings

All fittings required for proper installation of fence shall be malleable iron or heavy duty pressed steel and must be hot dipped galvanized after fabrication.

## 19. Galvanizing

All items shall be hot-dip galvanized after fabrication in accordance with the latest approved ASTM Specifications. Unless specified otherwise, minimum galvanizing shall be 2.0 ounces of zinc per square foot of surface.

## 20. Tolerance

Standard Mill Tolerance on all framework members and chain link fabric will apply.

### C. CONSTRUCTION:

#### 1. Concrete:

All concrete shall conform to the General Specifications for Concrete Work. The cost of the concrete shall be included in the fencing pricing.

#### 2. Galvanized Chain-Link Fence:

The fenced areas are shown on the plot plan and the fence shall be installed in accordance with the manufacturer's recommendation and these specifications.

The fence shall be either eight (8') or nine (9') feet high (as per the drawing and application) above finished rock grade when erected (including barbed wire). The fence fabric shall be stretched tight.

All line posts shall be spaced not more than ten (10') feet apart on centers. They shall be set not less than two and one-half (2-1/2') feet in concrete, the concrete to be not less than ten (10") inches in diameter. Posts shall be centered in the concrete and holes.

Extension arms are to be in the shape of a forty-five degree (45°), designed to extend at a forty-five (45°) degree angle to the outside from vertical, with lock wire for securely fastening the barbed wire, equally spaced with the top strands located twelve (12") inches above the fabric and twelve (12") inches out from the fence line. The barbed wire shall be so attached to the extension arm in an angle slot that it will automatically lock in place by tension. The barbed wire will be stretched tight the full length before locking in.

The razor wire (if required on the drawings) shall be attached to the barbed wire and extension arms using hog rings. The razor wire shall be positioned so that one complete coil extends approximately eighteen inches (18") horizontally along the barbed wire.

Braces are to be installed midway between the top rail and ground, and to extend from terminal post to first adjacent line post. Braces are to be securely fastened to posts by heavy duty pressed steel connections, then trussed from line post back to base of terminal post with three-eighths (3/8") inch galvanized rod, complete with truss tightener.

Terminal end and corner posts shall be set not less than three-feet, six-inches (3'-6") deep in concrete, the concrete to be not less than eighteen (18") inches in diameter. Gate posts shall be set not less than three-feet, six-inches (3'-6") deep in concrete, the concrete to be not less than twenty-four inches (24") in diameter.

The chain-link fabric shall be securely fastened to the line post with six-gauge (6 ga.) wire clips spaced approximately fourteen (14") inches apart. The chain-link fabric shall be securely fastened to the top rail with nine-gauge (9 ga.) tie wires on approximately twenty-four inch (24") centers and to the bottom tension wire with eleven-gauge (11 ga.) hog rings on twenty-four inch (24") centers. The chain-link fabric shall be securely fastened to all terminal posts by one-fourth (1/4") inch by three-fourth (3/4") inch tension bars with heavy eleven gauge (11 ga.) pressed steel bands spaced approximately fourteen (14") inches apart.

The fence shall be installed level with finish grade as directed by GRDA. The finished job will leave the bottom portion of the fabric even with the top of the crushed rock.

### 3. Gates:

The gates shall be located as shown on the drawings and shall be installed in accordance with the manufacturer's recommendations. Post spacing must be such that the gate may be located beginning at any ten (10') foot interval in any side, except within the first ten-foot (10') distance from any corner post.

The gate stop (for latch plunger) and gate keepers shall be installed in concrete that is eighteen inches (18") in diameter and a minimum of two-feet (2') deep. Gate stop shall be positioned with its edges at the elevation of the finished grade.

Gate keepers shall be positioned to support and hold the gate in the open position. Keepers shall be located approximately two-thirds (2/3) of the gate section length away from the gate post and elevated above the finished grade to engage the bottom gate pipe rail.

Three strands of barbed wire shall be attached to the gate-frame posts using bands above the fabric, as shown on the drawing. Razor wire, if required on the drawings, shall be installed around the barbed wire strands, and attached to the barbed wire with hog rings.

TR-20     TECHNICAL DRAWINGS

A list of drawings that pertain to this project is included on the project cover drawings:

S294DZ01  
S294DZ02  
S294DZ03

TR-21     MATERIAL LIST

The material listed on the following drawing is the material being furnished by GRDA and the Contractor. All other materials required for the completion of this work but not listed herein are to be furnished by the Contractor.

S294DM01     MATERIAL LIST SHEET 1  
S294DM02     MATERIAL LIST SHEET 2  
S294DM03     MATERIAL LIST SHEET 3  
S294DM04     MATERIAL LIST SHEET 4  
                  T-Line work spreadsheet

TR-22     CABLE TABULATION

The cable tabulation for the project is found on the following drawing. The contractor is responsible for furnishing cables and installing in the raceway. Cables shall be pulled between field equipment and control panels and terminated on both ends.

S294DT ---     CABLE SCHEDULE/CABLE TABS Set

TR-23     INSULATED CONDUCTORS

**1. General**

Insulated cable, conductors, and conductor accessories shall be furnished and installed in accordance with the requirements of this section of these specifications. Insulated cable, conductors, and conductor accessories shall be furnished in quantities sufficient for a complete installation as indicated in the circuit lists, on the drawings, and in these specifications.

In general, all devices furnished under these specifications and requiring electrical connections shall be designed for wiring into electrical enclosures with terminal blocks. Terminal blocks shall be furnished for conductors requiring connection to circuits external to the specified equipment, for internal circuits crossing shipping splits, and where equipment parts replacement and maintenance will be facilitated.

Splices will not be permitted.

All wiring leaving an enclosure shall leave from terminal blocks and not from other devices in the enclosure.

Auxiliary equipment such as terminal blocks, auxiliary relays, or contactors shall be readily accessible. Auxiliary equipment shall be located in compartments, enclosures, or junction boxes in such an arrangement that service personnel will have direct access to the equipment without removal of barriers, cover plates, or wiring.

Terminal blocks for external connections shall be grouped in the instrument and control compartment for easy accessibility, unrestricted by interference from structural members and instruments. Sufficient space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block.

Terminal blocks shall not be mounted in compartments containing uninsulated conductors operating at voltages above 1000 volts.

Materials containing asbestos shall not be used in any of the wiring devices or cable.

Cable reels shall be stored and handled in a manner which will prevent physical damage to the cable. Cable reels shall be stored on a hard surface to prevent contact between cable insulation and earth due to sinking of the reel.

Installation shall be defined to include placement, terminating conductors, coiling and taping of spare conductors, identification, testing, and verification of each circuit, cable, and conductor. Installation of cable in existing trays or cable trench shall also include removal and replacement of existing cable tray or cable trench covers.

Terminating a conductor shall include installing cable termination kits for shielded cable, attaching the conductor at its designated location and insulating the entire connection where specified or required by the application.

## **2. Cable Specifications**

The cable furnished shall conform to the Cable Specification Sheet(s) included at the end of this section.

The term "Type" used in the circuit list, on the drawings, and in these specifications refers to the letter identification indicated on each Cable Specification Sheet.

### **2.1 Coaxial Cable**

Coaxial cable (when specified) used for connection between carrier cabinets and line tuning units shall be 52 ohm RG-8A/U coaxial cable. The cable shall have an 8 mil thick aluminum flat tape water block and an overall chlorinated polyethylene jacket. The cable shall be Belden Catalog No. 9251-A282-BV. This cable is a special run item.

## 2.2 Manufacturers

The equipment shall be manufactured by one of the manufacturers identified on the Cable Specification Sheets included at the end of this section.

## 2.3 Test Reports

Unless otherwise specified, the Contractor shall submit three copies of manufacturers' test reports on each cable to the Engineer.

## 2.4 Color Coding

The color code used for multiconductor, shielded control cable shall be in accordance with Table E-1 of ICEA S-73-532 as indicated on the Specification and Data Sheet(s). All of the wiring diagrams being prepared by the Engineer are based on the color code specified on the Specification and Data Sheet(s). The Tables E-1 color codes are as follows:

<b>Conductor</b>	<b>Method 1 Table E-1</b>
1	Black
2	White
3	Red
4	Green
5	Orange
6	Blue
7	White-Black
8	Red-Black
9	Green-Black
10	Orange-Black
11	Blue-Black
12	Black-White
13	Red-White
14	Green-White
15	Blue-White

## 3. Conductor Accessories

All conductor accessories including connectors, terminations, insulating materials, support grips, markers, and cable ties shall be furnished and installed.

Supplier's installation instructions shall be obtained for cable accessories. These instructions shall be in the possession of the craftsmen while installing the accessories and shall be available to GRDA's designated Work Inspector for reference.

### **3.1 Terminal Connectors for Conductors 8 AWG and Larger**

Terminal connectors for conductors 8 AWG and larger shall be pressure or bolted clamp type, Burndy Qiklug, Varilug, or acceptable equal; or compression type, Burndy Type YAV or YA (long barrel), Panduit Type LCA or LCC, or acceptable equal. Acceptable connectors included with Owner-furnished equipment may be used.

### **3.2 Terminal Connectors for Conductors Smaller than 8 AWG**

Terminal connectors for conductors smaller than 8 AWG shall be compression type connectors properly sized for the conductor and the terminal. The connectors shall be constructed of fine grade high conductivity copper in accordance with QQ-C-576 and shall be tin plated in accordance with MIL-T-10727. The interior surface of the connector wire barrel shall be serrated, and the exterior surface of the connector wire barrel shall be provided with crimp guides.

Noninsulated terminal connectors shall be provided on conductors terminated on devices equipped with individual fitted covers, such as General Electric Type SB-1 control switches and General Electric Type HEA lockout relays. Preinsulated ring type terminal connectors shall be used on all current and potential transformer circuits. All other terminal connectors for conductors smaller than 8 AWG shall be preinsulated ring type or preinsulated spade type.

Preinsulated terminal connectors shall include a vinyl insulating sleeve, color coded to indicate conductor size. Preinsulated terminal connectors shall include a metallic support sleeve bonded to the vinyl insulating sleeve and designed to grip the conductor insulation.

Ring type connectors shall be manufactured by AMP, 3M, Panduit, or acceptable equal. Spade type connectors shall be AMP slotted spring spade, 3M Scotchlok Series 6l snap spade, or Panduit locking fork terminal connectors.

### **3.3 Terminal Blocks**

Terminal blocks for conductors rated 600 volts or less shall be strap screw type, rated 600 volts, shall have 20 percent more terminal points than the quantity of conductors requiring termination, and shall have white marking strips. Terminal blocks shall be sized for the conductor being terminated except that terminal blocks for all conductors 10 AWG and smaller shall be Marathon 1500 Series or acceptable equal.

Each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary devices shall be permanently labeled to coincide with the identification indicated on the drawings. All terminals provided for termination of external circuits shall be identified by inscribing terminal designations acceptable to GRDA on the terminal block white marking strips with permanent black ink. All internal wiring terminations shall be identified by printing on conductor identification sleeves. A conductor identification

sleeve shall be provided on each end of each internal conductor. Each sleeve shall be marked with the opposite end destination identification using permanent black ink. Conductor identification shall be permanent, unaffected by age, heat, or solvents, and not easily dislodged. Adhesive labels are not acceptable.

The arrangement of connections on terminal blocks shall be acceptable to GRDA.

All connections requiring disconnect plug and receptacle type devices shall be provided with factory terminated conductors on each plug and receptacle. Plugs and receptacles shall be factory wired into junction boxes containing terminal blocks for external connections. All conductors on the disconnect portion of plug-receptacle assemblies shall be in a common jacket. The plug-receptacle assemblies shall have provisions for locking the devices together. The assembly shall also be watertight when installed outdoors.

All temporary wiring installed in the factory for equipment testing shall be removed prior to shipment of the equipment.

Reference to NEC means the codes and standards as defined by the USA National Electrical Code, ANSI/NFPA 70.

### **3.4 Crimping Tools**

Crimping tools used to secure conductors in compression type connectors or terminal lugs shall be those made for that purpose and for the conductor sizes involved. The crimping tools shall accurately crimp the connector barrel and shall accurately crimp the conductor insulation support sleeve where provided. Crimping tools shall be provided with guides to position connectors in the tool, shall be provided with stops to prevent overcrimping, and shall be of a type which prevents the tools from opening until the crimp action is completed. Crimping tools shall be a product of the connector manufacturer or shall be as recommended by the connector manufacturer and acceptable to the Engineer for use with the connectors. The Contractor shall establish and maintain a tool certification program to ensure that crimping tools are kept in accurate operating condition.

### **3.5 Insulating Materials**

Insulating materials for termination insulation shall be in accordance with the following.

**3.5.1 600 Volt Cable.** Insulating materials for terminal connectors or compression type connectors shall consist of varnished cambric tape, rubber tape, and vinyl tape. Taping materials shall be as listed below or acceptable equal:

Varnished Cambric Tape--3M Company Irvington 2520.

Rubber Tape--3M Company Scotch 130C.

Vinyl Tape--3M Company Scotch 33+.



### **3.6 Support Grips**

Cable support grips shall be either split or closed woven wire type as manufactured by The Kellems Division, Harvey Hubbell Incorporated, Stonington, Connecticut.

### **3.7 Wire and Cable Markers**

Markers for wire and cable circuits shall be of an opaque nylon material arranged to include a marker board, nonreleasing holding device, and cable fastening tail. The marker board shall not be less than 3/4 inch wide, 2-1/2 inches long, and 15 mils thick and shall be Panduit Corp. Part No. MP250 marker plates or acceptable equal. One side shall be roughened to hold black nylon marking ink from a fine tip pen similar to Thomas & Betts Company "TY-RAP" marking pen, Catalog No. WTI63M-1, or Panduit Corp. Part No. PFX-0 marking pen. Identification shall be permanent and waterproof. The holding device shall be designed to allow the fastening tail to pass around the cable through the holding device and prevent the removal of the tail without cutting it loose from the marker.

### **3.8 Cable Ties**

Lacing materials for field installed cable shall be nonreleasing weather-resistant black nylon ties manufactured by Thomas & Betts Company, Elizabeth, New Jersey; Panduit Corp., Tinley Park, Illinois; 3M Company; or acceptable equal.

### **3.9 Arcproofing Material**

Material for arcproofing cable shall be an unsupported intumescent self-extinguishing elastomer tape, 3M Company Scotch Brand No. 77 or acceptable equal, and a pressure sensitive silicone adhesive backed glass cloth holding tape, 3M Company Scotch Brand No. 69 or acceptable equal.

### **3.10 Cable Shield Bonding Connectors**

Cable shield bonding connectors for use with shielded power, control, and instrumentation cable shall be Scotchlock 4460, manufactured by the 3M Company; Nicopress Shield Connector B-2974, manufactured by National Telephone Supply Company; Surgegard Shield Bond Connector, manufactured by Brand-Rex Company; or acceptable equal.

Cable shield bonding connectors shall be installed on one end of each shielded power, control, and instrumentation cable listed in the circuit lists.

## **4. Installation**

Conductor installation shall be in accordance with the cable manufacturer's recommendations and the articles which follow.

### **4.1 Cable Placement**

All cable described in the circuit lists shall be routed as indicated therein. Routing of other cable shall be as indicated on the drawings.

Cable shall not be handled when the cable temperature is below the minimum temperature recommended by the manufacturer. If cable heating is required prior to placement, the cable shall be stored in a heated building in accordance with the manufacturer's recommendations for at least 24 hours. Cable shall be placed the same day it is removed from heated storage.

If at any time during the progress of the work the Contractor finds raceways which appear inadequate to accommodate the assigned cable, he shall notify GRDA's designated Work Inspector at once and shall discontinue any further work on the questionable raceway until advised by GRDA's designated Work Inspector as to how he shall proceed.

Immediately prior to the placement of each cable or cable group, the raceway route to be followed shall be inspected and ascertained to be complete in installation and free of all materials detrimental to the cable or its placement. All cable assigned to a particular duct or conduit shall be grouped and pulled in simultaneously using cable grips and acceptable lubricants.

All cable shall be carefully checked both as to size and length before being pulled into conduits or ducts. Cable pulled into the wrong conduit or duct or cut too short to rack, train, and splice as specified herein shall be removed and replaced by and at the expense of the Contractor. Cable removed from one conduit or duct shall not be pulled into another conduit or duct.

**4.1.1 Cable in Trays.** All cable shall be carefully laid in or pulled through the tray system so that neither the cable nor the trays are damaged. Cable may be laid along the side of the tray system during placement provided it is protected from dirt, water, oil, or other detrimental materials and from mechanical injury. Cable shall be cut sufficiently long to conform to the contour of the trays, with particular attention paid to vertical inside bends. All excessive slack shall be removed from the cable so that it lies parallel to the sides of the trays. Multiple single conductor cable which constitutes a single power circuit shall be grouped together to minimize magnetic influence on other cable in the area. The cable shall be tied to the trays with nylon ties at 10 foot intervals to hold it in place. Cable clamps designed for holding the cable inside the trays shall be installed at all vertical bends.

**4.1.2 Not Used**

**4.1.3 Cable Pulling.** Fishing and pulling shall be done with flexible round metal tape, CO<sub>2</sub> propelled polyethylene cord, nylon rope, or manila rope.

Unless specified otherwise or acceptable to GRDA's designated Work Inspector, cable shall not be pulled in a single pull through two sections of Engineer-designed raceway connected by a manhole or pull box. Cable shall be pulled out at each manhole and pull box to the length required for termination. Prior to repulling of the pulled out cable, the cable shall be thoroughly inspected, cleaned, and relubricated. Damaged cable shall be removed and replaced by and at the expense of the Contractor.

Cable may be pulled in a single pull through two sections of Engineer- designed raceway connected by a manhole or pull box only if it can be determined by calculation to the satisfaction of GRDA's designated Work Inspector, that the pulling tension will not exceed the maximum tension allowed by the cable manufacturer.

**4.1.4 Cable Grips.** Factory installed pulling eyes shall be used for pulling cable where they are available. Woven wire cable grips shall be used to pull all single conductor cable 2/0 AWG and larger, where pulling eyes are not available, and all multi-conductor cable. Pulling loops shall be used to pull single conductor cable smaller than 2/0 AWG. All sharp points and edges on the hardware attaching the pulling rope to the cable shall be taped to prevent snagging or damaging the raceway.

When a cable grip or pulling eye is used for pulling, the area of the cable covered by the grip or seal plus 6 inches shall be cut off and discarded when the pull is completed. When pulling loops are used, the entire loop shall be cut off and discarded when the pull is completed.

As soon as the cable is pulled into place, the pulling eyes, cable grips, or pulling loops shall be removed and any cable which was sealed shall be resealed.

**4.1.5 Swivels.** A reliable nonfreezing type of swivel, or swivel connection, shall be inserted between the pulling rope and the cable pulling eye, grip, or loop to prevent twisting under strain.

**4.1.6 Feeding Tubes.** A 4 inch or larger flexible feeding tube, with a removable nozzle sized to fit the ducts, shall be used in pulling all underground cable. The bending radius of the tube shall not be less than the minimum bending radius of the cable specified in this section under the article titled Cable Bends.

**4.1.7 Pulling Lubricants.** Only lubricants recommended by the cable manufacturer and acceptable to GRDA's designated Work Inspector shall be used. Lubricants shall be applied liberally and continuously during the pull.

**4.1.8 Inspection.** The outside of each cable reel shall be carefully inspected and protruding nails, fastenings, or other objects which might damage the cable shall be removed. A thorough visual inspection for flaws, breaks, or abrasions in the cable sheath shall be made as the cable leaves the reel, and the pulling speed shall be slow enough to permit this inspection. Damage to the sheath or finish of the cable shall be sufficient cause for rejecting the cable. Cable damaged in any way during installation shall be replaced by and at the expense of the Contractor.

**4.1.9 Pulling Tension.** The pulling tension of any cable shall not exceed the maximum tension recommended by the cable manufacturer. Pulling mechanisms of both the manual and power types used by the Contractor shall have the rated capacity in tons clearly marked on the mechanism. Whenever the capacity of the pulling mechanism

exceeds the recommended pulling tension of the cable as given by the cable manufacturer, a dynamometer shall be used to show the tension on the cable and the indicator shall be constantly watched. If any excessive strain develops, the pulling operation shall be stopped at once and the difficulty determined and corrected.

**4.1.10 Sidewall Pressure.** To avoid insulation damage from excessive sidewall pressure at bends, the pulling tension in pounds at a bend shall not exceed 300 times the radius of the bend in feet.

**4.1.11 Cable Bends.** Tape shielded, flat tape armored, and wire armored cable shall not be bent to a radius of less than 12 times the overall cable diameter. All other cables shall not be bent to a radius of less than eight times the cable diameter.

**4.1.12 Supports.** All cable supports and securing devices shall have bearing surfaces located parallel to the surfaces of the cable sheath and shall be installed to provide adequate support without deformation of the cable jackets or insulation.

Adequate cable end lengths shall be provided and properly placed in junction boxes to avoid longitudinal strains and distorting pressures on the cable at conduit bushings and duct end bells.

Final inspection shall be made after all cable is in place and, where supports or raceway fittings deform the cable jacket, additional supports shall be provided as directed by GRDA's designated Work Inspector. Additional cable protection such as a wrapping of light rubber belting, friction tape, or similar material shall be provided where required.

Cable in vertical runs shall be supported by woven wire grips in accordance with the NEC requirements, except that the distance between supports shall conform to the following:

<b>Conductor Size</b>	<b>Vertical Cable Support Spacing</b>	
	<b>Aluminum Conductor</b>	<b>Copper Conductor</b>
1/0 AWG and smaller	150 feet	150 feet
2/0 AWG thru 500 Mcm	100 feet	50 feet
Larger than 500 Mcm	70 feet	30 feet

**4.1.13 Not Used.**

**4.1.14 Spare Conductors.** All spare conductors of a multi-conductor cable shall be left at their maximum lengths for possible replacement of any other conductors in the cable. Each spare conductor shall be neatly coiled and then taped to the conductors being used.

**4.1.15 Lacing.** Nylon ties shall be used to neatly lace together conductors entering switchboards and similar locations after the conductors have emerged from their supporting raceway and before they are attached to terminals.

**4.1.16 Cable Identification.** The Contractor shall identify the ends of all circuits listed in the circuit lists.

Each marker shall bear the number of the circuit according to the circuit lists and drawings.

At terminations, the Contractor shall identify each conductor of power circuits, each multi-conductor cable, and each conductor of circuits consisting of multiple single conductors where the conductors are not otherwise identified. Markers shall be attached where the first individual conductor is routed away from the assembly. Each phase of multiphase power circuits shall be individually identified.

One end of each marker board shall remain free of the fastening tail, and the entire marker shall be so attached that it is readily visible for circuit identification.

**4.1.17** Not Used.

## **4.2 Splices**

No splices shall be made in conductors for instrument circuits or control circuits. Shields may be spliced where necessary to permit connection to the station ground.

Power cable circuits may be spliced only by methods and at locations acceptable to GRDA's designated Work Inspector.

## **4.3 Terminations**

Cable shall be terminated in accordance with the following requirements:

Train cable in place and cut squarely to required length. Avoid sharp bends.

Remove necessary amount of cable jacket and insulation without damage to the conductor.

Install terminals or terminal connectors as required, ensuring a firm metal-to-metal contact.

Insulate each connection of cable to an insulated conductor (whether cable, bus, or equipment bushing). The insulation shall cover all exposed surfaces of the

conductors; the insulation voltage level of the completed termination shall be not less than the insulation voltage level of the connected conductors.

**4.3.1 Insulation of 600 Volt Cable Connections.** Where connections of cable rated 600 volts or less require insulation, all exposed conductor, and connector surfaces shall be covered with tape in accordance with the following:

One half-lapped layer of varnished cambric tape.

A minimum of three half-lapped layers of rubber tape, elongated not more than 20 percent, applied over the varnished cambric tape.

A minimum of three half-lapped layers of vinyl tape applied over the rubber tape. The vinyl tape shall extend a minimum of two cable diameters over the cable jacket and a similar distance over the insulation of the conductor to which the cable is connected.

#### **4.4 Tests after Placement**

All insulated conductors shall be electrically tested after placement.

All circuits, including lighting circuits, shall be tested with the circuit complete except for connections to equipment. All splices, stress cones on shielded cable, and terminal connector attachments shall be complete prior to testing.

In addition to the tests performed after cable placement is complete, continuity tests and insulation tests shall be performed on all supervisory and communication cable before and after each splice is made.

Any circuit failing to test satisfactorily shall be replaced or repaired and then retested.

All equipment and labor required for testing shall be furnished by the Contractor.

**4.4.1 Continuity and Identification Tests.** All insulated conductors shall be tested for continuity and conductor identification.

**4.4.1.1 Continuity tests.** Continuity tests shall include all tests necessary to confirm that each conductor is continuous throughout its entire length.

**4.4.1.2 Identification tests.** Identification tests shall include all tests necessary to confirm that the conductor being investigated originates and terminates at the locations designated in the circuit lists or indicated on the drawings.

**4.4.2 Insulation Tests.** Resistance from ground provided by the insulation on all field installed insulated conductors shall be measured.

**4.4.2.1 Cable rated 600 volts and below.** All insulated conductors except supervisory and communication cable, rated 600 volts and below shall be tested with a 1000 volt megger or an equivalent testing device. Insulation resistance measurements shall be made between each conductor and ground and between each conductor and all other conductors of the same circuit. Minimum acceptable resistance values shall be approximately 500 megohms.


**4.4.2.2 Supervisory and communication cable.** All insulated conductors of supervisory and communication cable shall be tested with a 500 volt megger or an equivalent testing device. Insulation resistance measurements shall be made between each conductor and the cable shielding tape and between the two conductors in each pair. Minimum acceptable resistance values shall be 500 megohms divided by the actual cable length in miles.

## **5. Cable Inventory Report**


The Contractor shall prepare a cable inventory report of all power and control on order and stored onsite. The report shall include scheduled delivery dates for cable on order. The report shall be updated every two weeks and a copy shall be given to GRDA's designated Work Inspector.

## **6. OPGW Line Termination**

The OPGW outdoor splice enclosure shall be furnished and installed as indicated on the drawings. The OPGW outdoor splice enclosure shall be furnished with pole mounting brackets. The splice closure shall be sized to accommodate a 24 fusion splice tray. The OPGW splice closure shall be complete with splice tray and all accessories required for splicing the cable and sealing the splice closure.

<b>600 VOLT</b>	600V, MULTI-CONDUCTOR, EPR INSULATION, NON-SHIELDED, CPE JACKET (E-1 COLOR CODE)								TYPE					
	(FLAME RETARDANT CONTROL CABLE) (UL TYPE TC, 90C)								<b>600MULTI</b>					
SPECIFICATIONS:														
REFERENCE:	ICEA S-73-532 (NEMA WC 57), ICEA T-29-520 (FLAME TEST), IEEE 1202, U-44, UL-62, UL-1277.													
CONDUCTOR:	TINNED, ANNEALED COPPER PER ASTM B33. CLASS B STRANDING PER ASTM B8: NORMAL MAXIMUM OPERATING TEMPERATURE 90 C (ICEA S-73-532, ARTICLE 2.3.3); WET OR DRY													
INSULATION:	EXTRUDED FLAME-RETARDANT ETHYLENE PROPYLENE RUBBER (EPR); NOT LESS THAN 30 MILS AVERAGE THICKNESS; XHHW-2, VW-1													
SHEILD:	NONE													
JACKET:	CABLE ASSEMBLY: BLACK FLAME RETARDANT, SUNLIGHT RESISTANT, CHLORINATED POLYETHYLENE (CPE). THE MINIMUM THICKNESS SHALL BE NOT LESS THAN 80 PERCENT OF THE VALUES INDICATED BELOW.													
CONDUCTOR IDENTIFICATION:	ICEA S-73-532, APPENDIX E, METHOD 1, COLORED COMPOUNDS WITH TRACERS, TABLE E-1. TRACERS SHALL BE CONTINUOUS THROUGHOUT THE LENGTH OF CONDUCTOR. COLOR BANDS OR MARKINGS APPLIED AT DISCRETE INTERVALS ARE NOT ALLOWED.													
ASSEMBLY:	TWO CONDUCTOR CABLE SHALL BE FLAT. FOR THREE CONDUCTORS OR MORE, THE CONDUCTORS SHALL BE CABLED TOGETHER WITH FLAME RETARDANT POLYPROPYLENE FILLERS, AS NECESSARY, TO MAKE THE FINISHED CABLE ROUND.													
FACTORY TESTS:	IN ADDITION TO THE REQUIREMENTS OF ICEA S-73-532, EACH CONDUCTOR AND THE FINISHED CABLES SHALL MEET THE FLAME TEST REQUIREMENTS PER IEEE 1202 USING A GAS-BURNER FLAME SOURCE.													
CABLE DETAILS														
NUMBER OF CONDUCTORS	AVERAGE ASSEMBLY JACKET THICKNESS (INCHES)				O.D. MAXIMUM (INCHES)				COLOR CODE ICEA S-73-532 TABLE E1					
	16 AWG	14 AWG	12 AWG	10 AWG	16 AWG	14 AWG	12 AWG	10 AWG	COLOR NO.	BASE	TRACER	COLOR NO.	BASE	TRACER
2	0.045	0.045	0.045	0.045	0.38	0.43	0.47	0.53	1	BK	-	11	BL	BK
3	0.045	0.045	0.045	0.045	0.40	0.45	0.50	0.55	2	W	-	12	BK	W
4	0.045	0.045	0.045	0.060	0.44	0.48	0.54	0.63	3	R	-	13	R	W
5	0.045	0.045	0.045	0.060	0.48	0.52	0.62	0.68	4	G	-	14	G	W
6	0.045	0.045	0.060	0.060	0.52	0.57	0.66	0.73	5	O	-	15	BL	W
7	0.045	0.045	0.060	0.060	0.52	0.57	0.66	0.73	6	BL	-	16	BK	R
8	0.045	0.060	0.060	0.060	0.56	0.64	0.71	0.79	7	W	BK	17	W	R
9	0.060	0.060	0.060	0.060	0.64	0.69	0.77	0.87	8	R	BK	18	O	R
10	0.060	0.060	0.060	0.060	0.66	0.74	0.82	0.97	9	G	BK	19	BL	R
12	0.060	0.060	0.060	0.080	0.70	0.76	0.86	1.00	10	O	BK			
15	0.060	0.060	0.060	0.080	0.76	0.86	0.99	1.10						
19	0.060	0.060	0.080	0.080	0.83	1.02	1.12	1.19						
CABLE SHALL BE UL LISTED TC														
A DURABLE MARKING SHALL BE PROVIDED ON THE SURFACE OF THE CABLE AT INTERVALS NOT EXCEEDING 24 INCHES. MARKING SHALL INCLUDE MANUFACTURER'S NAME, INSULATING MATERIAL, CONDUCTOR SIZE, SEQUENTIAL FOOT MARKINGS, VOLTAGE CLASS, AND TYPE TC.														
					Grand River Dam Authority					600V MULTI FREP/CPE				
600MULTI					CABLE SPECIFICATION					SHEET 1 OF 1 4/4/2011				



<b>600 VOLT</b>	600V, 4 CONDUCTOR (WITH GROUND), EPR INSULATION, NON-SHIELDED, CPE JACKET (E-1 COLOR CODE)  (FLAME RETARDANT POWER CABLE) (UL TYPE TC, 90C)	TYPE  <b>600POWR</b>	
<p><b>SPECIFICATIONS:</b></p> <p>REFERENCE: ICEA S-95-658 (NEMA WC 70), ICEA T-29-520 (FLAME TEST), IEEE 1202, U-44, UL-62, UL-1277.</p> <p>CONDUCTOR: TINNED, ANNEALED COPPER PER ASTM B33. CLASS B STRANDING PER ASTM B8: NORMAL MAXIMUM OPERATING TEMPERATURE 90 C; WET OR DRY</p> <p>INSULATION: EXTRUDED FLAME-RETARDANT ETHYLENE PROPYLENE RUBBER (EPR)</p> <p>SHEILD: NONE</p> <p>JACKET: BLACK FLAME RETARDANT, SUNLIGHT RESISTANT, CHLORINATED POLYETHYLENE (CPE).</p> <p>GROUND CONDUCTOR: ICEA S-95-658, PARAGRAPH 5.3</p> <p>CONDUCTOR IDENTIFICATION: ICEA S-73-532, APPENDIX E, METHOD 1, COLORED COMPOUNDS WITH TRACERS, TABLE E-1. TRACERS SHALL BE CONTINUOUS THROUGHOUT THE LENGTH OF CONDUCTOR. COLOR BANDS OR MARKINGS APPLIED AT DISCRETE INTERVALS ARE NOT ALLOWED.</p> <p>ASSEMBLY: CONDUCTORS SHALL BE CABLED TOGETHER WITH FLAME RETARDANT POLYPROPYLENE FILLERS, AS NECESSARY, TO MAKE THE FINISHED CABLE ROUND.</p> <p>FACTORY TESTS: IN ADDITION TO THE REQUIREMENTS OF ICEA S-95-658, EACH CONDUCTOR AND THE FINISHED CABLES SHALL ALSO MEET THE FLAME TEST REQUIREMENTS PER IEEE 1202 USING A GAS-BURNER FLAME SOURCE.</p>			
<b>CABLE DETAILS</b>			
PHASE CONDUCTOR SIZE (AWG OR KCMIL)	GROUND CONDUCTOR SIZE (AWG)	AVERAGE ASSEMBLY JACKET THICKNESS (INCHES)	O.D. MAX (INCHES)
8	10	0.060	0.73
6	8	0.060	0.82
4	8	0.080	0.98
2	6	0.080	1.12
1	6	0.080	1.27
1/0	6	0.080	1.37
2/0	6	0.080	1.48
4/0	4	1.100	1.81
250	4	1.100	1.98
350	3	1.100	2.24
500	2	1.100	2.57
<p>CABLE SHALL BE UL LISTED TYPE XHHW-2, VW-1, TYPE TC</p> <p>A DURABLE MARKING SHALL BE PROVIDED ON THE SURFACE OF THE CABLE AT INTERVALS NOT EXCEEDING 24 INCHES. MARKING SHALL INCLUDE MANUFACTURER'S NAME, INSULATING MATERIAL, CONDUCTOR SIZE, SEQUENTIAL FOOT MARKINGS, VOLTAGE CLASS, AND TYPE TC.</p>			<p><b>600V POWER FREP/CPE</b></p> <p><b>SHEET 1 OF 1 4/4/2011</b></p>
 <p>Grand River Dam Authority</p>	<b>Grand River Dam Authority</b>		
<b>600POWR</b>	<b>CABLE SPECIFICATION</b>		

# GRAND RIVER DAM AUTHORITY

## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

### TR-24 – SEDIMENT EROSION AND ENVIRONMENTAL CONTROL

#### **1. General**

This section covers materials and procedures selected to control erosion during construction, to assure that sediment is trapped for removal, and to provide direction should environmental artifact be discovered during construction.

Sediment and erosion control facilities shall be constructed in such a manner as to insure that sediment and sediment laden water do not enter the drainage system, public roadways, or violate applicable water standards.

It is the intent of these specifications that the substation shall be constructed with a minimum of disruption to the natural surroundings and ground cover.

#### **2. Description of Control Methods**

Sediment and erosion control procedures and methods shall be in accordance with applicable State, County, and City requirements and as specified herein. Silt fence or straw bales may be used to control soil erosion and sediment runoff at the Contractor's option.

##### **2.1 Silt Fence**

The silt fence is intended to intercept water runoff and reduce the transport of sediment from the construction site by providing a temporary barrier to sediment and reducing runoff velocities. Silt fencing shall be installed where ground cover is removed and sloping grades are present. Filter fabric material shall be Synthetic Industries 401 or acceptable equal.

##### **2.2 Straw Bales**

Straw bales are intended to intercept water runoff, filter runoff of sediment from the construction site, and reduce runoff velocities. Straw bales shall be installed where ground cover is removed and sloping grades are present.

#### **3. Maintenance**

Sediment and erosion control facilities shall be inspected and maintained according to the SWPP. At no time shall more than one foot of sediment be allowed to accumulate behind the silt fence and straw bales. Accumulated sediment shall be removed and any damaged silt fence or straw bales repaired.

#### **4. Removal of Facilities**

Silt fences and straw bales shall be removed when they have served their useful purpose, but not before the upslope area has been repaired, seeded, and permanently stabilized as directed by GRDA's designated Work Inspector.

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## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

### **5. Environmental Artifacts**

Construction personnel shall be cautioned to watch for buried artifacts and bones during earth moving. If any such items are found, work should cease immediately and the GRDA Inspector notified.

### **6. Erosion and Environmental Planning and Permitting**

The following permits and plans shall be developed and implemented by the Contractor.

#### **6.1 Spill Prevention Control and Countermeasure (SPCC) Plan**

If the contractor will have oil and fuel storage in excess of 1,320 gallons on one site during construction, the Contractor shall design, implement, manage, and maintain a SPCC Plan. The Contractor shall be responsible for its development and implementation, with concurrence from GRDA.

#### **6.2 Construction Storm Water Pollution Prevention (SWPP) Permit**

The Contractor is required to design, implement, manage, and maintain Best Management Practices to reduce the amount of pollutants in storm water discharges. The Contractor shall be responsible for obtaining this permit. Guidelines for the development of the SWPP are included in Appendix A.

#### **6.2 NPDES General Storm Water Permit for Construction**

The Contractor shall be to obtain a NPDES General Storm Water Permit for Construction.

## TR-25 – TRANSMISSION LINE REQUIREMENTS

### **1. General**

This section specifies the general technical requirements applicable to the technical specifications sections, including furnishing and installing materials for and documenting the construction of overhead electric transmission lines.

The requirements of this section are intended as an addition to and not to be in conflict with any specific requirements included in any other section of the technical specifications.

#### **1.1 Codes and Standards**

Work performed under these specifications shall be done in accordance with the following codes and standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Purchaser's specifications. In case of conflict, the latter shall govern to the extent of such difference:

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## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

Work	In Accordance With
Transmission Line Construction and Materials	National Electrical Safety Code (ANSI C2). Federal and State Occupational Safety and Health Act (OSHA). American Concrete Institute. American Institute of Steel Construction. American Iron and Steel Institute. American Institute of Timber Construction. American National Standard Institute. American Society of Civil Engineers. American Society of Mechanical Engineers. American Society for Testing and Materials. American Welding Society. Concrete Reinforcing Steel Institute. Institute of Electrical and Electronics Engineers, Inc. National Electrical Manufacturer's Association. Underwriters' Laboratories, Inc.

### 2. Existing Underground Facilities

The Contractor shall be solely responsible for locating all existing underground installations, in advance of drilling pole holes, by contacting the owners thereof and prospecting.

The Contractor shall use his own information and shall not rely upon any information indicated on the drawings concerning existing underground installations.

The Contractor will be held responsible for any interruption in the service of underground facilities resulting from his operations, unless the facilities' owner has given specific approval for the interruption in each case.

Should facilities become damaged during construction and the Owner of said facilities choose not to do its own repair work, the Contractor shall restore the facilities to a condition equal to or better than that prior to construction. The Contractor shall perform

# GRAND RIVER DAM AUTHORITY

## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

all repair and restoration work to the complete satisfaction of the owners of the damaged facilities.

Should the owner of damaged facilities as described above choose to do its own repair work, the Contractor shall provide assistance as requested and assume all just and reasonable expenses thus incurred by the parties whose facilities were damaged.

The Contractor is responsible for ensuring inspection requirements are met as stated by all governing authorities for all repaired or reconditioned underground utility facilities. The Contractor is responsible for all applicable inspection fees.

The Contractor shall accurately locate each underground facility encountered on the drawings. Facilities' original location and relocation (where applicable) shall be clearly identified on all drawings. Upon completion, the Contractor shall submit the marked copy of the drawings to GRDA as part of the field records.

### **3. Not Used**

### **4. Modification and Removal of Existing Facilities**

#### **4.1 General**

The existing 161 kV and 69 kV transmission lines will require modification in order to properly execute project construction. The Contractor shall make such modifications and removals as indicated on the drawings and as required by these Specifications.

The Contractor will coordinate all work regarding modifications and removal of existing facilities with GRDA to minimize interruptions on GRDA's system. Prior to starting the modification and/or removal work, the Contractor will prepare and submit to GRDA a proposed detailed schedule for such work. The Contractor shall not proceed with the modification and/or removal work until the schedule has been approved by GRDA.

The Contractor shall protect from damage all existing structures and materials that are to remain in place. Existing facilities that are damaged during modification work shall be restored to their original condition to GRDA's satisfaction. The Contractor shall pay all costs in connection with repairing damages to existing facilities resulting from this work.

#### **4.1.1 Scope of Modifications**

Modification work on the existing 161 kV line is outlined in attachment G:

#### **4.1.2 Deposition of Razed Items**

The Contractor shall contact the GRDA Inspector regarding all razed equipment and materials. The GRDA Inspector, will determine where the razed material shall be stored on site.

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## **SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS**

### **4.1.3 Removal**

Where transmission line materials are designated for removal, the Contractor shall furnish all equipment, material, tools, labor, and other services as required to completely remove and dismantle the components and structure assemblies at the locations indicated on the drawings, except that where complete removal of anchor rods or ground rods is impractical, the rods shall be cut off 18 inches below finish grade and the upper segment removed.

Holes for removed foundation materials shall be filled with firmly tamped earth.

The Contractor shall furnish and install all guard structures required for removal of the conductors over roads, existing lines, and other obstructions. Splices shall not be allowed to move through the bullwheels during the removal process.

### **4.1.4 Modification**

Where transmission line structures are designated for modification, the Contractor shall furnish all equipment, material, tools, labor, and other services as required to complete the modification work as indicated on the drawings.

### **4.1.5 Conductors**

Existing conductors to be removed may be prone to breakage because of embrittlement over a long service life. Extreme care must be exercised when removing this conductor to insure safety of workers.

### **4.1.6 Protection**

The Contractor shall protect from damage all existing structures and materials which are to remain in place. The Contractor shall repair, or cause to be repaired and pay all costs in connection therewith, all damages resulting from his work.

### **4.1.7 Cleanup**

At the completion of the modification work, all structure site areas shall be cleaned of all debris and rubbish

## **5 Not Used**

## **6. Preservation, Restoration, and Cleanup**

### **6.1 Site Restoration and Cleanup**

The Contractor shall clean up construction debris, excess excavation, and excess materials, and completely restore fences, mailboxes, ditches, culverts, signposts, and similar items immediately following structure setting and framing.

The Contractor shall stockpile excavated materials in a manner that will cause the least damage to adjacent lawns, grassed areas, gardens, shrubbery, or fences, regardless of whether these are on private property, or on city, state, or county rights-of-way.

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## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

Contractor shall remove all excavated materials from grassed and planted areas, and leave these surfaces in a condition equivalent to their original condition and replace topsoil areas raked and graded to conform to their original contours.

At the conclusion of each day's work, the Contractor shall thoroughly clean all spilled soil, gravel, or other foreign materials caused by the construction operations from all streets and roads.

The Contractor shall reopen, grade, and restore natural drainage at all existing ditches and culverts. Contractor shall repair or replace damaged or broken culverts to their original condition.

Upon completion of construction operations, the Contractor shall hand-rake and drag all former grassed and planted areas, leaving all disturbed areas free from rocks, gravel, clay, or any other foreign material. The finished surface shall conform to the original surface, and shall be free-draining and free from holes, ruts, rough spots, or other surface features detrimental to a seeded area.

The Contractor shall replace damaged or destroyed vegetation in a manner suitable to GRDA.

If required by GRDA, an approved dust-preventive treatment shall be used on all unpaved streets, roads, detours, or haul roads used in the construction area. Alternatively, water shall be applied to the construction area periodically to prevent dust. Applicable environmental regulations for dust prevention shall be adhered to.

### **7. Not Used**

### **8. Material and Equipment**

#### **8.1 General**

A Bill of Material is shown on the drawings and indicates Owner-furnished material items.

Material items are specified on the transmission line construction assembly drawings and in the Bill of Material with specific manufacturers' names and catalog numbers. When furnishing additional units of Owner-furnished material, those items shall match exactly any Owner-furnished material item. Material not specified, and not furnished by GRDA, shall be furnished by the Contractor.

#### **8.2 Owner-Furnished Materials**

Owner-furnished materials are listed and identified in the Bill of Material. The Contractor shall obtain Owner-furnished material items from GRDA's designated storage area and transport them to the jobsite.

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## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

The Contractor will receive, unload, inspect, and properly protect Owner-furnished material at the jobsite and will immediately report and return to GRDA any material found damaged or unsuitable for use.

Owner-furnished material damaged by the Contractor shall be promptly replaced or, if approved by Owner, satisfactorily repaired.

The costs for handling, installing, adjusting, and integrating in the project all Owner-furnished material shall be included in the Contract Price.

### **8.3 Contractor-Furnished Materials**

The Contractor shall provide all incidental material items, connections, and other items that are not specified on the drawings or Bill of Material, but are necessary to complete the work as specified as though such material items, connections and other items were shown on the drawings and/or the Bill of Material. Contractor-furnished materials shall be in accordance with the drawings and Specifications.

### **8.4 Salvaged Materials**

The Contractor shall deliver all salvaged poles, structures, equipment, conductors, and materials to GRDA's storage area and unload as directed by GRDA. The Contractor shall dispose of all materials not being salvaged.

The Contractor shall obtain a signed voucher from GRDA's storekeeper for all returned material.

The Contractor shall disassemble, sort, and store all structures and materials. Wood and concrete poles removed shall be freed of dirt and other debris and inspected for damage. The Contractor shall identify and inform Owner of any wood poles that may need treatment to prevent further deterioration and notify Owner of any damage needing repair.

The Contractor shall spool and tag all conductors, shield wires, fiber optic cables, and guy wires with information concerning the type and approximate length of conductor or wire in feet contained in each spool.

The Contractor shall provide all reels, shoring, and crating required for the storage of salvaged structures, equipment, and materials.

## **9. Protection of the Environment**

### **9.1 General**

The Contractor shall observe the rules and regulations of GRDA and the state, local, and federal agencies having jurisdiction over the protection of the environment.



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## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

### 10 Traffic Control

Traffic control shall be the responsibility of the Contractor and shall be in accordance with applicable state, county, and municipality statutes and guidelines. GRDA shall be provided a copy of the approved traffic control permit.

### TR-26 – CONTRACTOR FURNISHED MATERIAL – T-LINE

#### 1. General

##### 1.1 Scope of Supply

The materials included in this section shall be furnished and installed by the Contractor under these specifications. The equipment and materials are in addition to those specified elsewhere and are necessary to make a complete operational installation as intended by the drawings and these specifications.

This section describes the material, functions, and general arrangements desired. The content of these specifications does not necessarily cover all design details and features. The right is reserved to require modifications of construction details or operations features which may not have been discussed in these specifications and which, in the estimation of the Engineer, are substandard or undesirable.

Installation of materials shall be accomplished in a neat and workmanlike manner. All work shall be in accordance with the best practices of the electrical construction industry. The completed installation shall provide a minimum of hazard to personnel and shall not interfere with the use, as intended, of the area in which they are installed.

#### 2. Material

Contractor-furnished material shall be in accordance with the drawings and the following articles. The Contractor shall be responsible for determining the quantities of material required.

### TR-28 – T-LINE INSTALLATION OF AERIAL CONDUCTORS

#### 1 General

##### 1.1 Scope of Supply

This section covers the installation of transmission line aerial wires and conductors as shown on the drawings. Wires shall be installed in accordance with these specifications: IEEE 524, "Guide to the Installation of Overhead Transmission Line Conductors"; and manufacturer's recommendations.

This section does not cover requirements for furnishing, installing, and field testing of overhead fiber-optic wires and cables including OPGW and ADSS types.

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## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

Installed aerial wires and conductors shall be free from damage including any deformity in, or foreign matter on, the wires or conductors that can be detected visually or by feel.

Contractor shall provide to Owner sagging plan and snub-off locations prior to commencing stringing.

### 1.2 Codes and Standards

Work performed under these specifications shall be done in accordance with the following codes and standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Purchaser's specifications. In case of conflict, the latter shall govern to the extent of such difference:

Work	In Accordance With
Transmission Line Installation of Aerial Wires and Conductors	IEEE 524
Grounding Wire During Installation	IEEE 524a, and OSHA Code of Federal Regulations 29 CFR, Part 1926

### 2. Stringing Blocks

Stringing blocks shall be securely fastened to the supporting structures. Stringing blocks may be attached to the insulators units or assemblies or they may be supported by brackets or hangers that are attached to the structures. The stringing blocks shall support the aerial wires or conductors at their permanent or "clipped in" elevations. Double stringing blocks shall be used when wires or conductors are pulled through line deflection angles 30 degrees or larger.

Stringing blocks shall have neoprene or urethane inserts covering all parts that come in contact with the wire or conductor. Stringing blocks shall be designed and used so that the pulling line does not damage or deposit foreign matter in the sheave or insert in a manner that might cause damage to the conductor. Sheaves shall operate freely. Sheave diameters and sheave grooves shall be selected in accordance with IEEE Paper C 73 377-9, "A Guide for the Selection and Application of Transmission Conductor Stringing Sheaves." For all tangent structures, stringing blocks shall be used with a minimum 14 inch diameter.

Conductors shall be clipped in at angle structures first. Angle blocks and hardware shall be as close to their final position as possible.

# GRAND RIVER DAM AUTHORITY

## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

### 3. Not Used

#### 4. Stringing of Wires and Conductors

All wires and conductors shall be strung from reels firmly mounted on stands secured against displacement. Reel equipment shall include adjustable braking devices that shall be used to prevent wire or conductor overrun between the reel and the tensioning equipment. All reel equipment shall be continuously attended during wire or conductor pulling to ensure proper operation. The horizontal distance between the tensioner or puller and the nearest structure, or a snub-off anchor and the nearest structure, shall be at least 3 times the vertical distance. Each conductor reel shall be inspected and any protruding fasteners or other objects that might damage the wire or conductor shall be removed. A thorough visual inspection for flaws, breaks, or abrasions as the wire or conductor leaves the reel shall be conducted. Damaged portions of the wire or conductor shall be cut out and the wire or conductor spliced as specified hereinafter. Splices shall not be pulled through stringing blocks.

All wires and conductors shall be strung using double bull wheel continuously controlled tensioning equipment located in line with each pull and anchored. Tensioning bull wheels shall be provided with multiple conductor grooves, and with a diameter sized for the outside diameter of the wire or conductor being pulled. The wire or conductor grooves shall be lined with neoprene or other acceptable resilient material to provide cushioning in the grooves and protect wires or conductors smaller than the groove diameter from being flattened or otherwise damaged. Tensioning brakes and brake controls shall automatically maintain running tension after the set tension is obtained, and shall be supplemented by a fail-safe type brake that automatically engages upon loss of the running tension brakes.

Wire and conductor grips shall be of a type that will not damage the wire or conductor and shall be acceptable to GRDA. Wire or conductor that is damaged by the conductor grips shall be repaired or the damaged section shall be cut off.

During stringing, the tension on any wire or conductor shall not exceed 50 percent of the tension required by the stringing sag charts at the existing temperature. During stringing, the sag on any wire or conductor in any span shall not be less than that required by the stringing sag chart at the existing temperature.

Two-way communication shall be maintained at all times between the puller, tensioner, and personnel following the running board.

Wooden planks or other nonmetallic lagging shall be used and shall be acceptable to GRDA to protect wires and conductors from direct contact with the ground during splicing and dead-ending operations. During pulling operations, the wire or conductor shall be kept clear of the ground and all other objects that might cause abrasion, kinks, loosening of strands, or other damage.

# GRAND RIVER DAM AUTHORITY

## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

If, at any time during the stringing and sagging operation, it becomes necessary to leave the wire or conductor in the stringing blocks for an extended period of time because of equipment failures, inclement weather, or other delay, the wire or conductor sag shall be adjusted to twice normal sag or greater consistent with the maintenance of standard clearance at all crossings of utilities, roads, and railroad tracks.

GRDA may require the wire or conductor to be lowered after periods of stringing inactivity or exceedingly high wind to inspect for damage. The lowering of the conductor and the repair or replacement found necessary shall not be cause for extra compensation.

### **5. Splicing and Dead-Ending**

Full tension splices and dead ends shall be installed in accordance with the manufacturer's recommendations.

Splices shall not be installed in spans adjacent to or crossing creeks, railroads, major overhead utility lines, state or federal highways, or within 50 feet of suspension points or within 75 feet of dead-end fittings.

No splices shall be made in dead-end spans without prior approval by GRDA.

Compression fittings shall be filled with filler compound, if required, as recommended by the manufacturer before compressing. Joint compound shall be applied to all flat-to-flat surface connections on dead-end bodies and jumper terminals. The joint compound shall be applied immediately following wire brush cleaning of contact surfaces.

The proper die size to compress the aluminum barrel shall be selected. The die size indicated on the aluminum barrel should match that indicated on the compression dies.

A minimum of 15 feet of the wire or conductor shall be supported straight out from the end of the dead end so that the weight of the conductor does not hang unsupported from the end of the dead end when compressing.

The aluminum barrel shall be compressed starting adjacent to the knurl. The dead-end barrel or sleeve shall continue to be compressed toward the end. Each compression shall be overlapped by an amount sufficient to prevent the formation of ridges between adjacent compressions. The die grooves shall be lubricated with a lightweight oil. Oil coating shall be maintained during the entire compression operation.

After compressing, all burrs and sharp edges shall be removed from the joint surfaces with a file or abrasive cloth. The wire or conductor shall be cleaned of any excess filler compound that has been forced out of the connection during compression.

# GRAND RIVER DAM AUTHORITY

## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

Jumper loops installed between dead-end fitting terminals shall be formed into a regular shape to present a neat appearance. Where jumper loops are attached to vertical suspension insulators, the jumper loops shall allow the suspension insulators to remain plumb during cold weather.

All splices, taps, and dead ends in the wires and conductors shall be made as required to provide complete electrical circuits. All splice and dead-end installations shall be performed in the presence of, and are subject to the inspection and acceptance of, GRDA.

### **6. Sagging**

All wires and conductors shall be sagged within 24 hours after stringing in accordance with stringing sag charts furnished by GRDA. No conductor shall be stressed above the stress required by the stringing sag for the temperature existing at the time of sagging. The wire or conductor temperature shall be determined at the time of sagging by means of a sagging thermometer suspended at least 10 feet above the ground. The temperature so determined shall be used as the sagging temperature.

The sag of wires and conductors shall be measured by the direct line of sight (transit) method or, where acceptable to GRDA, by the return wave method. The accuracy of the return wave method shall be demonstrated by measuring conductor sag on a representative span using both the transit and return wave methods, and comparing the sags measured by the two methods.

Sag spans should be at or near each end of the sag section. For sag sections over 2 miles long, additional sag span(s) shall be used near the center of the sag section. Sag spans should be the longer, more level spans. If the sag span is not a level span, the transit shall be located at the lower structure to increase conductor control. Sag spans should also be located on each side of line angles greater than 10 degrees.

A sag section should not exceed 4.5 miles, or approximately 20 spans, in length.

Dynamometers on tensioning equipment may be used to ensure that conductors are not overstressed, but shall not be used as a substitute for sag measurements.

Sags shall be held to the values indicated on the sag charts with a minus tolerance of zero to a plus tolerance of 1 inch (-0, +1 inch). An accurate sagging log shall be kept listing the date, time, temperature, spans where sags are checked, computed sag, measured sag, and any other pertinent data or remarks. This log shall be available to GRDA for review at all times and given to GRDA as a permanent record when the sagging operation is completed on the line. For each line section sagged, clearance shall be obtained from GRDA on the completed sagging operation for that section before proceeding to the next section of line. Such assistance shall be provided as may be required by GRDA in checking the sags. Any change in this procedure shall be presented to GRDA for acceptance.

# GRAND RIVER DAM AUTHORITY

## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

During sagging operations, temporary guys, anchors, and reinforcements shall be provided as required to maintain all structures in alignment.

Any sagging activities shall not be performed during periods of high or gusty winds that, in the judgment of GRDA, might prevent accurate sag measurements.

### 7. Not Used

### 8. Grounding During Wire Installation

Grounding of wires and equipment during the installation of wires shall be in accordance with these specifications: IEEE 524a, "Guide to Grounding During the Installation of Overhead Transmission Line Conductors," and OSHA Code of Federal Regulations 29 CFR, Part 1926, "Construction."

All grounding cables shall be flexible, stranded copper, and be regularly inspected. The grounding cables shall be sized based on the maximum potential fault current. The minimum conductor size shall be AWG 4/0 (diameter = 0.460"). Aluminum conductor is not acceptable.

The installation and removal of grounding devices shall be performed with an insulated ground stick. Grounding cables shall be connected to the ground source first, then to the object being grounded. Personnel should never be in series with a ground lead. When removing grounds, they shall be removed from the grounded object first and then from the ground source.

#### 8.1 Pulling Site Grounding

The puller shall be grounded to an acceptable ground, such as driver ground rods, structure ground grid, or substation yard grid. The puller and ground source shall be surrounded with warning barriers. The first tower away from the puller shall use traveler grounds bonded to the grounding source used at the pulling site and a running ground shall be installed in front of the puller connected to the common ground point at the puller site.

#### 8.2 Tensioner Site

The tensioner, reel carts, and reel trailers shall be bonded together and grounded to a common point. The first tower away from the tensioner shall incorporate the use of traveling grounds bonded to the grounding source used at the tension site. When pulling bundled conductors, the subconductors shall be bonded together. Clearly marked barriers shall be installed around the tensioner and ground source.

#### 8.3 Not Used

#### 8.4 Splicing

Splicing vehicles shall be effectively grounded prior to making splices in the conductors. The anchor site ground system shall be left in place until the spliced conductors are raised

# GRAND RIVER DAM AUTHORITY

## SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

to clear the splicing site. When the splice is completed, the jumper connecting the phase and subconductors together shall be removed prior to raising the conductor with the winch line above the splicing site and out of reach of all ground personnel. These procedures shall be repeated until all splices are complete and all phases are raised to clear the splice site. Splicing shall be performed on either an insulated platform or on a conductive metallic grounding mat bonded to both grounds. When a grounding mat is used, the grounding mat shall be roped off and an insulated walkway provided for access to the mat.

### **8.5 Traveler Grounds**

Traveler grounds shall be installed at the first and last structures of each pull section, on either side of energized crossings and at intervals of not more than 2 miles.

### **8.6 Grounding During Dead-Ending Operation**

Bypass jumpers shall be installed on each subconductor on both sides of the structure prior to installing dead ends.

(End)  
5/10/12

**Construction  
Storm Water Pollution  
Prevention Plan**

**for the**

**Grand River Dam Authority  
Afton Substation  
Additions**

**January, 2010**



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ADDENDUM B - NOTICE OF INTENT

See Reverse Side for Instructions

Oklahoma Department of Environmental Quality

DEQ FORM 605-002A Sept. 3, 2009



Notice of Intent (NOI) for Storm Water Discharges Associated with CONSTRUCTION ACTIVITY on Sites of One Acre or More Acres Under the OPDES General Permit OKR10

SUBMISSION OF THIS NOTICE OF INTENT CONSTITUTES NOTICE THAT THE PARTY IDENTIFIED IN Part I OF THIS FORM INTENDS TO BE AUTHORIZED BY AN OPDES PERMIT ISSUED FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY IN THE STATE OF OKLAHOMA. BECOMING A PERMITTEE OBLIGATES SUCH DISCHARGER TO COMPLY WITH THE TERMS AND CONDITIONS OF THE PERMIT. IN ORDER TO OBTAIN AUTHORIZATION, ALL REQUESTED INFORMATION MUST BE PROVIDED ON THIS FORM. SEE INSTRUCTIONS ON BACK OF FORM.

IF YOUR FACILITY OR SITE IS ON INDIAN COUNTRY LAND, FILE YOUR NOI WITH THE EPA, USING EPA FORM 3510-9.

[X] NEW APPLICATION [ ] MODIFICATION OF CURRENT PERMIT Enter Authorization Number: OKR10

I. Facility Owner/Operator Information

If you are a Co-permittee, check this box [ ]

Name: Grand River Dam Authority Phone: (918) 256-5545
Address: PO Box 409 Status of Owner/Operator: S
City: Vinita State: OK Zip Code: 74301 E-mail Address: baverill@grda.com

II. Site Information

Name of the project: Afton Substation Expansion Address: approx 1 1/2 mi. East; located near US 59
City: Afton County: Ottawa ZIP Code: 74331

Telephone No. (918) 825-0280 Location: Latitude: 36° 41' 24" Longitude: 94° 55' 41"

Has a Storm Water Pollution Prevention Plan (SWP3) been developed? [X] Yes [ ] No

Address of location of SWP3 for viewing: [ ] Address in I. Above [ ] Address in II. Above [X] Other, please specify below

Address: 635 Highway 69A Phone: (918) 825-0280
City: Pryor Zip Code: 74362

Name of Receiving Water Body: un-named tributary of Horse Creek

Is the Receiving Water Body on the DEQ 303(d) list? [X] Yes [ ] No Is this facility/site on Indian Country land? [ ] Yes [X] No (See Instructions)

Is there an approved TMDL applicable to this site? [X] Yes [ ] No (Bacteria)

Is this site a part of the common plan of development or sale? [ ] Yes [X] No Estimated area to be disturbed (to nearest acre): 2

02 / 01 / 2011 02 / 01 / 2012
Month Day Year Month Day Year
Construction Start Date Estimated Completion Date

Is the Storm Water Pollution Prevention Plan in compliance with all Applicable local sediment and erosion plans? [ ] Yes [ ] No [X] None

ENDANGERED SPECIES
Based on the instructions provided in Part 11 and Addendum A of the permit, is the proposed construction or land disturbing activity within the corridor of any of the listed sensitive waters or watersheds?
[ ] Yes [X] No
If the answer is yes, please refer to Part 11.2. Step 2.
All permit eligibility requirements with regard to protection of endangered species through the indicated Section of Part 1.3.2.E.2 of the permit have been complied with. (check one or more boxes):
a. [ ] b. [ ] c. [ ] d. [ ] e. [ ]

III. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage this system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I understand that continued coverage under this permit is contingent upon maintaining eligibility as provided for in Part 1.3.

Name (Please Print): Kevin Easley Date: 11-29-10
Signature: [Signature] Title: Chief Executive Officer

For DEQ use only: Assigned Authorization Number: OKR10

**ADDENDUM D - CONTRACTOR CERTIFICATION**

(Optional; sample format)

\_\_\_\_\_  
(Name of Owner/Operator)

\_\_\_\_\_  
(Project Name)

Contractors, builders, regular suppliers or others (contractors) involved in construction activity who are not the owner/operator, developer, or general contractor, and have not been issued the Storm Water Construction General Permit (Permit) authorization, execute this Contractor Certification which places the responsibility of complying with and abiding by the intent and purpose of the permit with the contractor for any and all work performed under the authority and direction of the contractor. Furthermore, the contractor assumes responsibility to avoid or eliminate any actual or potential adverse effects upon the environment according to the Storm Water Pollution Prevention Plan (SWP3), during all phases of building, construction, or delivery activity on any and all construction sites under the control and responsibility of the contractor as described in the SWP3.

1. Contractor company name: \_\_\_\_\_
2. Contractor address: \_\_\_\_\_
3. Project locations: \_\_\_\_\_

\_\_\_\_\_  
(For additional addresses, attach list to this form)

4. Contractor must be thoroughly familiar with the original Notice of Intent (NOI) filed by \_\_\_\_\_  
\_\_\_\_\_ with the Oklahoma Department of Environmental Quality.

\_\_\_\_\_  
(Owner/Operator Name)

Contractor must also be thoroughly familiar with, and adhere to, the Storm Water Pollution Prevention Plan (SWP3) and the Best Management Practices (BMP) on file at the following location; \_\_\_\_\_

The Contractor is certifying below that they assume all physical responsibility for any and all construction activities performed by the Contractor or under the direction and control of the Contractor, to avoid or eliminate any actual or potential adverse effects upon the environment pertaining to the properties listed in Item 3 above.

**Certification**

I certify that I understand the terms and conditions of the Oklahoma Pollutant Discharge Elimination System Act (OPDES) General Permit that authorizes storm water discharges associated with construction activity from the construction site identified as part of this certification. I have read and understand the Owner/Operators Notice of Intent and Part 1.3 eligibility requirements for coverage under the general permit for storm water discharges from construction activities, including those requirements published in the modified OPDES General Permit OKR10 of Month Date, 2007, and the SWP3 and BMP described pertaining to the project locations in Item 3 above. I agree that as a contractor, builder, regular supplier, or a support service company, I am responsible for installing and/or maintaining the appropriate pollution prevention measures that I am responsible for according to the agreement I have with the permittee.

I understand that continued coverage under this permit is contingent upon maintaining eligibility as provided for in Part 1.3 of the permit.

Signature: \_\_\_\_\_ Title: \_\_\_\_\_  
Print Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Plan Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage this system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

---

Name (Printed)

---

Date

---

Signature

# Afton Substation Construction Pollution Prevention Plan

## I. *SITE DESCRIPTION*

A. **Project Name:** Afton Substation

B. **Project Location:** Approximately 1½ miles east of Afton, Oklahoma near Highway U.S. 59 and in the SE¼ of the NE¼ of the SE¼ of Section 34, Township 26 North and Range 22 East, Ottawa County. This location is noted in the excerpt of the 7.5 minute series USGS map included as Appendix A.

C. **Project Owner:** Grand River Dam Authority  
PO Box 409  
Vinita, Oklahoma 74301

D. **Description:** An aerial photo of the existing site is included in Appendix A. The GRDA owns 2.4 acres at this site. 1.3 additional acres will be acquired for the expansion. Of the original 2.4 acres, 0.95 is occupied by the existing substation. Some activity will occur at the existing site and on an additional 0.45 acre located within the bounds of the original property. Of the newly acquired 1.3 acres, approximately 1.0 acre will be disturbed by construction activity. The total area to be disturbed by construction activity will therefore be 0.95 acre + 0.45 acre + 1.0 acre = 2.4 acres.

### E. **Activities**

Soil disturbing activities will include site grading, installation of erosion and sediment controls, placing a barbed wire fence at the property line and enclosing the original plus the additions to the substation site with chain link fencing, compaction of soil to establish a substation equipment base, placement of rock, steel structure disassembly, steel erection, grading of affected area to provide uniform drainage from the substation site perimeter, and preparation for and completion of final planting and seeding. A five to six feet wide buffer strip between the barbed wire and chain link fences will be left disturbed to the greatest extent practicable. The existing rock entrance to the substation will be utilized by construction vehicles.

See **Appendix B** for post-construction runoff flow paths.

## **F. Runoff Coefficient**

The site area is about 3.7 acres with a preconstruction runoff coefficient of approximately 0.21 (including 2.4 acres on which the existing substation is located and the addition 1.3 acres). It is estimated 2.4 acres of the site will be disturbed by construction activity to establish a base for electrical equipment, establish required drainage, and place rock on the graded site. The post construction runoff coefficient is calculated to be 0.26. The runoff coefficients for the site are calculated based on values taken from the EPA publication *Storm Water Management For Construction Activities; Developing Pollution Prevention Plans and Best Managements Practices*, page 2.12, September 1992. (note – Since no coefficient for rock-covered substations is listed, the average runoff coefficient for railroad yards was used for area to be occupied by the finished substation.)

## **Sequence of Major Activities**

- 1) install silt fence
- 2) grading
- 3) remove/install fence(s)
- 4) steel disassembly
- 5) steel erection
- 6) install substation rock
- 7) clean up
- 8) restore portion of site not established as a substation

## **II. STORM WATER POLLUTION PREVENTION PLAN (SWPPP) MANAGER, the SITE COORDINATOR, AND RELATED DUTIES**

The plan manager is Mr. Bud Averill. Mr. Averill is the Grand River Dam Authority Project Engineer. His office number is (918)824-7843, or cell phone number (918)706-8832. Mr. Averill's duties include

- 1) implement the SWPP Plan with the aid of a designated SWPPP team,
- 2) oversee maintenance practices and Best Management Practices (included as Section IV),
- 3) conduct or provide for inspection and monitoring and, based on these site inspections, incorporate into the Plan any noted changes on the site, any additional discharges, and any additional controls that may be required to prevent the discharge of pollutants,
- 4) identify potential pollution sources and ensure they are incorporated in the Plan,
- 5) ensure any changes in construction plans are addressed in the Plan, and
- 6) identify any deficiencies in the SWPPP and correct them.

Mr. Dee Frost (cell #918-557-7277) will be the GRDA Site Coordinator and will ensure all housekeeping and monitoring procedures are implemented and the integrity of the controls is maintained during the earth work portion of the project. Perry Friedrich, GRDA Environmental Superintendent, will provide regulatory assistance pertaining to the Plan (e.g. waste disposal requirements, guidance documents).

### **III. SITE PLAN**

**Appendix A** is a topographic map showing the general location of the construction area. **Appendix B** consists of two site maps showing preconstruction, construction, and post-construction details.

### **IV. STORM WATER MANAGEMENT CONTROLS**

#### **A. Temporary Controls**

- 1) To prevent soil from washing downgradient from the perimeters of the site silt fencing will be placed along the site perimeter.
- 2) To prevent sediment from being washed from any soil stockpile(s), silt fencing will be installed around the perimeter of any such stockpile(s).
- 3) To minimize soil entrained in sheet flow from the site the following measures will be implemented.
  - a) The disturbed areas will be graded and maintained to the slopes indicated in Appendix B to slow any general (sheet) runoff that may occur.
  - b) Grading will be accomplished to divert the flow around the substation itself and sediment traps will be placed at the downstream points of redirected flow.
  - c) A five to six feet wide inter-fence buffer strip will be left undisturbed.
  - d) The area east of site (i.e. the grass-covered area between the existing substation and the highway – see photo included in Appendix A) will not be disturbed by construction activity. Light vehicle parking only will be accomplished in this area.
- 4) To prevent vehicle tracking (e.g. the carrying of soil off-site in the treads of construction vehicle tires) the existing site entrance will be used as the construction entrance.

#### **B. Permanent Controls**

The finished site will be graded to accomplish a uniform storm water runoff flow path from the substation site perimeter.

#### **C. Stabilization**

- (1) From the beginning of construction activity, mature vegetation existing on the site will be preserved to the greatest extent practicable.
- (2) Temporary stabilization of disturbed areas of the site will be accomplished by seeding with rye grass and wheat. Seeding activities will be logged as required on the Other Controls table included in the Inspection & Maintenance Record included as Appendix C to this Plan.
- (3) Once temporary stabilization is accomplished, native vegetation will be allowed to grow to provide stabilization.



Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after construction activity in that portion of the site has temporarily or permanently ceased. Exceptions are:

- 1) where initiation of stabilization measures are precluded by severe climatological conditions,
- 2) where construction activity on a portion of the site is temporarily ceased, but earth disturbing activities will be resumed within 21 days, stabilization measures are not required to be initiated on that portion of the site, and
- 3) in areas experiencing droughts where initiation of stabilization measures within 14 days of the cessation of construction activity is precluded by arid conditions.

#### **D. Good Housekeeping**

The following good housekeeping practices will be followed during the construction project.

- 1) Only an amount of product(s) required for work to progress will be stored on-site and in a manner to minimize contact with storm water.
- 2) Products will be kept in their original containers with the original manufacturer's label.
- 3) Whenever possible, all product will be used before disposing of the container (i.e. the container must be empty of all pourable residue before it is considered empty).
- 4) Manufacturer's recommendations for proper use of products will be followed. Manufacturer's recommendations for proper disposal will be followed provided those recommendation are consistent with E.6 and E.7 below.
- 5) Any containers of fuel or lubricants will be stored in a manner to minimize contact with storm water. Fuels and lubricants in containers 55 gallons or larger will be stored in a diked area and inspected daily for leaks.
- 6) Vehicle fueling and lubrication is to be accomplished by utilizing standard procedures designed to minimize the potential for spills or overfilling.
- 7) Any spills are to be cleaned-up immediately upon discovery and the spill debris contained for proper disposal.
- 8) Product material safety data sheets (MSDS) will be retained and made available by the Plan Manager.
- 9) Litter and construction debris will be collected **daily** for proper disposal.

#### **E. Spill Prevention and Response**

- 1) Personnel responsible for implementing the plan in the event of a spill  
The Site Coordinator (Dee Frost ) will be responsible for implementing the plan. Mr. Frost's telephone number is (918) 557-7277.
- 2) Site Chemical Inventory (maximum amounts to be on-site)  
Diesel fuel - 1 x 1,000 tank (steel, on legs, within earthen berm)  
Gasoline – maximum of 3 x 5 gallon cans (stored on pallet within berm)  
Paint – maximum of 5 x 16 ounce aerosol cans (covered storage)  
Lubricant (WD 40 or equivalent) – maximum of 10 x 16 ounce aerosol cans (covered storage)

### 3) Spill Equipment

The following equipment will be available to all employees on-site for use in the event of a spill. This equipment will be located in the tool trailer that will be parked on-site during construction. In addition to spill control equipment the trailer will contain the tools used by construction personnel and will therefore be readily accessible. The spill control equipment includes:

shovels; chemical resistant gloves; goggles; rags; absorbent; empty drums.

### 4) Notification

The Site Coordinator (Dee Frost 918-557-7277) will be notified of any spills. The Site Coordinator will in turn notify the Plan Manager (Bud Averill 918-824-7843 or 918 706-8832) and the GRDA Environmental Superintendent (Perry Friedrich 256-0890 or 825-7879)

In the event the spill is a reportable spill as defined in Appendix D (definition of a reportable spill), the GRDA Environmental Superintendent, or in his absence the Site Coordinator, will notify the appropriate agencies as listed in Appendix D.

Should the spill be on a scale which requires the assistance of an outside response firm, the Site Coordinator will utilize the state contract and notify:

(1) Boomer Environmental (405)417-3333 or (877)670-9729

--OR--

(2) Basin Environmental & Safety (405) 232-5737 or (888)302-2378  
for assistance in containment and clean-up.

### 5) Containment and Cleanup

Immediate response to minor spills will be made by site personnel under the direction of the supervisor on-site and the GRDA Site Coordinator.

Equipment to be employed will include shovels, chemical resistant gloves, goggles, rags, absorbents, and motorized construction equipment as needed and available. All residue, debris, and contaminated soil will be placed in the drums maintained for this purpose on site. Should clean-up assistance be required, a firm listed in (4) above will be contacted.

### 6) Waste Evaluation

- a) Any waste streams will be evaluated to determine if they are construction/demolition (C/D) wastes as defined by the attached excerpt from OAC252:515 (included as **Appendix E**), non-hazardous industrial waste (NHIW) as listed on Appendix F to OAC252:515 (included as **Appendix F** to this plan), or hazardous waste.
- b) These waste streams will be segregated and secured.

- 7) Waste Disposal
  - a) Any C/D wastes will be managed by routing to an approved municipal solid waste landfill.
  - b) Any NHIW will be managed in accordance with OAC252:31
    - i) In concert with Perry Friedrich, a certification will be forwarded to the ODEQ stating the NHIW is not a hazardous waste (see attached certification included as **Appendix G**).
    - ii) Information used to make the certification will be maintained by the Site Coordinator and the Environmental Superintendent (ES).
    - iii) The Site Coordinator and the ES will maintain records itemizing the type, quantity, and source of the NHIW generated.
  - c) If any hazardous waste is generated, the Site Coordinator and the ES will
    - i) verify the hazardous waste is segregated and stored as required,
    - ii) evaluate the activity which resulted in the generation of the waste and seek alternatives that will not result in hazardous waste being generated, and
    - iii) evaluate transporter qualification and facility compliance prior to releasing any hazardous waste.

A Spill Prevention Control and Countermeasure (SPCC) Plan is being prepared by an engineering contractor. The Plan will be complete prior to placing the substation in operation and will be available at the site.

#### **F. Other Wastes**

The only discharge from the site will be storm water discharges associated with construction activity. There will be no industrial activity conducted on the site (e.g. dedicated concrete plants, dedicated asphalt plants),

#### **G. Other Controls**

- 1) Dust Suppression  
A water truck will be utilized if needed to control dust during the earth work portion of the project.
- 2) Sanitary Waste  
On-site personnel will utilize portable facilities (e.g. porta-potties)
- 3) Should a spill occur, the SWPP Plan must be modified within 14 calendar days of knowledge of the release to provide
  - a description of the release,
  - the circumstances leading to the release, and
  - the date of the release.

In addition, the plan must be reviewed to identify measures to prevent the reoccurrence of such releases and to respond to such releases, and the plan must be modified where appropriate.

## ***V. APPLICABLE PERMITS***

No site permits in addition to the authorization to discharge under General Permit OKR10 are required for this activity.

## ***VI. ARCHAEOLOGICAL CONSIDERATIONS***

At Part 10, Historic Preservation, General Permit OKR10 states “The Environmental Protection Agency has determined that the Oklahoma Department of Environmental Quality’s NPDES permitting activities are not Federal undertakings and, therefore, are not subject to review under Section 106 of the National Historic Preservation Act. However, applicants and permittees must comply with the State Antiquities Act (Title 53, Chapter 20, Section 361) where applicable and the Burial Desecration Law (Title 21, Chapter 47, Section 1168.0-1168.6), as well as with any applicable local laws concerning the identification and protection of historic properties.”

Construction activities at the Afton substation will be conducted in accordance with the applicable portions of the statutes referenced in the preceding paragraph. In addition, Title 21, Subchapter 47, Section 1168.7 is applicable to activities undertaken by the Grand River Dam Authority. 1168.7 A. states “Any federal or state department or agency which, in the performance of its duties, discovers a burial ground, human skeletal remains or burial furniture shall immediately cease any activity which may cause further disturbance of the site and shall report the presence and location of any skeletal remains to an appropriate law enforcement officer as required by Section 1168 et seq. of Title 21 of the Oklahoma Statutes and shall comply with all other provisions of said sections.”

Title 53, Chapter 20, Section 361, and Title 21, Chapter 47. Sections 1168.0 – 1168.7 are included as Appendix H.

## ***VII. MAINTENANCE & INSPECTION PROCEDURES***

### **A. Erosion and Sediment Control Inspection and Maintenance Practices**

All control measures will be inspected at least once each week **and** following any rainfall event of 0.5 inches or greater. These inspections will be performed by Mr. Frost, the Site Coordinator, or his designee using the inspection forms included as **Appendix C**. Any noted deficiencies will be corrected immediately. If the inspections reveal deficiencies that are a result of inadequacies in the SWPPP, the Plan Manager, the Site Coordinator and the GRDA Environmental Superintendent will make changes to the Plan to address those inadequacies. Changes to the Plan will be implemented as soon as practicable.

- 1) All control measures will be maintained in good working order. If a repair is necessary it will be initiated within 24 hours of discovery.
- 2) Collected sediment will be removed from a silt fence or sediment trap when it has reached one-third the height of the control.
- 3) Silt fences will be inspected for depth of sediment, tears, secure attachment to posts, and to ensure posts are firmly in the ground.
- 4) Any temporary and permanent seeding and planting will be inspected for bare spots, washouts, and health growth.
- 5) A maintenance report will be made after each inspection (see attached report form).
- 6) Any additional individuals with inspection and maintenance responsibilities will receive training from Mr. Frost. This training will include attention to practices necessary for keeping the sediment controls in good working order.

#### **B. Non-Storm Water Discharges**

The Site Coordinator will include in his report any observed non-stormwater discharges. Any such observed discharges will be discontinued immediately upon discovery.

### ***VIII. ENDANGERED SPECIES***

Part 11 of Permit OKR10 addresses endangered species habitat. The Afton Substation site is not included in the Addendum A list nor is it identified on the map on [Permit] page 36 as an Oklahoma Sensitive Water and Watersheds for Federal & State listed Species.

The applicable requirements set forth in OKR10 Part 11, Section 11.2 Step 2 are addressed in section IV. of this SWPPP.

### ***IX. SIGNATORY REQUIREMENTS***

#### **A. Signatory Responsibility**

- 1) All NOIs, NOTs, reports, or other information requested by the Director of the Oklahoma Department of Environmental Quality must be signed by the GRDA Chief Executive Officer or his duly authorized representative.
- 2) A duly authorized representative is that individual who has been so designated, in writing, by the Chief Executive Officer.  
The designation is to be submitted in writing to the ODEQ Director. The duly authorized representative is the individual or position having responsibility for the overall operation of the facility or activity.

- 3) NOI submittal will be made by the GRDA Environmental Department Superintendent. Upon receipt of the completion of the project, the Environmental Department Superintendent will be notified and the site will be evaluated. Once the determination that the site meets the criteria provided in Section 8 of Permit OKR10, the Environmental Department Superintendent will submit the NOT with the appropriate signature.

## **B. Certification**

Any person signing NOIs, NOTs, reports, or other information submitted to the ODEQ Director shall make the following certification:

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage this system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.” (see page iii for signature)

## **X. . RETENTION OF RECORDS**

### **A. Documents**

Copies of the SWPPP and all reports, and records of data used to complete the NOI to be covered by General Permit OKR10, will be maintained by the SWPPP Plan Manager for at least three (3) years from the date on which final stabilization is achieved.

A copy of the General Permit OKR10 will be kept with the SWPPP.

The following records shall be maintained and attached to the SWPPP:

- the dates when major grading activities occur;
- the dates when construction activities permanently cease on a portion of the site; and
- the dates when stability procedures are initiated.

## **B. Accessibility**

A copy of the SWPPP required by General Permit OKR10, and a copy of the Permit itself, will be retained at the construction site and at the GRDA Transmission & Engineering Field Headquarters at 635 Highway 69A Pryor, OK during construction and until final stabilization is achieved.

The individual with day-to-day operation control over SWPPP implementation (i.e. the Site Coordinator) will have a copy of the Plan available on-site for use by all operators and any individuals identified as having responsibilities under the Plan whenever personnel are on the construction site.

## **C. Addresses**

All written correspondence concerning this permit, including the submittal of NOIs and NOTs shall be sent to

Oklahoma Department of Environmental Quality  
Environmental Complaints and Local Services  
Storm Water Unit  
PO Box 1677  
Oklahoma City, Oklahoma 73101-1677

## **XI. POSTING**

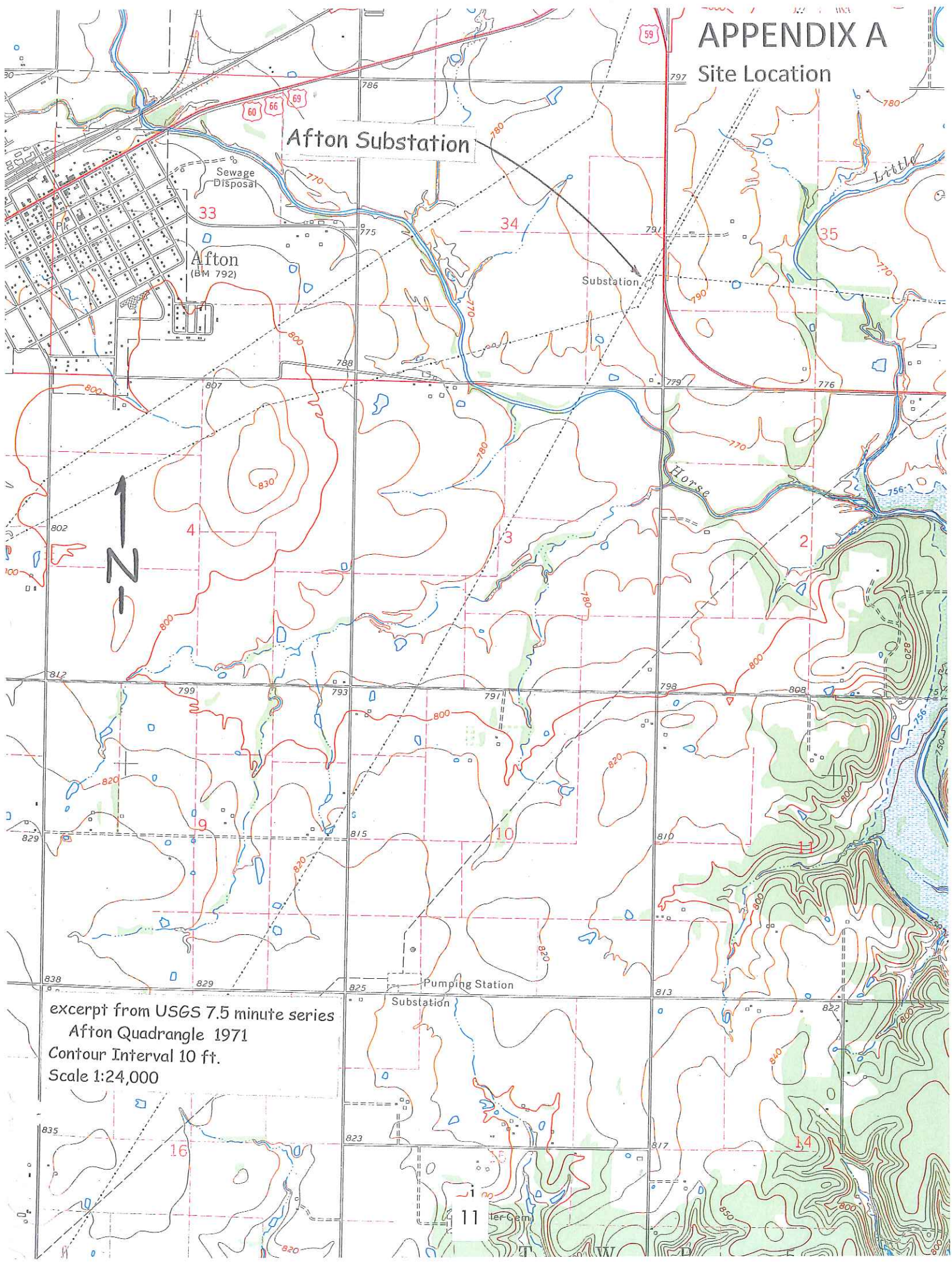
The following information will be posted near the main entrance to the construction site:

- 1) the OPDES permit number of the project (OKR10),
- 2) the name and telephone number of the local contact person,
- 3) a brief description of the project, and
- 4) the location of the SWPPP if the site is inactive or if the Plan is not accessible when personnel are not on-site.

Permit OKR10 does not provide the public with any right to trespass on a construction site for any reason, including inspection of a site; nor does the Permit require the GRDA to allow members of the public access to the construction site.

# APPENDIX A

## Site Location



excerpt from USGS 7.5 minute series  
Afton Quadrangle 1971  
Contour Interval 10 ft.  
Scale 1:24,000

11



## Site Drawings



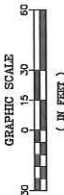
HORIZONTAL CONTROL BASED ON NGS MONUMENT AFON POINT AND NGS CROSS STATIONS OKCLARK AND WET. VERTICAL IS BASED ON Q 183 PD/60254 AND THE NGS CROSS STATIONS ABOVE. HORIZONTAL DATUM IS OKLAHOMA NORTH NAD 83 GRID AND THE VERTICAL DATUM IS MVD 88.

PT. NO.	NORTHING	EASTING	ELEV.	DESCRIPTION
1	629236.0498	2869192.5978	789.91	CAPPED IRON ROD
2	629450.7428	2869202.3258	785.65	60D NAL W/DISC
3	629597.0451	2869216.5966	60D NAL W/DISC	
4	629597.0451	2869216.5966	60D NAL W/DISC	
5	629508.9255	2869038.0240	60D NAL W/DISC	
6	629479.6440	2868953.3958	60D NAL W/DISC	
7	629159.5479	2869207.6451	60D NAL W/DISC	
8	629175.1624	2868944.1891	60D NAL W/DISC	

**LEGEND:**

- UNDERCUT AREA X.X FT. AND CONSTRUCT 6" OF AGGREGATE BASE COURSE COMPACTED TO 95% MODIFIED PROCTOR OVER APPROVED SUBGRADE MATERIAL COMPACTED TO 95% STANDARD PROCTOR.
- REMOVE AND DISPOSE OF EXISTING GRAVEL DRIVEWAY AND PLACE 4" OF TOPSOIL AND SEED AND MULCH OUTSIDE OF THE PROPOSED FENCE.
- CONTRACTOR SHALL GRADE THE EXISTING GRAVEL DRIVE AS AN EVEN CROSS SLOPE AND PLACE AN ADDITIONAL 6" OF AGGREGATE BASE COURSE COMPACTED TO 95% MODIFIED PROCTOR.
- UNDERCUT AREA X.X FT. AND CONSTRUCT 6" OF 3/4" WASHED GRAVEL OVER APPROVED SUBGRADE MATERIAL COMPACTED TO 95% STANDARD PROCTOR.
- 785 --- EXISTING CONTOUR
- - - - - 785 X - - - - - PROPOSED CONTOUR
- 785 --- SPOT ELEVATION
- --- EXISTING BREAKLINE
- --- PROPERTY LINE
- --- EXISTING OVERHEAD ELECTRIC
- --- EXISTING CHAINLINK FENCE
- --- EXISTING BARBED WIRE FENCE
- --- PROPOSED CHAINLINK FENCE
- --- PROPOSED BARBED WIRE FENCE
- --- SILT FENCE
- --- DIRECTION OF DRAINAGE FLOW
- --- DISTURBED AREA = 3.50 AC

SYMBOL	DESCRIPTION
	EXISTING CONTROL DEVICES TO REMAIN TO BE REINSTALLED
	PROPOSED CONCRETE FOUNDATIONS (TYPICAL)



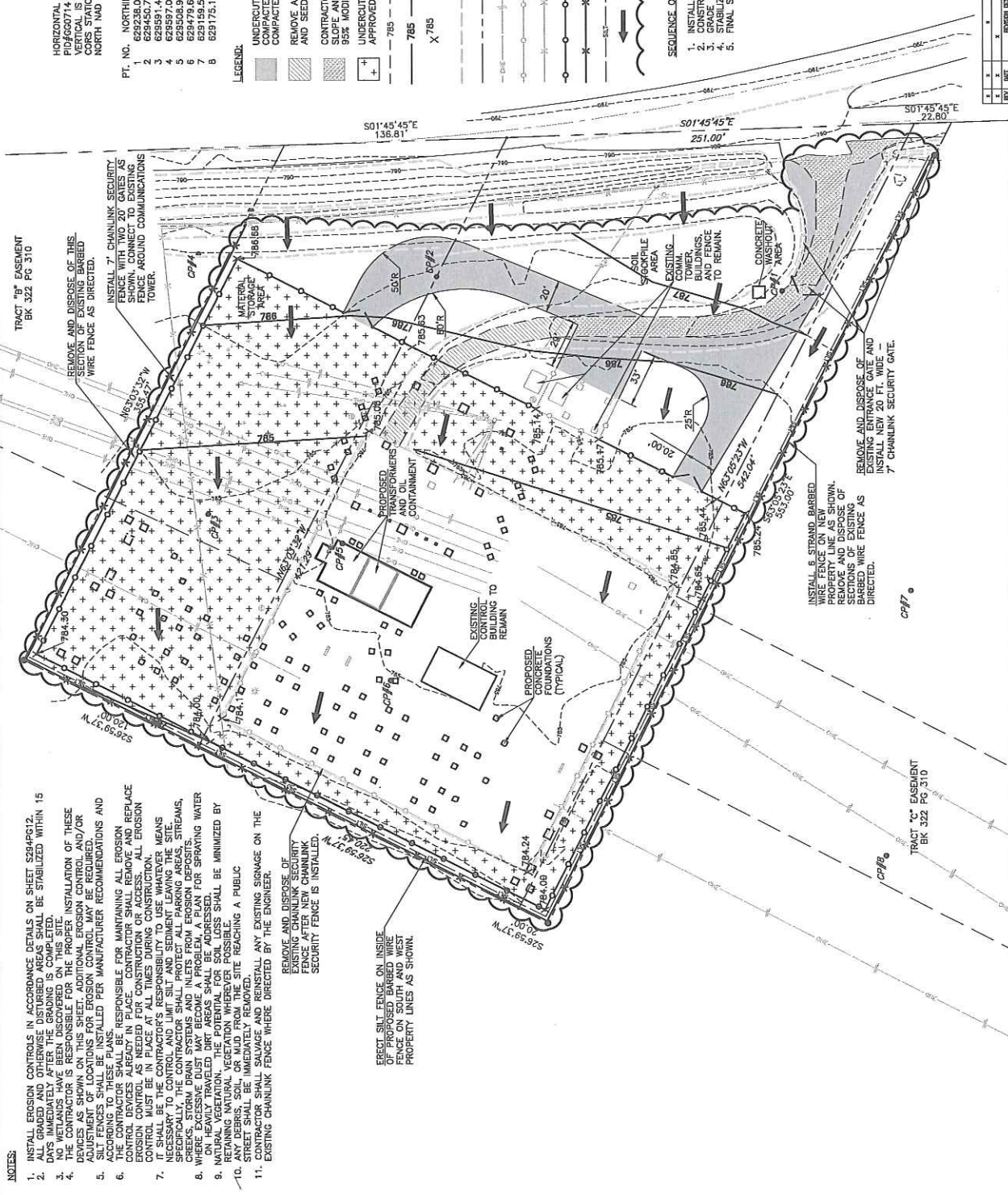
**SEQUENCE OF CONSTRUCTION:**

1. INSTALL ALL EROSION CONTROL DEVICES TO REMAIN TO BE REINSTALLED ON PAD.
2. GRADE ALL AREAS TO FINAL GRADE.
3. STABILIZE ALL DISTURBED AREAS.
4. STABILIZE ALL DISTURBED AREAS.
5. FINAL SITE CLEANUP.

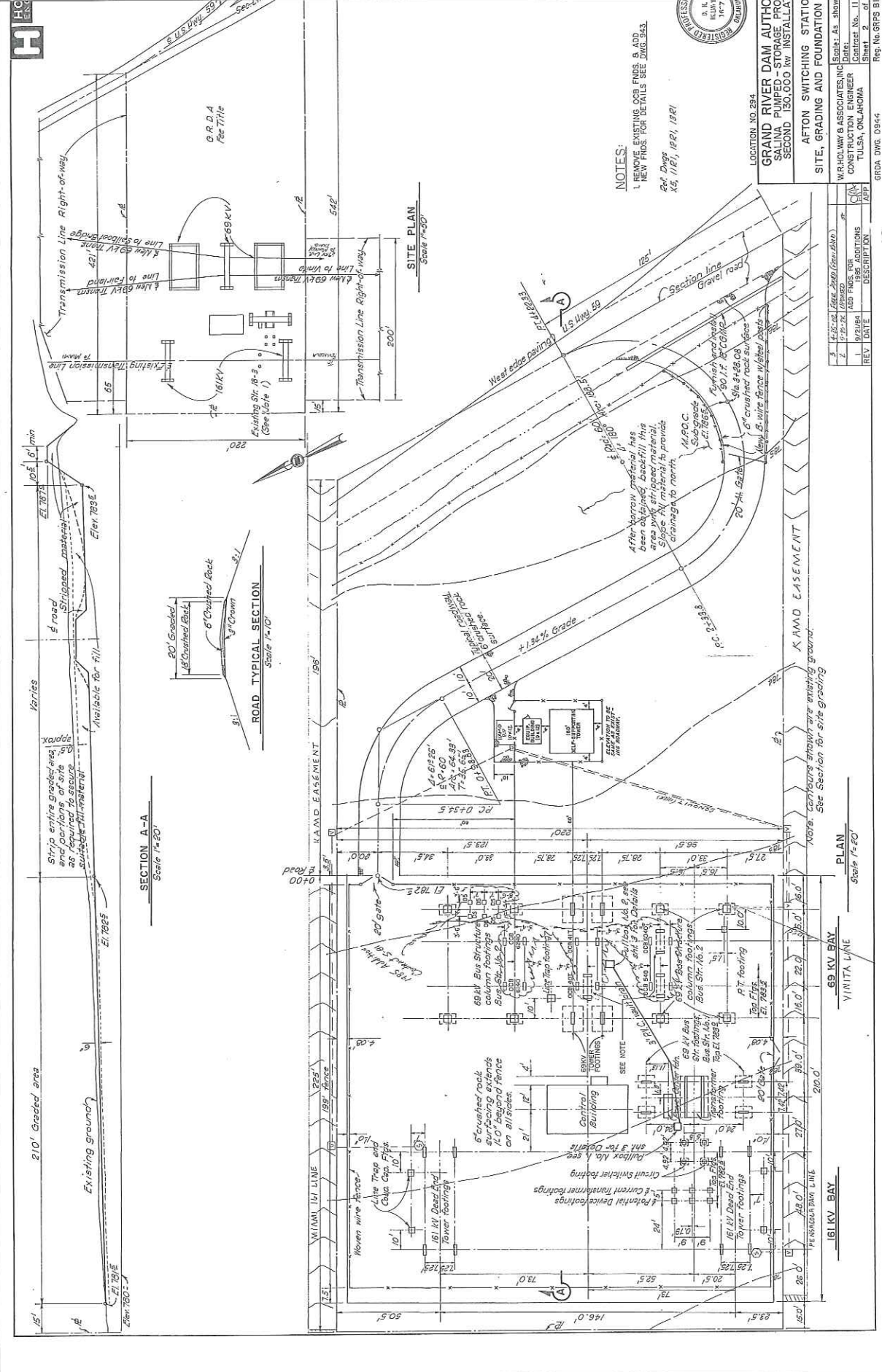
PRELIMINARY - NOT FOR CONSTR  
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION  
AFTON, OKLAHOMA

SITE GRADING  
PLAN

SCALE: 1" = 30'	DRAWN BY: DM	CHECKED BY: JLM	DATE: 08/11/2011
PROJECT NO.: S294PC11		DRAWN FOR: AFTON	



- NOTES:**
1. INSTALL EROSION CONTROLS IN ACCORDANCE WITH SHEET S294PC12.
  2. ALL GRADED AND OTHERWISE DISTURBED AREAS SHALL BE STABILIZED WITHIN 15 DAYS IMMEDIATELY AFTER THE GRADING IS COMPLETED.
  3. NO WETLANDS HAVE BEEN DISCOVERED ON THIS SITE.
  4. THE CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION OF THESE EROSION CONTROLS ON THIS SHEET. ADDITIONAL EROSION CONTROL AND/OR ADJUSTMENT OF LOCATIONS FOR EROSION CONTROL MAY BE REQUIRED.
  5. SILT FENCES SHALL BE INSTALLED PER MANUFACTURER RECOMMENDATIONS AND ACCORDING TO THESE PLANS.
  6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL EROSION CONTROL DEVICES ALREADY IN PLACE. CONTRACTOR SHALL REMOVE AND REPLACE EROSION CONTROL AS NEEDED FOR CONSTRUCTION OR ACCESS. ALL EROSION CONTROL MUST BE IN PLACE AT ALL TIMES DURING CONSTRUCTION.
  7. EROSION CONTROL SHALL BE INSTALLED AND MAINTAINED BY MEANS NECESSARY TO CONTROL AND LIMIT SILT AND SEDIMENT LEAVING THE SITE. SPECIFICALLY, THE CONTRACTOR SHALL PROTECT ALL PARKING AREAS, STREAMS, CREEKS, STORM DRAIN SYSTEMS AND INLETS FROM EROSION DEPOSITS.
  8. WHEN HEAVILY TRAVELLED DRIFT AREAS SHALL BE ADDRESSED BY EROSION CONTROL. THE POTENTIAL FOR SOIL LOSS SHALL BE MINIMIZED BY RETAINING NATURAL VEGETATION WHEREVER POSSIBLE.
  9. NATURAL VEGETATION SHALL BE IMMEDIATELY REMOVED.
  10. CONTRACTOR SHALL SALVAGE AND REINSTALL ANY EXISTING SIGNAGE ON THE STREET THAT IS IMMEDIATELY REMOVED.
  11. CONTRACTOR SHALL SALVAGE AND REINSTALL ANY EXISTING SIGNAGE ON THE EXISTING CHAINLINK FENCE WHERE DIRECTED BY THE ENGINEER.



NOTES:  
 1. REMOVE EXISTING COB FNS B ADD NEW FNS FOR DETAILS SEE DWG 9-3.  
 2. SEE DWG XS, 11E, 12E, 12E1



LOCATION: NO. 294  
**GRAND RIVER DAM AUTHORITY**  
 SALINA PUMPED-STORAGE PROJECT  
 SECOND 150,000 KW INSTALLATION  
**AFTON SWITCHING STATION**  
 SITE, GRADING AND FOUNDATION

Scale: As Shown	Sheet 2 of 2
Contract No. 11	Sheet 2 of 2
CONSTRUCTION ENGINEER	APPT
TULSA, OKLAHOMA	APPT
REV. DATE	DESCRIPTION
3 14/54	See DWG 9-3 (New 240)
2 12/72	Added FNS FOR FOUNDATIONS
1 07/68	Added FNS FOR FOUNDATIONS

W. R. HOLWAY & ASSOCIATES, INC.  
 1101 N. W. 11th St.  
 TULSA, OKLAHOMA 74104  
 Reg. No. GRPS 614

Afton Substation

U.S. 59

← NORTH



**APPENDIX C**  
**Inspection Forms**

**AFTON Substation**

**SWPPP INSPECTION AND MAINTENANCE RECORD**

This checklist is to be completed once every seven (7) days **and** within 24 hours of any rainfall event of 0.5 inches or more.

Permit OKR10 requires any deficiencies observed during the inspection to be corrected within 24 hours.

Inspector: \_\_\_\_\_ Date: \_\_\_\_\_

Qualifications of Inspector: \_\_\_\_\_  
\_\_\_\_\_

Approximate Date & Amount of Last Rainfall: \_\_\_\_\_  
\_\_\_\_\_

**Stabilization**

<i>Area</i>	<i>Stabilized Yes/No</i>	<i>Stabilized With</i>	<i>Condition</i>	<i>Action Required</i>
<i>Buffer Zone</i>				
<i>Drainage Banks</i>				
<i>Swales</i>				

### Material Storage

Only materials in quantities sufficient to allow the site activities to progress are to be stored on-site. Excess material(s) is to be removed. All material is to be stored in a manner to prevent container corrosion and entrainment of contents in runoff. All materials that would be entrained in runoff are to be stored in a manner to prevent exposure to storm water.

Is excess material on site?     Yes     No

### Storage Areas

<i>Material</i>	<i>Located to Prevent Runoff (Y/N)</i>	<i>Evidence of Leak (Y/N)</i>	<i>Action Required</i>
<i>Fuel</i>			
<i>Lubricants</i>			
<i>Paints</i>			
<i>Thinners</i>			

### Silt Fences

<i>Location</i>	<i>Depth of Sediment</i>	<i>Condition of Fence</i>	<i>Sediment Leak (Y/N)</i>	<i>Action Required</i>
<i>Construction Site Perimeter</i>				
<i>Topsoil Storage</i>				
<i>Other</i>				
<i>Other</i>				

**Other Controls**

<i>Control</i>	<i>Condition</i>	<i>Action Required</i>
<i>Entrance</i>		
<i>Soil Surface</i>		
<i>Buffer Strip</i>		
<i>Sediment Traps</i>		
<i>Seeding for temporary stabilization</i>	<i>Date:</i>	<i>Area seeded:</i>
<i>Daily Debris Pick-Up</i>		
<i>Other</i>		

Is there evidence of silt entering the drainage ditches?

What is the source of the sediment?

What is the corrective action required?

Is there evidence of silt leaving the site via the east or west swales?

What is the source of the sediment?

What is the corrective action required?

Are changes required to the SWPPP?  
Reason for change(s):

Change(s) required:

## Report Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage this system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

---

Name (Printed)

---

Date

---

Signature

## APPENDIX D

### Reportable Spill Definition

A reportable gasoline or diesel fuel spill is

(1) any aboveground release of 25 gallons or more. Any release, regardless of quantity, must be recorded by the owner or operator and contained and cleaned up immediately. All of the following releases must be reported to the Oklahoma Corporation Commission by telephone (405-521-4945) within 24

hours of discovery, with a written confirmation to follow within 20 days:

(a) All known belowground releases in any quantity; for example, a release resulting from a line broken during an excavation.

(b) Any aboveground release of petroleum greater than 25 gallons.

(c) Any aboveground release of petroleum that is less than 25 gallons, but cannot be contained and cleaned up within 24 hours.

(d) All owners and/or operators of aboveground storage tank systems must maintain records of all reportable and non-reportable events listed in this section sufficient to permit adequate inspection and review by PSTD. These records must be kept for 3 years following the date of the event.

OR

(2) any release to a waterway that causes (1) a visible sheen upon the surface of the water or (2) an accumulation of sludge on the shoreline.

In the event of the occurrence of a reportable spill as defined in (1) above, the following agencies are to be notified:

Oklahoma Corporation Commission (405) 521-4945

Oklahoma Department of Environmental Quality (800) 424-8802

In the event of the occurrence of a reportable spill as defined in (2) above, the following agencies are to be notified:

Oklahoma Department of Environmental Quality (800) 424-8802

U.S. Environmental Protection Agency (800) 372-7745

National Response Center (800) 424-8802



**252:515-1-2. Definitions**

The following words or terms, when used in this Chapter, shall have the following meaning, unless the context clearly indicates otherwise. Any term not defined in this Chapter shall be defined as set forth in OAC 252:515-1-3.

**"Active"** means, when used to describe a solid waste disposal facility or a portion thereof (e.g., active MSWLF or active cell), any solid waste disposal facility, or portion thereof, accepting solid waste as of the effective date of this Chapter, regardless of whether such facility has obtained a solid waste permit from the DEQ.

**"Active life"** means the period of operation beginning with the initial receipt of solid waste and ending at completion of closure activities.

**"Active portion"** means:

- (A) that part of a land disposal facility that has or is receiving waste and that has not received either intermediate or final cover; or
- (B) solid waste process and storage areas at non-land disposal facilities.

**"Airport"** means a public-use airport open to the public without prior permission, and without restrictions within the physical capacities of available facilities.

**"Applicant"** means any person who applies for a new permit or a modification to an existing permit for a solid waste disposal facility identified in OAC 252:515-3-1(a) and (b).

**"Aquifer"** means a geological formation, group of formations, or portion of a formation capable of yielding significant quantities of groundwater to wells or springs.

**"Areas susceptible to mass movement"** means those areas of influence (i.e., areas characterized as having an active or substantial possibility of mass movement) where the movement of earth material at, beneath, or adjacent to the land disposal facility, because of natural or man-induced events, results in the downslope transport of soil and rock material by means of gravitational influence. Such areas include, but are not limited to, landslides, avalanches, debris slides and flows, soil fluxion, block sliding, and rock fall.

**"ASTM"** means the American Society for Testing and Materials.

**"Bird hazard"** means an increase in the likelihood of bird/aircraft collisions that may cause damage to the aircraft or injury to its occupants.

**"Buffer zone"** means a designated waste-free area within the permit boundary of a disposal facility, to separate waste handling, processing, and/or disposal activities from adjacent areas.

**"Citizen collection station"** means a designated location that is established or sponsored by a governmental entity and equipped with waste receptacles for exclusive, non-commercial use by individual residents to deposit their own household waste for collection and transportation to a permitted disposal site.

**"CLIMOCS"** means the following publication of the Oklahoma Climatological Survey: Shafer, Mark A., CLIMOCS: A Climatological Summary of 168 Oklahoma Cooperative Stations, Oklahoma Climatological Survey, February 1993, 184 pp.

**"Composite liner"** means a system installed at a land disposal facility composed of a recompacted clay liner overlain with a flexible membrane liner.

**"C&D landfill"** means a construction/demolition landfill.

**"Composting facility"** means a facility in which material is converted, under thermophilic conditions, to a product with a high humus content for use as a soil amendment or to prevent or remediate pollutants in soil, air, and stormwater run-off.

**"Construction/demolition waste"** means waste composed of the following:

- (A) asbestos-free waste from construction and/or demolition projects that may include such materials as metal, concrete, brick, asphalt, glass, roofing materials, limited amounts of packing materials, sheetrock, or lumber;
- (B) wood waste that may include such materials as yard waste, lumber, wood chips, wood shavings, sawdust, plywood, tree limbs, or tree stumps;
- (C) yard waste that may include such materials as grass clippings, tree limbs, tree stumps, shrubbery, flowers, or other vegetative matter resulting from land clearing or landscaping operations; or
- (D) residential lead-based paint waste.

**"Contaminated stormwater"** means:

- (A) water such as leachate and gas collection condensate, or stormwater that has come into direct contact with solid waste or waste handling and/or treatment areas;
- (B) stormwater discharged from areas of a land disposal facility with less than six inches of waste-free, compacted earthen material; or
- (C) wastewater resulting from washing vehicles or areas that are or have been in direct contact with solid waste.

**"DEQ"** means the Oklahoma Department of Environmental Quality.

**"Disease vector"** means rodents, flies, mosquitoes, or other animals, including insects, capable of transmitting disease to humans.

**"Displacement"** means the relative movement of any two sides of a fault measured in any direction.

**"Disposal"** means the final disposition of waste and shall be taken to include any discharge, deposit, injection, dumping, spilling, leaking, or placing of waste into or on the land or water so that the waste or any constituent thereof may enter the environment, including the air and any surface waters or ground waters.

**"Disposal area"** means that part of a land disposal facility where waste is disposed.

**"Disposal facility"** means disposal site as defined at 27A O.S. § 2-10-103.

**"Engineer"** means a licensed, professional engineer.

**"EPA"** means the United States Environmental Protection Agency.

**"Existing"** means, when used to describe a solid waste disposal facility or portion thereof (e.g. existing MSWLF or existing cell), any solid waste disposal facility, or portion thereof, that had a solid waste permit as of the effective date of this Chapter.

**"Facility"** means all contiguous land and structures, other appurtenances, and improvements on the land used for the handling, processing, storage, and/or disposal of solid waste.

**"Fault"** means a fracture or a zone of fractures in any material along which strata on one side have been displaced with respect to that on the other side.

**"Final closure"** means a disposal facility has permanently ceased to accept solid waste for disposal and all required closure activities have been completed for the entire facility in accordance with the approved closure plan. Final closure is not synonymous with phased closure.

**"Flood"** means the general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of a lake, stream, river or other body of surface water, or the unusual and rapid accumulation or runoff of surface waters from any source.

**"Flood, One hundred year (100 year)"** means a flood that has a one percent or greater chance of occurrence in any given one year period, or of a magnitude equaled or exceeded once in 100 years on the average over a significantly long period.

**"Flood plain"** means the lowland and relatively flat areas adjoining inland waters that are inundated by the 100-year flood.

**"Gas condensate"** means the liquid generated as a result of gas recovery processes.

**"Generator"** means, in the context of NHIW, any person, by site, whose act or process produces NHIW, or whose act first causes an NHIW to become

subject to regulation.

**"Groundwater"** means water below the land surface in a zone of saturation.

**"Hazardous waste"** means those wastes subject to regulation under OAC 252:205.

**"HBV"** means hepatitis B virus.

**"HIV"** means human immunodeficiency virus.

**"Holocene"** means the most recent epoch of the Quaternary period, extending from the end of the Pleistocene Epoch to the present.

**"Household hazardous waste"** means household waste that is corrosive, toxic, ignitable, or reactive, including, but not limited to: freon-containing appliances or tanks; non-empty propane tanks; oil, antifreeze, and other motor vehicle fluids; gasoline, kerosene, or diesel fuel; liquid paints; solvents; pesticides, herbicides, fungicides, or rodenticides; caustic cleaners; lead-acid batteries; swimming pool chemicals; unused firearm rounds; and acids and bases.

**"Household waste"** means any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

**"Injection well"** means a facility subject to regulation by OAC 252:652, Underground Injection Control.

**"Karst terrains"** means areas where karst topography, with its characteristic surface and subterranean features, is developed as the result of dissolution of limestone, dolomite, or other soluble rock. Characteristic features of karst terrains include, but are not limited to, sinkholes, sinking streams, caves, large springs, and blind valleys.

**"Land disposal facility"** means a landfill, or any other discrete area of land or land excavation, where solid waste is placed for treatment, processing, and/or disposal. Land disposal facility does not include:

- (A) land application where solid waste is placed onto, or incorporated into, the soil as a soil amendment, fertilizer, or other legitimate agricultural purpose;
- (B) a surface impoundment that is either permitted by the DEQ's Water Quality Division or is a part of an approved liquid waste management system at a permitted solid waste disposal facility;
- (C) a yard waste composting facility;
- (D) an injection well; or
- (E) a solid waste transfer station.

**"Landfill"** means a discrete area of land or a land excavation in which solid waste is placed for permanent disposal.

**"Large NHIW generator"** means any business, by site, that generates over 10,000 tons of NHIW in Oklahoma during a calendar year. This definition does not include facilities that are permitted to receive and process solid waste generated by others.

**"Leachate"** means liquid that has passed through or

emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste. This includes:

- (A) fluid collected in a leachate collection system, including its sumps, surface impoundments, tanks, or other similar locations;
- (B) fluid collected on top of the bottom liner of a disposal cell that has received solid waste; and
- (C) leachate seeps from disposal cells that have received solid waste.

**"Liquid waste"** means any waste that is determined to contain "free liquids" as defined by the PFLT.

**"Lithified earth material"** means all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock that formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete, and asphalt, or unconsolidated earth materials, soil, or regolith lying at or near the earth surface.

**"Litter fence"** means an easily portable fence to be located adjacent to the working face to assist with control of blowing material.

**"Lower explosive limit"** means the lowest percent by volume of a mixture of explosive gases that will propagate flame in air at 25°C and atmospheric pressure.

**"Maximum horizontal acceleration"** means the maximum expected horizontal acceleration of lithified earth material, depicted on a seismic hazard map, with a 90 percent or greater probability that the acceleration will not be exceeded in 250 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.

**"MSWLF"** means Municipal Solid Waste Landfill; a publicly or privately owned landfill that is or has received household waste. A MSWLF may also receive other types of non-hazardous solid wastes, such as nonhazardous sludge, NHIW, special waste, and construction/demolition waste.

**"Natural disaster"** means a natural occurrence or event (such as a tornado, flood, or forest or prairie fire) of such magnitude that the resultant damage and destruction produce quantities of wastes that overtax available solid waste management systems.

**"NHIW"** means non-hazardous industrial solid waste, as defined at 27A O.S. § 2-10-103. Examples of NHIW are listed in Appendix F of this Chapter.

**"Non-contaminated stormwater"** means:

- (A) stormwater that has not come into direct contact with solid waste, waste handling and/or treatment areas;
- (B) stormwater discharging from areas of a

land disposal facility that has at least six inches of waste-free, compacted earthen material; and  
(C) wastewater resulting from washing vehicles or areas that have not been in direct contact with solid waste.

**"Oklahoma Uniform Environmental Permitting Act"** means 27A O.S. § 2-14-101 *et seq.* and the rules adopted thereunder at OAC 252:4 ("Rules of Practice and Procedure").

**"Open burning"** means the combustion of solid waste without:

- (A) control of combustion air to maintain adequate temperature for efficient combustion;
- (B) containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion; and
- (C) control of the emission of the combustion products.

**"Operating record"** means all of the collective records of the facility relating to the site. Such records include, but are not limited to: the permit, modifications, and approvals; records concerning waste received; any sampling or analyses performed by the facility; closure, post-closure and corrective action plans; financial assurance records; inspection and compliance evaluation correspondence; reports; and scale tickets and related fee payment documentation.

**"Owner/operator"** means the person who owns a solid waste disposal facility and/or is responsible for the overall operation of a facility or part of a facility.

**"OWRB"** means the Oklahoma Water Resources Board.

**"Permit boundary"** means the outermost edge of the area described by legal description in the owner/operator's permit. The permitted boundary includes the area in the buffer zone.

**"PFLT"** means Paint Filter Liquids Test, EPA Method 9095.

**"Phased closure"** means the closing of individual disposal cells at a land disposal facility as they become full. Phased closure is not synonymous with final closure.

**"Piezometer"** means a small-diameter well used to make groundwater elevation measurements.

**"Point source discharge"** means any discharge of water that, when leaving the permit boundary of a facility, has been channeled or altered by man's activity in working that site.

**"Poor foundation conditions"** means those areas where features exist which indicate that a natural or man-induced event may result in inadequate foundation support for the structural components of a land disposal facility.

**"POTW"** means Publicly Owned Treatment Works; a wastewater treatment system, as defined at 27A O.S. § 2-6-101, that is owned by a State or municipality for the treatment of municipal or industrial wastewaters.

**"Qualified groundwater scientist"** means a scientist

or engineer who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields as may be demonstrated by State registration, professional Certifications, or completion of accredited university programs that enable that individual to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action.

**"Recharge area"** means an area where water is absorbed and added to the zone of saturation.

**"Regulated medical waste"** means a waste or reusable material that contains an etiologic agent and is generated in the diagnosis, treatment or immunization of human beings or animals; research pertaining to the diagnosis, treatment or immunization of human beings or animals; or the production or testing of biological products. Such waste includes, but is not limited to:

- (A) cultures and stocks of etiologic agents or live vaccines, and culture dishes, devices, paper, and cloth that has come into contact with such cultures, stocks or live vaccines;
- (B) human blood, blood products, and human body fluids, except urine or feces;
- (C) pathological wastes consisting of human tissues, organs, and body parts removed during surgery, autopsy, biopsy and other medical procedures;
- (D) untreated sharps;
- (E) used blood collection bags, tubes, and vials;
- (F) contaminated carcasses, body parts and bedding of animals intentionally exposed to pathogens in research, in the production of biologicals or the "in vivo" testing of pharmaceuticals;
- (G) items contaminated with blood or other human body fluids which drip freely or would release such materials in a liquid or semi-liquid state if compressed or are caked with dried blood or body fluids and are capable of releasing these materials;
- (H) isolation wastes unless determined to be non-infectious by the infection control committee at the health care facility;
- (I) HIV-containing cell or tissue cultures, organ cultures, and HIV- or HBV-containing culture medium or other solutions; and blood, organs, or other tissues from experimental animals infected with HIV or HBV;
- (J) all disposable materials that have come in contact with cytotoxic or antineoplastic agents during the preparation, handling, and administration of such agents. Such wastes include, but are not limited to, masks, gloves,

gowns, empty IV tubing and bags, vials, and other contaminated materials; and

(K) any other material or equipment which, in the determination of the health care facility staff, infection control committee or other responsible party, presents a significant danger of infection because it is contaminated with, or may reasonably be expected to be contaminated with, etiologic agents.

**"Residential lead-based paint waste"** means lead-based paint debris, chips, dust, sludges, and other similar wastes generated as a result of abatement, rehabilitation, renovation, or remodeling activities in individual residences.

**"Run-off"** means any rainwater, leachate, or other liquid that drains over land from any part of a facility.

**"Run-on"** means any rainwater, leachate, or other liquid that drains over land onto any part of a facility.

**"Saturated zone"** means that part of the earth's crust in which all voids are filled with water.

**"Scavenging"** means the uncontrolled, unorganized sorting, collecting, or removing of solid waste at the disposal site.

**"Seismic impact zone"** means an area with a ten percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in two hundred fifty (250) years;

**"Sludge"** means the definition found at 27A O.S. § 2-10-401.

**"Solid waste"** means the definition found at 27A O.S. § 2-10-103.

**"Special waste"** means those wastes that are not hazardous wastes but because of their nature or volume, require special or additional handling aside from that given to routine household refuse. This includes but is not limited to: sludge, septic tank pumpings, grease trap wastes, dead animals, packing house offal and tankage, waste fats and oils, hatchery wastes, cannery wastes, NHIW, tires, and asbestos wastes.

**"Structural components"** mean liners, leachate collection systems, final covers, run-on/run-off systems, and any other component used in the construction and operation of a land disposal facility that is necessary for protection of human health and the environment.

**"Surface impoundment"** means a natural topographic depression, human-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), that is designed to hold an accumulation of liquid wastes or wastes containing free liquids and that is not an injection well. Examples of surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons.

**"Surface water"** means water that stands on the surface of the land in reservoirs, lakes, ponds, sloughs, or swamps, or that flows across the land in rivers, creeks, or streams.

**"SW-846"** means EPA Publication SW-846, Test

Methods for the Evaluation of Solid Waste Physical/Chemical Characteristics.

**"Tremie pipe"** means a device, usually a small-diameter flexible or rigid pipe, that carries filter pack or bentonite cement from the bottom to the top of a borehole or annular space without forming void spaces. In some cases, a well casing or hollow stem auger can be considered a tremie pipe.

**"Unstable area"** means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of the structural components responsible for preventing releases from a land disposal facility. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and Karst terrains.

**"Uppermost aquifer"** means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

**"Waste pile"** means any non-containerized accumulation of solid, non-flowing waste.

**"Waste tire facility"** means the definition found at 27A O.S. § 2-11-402.

**"Waters of the state"** means the definition found at 27A O.S. § 2-6-101.

**"Wetlands"** mean those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include, but are not limited to, swamps, marshes, bogs, and similar areas.

**"Working face"** means the place within a land disposal facility where waste has been deposited and has not been covered with at least intermediate cover.

**"Yard waste composting facility"** means a composting facility that only accepts yard waste.

**"Zone of aeration"** means a subsurface zone containing water under a pressure lower than that of the atmosphere, including water held by capillarity; and containing air or gases generally under atmospheric pressure. This zone is bounded above by the land surface and below by the water table; and is synonymous with vadose zone and unsaturated zone.

**"Zone of saturation"** means a subsurface zone in which essentially all the interstices are filled with water under pressure greater than that of the atmosphere. Although the zone may contain interstices filled with gas or liquids other than water, it is still considered saturated. This zone is separated from the zone of aeration by the water table; and is synonymous with phreatic zone.

## APPENDIX F. NHIW WASTESTREAMS

- (1) Air pollution control equipment residues
- (2) Arsenically-treated wood that meets the exemption criteria of 40 CFR 261.4(b)(9)
- (3) Auto shredder fluff
- (4) Blasting media and other abrasives used to remove surface coatings
- (5) Coal combustion ash per 40 CFR 261.4(b)(4)
- (6) Combustible materials as defined in 49 CFR 173.120 and 173.124, that are not regulated as hazardous wastes
- (7) Containers which are RCRA empty in accordance with 40 CFR 261.7, or empty containers which have held pesticides (i.e., herbicides, fungicides, or rodenticides)
- (8) Cooling tower waters and other cooling process related wastes
- (9) Incinerator ash
- (10) Industrial sludges and industrial mud trap residues
- (11) Industrial wastewater treatment plant sludge (excluding sludge that is exclusively sanitary sewage)
- (12) Ink wastes
- (13) Lab related wastes, including lab packs
- (14) Lighting fixture ballasts containing non-TSCA regulated PCBs per 40 CFR Part 761
- (15) Miscellaneous chemical spill residue, primarily non-fuel related
- (16) Municipal and non-industrial wastewater treatment plant sludges
- (17) Non-hazardous pesticides (i.e., herbicides, fungicides, & rodenticides)
- (18) Oil filters meeting the requirements of 40 CFR 261.4(b)(13)
- (19) Outdated and off-specification products
- (20) Outdated, off-specification, or mislabeled over-the-counter medicines which are not hazardous in accordance with 40 CFR 261, Subparts C or D
- (21) Paint waste and related solvents
- (22) Petroleum contaminated soil and debris, oily rags and absorbents with > 1000 ppm TPH
- (23) Pharmaceutical waste not identified in (20)
- (24) Refractory & foundry sands and slag, retort, fly ash, cement kiln dust
- (25) Resins, polymers, and adhesives
- (26) Sludges containing materials washed from the interior of bulk materials carriers such as tank trucks or railroad tank cars
- (27) Wastes exempted by the RCRA Bevill waste exclusion in 40 CFR 261.4(b)(7)
- (28) Wastes rendered non-hazardous that were formerly hazardous pursuant to 40 CFR 261, Subpart C
- (29) Unknowns
- (30) Wastes from metal plating processes

# APPENDIX G

## NHIW Certification



### APPENDIX G. NHIW CERTIFICATION FORM

Please read instructions prior to completing this form.

Generator Name: \_\_\_\_\_

Mailing Address: \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Point of Generation Address: \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Generator Contact: \_\_\_\_\_ Title \_\_\_\_\_ Telephone \_\_\_\_\_

#### DETAILED WASTE DESCRIPTION

Waste Name: \_\_\_\_\_

If waste was generated out-of-state, is it classified as hazardous in the state of origin?  Yes  No  NA- Okla. waste

Approximate amount of waste

to be disposed:

Disposal frequency:

Physical characteristics:

- |                                      |                                 |                                   |                                   |                                 |                                      |
|--------------------------------------|---------------------------------|-----------------------------------|-----------------------------------|---------------------------------|--------------------------------------|
| <input type="checkbox"/> Tons        | <input type="checkbox"/> Pounds | <input type="checkbox"/> One-time | <input type="checkbox"/> Weekly   | <input type="checkbox"/> Solid  | <input type="checkbox"/> Liquid      |
| <input type="checkbox"/> Cubic yards | <input type="checkbox"/> Drum   | <input type="checkbox"/> Monthly  | <input type="checkbox"/> Annually | <input type="checkbox"/> Sludge | <input type="checkbox"/> Combination |
| <input type="checkbox"/> Other _____ |                                 |                                   |                                   |                                 |                                      |

Method used to determine waste is non-hazardous:  Analysis  Generator knowledge  Both Process

generating waste (be specific and use additional sheets if necessary):

#### DESIGNATED RECEIVING LANDFILL

Name: \_\_\_\_\_ Permit #: \_\_\_\_\_

#### GENERATOR CERTIFICATION

I understand this form must be signed by the original waste generator or other persons authorized by 27A O.S. §2-10-501(H). To the best of my knowledge, I certify:

- The information contained herein is accurate, complete, and representative of the waste to be disposed;
- The waste identified above is not a characteristically hazardous waste as identified by 40 CFR 261, Subpart C, is not a listed hazardous waste as identified by 40 CFR 261, Subpart D or contaminated with a listed hazardous waste, and is not otherwise identified as a hazardous waste by the Department of Environmental Quality; and
- This waste will be managed in accordance with all applicable statutes and rules of the Department of Environmental Quality.

Generator Signature

Printed name

Title

Date

## INSTRUCTIONS FOR COMPLETING THE NHIW CERTIFICATION

Enter the name of the generating facility, generator mailing address, address where the waste was generated, contact name and title of person at the generating facility who is knowledgeable about the waste, and phone number.

### DETAILED WASTE DESCRIPTION

1. Identify the name of the waste.
2. Identify the approximate amount of waste to be disposed under the plan, its frequency of disposal, and its physical characteristics.
3. Identify if the waste was determined to be non-hazardous by either knowledge of process, testing, or both. If requested by DEQ, the generator must be able to provide information about the waste, such as a list of chemical constituents entering into the waste and a list of chemical constituents likely to be in the waste, laboratory analyses, MSDS sheets, and other information used by the generator to determine the waste is nonhazardous.
4. Identify the process generating the waste. Please note that the waste generating description must be specific and sufficient to demonstrate the waste is non-hazardous.

### DESIGNATED RECEIVING LANDFILL

Identify the name of the landfill to receive the waste and its DEQ permit number.

### GENERATOR CERTIFICATION

Read the certification and sign and date the form. **Please note that the certification may only be dated and signed by one of the following:** 1) the original waste generator; 2) a person who identifies and is under contract with a generator and whose activities under the contract cause the waste to be generated; 3) a party to a remediation project under an order of the DEQ or under the auspices of the Oklahoma Energy Resources Board or other agencies of other states; or 4) a person responding to an environmental emergency.

The completed notification form should be submitted to the DEQ at the following address. Once submitted, the generator may dispose of the waste at the designated landfill.

Department of Environmental Quality  
Solid Waste Compliance Unit  
P. O. Box 1677  
Oklahoma City, OK 73102  
Phone (405) 702-5100  
Fax (405) 702-510



## Human Remains, Cemeteries, and Anthropology & Archaeology OAC 21:47-1168.4, 47-1168.7, and 20-361

### Oklahoma Statutes Citationized

#### Title 21. Crimes and Punishments

#### Chapter 47 - Human Remains and Tissue, Burial, Cemeteries, and Funerals

#### Section 1168.4 - Duty to Report Discovered Remains - Penalty for Failure to Report - Persons to Notify

Cite as: O.S. §, \_\_\_

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A. All persons who encounter or discover human skeletal remains or what they believe may be human skeletal remains or burial furniture thought to be associated with human burials in or on the ground shall immediately cease any activity which may cause further disturbance and shall report the presence and location of such human skeletal remains to an appropriate law enforcement officer.

B. Any person who willfully fails to report the presence or discovery of human skeletal remains or what they believe may be human skeletal remains within forty-eight (48) hours to an appropriate law enforcement officer in the county in which the remains are found shall be guilty of a misdemeanor.

C. Any person who knowingly disturbs human skeletal remains or burial furniture other than a law enforcement officer, registered mortician, a representative of the Office of the Chief Medical Examiner, a professional archaeologist or physical anthropologist, or other officials designated by law in performance of official duties, shall be guilty of a felony.

D. Anyone other than a law enforcement officer, registered mortician, a representative of the Office of the Chief Medical Examiner, a professional archaeologist or physical anthropologist, or other officials designated by law in performance of official duties, who disturbs or permits disturbance of a burial ground with the intent to obtain human skeletal remains or burial furniture shall be guilty of a felony.

E. The law enforcement officer, if there is a reason to believe that the skeletal remains may be human, shall promptly notify the landowner and the Chief Medical Examiner. If remains reported under this act are not associated with or suspected of association with any crime, the State Archaeologist and the State Historic Preservation Officer shall be notified within fifteen (15) days. If review by the State Archaeologist and the State Historic Preservation Officer of the human skeletal remains and any burial furniture demonstrates or suggests a direct historical relationship to a tribal group, then the State Archaeologist shall:

1. Notify the State Historic Preservation Officer; and
2. Consult with the tribal leader, designated by the Oklahoma Indian Affairs Commission, within fifteen (15) days regarding any proposed treatment or scientific studies and final disposition of the materials.

#### *Historical Data*

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Added by Laws 1987, c. 204, § 16, operative July 1, 1987; Amended by Laws 1997, H.B. No. 1213 c. 133. § 304, emerg. Effective Date Amended to July 1, 1999 by Laws 1998, c. 2 (First Extraordinary Session), §§ 23-26, effective June 19, 1998 (superseded document available).

**Oklahoma Statutes Citationized**

**Title 21. Crimes and Punishments**

**Chapter 47 - Human Remains and Tissue, Burial, Cemeteries, and Funerals**

**Section 1168.7 - Government Agencies' Discovery of Remains - Duties**

Cite as: O.S. §, \_\_\_

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A. Any federal or state department or agency which, in the performance of its duties, discovers a burial ground, human skeletal remains or burial furniture shall immediately cease any activity which may cause further disturbance of the site and shall report the presence and location of any skeletal remains to an appropriate law enforcement officer as required by Section 1168 et seq. of Title 21 of the Oklahoma Statutes and shall comply with all other provisions of said sections.

B. If it is determined that the burial ground, human skeletal remains or burial furniture is not directly related to a tribal group, the State Historic Preservation Officer shall work with the director of the federal or state department or agency until disposition of the burial ground, human skeletal remains or burial furniture has been completed to the satisfaction of the State Historic Preservation Officer.

**Historical Data**

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Added by Laws 1992, c. 214, § 2, eff. Sept. 1, 1992.

**Citationizer® Summary of Documents Citing This Document**

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Cite Name Level  
None Found.

**Citationizer: Table of Authority**

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Cite Name	Level
Title 21. Crimes and Punishments	
Cite	Name Level

## Oklahoma Statutes Citationized

### Title 53. Oklahoma Historical Societies and Associations

#### Chapter 20 - Oklahoma State Register of Historical Places

#### Section 361 - Anthropology and Archaeology - Donation of Materials Found or Discovered - License - Application - Contents of License - Additional License - Duration - Renewal - Disposition of Fees - Investigation Before Issuance of Permit - False Labeling, Description

Cite as: O.S. §, \_\_\_

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A. Any person, or persons, making any investigations, explorations, or excavations of any prehistoric ruins, ancient burial grounds, pictographs, petroglyphs, prehistoric specimens, utensils, and trinkets, and all other archaeological features discoveries in the state on state lands, shall donate to the state all articles, implements and material found or discovered by such investigations, explorations, or excavations, which shall be deposited with a museum or other recognized repository in the state, within ninety (90) days after the permit termination date, as provided in subsection F of this section.

B. 1. The State Archaeologist, in consultation with the State Historic Preservation Officer, shall study and evaluate the museums and institutions in this state and designate appropriate curatorial facilities. The characteristics of museums and institutions to be considered in making this determination shall include:

- a. the quality of the physical plant,
- b. previous experience in curation, and
- c. the availability of a professional staff trained in curation or archaeology.

2. All original field records, notes, photographs and other information collected, except for personal journals or diaries, or reasonable facsimiles of those records, notes, photographs and other information shall be housed in the same repository as the collections of artifacts and archaeological materials unless otherwise specified in the permit or by the State Archaeologist in consultation with the State Historic Preservation Officer.

3. All those collections of artifacts, archaeological materials, field records, maps, notes, photographs and other information collected pursuant to the provisions of this act shall be made available to the people of Oklahoma for study, examination and appreciation, provided that such availability can be arranged without contributing to the destruction or degradation of said artifacts, archaeological materials, field records, maps, notes, photographs and other information and objects and that such release of information is in the educational interest of the citizens of Oklahoma.

4. Any repository for materials as designated in accordance with paragraph 1 of this subsection may, as it deems necessary, charge a reasonable, one-time fee of a permit holder to help defray the costs of providing long-term storage of the materials.

C. Before any exploration or excavation is made in or on any prehistoric ruins or archaeological site in Oklahoma, on the Oklahoma State Register, or on property owned by or under the control of the State of Oklahoma or any of its political subdivisions, a permit shall first be obtained from the State Archaeologist, Oklahoma Archaeological Survey.

Such permit shall be issued upon:

1. Receipt of an application from any state agency, institution, company or individual who can show cause for having such a permit for the taking, salvage, excavation, restoration or conducting of scientific or educational studies at, in or on properties defined in this subsection;
2. Payment of a fee of Fifty Dollars (\$50.00);

<http://www.oscn.net/applications/oscn/DeliverDocument.asp?CiteID=80255>

11/18/2010

3. Determination by the State Archaeologist of the appropriateness of the permit request. This determination shall include:

- a. application on a form approved by the State Archaeologist,
- b. specifications on the need for the indicated research activity and shall include a research design providing for the recovery of scientific, archaeological or historical information,
- c. designation and qualifications of personnel involved in the project,
- d. specifications on the location, nature of the activity and time period required for the work, and
- e. a signed statement from the landowner or, for state lands, from the appropriate state agency, granting permission for access and removal of archaeological or historical specimens;

4. Signing an agreement to donate specimens or materials in compliance with subsection A of this section; and

5. A signed agreement establishing a mutually acceptable formula for determining a one-time fee, as authorized by subsection B of this section, or that no fee will be charged by the repository for the long-term curation of deposited materials relating to the licensed project.

D. Each permit shall accurately specify the locations, nature of the activity and the time period covered by the permit, and shall authorize or permit explorations or excavations only at the described location.

E. Copies of issued permits shall be on file with the State Archaeologist and the State Historic Preservation Officer.

F. Each permit shall expire at midnight one (1) year after the date of its issuance, provided, that any permit may be revoked by the State Archaeologist, upon consultation with the State Historic Preservation Officer, at any time upon being convinced that archaeological activities authorized by the permit are being conducted unlawfully or improperly. It shall be the duty of the State Archaeologist to monitor all projects granted permits. The following shall be considered proper actions for the conducting of archaeological work under a permit:

1. One copy of the permit shall be at the site of the project, either in the possession of the Principal Investigator of the project or a designated supervisory archaeologist at the project site;

2. The permit may be examined by the State Archaeologist or his designated representative on demand at any time during the period of the permit; and

3. Investigation or excavation of archaeological sites or ruins listed on the permit must be conducted in accordance with the National Historic Preservation Act, the Archaeological Resources Protection Act of 1979, and the permit provisions of this statute, as stipulated.

The permit may be renewed if cause is shown for the need of renewal. The fee for renewal shall be at the rate for a new application.

G. A final report shall be submitted to the State Archaeologist and the State Historic Preservation Officer each within a reasonable period of time after the termination of the permitted project. Applications for new permits from delinquent permit holders shall not be granted until the delinquent final reports are delivered. This final report shall be in accordance with federal standards and the "minimal standard for reports" which have been adopted by the State Historic Preservation Officer and the Oklahoma Archaeological Survey.

H. The fees, if any, collected under the provisions of this section shall be deposited in the Revolving Fund of the University of Oklahoma, and shall be used for the payment of the expenses in making investigations and for administration costs by the State Archaeologist as set out in this section; provided, that the State Archaeologist shall not issue any permit to any person until a thorough review has been made as to the purpose, place, and condition of the proposed explorations or excavations.

I. It shall be unlawful for any person to offer for sale or to purchase any archaeological specimen knowing the same to have been acquired in violation of this act.

J. Any person in possession of articles or materials acquired in violation of this act shall forfeit them to the state, pending

return to their rightful owner.

K. It shall be unlawful for any person to intentionally and knowingly deface American Indian or aboriginal paintings, pictographs, petroglyphs or other marks or carvings on rock or elsewhere that are of archaeological interest and pertain to early American Indian or aboriginal habitation of the country. It shall be unlawful to willingly injure, disfigure, remove or destroy any archaeological resources, including but not limited to, a prehistoric or historic structure, site, monument, marker, medallion, burial, burial marker or artifact without lawful authority as provided in this or related statutes. It shall be unlawful to enter onto the enclosed lands of another with the intent to intentionally injure, disfigure, remove, excavate, damage, take, dig into or destroy any archaeological remains or any prehistoric or historic site, American Indian or aboriginal campsite, artifact, burial, ruin or other materials wherever situated within the state without the consent of the owner.

L. Any person violating any of the provisions of this section shall be guilty of a misdemeanor and, upon conviction, shall forfeit to the state for final disposition all articles and materials and related records wrongfully acquired through his action or efforts, and shall also be fined not less than One Hundred Dollars (\$100.00) and not more than Five Hundred Dollars (\$500.00), or imprisoned in the county jail, not exceeding thirty (30) days, or both.

M. In order to protect and preserve historical, archaeological and scientific information, matters and objects and other archaeological remains, which may from time to time be found on privately owned lands within Oklahoma, the Legislature declares as a statement of purpose that archaeological excavations on privately owned lands should be discouraged except in accordance with and pursuant to the spirit and authority of this statute. Persons having knowledge of the location of archaeological sites in the State of Oklahoma are encouraged to communicate such information to a reputable museum, institution of higher learning, a recognized scientific or historical institution or society or the Oklahoma Archaeological Survey. Those institutions, societies or museums contacted with such information should in turn inform the State Archaeologist, Oklahoma Archaeological Survey, so that the information may be recorded in the inventory of sites maintained for the state.

#### *Historical Data*

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Amended by Laws 1965, HB 810, c. 396, § 309, emerg. eff. July 1, 1965; Amended by Laws 1968, HB 1280, c. 141, § 1, emerg. eff. April 8, 1968; Amended by Laws 1985, SB 239, c. 268, § 1, eff. November 1, 1985; Renumbered from 70 O.S. § 3309 by Laws 1985, SB 239, c. 268, § 2, eff. November 1, 1985.

#### *Citationizer® Summary of Documents Citing This Document*

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Cite Name	Level	
<b>Oklahoma Attorney General's Opinions</b>		
Cite	Name	Level
<u>1986 OK AG 43,</u>	<u>Question Submitted by: C.E. Metcalf, Executive Director, Oklahoma Historical Society</u>	Discussed at Length
<b>Title 21. Crimes and Punishments</b>		
Cite	Name	Level
<u>21 O.S. 1168.2,</u>	<u>Institution's and Museum's Duty to Consult Tribal Leaders or Others before Final Disposition of Remains</u>	Cited

#### *Citationizer: Table of Authority*

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Cite	Name	Level
None Found.		

**SOIL AND FOUNDATION INVESTIGATION  
AFTON SUBSTATION IMPROVEMENTS  
AFTON, OKLAHOMA**

Report

To

**GARVER  
Fayetteville, AR**

*January 2011*

January 27, 2011  
Job No. 10-313

GARVER  
1088 East Millsap Road  
Fayetteville, AR 72703

Attn: Mr. Alan E. Miner, P.E.  
Senior Project Manager

**SOIL and FOUNDATION INVESTIGATION  
PROPOSED AFTON SUBSTATION IMPROVEMENTS  
AFTON, OKLAHOMA**

**INTRODUCTION**

This report presents the results of the soil and foundation investigation performed for the proposed improvements to the existing Grand River Dam Authority substation in Afton, Oklahoma. These services were authorized on November 19, 2010, and have been performed in general accordance with our proposal of the same date (GHBW Proposal # SP10-074).

We understand the existing facility will be extended to the north and east. Several structures will be added including equipment/transformer pads, a ground storage tank, and steel towers. The towers will be about 50- to 60-ft tall self-supported structures. The project also includes redesigning the existing grounding grid. Final structure locations are not known at this time, but we understand that some will be within the existing portion of the facility and some will be in the new expansion area. Foundation loads are expected to be light. Site grading information is not available at this time, but is expected to be minor.

The purposes of this study were to explore subsurface conditions at the site and to develop recommendations to guide design and construction of foundation systems, as well as to provide site grading and construction criteria. Soil resistivity testing was performed to aid in redesign of the grounding grid. The results of the field and laboratory studies are discussed in the following report sections. Conclusions and recommendations are provided in subsequent report sections.

## **SUBSURFACE EXPLORATION**

Subsurface conditions at the site were investigated by drilling four (4) sample borings just outside of the existing perimeter fence to about 20-ft depth, obtaining soil/rock samples and Standard Penetration Values at 2- to 5-ft intervals. Boring locations were selected by Garver and staked by GHBW. Target boring locations had to be altered due to the presence of overhead electric lines. The borings were drilled with a truck-mounted Mobile B-53 rotary-drilling rig. The site vicinity is shown on Plate 1. The approximate boring locations are shown on the Plan of Borings, Plate 2. Logs of the borings, presenting descriptions of the subsurface strata encountered and results of field and laboratory tests, are included as Plates 3 through 6. A key to the terms and symbols used on the boring logs is presented as Plate 7.

Soil samples were obtained by driving a 2-inch-diameter split-barrel sampler into the strata using blows from a 140-lb safety hammer dropped 30 inches, in accordance with the Standard Penetration Test (SPT) procedures. The number of blows required to drive the standard split-barrel sampler the final 12 inches of an 18-inch total drive, or portion thereof, is defined as the Standard Penetration Number (N). Recorded N-values are shown on the boring logs in the "Blows Per Ft" column. Auger cuttings were collected where rock hardness precluded sampling via SPT procedures.

After recovery, all samples were examined and visually classified. Selected representative samples were placed in appropriate containers to prevent moisture loss and/or change in condition during transfer to our laboratory for further examination and testing.

The borings were drilled using dry auger drilling procedures to facilitate observation of groundwater. Observations regarding groundwater are noted in the lower-right portion of each log and are discussed in subsequent sections of this report.

## **LABORATORY TESTING**

To evaluate pertinent physical properties and engineering characteristics of the foundation and subgrade soils, laboratory tests consisting of *in-situ* water content determinations and soil classification tests were performed on selected representative samples. To develop a water content profile for each boring, seventeen (17) water content determinations were performed. Results of these tests are plotted on the logs in



accordance with the scale and symbol shown in the legend located in the upper-right corner of the log forms.

To verify field classification and to evaluate soil plasticity, four (4) liquid and plastic limit determinations (Atterberg limits) and four (4) sieve analyses were performed on selected representative samples. The Atterberg limits are plotted on the boring logs as small pluses connected with a dashed line using the water content scale. The percentage of soil passing the No. 200 Sieve is noted in the "- No. 200 %" column on the log form.

Soil resistivity testing was performed using the 4-point Wenner method on three 200-ft long lines. Measurements were made using a Gisco Model 400 resistivity meter with 12 volt internal power. Resistivity test locations are indicated on the Plan of Borings, Plate 2. Results of the soil resistivity tests are included as Appendix A.

## **SITE and SUBSURFACE CONDITIONS**

### **Site Conditions**

The project site is located on the west side of Highway 59, just north of its intersection with S530 Road in Afton, Oklahoma. A gravel entry drive connects the existing facility to Highway 59. The existing facility is a gravel covered yard surrounded by chain-link fence. The yard contains a small metal building and electrical equipment. High voltage lines enter the facility from both the north and south. The area surrounding the existing facility is open, grass-covered field. The terrain is low-lying and appears to be poorly drained.

### **Seismic Conditions**

The Ottawa County site is located in Seismic Zone 1, i.e. the "Area of lowest anticipated seismic damage". Based on the subsurface conditions encountered in the borings and the local geology, a Seismic Site Class C (very dense soil and soft rock) is considered applicable in accordance with the criteria of IBC 2000 and 2006. The liquefaction potential of the cohesive soils and rock encountered within the exploration depths of the borings is considered negligible.

### Site Geology

As described and mapped by the United States Geological Survey and shown on the Geologic Map of Oklahoma<sup>1</sup>, the project site is underlain by units of the Boone Formation and the residual cherty clay overburden soil blends. Typically, the limestone/cherty limestone units of the Boone decompose (weather) to somewhat erratic blends of chert fragments and clay/silty clay. The residual soil mantle may extend to significant depths on higher terrain and may contain hard chert seams and/or layers.

The Boone formation consists of gray, fine- to coarse-grained fossiliferous limestone interbedded with chert. Some sections may be predominantly limestone or chert. The cherts are dark in color in the lower part of the sequence and light in the upper part. The quantity of chert varies considerable both vertically and horizontally. The Boone formation is well known for dissolutional features, such as sinkholes, caves, and enlarged fissures.

### Subsurface Conditions

Based on the results of the borings, the subsurface conditions may be generalized into three (3) primary strata as follows:

Stratum I: The surficial soils at the site consist of stiff to very stiff dark brown silty clay with organics to about 0.5- to 2-ft depth. Stratum I exhibited moderate to low shear strength and moderate compressibility at the time of the field studies. However, the silty clay topsoil is considered to be "moisture-sensitive", and is expected to lose shear strength upon saturation and/or disturbance.

Stratum II: Stratum I is underlain by stiff to very stiff brown, dark brown, reddish tan and tan clay (Unified Soil Classification CH) to about 8- to 9-ft depth. Stratum II often contains ferrous and calcareous nodules as well as occasional limestone fragments. The clay exhibits moderate shear strength and moderate to low compressibility. Laboratory testing indicates that the Stratum II soils exhibit high plasticity. Significant shrink/swell potential is anticipated for the Stratum II clay due to its high plasticity.

Stratum IV: The basal stratum encountered within the exploration depths of the borings consists of moderately hard gray cherty limestone. Top of limestone is at 8 to 9 ft below existing grades at the boring locations. Auger refusal was encountered on the surface of the limestone.

---

<sup>1</sup> Geologic Map of Oklahoma, Oklahoma Geologic Commission and United States Geological Survey, 1954

Borings were advanced into the limestone using rotary wash drilling procedures. The limestone is strong and competent.

Shallow groundwater was not encountered at the time of the field studies (December 2010). Considering the relatively level terrain, the poor drainage conditions, and the presence of relatively pervious soils (Strata I) over impermeable clay soils (Stratum II), the site is considered to be prone to developing shallow perched groundwater conditions. Shallow groundwater levels will vary depending upon seasonal site conditions, precipitation and infiltration.

#### Significant Conditions

The site and subsurface conditions considered significant to design and construction of the project are:

1. The relatively level terrain and poor surface drainage conditions at the site;
2. The "moisture-sensitive" nature of the near surface Stratum I silty clay soils;
3. The highly plastic clay (Stratum II) at the site, and the significant shrink/swell potential anticipated for the clay due to its high plasticity;
4. The strong, competent cherty limestone (Stratum III) at about 8 to 9 ft below existing grades; and
5. The absence of shallow groundwater at the site in December 2010, but the potential for developing seasonal shallow perched groundwater conditions.

The relationship of these factors to design and construction of the project is considered in subsequent sections of this report.

### **ANALYSES and RECOMMENDATIONS**

#### Foundations

Foundations for the lightly-loaded structures must satisfy two (2) basic and independent design criteria. First, the maximum bearing pressure transmitted to the supporting strata must not exceed the allowable bearing pressure based on an allowable factor of safety with respect to bearing stratum shear strength. Second, foundation movements resulting from consolidation, shrinkage, or swelling of the supporting strata should be within tolerable limits for the structure. Construction factors such as installation of foundation units, fill placement, excavation procedures, and surface and groundwater conditions must also be considered.

Several new structures are planned for the project including equipment/transformer pads, an above-ground storage tank, and steel towers. Specific locations for the structures are not known at this time, but we understand that some will be within the existing portion of the facility and some will be in the new expansion area. Light foundation loads are expected. Site grading in the project area is expected to be minor.

The steel towers may be supported by straight-shaft drilled piers founded at least 4 ft into hard cherty limestone (Stratum III). Recommendations for drilled piers are presented in subsequent report sections. Shallow foundation systems are considered suitable to support all structures except for the steel towers. Shallow foundations may consist of either continuous and individual footings or of mats. Shallow foundations should be founded in engineered fill. The on-site soils are not considered suitable for foundation support due to the presence of high plasticity clay (Stratum II) at shallow depth in the project area. Significant shrink/swell potential is anticipated for the clay and foundation units founded in or near the clay may heave. Where shallow foundations are utilized, we recommend the clay be undercut to a depth of 5 ft below existing grades or to a depth of 3 ft beneath plan footing/mat bottom, whichever is greater. Recommendations for shallow foundations are presented in the following report sections.

#### Drilled Piers

Structural loads for the steel towers may be supported on a drilled pier foundation system. Straight-shaft drilled piers should penetrate at least 4 ft into competent cherty limestone to resist uplift forces exerted by the high plasticity overburden soils. Required pier depths are expected to be about 12 to 13 ft below existing ground surface elevation, but must be field verified. A minimum pier length of 10 ft and a minimum pier diameter of 18 inches are recommended. Drilled piers founded as recommended may be sized using a maximum net allowable end-bearing value of 25 kips per sq ft.

Uplift loads may be resisted by the weight of the drilled pier and the weight of the structure. Additional uplift resistance can be provided by skin friction between the pier and cherty limestone. The upper 4 ft of pier penetration into cherty limestone should be ignored from skin friction considerations as it will be utilized to resist potential uplift forces exerted by the clay stratum. An allowable skin friction value of 4000 lbs per sq ft may be used for penetration in excess of 4 ft into competent cherty limestone.

We understand that the piers may also be subjected to some lateral loads. The upper 4 ft of pier penetration should be neglected from lateral resistance considerations. Below 4 ft, an allowable lateral load resistance of 1500 lbs per sq ft of projected area of the pier may be used for penetration through the overburden soils, including engineered fill. Allowable lateral load resistance may be increased to 5 kips per sq ft of projected area of the pier for penetration into competent cherty limestone. A detailed lateral load analysis can be performed upon request.

The allowable bearing, skin friction and lateral resistance values may be increased by 33 percent under seismic loading conditions. The allowable values include a minimum factor of safety of 2.5 based on the measured shear strength of the on-site soils and the competence of the Stratum III cherty limestone. Settlement of properly installed piers should be minor. Drilled pier installation should be observed by the Geotechnical Engineer to verify suitable bearing and adequate pier penetration.

#### Shallow Footings

Structural loads for all structures except the steel towers may appropriately be supported on either continuous or individual footings or rigid mats founded in engineered fill at a minimum depth of 2 ft below lowest final adjacent grades. Footings/mats founded as recommended may be designed on the basis of a maximum net allowable soil bearing pressure of 2,000 lbs per sq ft.

Site grading is assumed to be minor in our analyses. To minimize the potential for foundation heave, we recommend that high plasticity clay soils be undercut from beneath footing bottoms. The undercut should extend to a depth of 5 ft below existing grades or to a depth of 3 ft beneath plan footing/mat bottom, whichever is greater. The undercut should have a minimum width determined by a 1-horizontal to 1-vertical projection from the edge of foundations to the undercut bottom. The undercut should be backfilled with low-plasticity select fill.

The recommended bearing values are based on a minimum factor of safety of greater than 2.5 with respect to the anticipated shear strength of the engineered fill. Post-construction settlement/heave should be less than 1.0 inch. Continuous and individual footings should have a minimum width of 18 inches and 24 inches, respectively. The

perimeter footings should be founded at a minimum depth of 2 ft below lowest adjacent final grade for frost protection.

#### Site Grading

We recommend that a pre-site grading meeting be held to review site and subgrade conditions at the time of construction. This meeting should include the Engineer, Geotechnical Engineer, General Contractor, Site Grading Contractor and Owner. At that time, specific site grading procedures, such as temporary drainage, type of equipment to be used and potential for undercut should be reviewed.

Site preparation should begin with stripping of all organic-laden soils. An average stripping depth of about 12 inches is anticipated. Following stripping, and prior to any fill placement, the subgrade should be proof-rolled with a loaded tandem-wheel dump truck or similar equipment. Proof-rolling should be observed by the Geotechnical Engineer. All soft or loose soils encountered should be processed and recompacted or excavated and replaced with select fill, whichever is appropriate.

Based on the results of the borings, mass undercut is not expected under dry site conditions. Undercuts on the order of 1 ft will likely be required under wet site conditions.

On-site soils are not considered suitable for use as select engineered fill. Imported borrow for fill or backfill should be an approved low-plasticity sandy clay (CL), clayey sand (SC), gravelly clay (CL), silt gravel (GM) or clay gravel (GC) having a liquid limit less than 45. The suitability of locally available "hillside" silt/clay gravel (GC or GM) having a liquid limit greater than 45 should be evaluated by the Geotechnical Engineer on a case by case basis. Fill placed beneath foundation units should be compacted to at least 98 percent of the Standard Proctor (ASTM D-698) maximum dry density at a water content within 3 percent of the optimum value. Fill placed outside of foundation areas should be compacted to at least 95 percent of the Standard Proctor (ASTM D-698) maximum dry density at a water content within 3 percent of the optimum value.

Fill and backfill should be placed in continuous, essentially horizontal lifts with a nominal loose thickness of 8 inches. All aggregate base material should be compacted to at least 95 percent of the Modified Proctor (ASTM D-1557) maximum dry density at a water content near the optimum value.

### CONSTRUCTION CONSIDERATIONS

Positive surface drainage should be established and maintained throughout construction operations. Water should not be allowed to pond in the project area. If ponding occurs and the foundation or subgrade soils become soft or otherwise disturbed, unsuitable soils should be excavated and wasted. Footing depths should be extended as required to bear on a suitable bearing stratum. Density and water content of all earthwork should be maintained until foundations are completed.

All footing excavations should be observed by the Geotechnical Engineer to verify suitable bearing. Concrete should be placed expeditiously following final clean up and approval to limit changes in foundation conditions.

For drilled pier installation, heavy-duty drilling equipment and rock-drilling tools will be needed to complete pier installation. Coring will be required to achieve the recommended penetration into hard cherty limestone. We recommend that Contract Documents include an allowance for drilling through intervals of rock that cannot be drilled with conventional augers fitted with rock teeth. This should include intervals where the pier excavation cannot be advanced without extraordinary effort and notably slow progress with conventional heavy-duty equipment of size, power, torque, and downthrust typically used in the project area. We recommend that the allowance for rock drilling be limited to zones where auger refusal is experienced and coring methods are required.

All pier excavations should be practically dry and clean prior to concrete placement. Where more than about 3 inches of water is present, pier shafts should be dewatered or underwater concrete placement methods used. Pier excavation, steel placement and concreting should be completed expeditiously to reduce the possibility of changes in foundation conditions.

The Owner or a designated representative thereof should monitor site preparation, grading work and foundation installation. Subsurface conditions significantly at variance with those encountered in the borings should be brought to the attention of the Geotechnical Engineer. Grubbs, Hoskyn, Barton & Wyatt, Inc. should be retained to review final design plans to insure the intent of this report was properly implemented. The conclusions and recommendations of this report should then be reviewed in light of the new information. Additionally, Grubbs, Hoskyn, Barton & Wyatt, Inc. should be retained to

provide testing and observation during excavation, grading, and construction phases of the project based upon our familiarity with the project, the subsurface conditions, and the intent of the recommendations in this report.

\* \* \* \* \*

The following plates are attached and complete this report:

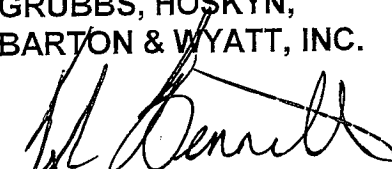
Plate 1	Site Vicinity
Plate 2	Sketch of Boring Locations
Plates 3 through 6	Logs of Borings
Plate 7	Key to Terms and Symbols
Appendix A	Soil Resistivity Test Results

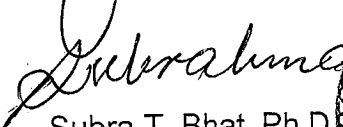
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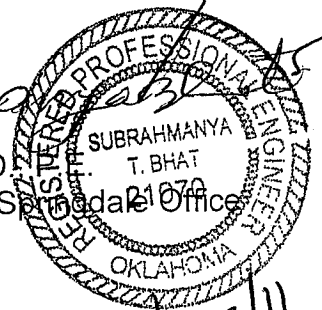
We appreciate the opportunity to be of service to you during this phase of the project. Should you have any questions regarding this report, or if we may be of additional assistance during subsequent phases of design or construction, please call on us.

Respectfully submitted,

**GRUBBS, HOSKYN,  
BARTON & WYATT, INC.**

  
Kyle A. Bennett, P.E.  
Project Engineer

  
Subra T. Bhat, Ph.D.  
Principal/Manager, Sarnada Office



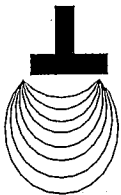
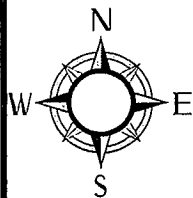
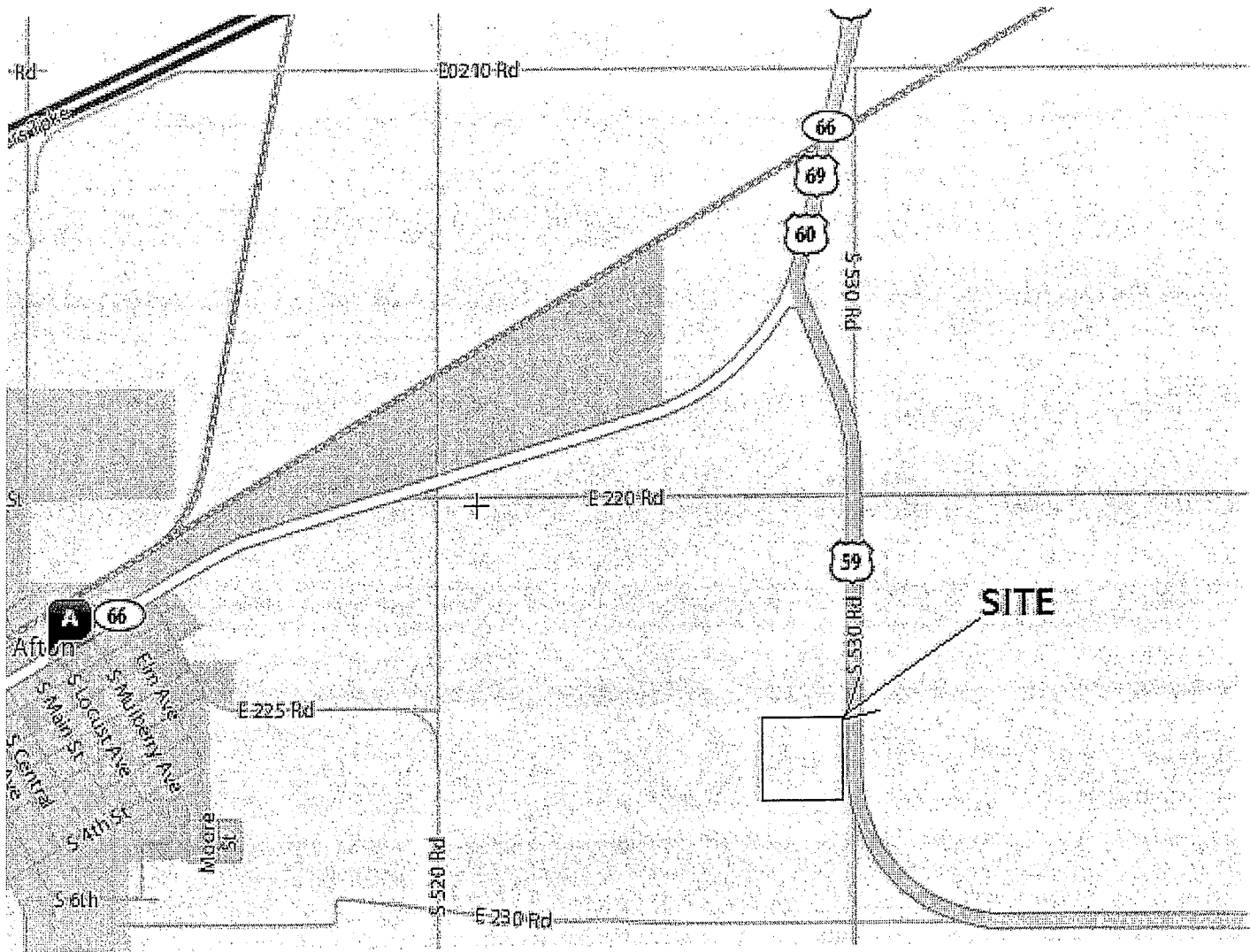
KAB/STB:

Copies Submitted: GARVER  
Attn: Mr. Alan Miner, P.E.  
Senior Project Manager

(3+email)

1/28/11



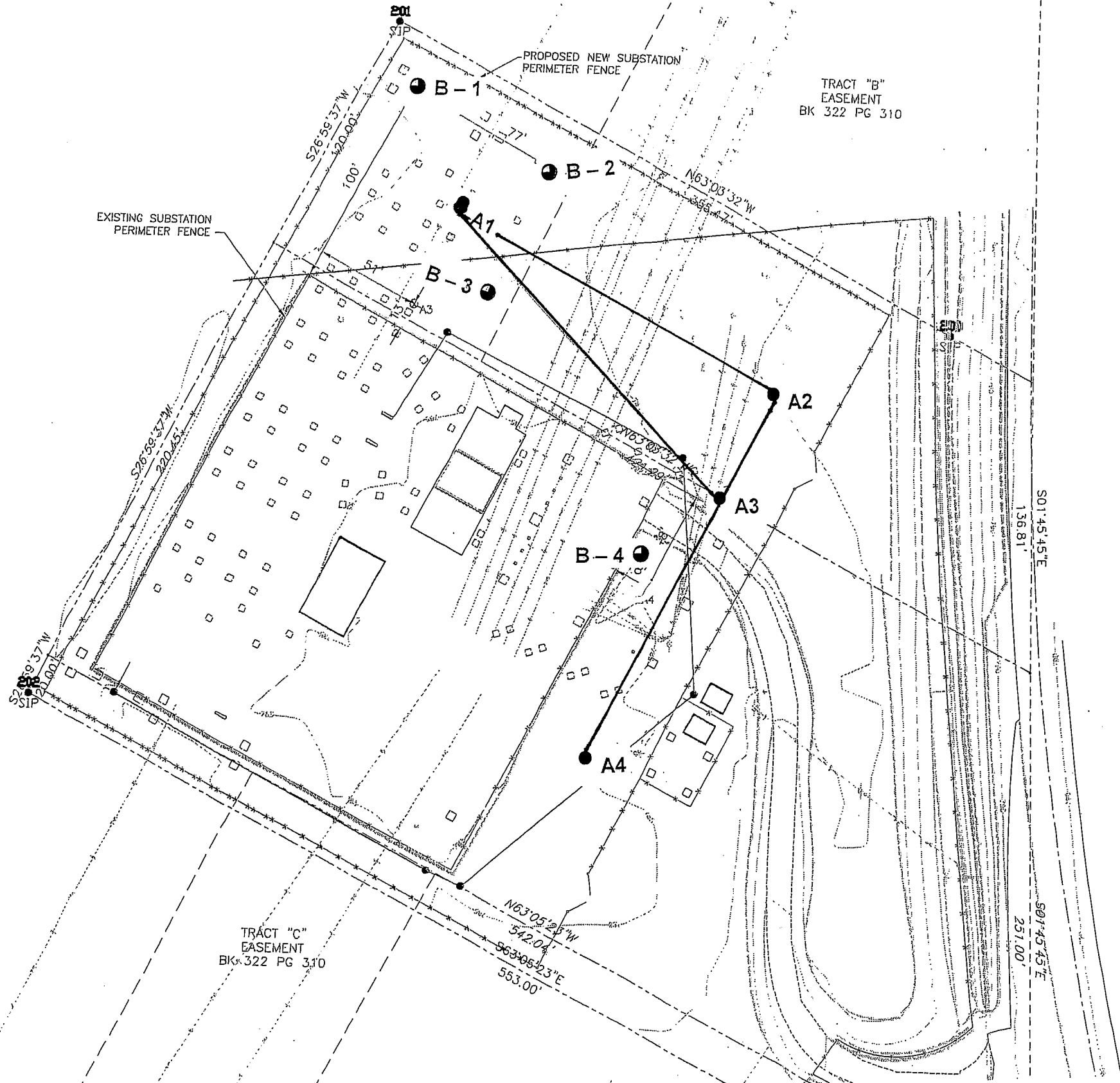


**Grubbs, Hoskyn,  
Barton & Wyatt, Inc.**  
Consulting Engineers

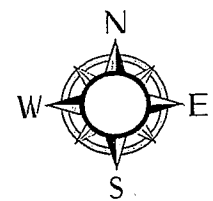
**SITE VICINITY  
AFTON SUBSTATION IMPROVEMENTS  
AFTON, OKLAHOMA**

Job No.: 10-313

Plate 1



Resistivity Test Points
Array 1: A1 - A2
Array 2: A1 - A3
Array 3: A2 - A4



**Grubbs, Hoskyn,  
 Barton & Wyatt, Inc.**  
 Consulting Engineers

**PLAN OF BORINGS**  
**AFTON SUBSTATION IMPROVEMENTS**  
**AFTON, OKLAHOMA**

Scale: 1" = 60 ft	Job No.: 10-313	Plate 2
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**Grubbs, Hoskyn,  
Barton & Wyatt, Inc.**  
Consulting Engineers

# LOG OF BORING NO. 1

Afton Substation  
Afton, Oklahoma

TYPE: Auger to 9 ft Wash

LOCATION: See Plate 2

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %				
						PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT					
			SURF. EL:			0.2	0.4	0.6	0.8	1.0	1.2	1.4	
						+	+	+	+	+	+	+	
						10	20	30	40	50	60	70	
			Firm to stiff dark brown silty clay to clay with organics	12									
			Very stiff brown clay with occasional fine gravel and calcareous nodules	21									72
5			- tan and brown with some ferrous nodules below 4.5 ft	19									
			- stiff tan and gray below 6.5 ft	17									
			- auger refusal at 9 ft	50/3"									
10			Moderately hard gray cherty limestone (horizontally bedded)										
				30/0"									
15													
				30/0"									
20													
			Note: Backfilled boring with 2 bags of hole plug.										
25													

COMPLETION DEPTH: 20.0 ft  
DATE: 12-22-10

DEPTH TO WATER  
IN BORING: Dry to 9 ft

DATE: 12/22/2010

06-185-1 10-313.GPJ 1-21-11



**Grubbs, Hoskyn,  
Barton & Wyatt, Inc.**  
Consulting Engineers

# LOG OF BORING NO. 2

Afton Substation  
Afton, Oklahoma

TYPE: Auger to 8 ft / Wash

LOCATION: See Plate 2

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %				
						PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT					
			SURF. EL:			0.2	0.4	0.6	0.8	1.0	1.2	1.4	
						+	+	+	+	+	+	+	
						10	20	30	40	50	60	70	
5			Stiff dark brown silty clay with organics	24			●						
			Very stiff brown and tan clay with ferrous nodules and some calcareous nodules and occasional fine gravel - tan and gray below 2 ft	40			●						85
				30				●					
				20					●				
10			- auger refusal at 8 ft Moderately hard gray cherty limestone (horizontally bedded)	30/0"									
				30/0"									
15				30/0"									
				30/0"									
20													
			Note: Backfilled boring with 2 bags of hole plug.										
25													

06-185-1 10-313.CPJ 1-21-11

COMPLETION DEPTH: 20.0 ft  
DATE: 12-22-10

DEPTH TO WATER  
IN BORING: Dry to 8 ft

DATE: 12/22/2010



**Grubbs, Hoskyn,  
Barton & Wyatt, Inc.**  
Consulting Engineers

# LOG OF BORING NO. 3

Afton Substation  
Afton, Oklahoma

TYPE: Auger to 8.5 ft /Wash

LOCATION: See Plate 2

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %				
						PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT					
			SURF. EL:			0.2	0.4	0.6	0.8	1.0	1.2	1.4	
						10	20	30	40	50	60	70	
			Very stiff dark brown silty clay to clay with organics	20									
			Very stiff dark brown and brown clay with ferrous nodules and occasional limestone fragments	28									
5			- stiff gray and tan below 4.5 ft	18									94
				12									
				30/0"									
			- auger refusal at 8.5 ft										
10			Moderately hard gray cherty limestone (horizontally bedded) - with clay seams below 9 ft										
				30/0"									
15													
				30/0"									
20													
25													

Note: Backfilled boring with 2 bags of hole plug.

COMPLETION DEPTH: 20.0 ft  
DATE: 12-21-10

DEPTH TO WATER  
IN BORING: Dry to 8.5 ft

DATE: 12/21/2010



**Grubbs, Hoskyn,  
Barton & Wyatt, Inc.**  
Consulting Engineers

# LOG OF BORING NO. 4

Afton Substation  
Afton, Oklahoma

TYPE: Auger to 9 ft /Wash

LOCATION: See Plate 2

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT			- No. 200 %				
						PLASTIC LIMIT	WATER CONTENT	LIQUID LIMIT					
			SURF. EL:			0.2	0.4	0.6	0.8	1.0	1.2	1.4	
						10	20	30	40	50	60	70	
			Very stiff dark brown silty clay with organics (FILL)	28									
			Very stiff mottled reddish tan, tan, brown and gray clay with decayed organic pockets to 3.5 ft	36									86
5			- stiff tan and gray with ferrous stains below 4.5 ft	17									
			- brown below 7.5 ft	12									
			- auger refusal at 9 ft	30/0"									
10			Moderately soft gray cherty limestone (horizontally bedded) - moderately hard below 9 ft										
				30/0"									
15													
				30/0"									
20													
			Note: Backfilled boring with 2 bags of hole plug.										
25													

06-185-1 10-313.GPJ 1-21-11

COMPLETION DEPTH: 20.0 ft  
DATE: 12-22-10

DEPTH TO WATER  
IN BORING: Dry to 9 ft

DATE: 12/22/2010



## SYMBOLS AND TERMS USED ON BORING LOGS

### SOIL TYPES

(SHOWN IN SYMBOLS COLUMN)



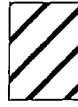
Gravel



Sand



Silt



Clay

Predominant type shown heavy

### SAMPLER TYPES

(SHOWN ON SAMPLES COLUMN)



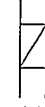
Shelby  
Tube



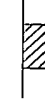
Rock  
Core



Split  
Spoon



No  
Recovery



Cutting

### TERMS DESCRIBING CONSISTENCY OR CONDITION

**COARSE GRAINED SOILS** (major portion retained on No. 200 sieve): Includes (1) Clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERM	N-VALUE	RELATIVE DENSITY
VERY LOOSE	0-4	0-15%
LOOSE	4-10	15-35%
MEDIUM DENSE	10-30	35-65%
DENSE	30-50	65-85%
VERY DENSE	50 and above	85-100%

**FINE GRAINED SOILS** (major portion passing No. 200 sieve): Includes (1) Inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH TON/SQ. FT.
VERY SOFT	Less than 0.25
SOFT	0.25-0.50
FIRM	0.50-1.00
STIFF	1.00-2.00
VERY STIFF	2.00-4.00
HARD	4.00 and higher

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil. The consistency ratings of such soils are based on penetrometer readings.

### TERMS CHARACTERIZING SOIL STRUCTURE

**SLICKENSIDED** - having inclined planes of weakness that are slick and glossy in appearance.

**FISSURED** - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.

**LAMINATED** - composed of thin layers of varying color and texture.

**INTERBEDDED** - composed of alternate layers of different soil types.

**CALCAREOUS** - containing appreciable quantities of calcium carbonate.

**WELL GRADED** - having a wide range in grain sizes and substantial amounts of all intermediate particle sizes.

**POORLY GRADED** - predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.

Terms used on this report for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in Technical Memorandum No.3-357, Waterways Experiment Station, March 1953

**APPENDIX A**



**Soil Resistivity Test Results**  
**Grand River Dam Authority - Afton Substation**  
**Afton, Oklahoma**  
**Job No. 10-313**

Point	Direction of Readings	Spacing "A", ft	Reading, Ohms	Resistivity, Ohm-cm
1	East-West	2.5	6.5	3088
2	East-West	5	2.4	2298
3	East-West	10	1.7	3256
4	East-West	20	1.2	4405
5	East-West	40	1.0	7430
6	East-West	60	0.7	8445
7	East-West	70	0.6	8579

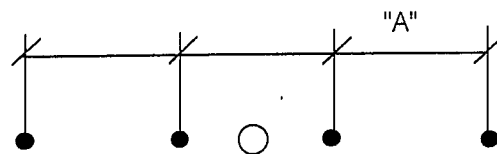
Location of Center of Array: Center of A1 and A2 resistivity end points, parallel to north fence line of existing substation

GPS Coordinates: 36.690336, -94.928128

Date: December 20, 2010

Weather: Clear, windy, 50 deg. F

Soil Conditions: Damp



Legend	
Probe Location	●
Center of Array	○

Resistivity Layout, typical

**Soil Resistivity Test Results**  
**Grand River Dam Authority - Afton Substation**  
**Afton, Oklahoma**  
**Job No. 10-313**

Point	Direction of Readings	Spacing "A", ft	Reading, Ohms	Resistivity, Ohm-cm
1	East-West	2.5	5.3	2537
2	East-West	5	2.7	2585
3	East-West	10	1.5	2873
4	East-West	20	1.3	4788
5	East-West	40	0.9	6894
6	East-West	60	0.7	8503
7	East-West	70	0.7	8780

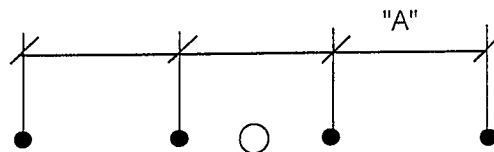
Location of Center of Array: Center of A1 and A3 resistivity end points

GPS Coordinates: 36.690261, -94.928137

Date: December 20, 2010

Weather: Clear, windy, 50 deg. F

Soil Conditions: Damp



Legend	
Probe Location	●
Center of Array	○

Resistivity Layout, typical

**Soil Resistivity Test Results**  
**Grand River Dam Authority - Afton Substation**  
**Afton, Oklahoma**  
**Job No. 10-313**

Point	Direction of Readings	Spacing "A", ft	Reading, Ohms	Resistivity, Ohm-cm
1	East-West	2.5	7.9	3782
2	East-West	5	3.9	3734
3	East-West	10	1.9	3639
4	East-West	20	1.1	4136
5	East-West	40	1.2	8809
6	East-West	60	0.7	8330
7	East-West	70	0.8	10389

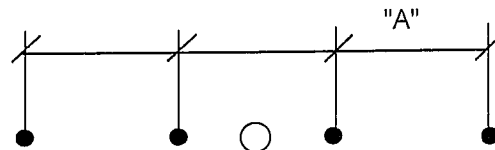
Location of Center of Array: Center of A2 and A4 resistivity end points, parallel to east fence line of existing substation

GPS Coordinates: 36.689825, -94.928028

Date: December 20, 2010

Weather: Clear, windy, 50 deg. F

Soil Conditions: Damp



Legend	
Probe Location	●
Center of Array	○

Resistivity Layout, typical

# PHASE 1 CONSTRUCTION SCHEDULE

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1. BEGIN CONSTRUCTION – AUGUST 01, 2012
2. SITE PREPARATION, REMOVE AND REPLACE FENCE, INSTALL NEW FIBER OPTIC, REMOVE EXISTING FIBER OPTIC (CABLE, VAULTS, AND CONDUITS), INSTALL PERIMETER GROUNDING, FENCE GROUNDING, INSTALL TRANSFORMER #1, #2, #3, & #4 FOUNDATIONS, INSTALL TRANSFORMER OIL CONTAINMENT, 15KV RISER FOUNDATIONS, MODIFICATIONS TO CONTROL HOUSE (AS PRACTICAL), BREAKER 6340 TEMPORARY FOUNDATION, CONDUIT FOR TEMPORARY BREAKER 6340 POSITION, 161KV BREAKER FOUNDATIONS , TRANSFORMER #2, ALL PIERS THAT CAN SAFELY BE INSTALLED (DUE TO OVERHEAD ENERGIZED LINES) NEAR TRANSFORMER #1 AND TRANSFORMER #2 POSITIONS,CABLE TRENCH FOR 161KV SECTION OF SUBSTATION, CONDUIT FROM 161KV BREAKER FOUNDATIONS TO CABLE TRENCH, UNDERGROUND GROUNDING FOR 161KV SECTION OF SUBSTATION, AND ANY OTHER WORK THAT CAN BE SAFELY PERFORMED IN SUBSTATION BEFORE RE-LOCATION OF OVERHEAD TRANSMISSION LINES.
3. THIS WORK TO BE COMPLETED BY OCTOBER 01, 2012.

## NOTES:

1. REFER TO DRAWING S294PG50 FOR TRENCH LAYOUT.
2. REFER TO DRAWING S294PG20 FOR GROUNDING PLAN.
3. REFER TO DRAWING S294PG30 FOR 161KV FOUNDATION PLAN
4. REFER TO DRAWING S294PH02 FOR NEW LAYOUT OF CONTROL HOUSE PLAN
5. TRANSFORMER #2 TO BE DELIVERED TO SITE AND PLACED ON FOUNDATION BY CONTRACTOR.

## REFERENCE DRAWINGS:

S294PE30	FENCE AND GROUNDING DETAILS
S294PE50	AFTON SUBSTATION BEFORE CONSTRUCTION
S294PE52	AFTON SUBSTATION PHASE II
S294PE53	AFTON SUBSTATION PHASE III
S294PE54	AFTON SUBSTATION PHASE IV
S294PE55	AFTON SUBSTATION PHASE V
S294PG20	GROUNDING PLAN
S294PG30	161KV FOUNDATION PLAN
S294PG34	TYPICAL FOUNDATION DETAILS
S294PG50	TRENCH LAYOUT PLAN
S294PZ01	OIL CONTAINMENT PLAN

## PHASE II CONSTRUCTION SCHEDULE

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1. OCTOBER 03, 2012 TO OCTOBER 10, 2012.
2. CHECK PHASING AND INSTALL TEMPORARY JUMPERS TO ENERGIZED 69 kV LINES (FEEDER 63 AND FEEDER 62) AT A POINT WHERE THEY CROSS, APPROXIMATELY 3 MILES EAST OF AFTON SUBSTATION. NEARBY CROSSING STRUCTURES ARE: FEEDER 63 – STRUCTURE 3-8 AND FEEDER 62 – STRUCTURE 60-3.
3. INSTALL 3 (1 PER PHASE) AMPACT LINE SWITCHES ON ENERGIZED 69 kV LINE – FEEDER 63 – WEST OF STRUCTURE 3-8.
4. OPEN BREAKER 6240.
5. OPEN NEWLY INSTALLED LINE SWITCHES, THUS DE-ENERGIZING SECTION OF FEEDER 63 FROM OPEN SWITCHES TO AFTON SUBSTATION. FEEDER 63 NOW BEING ENERGIZED FROM FEEDER 62.
6. INSTALL NEW TEMPORARY LINE FOR FEEDER 63 FROM LOCATION EAST OF EXISTING SOUTH DEAD-END BAY TO NEW VERTICAL DEAD-END STRUCTURE 1-1.
7. INSTALL TEMPORARY BREAKER 6340 AND SWITCHES ON EAST SIDE OF EXISTING SOUTH 69kV BAY FOR BREAKER 6340.
8. REMOVE SECTION OF FEEDER 63 FROM NEWLY INSTALLED STRUCTURE 1-1 TO PRESENT POSITION ON EAST END OF NORTH SIDE OF EXISTING 69kV DEAD-END.
9. CLOSE NEWLY INSTALLED LINE SWITCHES. CHECK PHASING AND INSTALL JUMPERS TO ENERGIZED 69kV BUS TO TEMPORARY FEEDER 63. CLOSE TEMPORARY BREAKER SWITCHES AND BREAKER 6340.
10. OPEN BREAKER 6140 AND OLD BREAKER 6240.
11. REMOVE ENERGIZED JUMPERS AT STRUCTURE 65-3 ON FEEDER 62. FEEDER 62 NOW BEING ENERGIZED FROM NEW LOCATION OF FEEDER 63 AT AFTON SUBSTATION.
12. INSTALL PERMANENT GUYED 3-POLE STRUCTURE (DESIGNATE 1-A) AND ANCHORS. THIS SECTION OF FEEDER 62 HAS 795 ACSR CONDUCTORS.
13. TRANSFER FEEDER 62 TO NEWLY INSTALLED STRUCTURE 1-A.
14. REMOVE SECTION OF FEEDER 62 FROM NORTH-EAST SIDE OF EXISTING 69kV SUBSTATION DEAD-END.
15. THIS WORK TO BE COMPLETED BY OCTOBER 10, 2012.

### NOTES:

1. CONDUCTORS ON FEEDER 63 - STR. 3-8 AND FEEDER 62 – STR. 60-3 ARE 4/0 ACSR.
2. CONDUCTORS ON FEEDER 62 - STR. 65-3 ARE 4/0 ACSR.
3. CONDUCTORS ON FEEDER 62 FROM EXISTING SUBSTATION DEAD-END TO STRUCTURE 1-1 ARE 795 ACSR.
4. USE ONLY QUALIFIED JOURNEYMAN LINEMAN EXPERIENCED IN WORKING ENERGIZED 69kV TRANSMISSION LINES TO PERFORM ALL TRANSMISSION LINE WORK.
5. GRDA TO PROVIDE POLES, ANCHORS, LINE HARDWARE, SWITCHES, CONDUCTOR AND SLEEVES FOR TEMPORARY LINE WORK.
6. THE HEIGHT OF THE TEMPORARY STRUCTURES IS UNKNOWN AT THIS TIME. IT IS ANTICIPATED STRUCTURE 1-A WILL BE (3) 70' CLASS 1 POLES AND STRUCTURE 1-1 WILL BE (1) 90' CLASS H1 POLE.

# PHASE II CONSTRUCTION SCHEDULE

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## REFERENCE DRAWINGS:

S294PE30 FENCE AND GROUNDING DETAILS  
S294PE50 AFTON SUBSTATION BEFORE CONSTRUCTION  
S294PE51 AFTON SUBSTATION PHASE I  
S294PE53 AFTON SUBSTATION PHASE III  
S294PE54 AFTON SUBSTATION PHASE IV  
S294PE55 AFTON SUBSTATION PHASE V

## PHASE III CONSTRUCTION SCHEDULE

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1. CONSTRUCT TEMPORARY 69kV TRANSMISSION LINE ACROSS SUBSTATION TO SLIGHTLY EAST OF TRANSFORMER #1 AND CONTROL BUILDING. THIS WORK TO BE PERFORMED OVER AN ENERGIZED 161/69kV TRANSFORMER AND BUS TO TEMPORARY VERTICAL POLE DEAD-END STRUCTURES LOCATED TO SOUTH AND NORTH OF NEW SUBSTATION FENCE. TEMPORARY ANCHORS MUST BE INSTALLED FOR CONDUCTOR TERMINATIONS.
2. CLEARANCE ON FEEDER 5 – OCTOBER 15 & 16, 2012 TO ALLOW TRANSFER OF FEEDER 5 TO TEMPORARY STRUCTURE SOUTH OF SUBSTATION.
3. CLEARANCE ON FEEDER 61 – OCTOBER 16, 2012 TO ALLOW TRANSFER OF FEEDER 61 TO TEMPORARY STRUCTURE NORTH OF SUBSTATION.
4. REMOVE TEMPORARY ANCHORS, ATTACH GUYS TO BISSECTOR ANCHORS, AND INSTALL JUMPERS AT STRUCTURES SOUTH AND NORTH OF SUBSTATION, TYING FEEDER 5 TO FEEDER 61.
5. INSTALL NEW RELAY SETTINGS FOR FEEDER 5/61.
6. RE-ENERGIZE FEEDER 5/61 FROM PENSACOLA TO MIAMI FREEHAUF (BY-PASSING AFTON SUBSTATION) BY END OF DAY – OCTOBER 16, 2012.
7. BEGIN CONSTRUCTION OF NEW 69kV SECTION OF SUBSTATION – OCTOBER 17, 2012.
8. INSTALL NEW FIBER OPTIC (AS NOTED), OTHER MODIFICATIONS TO CONTROL HOUSE , CONSTRUCT 69kV SECTION OF SUBSTATION INCLUDING , BUT NOT LIMITED TO , 69kV SECTION OF CABLE TRENCH, GROUNDING, FOUNDATIONS, BREAKER INSTALLATION, BUS, SWITCHES, CONTROL CABLE, OTHER MODIFICATIONS TO CONTROL BUILDING, RELAY PANEL CHANGE-OUT, AND 69kV CONNECTIONS TO TRANSFORMER #2.
9. THIS WORK TO BE COMPLETED BY JANUARY 11, 2013.

### NOTES:

1. REFER TO NOTES ON THIS DRAWING FOR FIBER OPTIC INSTALLATION.
2. GRDA TO FURNISH TEMPORARY POLES, LINE HARDWARE, ANCHORS, CONDUCTOR AND SHIELD WIRE FOR TEMPORARY LINE RE-ROUTE OF FEEDER 5 & 61.
3. ALL LINE OUTAGES MUST BE KEPT TO A MINIMUM. A HOLD-ORDER WILL BE PLACED ON 69kV SECTION OF BUS NEAR TRANSFORMER #1 WHEN STRINGING OVER ENERGIZED BUS.
4. USE ONLY QUALIFIED JOURNEYMAN LINEMAN EXPERIENCED IN WORKING OVER ENERGIZED CIRCUITS WHEN PERFORMING WORK ON TRANSMISSION LINES.

### REFERENCE DRAWINGS:

S294PE02	69kV EQUIPMENT PLAN VIEW
S294PE50	AFTON SUBSTATION BEFORE CONSTRUCTION
S294PE51	AFTON SUBSTATION PHASE I
S294PE52	AFTON SUBSTATION PHASE II
S294PE54	AFTON SUBSTATION PHASE IV
S294PE55	AFTON SUBSTATION PHASE V
S294PG20	GROUNDING PLAN
S294PG31	69kV FOUNDATION PLAN
S294PG33	TYPICAL FOUNDATION DETAILS
S294PG34	TYPICAL FOUNDATION DETAILS
S294PG50	TRENCH LAYOUT PLAN

## PHASE IV CONSTRUCTION SCHEDULE

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1. CONSTRUCT TEMPORARY 161kV TRANSMISSION LINE TO RE-ROUTE FEEDER 22 FROM SOUTH OF NEW SUBSTATION FENCE TO WEST SIDE OF FENCE, THEN NORTHWARD ALONG FENCE TO NORTHWEST OF FENCE, THEN EASTWARD TO TEMPORARY 3-POLE STRUCTURE LOCATED EAST OF SECTION OF FEEDER 22 TO MIAMI FREEHAUF. TEMPORARY ANCHORS MUST BE INSTALLED FOR CONDUCTOR TERMINATIONS. THIS SECTION OF LINE WILL BE INSTALLED UNDER EXISTING FEEDER 22 AND EAST OF PSO 138kV TRANSMISSION LINE.
2. CLEARANCE ON FEEDER 22 AND EXISTING 161kV TRANSFORMER (TRANSFORMER #1) BEGINNING JANUARY 28, 2013 TO FEBRUARY 01, 2013.
3. INSTALL TEMPORARY 3-POLE STRUCTURE AND ANCHORS TO NORTH OF EXISTING SOUTH SUBSTATION DEAD-END STRUCTURE.
4. TRANSFER SECTION OF OVERHEAD CONDUCTOR ACROSS 161kV SECTION OF SUBSTATION TO TEMPORARY 3-POLE STRUCTURE.
5. CONNECT TEMPORARY JUMPERS TO CIRCUIT SWITCHER #71.
6. REMOVE REMAINDER OF OVERHEAD CONDUCTOR AND SHIELD WIRE TO EXISTING NORTH SUBSTATION DEAD-END STRUCTURE.
7. INSTALL TEMPORARY 3-POLE STRUCTURE AND ANCHORS TO NORTH OF SUBSTATION FENCE.
8. TRANSFER EXISTING NORTH SECTION OF FEEDER 22 AND FIBER OPTIC TO TEMPORARY 3-POLE STRUCTURE.
9. INSTALL JUMPERS TO TEMPORARY 3-POLE STRUCTURES NORTH AND SOUTH OF FENCE.
10. CHECK PHASING AND ENERGIZE FEEDER 22 AND 161kV TRANSFORMER #1 BY END OF DAY, FEBRUARY 01, 2013.
11. BEGINNING ON FEBRUARY 01, 2013, CONSTRUCT NORTH SECTION OF 161kV SUBSTATION FROM SWITCH 133 AND SWITCH 129. CONSTRUCTION INCLUDES, BUT NOT LIMITED TO, INSTALLING THREE 161kV BREAKERS, SWITCHES, STEEL DEAD-ENDS, BUS SUPPORTS, BUS, CONDUIT, GROUNDING, MODIFICATIONS TO CONTROL HOUSE, RELAY PANELS, TRANSFORMER PANEL, CONNECTIONS TO TRANSFORMER #2, TERMINATIONS FROM RISER POLE OF 161kV TRANSFORMER #2 TO STATION SERVICE TRANSFORMER #4, INSTALL TWO 3-POLE STRUCTURES AND TEMPORARY ANCHORS TO SOUTH OF SWITCH 133 AND SWITCH 129, INSTALL CONDUCTORS, ISOLATION INSULATORS, AND SHIELD WIRE TO TEMPORARY 3-POLE STRUCTURES, INSTALL JUMPERS FROM OVERHEAD CONDUCTOR TO EAST SIDE OF 161kV BUS AND INSTALL SECTION OF FEEDER 62 FROM TEMPORARY DEAD-END STRUCTURE TO PERMANENT LOCATION ON NEW 69kV DEAD-END STEEL.
12. THIS WORK TO BE COMPLETED BY MAY 01, 2013.
13. CLEARANCE OF FEEDER 22 – MAY 02, 2013.
14. REMOVE JUMPERS FROM TEMPORARY 161kV LINE TO FEEDER 22 NEAR 3-POLE LOCATED NORTH OF NEW SUBSTATION DEAD-END. INSTALL NEW SECTION OF CONDUCTOR AND SPLICE IN TO EXISTING FEEDER 22. TRANSFER CONDUCTOR AND SHIELD WIRE TO NEW LOCATION ON NORTHEAST SUBSTATION STEEL DEAD-END. RE-INSTALL JUMPERS FROM TEMPORARY LINE TO NEW LOCATION OF FEEDER 22. ENERGIZE FEEDER 22.
15. ENERGIZE AND PERFORM CHECK-OUT ON TRANSFORMER #2 – MAY 03, 2013 TO MAY 10, 2013.
16. CLEARANCE ON FEEDER 5/61 – MAY 13, 2013 AND MAY 14, 2013.
17. INSTALL ADDITIONAL CONDUCTOR AND SHIELD WIRE, TRANSFER FEEDER 5 TO PERMANENT LOCATION ON SOUTH 69kV SUBSTATION DEAD-END, TRANSFER FEEDER 61 TO PERMANENT LOCATION ON NORTH 69kV SUBSTATION STEEL, REMOVE TEMPORARY 69kV TRANSMISSION LINE, AND ENERGIZE FEEDER 5 AND FEEDER 61 FROM WEST SIDE OF NEW 69kV BUS.
18. INSTALL SECTION OF NEW CONDUCTOR, AND TRANSFER FEEDER 62 TO PERMANENT LOCATION ON NEW 69kV SUBSTATION STEEL DEAD-END. ENERGIZE FEEDER 62 ON NORTH SECTION OF NEW 69kV BUS.



## PHASE IV CONSTRUCTION SCHEDULE

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19. RE-INSTALL JUMPERS TO ENERGIZED 69kV FEEDER 62 AT STRUCTURE 65-3. OPEN LINE-SWITCHES PREVIOUSLY INSTALLED ON FEEDER 63 WEST OF STRUCTURE 3-8.
20. OPEN TEMPORARY BREAKER 6340. TRANSFER FEEDER 63 TO PERMANENT LOCATION ON NORTHEAST 69kV SUBSTATION STEEL DEAD-END.
21. CLOSE LINE-SWITCHES NEAR STRUCTURE 3-8 ON FEEDER 63 AND ENERGIZE FEEDER 63 NOW LOCATED AT PERMANENT POSITION ON NORTH 69kV BUS.
22. CHECK OPEN SWITCH 6054 AND INSTALL SECTION OF FEEDER 60 TO PERMANENT LOCATION ON SOUTH SIDE OF NEW 69kV BUS. ENERGIZE FEEDER 60 FROM NEW 69kV BUS.

### NOTES:

1. REFER TO NOTES ON THIS DRAWING FOR FIBER OPTIC INSTALLATION.
2. GRDA TO FURNISH POLES, LINE HARDWARE, ANCHORS, CONDUCTOR AND SHIELD WIRE FOR TEMPORARY AND PERMANENT TRANSMISSION LINE CONSTRUCTION.
3. ALL LINE OUTAGES MUST BE KEPT TO A MINIMUM. A HOLD-ORDER WILL BE PLACED ON ENERGIZED LINES OR BUS WHEN PERFORMING WORK NEAR ENERGIZED CIRCUITS.
4. USE ONLY QUALIFIED JOURNEYMAN LINEMAN EXPERIENCED IN WORKING ON OR NEAR ENERGIZED CIRCUITS WHEN PERFORMING WORK ON TRANSMISSION LINES.

### REFERENCE DRAWINGS:

- S294PE01 161kV EQUIPMENT PLAN VIEW
- S294PE50 AFTON SUBSTATION BEFORE CONSTRUCTION
- S294PE51 AFTON SUBSTATION PHASE 1
- S294PE52 AFTON SUBSTATION PHASE II
- S294PE53 AFTON SUBSTATION PHASE III
- S294PE55 AFTON SUBSTATION PHASE V
- S294PG20 GROUNDING PLAN
- S294PG30 69kV FOUNDATION PLAN
- S294PG33 TYPICAL FOUNDATION DETAILS
- S294PG34 TYPICAL FOUNDATION DETAILS
- S294PG50 TRENCH LAYOUT PLAN

# PHASE V CONSTRUCTION SCHEDULE

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1. CLEARANCE ON FEEDER 22 AND EXISTING 161kV TRANSFORMER (TRANSFORMER #1) ON MAY 21, 2013 TO REMOVE SECTION OF LINE FROM TEMPORARY 3-POLE STRUCTURE SOUTH OF EXISTING STEEL LATTICE DEAD-END TO TEMPORARY 3-POLE STRUCTURE IN 161kV SUBSTATION. LINE TO BE RE-ENERGIZED AT END OF DAY
2. REMOVE EXISTING LATTICE TOWER, CIRCUIT SWITCHER #71, 161kV PT'S, CCVT'S, AND PRE-EXISTING 69kV STEEL, BREAKERS AND EQUIPMENT.
3. MOVE TRANSFORMER #1 TO NEW LOCATION.
4. CONSTRUCT SECTION OF 161kV SUBSTATION SOUTH OF SWITCH 133 AND SWITCH 129.
5. INSTALL POWER CABLE FROM RISER POLE FOR TRANSFORMER #1 TO STATION SERVICE TRANSFORMER #3.
6. COMPLETE INSTALLATION OF FINAL RELAY AND TRANSFORMER PANELS AND COMMUNICATION RACKS. COMPLETE FINAL MODIFICATION TO CONTROL BUILDING.
7. THIS WORK TO BE COMPLETED BY JUNE 25, 2013.
8. CLEARANCE ON FEEDER 22 AND TRANSFORMER #2 – JUNE 27, 2013.
9. REMOVE JUMPERS FROM TEMPORARY 161kV TRANSMISSION LINE ON NORTH AND SOUTH END OF SUBSTATION. SPLICE IN SECTION OF CONDUCTOR AND SHIELD WIRE AND TRANSFER FEEDER 126 (FORMERLY FEEDER 22) TO NEW LOCATION ON SOUTH-WEST STEEL SUBSTATION DEAD-END. INSTALL JUMPERS, CHECK PHASING, AND RE-ENERGIZE FEEDER 126, FEEDER 22, TRANSFORMER #1 AND TRANSFORMER #2.
10. SUBSTATION NOW FULLY ENERGIZED – JUNE 27, 2013.
11. REMOVE TEMPORARY 161kV TRANSMISSION LINE AND ANCHORS, RESTORE DISTURBED AREA AROUND SUBSTATION, REMOVE EXISTING FOUNDATIONS, RETURN EXCESS AND SURPLUS MATERIAL TO WAREHOUSE, INSTALL FINAL LAYER OF ROCK, AND COMPLETE ALL WORK RELATED TO PROJECT BY JULY 31, 2013.

## NOTES:

1. REFER TO NOTES ON THIS DRAWING FOR FIBER OPTIC INSTALLATION.
2. GRDA TO FURNISH POLES, LINE HARDWARE, ANCHORS, CONDUCTOR AND SHIELD WIRE FOR TEMPORARY AND PERMANENT TRANSMISSION LINE CONSTRUCTION.
3. ALL LINE OUTAGES MUST BE KEPT TO A MINIMUM. A HOLD-ORDER WILL BE PLACED ON ENERGIZED LINES OR BUS WHEN PERFORMING WORK NEAR ENERGIZED CIRCUITS.
4. USE ONLY QUALIFIED JOURNEYMAN LINEMAN EXPERIENCED IN WORKING ON OR NEAR ENERGIZED CIRCUITS WHEN PERFORMING WORK ON TRANSMISSION LINES.

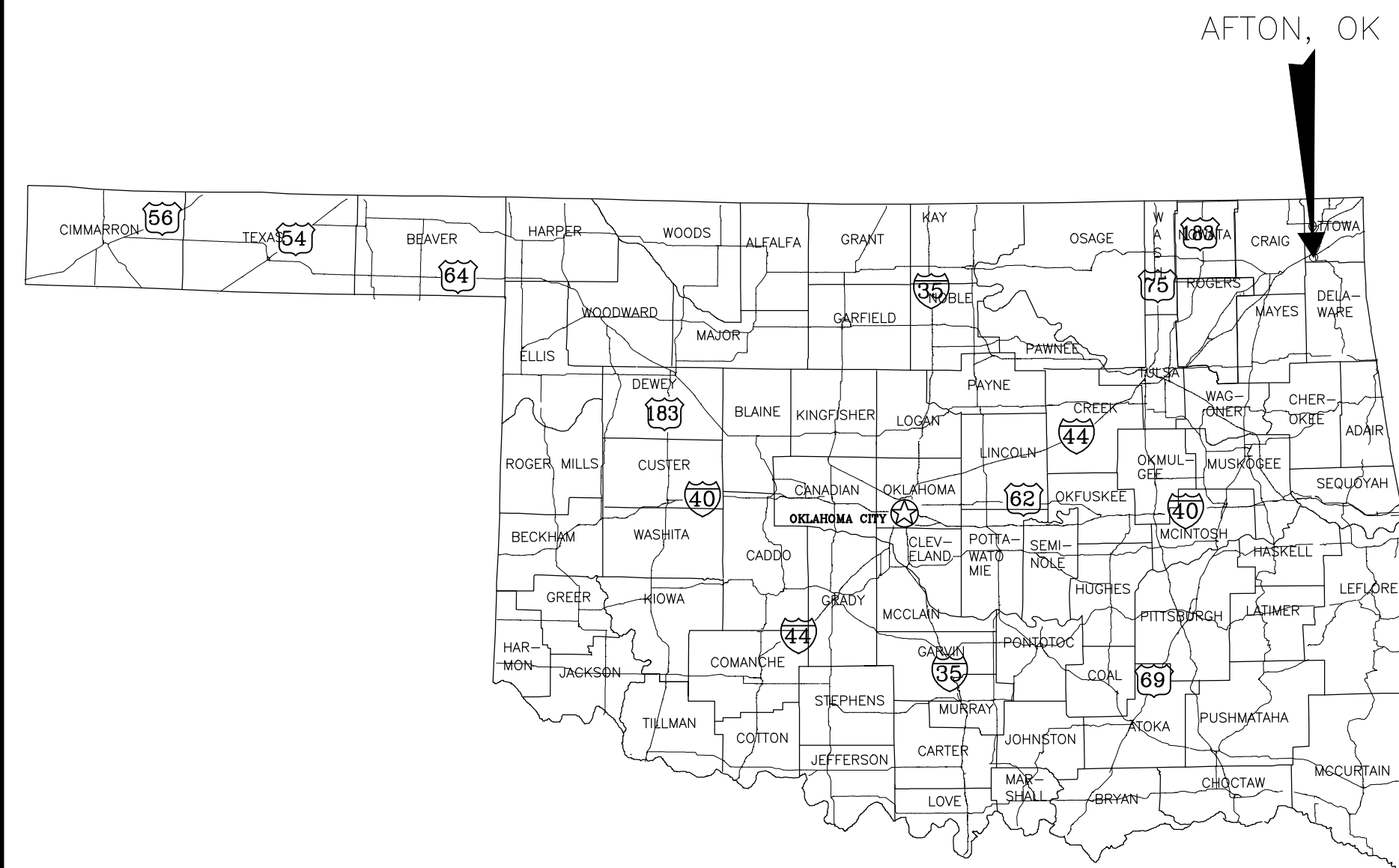
## REFERENCE DRAWINGS:

S294PE01	161kV EQUIPMENT PLAN VIEW
S294PE50	AFTON SUBSTATION BEFORE CONSTRUCTION
S294PE51	AFTON SUBSTATION PHASE 1
S294PE52	AFTON SUBSTATION PHASE II
S294PE53	AFTON SUBSTATION PHASE III
S294PE54	AFTON SUBSTATION PHASE IV
S294PG20	GROUNDING PLAN
S294PG30	161kV FOUNDATION PLAN
S294PG33	TYPICAL FOUNDATION DETAILS
S294PG34	TYPICAL FOUNDATION DETAILS
S294PG50	TRENCH LAYOUT PLAN

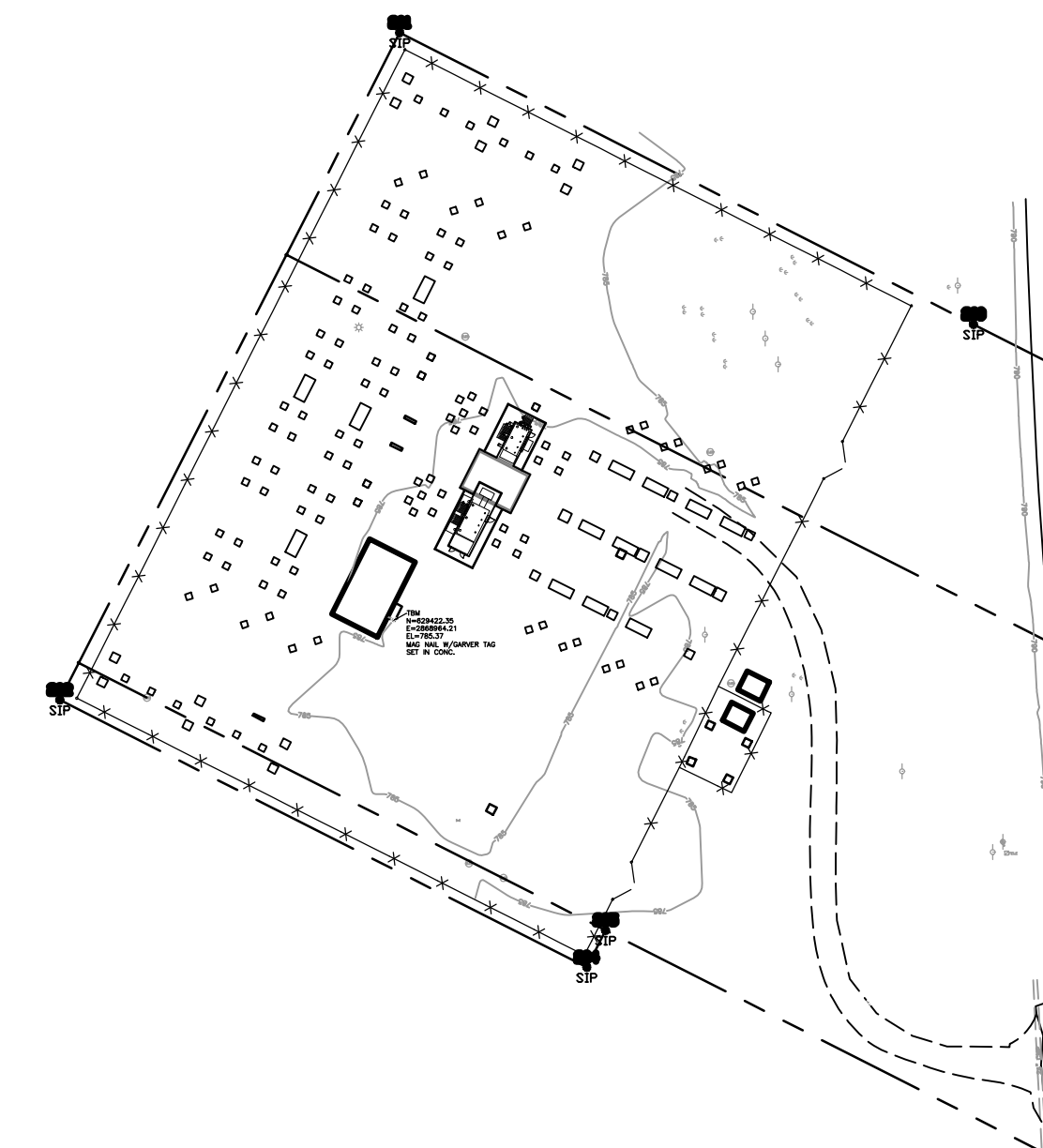
# GRDA AFTON SUBSTATION

## AFTON, OKLAHOMA

MAY 2012



**LOCATION MAP**



**SITE PLAN**

File: W:\Drafting\Drawings\Substation\AFTON\Garver CAD Drawings 2-16-12\S294Z001\_COVER.dwg Last\_Saved: 5/30/2012 12:45 PM Last\_Saved\_By: Ashultz  
 Last\_Plotting\_By: Shults, Ariene Plot\_Style: Garver Standard Full.ctb Plot\_Scale: 1:1 Plot\_Date: 5/30/2012 12:45 PM Plotter\_Used: DWG To PDF.pc3

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69KV			
COVER			
SCALE: NONE	DRAWN BY: DJR	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
 <small>Grand River Dam Authority P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. <b>S294Z001</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	AS	BA


# GRDA AFTON 161kV SUBSTATION 10045100

## DRAWING INDEX

Dwg. No	Rev.	Title	Dwg. No	Rev.	Title	Dwg. No	Rev.	Title	Dwg. No	Rev.	Title
S294Z001	0	COVER SHEET	S294PE51	0	AFTON SUB. PHASE I	S294PS07	2	69kV TRANSFORMER FDR BAY STRUCTURE VIEW H	S294SF009	2	BREAKER 200 FAILURE & CONTROL
S294Z002	2	DRAWING INDEX 1 OF 2	S294PE52	0	AFTON SUB. PHASE II	S294PS08	2	69kV TRANSFORMER FDR BAY STRUCTURE VIEW J & K	S294S001	3	CARRIER SCHEMATIC
S294Z003	1	DRAWING INDEX 2 OF 2	S294PE53	0	AFTON SUB. PHASE III	S294PS09	1	69kV BREAKER STRUCTURE VIEW L	S294SF010	3	21P PENSACOLA
S294Z005	0	ELECTRICAL LEGEND	S294PE54	0	AFTON SUB. PHASE IV	S294PS10	1	STEEL DETAILS SHEET 1 OF 5	S294SF011	2	21A PENSACOLA
S294PG01	0	PLAT OF SURVEY	S294PE55	0	AFTON SUB. PHASE V 100% COMPLETE	S294PS11	1	STEEL DETAILS SHEET 2 OF 5	S294SF012	2	BREAKER 12670 FAILURE & CONTROL
S294PG02	0	EXISTING TOPOGRAPHIC SURVEY	S294PG20	1	GROUNDING PLAN	S294PS12	1	STEEL DETAILS SHEET 3 OF 5	S294S002	3	CARRIER SCHEMATIC
S294PG03	0	COMMUNICATIONS EASEMENT	S294PG21	1	GROUNDING DETAILS	S294PS13	1	STEEL DETAILS SHEET 4 OF 5	S294SB100	1	BREAKER 100 DC SCH. DIA.
S294PG11	0	SITE GRADING PLAN	S294PE30	2	FENCE DETAIL	S294PS14	1	STEEL DETAILS SHEET 5 OF 5	S294SB100a	1	BREAKER 100 AC/DC SCH. DIA.
S294PG12	0	EROSION CONTROL AND SITE DETAILS	S294PG30	1	161kV FOUNDATION PLAN	S294PS15	0	161kV SWITCH STAND	S294SB100b	0	BREAKER 100 BKR AUX
S294PE01	1	161kV EQUIPMENT PLAN VIEW	S294PG31	0	69kV FOUNDATION PLAN	S294PS16	1	161kV DEAD-END STRUCTURE TENSION LOADS	S294SB2270	1	BREAKER 2270 DC SCH. DIA.
S294PE02	1	69kV EQUIPMENT PLAN VIEW	S294PG32	0	STATION CENTERLINE CONTROL POINTS	S294PS17	0	69kV DEAD-END STRUCTURE TENSION LOADS	S294SB2270a	1	BREAKER 2270 AC/DC SCH. DIA.
S294PE03	0	161kV ELEVATION VIEW A	S294PG33	1	TYPICAL FOUNDATION DETAILS	S294PS18	0	161kV DEAD-END STRUCTURE VERTICAL LOADS	S294SB2270b	0	BREAKER 2270 BKR AUX
S294PE04	0	161kV ELEVATION VIEW B	S294PG34	2	TYPICAL FOUNDATION DETAILS	S294PS19	0	161kV BUS SUPPORT STRUCTURE VERTICAL LOADS	S294SB200	1	BREAKER 200 DC SCH. DIA.
S294PE05	0	161kV ELEVATION VIEW C	S294PZ01	1	OIL CONTAINMENT PLAN	S294PS20	0	69kV DEAD-END VIEW F VERTICAL LOADS	S294SB200a	1	BREAKER 200 AC/DC SCH. DIA.
S294PE06	1	161kV ELEVATION VIEW D	S294PZ02	1	OIL CONTAINMENT DETAILS	S294PS21	0	69kV BREAKER STRUCTURE VIEW G VERTICAL LOADS	S294SB200b	0	BREAKER 200 BKR AUX
S294PE07	0	161kV ELEVATION VIEW E	S294PG40	1	161kV CABLE & CONDUITS	S294PS22	0	69kV TRANSFORMER FDR BAY STRUCTURE VIEW H V.L.	S294SB12670	1	BREAKER 12670 DC SCH. DIA.
S294PE08	1	161kV ELEVATION VIEW F1 & F2	S294PG41	0	69kV CABLE & CONDUITS	S294PS23	0	69kV TRANSFORMER FDR BAY STRUCTURE VIEW J & K V.L.	S294SB12670a	2	BREAKER 12670 AC/DC SCH. DIA.
S294PE09	1	161kV ELEVATION VIEW G1 & G2	S294PE40	0	LIGHTING PLAN VIEW	S294PS24	0	69kV BREAKER STRUCTURE VIEW L VERTICAL LOADS	S294SB12670b	0	BREAKER 12670 BKR AUX
S294PE10	0	69kV ELEVATION VIEW H	S294PG50	0	TRENCH LAYOUT PLAN	S294S0001	2	ONE LINE	S294SB300	1	BREAKER 300 DC SCH. DIA.
S294PE11	0	69kV ELEVATION VIEW J	S294PG51	1	TRENCH DETAILS	S294S0010	3	ONE LINE 161kV RING BUS			
S294PE12	1	69kV ELEVATION VIEW K	S294PH01	0	CONTROL HOUSE LAYOUT REMOVAL PLAN	S294S0011	2	ONE LINE TRANSFORMERS T1 & T2 161/69kV			
S294PE13	1	69kV ELEVATION VIEW L	S294PH02	1	CONTROL HOUSE LAYOUT	S294S0012	2	ONE LINE DIAGRAM - 69kV - BKR 540, 600, & 6140			
S294PE14	1	69kV ELEVATION VIEW M	S294PH03	0	CONTROL HOUSE GROUNDING	S294S0013	2	ONE LINE DIAGRAM - 69kV - FDR 60 VINITA - FDR 63 MONKEY ISLAND			
S294PE15	2	PARTS LIST 161kV EQUIP PLAN VIEW	S294PH04	1	PANEL VIEW A	S294SF001	3	BREAKER 100 PANEL 101 & THREE LINE AC DIAGRAM			
S294PE16	1	PARTS LIST 69kV EQUIP PLAN VIEW	S294PH05	1	PANEL VIEW B & C	S294SF002	1	BREAKER 2270 & 200 PANEL 102 & THREE LINE AC DIAGRAM			
S294PE17	2	PARTS LIST 161kV ELEVATION VIEW A	S294PH06	1	PANEL VIEW D & E	S294SF003	1	BREAKER 200 PANEL 103 & THREE LINE AC DIAGRAM			
S294PE18	1	PARTS LIST 161kV ELEVATION VIEW B	S294PH07	0	PANEL VIEW F	S294SF004	3	BREAKER 12670 PANEL 103 & THREE LINE AC DIAGRAM			
S294PE19	1	PARTS LIST 161kV ELEVATION VIEW C	S294PH08	0	PANEL VIEW G & H	S294SX001	2	TRANSFORMER NO.1 THREE LINE DIAGRAM			
S294PE20	2	PARTS LIST 161kV ELEVATION VIEW D	S294PH09	0	CABLE RACEWAY DETAIL	S294SX002	3	TRANSFORMER NO.2 THREE LINE DIAGRAM			
S294PE21	1	PARTS LIST 161kV ELEVATION VIEW E	S294PH10	0	CONTROL HOUSE BATTERY AREA EXHUAUST FAN	S294SF300	3	BREAKER 300 PANEL 104 & THREE LINE AC DIAGRAM			
S294PE22	2	PARTS LIST 161kV ELEVATION VIEW F1 & F2	S294PH11	0	GENERAL NOTES & MISC. DETAILS	S294SF400	1	BREAKER 400 PANEL 105 & THREE LINE AC DIAGRAM			
S294PE23	2	PARTS LIST 161kV ELEVATION VIEW G1 & G2	S294SH001	0	AC CONTROL HOUSE ONE-LINE	S294SF500	2	BREAKER 500 PANEL 106 & THREE LINE AC DIAGRAM			
S294PE24	2	PARTS LIST 69kV ELEVATION VIEW H	S294SH002	2	AC CONTROL HOUSE PANEL SCHEDULES	S249SF107	3	BKR 540 PANEL 107 & THREE LINE AC DIA.			
S294PE25	2	PARTS LIST 69kV ELEVATION VIEW J	S294WZ10	0	CONTROL HOUSE PANEL D 125VDC WIRING DIAGRAM	S294SF108	3	BKR 6140 & 600 PANEL 108 & THREE LINE AC DIA.			
S294PE26	2	PARTS LIST 69kV ELEVATION VIEW K	S294WZ11	0	CONTROL HOUSE PANEL E 125VDC WIRING DIAGRAM	S294SF109	3	BKR 6040 PANEL 109 & THREE LINE AC DIA.			
S294PE27	1	PARTS LIST 69kV ELEVATION VIEW L	S294WZ12	0	CONTROL HOUSE PANEL F 125VDC WIRING DIAGRAM	S294SF110	3	BKR 6340 & 700 PANEL 110 & THREE LINE AC DIA.			
S294PE28	3	PARTS LIST 69kV ELEVATION VIEW M	S294PS01	2	161kV STEEL PLAN VIEW	S294SF111	3	BKR 6240 & 800 PANEL 110, 112 & THREE LINE AC DIA.			
S294DE01	3	BILL OF MATERIALS SHEET 1 OF 4	S294PS02	1	69kV STEEL PLAN VIEW	S294SF112	1	SOUTH & NORTH BUS			
S294DE02	3	BILL OF MATERIALS SHEET 2 OF 4	S294PS03	1	161kV DEAD-END STRUCTURE VIEW A & END VIEW	S294SF005	3	21P MIAMI			
S294DE03	2	BILL OF MATERIALS SHEET 3 OF 4	S294PS04	2	161kV BUS SUPPORT STRUCTURE VIEW B, C, D, & E	S294SF006	2	21A MIAMI			
S294DE04	2	BILL OF MATERIALS SHEET 4 OF 4	S294PS05	1	69kV DEAD-END STRUCTURE VIEW F & END VIEW	S294SF007	3	BREAKER 100 FAILURE & CONTROL			
S294PE50	0	AFTON SUB. BEFORE CONSTRUCTION	S294PS06	1	69kV BREAKER STRUCTURE VIEW G & END VIEW	S294SF008	3	BREAKER 2270 FAILURE & CONTROL			

NOTE: RELAY DRAWINGS (S294WBXXX) ARE NOT INCLUDED

### ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69kV</small>			
DRAWING INDEX 1 OF 2			
SCALE: NONE	DRAWN BY: DJR	ENGR:	APPD: BA
		CH: MW	DATE: 3/7/2011
 <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. S294Z002	REV. 0

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# GRDA AFTON 161kV SUBSTATION 10045100

Dwg. No	Title	Dwg. No	Title	Dwg. No	Title	Dwg. No	Title
S294SB300a	BREAKER 300 AC/DC SCH. DIA.	S294SF118	BKR 540 FAILURE & CONTROL	S294WB001	CURRENT XFMR WIRING DIA. BKR 100	S294DT401	CABLE SCHEDULE CONTROL & INDICATION
S294SB300b	BREAKER 300 BRK AUX	S294SF119	21P FDR 61	S294WB002	CONTROL WIRING DIA. BKR 100	S294DT501	CABLE SCHEDULE 125VDC
S294SB400	BREAKER 400 DC SCH. DIA.	S294SF120	21A FDR 61	S294WB003	AUX WIRING DIA. BKR 100	S294DT502	CABLE SCHEDULE 125VDC
S294SB400a	BREAKER 400 AC/DC SCH. DIA.	S294SF121	BKR 6140 FAILURE & CONTROL	S294WB004	CURRENT XFMR WIRING DIA. BKR 2270	S294DT601	CABLE SCHEDULE ALARM INPUTS
S294SB400b	BREAKER 400 BKR AUX	S294SF122	BREAKER 600 FAILURE AND CONTROL	S294WB005	CONTROL WIRING DIA. BKR 2270	S294DT602	CABLE SCHEDULE ALARM INPUTS
S294SB500	BREAKER 500 DC SCH. DIA.	S294SF123	21P FDR 60	S294WB006	AUX WIRING DIA. BKR 2270	S294PE56	AFTON SUBSTATION TRANSMISSION LINE PLAN
S294SB500a	BREAKER 500 AC/DC SCH. DIA.	S294SF124	21A FDR 60	S294WB007	CURRENT XFMR WIRING DIA. BKR 200	S294PE57	AFTON SUBSTATION TRANSMISSION LINE PLAN
S294SB500b	BREAKER 500 BKR AUX	S294SF125	BKR 6040 FAILURE & CONTROL	S294WB008	CONTROL WIRING DIA. BKR 200	S294PS25	69Kv Switch Stand Vertical Break Switch
S294SB540	BREAKER 540 DC SCH. DIA.	S294SF126	21P FDR 63	S294WB009	AUX WIRING DIA. BKR 200	S294PG22	GROUNDING DETAILS – TRANSFORMER & LIGHTNING ARRESTOR
S294SB540a	BREAKER 540 AC/DC SCH. DIA.	S294SF127	21A FDR 63	S294WB010	CURRENT XFMR WIRING DIA. BKR 12670	S294PG23	GROUNDING DETAILS 3
S294SB540b	BREAKER 540 BKR AUX	S294SF128	BKR 6340 FAILURE & CONTROL	S294WB011	CONTROL WIRING DIA. BKR 12670	S294PG24	GROUNDING DETAILS 4
S294SB600	BREAKER 600 DC SCH. DIA.	S294SF129	BKR 700 FAILURE & CONTROL	S294WB012	AUX WIRING DIA. BKR 12670	S294PG25	FENCE DETAILS
S294SB600a	BREAKER 600 AC/DC SCH. DIA.	S294SF130	21P FDR 62	S294WB013	CURRENT XFMR WIRING DIA. BKR 300	S294PG26	GROUNDING DETAILS 5
S294SB600b	BREAKER 600 BKR AUX	S294SF131	21A FDR 62	S294WB014	CONTROL WIRING DIA. BKR 300		
S294SB6140	BREAKER 6140 DC SCH. DIA.	S294SF132	BKR 6240 FAILURE & CONTROL	S294WB015	CURRENT XFMR WIRING DIA. BKR 400		
S294SB6140a	BREAKER 6140 AC/DC SCH. DIA.	S294SF133	BKR 800 FAILURE & CONTROL	S294WB016	CONTROL WIRING DIA. BKR 400		
S294SB6140b	BREAKER 6140 BKR AUX	S294PP101	FDR 22 – 161kV MIAMI	S294WB017	CURRENT XFMR WIRING DIA. BKR 500		
S294SB6040	BREAKER 6040 DC SCH. DIA.	S294PP102	FDR 22 – 161kV MIAMI & BKR 2270	S294WB018	CONTROL WIRING DIA. BKR 500		
S294SB6040a	BREAKER 6040 AC/DC SCH. DIA.	S294PP103	FDR 126 – 161kV PENSACOLA	S294WB019	CURRENT XFMR WIRING DIA. BKR 540		
S294SB6040b	BREAKER 6040 BKR AUX	S294PP104	TRANSFORMER NO.1 & BKR 300	S294WB020	CONTROL WIRING DIA. BKR 540		
S294SB700	BREAKER 700 DC SCH. DIA.	S294PP105	BKR 400 & 69kV DIFF ZONE S1 & N1	S294WB021	CURRENT XFMR WIRING DIA. BKR 600		
S294SB700a	BREAKER 700 AC/DC SCH. DIA.	S294PP106	TRANSFORMER NO.2 & BKR 500	S294WB022	CONTROL WIRING DIA. BKR 600		
S294SB700b	BREAKER 700 BKR AUX	S294PP107	FDR 5 – 69kV PENSACOLA	S294WB023	CURRENT XFMR WIRING DIA. BKR 6140		
S294SB6340	BREAKER 6340 DC SCH. DIA.	S294PP108	FDR 61 – 69kV MIAMI	S294WB024	CONTROL WIRING DIA. BKR 6140		
S294SB6340a	BREAKER 6340 AC/DC SCH. DIA.	S294PP109	FDR 60 – 69kV VINITA	S294WB025	CURRENT XFMR WIRING DIA. BKR 6040		
S294SB6340b	BREAKER 6340 BKR AUX	S294PP110	BUS TIE BREAKERS	S294WB026	CONTROL WIRING DIA. BKR 6040		
S294SB800	BREAKER 800 DC SCH. DIA.	S294PP111	FDR 63 – 69kV MONKEY ISLAND PANEL 111	S294WB027	CURRENT XFMR WIRING DIA. BKR 700		
S294SB800a	BREAKER 800 AC/DC SCH. DIA.	S294PP112	FDR 62 – 69kV SAILBOAT BRIDGE PANEL 112	S294WB028	CONTROL WIRING DIA. BKR 700		
S294SB800b	BREAKER 800 BKR AUX	S294SR01	COMMUNICATIONS & ANNUNCIATOR PANEL	S294WB029	CURRENT XFMR WIRING DIA. BKR 6340		
S294SB6240	BREAKER 6240 DC SCH. DIA.	S294SR02	SCADA COMMUNICATIONS FOR STATION IED 1	S294WB030	CONTROL WIRING DIA. BKR 6340		
S294SB6240a	BREAKER 6240 AC/DC SCH. DIA.	S294SR03	SCADA COMMUNICATIONS FOR STATION IED 2	S294WB031	CURRENT XFMR WIRING DIA. BKR 800		
S294SB6240b	BREAKER 6240 BKR AUX	S294SR04	SCADA COMMUNICATIONS FOR STATION IED 3	S294WB032	CONTROL WIRING DIA. BKR 800		
S294SX101	TRANSFORMER NO.1 DC SCHEMATIC – PRIMARY	S294SR05	ANNUNCIATOR PNL 01	S294WB033	CURRENT XFMR WIRING DIA. BKR 6240		
S294SX102	TRANSFORMER NO.1 DC SCHEMATIC – ALTERNATE	S294SR06	ANNUNCIATOR NAME PLATE 01	S294WB034	CONTROL WIRING DIA. BKR 6240		
S294SX201	TRANSFORMER NO.2 DC SCHEMATIC – PRIMARY	S294SR07	ANNUNCIATOR PNL 02	S294DT101	CABLE SCHEDULE BUSHING CTs		
S294SX202	TRANSFORMER NO.2 DC SCHEMATIC – ALTERNATE	S294SR08	ANNUNCIATOR NAME PLATE 02	S294DT102	CABLE SCHEDULE BUSHING CTs		
S294SB301	BKR 300 FAILURE & CONTROL	S294SR09	ANNUNCIATOR PNL 03	S294DT201	CABLE SCHEDULE BUSHING CCVTs		
S294SB401	BKR 400 FAILURE & CONTROL	S294SR10	ANNUNCIATOR NAME PLATE 03	S294DT202	CABLE SCHEDULE BUSHING CCVTs		
S294SB402	87B–S1 BUS S1	S294SR11	ANNUNCIATOR PNL 04	S294DT301	CABLE SCHEDULE AC		
S294SB403	87B–N1 BUS N1	S294SR12	ANNUNCIATOR NAME PLATE 04	S294DT302	CABLE SCHEDULE AC		
S294SB501	BKR 500 FAILURE & CONTROL	S294SR13	ANNUNCIATOR TERMINATION DIAGRAM	S294DT303	CABLE SCHEDULE AC		
S294SF116	21P FDR 5	S294SR14	ANNUNCIATOR TERMINATION DIAGRAM	S294DT304	CABLE SCHEDULE AC		
S294SF117	21A FDR 5						

NOTE: RELAY DRAWINGS (S294WBXXX) ARE NOT INCLUDED

<b>ISSUED FOR BID</b>			
<b>GRAND RIVER DAM AUTHORITY</b>			
<b>AFTON SUBSTATION</b>		S294	
AFTON, OKLAHOMA 161/69kV			
DRAWING INDEX 2 OF 2			
SCALE: NONE	DRAWN BY: DKG	ENGR:	APPD: BA
CH: MW		DATE: 3/7/2011	
DRAWING No. S294Z003			REV. 0
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			

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REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

POWER, LIGHTING & SYSTEM LEGEND

Table listing electrical symbols and their descriptions. Includes items like UNDER CABINET LIGHT FIXTURE, 1x4 FLUORESCENT LIGHT, CABLE TRAY SYSTEM, LADDER TYPE, JUNCTION BOX 42 CUBIC INCH MINIMUM CAPACITY, etc.

ABBREVIATIONS

Table of electrical abbreviations and their meanings. Includes A (AMP), ABC (ABOVE COUNTER), ACS (ACCESS CONTROL SYSTEM), ACU (AIR CONDITIONING UNIT), AF (AMPS-FRAME), AFF (ABOVE FINISHED FLOOR), AFG (ABOVE FINISHED GRADE), AHJ (AUTHORITY HAVING JURISDICTION), AIC (AMPS INTERRUPTING CAPACITY), AM (AMP-METER), ANN (ANNUNCIATOR), AP (AERIAL PRIMARY), AS (AERIAL SECONDARY), AT (AMPS-TRIP), ATS (AUTOMATIC TRANSFER SWITCH), AUX (AUXILIARY), BFI (BLOWN FUSE INDICATOR), BI (BYPASS ISOLATION BREAKER), BKR (BREAKER), C (CONDUIT), CB (CIRCUIT BREAKER), CCTV (CLOSED CIRCUIT TELEVISION), CGRS (PVC COATED GALVANIZED RIGID STEEL), CKT (CIRCUIT), CL (CENTERLINE), COM (COMMON), CONT (CONTINUOUS), CP (CONTROL PANEL), CPT (CONTROL POWER TRANSFORMER), CR (CONTROL RELAY), CRI (COLOR RENDERING INDEX), CSD (CORD SET), CU (COEFFICIENT OF UTILIZATION), DEB (DIRECT EARTH BURIED), EC (EMPTY OR EMBEDDED CONDUIT), EF (EXHAUST FAN), EG (EQUIPMENT GROUND), EL (ELEVATION), EMT (ELECTRICAL METALLIC TUBING), ETM (ELAPSED TIME METER), FA (FIRE ALARM), FAP (FIRE ALARM PANEL), FC (FAN COIL), FDS (FUUSED DISCONNECT SWITCH), FLR (FLOOR), FOC (FIBER OPTIC CABLE), FS (FLOAT SWITCH), FT (FEET), FVNR (FULL VOLTAGE NON-REVERSING STARTER), FVR (FULL VOLTAGE REVERSING STARTER), GFCI (GROUND FAULT CIRCUIT INTERRUPTER), GND (GROUND), GRS (GALVANIZED RIGID STEEL), HID (HIGH INTENSITY DISCHARGE), HOA (HAND-OFF-AUTO), HP (HORSEPOWER OR HEAT PUMP), HR (HOUR), IG (ISOLATED GROUND), ISP (INDIVIDUALLY SHIELDED PAIR), JB (JUNCTION BOX), KVA (KILOVOLT-AMPERE), KVAR (KILOVOLT-AMPERE, REACTIVE), kW (KILOWATT), LA (LIGHTNING ARRESTER), LLF (LIGHT LOSS FACTOR), LO (LUGS ONLY), LOR (LOCAL-OFF-REMOTE), LV (LOW VOLTAGE), MCB (MAIN CIRCUIT BREAKER), MCC (MOTOR CONTROL CENTER), MCP (MOTOR CIRCUIT PROTECTOR), MFR (MANUFACTURER), MIN (MINIMUM), MLO (MAIN LUGS ONLY), MS (MOTOR STARTER), MTD (MOUNTED), NFDS (NON-FUSED DISCONNECT SWITCH), NL (NIGHT LIGHT), NTS (NOT TO SCALE), OC (ON CENTER), OH (OVERHEAD), OHP (OVERHEAD PRIMARY), OHS (OVERHEAD SECONDARY), OL (OVERLOAD), PB (PUSH BUTTON), PEC (PHOTO ELECTRIC CELL), PF (POWER FACTOR), PL (PILOT LIGHT), PMR (PHASE MONITOR RELAY), PNL (PANEL), PTT (PUSH-TO-TEST), PTZ (PAN-TILT-ZOOM), PVC (SCHEDULE 40 POLYVINYL CONDUIT), RECPT (RECEPTACLE), RM (ROOM), RTS (REFER TO SHEET), RVAT (REDUCED VOLTAGE AUTO-TRANSFORMER STARTER), S (SECOND), SA (SURGE ARRESTER), SDBC (SOFT DRAWN BARE COPPER), SE (SERVICE ENTRANCE), SHT (SHEET), SN (SOLID NEUTRAL), SS (STAINLESS STEEL), STA (STATION), SW (SWITCH), TEL (TELEPHONE), TD (TIME DELAY), TDE (TIME DELAY ON ENERGIZATION), TDD (TIME DELAY ON DE-ENERGIZATION), THD (TOTAL HARMONIC DISTORTION), TYP (TYPICAL), TC (TIME CLOCK), UG (UNDER GROUND), UGE (UNDER GROUND ELECTRIC), UGP (UNDERGROUND PRIMARY), UGS (UNDERGROUND SECONDARY), UH (UNIT HEATER), UTP (UNSHIELDED TWISTED PAIR), V (VOLT), VA (VOLT-AMP), VFD (VARIABLE FREQUENCY DRIVE), VM (VOLT-METER), W (WATT OR WIRE), WH (WEATHER HEAD), WM (WATT METER), WP (WEATHERPROOF), W/ (WITH), XMFR (TRANSFORMER).

EQUIPMENT LINE TYPES

Legend for equipment line types: solid line for PROPOSED OR NEW EQUIPMENT, dashed line for EXISTING EQUIPMENT.

CONTROL SCHEMATIC LEGEND

Table listing control schematic symbols and their descriptions. Includes WIRING WITHIN PANEL, WIRING TO FIELD DEVICE, PUSHBUTTON SWITCH, LIMIT SWITCH CONTACT, RELAY COIL, SOLENOID, TIME DELAY CONTACT, PRESSURE SWITCH, etc.

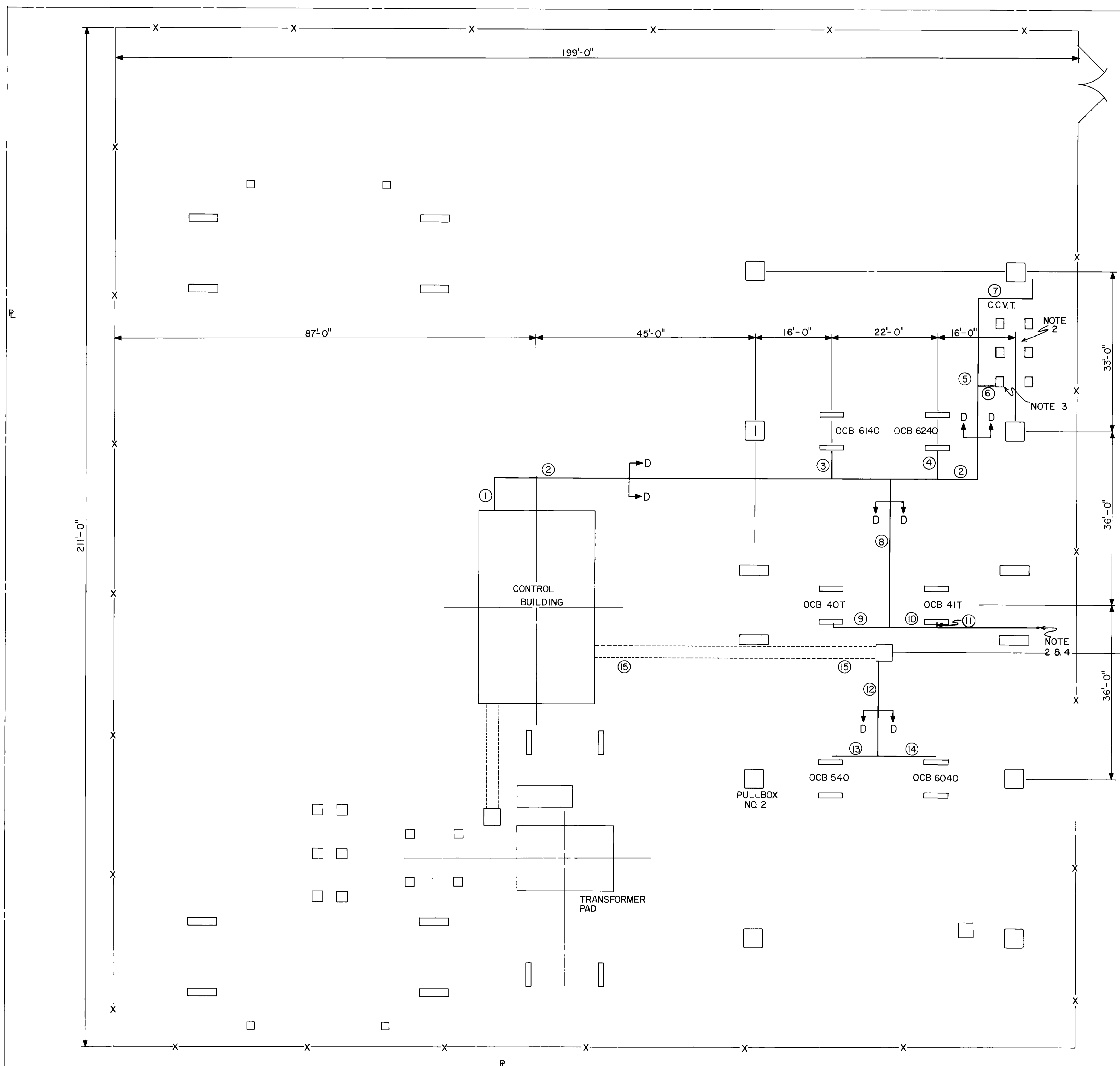
GENERAL NOTES:

1. SOME SYMBOLS OR ABBREVIATIONS MAY APPEAR ON THIS SHEET AND NOT BE UTILIZED ON THE PROJECT.

ISSUED FOR BID

Project information box including GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294, ELECTRICAL LEGEND, SCALE: NONE, DRAWN BY: DJR, ENGR: CH: MW, APPD: BA, DATE: 3/7/2011, and a revision table.

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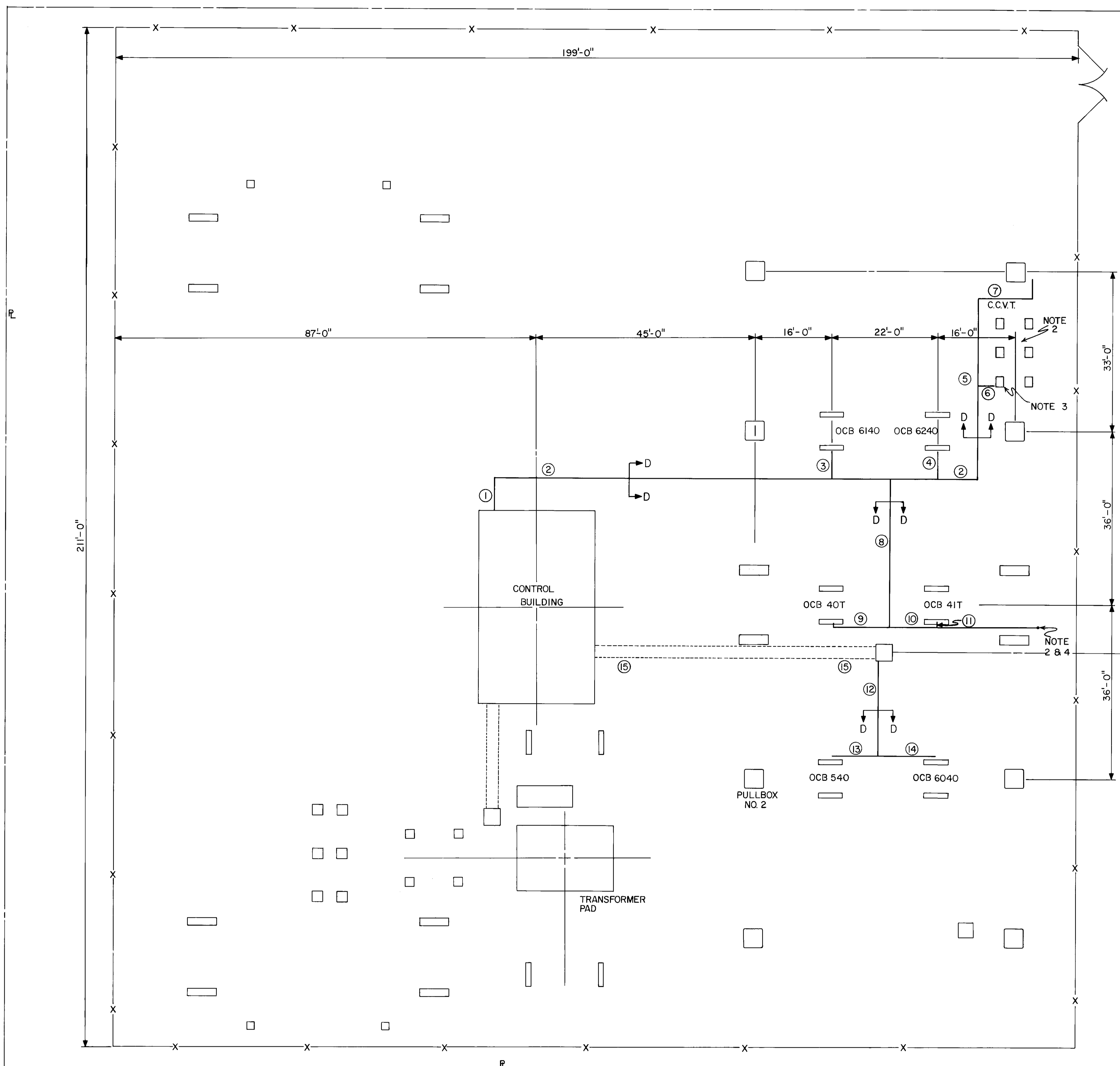
**NOTES**

1. FOR CABLE TRENCH SECTIONS & DETAILS SEE GRDA DWG. D.896
2. INSTALL 1-1/4" CONDUIT BETWEEN CC.V.T.'S
3. INSTALL JUNCTION BOX, INCLUDING ONE 12 POINT TERMINAL BLOCK, ON ØC STRUCTURE ON 69KV C.C.V.T.'S
4. EXTEND CABLE UP STRUCTURE TO CC.V.T. INSTALL JCT. BOX INCLUDING ONE 12 POINT TERM. BLOCK NEAR Ø C
5. LAST NUMBER USED WAS (15)

⊥ FOR CABLE TRENCH RUNNING TO EQUIPMENT HOUSE FOR MICROWAVE TOWER

1985 ADDITION

LOCATION NO. 294		AFTON SWITCHING STATION	
<b>CABLE TRENCH LAYOUT</b>			
<b>GRAND RIVER DAM AUTHORITY</b>			
1	12-17-84	ADD CABLE TRENCH TO MICRO WAVE HOUSE	DATE: 18 OCT. 84
REV	DATE	DESCRIPTION	SIZE
AP			OF
			D 949



**NOTES**

- 1. FOR CABLE TRENCH SECTIONS & DETAILS SEE GRDA DWG. D.896
  - 2. INSTALL 1-1/4" CONDUIT BETWEEN CC.V.T.'S
  - 3. INSTALL JUNCTION BOX, INCLUDING ONE 12 POINT TERMINAL BLOCK, ON ØC STRUCTURE ON 69KV C.C.V.T.'S
  - 4. EXTEND CABLE UP STRUCTURE TO CC.V.T. INSTALL JCT. BOX INCLUDING ONE 12 POINT TERM. BLOCK NEAR Ø C
  - 5. LAST NUMBER USED WAS (15)
- ⊥ FOR CABLE TRENCH RUNNING TO EQUIPMENT HOUSE FOR MICROWAVE TOWER

1985 ADDITION

LOCATION NO. 294		AFTON SWITCHING STATION	
<b>CABLE TRENCH LAYOUT</b>			
<b>GRAND RIVER DAM AUTHORITY</b>			
1	12-17-84	ADD CABLE TRENCH TO MICRO WAVE HOUSE	DATE: 18 OCT. 84
REV	DATE	DESCRIPTION	SIZE
AP	SHEET	OF	949



Afton Substation

S294DE01	BILL OF MATERIALS SHEET 1 OF 4
S294DE02	BILL OF MATERIALS SHEET 2 OF 4
S294DE03	BILL OF MATERIALS SHEET 3 OF 4
S294DE04	BILL OF MATERIALS SHEET 4 OF 4

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SUBSTATION			*PROVIDE MATERIAL AS LISTED, OR EQUIVALENT TO:		GRDA CATALOG NUMBER	SPECIFICATION
ITEM NO.	BOM NO.	QNTY.	DESCRIPTION	*MANUFACTURER	*VENDOR NO.	
1	1	2	CENTER BREAK VEE GOAB DISCONNECT SWITCH 2000A, 161 KV NOMINAL.	CLEAVELAND/PRICE	G04	AMPS: 2,000; KV NOM.: 161; KV MAX.: 170; KV BIL: 750; KA MOM. 120; ANSI TR# 291
2	2	10	VERTICAL BREAK GOAB SWITCH; 2000A, 161 KV NOMINAL	CLEAVELAND/PRICE	C06B033G18	AMPS: 2,000; KV NOM.: 161; KV MAX.: 170; KV BIL: 750; KA MOM. 120; ANSI TR# 291
3	3	10	GOAB SWITCH MANUAL HANDCRANK OPERATOR, WORMGEAR DRIVEN	CLEAVELAND/PRICE	GH-C	MANUAL WORMGEAR OPERATOR WITH 40:1 RATIO.
3A	3A	16	SWITCH OPERATOR GROUNDING PLATFORM, 48"X36", STEEL GRATING, WITH TWO (2) 9/16" HOLES FOR ATTACHING TO GROUNDING CONDUCTOR	CLEAVELAND/PRICE	C110A188H001	GALVANIZED STEEL GRATING
4	4	4	161KV SF6 BREAKER, 3000A	HVB	HS170	AMPS: 3,000; KV MAX.: 170 KV BIL.: 750 KV; RATED SHORT CIRCUIT CURRENT: 40 KA; RATED LOW FREQUENCY WITHSTAND VOLTAGE (60-50HZ): 365; RATED GASS PRESSURE AT 20°C (68°F): 551.6 KPA (80PSIG); CREEPAGE: 142.91" (3630 MM); STRIKE: 52.80" (1341 MM); HEIGHT: 59.06" (1500 MM)
5	5	6	98 KV MCOV ARRESTOR	HUBBELL/OHIO BRASS	217598-5001	LINE VOLTAGE: 161 KV; 8/20 MAXIMU DISCHARGE VOLTAGE @ 1.5 KA: 242 KV; 8/20 MAXIMU DISCHARGE VOLTAGE @ 3 KA: 254; 8/20 MAXIMU DISCHARGE VOLTAGE @ 5 KA: 265; 8/20 MAXIMU DISCHARGE VOLTAGE @ 10 KA: 283; 8/20 MAXIMU DISCHARGE VOLTAGE @ 20 KA: 307 KV; MAXIMUM DISCHARGE VOLTAGE @ 40 KA: 341
6	6	12	CCVT, 161-66.4kV / 115V W/CARRIER ACCESSORY, WITH X & Y WINDINGS.	AREVA	CCV 100/123	TANK DEMENSIONS, INTERIOR: 15.7" X 15.7" X 15.7"; TANK DEMENSIONS, EXTERIOR: 17.9" X 17.9" X 17.9"
7	7	2	WAVE TRAP, BROAD BAND FREQUENCY	AREVA	0.265/800/20-2	AMPS: 800; TOTAL HEIGHT: 40.1"; DIAMETER: 31.1"; ISC (KA)-2S: 20; ISC (KAP): 51
8	8	288	10" SUSPENSION INSULATOR; 20,000 LB. M&E STRENGTH, 10 KV RMS TO GROUND PER BELL ANSI CLASS 52-3	LAPP	8200-70	LEAKAGE DISTANCE: 11.5"; DRY ARCHING DISTANCE: 7.75"; LOW FREQUENCY DRY FLASHOVER: 80 KV; LOW FREQUENCY WET FLASHOVER: 50 KV; IMPULSE FLASHOVER, POSTIVE: 125 KV; IMPULSE FLASHOVER, NEGITIVE: 130 KV; LOW FREQUENCY PUNCTURE VOLTAGE: 110 KV
9	9	90	161KV POST INSULATOR, T.R. 291	LAPP	315291-PA-70	LINE VOLTAGE: 161 KV; IMPULSE FLASHOVER, POSITIVE: 810 KV; LOW FREQUENCY PUNCTURE VOLTAGE: 315 KV
10	10	78	5" BC BUS SUPPORT; ALUMINUM WELDMENT; TUBE TO INSULATOR; 3" IPS	ANDERSON/FARGO	WTH-30-5	LENGTH: 9.375"; TUBE/CONDUCTOR SIZE: 5" IPS; BOLT CIRCLE DIAMETER: 3" BOLT SIZE: 0.625"; 356-T6 CAST ALUMINUM ALLOY BODY, GALVANIZED STEEL MOUNTING HARDWARE, STSL SPRING
11	11	3600'	3" IPS ALUMINUM BUS *	N/A	N/A	* NOTE: USE SCHEDULE 80, 6063-T6 ALUMINUM FOR BUS WORK
12	12	42	TEE/WELDMENT/ALUM/TUBE TO TWO TUBE; 3" IPS TO 3" IPS; ALUMINUM ALLOY ANGLE WELDMENT TEE FOR CONNECTING ALUMINUM TUBING MAIN TO TWO ALUMINUM TUBING TAPS AT 15" (30" TUBE TO TUBE)	ANDERSON/FARGO	WTT2-15-3014	TUBING MAIN TAP IPS/EHIPS: 3"; TUBING TAP IPS/EHIPS: 1-1/2"
13	13	84	TEE/WELDMENT/ALUM/TUBE TO TUBE; 3" IPS TO 3" IPS; ALUMINUM ALLOY ANGLE WELDMENT TEE FOR CONNECTING ALUMINUM TUBING MAIN TO ALUMINUM TUBING TAP AT 15"	ANDERSON/FARGO	WTT-15-3014	TUBING MAIN TAP IPS/EHIPS: 3"; TUBING TAP IPS/EHIPS: 1-1/2"
14	14	12	TEE/WELDMENT/ALUM/TUBE TO TUBE; 3" IPS TO 3" IPS; ALUMINUM WELDMENT STRAIGHT ALLOY TEE FOR CONNECTING ALUMINUM TUBING MAIN TO ALUMINUM TUBING TAP	ANDERSON/FARGO	WTT-3030	TUBING MAIN TAP IPS/EHIPS: 3"; TUBING TAP IPS/EHIPS: 3"
15	15	24	TERMINAL/WELDMENT/ALUM/TUBE TO FLAT/CENTER FORMED; 3" IPS; ALUMINUM ALLOY WELDMENT FOR CONNECTING ALUMINUM TUBING TO ALUMINUM OR COPPER FLAT PAD, NEMA 4 HOLE PAD	ANDERSON/FARGO	WSTF-30-D-CF	ALUMINUM CONDUCTOR SIZE: 3"
16	16	150	TERMINAL/COMPRESSION/ALUM/CABLE TO FLAT; 795 (26/7) ACSR TO NEMA 4 HOLE PAD	ANDERSON/FARGO	ACF-1000-C	CONVENTIONAL COMPRESSION: 1.092-1.196"; ACSR: 795 (24/7) (26/7) (54/7)
16a	16a	276	TERMINAL/WELDMENT/ALUM/CABLE (X2)TO FLAT; 556.5 (18/1) ACSR TO NEMA 4 HOLE PAD	SEFCOR	WFC2-24-4B	WELDMENT, 2 CABLES TO FLAT; ACSR 556.5 (18/1)
17	17	430	BOLT SET/STAINLESS STEEL/ (4) 1/2" X 2 1/2"	N/A	N/A	
17a	17a	24	STAINLESS STEEL BOLT, NUT, LOCK WASHER, 2-FLATS	COOPER INDUSTRIES	40717-5S	FOR ARRESTOR/SPACER PAD CONNECTION
18	18	16	TEE-TAP/COMPRESSION/ALUM/CABLE TO PAD; 795 (26/7) ACSR TO NEMA 4 HOLE PAD	ANDERSON/FARGO	2112	O.D.: 1.045-1.140"; AAC SIZE KCMIL: 874.5, 900, 954; ACSR SIZE KCMIL: 715.5 (26/7) (30/19), 795(24/7) (26/7) (45/7), 795 (54/7) (30/19) 900 (45/7)
18a	18a	12	TEE-TAP/COMPRESSION/ALUM/CABLE TO PAD:556.5 (18/1) ACSR TO NEMA 4 HOLE PAD	ANDERSON/FARGO	2110	O.D.: 0.856-0.950 ACSR SIZE KCMIL: 556.5 (18/1)
18b	18b	12	ALUM. NEMA 4-HOLE SPACER, 3"X3"X3/8" W/ 9/16" HOLES	COOPER INDUSTRIES	40640	ALUM. NEMA 4-HOLE SPACER-3/8" THICK
19	19	21	TERMINAL/JUMPER/ALUM/COMPRESSION TO TWO HOLE PAD; 4/0 PENGUIN TO NEMA 2 HOLE PAD	ANDERSON/FARGO	JTS07	O.D.: 0.595-.0880"; AAC SIZE KCMIL: 300, 336.4, 350; ACSR SIZE KCMIL: 266.8 (18/1) (6/7 (26/7), 300(26/7)
20	20	30	DEADEND/BOLTED/QUADRANT STRAIN CLAMP/ALUM; 795 (26/7) ACSR (SOCKET TYPE)	ANDERSON/FARGO	SD-112-S	CLAMPING RANGE: .50-1.20"; ULTIMATE BODY STRENGTH: 30,000 LBS.
21	21	10	DEADEND/BOLTED/QUADRANT STRAIN CLAMP/DUCTILE IRON: 3/8" E.H.S.; SOCKET TYPE	ANDERSON/FARGO	SWDE-55-C	CLAMPING RANGE: .22-.55"; ULTIMATE BODY STRENGTH: 18,000 LBS.
22	22	144	END PLUG/WELDMENT/ALUM; 3" IPS/SCH80, 3.5" O.D.	ANDERSON/FARGO	WEBH-30	3"IPS/SCH80
23	23	12	BUS SUPPORT/ALUM/CABLE TO INSULATOR; 795 (26/7) ACSR	ANDERSON/FARGO	ACS-13-5	ACC: 600-1250 MCM; ACSR: 556.5-1113
24	24	18	Y-CLEVIS BALL/HOT LINE/FORGED STEEL; ULTIMATE STRENGTH: 30,000 LB.	ANDERSON/FARGO	HYBC-30	ULTIMATE BODY STRENGTH: 30,000 LBS.
25	25	6	BALL EYE/FORGED STEEL; ULTIMATE STRENGTH: 30,000 LB.	ANDERSON/FARGO	BE-30	ULTIMATE BODY STRENGTH: 30,000 LBS.
26	26	116	TEE/WELDMENT/ALUM/TUBE TO FLAT; 3" IPS; NEMA 4 HOLE PAD	ANDERSON/FARGO	WTTFR-30-60-D	ALUMINUM CONDUCTOR RANGE IPS/EHIPS: 3-6
27	27	50	COUPLER/WELDMENT/ALUM/TUBE TO TUBE; 3" IPS TO 3" IPS	ANDERSON/FARGO	WCI-3030	LENGTH: 18"; TUBE/CONDUCTOR SIZE: 3" IPS
28	28	12	TERMINAL/WELDMENT/ALUM/TUBE TO FLAT; 3" IPS; NEMA 4 HOLE PAD	ANDERSON/FARGO	WSTF30D	TUBE/CONDUCTOR SIZE: 3" IPS
29	29	36	TERMINAL/COMPRESSION/ALUMINUM/CABLE TO FLAT; 4/0 PENGUIN TO NEMA 2 HOLE PAD	ANDERSON/FARGO	ACF-4/0-B	5.875" LONG
30	30	550'	1 1/2" IPS ALUMINUM BUS	N/A	N/A	* NOTE: USE SCHEDULE 80, 6063-T6 ALUMINUM FOR BUS WORK
31	31	114	3" BUS SUPPORT/ALUMINUM WELDMENT; 3" BOLT CIRCLE DIA.	ANDERSON/FARGO	WTH303	LENGTH: 6.75"; TUBE/CONDUCTOR SIZE: 3" IPS; BOLT CIRCLE DIAMETER: 3" BOLT SIZE: 0.5"; 356-T6 CAST ALUMINUM ALLOY BODY, GALVANIZED STEEL MOUNTING HARDWARE, STSL SPRING
32	32	120	69KV POST INSULATOR; T.R. 216	LAPP	315216-70	LENGTH: 30"; BOLT CIRCLE DIAMETER: 3"; BOLT SIZE: 1/2-13; VOLTAGE CLASS: 69 KV; BIL: 350 KV; IMPULSE: 390 KV; COMPR.: 25,000 LB; TORSION: 15,000 LB; CANTILEVER: 1,500 LB; TENSILE 16,000 LB; LEAKAGE: 72"; ANSI TR: TR216; DIAMETER: 7.84"
33	33	11	69KV SF6 BREAKER; 2000A	AREVA	CX05771	AMPS: 2,000; RATED SHORT-CIRCUIT CURRENT: 31.5 KA; PATED GASS PRESSURE AT 20°C (68°F): 66.7 PSIG (LOW PRESSURE ALARM 52.2 PSIG MINIMUM PRESSURE 47.9PSIG)
34	34	72	69KV HOOKSTICK SWITCH; 2000A	CLEAVELAND/PRICE	G18	NOM. KV: 69; MAX. KV: 72.5; BIL KV: 350; AMPS: 2000; MOM. KA: 100
35	35	23	CCVT, 3-PHASE, 40.25KV-115/67V, 350/600.1, WITH X & Y WINDINGS.	AREVA	CCV 72.5	TANK DEMENSIONS, INTERIOR: 15.7" X 15.7" X 15.7"; TANK DEMENSIONS, EXTERIOR: 17.9" X 17.9" X 17.9"
36	36	15	42KV MCOV ARRESTOR; STATION CLASS	HUBBELL/OHIO BRASS	2194525001	5 MICRO SECOND 10 KA IR KV: 135; 500 A SWITCHING SURGE IR KV: 100; MAXIMUM 8/20 DISCHARGE VOLTAGE(@ 1.5 KA: 107 KV; @ 3.0 KA: 112 KV; @ 5 KA: 117 KV; @ 10 KA: 125 KV; @ 20 KA: 136 KV; @ 40 KA: 151 KA)
37	37	2	69KV VERTICAL BREAK GOAB SWITCH; 2000A	CLEAVELAND/PRICE	G24	NOM. KV: 69; MAX. KV: 72.5; BIL KV: 350; AMPS: 2000; MOM. KA: 100

**REFERENCE DRAWINGS**

S294PE15 PARTS LIST 161KV EQUIPMENT PLAN VIEW  
 S294PE16 PARTS LIST 69KV EQUIPMENT PLAN VIEW  
 S294PE17 161KV ELEVATION VIEW PARTS LIST VIEW A  
 S294PE18 161KV ELEVATION VIEW PARTS LIST VIEW B  
 S294PE19 161KV ELEVATION VIEW PARTS LIST VIEW C  
 S294PE20 161KV ELEVATION VIEW PARTS LIST VIEW D  
 S294PE21 161KV ELEVATION VIEW PARTS LIST VIEW E  
 S294PE22 161KV ELEVATION VIEW PARTS LIST VIEW F1 & F2  
 S294PE23 161KV ELEVATION VIEW PARTS LIST VIEW G1 & G2  
 S294PE24 69W ELEVATION VIEW PARTS LIST VIEW H  
 S294PE25 69W ELEVATION VIEW PARTS LIST VIEW J  
 S294PE26 69W ELEVATION VIEW PARTS LIST VIEW K  
 S294PE27 69W ELEVATION VIEW PARTS LIST VIEW L  
 S294PE28 69W ELEVATION VIEW PARTS LIST VIEW M  
 S294PE30 FENCE DETAILS  
 S294PG20 GROUNDING PLAN  
 S294PG21 GROUNDING DETAILS

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA 161/69kv			
BILL OF MATERIALS SHEET 1 OF 4			
SCALE: NONE	DRAWN BY: BDC	ENGR:	APPD: BA
		CH: MW	DATE: 3/7/2011
		DRAWING No. S249DE01	REV. 0

0	5/29/12	ISSUED FOR BID	AS	BA
REV	DATE	REVISION DESCRIPTION	DFT	ENG

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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Last\_plotted\_by: Shults, Ariene Plot\_Style: Garver Standard Halftone Scale: 1:96 Plot\_Date: 5/29/2012 10:57 AM Plotter\_used: DWG To PDF.pc3

38	38	6	TERMINAL/COMPRESSION/CABLE TO FLAT; 1/0 ACSR TO NEMA 4 HOLE PAD	ANDERSON/FARGO	CCLS-398-C		LENGTH: 6.5"; TUBE/CONDUCTOR SIZE: #1 TO 1/0 ACSR; CAST ALUMINUM CABLE TO FLAT TERMINAL WITH NEMA 4-HOLE PAD - 3" WIDE BY 7/16" THICK
39	39	6	PARALLEL CRIMP CONNECTOR; 1/0 ACSR TO 1/0 ACSR	BURNDY	YC25A25		RUN(ALUMINUM: 6 SOL. - 4 STR.; ACSR, 621, 5005: 1/0); TAP(ALUMINUM: 6 SOL. AND STR.; ACSR, 621, 5005: N/A)
40	40	6	15KV POST INSULATOR; T.R. 205	LAPP	315205-70		LEAKAGE DISTANCE: 15.5"; CANTILEVER STRENGTH, UPRIGHT: 2000 LB.; CANTILEVER STRENGTH, UNDERHUNG: 2000; TENSILE: 8500 LB; TORSION: 7000; COMPRESSION: 10000; VOLTAGE CALSS: 15 KV; IMPULSE FLASHOVER, POSITIVE: 125 KV; LOW FREQUENCY WITHSTAND, 10 SEC. WET: 45 KV; IMPULSE WITHSTAND: 110 KV
41	41	6	BUS SUPPORT/ALUM/CABLE TO INSULATOR; 1/0 ACSR	ANDERSON/FARGO	ACS63		LENGTH: 3"; TUBE/CONDUCTOR SIZE: #4 TO 4/0ACSR; BOLT CIRCLE DIA.: 3"; 356-T6 CAST ALUMINUM ALLOY BODY, GALVANIZED STEEL MOUNTING HARDWARE, ALUMINUM ALLOY CLAMPING MATEIAL
42	42	6	15KV FUSED CUT-OUT W/ #1/0 ACSR EYE-BOLT CONNECTOR	S&C	98072-M		ANSI: 15; THREE PHASE MAX.: 15 KV; PHASE TO NEUTRAL MAX.: 8.7 KV; BIL 125 KV; MAX. AMPS, 20 RMS; LEAKAGE: 11"
43	43	6	TERMINATION/6-SKIRT/OUTDOOR; 15 KV; #1/0 ACSR	3M	5681		O.D.: .637-1.12"; CONDUCTOR RANGE:(15 KV: #2 - 4/0),(25 KV: #2 - 2/0)
44	44	6	STEM CONNECTOR, #1/0 ACSR	3M	SC0010		CONDUCTOR SIZE: 1/0
45a	45a	650'	FENCE GROUNDING, CONDUCTOR, #2 CCS 40% DSA	ACA	4-THOUGHT		#2 40% DSA
45b	45b	2000'	EQUIPMENT GROUNDING CONDUCTOR, 19#9 CCS 40% DSA	ACA	4-THOUGHT		19 # 9 40% DSA
46	46	80	GROUNDING/TWO HOLE COMPRESSION LUG; 4/0 AWG; FLAT STUD HOLE: 3/8"; STUD HOLE SPACING: 1-3/4"	BURNDY	YA282NTC38		COPPER CONDUCTOR RANGE (CABLE: 4/0 AWG); CABLE DIA.: 3/8"; STUD HOLE SIZE: 1-3/4"
47	47	20	BRONZE GROUND CLAMP/TWO CABLES TO FLAT: #4/0 AWG (OR 19 #9 CCS)	ANDERSON/FARGO	GC-143A-G2		COPPER CONDUCTOR RANGE (CABLE: #6 SOL-2/0 STR)
48	48	430	BRONZE GROUND CLAMP/CABLE TO FLAT; #4/0 AWG (OR 19#9 CCS)	ANDERSON/FARGO	GC-141A-G2		COPPER CONDUCTOR RANGE (CABLE: #6 SOL-2/0 STR; CABLE DIA.: .162-.419")
49	49	25	FLEXIBLE GROUNDING BRAID/COPPER; 200 A RATING KCML 168.8	ANDERSON/FARGO	GB-200-5B		2' LONG, AMPS: 200; CIRCULAR MILS OR BRAIDS: 168,840
50a	50a	5	GROUND CLAMP/BRONZE/FLEXIBLE BRAID TO PIPE; 4" O.D.	ANDERSON/FARGO	GC-110-142C		*SIZE AS REQUIRED; FLEXIBLE BRAID TO TUBE CLAMP.
50b	50b	40	GROUND CLAMP/BRONZE/FLEXIBLE BRAID TO PIPE; 2" O.D.	ANDERSON/FARGO	GC-110-61C		*SIZE AS REQUIRED; FLEXIBLE BRAID TO TUBE CLAMP.
51a	51a	50 EA	GROUND CLAMP/BRONZE/CABLE TO PIPE; #4/0 AWG (OR 19#9 CCS) 2.5" O.D.	ANDERSON/FARGO	GC-111-7C		
51b	51b	10 EA	GROUND CLAMP/BRONZE/CABLE TO PIPE; #4/0 AWG (OR 19#9 CCS) 3" O.D.	ANDERSON/FARGO	GC-111-8C		
51c	51c	100 EA	GROUND CLAMP/BRONZE/CABLE TO PIPE; #4/0 AWG (OR 19#9 CCS) #2 TO 2" O.D.	ANDERSON/FARGO	GC-111-6B		
52	52	4	CAST GROUND PLATE CONNECTIONS	ERICO	B162-2Q		*FIT AS REQUIRED; 4/0 COPPER STUD FOR CONDUCTOR RANGE: CABLE:14 AWG SOL MIN. TO #4/0 STR MAX. FOR TRANSFORMER PADS
53	53	2	LINE TUNER UNIT (LTU)	AREVA	45XX1121		LINE TUNER
54		12500'	GROUND GRID CONDUCTOR; 4/0 COPPER				4/0 COPPER, ANNEALED SOFT DRAWN
55		10	COPPER CLAD STEEL GROUND RODS				3/4" X 10'
56		250 CONNECTIONS	GROUND GRID 4-WAY CONNECTION POINTS				
			4-WAY MOLD	ERICO	XBQ2P2P		*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
			250 WELD METAL PER CONNECTION	ERICO			*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
57		260 CONNECTIONS	GROUND GRID 3-WAY 4/0 TO 4/0 CONNECTION POINTS				
			3-WAY MOLD	ERICO	TAC-2Q2Q		*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
			250 WELD METAL PER CONNECTION	ERICO			*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
58		50 CONNECTIONS	GROUND GRID TO FENCE 3-WAY 19#9 TO 4/0 CONNECTION POINTS -FENCE				
			3-WAY MOLD 4/0 RUN WITH 19#9 TAP	ERICO	TAC-2Q9F*		*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
			300 WELD METAL PER CONNECTION	ERICO			*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
59		170 CONNECTIONS	GROUND GRID 3-WAY 19#9 TO 4/0 CONNECTION POINTS - EQUIPMENT GROUNDS				
			3-WAY MOLD 4/0 RUN WITH 19#9 TAP	ERICO	TAC-2Q9F*		*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
			300 WELD METAL PER CONNECTION	ERICO			*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
60		10 CONNECTIONS	GROUND ROD TO GROUND GRID CONNECTION POINTS				
			GY CONNECTION FOR GROUND ROD	ERICO	GTC-182Q		*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
			150 WELD METAL PER CONNECTION	ERICO			*VERIFY PART NUMBER WITH ERICO OR THERMOWELD BRAND
61a		150	SPLIT BOLT CONNECTIONS FOR FENCE GROUNDING CONDUCTOR #2 CCS TO BARBED WIRE	BURNDY	KS22		
61b		60	SPLIT BOLT CONNECTIONS FOR FENCE GROUNDING CONDUCTOR #4/0 TO #2 CCS TO BARBED WIRE	BURNDY	KS29		
62		20	CROSS CLAMP CONNECTOR; 1 STR. TO 4/0 STR.	BURNDY	QPX2828-Y		FOR TRENCH GROUND TO GRID CONNECTION
63		24500'	MULTI-CONDUCTOR CABLE, 4 CONDUCTOR #10 AWG				THWN-2, TPE JACKET, ICEA COLOR CODE K1
64		6500'	MULTI-CONDUCTOR CABLE, 7 CONDUCTOR #12 AWG				THWN-2, TPE JACKET, ICEA COLOR CODE K1
65		6000'	MULTI-CONDUCTOR CABLE, 12 CONDUCTOR #12 AWG				THWN-2, TPE JACKET, ICEA COLOR CODE K1
66		1200'	SINGLE CONDUCTOR #1 AWG	KERITE	101C15-33200		UNDERGROUND DISTRIBUTION CABLE (URD,UD) CONCENTRIC NEUTRAL, 15KV COPPER (UL) - 90' C RATING, ONE-THIRD NEUTRAL, 133% INSULATION
67		1200'	SINGLE CONDUCTOR 250 MCM				THWN-2, COLOR BLACK STRANDED COPPER
68		0	NOT USED				
69		350'	SINGLE CONDUCTOR #4 AWG				THWN-2, COLOR BLACK STRANDED COPPER
70		100'	SINGLE CONDUCTOR #3/0 AWG				THWN-2, COLOR BLACK STRANDED COPPER
71		2000'	MULTI-CONDUCTOR CABLE, 4 CONDUCTOR #12 AWG				THWN-2, TPE JACKET, ICEA COLOR CODE K1
72		4500'	MULTI-CONDUCTOR CABLE, 4 CONDUCTOR #8 AWG				THWN-2, TPE JACKET, ICEA COLOR CODE K1
73		150'	SINGLE CONDUCTOR #3 AWG				THWN-2, COLOR BLACK STRANDED COPPER
74		150'	SINGLE CONDUCTOR #8 AWG				THWN-2, COLOR BLACK STRANDED COPPER
75		200'	SINGLE CONDUCTOR #6 AWG				THWN-2, COLOR BLACK STRANDED COPPER
76		5400'	MULTI-CONDUCTOR CABLE, 2 CONDUCTOR #12 AWG				THWN-2, TPE JACKET, ICEA COLOR CODE K1
77		150'	MULTI-CONDUCTOR CABLE, 2 CONDUCTOR #3/0 AWG				THWN-2, TPE JACKET, ICEA COLOR CODE K1
78		2000'	SINGLE CONDUCTOR #12 AWG				THWN-2, COLOR BLACK STRANDED COPPER
79		2000'	SINGLE CONDUCTOR #12 AWG				THWN-2, COLOR WHITE STRANDED COPPER
80		2000'	SINGLE CONDUCTOR #12 AWG				THWN-2, COLOR GREEN STRANDED COPPER

**REFERENCE DRAWINGS**

S294PE15 PARTS LIST 161KV EQUIPMENT PLAN VIEW  
S294PE16 PARTS LIST 69KV EQUIPMENT PLAN VIEW  
S294PE17 161KV ELEVATION VIEW PARTS LIST VIEW A  
S294PE18 161KV ELEVATION VIEW PARTS LIST VIEW B  
S294PE19 161KV ELEVATION VIEW PARTS LIST VIEW C  
S294PE20 161KV ELEVATION VIEW PARTS LIST VIEW D  
S294PE21 161KV ELEVATION VIEW PARTS LIST VIEW E  
S294PE22 161KV ELEVATION VIEW PARTS LIST VIEW F1 & F2  
S294PE23 161KV ELEVATION VIEW PARTS LIST VIEW G1 & G2  
S294PE24 69KV ELEVATION VIEW PARTS LIST VIEW H  
S294PE25 69KV ELEVATION VIEW PARTS LIST VIEW J  
S294PE26 69KV ELEVATION VIEW PARTS LIST VIEW K  
S294PE27 69KV ELEVATION VIEW PARTS LIST VIEW L  
S294PE28 69KV ELEVATION VIEW PARTS LIST VIEW M  
S294PE30 FENCE DETAILS  
S294PG20 GROUNDING PLAN  
S294PG21 GROUNDING DETAILS

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV  
BILL OF MATERIALS  
SHEET 2 OF 4

SCALE: NONE DRAWN BY: BDC ENGR: APPD: BA  
CH: MW DATE: 3/7/2011

0	5/29/12	ISSUED FOR BID	AS	BA
		REVISION DESCRIPTION	DFT	ENG
				DRAWING No. S249DE02
				REV. 0

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Last Plotted by: Shults, Arlene Plot Style: Monochrome.ctb Plot Scale: 1:96 Plot Date: 5/29/2012 9:52 AM Plotter Used: DWG To PDF.pc3

MISCELLANEOUS						
81	25	45" COUPLER/WELDMENT/ALUM/TUBE TO TUBE 45" TUBE/CONDUCTOR; 3" IPS	ANDERSON/FARGO	WLH-45-3030		45" TUBE/CONDUCTOR SIZE: 3" IPS/SCH80
CONTROL HOUSE						
82	2	CUSTOM CABLE TRAY RISER	TRENWA	CUSTOM		PER DRAWINGS
83	4	3-WAY CABLE TRAY T	REDIRAIL	H15AR-36-90-VT-12		HEIGHT 5", ALUMINUM LADDER, WIDTH 36", ANGLE 90°, VERTICAL TEE, RADIUS 12"
84	2	10 FT CABLE TRAY SECTION, HEIGHT: 5", WIDTH: 36"	REDIRAIL	H15AR-BLANK-06-36-10		HEIGHT 5", ALUMINUM LADDER, WIDTH 36", LADDER RUNGS ROUND, RUNG SPACING 6", SECTION LENGTH 10'
85	3	12FT CABLE TRAY SECTION, HEIGHT: 5", WIDTH: 36"	REDIRAIL	H15AR-BLANK-06-36-12		HEIGHT 5", ALUMINUM LADDER, WIDTH 36", LADDER RUNGS ROUND, RUNG SPACING 6", SECTION LENGTH 12'
86	LOT	CABLE TRAY HARDWARE	REDIRAIL	REDIRAIL ACCESSORIES		LOT OF NUTS AND BOLTS, HANGER RODS, AND HANGER ROD HARDWARE
87	13	CRIMP CONNECTOR	BURNDY	#YGH29C26		COPPER CABLE TAP CONNECTOR RANGE 3/0 STR. . 2/0 STR.
PANELS						
88	1	MAIN AC CIRCUIT BREAKER PANEL BOARD A: SERVICE ENTRANCE RATED AC, 240/120V, 3Ø, 4 WIRE, 400A MCB NEMA 1 ENCLOSURE, TOP FEED, WITH 2-200AMP/3P BRANCH BREAKERS AND PREPARED SPACES FOR 8 ADDITIONAL 3P BREAKERS; MINIMUM 22KAL; B PHASE HIGH LEG; COPPER BUS, TIN PLATED; ALUM GROUND BAR	SQUARE D	I-LINE TYPE HCN, VERTICAL MCB, WITH 400A LA MAIN, 2-200A/3P QD BRANCH, 8-20/3P FA PREPARED SPACES		
89	1	AC PANEL BOARD B: 240V, 3Ø, 3 WIRE, 200A MCB NEMA 1 ENCLOSURE, TOP FEED, WITH 42 20A/1P BRANCH BREAKERS, MINIMUM 10KAIC; COPPER BUS, TIN PLATED; ALUM GROUND BAR	SQUARE D	NQ PANEL BOARD, 42 CIRCUIT.		
89a	1	AC PANEL BOARD C: 240/120V, 1Ø, 3 WIRE, 200A MCB NEMA 1 ENCLOSURE, TOP FEED, WITH 42 20A/1P BRANCH BREAKERS, MINIMUM 10KAIC; COPPER BUS, TIN PLATED; ALUM GROUND BAR	SQUARE D	NQ PANEL BOARD, 42 CIRCUIT.		
90	3	DC PANEL BOARDS D,E,F: 125/250V DC, 3W, 200A MCB, 10KA RMS SYM SCCR, 10KAC BREAKERS, NEMA 12 ENCLOSURE, TOP FEED, 225 AMP BUS, WITH 20 - 30A/2P THERMAL-MAGNETIC TRIP BREAKERS, DC RATED	SQUARE D	I-LINE TYPE HCN, VERTICAL MCB, WITH 200A JD MAIN		
91	1	HOUR REPEAT CYCLE TIMER	SSAC	#TRDU120A1		TIME DELAY RELAY, 120VAC, 8-PIN DPDT OUTPUT, 10A MAX OUTPUT, NINE-FUNCTION, 0.1SEC-1.705HR
92	1	HAND-OFF-AUTO SWITCH	ALLEN BRADLEY	#800T-J2A		3-POSITION SELECTOR SWITCH, MAINTAINED POSITION, STANDARD OPERATOR, NON-ILLUMINATED, 2-NO CIRCUITS FOR HOA.
93	1	PPT PILOT LIGHT	ALLEN BRADLEY	#800T-PT16G		INDICATING LIGHT: LIGHT TYPE - PRESS-TEST INDICATING LIGHT; SIZE - 30.5 MM; NEMA - 4.13; LAMP TYPE - INCANDESCENT; POWER SOURCE - TRANSFORMER; VOLTAGE - 120VAC; LENS STYLE/SIZE - STANDARD; LENS MATERIAL - PLASTIC; COLOR - GREEN; LAMP NUMBER - 755; BEZEL - METAL; ADDITIONAL INFORMATION - PUSH-TO-TEST CONTACT BLOCK; STANDARD 1NO-1NC; MANUFACTURER SERIES - 800T
94	1	AUTOMATIC TRANSFER SWITCH, 400A, 35 KAIC 3 PH, 4W	ASCO	ASCO SERIES 300, WITH DUAL INPUT SOURCE CIRCUIT BREAKER		ATS, 400A, 3PH, 4W, 150A GROUND BUS, FULL NEUTRAL BUS, UL 1008 CERTIFIED, RATED FOR SERVICE ENTRANCE, 35KAIC, DUAL SOURCE CIRCUIT BREAKERS 400AF/400AT, THERMAL MAGNETIC, WITH TRIP SETTINGS.
LIGHTING						
95	6	OVERHEAD LIGHTS (MATCHING EXISTING)		NONE		MATCH EXISTING OR EQUAL
MISCELLANEOUS						
96	1	BATTERY CHARGING EXHAUST FAN	GRAINGER	1BLH6		EXHAUST FAN, CORROSION RESISTANT SHUTTER MOUNT, PROPELLER DIA 10 IN, CFM @ 0.000-IN SP 524, @ 0.125-IN SP 379, SONES @ 0.000-IN SP @ 5 FT 12.3, VOLTAGE 115, 60 HZ, SINGLE PHASE, FULL LOAD AMPS 1.9, MOTOR HP 1/20, MOTOR TYPE SHADED POLE, MOTOR ENCLOSURE TOTALLY ENCLOSED AIR-OVER, HEIGHT 13 IN, WIDTH 13 IN, MAX DEPTH 13 1/2 IN, SQ OPENING REQUIRED 10 1/2 IN, FRAME MATERIAL FIBERGLASS, PROPELLER MATERIAL FIBERGLASS REINFORCED POLYPROPYLENE, NUMBER OF BLADES 4
97	1	MOTORIZED DAMPER	GRAINGER	#3HHP3		MOTORIZED DAMPER, SINGLE PANEL, POWER OPEN, SPRING RETURN, VOLTAGE 120/240, 60 HZ, SINGLE PHASE, FOR FAN DIA 12 IN, SQ OPENING REQUIRED 13 IN
98	1	LOUVER	GRAINGER	#4F421		INTAKE LOUVER, FIXED HEIGHT, ADJUSTABLE WIDTH, MAX EXHAUST 875 CFM, MAX INTAKE 616 CFM, INSIDE HEIGHT 14 IN, OUTSIDE HEIGHT 18 IN, INSIDE WIDTH 12 TO 18 IN, OUTSIDE WIDTH 16 TO 24 IN, MIN WALL OPENING 14H X 12W IN, FLANGE WIDTH 2 IN, MOUNTING HOLE SIZE 9/32 X 1/2 IN, FREE AREA 0.36 TO 0.55 SQUARE-FT, MAX VELOCITY 3000 FPM, CONSTRUCTION MATERIAL G90 GALVANIZED STEEL, FOR USE WITH INTAKE OR EXHAUST APPLICATIONS, INCLUDES BIRD SCREEN AND SCREEN FASTENERS
BATTERY RACKS						
99	1	DC BATTERY CHARGER	C&D TECHNOLOGIES	ARE-M13035		DC OUTPUT 132V @ 35A, RIPPLE ON BATTERY 30 MV MS, OFF BATTERY 100MV MS, DC CIRCUIT BREAKER 50AMP, TERMINAL BLOCK CAPACITY 2/0-14AWG.
100	1	36" HIGH FLOOR STAND FOR CHARGER	C&D TECHNOLOGIES	OPTIONAL STAND FOR MODEL ARE-M13035 CHARGER		36" HIGH FLOOR STAND, SUPPLY WITH CHARGER
101	4	BATTERY RACKS	C&D TECHNOLOGIES	802-05		3-TIER, 5' WIDE
102	48	INTER-UNIT BATTERY JUMPERS	C&D TECHNOLOGIES	PK02662		FACTORY MADE INTER-UNIT JUMPERS
103	8	TERMINAL PLATES	C&D TECHNOLOGIES	PT00496		3-HOLE FLAG TERMINAL FOR CONNECTING MULTIPLE CABLES TO BATTERY RACKS
104	60	BATTERY	C&D TECHNOLOGIES	4JC-100		MULTI PURPOSE FLOODED LEAD-CALCIUM, 4 CELLS IN A 4 CELL JAR, 8V, 100AH (8HR RATE)
105	4	OIL CONTAINMENT FOR BATTERY RACKS	C&D TECHNOLOGIES	SP26064L		STANDARD SPILL CONTAINMENT/ABSORPTION TO FIT SUPPLIED BATTERY RACKS
106	1	BATTERY CHARGING HYDROGEN SENSOR (CEILING MOUNT)	SBS	HGDI-DR		HYDROGEN GAS DETECTOR (110/220VAC, 50/60HZ) WITH CONTACTS FOR 1% AND 2% DETECTION LEVELS
107	8	#2AWG WIRE JUMPERS BETWEEN TIERS	C&D TECHNOLOGIES	RA02177-40		#2 AWG CABLE, 40" LONG WITH LUGS
108	4	4/0 BARE COPPER CRIMP CONNECTOR	BURNDY	#YGH29C26		COMMERCIAL COPPER CABLE RANGE 3/0 STR. . 2/0 STR.
TRANSFORMERS						
109	2	150 KVA TRANSFORMERS	GE	PROLEC		THREE PHASE PAD MOUNTED TRANSFORMER, OIL FILLED, 150KVA, 13,200V-3Ø DELTA PRIMARY , 120/240V 3Ø MID-TAP GROUNDED SECONDARY, WITH TWO (2) 2.5% TAPS ABOVE AND BELOW.
110	2	TRANSFORMER PADS	NONE	NONE		SIZE PAD FOR TRANSFORMER SUPPLIED.

**REFERENCE DRAWINGS**

- S204PE15 PARTS LIST 161KV EQUIPMENT PLAN VIEW
- S204PE16 PARTS LIST 69KV EQUIPMENT PLAN VIEW
- S204PE17 161KV ELEVATION VIEW PARTS LIST VIEW A
- S204PE18 161KV ELEVATION VIEW PARTS LIST VIEW B
- S204PE19 161KV ELEVATION VIEW PARTS LIST VIEW C
- S204PE20 161KV ELEVATION VIEW PARTS LIST VIEW D
- S204PE21 161KV ELEVATION VIEW PARTS LIST VIEW E
- S204PE22 161KV ELEVATION VIEW PARTS LIST VIEW F1 & F2
- S204PE23 161KV ELEVATION VIEW PARTS LIST VIEW G1 & G2
- S204PE24 69KV ELEVATION VIEW PARTS LIST VIEW H
- S204PE25 69KV ELEVATION VIEW PARTS LIST VIEW J
- S204PE26 69KV ELEVATION VIEW PARTS LIST VIEW K
- S204PE27 69KV ELEVATION VIEW PARTS LIST VIEW L
- S204PE28 69KV ELEVATION VIEW PARTS LIST VIEW M
- S204PE30 FENCE DETAILS
- S204PG20 GROUNDING PLAN
- S204PG21 GROUNDING DETAILS

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>BILL OF MATERIALS</b> <b>SHEET 3 OF 4</b>			
SCALE: NONE	DRAWN BY: BDC	ENGR:	APPD: BA
0	5/29/12	CH: MW	DATE: 3/7/2011
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S249DE03</b>	REV. <b>0</b>

REV	DATE	ISSUED FOR BID	AS	BA
REV	DATE	REVISION DESCRIPTION	DFT	ENG


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 Last\_plotted\_by: Shults, Arlene Plot\_Style: Garver Standard Full.ctb Plot\_Scale: 1:96 Plot\_Date: 5/29/2012 9:52 AM Plotter\_used: DWG To PDF.pc3

108		4	4/0 BARE COPPER CRIMP CONNECTOR	BURNDY	#YGHC29C26		COMMERCIAL COPPER CABLE RANGE 3/0 STR. . 2/0 STR.
TRANSFORMERS							
109		2	150 KVA TRANSFORMERS	GE	PROLEC		THREE PHASE PAD MOUNTED TRANSFORMER, OIL FILLED, 150KVA, 13,200V-3Ø DELTA PRIMARY , 120/240V 3Ø MID-TAP GROUNDED SECONDARY, WITH TWO (2) 2.5% TAPS ABOVE AND BELOW.
110		2	TRANSFORMER PADS	NONE	NONE		SIZE PAD FOR TRANSFORMER SUPPLIED.
JUMPER CONDUCTORS							
111		3000 FT	795 DRAKE ACSR, 26/7 - JUMPERS FOR LINE TO BUS, BREAKER TO BUS, ETC.	NONE	NONE		
111a		2000 FT	556.5 OSPREY ACSR, (18/1) JUMPERS (69kV) BREAKER TO BUS, ETC.	NONE	NONE	46-799	
112		1000 FT	3/8" EHS STATIC SHIELD WIRE	NONE	NONE		
113		500 FT	477 HAWK ACSR, 26/7 - JUMPERS LINE TO BUS	NONE	NONE		
114		400 FT	4/0 PENGUIN ACSR, 6/1 - JUMPERS TO LIGHTNING ARRESTORS	NONE	NONE		
TRENCH							
Note: The trench is a system and as such must be supplied by one vendor, using standard and custom designed components. The following drawings must be sent to the vendors to enable them to design a complete system using their components: S294PG50, S294PG51, S294PH02 AND S294PH09. Trench vendor shall submit final layout drawings and specifications to GRDA for approval.							
Trench bases shall be made of concrete or like material, and lids shall be made of steel. Both shall meet AASHTO H-10 load requirements of 16,000lbs per axle.							
115		36ea	8' base, AASHTO H-10, 24"W x 16"D	CONCAST INC.	#8824LT		
116		144ea	Steel Cover, AASHTO H-10, 28 3/4"W x 23 7/8"L x 3"D	CONCAST INC.	#8025LTSG		
117		1ea	Custom TEE with Steel Covers, AASHTO H-10, 24"W x 24"W x 40"W x 16"D (See Drawings)	CONCAST INC.	NONE		
118		14ea	8' base, AASHTO H-10, 40"W x 16"D	CONCAST INC.	#8840LT		
119		144ea	Steel Cover, AASHTO H-10, 44 3/4"W x 23 7/8"L x 3"D	CONCAST INC.	#8041LTSG		
120		2ea	Custom TEE with Risers and Steel Covers, AASHTO H-10, 40"W x 40"W x 40"W x 16"D (See Drawings)	CONCAST INC.	NONE		

**REFERENCE DRAWINGS**

- S294PE15 PARTS LIST 161KV EQUIPMENT PLAN VIEW
- S294PE16 PARTS LIST 69KV EQUIPMENT PLAN VIEW
- S294PE17 161KV ELEVATION VIEW PARTS LIST VIEW A
- S294PE18 161KV ELEVATION VIEW PARTS LIST VIEW B
- S294PE19 161KV ELEVATION VIEW PARTS LIST VIEW C
- S294PE20 161KV ELEVATION VIEW PARTS LIST VIEW D
- S294PE21 161KV ELEVATION VIEW PARTS LIST VIEW E
- S294PE22 161KV ELEVATION VIEW PARTS LIST VIEW F1 & F2
- S294PE23 161KV ELEVATION VIEW PARTS LIST VIEW G1 & G2
- S294PE24 69KV ELEVATION VIEW PARTS LIST VIEW H
- S294PE25 69KV ELEVATION VIEW PARTS LIST VIEW J
- S294PE26 69KV ELEVATION VIEW PARTS LIST VIEW K
- S294PE27 69KV ELEVATION VIEW PARTS LIST VIEW L
- S294PE28 69KV ELEVATION VIEW PARTS LIST VIEW M
- S294PE30 FENCE DETAILS
- S294PG20 GROUNDING PLAN
- S294PG21 GROUNDING DETAILS

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>BILL OF MATERIALS</b> SHEET 4 OF 4			
SCALE: NONE	DRAWN BY: BDC	ENGR:	APPD: BA
		CH: MW	DATE: 3/7/2011
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S249DE04</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

## Afton Substation

S294DT101	CABLE SCHEDULE BUSHING CT'S
S294DT102	CABLE SCHEDULE BUSHING CT'S
S294DT201	CABLE SCHEDULE BUSHING CCVTS
S294DT202	CABLE SCHEDULE BUSHING CCVTS
S294DT301	CABLE SCHEDULE AC
S294DT302	CABLE SCHEDULE AC
S294DT303	CABLE SCHEDULE AC
S294DT304	CABLE SCHEDULE AC
S294DT401	CABLE SCHEDULE CONTROL AND INDICATION
S294DT501	CABLE SCHEDULE 125VDC
S294DT502	CABLE SCHEDULE 125VDC
S294DT601	CABLE SCHEDULE ALARM INPUTS
S294DT602	CABLE SCHEDULE ALARM INPUTS

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 Last Plotted By: Shults, Arlene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 5/31/2012 9:34 AM Plotter Used: DWG To PDF.pc3

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION					NOTES				
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*	PURCHASED BY	INSTALLED BY	NOTES
Y11	1	01	4	10	-	XLPE	PVC	E1/K1	CT	B100-246X	-	SF001	21A-22	101	SF001	185	C	C	
Y11	1	02	4	10	-	XLPE	PVC	E1/K1	CT	B100-246Y	-	SF001	21P-22	101	SF001	185	C	C	
Y11	1	02A	4	10	-	XLPE	PVC	E1/K1	CT	TBX-X	101	SF001	50BF-2270	102	SF002	15	C	C	
Y11	1	03	4	10	-	XLPE	PVC	E1/K1	CT	B100-135Y	-	SF001	50BF-100	101	SF001	185	C	C	
Y11	1	03A	4	10	-	XLPE	PVC	E1/K1	CT	TBX-X	101	SF001	21P-126	103	SF004	20	C	C	
Y11	1	04	4	10	-	XLPE	PVC	E1/K1	CT	B100-135X	-	SF001	21A-126	103	SF004	185	C	C	
Y11	1	05	4	10	-	XLPE	PVC	E1/K1	CT	B2270-246X	-	SF002	50BF-2270	102	SF002	235	C	C	
Y11	1	06	4	10	-	XLPE	PVC	E1/K1	CT	B2270-246Y	-	SF002	21P-22	101	SF001	235	C	C	
Y11	1	07	4	10	-	XLPE	PVC	E1/K1	CT	B2270-135Y	-	SF002	87T/T1	104	SX002	20	C	C	
Y11	1	08	4	10	-	XLPE	PVC	E1/K1	CT	B200-135X	-	SF003	87T/T1	104	SX001	20	C	C	
Y11	1	09	4	10	-	XLPE	PVC	E1/K1	CT	B200-246Y	-	SF003	50BF-200	102	SF002	165	C	C	
Y11	1	10	4	10	-	XLPE	PVC	E1/K1	CT	B200-246X	-	SF003	87T/T2	106	SX002	165	C	C	
Y11	1	11	4	10	-	XLPE	PVC	E1/K1	CT	B12670-135X	-	SF004	50BF-12670	103	SF004	140	C	C	
Y11	1	12	4	10	-	XLPE	PVC	E1/K1	CT	B12670-135Y	-	SF004	21P-126	103	SF004	140	C	C	
Y11	1	13	4	10	-	XLPE	PVC	E1/K1	CT	B12670-246Y	-	SF004	87T/T1	104	SX001	140	C	C	
Y11	1	14	4	10	-	XLPE	PVC	E1/K1	CT	TP1-CT 21,22,23	-	SX001	50/51/T1	104	SX001	110	C	C	
Y11	1	15	4	10	-	XLPE	PVC	E1/K1	CT	TP1-TERT	-	SX001	87T/T1	104	SX001	110	C	C	
Y11	1	16	4	10	-	XLPE	PVC	E1/K1	CT	TP1-CX0	-	SX001	87T/T1	104	SX001	110	C	C	
Y11	1	17	4	10	-	XLPE	PVC	E1/K1	CT	B300-135X	-	SF300	87T/T1	104	SX001	150	C	C	
Y11	1	18	4	10	-	XLPE	PVC	E1/K1	CT	B400-246X	-	SF400	87T/T1	104	SX001	180	C	C	
Y11	1	19	4	10	-	XLPE	PVC	E1/K1	CT	TP2-CT 4,5,6	-	SX002	50/51/T2	106	SX002	160	C	C	
Y11	1	20	4	10	-	XLPE	PVC	E1/K1	CT	TP2-TERT	-	SX002	87T/T2	106	SX002	160	C	C	
Y11	1	21	4	10	-	XLPE	PVC	E1/K1	CT	TP2-CX0	-	SX002	87T/T2	106	SX002	160	C	C	
Y11	1	22	4	10	-	XLPE	PVC	E1/K1	CT	B400-135X	-	SF400	87T/T2	106	SX002	230	C	C	
Y11	1	23	4	10	-	XLPE	PVC	E1/K1	CT	B500-246X	-	SF500	87T/T2	106	SX002	280	C	C	
Y11	1	24	4	10	-	XLPE	PVC	E1/K1	CT	B300-246X	-	SF300	87B/S1	105	SF112	150	C	C	
Y11	1	25	4	10	-	XLPE	PVC	E1/K1	CT	B540-246X	-	SF107	B300-246X	-	SF300	50	C	C	
Y11	1	26	4	10	-	XLPE	PVC	E1/K1	CT	B6040-246X	-	SF109	B540-246X	-	SF107	50	C	C	
Y11	1	27	4	10	-	XLPE	PVC	E1/K1	CT	B800-246X	-	SF111	B6040-246X	-	SF109	90	C	C	
Y11	1	28	4	10	-	XLPE	PVC	E1/K1	CT	B500-135X	-	SF500	87B/N1	105	SF112	270	C	C	
Y11	1	29	4	10	-	XLPE	PVC	E1/K1	CT	B6140-135X	-	SF108	B500-135X	-	SF500	50	C	C	
Y11	1	30	4	10	-	XLPE	PVC	E1/K1	CT	B6340-135X	-	SF110	B6140-135X	-	SF108	50	C	C	
Y11	1	31	4	10	-	XLPE	PVC	E1/K1	CT	B6340-135X	-	SF110	B6240-135X	-	SF111	X	C	C	
Y11	1	32	4	10	-	XLPE	PVC	E1/K1	CT	B300-246X	-	SF300	50BF-300	104	SF300	210	C	C	
Y11	1	33	4	10	-	XLPE	PVC	E1/K1	CT	B400-135Y	-	SF400	50BF-400	105	SF400	255	C	C	

**GENERAL LEGEND:**

Y YEAR  
 CT BUSHING CURRENT TRANSFORMER  
 CB CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161KV)  
 TP TRANSFORMER, POWER  
 TS TRANSFORMER, STATION SERVICE  
 PR PANEL, RELAY  
 CB CIRCUIT BREAKER, LOW VOLTAGE (120-480V)  
 PT POTENTIAL TRANSFORMER  
 FU FUSE UNIT OR HOLDER  
 PB PANEL, CIRCUIT BREAKER

\* LENGTHS ARE APPROXIMATE, CONTRACTOR  
 TO VERIFY ACTUAL LENGTHS.

JB PANEL, JUNCTION OR SPLICE  
 CC CONTRACTOR  
 OW OWNER (OTHERS)

**DRAWING IDENTIFICATION LEGEND:**

DRAWING TYPE:  
 D-DOCUMENTS  
 P-PHYSICAL  
 S-SCHEMATIC  
 W-WIRING

EQUIPMENT:  
 B-BREAKER/RECLOSER  
 C-CIRCUIT SWITCHER/MOS  
 E-ELEC LAYOUT/ELEV.  
 F-FEEDER  
 G-GROUNDING, CONDUIT, TRENCH  
 H-CONTROL HOUSE  
 M-MATERIALS LIST  
 O-OPERATING ONE-LINE  
 P-PANELS  
 Q-CAP BANKS  
 R-RTU, ANN, DFR  
 S-STEEL  
 T-CABLE TABS  
 X-TRANSFORMERS  
 Z-MISC.

NUMBER ASSIGNED:  
 NUMBER ASSIGNED IN  
 NUMERIC ORDER OR  
 ITEM SPECIFIC

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**CABLE SCHEDULE  
 BUSHING C.T.'S**

SCALE: NONE DRAWN BY: DJR ENGR: AEM APPD: BA  
 CH: MW DATE: 3/7/2011



DRAWING No. S294DT101 REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID		BA

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 Last Plotted By: Shults, Ariene Plot Style: Garver Standard Half.ctb Plot Date: 5/31/2012 9:34 AM Plotter used: Adobe PDF

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION					NOTES				
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*	PURCHASED BY	INSTALLED BY	NOTES
Y11	1	34	4	10	-	XLPE	PVC	E1/K1	CT	B500-135Y	-	SF500	50BF-500	106	SF500	280	C	C	
Y11	1	35	4	10	-	XLPE	PVC	E1/K1	CT	B540-135X	-	SF107	21P-5	107	SF107	215	C	C	
Y11	1	36	4	10	-	XLPE	PVC	E1/K1	CT	B600-246X	-	SF108	21P-5	107	SF107	250	C	C	
Y11	1	37	4	10	-	XLPE	PVC	E1/K1	CT	B600-246Y	-	SF108	21A-5	107	SF107	250	C	C	
Y11	1	38	4	10	-	XLPE	PVC	E1/K1	CT	TBX-X	108	SF108	50BF-6140	108	SF108	20	C	C	
Y11	1	39	4	10	-	XLPE	PVC	E1/K1	CT	B600-135X	-	SF108	21P-61	108	SF108	10	C	C	
Y11	1	40	4	10	-	XLPE	PVC	E1/K1	CT	B6140-246X	-	SF108	21P-61	108	SF108	280	C	C	
Y11	1	41	4	10	-	XLPE	PVC	E1/K1	CT										
Y11	1	42	4	10	-	XLPE	PVC	E1/K1	CT										
Y11	1	43	4	10	-	XLPE	PVC	E1/K1	CT	B540-135Y	-	SF107	50BF-540	107	SF107	250	C	C	
Y11	1	44	4	10	-	XLPE	PVC	E1/K1	CT	B600-135Y	-	SF108	50BF-600	108	SF108	250	C	C	
Y11	1	45	4	10	-	XLPE	PVC	E1/K1	CT	B6140-246Y	-	SF108	50BF-6140	108	SF108	280	C	C	
Y11	1	46	4	10	-	XLPE	PVC	E1/K1	CT	B6040-135X	-	SF109	21P-60	109	SF109	200	C	C	
Y11	1	47	4	10	-	XLPE	PVC	E1/K1	CT	B700-246X	-	SF110	21P-60	109	SF109	250	C	C	
Y11	1	48	4	10	-	XLPE	PVC	E1/K1	CT	B700-246Y	-	SF110	21A-60	109	SF109	250	C	C	
Y11	1	49	4	10	-	XLPE	PVC	E1/K1	CT										
Y11	1	50	4	10	-	XLPE	PVC	E1/K1	CT	B700-135X	-	SF110	21P-63	111	SF110	280	C	C	
Y11	1	51	4	10	-	XLPE	PVC	E1/K1	CT	B6340-246X	-	SF110	21P-63	111	SF110	280	C	C	
Y11	1	52	4	10	-	XLPE	PVC	E1/K1	CT	50BF-800	110	SF111	21A-62	112	SF111	15	C	C	
Y11	1	53	4	10	-	XLPE	PVC	E1/K1	CT										
Y11	1	54	4	10	-	XLPE	PVC	E1/K1	CT	B6040-135Y	-	SF109	50BF-6040	109	SF109	250	C	C	
Y11	1	55	4	10	-	XLPE	PVC	E1/K1	CT	B700-135Y	-	SF110	50BF-700	110	SF110	215	C	C	
Y11	1	56	4	10	-	XLPE	PVC	E1/K1	CT	B6340-246Y	-	SF110	50BF-6340	111	SF110	250	C	C	
Y11	1	57	4	10	-	XLPE	PVC	E1/K1	CT	B800-135X	-	SF111	21P-62	112	SF111	280	C	C	
Y11	1	58	4	10	-	XLPE	PVC	E1/K1	CT	B6240-246X	-	SF111	21P-62	112	SF111	280	C	C	
Y11	1	59	4	10	-	XLPE	PVC	E1/K1	CT										
Y11	1	60	4	10	-	XLPE	PVC	E1/K1	CT	B6240-246Y	-	SF111	21A-62	112	SF111	280	C	C	
Y11	1	61	4	10	-	XLPE	PVC	E1/K1	CT	B800-135Y	-	SF111	50BF-800	110	SF111	250	C	C	

GENERAL LEGEND:

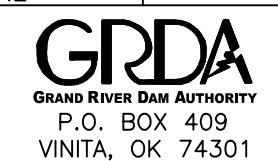
- |    |   |    |                           |
|----|---|----|---------------------------|
| Y  | YEAR  | JB | PANEL, JUNCTION OR SPLICE |
| CT | BUSHING CURRENT TRANSFORMER                 | CC | CONTRACTOR                |
| CB | CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161KV) | OW | OWNER (OTHERS)            |
| TP | TRANSFORMER, POWER                          |    |                           |
| TS | TRANSFORMER, STATION SERVICE                |    |                           |
| PR | PANEL, RELAY                                |    |                           |
| CB | CIRCUIT BREAKER, LOW VOLTAGE (120-480V)     |    |                           |
| PT | POTENTIAL TRANSFORMER                       |    |                           |
| FU | FUSE UNIT OR HOLDER                         |    |                           |
| PB | PANEL, CIRCUIT BREAKER                      |    |                           |

\* LENGTHS ARE APPROXIMATE, CONTRACTOR TO VERIFY ACTUAL LENGTHS.

DRAWING IDENTIFICATION LEGEND:

- |               |                              |                    |
|---------------|------------------------------|--------------------|
| DRAWING TYPE: | EQUIPMENT:                   | NUMBER ASSIGNED:   |
| D-DOCUMENTS   | B-BREAKER/RECLOSER           | NUMBER ASSIGNED IN |
| P-PHYSICAL    | C-CIRCUIT SWITCHER/MOS       | NUMERIC ORDER OR   |
| S-SCHEMATIC   | E-ELEC LAYOUT/ELEV.          | ITEM SPECIFIC      |
| W-WIRING      | F-FEEDER                     |                    |
|               | G-GROUNDING, CONDUIT, TRENCH |                    |
|               | H-CONTROL HOUSE              |                    |
|               | M-MATERIALS LIST             |                    |
|               | O-OPERATING ONE-LINE         |                    |
|               | P-PANELS                     |                    |
|               | Q-CAP BANKS                  |                    |
|               | R-RTU, ANN, DFR              |                    |
|               | S-STEEL                      |                    |
|               | T-CABLE TABS                 |                    |
|               | X-TRANSFORMERS               |                    |
|               | Z-MISC.                      |                    |

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA 161/69KV			
CABLE SCHEDULE BUSHING C.T.'S			
SCALE: NONE	DRAWN BY: DJR	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
		DRAWING No.	REV.
		S294DT102	0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID		BA



CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION						NOTES		
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-			
Y11	2	01	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-1/A	-	SF001	JB-CCVT1	-	SF001	70	C	C
Y11	2	02	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-1/B	-	SF001	JB-CCVT1	-	SF001	55	C	C
Y11	2	03	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-1/C	-	SF001	JB-CCVT1	-	SF001	40	C	C
Y11	2	04	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT1	-	SF001	TB-CCVT1	101	SF001	320	C	C
Y11	2	04A	7	12	-	XLPE	PVC	E1/K1	CCVT	TBX-X	101	SF001	BKR 2270 50BF	102	SF001	20	C	C
Y11	2	05	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-2/A	-	SF003	JB-CCVT2	-	SF003	70	C	C
Y11	2	06	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-2/B	-	SF003	JB-CCVT2	-	SF003	55	C	C
Y11	2	07	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-2/C	-	SF003	JB-CCVT2	-	SF003	40	C	C
Y11	2	08	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT2	-	SF003	TB-CCVT2	102	SF002	230	C	C
Y11	2	09	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-3/A	-	SF003	JB-CCVT3	-	SF003	45	C	C
Y11	2	10	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-3/B	-	SF003	JB-CCVT3	-	SF003	30	C	C
Y11	2	11	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-3/C	-	SF003	JB-CCVT3	-	SF003	15	C	C
Y11	2	12	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT3	-	SF003	TB-CCVT3	103	SF003	75	C	C
Y11	2	12A	7	12	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT3	103	SF003	TB-CCVT3	102	SF002	20	C	C
Y11	2	13	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-4/A	-	SF004	JB-CCVT4	-	SF004	45	C	C
Y11	2	14	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-4/B	-	SF004	JB-CCVT4	-	SF004	30	C	C
Y11	2	15	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-4/C	-	SF004	JB-CCVT4	-	SF004	15	C	C
Y11	2	16	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT4	-	SF004	JB-CCVT4	103	SF004	105	C	C
Y11	2	16A	7	12	-	XLPE	PVC	E1/K1	CCVT	TBX-X	103	SF004	BKR 100 50BF	101	SF004	30	C	C
Y11	2	17	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-S/A	-	SF300	JB-CCVTS	-	SF300	40	C	C
Y11	2	18	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-S/B	-	SF300	JB-CCVTS	-	SF300	35	C	C
Y11	2	19	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-S/C	-	SF300	JB-CCVTS	-	SF300	30	C	C
Y11	2	20	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVTS	-	SF300	JB-CCVTS	104	SF300	160	C	C
Y11	2	20A	12	10	-	XLPE	PVC	E1/K1	CCVT	TB-CCVTS	104	SF300	BKR 400 50BF	105	SF400	20	C	C
Y11	2	21	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-N/A	-	SF500	JB-CCVTN	-	SF500	40	C	C
Y11	2	22	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-N/B	-	SF500	JB-CCVTN	-	SF500	35	C	C
Y11	2	23	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-N/C	-	SF500	JB-CCVTN	-	SF500	30	C	C
Y11	2	24	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVTN	-	SF500	JB-CCVTN	106	SF500	220	C	C
Y11	2	24A	12	10	-	XLPE	PVC	E1/K1	CCVT	TB-CCVTN	106	SF500	BKR 400 50BF	105	SF400	20	C	C
Y11	2	25	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-5/A	-	SF107	JB-CCVT5	-	SF107	30	C	C
Y11	2	26	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-5/B	-	SF107	JB-CCVT5	-	SF107	40	C	C
Y11	2	27	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-5/C	-	SF107	JB-CCVT5	-	SF107	50	C	C
Y11	2	28	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT5	-	SF107	TB-CCVT5	107	SF107	230	C	C
Y11	2	29	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-61/A	-	SF108	JB-CCVT61	-	SF108	30	C	C
Y11	2	30	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-61/B	-	SF108	JB-CCVT61	-	SF108	40	C	C

GENERAL LEGEND:

Y	YEAR	JB	PANEL, JUNCTION OR SPLICE
CT	BUSHING CURRENT TRANSFORMER	CC	CONTRACTOR
CB	CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161kV)	OW	OWNER (OTHERS)
TP	TRANSFORMER, POWER		
TS	TRANSFORMER, STATION SERVICE		
PR	PANEL, RELAY		
CB	CIRCUIT BREAKER, LOW VOLTAGE (120-480V)		
PT	POTENTIAL TRANSFORMER		
FU	FUSE UNIT OR HOLDER		
PB	PANEL, CIRCUIT BREAKER		

\* LENGTHS ARE APPROXIMATE, CONTRACTOR TO VERIFY ACTUAL LENGTHS.

DRAWING IDENTIFICATION LEGEND:

DRAWING TYPE:	EQUIPMENT:	NUMBER ASSIGNED:
D-DOCUMENTS	B-BREAKER/RECLOSER	NUMBER ASSIGNED IN
P-PHYSICAL	C-CIRCUIT SWITCHER/MOS	NUMERIC ORDER OR
S-SCHEMATIC	E-ELEC LAYOUT/ELEV.	ITEM SPECIFIC
W-WIRING	F-FEEDER	
	G-GROUNDING, CONDUIT, TRENCH	
	H-CONTROL HOUSE	
	M-MATERIALS LIST	
	O-OPERATING ONE-LINE	
	P-PANELS	
	Q-CAP BANKS	
	R-RTU, ANN, DFR	
	S-STEEL	
	T-CABLE TABS	
	X-TRANSFORMERS	
	Z-MISC.	

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
<b>CABLE SCHEDULE CCVT'S</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: SRF	APPD: BA
		CH: MW	DATE: 3/7/2011
		DRAWING No. S294DT201	REV. 0
GRAND RIVER DAM AUTHORITY P.O. BOX 408 VINITA, OK 74301			

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID		BA

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 Last Plotted By: Shults, Arlene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 5/31/2012 9:39 AM Plotter Used: DWG To PDF.pc3

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION						NOTES			
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*	PURCHASED BY	INSTALLED BY	NOTES
Y11	2	31	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-61/C	-	SF108	JB-CCVT61	-	SF108	50	C	C	
Y11	2	32	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT61	-	SF108	TB-CCVT61	108	SF108	240	C	C	
Y11	2	32A	7	12	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT61	108	SF108	BKR 600 50BF	110	SF108	30	C	C	
Y11	2	33	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-60/A	-	SF109	JB-CCVT60	-	SF109	30	C	C	
Y11	2	34	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-60/B	-	SF109	JB-CCVT60	-	SF109	40	C	C	
Y11	2	35	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-60/C	-	SF109	JB-CCVT60	-	SF109	50	C	C	
Y11	2	36	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT60	-	SF109	TB-CCVT60	109	SF109	230	C	C	
Y11	2	36A	7	12	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT60	-	SF109		109	SF109	50	C	C	
Y11	2	37	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-63/A	-	SF110	JB-CCVT63	-	SF110	30	C	C	
Y11	2	38	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-63/B	-	SF110	JB-CCVT63	-	SF110	40	C	C	
Y11	2	39	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-63/C	-	SF110	JB-CCVT63	-	SF110	50	C	C	
Y11	2	40	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT63	-	SF110	TB-CCVT63	111	SF110	240	C	C	
Y11	2	40A	7	12	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT63	111	SF110	BKR 700 50BF	110	SF110	20	C	C	
Y11	2	41	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-62/A	-	SF111	JB-CCVT62	-	SF111	30	C	C	
Y11	2	42	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-62/B	-	SF111	JB-CCVT62	-	SF111	40	C	C	
Y11	2	43	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-62/C	-	SF111	JB-CCVT62	-	SF111	50	C	C	
Y11	2	44	12	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT62	-	SF111	TB-CCVT62	112	SF111	295	C	C	
Y11	2	44A	12	10	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT62	112	SF111	BKR 800 50BF	110	SF111	30	C	C	
Y11	2	45	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-S1	-	SF300	JB-CCVT-S1	-	SF300	30	C	C	
Y11	2	46	7	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT-S1	-	SF300	BKR 300 50BF	104	SF300	280	C	C	
Y11	2	46A	7	12	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT-S1	104	SF300	BKR 540 50BF	107	SF300	50	C	C	
Y11	2	46B	7	12	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT-S1	107	SF300	BKR 600 50BF	110	SF300	35	C	C	
Y11	2	46C	7	12	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT-S1	110	SF300	BKR 6040 50BF	109	SF300	20	C	C	
Y11	2	47	7	12	-	XLPE	PVC	E1/K1	CCVT	CCVT-N1	-	SF500	JTB-CCVT-N1	-	SF500	30	C	C	
Y11	2	48	7	10	-	XLPE	PVC	E1/K1	CCVT	JB-CCVT-N1	-	SF500	BKR 500 50BF	106	SF500	335	C	C	
Y11	2	48A	7	12	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT-N1	106	SF500	BKR 6140 50BF	108	SF500	40	C	C	
Y11	2	48B	7	12	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT-N1	108	SF500	BKR 6340 50BF	111	SF500	40	C	C	
Y11	2	48C	7	12	-	XLPE	PVC	E1/K1	CCVT	TB-CCVT-N1	111	SF500	BKR 6240 50BF	112	SF500	40	C	C	

GENERAL LEGEND:

Y YEAR  
 CT BUSHING CURRENT TRANSFORMER  
 CB CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161kV)  
 TP TRANSFORMER, POWER  
 TS TRANSFORMER, STATION SERVICE  
 PR PANEL, RELAY  
 CB CIRCUIT BREAKER, LOW VOLTAGE (120-480V)  
 PT POTENTIAL TRANSFORMER  
 FU FUSE UNIT OR HOLDER  
 PB PANEL, CIRCUIT BREAKER

\* LENGTHS ARE APPROXIMATE, CONTRACTOR TO VERIFY ACTUAL LENGTHS.

JB PANEL, JUNCTION OR SPLICE  
 CC CONTRACTOR  
 OW OWNER (OTHERS)


DRAWING IDENTIFICATION LEGEND:

DRAWING TYPE:  
 D-DOCUMENTS  
 P-PHYSICAL  
 S-SCHEMATIC  
 W-WIRING

EQUIPMENT:  
 B-BREAKER/RECLOSER  
 C-CIRCUIT SWITCHER/MOS  
 E-ELEC LAYOUT/ELEV.  
 F-FEEDER  
 G-GROUNDING, CONDUIT, TRENCH  
 H-CONTROL HOUSE  
 M-MATERIALS LIST  
 O-OPERATING ONE-LINE  
 P-PANELS  
 Q-CAP BANKS  
 R-RTU, ANN, DFR  
 S-STEEL  
 T-CABLE TABS  
 X-TRANSFORMERS  
 Z-MISC.

NUMBER ASSIGNED:  
 NUMBER ASSIGNED IN  
 NUMERIC ORDER OR  
 ITEM SPECIFIC

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA 161/69kV			
CABLE SCHEDULE CCVT'S			
SCALE: NONE	DRAWN BY: DJR	ENGR: SRF	APPD: BA
		CH: MW	DATE: 3/7/2011
		DRAWING No.	REV.
		S294DT202	0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID		BA

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 Last Plotted By: Shults, Arlene Plot Date: 5/31/2012 9:41 AM Plotter used: Adobe PDF

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION						NOTES			
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*	PURCHASED BY	INSTALLED BY	
Y11	3	01A	1	1	FULL CONC	133%	LLDPE	-	AC	T1 A-PH	-	SH001	T3 A-PH	-	SH001	125'	C	C	
Y11	3	01B	1	1	FULL CONC	133%	LLDPE	-	AC	T1 B-PH	-	SH001	T3 B-PH	-	SH001	125'	C	C	
Y11	3	01C	1	1	FULL CONC	133%	LLDPE	-	AC	T1 C-PH	-	SH001	T3 C-PH	-	SH001	125'	C	C	
Y11	3	02A	1	1	FULL CONC	133%	LLDPE	-	AC	T2 A-PH	-	SH001	T4 A-PH	-	SH001	160'	C	C	
Y11	3	02B	1	1	FULL CONC	133%	LLDPE	-	AC	T2 B-PH	-	SH001	T4 B-PH	-	SH001	160'	C	C	
Y11	3	02C	1	1	FULL CONC	133%	LLDPE	-	AC	T2 C-PH	-	SH001	T4 C-PH	-	SH001	160'	C	C	
Y11	3	03A	2	250MCM	-	THWN-2	TPE	-	AC	T3 A-PH	-	SH001	ATS LINE 1-A	-	SH001	45'	C	C	
Y11	3	03B	2	250MCM	-	THWN-2	TPE	-	AC	T3 B-PH	-	SH001	ATS LINE 1-B	-	SH001	45'	C	C	
Y11	3	03C	2	250MCM	-	THWN-2	TPE	-	AC	T3 C-PH	-	SH001	ATS LINE 1-C	-	SH001	45'	C	C	
Y11	3	03N	2	250MCM	-	THWN-2	TPE	-	AC	T3 NEUTRAL	-	SH001	ATS NEU BUS	-	SH001	45'	C	C	
Y11	3	03EG	1	1	-	THWN-2	TPE	-	AC	T3 GROUND	-	SH001	ATS GND BUS	-	SH001	45'	C	C	
Y11	3	04A	2	250MCM	-	THWN-2	TPE	-	AC	T4 A-PH	-	SH001	ATS LINE 2-A	-	SH001	30'	C	C	
Y11	3	04B	2	250MCM	-	THWN-2	TPE	-	AC	T4 B-PH	-	SH001	ATS LINE 2-B	-	SH001	30'	C	C	
Y11	3	04C	2	250MCM	-	THWN-2	TPE	-	AC	T4 C-PH	-	SH001	ATS LINE 3-C	-	SH001	30'	C	C	
Y11	3	04N	2	250MCM	-	THWN-2	TPE	-	AC	T4 NEUTRAL	-	SH001	ATS NEU BUS	-	SH001	30'	C	C	
Y11	3	04EG	1	1	-	THWN-2	TPE	-	AC	T4 GROUND	-	SH001	ATS GND BUS	-	SH001	30'	C	C	
Y11	3	05A	2	250MCM	-	THWN-2	TPE	-	AC	ATS LOAD A	-	SH001	MDPA-A	-	SH001	40'	C	C	
Y11	3	05B	2	250MCM	-	THWN-2	TPE	-	AC	ATS LOAD B	-	SH001	MDPA-B	-	SH001	40'	C	C	
Y11	3	05C	2	250MCM	-	THWN-2	TPE	-	AC	ATS LOAD C	-	SH001	MDPA-C	-	SH001	40'	C	C	
Y11	3	05N	2	250MCM	-	THWN-2	TPE	-	AC	ATS NEU BUS	-	SH001	MDPA NEU BUS	-	SH001	40'	C	C	
Y11	3	05EG	1	1	-	THWN-2	TPE	-	AC	ATS GND BUS	-	SH001	MDPA GND BUS	-	SH001	40'	C	C	
Y11	3	06A	1	3/0	-	THWN-2	TPE	-	AC	CB-1A	A	SH001	PNL B-PH A	B	SH002	10'	C	C	
Y11	3	06B	1	3/0	-	THWN-2	TPE	-	AC	CB-1B	A	SH001	PNL B-PH B	B	SH002	10'	C	C	
Y11	3	06C	1	3/0	-	THWN-2	TPE	-	AC	CB-1C	A	SH001	PNL B-PH C	B	SH002	10'	C	C	
Y11	3	06N	1	3/0	-	THWN-2	TPE	-	AC	MDP-A-NEU BUS	A	SH001	PNL B-NEU BUS	B	SH002	10'	C	C	
Y11	3	06EG	1	6	-	THWN-2	TPE	-	AC	MDP-A-GND BUS	A	SH001	PNL B-GND BUS	B	SH002	10'	C	C	
Y11	3	07A	1	3/0	-	THWN-2	TPE	-	AC	CB-2A	A	SH001	PNL C-PHA	C	SH002	15'	C	C	
Y11	3	07C	1	3/0	-	THWN-2	TPE	-	AC	CB-2C	A	SH001	PNL C-PHC	C	SH002	15'	C	C	
Y11	3	07N	1	3/0	-	THWN-2	TPE	-	AC	MDP-A-NEU BUS	A	SH001	PNL C-NUE BUS	C	SH002	15'	C	C	
Y11	3	07EG	1	6	-	THWN-2	TPE	-	AC	MDP-A-GND BUS	A	SH001	PNL C-GND BUS	C	SH002	15'	C	C	
Y11	3	08A	1	4	-	THWN-2	TPE	-	AC	CB-3A	A	SH001	T1	-	SH001	100'	C	C	
Y11	3	08B	1	4	-	THWN-2	TPE	-	AC	CB-3B	A	SH001	T1	-	SH001	100'	C	C	
Y11	3	08C	1	4	-	THWN-2	TPE	-	AC	CB-3C	A	SH001	T1	-	SH001	100'	C	C	
Y11	3	09A	1	10	-	THWN-2	TPE	-	AC	CB-4A	A	SH001	BATT. CHARGER	-	SH001	60'	C	C	
Y11	3	09C	1	10	-	THWN-2	TPE	-	AC	CB-4C	A	SH001	BATT. CHARGER	-	SH001	60'	C	C	
Y11	3	09EG	1	10	-	THWN-2	TPE	-	AC	MDP-A-GND BUS	A	SH001	BATT. CHARGER	-	SH001	60'	C	C	
Y11	3	10	4	12	-	XPLE	PVC	E1/K1	AC	CB-1	B	S0002	1/2 HP SUMP	-		100'	C	C	
Y11	3	11	4	10	-	XPLE	PVC	E1/K1	AC	CB-2	B	S0002	7.5KW HTR	-		60'	C	C	
Y11	3	12	4	8	-	XPLE	PVC	E1/K1	AC	CB-5	B	S0002	EQUIP COND HTR	-		60'	C	C	
Y11	3	13	4	10	-	XPLE	PVC	E1/K1	AC	CB-6	B	S0002	HEAT PUMP	-		60'	C	C	

**GENERAL LEGEND:**

Y YEAR  
 CT BUSHING CURRENT TRANSFORMER  
 CB CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161KV)  
 TP TRANSFORMER, POWER  
 TS TRANSFORMER, STATION SERVICE  
 PR PANEL, RELAY  
 CB CIRCUIT BREAKER, LOW VOLTAGE (120-480V)

JB PANEL, JUNCTION OR SPLICE  
 CC CONTRACTOR  
 OW OWNER (OTHERS)  
 PT POTENTIAL TRANSFORMER  
 FU FUSE UNIT OR HOLDER  
 PB PANEL, CIRCUIT BREAKER

\* LENGTHS ARE APPROXIMATE, CONTRACTOR TO VERIFY ACTUAL LENGTHS.

**DRAWING IDENTIFICATION LEGEND:**

**DRAWING TYPE:**  
 D-DOCUMENTS  
 P-PHYSICAL  
 S-SCHEMATIC  
 W-WIRING  
  
**EQUIPMENT:**  
 B-BREAKER/RECLOSER  
 C-CIRCUIT SWITCHER/MOS  
 E-ELEC LAYOUT/ELEV.  
 F-FEEDER  
 G-GROUNDING, CONDUIT, TRENCH  
 H-CONTROL HOUSE  
 M-MATERIALS LIST  
 O-OPERATING ONE-LINE

**P-PANELS**  
 Q-CAP BANKS  
 R-RTU, ANN, DFR  
 S-STEEL  
 T-CABLE TABS  
 X-TRANSFORMERS  
 Z-MISC.

NUMBER ASSIGNED:  
 NUMBER ASSIGNED IN  
 NUMERIC ORDER OR  
 ITEM SPECIFIC

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

CABLE SCHEDULE  
 AC POWER & REALAY COMM.

SCALE: NONE DRAWN BY: DJR ENGR: SRF APPD: BA  
 CH: MW DATE: 3/7/2011



DRAWING No.  
 S294DT301 REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID		BA

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 Last\_plotted\_by: Shults, Arlene Plot\_Style: Monochrome.ctb Plot\_Scale: 1:1 Plot\_Date: 5/31/2012 9:44 AM Plotter\_used: DWG To PDF.pc3

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION								NOTES	
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*	PURCHASED BY		INSTALLED BY
Y11	3	14B	1	3	-	THWN-2	TPE	-	AC	CB-9B	B	SH002	INDOOR AIR	-	SH002	-	C	C	
Y11	3	14C	1	3	-	THWN-2	TPE	-	AC	CB-9C	B	SH002	INDOOR AIR	-	SH002	-	C	C	
Y11	3	14EG	1	8	-	THWN-2	TPE	-	AC	PNL B GND BUS	B	SH002	INDOOR AIR	-	SH002	-	C	C	
Y11	3	15B	1	6	-	THWN-2	TPE	-	AC	CB-10B	B	SH002	PB	LCP	SH002	-	C	C	
Y11	3	15C	1	6	-	THWN-2	TPE	-	AC	CB-10C	B	SH002	PB	LCP	SH002	-	C	C	
Y11	3	15EG	1	8	-	THWN-2	TPE	-	AC	PNL B GND BUS	B	SH002	PB	LCP	SH002	-	C	C	
Y11	3	16A	1	12	-	THWN-2	TPE	-	AC	CB-1A	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	16N	1	12	-	THWN-2	TPE	-	AC	PNL C NEU BUS	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	16EG	1	12	-	THWN-2	TPE	-	AC	PNL C GND BUS	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	17A	1	12	-	THWN-2	TPE	-	AC	CB-2A	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	17N	1	12	-	THWN-2	TPE	-	AC	PNL C NEU BUS	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	17EG	1	12	-	THWN-2	TPE	-	AC	PNL C GND BUS	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	18C	1	12	-	THWN-2	TPE	-	AC	CB-3C	C	SH002	RECEPT	-	SH002	-	C	C	
Y11	3	18N	1	12	-	THWN-2	TPE	-	AC	PNL C NEU BUS	C	SH002	RECEPT	-	SH002	-	C	C	
Y11	3	18EG	1	12	-	THWN-2	TPE	-	AC	PNL C GND BUS	C	SH002	RECEPT	-	SH002	-	C	C	
Y11	3	19C	1	12	-	THWN-2	TPE	-	AC	CB-4C	C	SH002	RECEPT	-	SH002	-	C	C	
Y11	3	19N	1	12	-	THWN-2	TPE	-	AC	PNL C NEU BUS	C	SH002	RECEPT	-	SH002	-	C	C	
Y11	3	19EG	1	12	-	THWN-2	TPE	-	AC	PNL C GND BUS	C	SH002	RECEPT	-	SH002	-	C	C	
Y11	3	20A	1	12	-	THWN-2	TPE	-	AC	CB-5A	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	20N	1	12	-	THWN-2	TPE	-	AC	PNL C NEU BUS	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	20EG	1	12	-	THWN-2	TPE	-	AC	PNL C GND BUS	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	21A	1	12	-	THWN-2	TPE	-	AC	CB-6A	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	21N	1	12	-	THWN-2	TPE	-	AC	PNL C NEU BUS	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	21EG	1	12	-	THWN-2	TPE	-	AC	PNL C GND BUS	C	SH002	LIGHTS	-	SH002	-	C	C	
Y11	3	22C	1	12	-	THWN-2	TPE	-	AC	CB-7C	C	SH002	P-4F,N17,N18	-	SH002	-	C	C	
Y11	3	22N	1	12	-	THWN-2	TPE	-	AC	PNL C NEU BUS	C	SH002	P-4F,N17,N18	-	SH002	-	C	C	
Y11	3	22EG	1	12	-	THWN-2	TPE	-	AC	PNL C GND BUS	C	SH002	P-4F,N17,N18	-	SH002	-	C	C	
Y11	3	23	4	8	-	XLPE	PVC	E1/K1	AC	CB-8	C	SH002	CB-300	-	SB300a	-	C	C	
Y11	3	23A	4	8	-	XLPE	PVC	E1/K1	AC	CB-300	-	SB300a	CB-400	-	SB400a	-	C	C	
Y11	3	23B	4	8	-	XLPE	PVC	E1/K1	AC	CB-400	-	SB400a	CB-500	-	SB500a	-	C	C	
Y11	3	24	4	8	-	XLPE	PVC	E1/K1	AC	CB-9	C	SH002	CB-540	-	SB540a	-	C	C	
Y11	3	24A	4	8	-	XLPE	PVC	E1/K1	AC	CB-540	-	SB540a	CB-600	-	SB600a	-	C	C	
Y11	3	24B	4	8	-	XLPE	PVC	E1/K1	AC	CB-600	-	SB600a	CB-6140	-	SB6140a	-	C	C	
Y11	3	25	4	8	-	XLPE	PVC	E1/K1	AC	CB-10	C	SH002	CB6040	-	SB6040a	-	C	C	
Y11	3	25A	4	8	-	XLPE	PVC	E1/K1	AC	CB-6040	-	SB6040a	CB-700	-	SB600a	-	C	C	
Y11	3	25B	4	8	-	XLPE	PVC	E1/K1	AC	CB-700	-	SB700a	CB-6340	-	SB6340a	-	C	C	
Y11	3	26	4	8	-	XLPE	PVC	E1/K1	AC	CB-11	C	SH002	CB-800	-	SB800a	-	C	C	
Y11	3	26A	4	8	-	XLPE	PVC	E1/K1	AC	CB-800	-	SB800a	CB-6240	-	SB6240a	-	C	C	
Y11	3	27	4	8	-	XLPE	PVC	E1/K1	AC	CB-12	C	SH002	CB-100	-	SB100a	-	C	C	
Y11	3	28	4	8	-	XLPE	PVC	E1/K1	AC	CB-13	C	SH002	CB-200	-	SB200a	-	C	C	

**GENERAL LEGEND:**

Y YEAR  
 CT BUSHING CURRENT TRANSFORMER  
 CB CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161kV)  
 TP TRANSFORMER, POWER  
 TS TRANSFORMER, STATION SERVICE  
 PR PANEL, RELAY  
 CB CIRCUIT BREAKER, LOW VOLTAGE (120-480V)  
 PT POTENTIAL TRANSFORMER  
 FU FUSE UNIT OR HOLDER  
 PB PANEL, CIRCUIT BREAKER

JB PANEL, JUNCTION OR SPLICE  
 CC CONTRACTOR  
 OW OWNER (OTHERS)

**DRAWING IDENTIFICATION LEGEND:**

**DRAWING TYPE:**  
 D-DOCUMENTS  
 P-PHYSICAL  
 S-SCHEMATIC  
 W-WIRING

**EQUIPMENT:**  
 B-BREAKER/RECLOSER  
 C-CIRCUIT SWITCHER/MOS  
 E-ELEC LAYOUT/ELEV.  
 F-FEEDER  
 G-GROUNDING, CONDUIT, TRENCH  
 H-CONTROL HOUSE  
 M-MATERIALS LIST  
 O-OPERATING ONE-LINE

**P-PANELS**  
 Q-CAP BANKS  
 R-RTU, ANN, DFR  
 S-STEEL  
 T-CABLE TABS  
 X-TRANSFORMERS  
 Z-MISC.

**NUMBER ASSIGNED:**  
 NUMBER ASSIGNED IN  
 NUMERIC ORDER OR  
 ITEM SPECIFIC

\* LENGTHS ARE APPROXIMATE, CONTRACTOR  
 TO VERIFY ACTUAL LENGTHS.

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA 161/69kV			
CABLE SCHEDULE AC POWER & RELAY COMM.			
SCALE: NONE	DRAWN BY: DJR	ENGR: SRF	APPD: BA
		CH: MW	DATE: 3/7/2011
DRAWING No. S294DT302		REV. 0	

0	5/29/12	ISSUED FOR BID	BA
REV	DATE	REVISION DESCRIPTION	DFT ENG



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Last Plotted By: Shults, Arlene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 5/31/2012 9:46 AM Plotter Used: DWG To PDF.pc3

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION									NOTES	
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*	PURCHASED BY	INSTALLED BY		
Y11	3	29	4	8	-	XLPE	PVC	E1/K1	AC	CB-14	C	SH002	CB-12670	-	SB12670a	-	C	C		
Y11	3	30	4	8	-	XLPE	PVC	E1/K1	AC	CB-15	C	SH002	CB-2270	-	SB2270a	-	C	C		
Y11	3	31	2	12	12	XLPE	PVC	E1/K1	AC	CB-16	C	SH002	T1	-	-	-	C	C		
Y11	3	32	2	12	12	XLPE	PVC	E1/K1	AC	CB-17	C	SH002	P101-106	-	-	-	C	C		
Y11	3	33	2	12	12	XLPE	PVC	E1/K1	AC	CB-18	C	SH002	P107-112	-	-	-	C	C		
Y11	3	34	2	12	12	XLPE	PVC	E1/K1	AC	CB-19	C	SH002	BAT. EX. FAN	-	-	50'	C	C		
Y11	3	35	4	10	-	XLPE	PVC	E1/K1	AC	CB-1	LCP	SH002	LIGHTS	-	SH002	300'	C	C		
Y11	3	36	4	10	-	XLPE	PVC	E1/K1	AC	CB-2	LCP	SH002	LIGHTS	-	SH002	300'	C	C		
Y11	3	37	4	10	-	XLPE	PVC	E1/K1	AC	CB-3	LCP	SH002	LIGHTS	-	SH002	300'	C	C		
Y11	3	38	4	10	-	XLPE	PVC	E1/K1	AC	CB-4	LCP	SH002	LIGHTS	-	SH002	300'	C	C		
Y11	3	39	4	10	-	XLPE	PVC	E1/K1	AC	CB-5	LCP	SH002	LIGHTS	-	SH002	300'	C	C		
Y11	3	40	4	10	-	XLPE	PVC	E1/K1	AC	CB-6	LCP	SH002	LIGHTS	-	SH002	300'	C	C		
Y11	3	41	2	12	-	XLPE	PVC	E1/K1	AC	CB-13/15	B	SH002	LTU-4	-	-	-	C	C		
Y11	3	42	1	8	-	5kV	PVC	-	AC	LTU-4	-	S002	UPLC-4	P103	S002	-	C	C	133% BIL, TYPE MV-90, SUNLIGHT RESISTANT	
Y11	3	43	1	8	-	5kV	PVC	-	AC	LTU-1	-	S001	UPLC-1	P101	S001	-	C	C	133% BIL, TYPE MV-90, SUNLIGHT RESISTANT	
Y11	3	44	2	12	-	XLPE	PVC	E1/K1	AC	CB-17/19	B	SH002	LTU-1	-	-	-	C	C		
Y11	3	-																		
Y11	3	-																		
Y11	3	-																		
Y11	3	-																		
Y11	3	50	9	24	W/SHLD	PE	PVC	-	RS232	21P-FDR 22	101	SF005	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	51	9	24	W/SHLD	PE	PVC	-	RS232	21A-FDR 22	101	SF006	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	52	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 100	101	SF007	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	53	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 2270	102	SF008	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	54	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 200	102	SF009	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	55	9	24	W/SHLD	PE	PVC	-	RS232	21P-FDR 126	103	SF010	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	56	9	24	W/SHLD	PE	PVC	-	RS232	21A-FDR 126	103	SF011	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	57	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 12670	103	SF012	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	58	9	24	W/SHLD	PE	PVC	-	RS232	87/T1	104	SX101	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	59	9	24	W/SHLD	PE	PVC	-	RS232	87/T2	106	SX201	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	60	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 300	104	SB301	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	61	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 400	105	SB401	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	62	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 500	106	SB501	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	63	9	24	W/SHLD	PE	PVC	-	RS232	21P-FDR 5	107	SF116	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	64	9	24	W/SHLD	PE	PVC	-	RS232	21A-FDR 5	107	SF117	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	65	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 540	107	SF118	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	66	9	24	W/SHLD	PE	PVC	-	RS232	21P-FDR 61	108	SF119	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	67	9	24	W/SHLD	PE	PVC	-	RS232	21A-FDR 61	108	SF120	GRDA SCADA	-	-	TBD	GRDA	C		
Y11	3	68	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 6140	108	SF121	GRDA SCADA	-	-	TBD	GRDA	C		

**GENERAL LEGEND:**

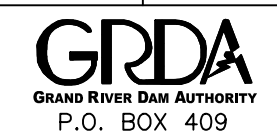
Y	YEAR	JB	PANEL, JUNCTION OR SPLICE
CT	BUSHING CURRENT TRANSFORMER	CC	CONTRACTOR
CB	CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161KV)	OW	OWNER (OTHERS)
TP	TRANSFORMER, POWER		
TS	TRANSFORMER, STATION SERVICE		
PR	PANEL, RELAY		
CB	CIRCUIT BREAKER, LOW VOLTAGE (120-480V)		
PT	POTENTIAL TRANSFORMER		
FU	FUSE UNIT OR HOLDER		
PB	PANEL, CIRCUIT BREAKER		

\* LENGTHS ARE APPROXIMATE, CONTRACTOR TO VERIFY ACTUAL LENGTHS.

**DRAWING IDENTIFICATION LEGEND:**

D-DOCUMENTS	B-BREAKER/RECLOSER	P-PANELS	NUMBER ASSIGNED:
P-PHYSICAL	C-CIRCUIT SWITCHER/MOS	Q-CAP BANKS	NUMBER ASSIGNED IN
S-SCHEMATIC	E-ELEC LAYOUT/ELEV.	R-RTU, ANN, DFR	NUMERIC ORDER OR
W-WIRING	F-FEEDER	S-STEEL	ITEM SPECIFIC
	G-GROUNDING, CONDUIT, TRENCH	T-CABLE TABS	
	H-CONTROL HOUSE	X-TRANSFORMERS	
	M-MATERIALS LIST	Z-MISC.	
	O-OPERATING ONE-LINE		

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69KV</small>	
<b>CABLE SCHEDULE AC POWER &amp; RELAY COMM.</b>	
SCALE: NONE	DRAWN BY: DJR
ENGR: SRF	APPD: BA
CH: MW	DATE: 3/7/2011
	
DRAWING No. S294DT303	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID		BA

File: W:\Drafting\Drawings\AFTON\Carver CAD Drawings 2-16-12\S294DT304 CABLE SCHEDULE AC.dwg Last Save: 5/31/2012 9:47 AM Last saved by: Ashults  
 Last Plotted By: Shults, Arlene Plot Style: Carver Standard Half.ctb Plot Scale: 1:2 Plot Date: 5/31/2012 9:48 AM Plotted using: Adobe PDF

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION					NOTES				
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*	PURCHASED BY	INSTALLED BY	NOTES
Y11	3	69	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 600	110	SF122	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	70	9	24	W/SHLD	PE	PVC	-	RS232	21P-FDR 60	109	SF123	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	71	9	24	W/SHLD	PE	PVC	-	RS232	21A-FDR 60	109	SF124	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	72	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 6040	109	SF125	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	73	9	24	W/SHLD	PE	PVC	-	RS232	21P-FDR 63	111	SF126	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	74	9	24	W/SHLD	PE	PVC	-	RS232	21A-FDR 63	111	SF127	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	75	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 6340	111	SF128	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	76	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 700	110	SF129	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	77	9	24	W/SHLD	PE	PVC	-	RS232	21P-FDR 62	112	SF130	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	78	9	24	W/SHLD	PE	PVC	-	RS232	21A-FDR 62	112	SF131	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	79	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 6240	112	SF132	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	80	9	24	W/SHLD	PE	PVC	-	RS232	50BF-CB 800	110	SF133	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	81	9	24	W/SHLD	PE	PVC	-	RS232	ANNUNCIATOR 1	201	SR05	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	82	9	24	W/SHLD	PE	PVC	-	RS232	ANNUNCIATOR 2	201	SR07	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	83	9	24	W/SHLD	PE	PVC	-	RS232	ANNUNCIATOR 3	201	SR09	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	84	9	24	W/SHLD	PE	PVC	-	RS232	ANNUNCIATOR 4	201	SR11	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	85	9	24	W/SHLD	PE	PVC	-	RS232	87B/S1	105	SB402	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	86	9	24	W/SHLD	PE	PVC	-	RS232	87B/N1	105	SB403	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	87	9	24	W/SHLD	PE	PVC	-	RS232	50/51-T1	104	SX102	GRDA SCADA	-	-	TBD	GRDA	C	
Y11	3	88	9	24	W/SHLD	PE	PVC	-	RS232	50/51-T2	106	SX202	GRDA SCADA	-	-	TBD	GRDA	C	

**GENERAL LEGEND:**

- |    |   |    |                           |
|----|---|----|---------------------------|
| Y  | YEAR  | JB | PANEL, JUNCTION OR SPLICE |
| CT | BUSHING CURRENT TRANSFORMER                 | CC | CONTRACTOR                |
| CB | CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161kV) | OW | OWNER (OTHERS)            |
| TP | TRANSFORMER, POWER                          |    |                           |
| TS | TRANSFORMER, STATION SERVICE                |    |                           |
| PR | PANEL, RELAY                                |    |                           |
| CB | CIRCUIT BREAKER, LOW VOLTAGE (120-480V)     |    |                           |
| PT | POTENTIAL TRANSFORMER                       |    |                           |
| FU | FUSE UNIT OR HOLDER                         |    |                           |
| PB | PANEL, CIRCUIT BREAKER                      |    |                           |

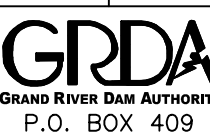
\* LENGTHS ARE APPROXIMATE, CONTRACTOR TO VERIFY ACTUAL LENGTHS.

**DRAWING IDENTIFICATION LEGEND:**

- |   |           |   |                            |   |               |  |  |
|---|-----------|---|----------------------------|---|---------------|--|--|
| D | DOCUMENTS | B | BREAKER/RECLOSER           | P | PANELS        |  |  |
| P | PHYSICAL  | C | CIRCUIT SWITCHER/MOS       | Q | CAP BANKS     |  |  |
| S | SCHEMATIC | E | ELEC LAYOUT/ELEV.          | R | RTU, ANN, DFR |  |  |
| W | WIRING    | F | FEEDER                     | S | STEEL         |  |  |
|   |           | G | GROUNDING, CONDUIT, TRENCH | T | CABLE TABS    |  |  |
|   |           | H | CONTROL HOUSE              | X | TRANSFORMERS  |  |  |
|   |           | M | MATERIALS LIST             | Z | MISC.         |  |  |
|   |           | O | OPERATING ONE-LINE         |   |               |  |  |

NUMBER ASSIGNED:  
NUMBER ASSIGNED IN  
NUMERIC ORDER OR  
ITEM SPECIFIC

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>CABLE SCHEDULE</b> <b>AC POWER &amp; RELAY COMM.</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: SRF	APPD: BA
		CH: MW	DATE: 3/7/2011
		DRAWING No.	REV.
		S294DT304	0

0	5/29/12	ISSUED FOR BID	BA
REV	DATE	REVISION DESCRIPTION	DFT ENG

File: W:\Drafting\Drawings\AFTON\Garver CAD Drawings 2-16-12\S294DT401 CABLE SCHEDULE CONTROL & INDICATION.dwg Last Saved: 5/31/2012 9:49 AM Last Saved By: Ashultz  
 Last Plotted By: Shults, Ariene Plot Style: Garver Standard Plot.ctb Plot Date: 5/31/2012 9:49 AM Plotter used: Adobe PDF

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION						NOTES			
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294--	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294--	APPROXIMATE LENGTH (feet)*	PURCHASED BY	INSTALLED BY	NOTES
Y11	4	01	12	10	-	XLPE	PVC	E1/K1	C&I	B100	-	SB100a	50BF-100	101	SB100	185	C	C	
Y11	4	02	12	10	-	XLPE	PVC	E1/K1	C&I	B2270	-	SB2270a	50BF-2270	102	SB2270	235	C	C	
Y11	4	03	12	10	-	XLPE	PVC	E1/K1	C&I	B200	-	SB200a	50BF-200	102	SB200	165	C	C	
Y11	4	04	12	10	-	XLPE	PVC	E1/K1	C&I	B12670	-	SB12670a	50BF-12670	103	SB12670	140	C	C	
Y11	4	05	12	10	-	XLPE	PVC	E1/K1	C&I	B300	-	SB300a	50BF-300	104	SB300	150	C	C	
Y11	4	06	12	10	-	XLPE	PVC	E1/K1	C&I	B400	-	SB400a	50BF-400	105	SB400	180	C	C	
Y11	4	07	12	10	-	XLPE	PVC	E1/K1	C&I	B500	-	SB500a	50BF-500	106	SB500	280	C	C	
Y11	4	08	12	10	-	XLPE	PVC	E1/K1	C&I	B540	-	SB540a	50BF-540	107	SB540	215	C	C	
Y11	4	09	12	10	-	XLPE	PVC	E1/K1	C&I	B600	-	SB600a	50BF-600	110	SB600	250	C	C	
Y11	4	10	12	10	-	XLPE	PVC	E1/K1	C&I	B6140	-	SB6140a	50BF-6140	108	SB6140	280	C	C	
Y11	4	11	12	10	-	XLPE	PVC	E1/K1	C&I	B6040	-	SB6040a	50BF-6040	109	SB6040	200	C	C	
Y11	4	12	12	10	-	XLPE	PVC	E1/K1	C&I	B700	-	SB700a	50BF-700	110	SB700	215	C	C	
Y11	4	13	12	10	-	XLPE	PVC	E1/K1	C&I	B6340	-	SB6340a	50BF-6340	111	SB6340	280	C	C	
Y11	4	14	12	10	-	XLPE	PVC	E1/K1	C&I	B800	-	SB800a	50BF-800	110	SB800	250	C	C	
Y11	4	15	12	10	-	XLPE	PVC	E1/K1	C&I	B6240	-	SB6240a	50BF-6240	112	SB6240	280	C	C	
Y11	4	16	12	10	-	XLPE	PVC	E1/K1	C&I	B100	-	SB100a	21P-21A/22	101	SF005/006	185	C	C	
Y11	4	17	12	10	-	XLPE	PVC	E1/K1	C&I	B100	-	SB100a	21P-21A/126	103	SF010/011	185	C	C	
Y11	4	18	12	10	-	XLPE	PVC	E1/K1	C&I	B2270	-	SB2270a	21P-21A/22	101	SF005/006	235	C	C	
Y11	4	19	12	10	-	XLPE	PVC	E1/K1	C&I	B12670	-	SB12670a	21P-21A/126	103	SF010/011	140	C	C	
Y11	4	20	12	10	-	XLPE	PVC	E1/K1	C&I	B540	-	SB540a	21P-21A/5	107	SF116/117	215	C	C	
Y11	4	21	12	10	-	XLPE	PVC	E1/K1	C&I	B600	-	SB600a	21P-21A/5	107	SF116/117	250	C	C	
Y11	4	22	12	10	-	XLPE	PVC	E1/K1	C&I	B600	-	SB600a	21P-21A/61	108	SF119/120	250	C	C	
Y11	4	23	12	10	-	XLPE	PVC	E1/K1	C&I	B6140	-	SB6140a	21P-21A/61	108	SF119/120	280	C	C	
Y11	4	24	12	10	-	XLPE	PVC	E1/K1	C&I	B6040	-	SB6040a	21P-21A/60	109	SF123/124	200	C	C	
Y11	4	25	12	10	-	XLPE	PVC	E1/K1	C&I	B700	-	SB700a	21P-21A/60	109	SF123/124	215	C	C	
Y11	4	26	12	10	-	XLPE	PVC	E1/K1	C&I	B700	-	SB700a	21P-21A/63	111	SF126/127	280	C	C	
Y11	4	27	12	10	-	XLPE	PVC	E1/K1	C&I	B6340	-	SB6340a	21P-21A/63	111	SF126/127	280	C	C	
Y11	4	28	12	10	-	XLPE	PVC	E1/K1	C&I	B800	-	SB800a	21P-21A/62	112	SF130/131	250	C	C	
Y11	4	29	12	10	-	XLPE	PVC	E1/K1	C&I	B6240	-	SB6240a	21P-21A/62	112	SF130/131	280	C	C	
Y11	4	30	7	12	-	XLPE	PVC	E1/K1	C	8TT1	-	SX101	63FP	104		C	C		
Y11	4	31	7	12	-	XLPE	PVC	E1/K1	C	8TT2	-	SX201	63FP	106		C	C		
Y11	4	32																	
Y11	4	33																	
Y11	4	34																	
Y11	4	35																	

GENERAL LEGEND:

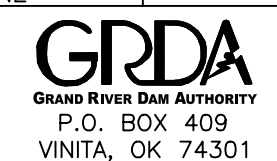
- |    |   |    |                           |
|----|---|----|---------------------------|
| Y  | YEAR  | JB | PANEL, JUNCTION OR SPLICE |
| CT | BUSHING CURRENT TRANSFORMER                 | CC | CONTRACTOR                |
| CB | CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161kV) | OW | OWNER (OTHERS)            |
| TP | TRANSFORMER, POWER                          |    |                           |
| TS | TRANSFORMER, STATION SERVICE                |    |                           |
| PR | PANEL, RELAY                                |    |                           |
| CB | CIRCUIT BREAKER, LOW VOLTAGE (120-480V)     |    |                           |
| PT | POTENTIAL TRANSFORMER                       |    |                           |
| FU | FUSE UNIT OR HOLDER                         |    |                           |
| PB | PANEL, CIRCUIT BREAKER                      |    |                           |

\* LENGTHS ARE APPROXIMATE, CONTRACTOR TO VERIFY ACTUAL LENGTHS.

DRAWING IDENTIFICATION LEGEND:

- |   |           |   |                            |  |                    |
|---|-----------|---|----------------------------|--|--------------------|
| D | DOCUMENTS | B | BREAKER/RECLOSER           |  | NUMBER ASSIGNED:   |
| P | PHYSICAL  | C | CIRCUIT SWITCHER/MOS       |  | NUMBER ASSIGNED IN |
| S | SCHEMATIC | E | ELEC LAYOUT/ELEV.          |  | NUMERIC ORDER OR   |
| W | WIRING    | F | FEEDER                     |  | ITEM SPECIFIC      |
|   |           | G | GROUNDING, CONDUIT, TRENCH |  |                    |
|   |           | H | CONTROL HOUSE              |  |                    |
|   |           | M | MATERIALS LIST             |  |                    |
|   |           | O | OPERATING ONE-LINE         |  |                    |
|   |           | P | PANELS                     |  |                    |
|   |           | Q | CAP BANKS                  |  |                    |
|   |           | R | RTU, ANN, DFR              |  |                    |
|   |           | S | STEEL                      |  |                    |
|   |           | T | CABLE TABS                 |  |                    |
|   |           | X | TRANSFORMERS               |  |                    |
|   |           | Z | MISC.                      |  |                    |

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY	
AFTON SUBSTATION	S294
AFTON, OKLAHOMA 161/69kV	
CABLE SCHEDULE CONTROL & INDICATION	
SCALE: NONE	APPD: BA
DRAWN BY: DJR	ENGR: AEM
CH: MW	DATE: 3/7/2011
	
DRAWING No. S294DT401	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID		BA

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION					NOTES				
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*	PURCHASED BY	INSTALLED BY	NOTES
Y11	5	01	4	10	-	XLPE	PVC	E1/K1	DC	CB-2	D	WZ10	TB-FU1	101	S001	60	C	C	
Y11	5	02	4	10	-	XLPE	PVC	E1/K1	DC	CB-3	D	WZ10	TB-FU1	102	SF008	60	C	C	
Y11	5	03	4	10	-	XLPE	PVC	E1/K1	DC	CB-4	D	WZ10	TB-FU1	103	SF010	60	C	C	
Y11	5	04	4	10	-	XLPE	PVC	E1/K1	DC	CB-5	D	WZ10	TB-FU1	104	SX101	60	C	C	
Y11	5	05	4	10	-	XLPE	PVC	E1/K1	DC	CB-6	D	WZ10	TB-FU1	105	SB402	60	C	C	
Y11	5	06	4	10	-	XLPE	PVC	E1/K1	DC	CB-7	D	WZ10	TB-FU1	106	SX201	60	C	C	
Y11	5	07	4	10	-	XLPE	PVC	E1/K1	DC	CB-8	D	WZ10	TB-FU1	107	SF116	60	C	C	
Y11	5	08	4	10	-	XLPE	PVC	E1/K1	DC	CB-9	D	WZ10	TB-FU1	108	SF119	60	C	C	
Y11	5	09	4	10	-	XLPE	PVC	E1/K1	DC	CB-10	D	WZ10	TB-FU1	109	SF123	60	C	C	
Y11	5	10	4	10	-	XLPE	PVC	E1/K1	DC	CB-11	D	WZ10	TB-FU1	110	SF122	60	C	C	
Y11	5	11	4	10	-	XLPE	PVC	E1/K1	DC	CB-12	D	WZ10	TB-FU1	111	SF126	60	C	C	
Y11	5	12	4	10	-	XLPE	PVC	E1/K1	DC	CB-13	D	WZ10	TB-FU1	112	SF130	60	C	C	
Y11	5	13	4	10	-	XLPE	PVC	E1/K1	DC	CB-14	D	WZ10	B100-P	-	SB100a	185	C	C	
Y11	5	14	4	10	-	XLPE	PVC	E1/K1	DC	CB-15	D	WZ10	B100-PB	-	SB100a	185	C	C	
Y11	5	15	4	10	-	XLPE	PVC	E1/K1	DC	CB-16	D	WZ10	B2270-P	-	SB2270a	220	C	C	
Y11	5	16	4	10	-	XLPE	PVC	E1/K1	DC	CB-17	D	WZ10	B2270-PB	-	SB2270a	220	C	C	
Y11	5	17	4	10	-	XLPE	PVC	E1/K1	DC	CB-18	D	WZ10	B200-P	-	SB200a	150	C	C	
Y11	5	18	4	10	-	XLPE	PVC	E1/K1	DC	CB-19	D	WZ10	B200-PB	-	SB200a	150	C	C	
Y11	5	19																	
Y11	5	20																	
Y11	5	21																	
Y11	5	22																	
Y11	5	23																	
Y11	5	24	4	10	-	XLPE	PVC	E1/K1	DC	CB-1	E	WZ11	B1270-P	-	SB1270a	130	C	C	
Y11	5	25	4	10	-	XLPE	PVC	E1/K1	DC	CB-2	E	WZ11	B12670-PB	-	SB12670a	130	C	C	
Y11	5	26	4	8	-	XLPE	PVC	E1/K1	DC	CB-3	E	WZ11	B300-TB1	-	SB300a	240	C	C	
Y11	5	27	4	10	-	XLPE	PVC	E1/K1	DC	CB-4	E	WZ11	B300-TB1A	-	SB300a	240	C	C	
Y11	5	28	4	10	-	XLPE	PVC	E1/K1	DC	CB-5	E	WZ11	B300-TB1B	-	SB300a	240	C	C	
Y11	5	29	4	8	-	XLPE	PVC	E1/K1	DC	CB-6	E	WZ11	B400-TB1	-	SB400a	255	C	C	
Y11	5	30	4	10	-	XLPE	PVC	E1/K1	DC	CB-7	E	WZ11	B400-TB1A	-	SB400a	255	C	C	
Y11	5	31	4	10	-	XLPE	PVC	E1/K1	DC	CB-8	E	WZ11	B400-TB1B	-	SB400a	255	C	C	
Y11	5	32	4	8	-	XLPE	PVC	E1/K1	DC	CB-9	E	WZ11	B500-TB1	-	SB500a	300	C	C	
Y11	5	33	4	10	-	XLPE	PVC	E1/K1	DC	CB-10	E	WZ11	B500-TB1A	-	SB500a	300	C	C	
Y11	5	34	4	10	-	XLPE	PVC	E1/K1	DC	CB-11	E	WZ11	B500-TB1B	-	SB500a	300	C	C	
Y11	5	35	4	8	-	XLPE	PVC	E1/K1	DC	CB-12	E	WZ11	B540-TB1	-	SB540a	215	C	C	

GENERAL LEGEND:

Y YEAR  
 CT BUSHING CURRENT TRANSFORMER  
 CB CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161kV)  
 TP TRANSFORMER, POWER  
 TS TRANSFORMER, STATION SERVICE  
 PR PANEL, RELAY  
 CB CIRCUIT BREAKER, LOW VOLTAGE (120-480V)  
 PT POTENTIAL TRANSFORMER  
 FU FUSE UNIT OR HOLDER  
 PB PANEL, CIRCUIT BREAKER

JB PANEL, JUNCTION OR SPLICE  
 CC CONTRACTOR  
 OW OWNER (OTHERS)

DRAWING IDENTIFICATION LEGEND:

DRAWING TYPE:  
 D-DOCUMENTS  
 P-PHYSICAL  
 S-SCHEMATIC  
 W-WIRING

EQUIPMENT:  
 B-BREAKER/RECLOSER  
 C-CIRCUIT SWITCHER/MOS  
 E-ELEC LAYOUT/ELEV.  
 F-FEEDER  
 G-GROUNDING, CONDUIT, TRENCH  
 H-CONTROL HOUSE  
 M-MATERIALS LIST  
 O-OPERATING ONE-LINE  
 P-PANELS  
 Q-CAP BANKS  
 R-RTU, ANN, DFR  
 S-STEEL  
 T-CABLE TABS  
 X-TRANSFORMERS  
 Z-MISC.

NUMBER ASSIGNED:  
 NUMBER ASSIGNED IN  
 NUMERIC ORDER OR  
 ITEM SPECIFIC

\* LENGTHS ARE APPROXIMATE, CONTRACTOR  
 TO VERIFY ACTUAL LENGTHS.

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
CABLE SCHEDULE 125VDC			
SCALE: NONE	DRAWN BY: DJR	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
DRAWING No. S294DT501			REV. 0
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID		BA



File: W:\Drafting\Drawings\Substation\AFTON\Carver CAD Drawings 2-16-12\S294DT502 CABLE SCHEDULE 125VDC.dwg Last Saved: 5/31/2012 9:51 AM Last saved by: Ashultz  
 Last Plotted By: Shultz, Arlene Plot Style: Carver Standard Half.ctb Plot Scale: 1:2 Plot Date: 5/31/2012 9:51 AM Plotter used: Adobe PDF

CABLE NO.			CABLE DESCRIPTION								CABLE INSTALLATION						NOTES		
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*			
Y11	5	36	4	10	-	XLPE	PVC	E1/K1	DC	CB-13	E	WZ11	B540-TB1A	-	SB540a	215	C	C	
Y11	5	37	4	10	-	XLPE	PVC	E1/K1	DC	CB-14	E	WZ11	B540-TB1B	-	SB540a	215	C	C	
Y11	5	38																	
Y11	5	39																	
Y11	5	40	4	8	-	XLPE	PVC	E1/K1	DC	CB-15	E	WZ11	B600-TB1	-	SB600a	200	C	C	
Y11	5	41	4	10	-	XLPE	PVC	E1/K1	DC	CB-16	E	WZ11	B600-TB1A	-	SB600a	200	C	C	
Y11	5	42	4	10	-	XLPE	PVC	E1/K1	DC	CB-17	E	WZ11	B600-TB1B	-	SB600a	200	C	C	
Y11	5	43	4	8	-	XLPE	PVC	E1/K1	DC	CB-18	E	WZ11	B6140-TB1	-	SB6140a	280	C	C	
Y11	5	44	4	10	-	XLPE	PVC	E1/K1	DC	CB-19	E	WZ11	B6140-TB1A	-	SB6140a	280	C	C	
Y11	5	45	4	10	-	XLPE	PVC	E1/K1	DC	CB-20	E	WZ11	B6140-TB1B	-	SB6140a	280	C	C	
Y11	5	46	4	8	-	XLPE	PVC	E1/K1	DC	CB-1	F	WZ12	B6040-TB1	-	SB6040a	215	C	C	
Y11	5	47	4	10	-	XLPE	PVC	E1/K1	DC	CB-2	F	WZ12	B6040-TB1A	-	SB6040a	215	C	C	
Y11	5	48	4	10	-	XLPE	PVC	E1/K1	DC	CB-3	F	WZ12	B6040-TB1B	-	SB6040a	215	C	C	
Y11	5	49	4	8	-	XLPE	PVC	E1/K1	DC	CB-4	F	WZ12	B700-TB1	-	SB700a	250	C	C	
Y11	5	50	4	10	-	XLPE	PVC	E1/K1	DC	CB-5	F	WZ12	B700-TB1A	-	SB700a	250	C	C	
Y11	5	51	4	10	-	XLPE	PVC	E1/K1	DC	CB-6	F	WZ12	B700-TB1B	-	SB700a	250	C	C	
Y11	5	52	4	8	-	XLPE	PVC	E1/K1	DC	CB-7	F	WZ12	B6340-TB1	-	SB6340a	280	C	C	
Y11	5	53	4	10	-	XLPE	PVC	E1/K1	DC	CB-8	F	WZ12	B6340-TB1A	-	SB6340a	280	C	C	
Y11	5	54	4	10	-	XLPE	PVC	E1/K1	DC	CB-9	F	WZ12	B6340-TB1B	-	SB6340a	280	C	C	
Y11	5	55	4	8	-	XLPE	PVC	E1/K1	DC	CB-10	F	WZ12	B800-TB1	-	SB800a	240	C	C	
Y11	5	56	4	10	-	XLPE	PVC	E1/K1	DC	CB-11	F	WZ12	B800-TB1A	-	SB800a	240	C	C	
Y11	5	57	4	10	-	XLPE	PVC	E1/K1	DC	CB-12	F	WZ12	B800-TB1B	-	SB800a	240	C	C	
Y11	5	58	4	8	-	XLPE	PVC	E1/K1	DC	CB-13	F	WZ12	B6240-TB1	-	SB6240a	300	C	C	
Y11	5	59	4	10	-	XLPE	PVC	E1/K1	DC	CB-14	F	WZ12	B6240-TB1A	-	SB6240a	300	C	C	
Y11	5	60	4	10	-	XLPE	PVC	E1/K1	DC	CB-15	F	WZ12	B6240-TB1B	-	SB6240a	300	C	C	
Y11	5	61	4	8	-	XLPE	PVC	E1/K1	DC	CB-16	F	WZ12	T1(DC+,-)	-		255	C	C	
Y11	5	62	4	10	-	XLPE	PVC	E1/K1	DC	CB-17	F	WZ12	T2(DC+,-)	-		300	C	C	
Y11	5	63	4	-	-	XLPE	PVC	E1/K1	DC	DC CHARGER			CB-1	D	WZ10		C	C	
Y11	5	64	2	#3/0	-	-	-	-	DC	BATTERY		WZ10	PANEL F	D	WZ10		C	C	
Y11	5	65	2	#3/0	-	-	-	-	DC	BATTERY		WZ10	PANEL F	E	WZ11		C	C	
Y11	5	66	2	#3/0	-	-	-	-	DC	BATTERY		WZ10	PANEL F	F	WZ12		C	C	
Y11	5	67																	
Y11	5	68																	
Y11	5	69																	
Y11	5	70																	

GENERAL LEGEND:

Y	YEAR	JB	PANEL, JUNCTION OR SPLICE
CT	BUSHING CURRENT TRANSFORMER	CC	CONTRACTOR
CB	CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161KV)	OW	OWNER (OTHERS)
TP	TRANSFORMER, POWER		
TS	TRANSFORMER, STATION SERVICE		
PR	PANEL, RELAY		
CB	CIRCUIT BREAKER, LOW VOLTAGE (120-480V)		
PT	POTENTIAL TRANSFORMER		
FU	FUSE UNIT OR HOLDER		
PB	PANEL, CIRCUIT BREAKER		

\* LENGTHS ARE APPROXIMATE, CONTRACTOR TO VERIFY ACTUAL LENGTHS.

DRAWING IDENTIFICATION LEGEND:

D-DOCUMENTS	EQUIPMENT:	B-BREAKER/RECLOSER	NUMBER ASSIGNED:
P-PHYSICAL	C-CIRCUIT SWITCHER/MOS	E-ELEC LAYOUT/ELEV.	NUMBER ASSIGNED IN
S-SCHEMATIC	F-FEEDER	G-GROUNDING, CONDUIT, TRENCH	NUMERIC ORDER OR
W-WIRING	H-CONTROL HOUSE	M-MATERIALS LIST	ITEM SPECIFIC
	O-OPERATING ONE-LINE	P-PANELS	
	Q-CAP BANKS	R-RTU, ANN, DFR	
	S-STEEL	T-CABLE TABS	
	X-TRANSFORMERS	Z-MISC.	

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69kV

**CABLE SCHEDULE**  
**125VDC**

SCALE: NONE    DRAWN BY: DJR    ENGR: AEM    APPD: BA  
 CH: MW    DATE: 3/7/2011

0 5/29/12 ISSUED FOR BID BA  
 REV DATE REVISION DESCRIPTION DFT ENG

DRAWING No.  
**S294DT502**    REV. 0

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

CABLE NO.			CABLE DESCRIPTION							CABLE INSTALLATION					NOTES				
YEAR INSTALLED	SERIES	NUMBER	NUMBER OF CONDUCTORS	AWG WIRE SIZE	GROUND	INSULATION	JACKET	METHOD 1 ICEA COLOR CODE	USED FOR	FROM EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	TO EQUIPMENT	PANEL NO.	DRAWING NUMBER S294-	APPROXIMATE LENGTH (feet)*	PURCHASED BY	INSTALLED BY	NOTES
Y11	6	01	12	#16	-	XLPE	PVC	E1/K1	AL	21P	101	SF005	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	02	12	#16	-	XLPE	PVC	E1/K1	AL	21A	101	SF006	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	03	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	101	SF007	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	04	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	102	SF008	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	05	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	102	SF009	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	06	12	#16	-	XLPE	PVC	E1/K1	AL	21P	103	SF010	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	07	12	#16	-	XLPE	PVC	E1/K1	AL	21A	103	SF011	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	08	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	103	SF012	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	09	12	#16	-	XLPE	PVC	E1/K1	AL	87,86TP,86TPP	104	SX101	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	10	12	#16	-	XLPE	PVC	E1/K1	AL	87,86TP,86TPP	106	SX201	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	11	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	104	SB301	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	12	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	105	SB401	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	13	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	106	SB501	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	14	12	#16	-	XLPE	PVC	E1/K1	AL	21P	107	SF116	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	15	12	#16	-	XLPE	PVC	E1/K1	AL	21A	107	SF117	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	16	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	107	SF118	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	17	12	#16	-	XLPE	PVC	E1/K1	AL	21P	108	SF119	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	18	12	#16	-	XLPE	PVC	E1/K1	AL	21A	108	SF120	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	19	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	108	SF121	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	20	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	110	SF122	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	21	12	#16	-	XLPE	PVC	E1/K1	AL	21P	109	SF123	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	22	12	#16	-	XLPE	PVC	E1/K1	AL	21A	109	SF124	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	23	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	109	SF125	ANNUNCIATOR	201	SR01	-	C	C	
Y11	6	24	12	#16	-	XLPE	PVC	E1/K1	AL	21P	111	SF126	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	25	12	#16	-	XLPE	PVC	E1/K1	AL	21A	111	SF127	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	26	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	111	SF128	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	27	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	110	SF129	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	28	12	#16	-	XLPE	PVC	E1/K1	AL	21P	112	SF130	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	29	12	#16	-	XLPE	PVC	E1/K1	AL	21A	111	SF131	ANNUNCIATOR	-	SR06	-	C	C	
Y11	6	30	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	112	SF132	ANNUNCIATOR	201	SR08	-	C	C	
Y11	6	31	12	#16	-	XLPE	PVC	E1/K1	AL	50BF,86BF	110	SF133	ANNUNCIATOR	201	SR06	-	C	C	
Y11	6	32	12	#16	-	XLPE	PVC	E1/K1	AL	UPLC	101	S001	ANNUNCIATOR	-	SR04	-	C	C	
Y11	6	33	12	#16	-	XLPE	PVC	E1/K1	AL	UPLC	103	S002	ANNUNCIATOR	-	SR04	-	C	C	
Y11	6	34	12	#16	-	XLPE	PVC	E1/K1	AL	87B, 86B	105	SB402	ANNUNCIATOR	-	SR06	-	C	C	
Y11	6	35	12	#16	-	XLPE	PVC	E1/K1	AL	87B, 86B	105	SB403	ANNUNCIATOR	-	SR06	-	C	C	

GENERAL LEGEND:

Y YEAR  
 CT BUSHING CURRENT TRANSFORMER  
 CB CIRCUIT BREAKER, HIGH VOLTAGE (69 OR 161KV)  
 TP TRANSFORMER, POWER  
 TS TRANSFORMER, STATION SERVICE  
 PR PANEL, RELAY  
 CB CIRCUIT BREAKER, LOW VOLTAGE (120-480V)  
 PT POTENTIAL TRANSFORMER  
 FU FUSE UNIT OR HOLDER  
 PB PANEL, CIRCUIT BREAKER  
 JB PANEL, JUNCTION OR SPLICE  
 CC CONTRACTOR  
 OW OWNER (OTHERS)

\* LENGTHS ARE APPROXIMATE, CONTRACTOR TO VERIFY ACTUAL LENGTHS.

DRAWING IDENTIFICATION LEGEND:

DRAWING TYPE:  
 D-DOCUMENTS  
 P-PHYSICAL  
 S-SCHEMATIC  
 W-WIRING  
 EQUIPMENT:  
 B-BREAKER/RECLOSER  
 C-CIRCUIT SWITCHER/MOS  
 E-ELEC LAYOUT/ELEV.  
 F-FEEDER  
 G-GROUNDING, CONDUIT, TRENCH  
 H-CONTROL HOUSE  
 M-MATERIALS LIST  
 O-OPERATING ONE-LINE  
 P-PANELS  
 Q-CAP BANKS  
 R-RTU, ANN, DFR  
 S-STEEL  
 T-CABLE TABS  
 X-TRANSFORMERS  
 Z-MISC.  
 NUMBER ASSIGNED:  
 NUMBER ASSIGNED IN NUMERIC ORDER OR ITEM SPECIFIC

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69kV

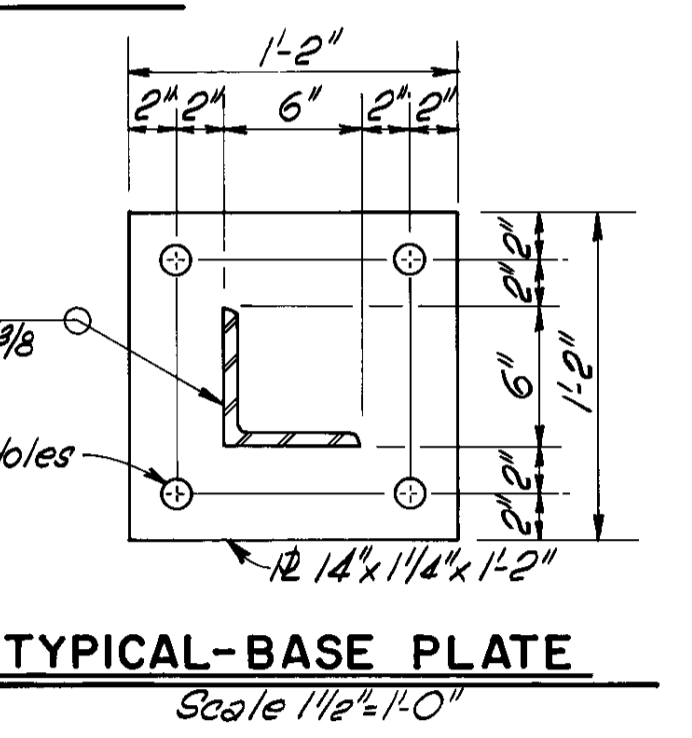
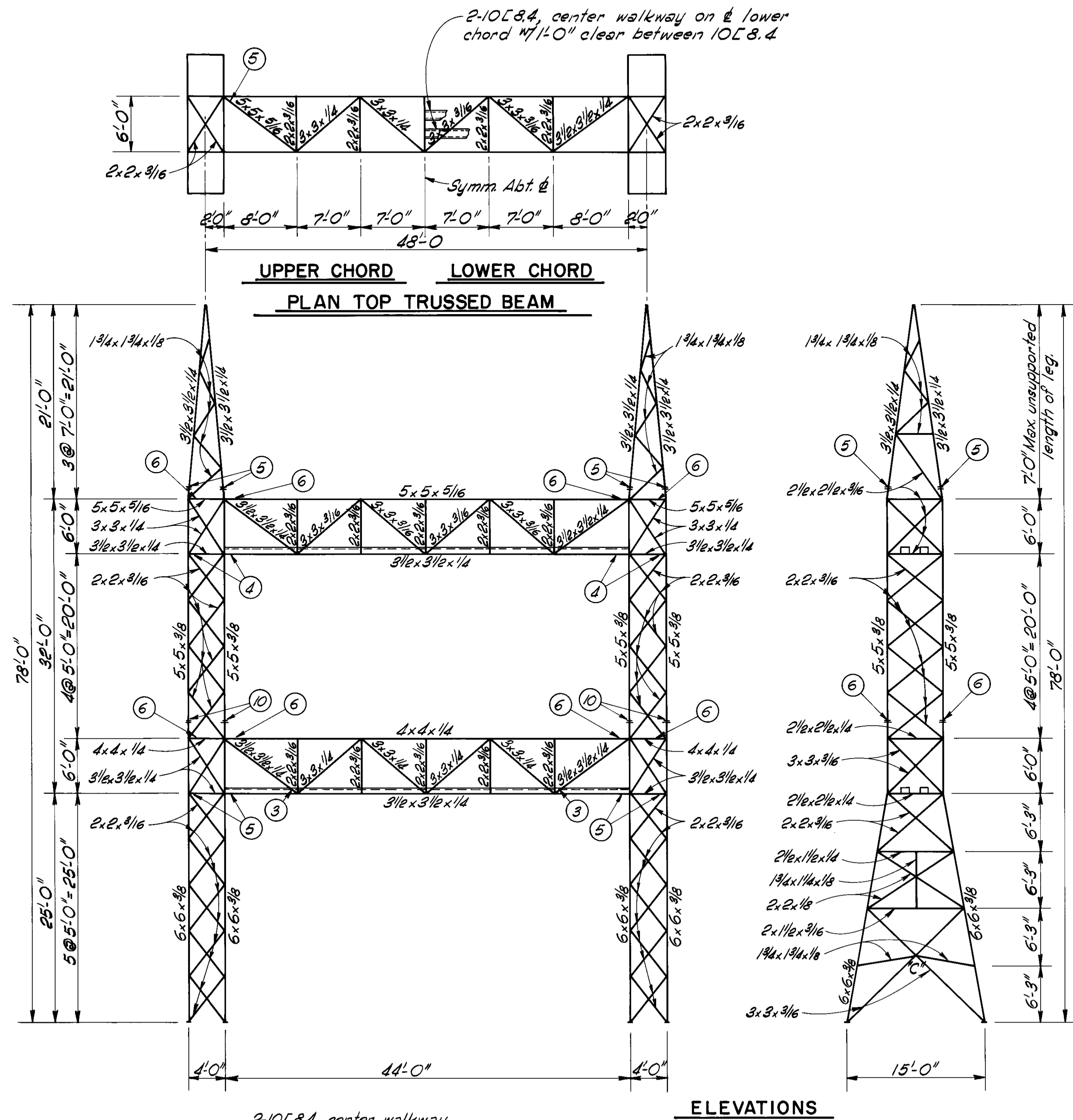
CABLE SCHEDULE  
 ANNUNCIATOR ALARM INPUTS

SCALE: NONE DRAWN BY: DJR ENGR: AEM APPD: BA  
 CH: MW DATE: 3/7/2011

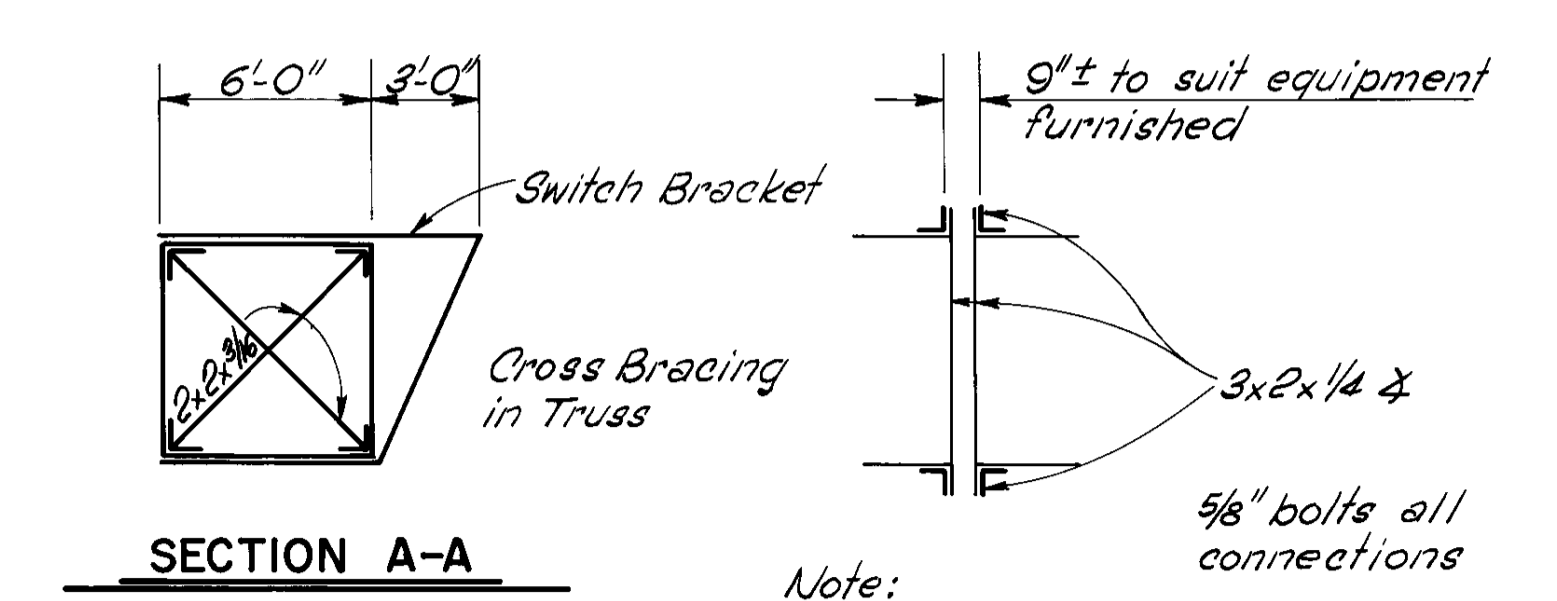


DRAWING No. S294DT601 REV. 0

0	5/29/12	ISSUED FOR BID	BA
REV	DATE	REVISION DESCRIPTION	DFT ENG

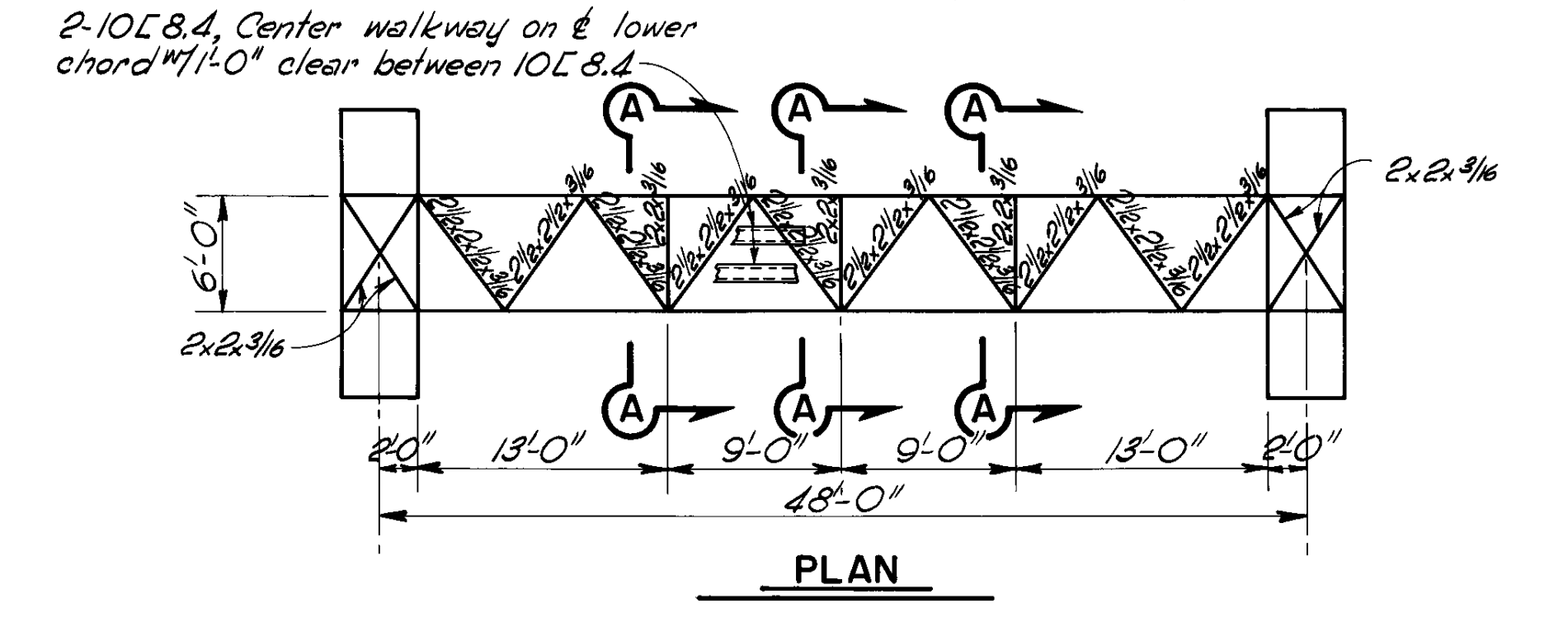


**161 KV DEAD-END TOWER**  
(2 Req'd)

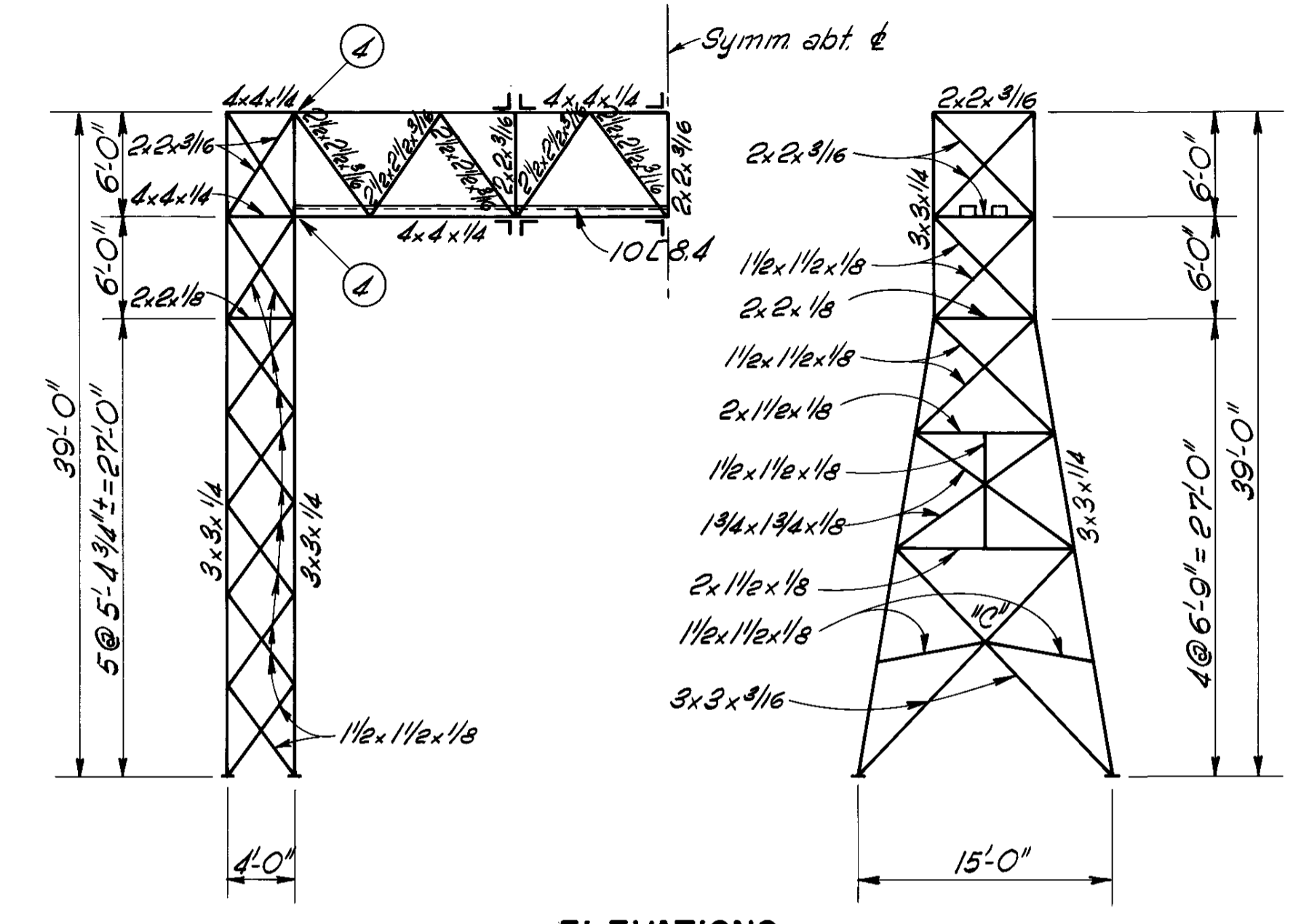


**SECTION A-A**

Note:  
Members shown in plan view are for each face; chords are shown in elevation view.

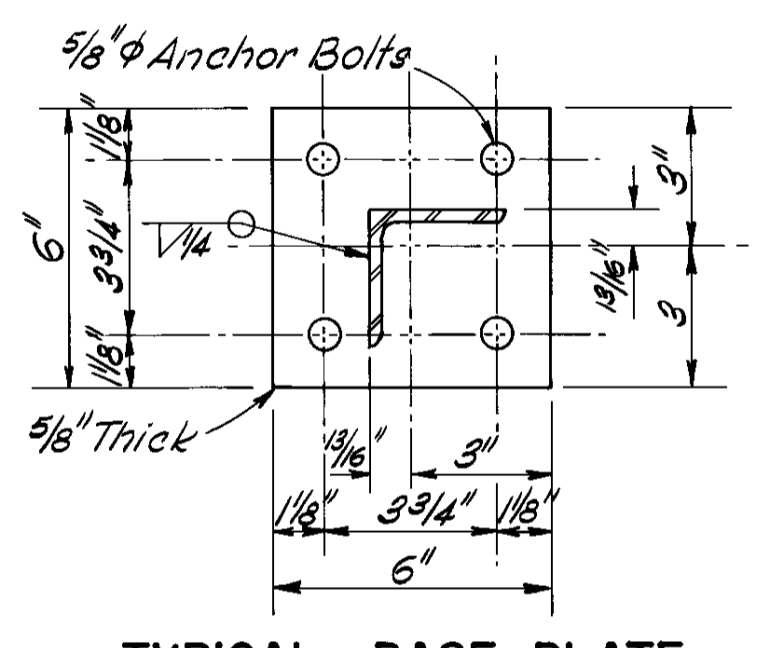


**PLAN**



**ELEVATIONS**

**69 KV BUS STRUCTURE No. 1**  
(1 Req'd)



**TYPICAL - BASE PLATE**

- Notes:
- At joints labeled "C", connect opposite faces with  $2 \times 2 \times 1/8$ .
  - Provide attachment and support for shield wires, conductors, and other equipment.
  - $5/8$ "  $\phi$   $\times$  7" galv. step bolts @ 1'-4" c.c., required up one leg of tower.
  - All connections are  $5/8$ " bolts, two required each connection. Members requiring more than 2 bolts, are noted with number required inside  $\odot$  and redundants may have one bolt.
  - Opposite sides, also top and bottom of trussed beams, are alike, not rolled.

REF. DWGS.  
X-2121 thru X-2821  
X-43 - X-62



"AS BUILT"

**GRAND RIVER DAM AUTHORITY**  
SALINA PUMPED - STORAGE PROJECT  
SECOND 130,000 kw INSTALLATION

**AFTON SWITCHING STATION**  
STRUCTURAL STEEL

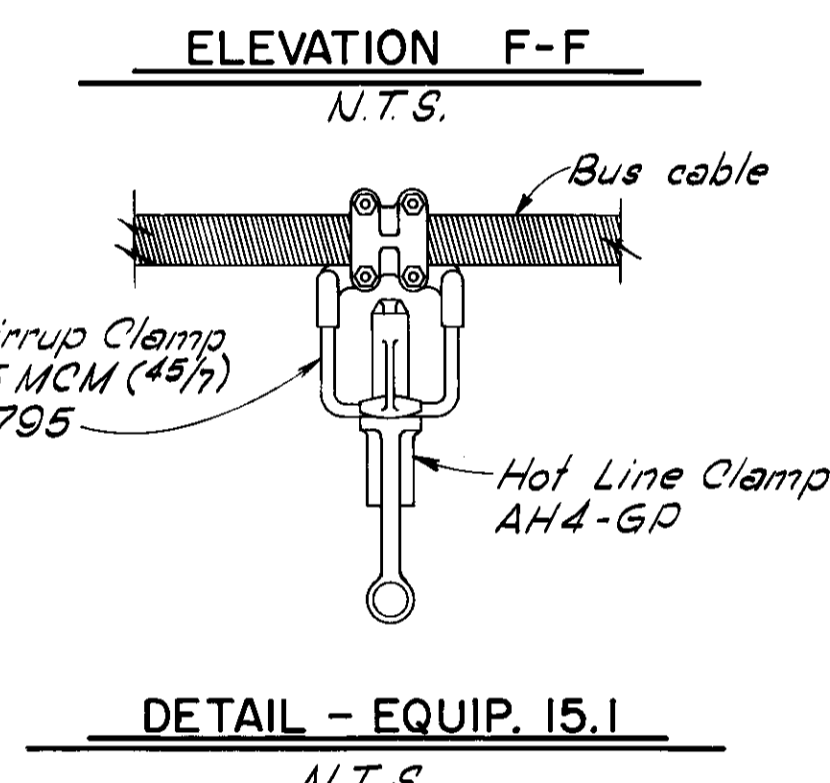
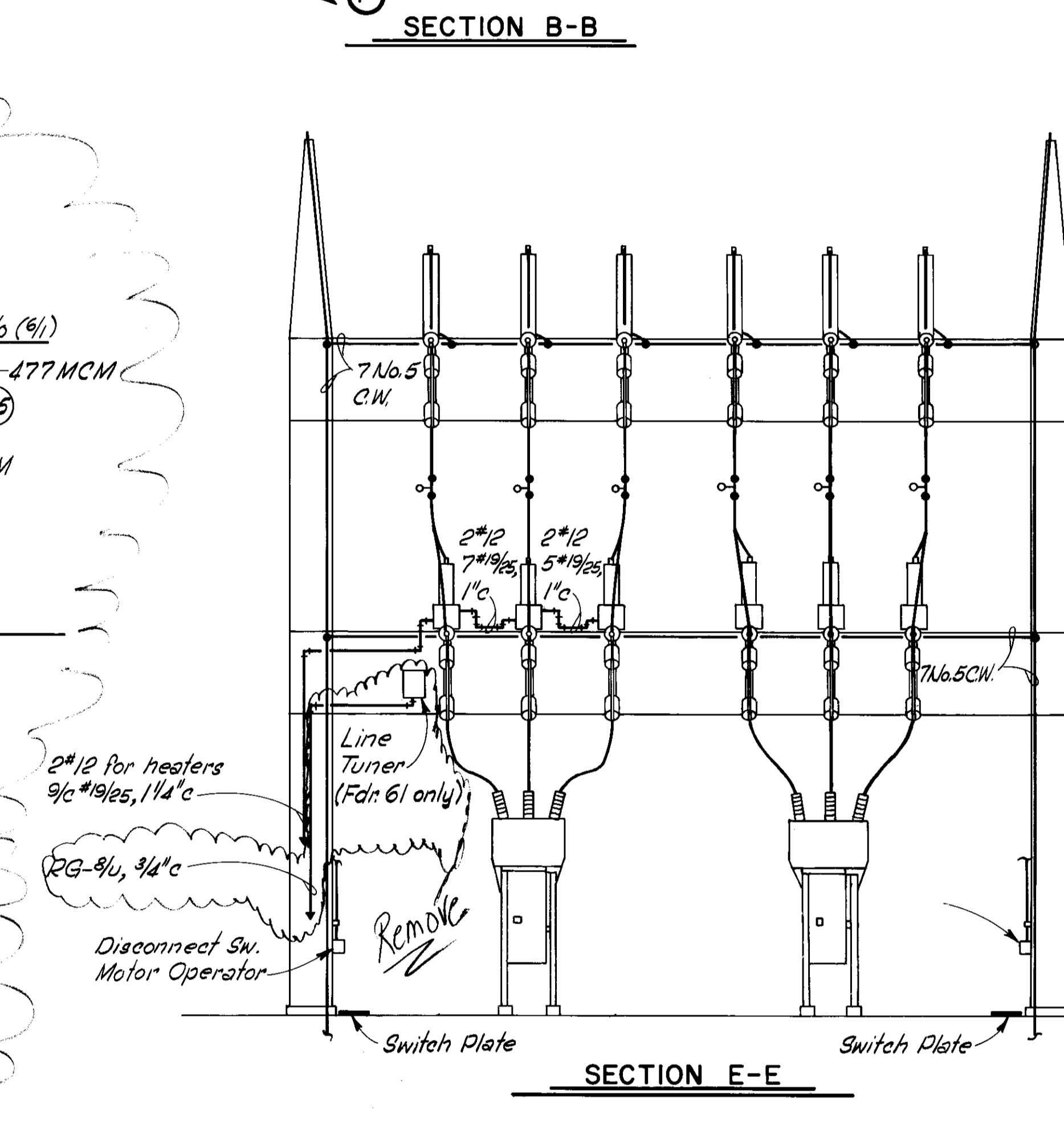
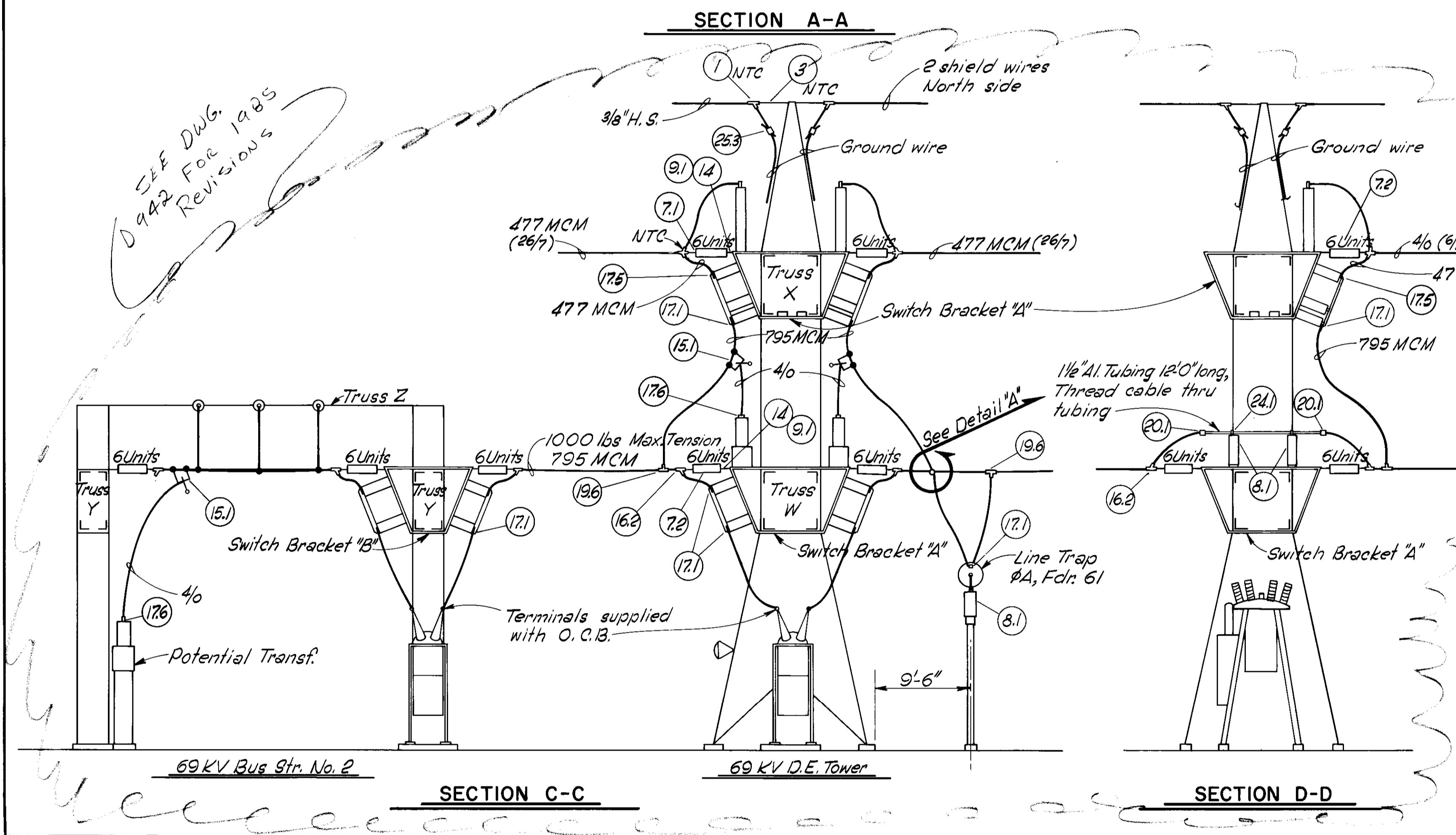
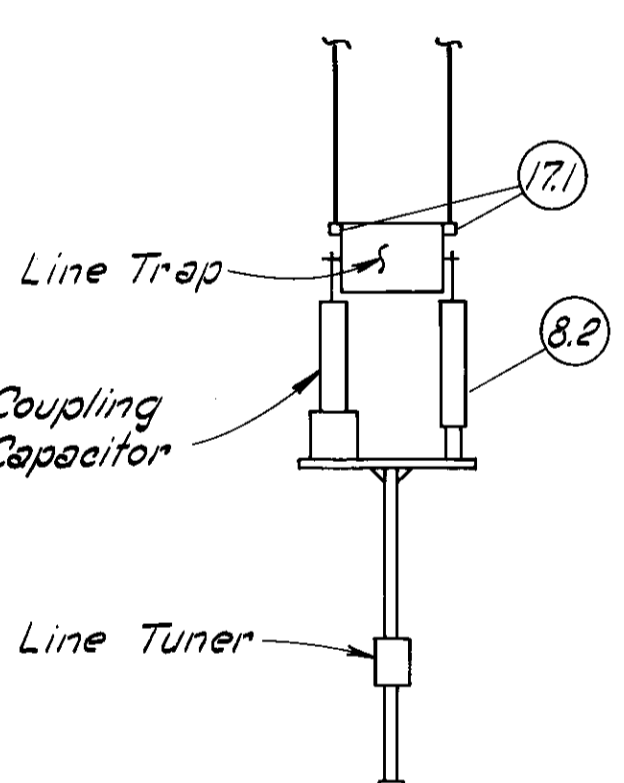
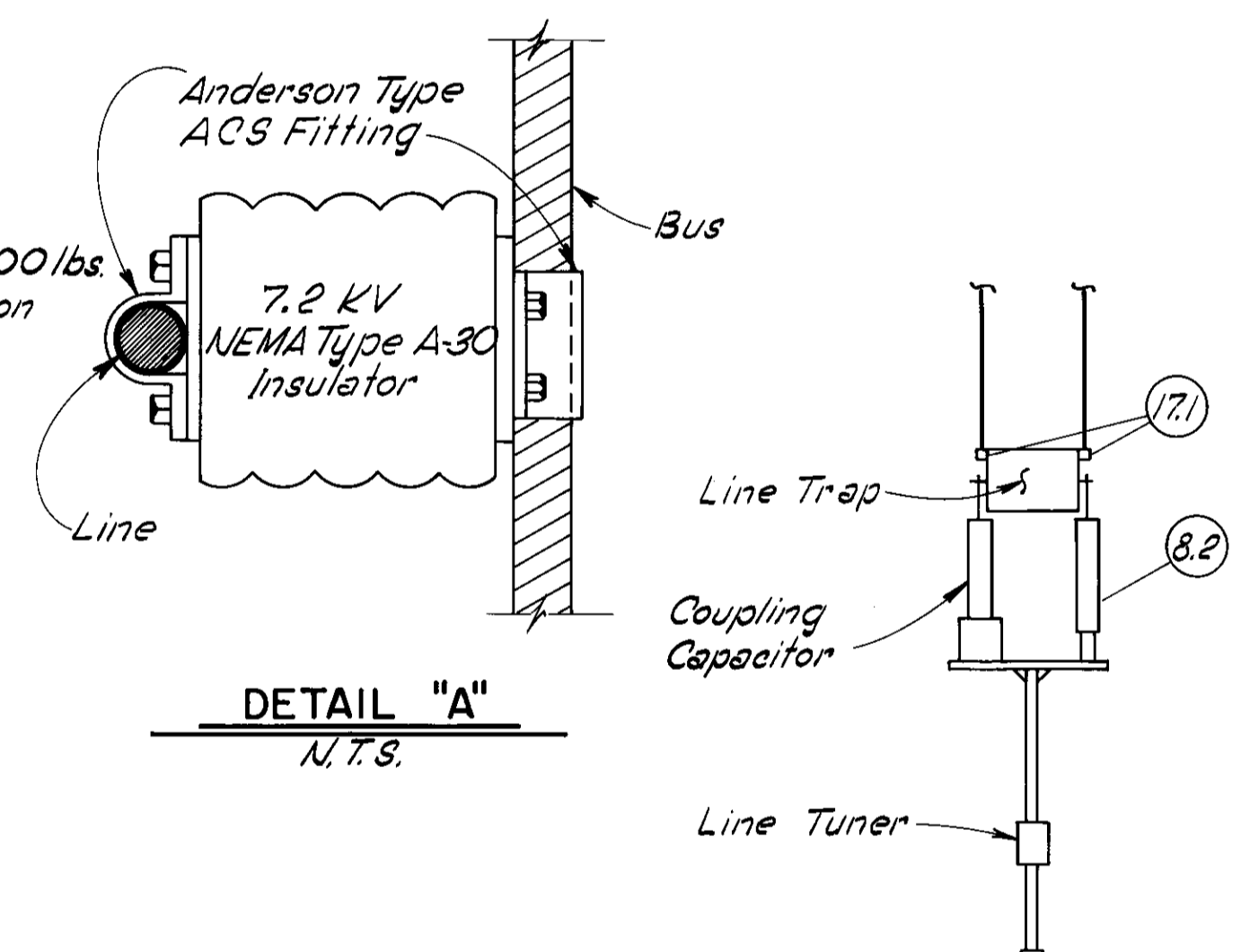
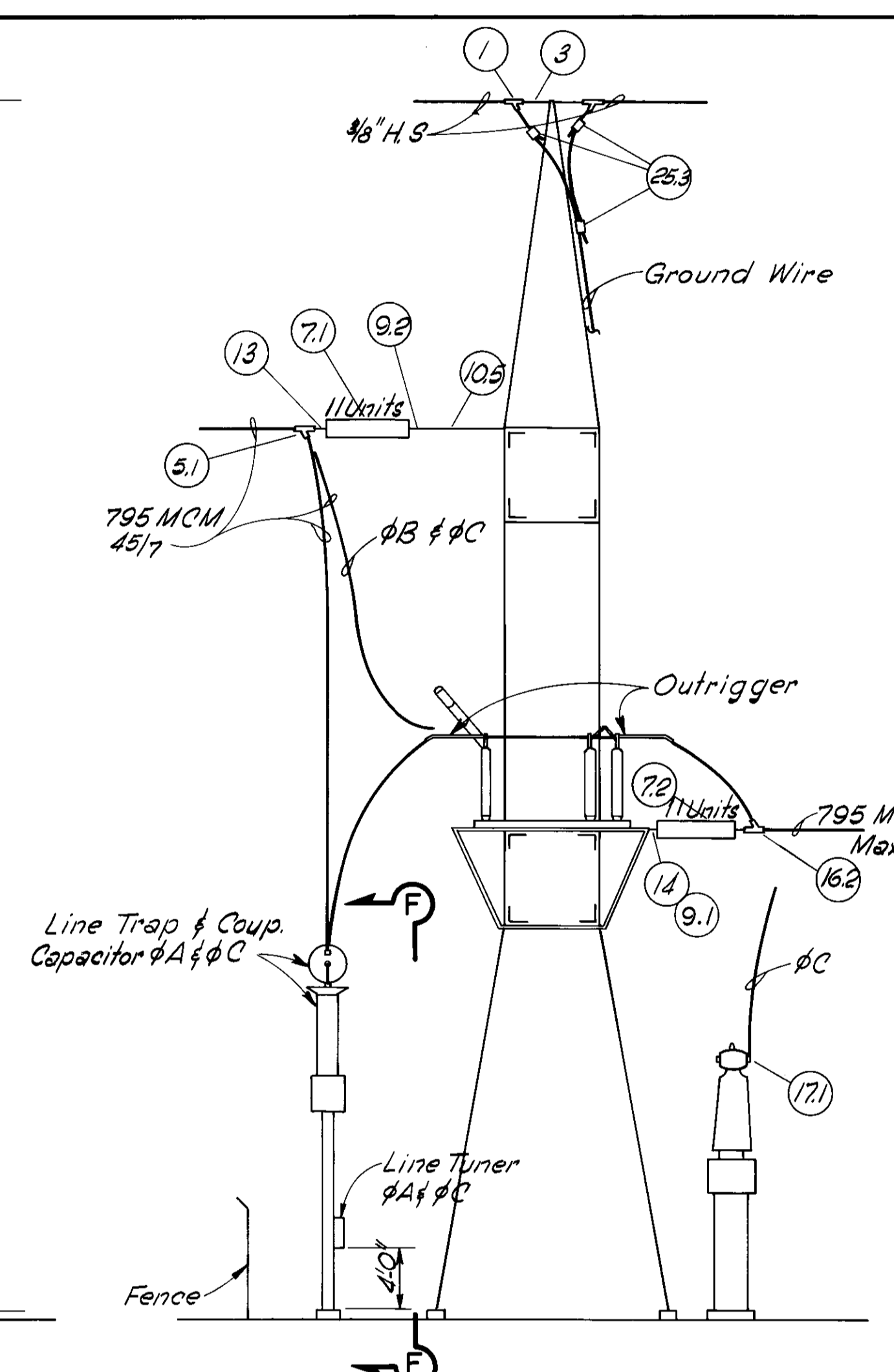
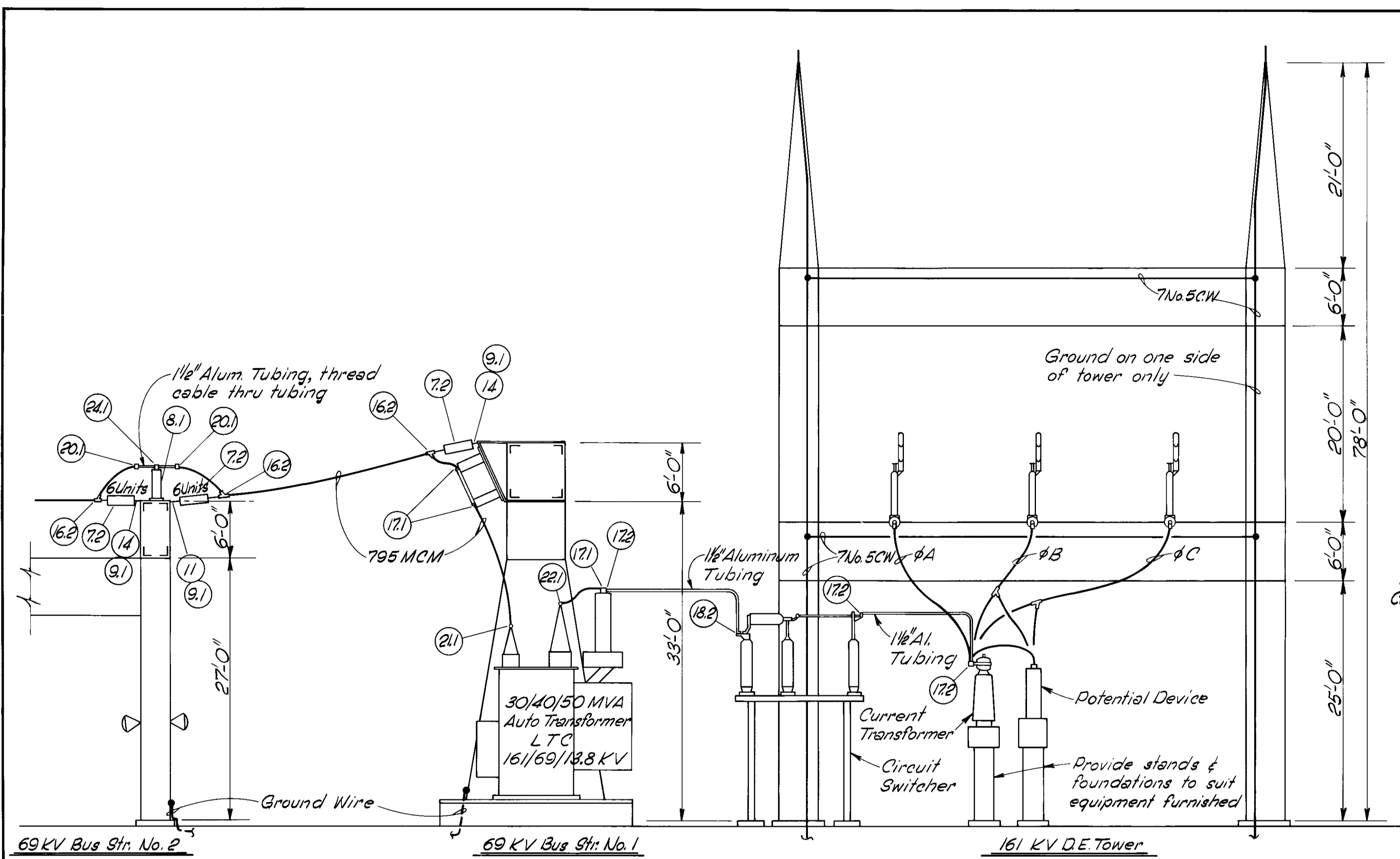
**161-KV DEAD-END TOWER & 69KV BUS STR. No. 1**

W.R.HOLWAY & ASSOCIATES, INC.  
CONSTRUCTION ENGINEER  
TULSA, OKLAHOMA

Scale: 1/8"=1'-0" or As shown  
Date: 1972  
Contract No. 11  
Sheet 9 of 13 sheets

CLEARANCES			
Minimum (Rigid part to rigid part) AIEE 1954	69 KV 350 BIL	115 KV 550 BIL	161 KV 750 BIL
φ to φ	31"	53"	72"
φ to Gnd.	25"	42"	58"
<b>Working</b>			
φ to φ	48"	66"	84"
φ to Gnd.	36"	54"	72"

REV.	DESCRIPTION	DATE	APP.
1	REV. FOR 1985 CONSTR	10/84	[Signature]



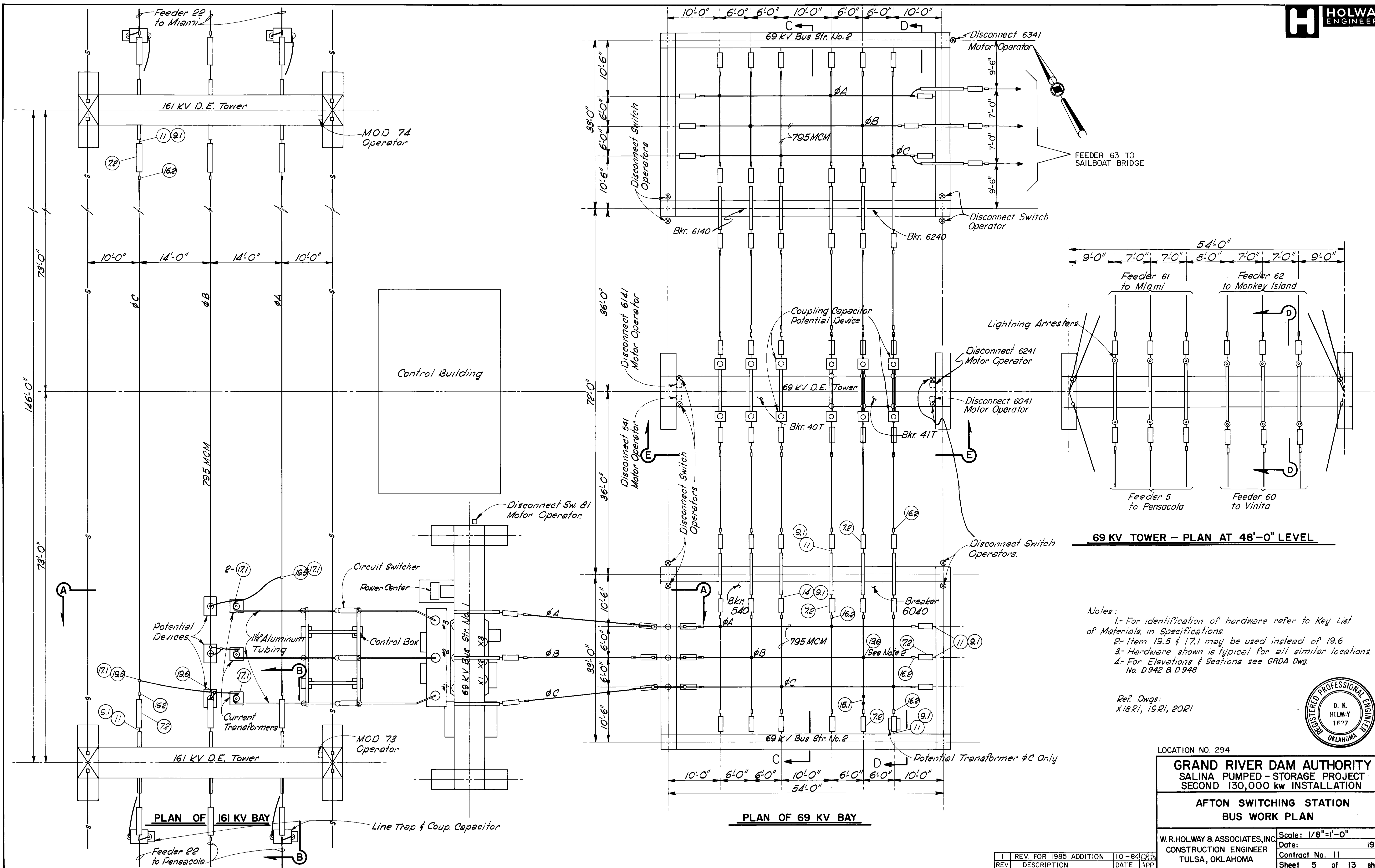
Notes:  
 1: Conduit work shown typical for Feeder Nos. 60 & 61 Grounding same on other side of tower.  
 2: Install ground wire connectors on tower at approx. 4'-0" centers.  
 3: NTC - Not this Contract

Ref. Dwg. X18 R1, 19 R1, 20 R1



LOCATION NO. 294  
**GRAND RIVER DAM AUTHORITY**  
 SALINA PUMPED - STORAGE PROJECT  
 SECOND 130,000 kw INSTALLATION

**AFTON SWITCHING STATION**  
**BUS WORK SECTIONS**  
 W.R. HOLWAY & ASSOCIATES, INC.  
 CONSTRUCTION ENGINEER  
 TULSA, OKLAHOMA  
 Scale: 1/8" = 1'-0" or As shown  
 Date: 1970  
 Contract No. 11  
 Sheet 6 of 13 sheets



**69 KV TOWER - PLAN AT 48'-0" LEVEL**

Notes:  
 1- For identification of hardware refer to Key List of Materials in Specifications.  
 2- Item 19.5 & 17.1 may be used instead of 19.6  
 3- Hardware shown is typical for all similar locations.  
 4- For Elevations & Sections see GRDA Dwg. No. D942 & D948

Ref. Dwg:  
 X18R1, 19R1, 20R1



LOCATION NO. 294  
**GRAND RIVER DAM AUTHORITY**  
 SALINA PUMPED - STORAGE PROJECT  
 SECOND 130,000 kw INSTALLATION

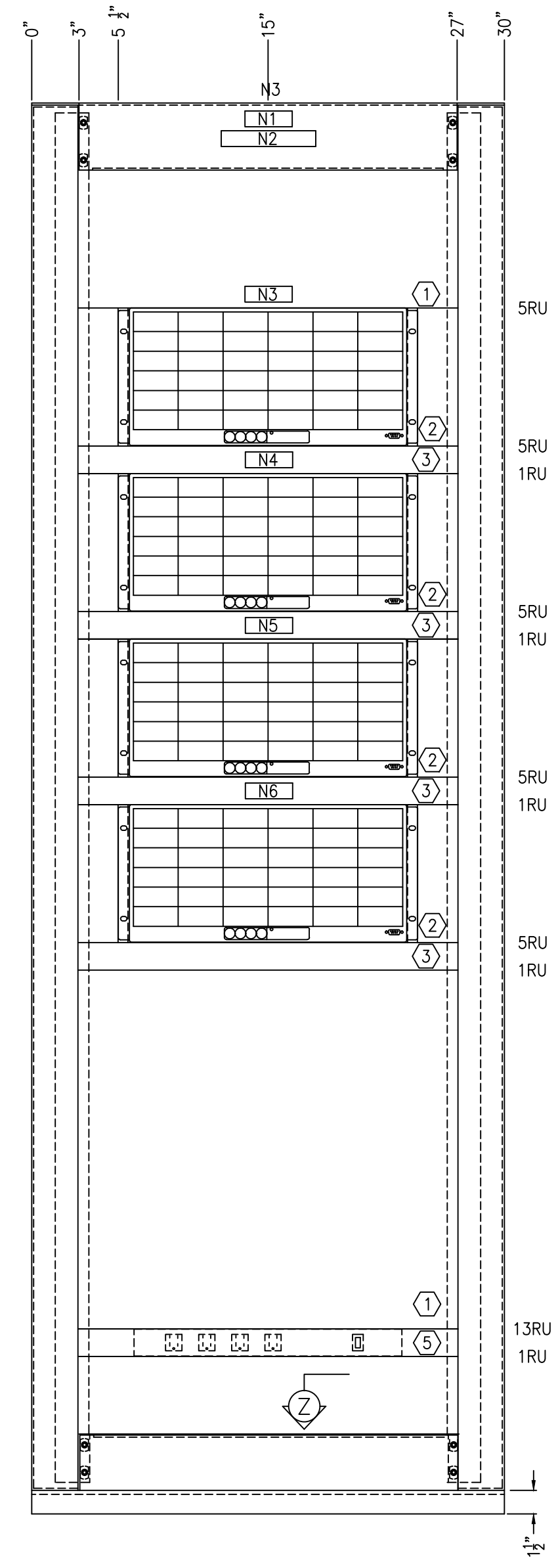
**AFTON SWITCHING STATION**  
**BUS WORK PLAN**

W.R.HOLWAY & ASSOCIATES, INC.  
 CONSTRUCTION ENGINEER  
 TULSA, OKLAHOMA

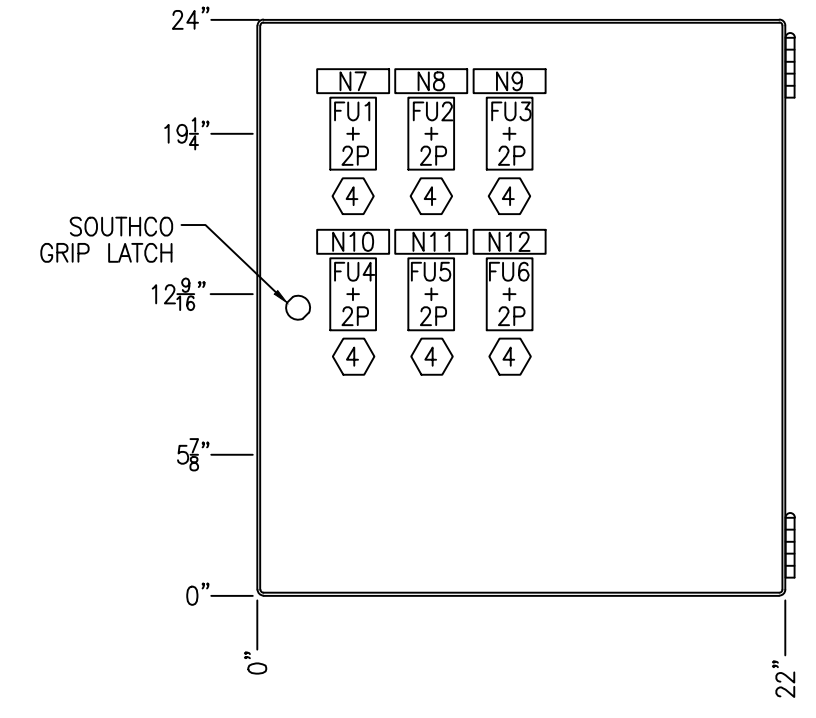
REV.	DESCRIPTION	DATE	APP.
1	REV. FOR 1985 ADDITION	10-84	WJH

Scale: 1/8"=1'-0"  
 Date: 1970  
 Contract No. 11  
 Sheet 5 of 13 sheets

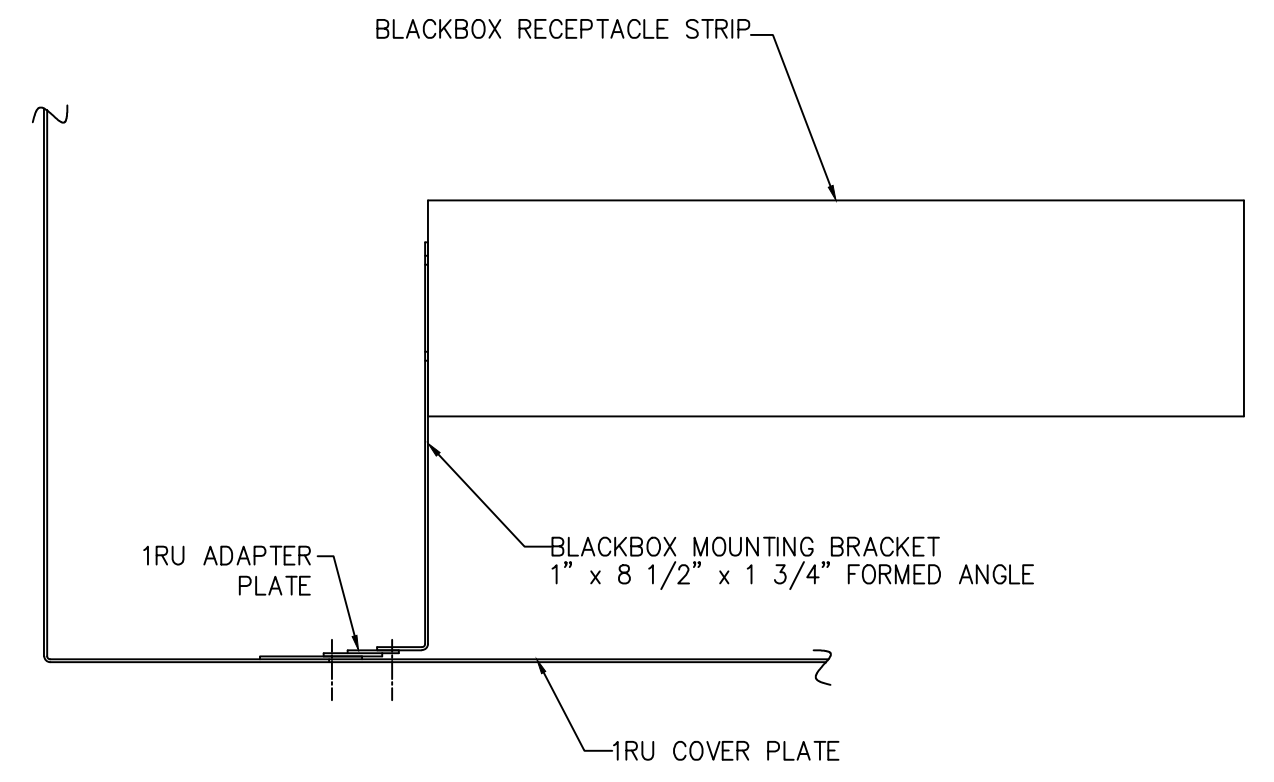
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FRONT VIEW PNL 201  
COMMUNICATIONS & ANNUNCIATOR



REAR VIEW  
SUB PANEL



PARTIAL SECTION Z-Z  
NTS  
TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION	
1	2	BLANK PANEL	
2	4	SCHWEITZER SEL-2523 ANNUNCIATOR	AL
		36 PT. -125VDC, PART NO. 252301H130XAXXX	
3	4	1RU BLANK PANEL	
4	6	MARATHON #F30A2S FUSE BLOCK WITH TYPE NON-10 AMP FUSES	FU
5	1	BLACK BOX RECEPTACLE STRIP, 120VAC, 8 PLUGS W/SURGE PROTECTION, #SP196A-R2	
6	1 LOT	GEN. ELE TYPE EB-25 TERMINAL BLOCKS 12 CIRCUIT, S# EB25B12	TB
NOT SHOWN:			
EDWARDS-SIGNALS, 125VDC, 4" VIBRATING BELL, CAT. NO. 435-6P1			

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 201			1.0x3.0	.187
2	1	ANNUNCIATOR	PANEL		1.0x6.0	.375
3	1	ANNUNCIATOR	NO. 1		1.0x3.0	.187
4	1	ANNUNCIATOR	NO. 2			
5	1	ANNUNCIATOR	NO. 3			
6	1	ANNUNCIATOR	NO. 4			
7	1	ANNUNCIATOR	NO. 1	FU1 (10A)		
8	1	ANNUNCIATOR	NO. 2	FU2 (10A)		
9	1	ANNUNCIATOR	NO. 3	FU3 (10A)		
10	1	ANNUNCIATOR	NO. 4	FU4 (10A)		
11	1	SPARE		FU5 (10A)		
12	1	POWER STRIP		FU6 (10A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

- NOTES:
- ⬡ INDICATES TYPICAL BILL OF MATERIAL ITEM NO.
  - INDICATES TYPICAL NAMEPLATE ITEM NO.
  - 11GA. CONSTRUCTION UNLESS OTHERWISE INDICATED.
  - PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY.  
INTERIOR - HENTZEN WHITE.
  - ▲ INDICATES CUTOUT AND COVER.

**ISSUED FOR BID**

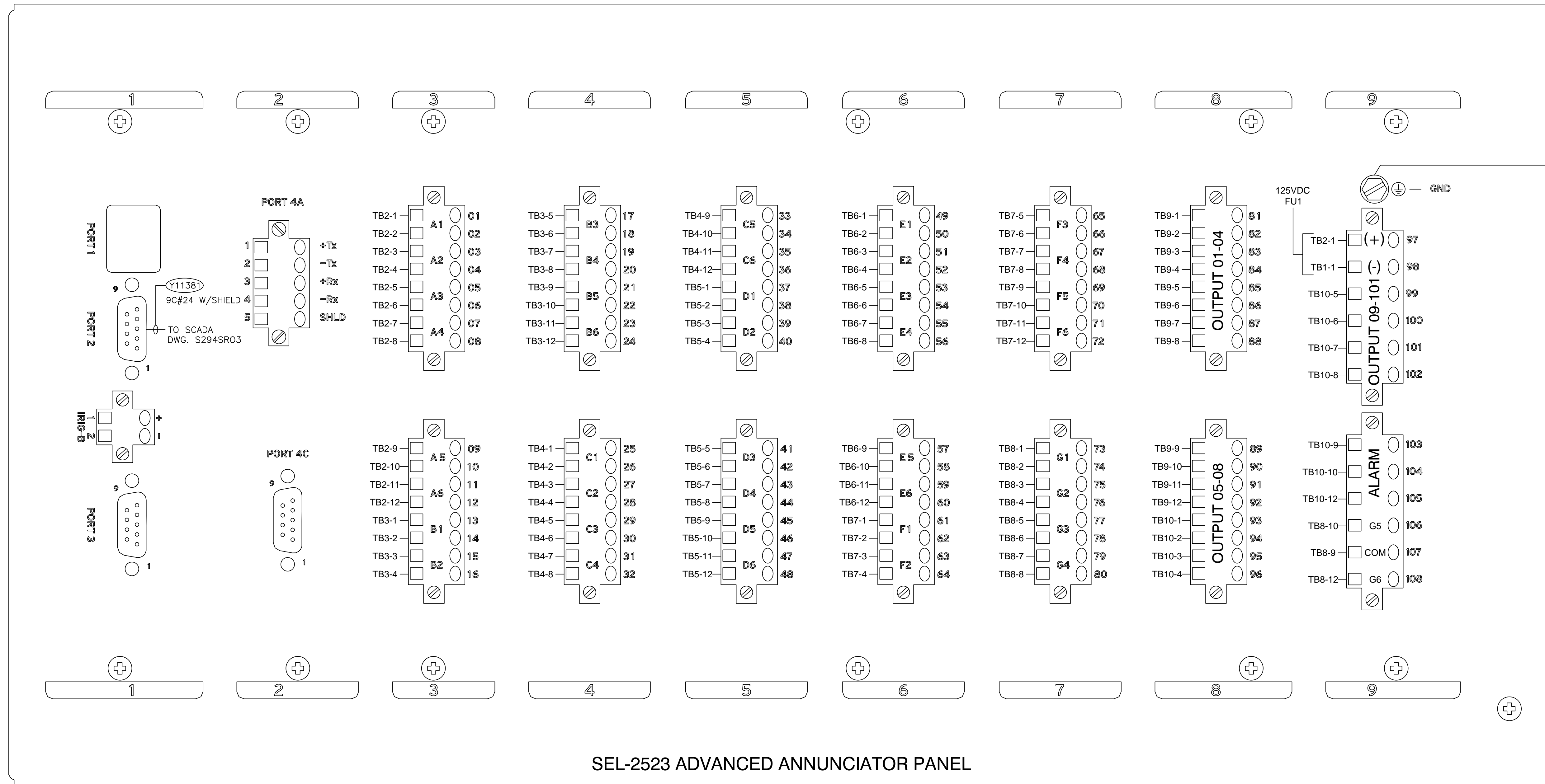
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

COMM. & ANNUNCIATOR PANEL 201  
PANEL 201 ELEVATION

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CH: NN	DATE: 3/7/2011	DRAWING No. S294SR01	
REV	DATE	REVISION DESCRIPTION	DFT ENG
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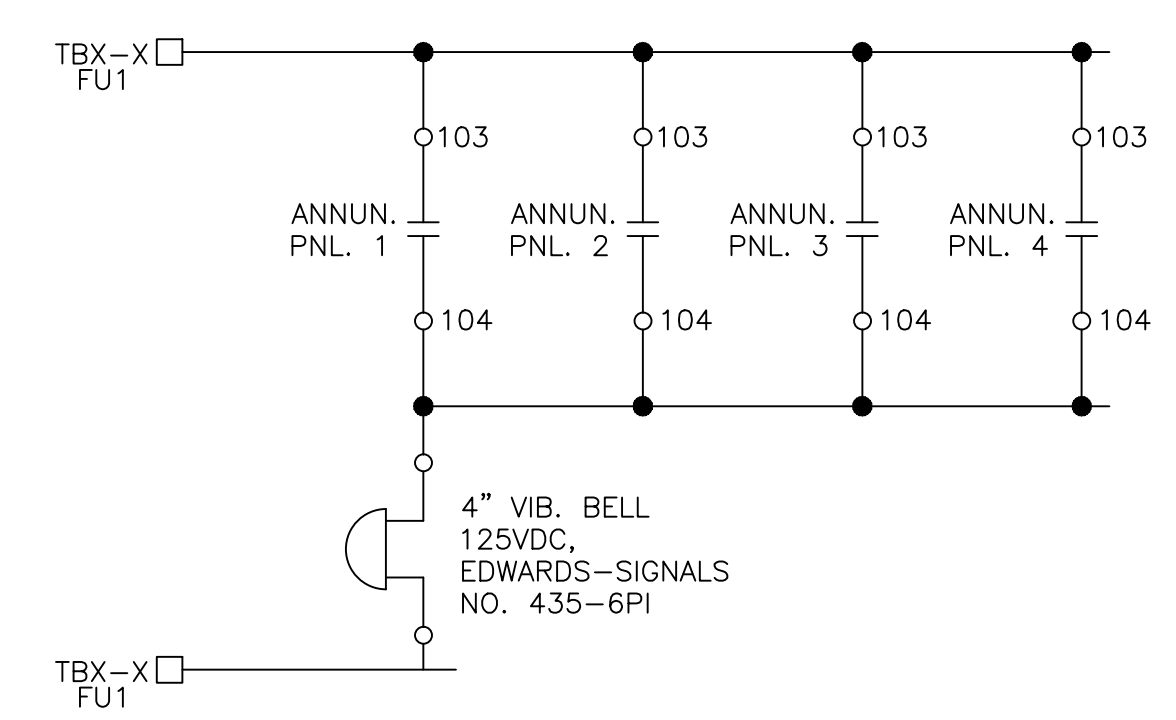
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P.O. BOX 409  
VINITA, OK 74301

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**SEL-2523 ADVANCED ANNUNCIATOR PANEL**

**ANNUNCIATOR AUDIBLE ALARM SCHEMATIC**



**ISSUED FOR BID**

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

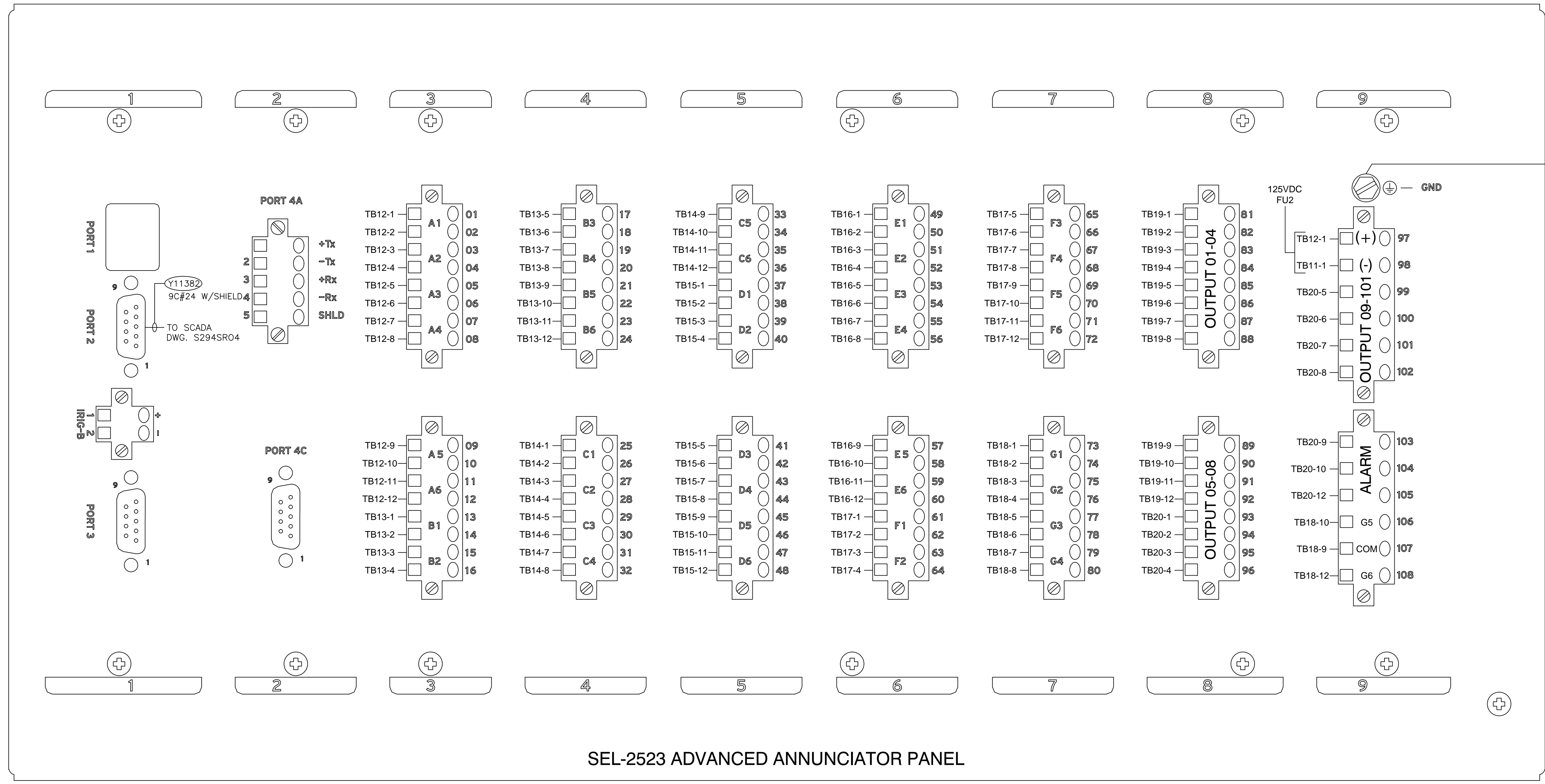
**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

SCADA COMMUNICATIONS FOR STATION IED'S  
 PNL 201, ANNUNCIATOR PANEL NO. 01

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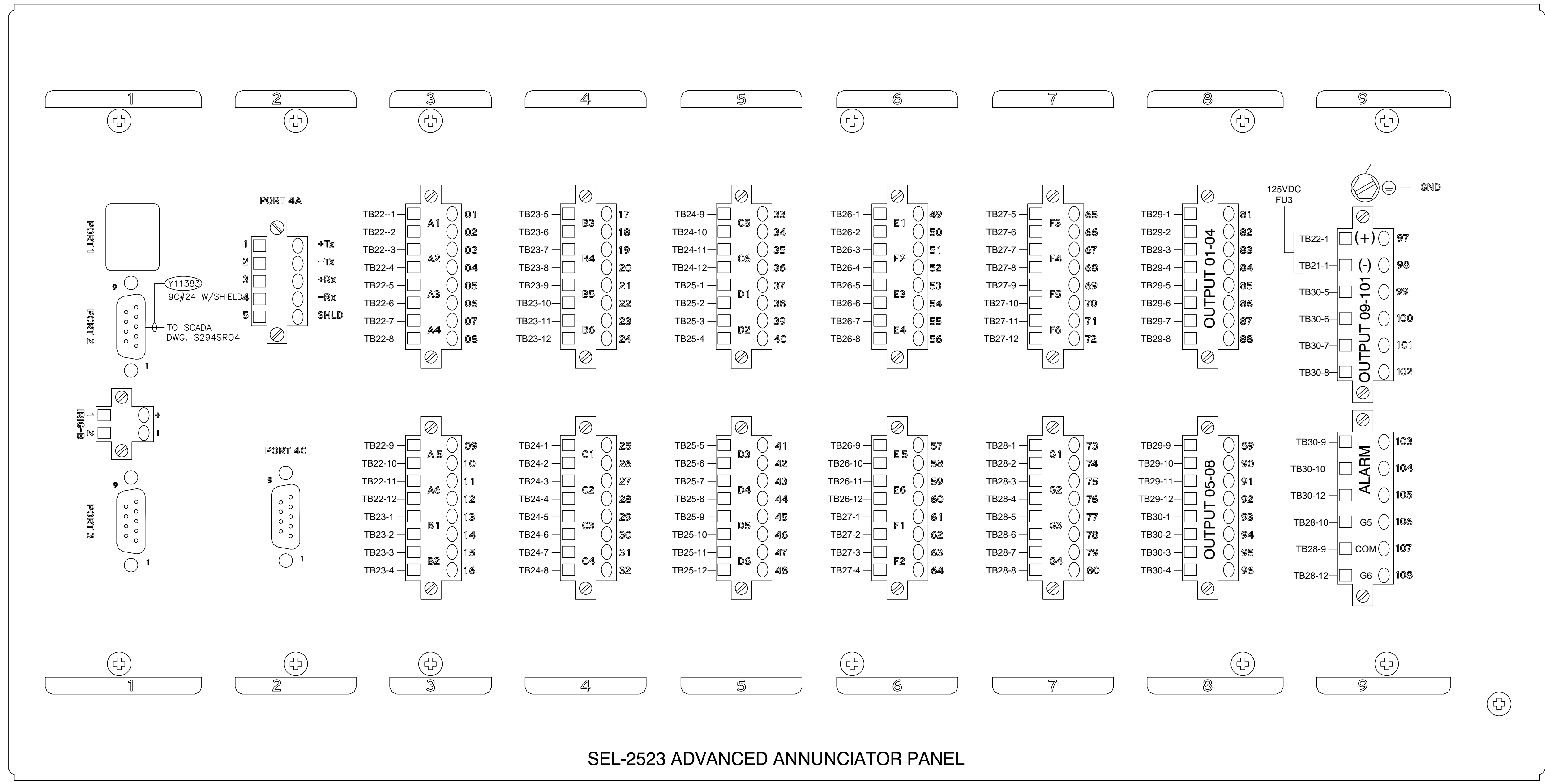
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<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 <small>AFTON, OKLAHOMA</small> 161/69KV			
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CH: NN	DATE: 3/7/2011	<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY</small> P.O. BOX 409 VINITA, OK 74301	
DRAWING No.		REV.	
S294SR07		0	

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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SEL-2523 ADVANCED ANNUNCIATOR PANEL

**ISSUED FOR BID**

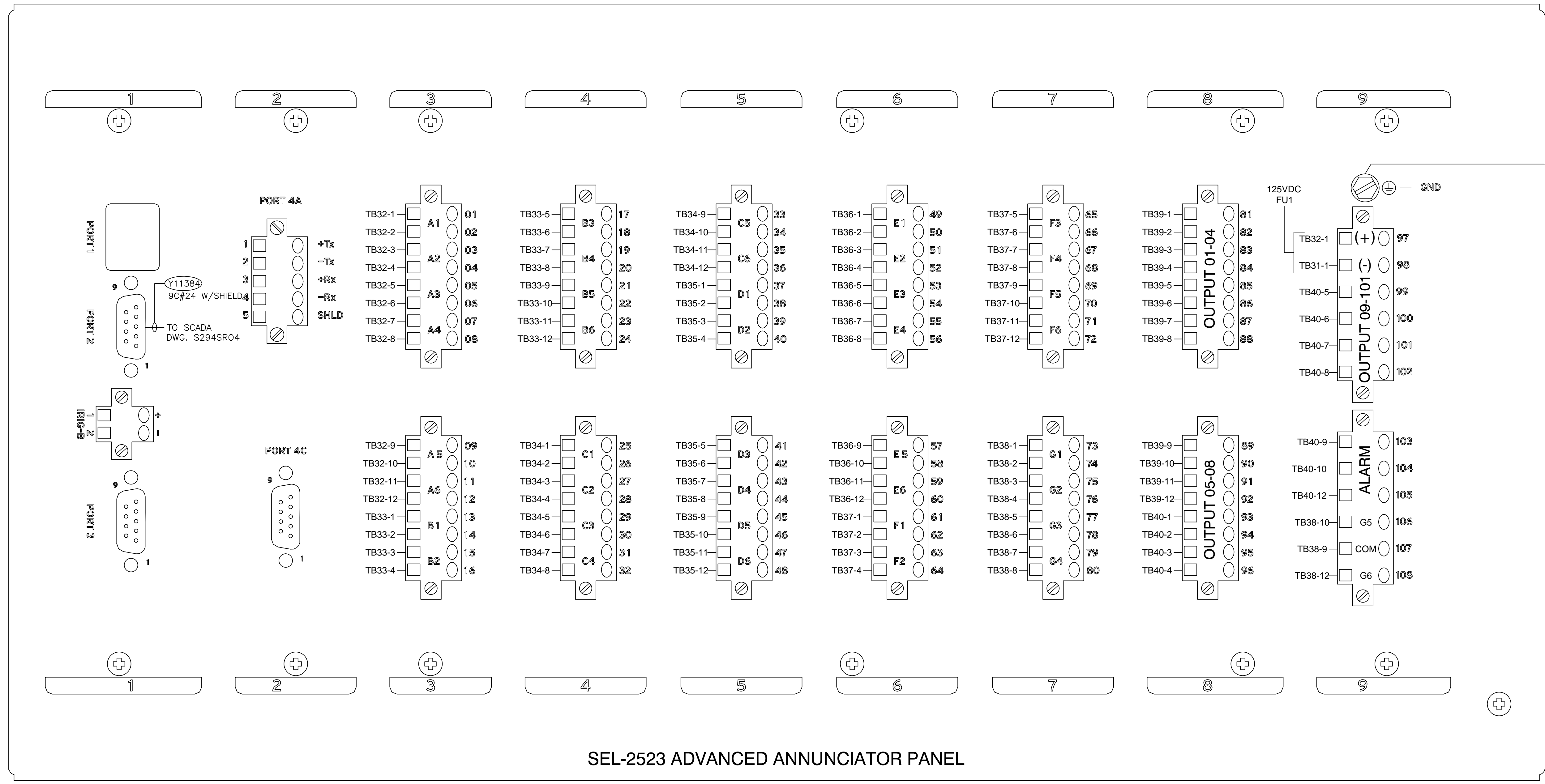
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 AFTON, OKLAHOMA  
 161/69KV

SCADA COMMUNICATIONS FOR STATION IED'S  
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**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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SEL-2523 ADVANCED ANNUNCIATOR PANEL

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

SCADA COMMUNICATIONS FOR STATION IED'S  
 PNL 201, ANNUNCIATOR PANEL NO. 04

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CH: NN	DATE: 3/7/2011	DRAWING No. S294SR11	
REV	DATE	REVISION DESCRIPTION	DFT ENG

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 REV DATE REVISION DESCRIPTION DFT ENG

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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A	MIAMI 161kV FDR. 22 POWER LINE CARRIER ALARM PANEL 101	PENSACOLA 161kV FDR. 126 POWER LINE CARRIER ALARM PANEL 103	69kV BKR. 300 50BF LOP/RELAY ALARM PANEL 104	69kV BKR. 500 50BF LOP/RELAY ALARM PANEL 106	69kV BKR. 6140 50BF LOP/RELAY ALARM PANEL 108	69kV BKR. 800 50BF LOP/RELAY ALARM PANEL 110
B	MIAMI 161kV FDR. 22 21P LOP/RELAY ALARM PANEL 101	PENSACOLA 161kV FDR. 126 21P LOP/RELAY ALARM PANEL 103	69kV SOUTH BUS DIFFERENTIAL RELAY ALARM PANEL 105	PENSACOLA 69kV FDR. 5 21P LOP/RELAY ALARM PANEL 107	VINITA 69kV FDR. 60 21P LOP/RELAY ALARM PANEL 109	MONKEY ISLAND 69kV FDR. 63 21P LOP/RELAY ALARM PANEL 111
C	MIAMI 161kV FDR. 22 21A LOP/RELAY ALARM PANEL 101	PENSACOLA 161kV FDR. 126 21A LOP/RELAY ALARM PANEL 103	69kV BKR. 400 50BF LOP/RELAY ALARM PANEL 105	PENSACOLA 69kV FDR. 5 21A LOP/RELAY ALARM PANEL 107	VINITA 69kV FDR. 60 21A LOP/RELAY ALARM PANEL 109	MONKEY ISLAND 69kV FDR. 63 21A LOP/RELAY ALARM PANEL 111
D	161kV BKR. 100 50BF LOP/RELAY ALARM PANEL 101	161kV BKR. 12670 50BF LOP/RELAY ALARM PANEL 103	69kV NORTH BUS DIFFERENTIAL RELAY ALARM PANEL 105	69kV BKR. 540 50BF LOP/RELAY ALARM PANEL 107	69kV BKR. 6040 50BF LOP/RELAY ALARM PANEL 109	69kV BKR. 6340 50BF LOP/RELAY ALARM PANEL 111
E	161kV BKR. 2270 50BF LOP/RELAY ALARM PANEL 102	TRANSF. NO. 1 87T/T1 DIFFERENTIAL RELAY ALARM PANEL 104	TRANSF. NO. 2 87T/T2 DIFFERENTIAL RELAY ALARM PANEL 106	MIAMI 69kV FDR. 61 21P LOP/RELAY ALARM PANEL 108	69kV BKR. 600 50BF LOP/RELAY ALARM PANEL 110	SAILBOAT BRIDGE 69kV FDR. 62 21P LOP/RELAY ALARM PANEL 112
F	161kV BKR. 200 50BF LOP/RELAY ALARM PANEL 102	TRANSF. NO. 1 50/51/T1 OVERCURRENT RELAY ALARM PANEL 104	TRANSF. NO. 2 50/51/T2 OVERCURRENT RELAY ALARM PANEL 106	MIAMI 69kV FDR. 61 21A LOP/RELAY ALARM PANEL 108	69kV BKR. 700 50BF LOP/RELAY ALARM PANEL 110	SAILBOAT BRIDGE 69kV FDR. 62 21A LOP/RELAY ALARM PANEL 112

**ANNUNCIATOR PANEL NO. 1**  
**SEL-2523 ADVANCED ANNUNCIATOR**

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
ANNUNCIATOR NO. 1 NAME PLATE PANEL NO. 201			
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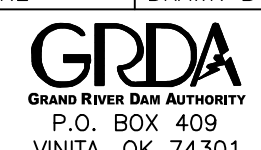


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B	161kV BKR. 100 LOW GAS DENSITY ALARM	161kV BKR. 200 LOW GAS DENSITY ALARM	69kV BKR. 300 LOW GAS DENSITY ALARM	69kV BKR. 500 LOW GAS DENSITY ALARM	69kV BKR. 600 LOW GAS DENSITY ALARM	69kV BKR. 6040 LOW GAS DENSITY ALARM
C	161kV BKR. 100 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	161kV BKR. 200 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	69kV BKR. 300 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	69kV BKR. 500 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	69kV BKR. 600 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	69kV BKR. 6040 LOW GAS LOCKOUT TRIP 1 OR TRIP 2
D	161kV BKR. 100 MOTOR TROUBLE ALARM	161kV BKR. 200 MOTOR TROUBLE ALARM	69kV BKR. 300 MOTOR TROUBLE ALARM	69kV BKR. 500 MOTOR TROUBLE ALARM	69kV BKR. 600 MOTOR TROUBLE ALARM	69kV BKR. 6040 MOTOR TROUBLE ALARM
E	161kV BKR. 2270 LOW GAS DENSITY ALARM	161kV BKR. 12670 LOW GAS DENSITY ALARM	69kV BKR. 400 LOW GAS DENSITY ALARM	69kV BKR. 540 LOW GAS DENSITY ALARM	69kV BKR. 6140 LOW GAS DENSITY ALARM	69kV BKR. 700 LOW GAS DENSITY ALARM
F	161kV BKR. 2270 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	161kV BKR. 12670 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	69kV BKR. 400 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	69kV BKR. 540 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	69kV BKR. 6140 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	69kV BKR. 700 LOW GAS LOCKOUT TRIP 1 OR TRIP 2

**ANNUNCIATOR PANEL NO. 2**  
**SEL-2523 ADVANCED ANNUNCIATOR**

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
ANNUNCIATOR NO. 2 NAME PLATE PANEL NO. 201			
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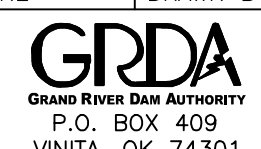
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A	69kV BKR. 700 MOTOR TROUBLE ALARM	69kV BKR. 800 MOTOR TROUBLE ALARM	TRANSF. NO. 1 ALARM HIGH WINDING TEMPATURE	TRANSF. NO. 2 ALARM HIGH WINDING TEMPATURE	BATTERY CHARGER LOSS OF AC POWER ALARM	86 BREAKER FAILURE RELAY TRIPPED 161kV BKR. 2270
B	69kV BKR. 6340 LOW GAS DENSITY ALARM	69kV BKR. 6240 LOW GAS DENSITY ALARM	TRANSF. NO. 1 ALARM HIGH LIQUID TEMPERATURE, MAIN TANK OR LTC COMPARTMENT	TRANSF. NO. 2 ALARM HIGH LIQUID TEMPERATURE, MAIN TANK OR LTC COMPARTMENT	BATTERY CHARGER FAILURE ALARM	86 BREAKER FAILURE RELAY TRIPPED 161kV BKR. 200
C	69kV BKR. 6340 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	69kV BKR. 6240 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	TRANSF. NO. 1 ALARM LTC TROUBLE OR FAILURE	TRANSF. NO. 2 ALARM LTC TROUBLE OR FAILURE	BATTERY CHARGER HIGH VOLTAGE SHUTDOWN ALARM	86 BREAKER FAILURE RELAY TRIPPED 161kV BKR. 12670
D	69kV BKR. 6340 MOTOR TROUBLE ALARM	69kV BKR. 6240 MOTOR TROUBLE ALARM	TRANSF. NO. 1 ALARM HOT OIL TEPERATURE MAIN TANK	TRANSF. NO. 2 ALARM HOT OIL TEPERATURE MAIN TANK	BATTERY CHARGER NO CHARGE ALARM	86 BREAKER FAILURE RELAY TRIPPED 69kV BKR. 300
E	69kV BKR. 800 LOW GAS DENSITY ALARM	TRANSF. NO. 1 ALARM SUDDEN PRESSURE, MAIN TANK OR LTC COMPARTMENT	TRANSF. NO. 2 ALARM SUDDEN PRESSURE, MAIN TANK OR LTC COMPARTMENT	BATTERY CHARGER DC GROUND ALARM	BATTERY CHARGER CURRENT LIMIT ALARM	86 BREAKER FAILURE RELAY TRIPPED 69kV BKR. 400
F	69kV BKR. 800 LOW GAS LOCKOUT TRIP 1 OR TRIP 2	TRANSF. NO. 1 ALARM LOW OIL LEVEL, MAIN TANK OR LTC COMPARTMENT	TRANSF. NO. 2 ALARM LOW OIL LEVEL, MAIN TANK OR LTC COMPARTMENT	BATTERY CHARGER LOW/HIGH DC VOLTS ALARM	86 BREAKER FAILURE RELAY TRIPPED 161kV BKR. 100	86 BREAKER FAILURE RELAY TRIPPED 69kV BKR. 500

**ANNUNCIATOR PANEL NO. 3**  
**SEL-2523 ADVANCED ANNUNCIATOR**

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
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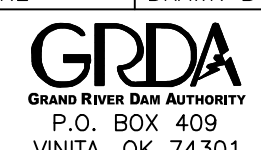
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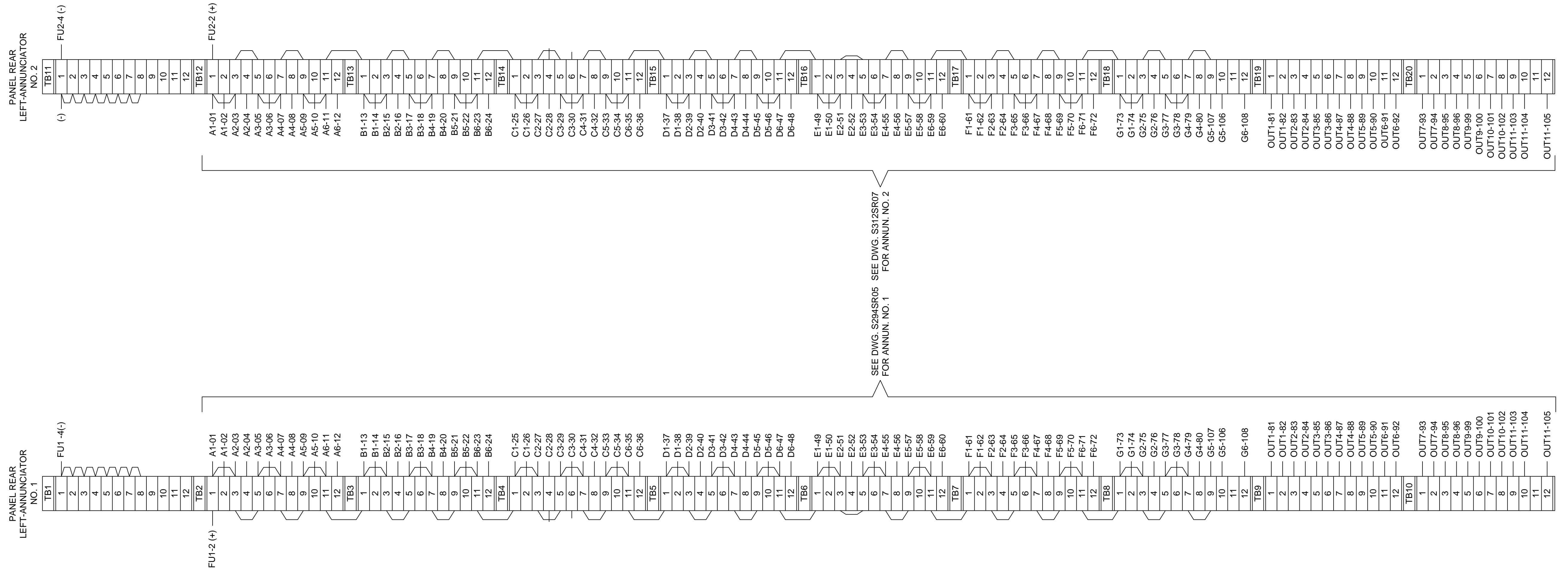
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B	86 BREAKER FAILURE RELAY TRIPPED 69KV BKR. 600	86 BREAKER FAILURE RELAY TRIPPED 69KV BKR. 6240	86TA/T2 TRANSFORMER ALTERNATE BACKUP OC RELAY TRIPPED			
C	86 BREAKER FAILURE RELAY TRIPPED 69KV BKR. 6140	86B/S1 BUS DIFFERENTIAL RELAY TRIPPED				
D	86 BREAKER FAILURE RELAY TRIPPED 69KV BKR. 6040	86B/N1 BUS DIFFERENTIAL RELAY TRIPPED				
E	86 BREAKER FAILURE RELAY TRIPPED 69KV BKR. 700	86TP/T1 TRANSFORMER DIFFERENTIAL PRIMARY RELAY TRIPPED				
F	86 BREAKER FAILURE RELAY TRIPPED 69KV BKR. 6340	86TA/T1 TRANSFORMER ALTERNATE BACKUP OC RELAY TRIPPED				

**ANNUNCIATOR PANEL NO. 4**  
**SEL-2523 ADVANCED ANNUNCIATOR**

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
ANNUNCIATOR NO. 4 NAME PLATE PANEL NO. 201			
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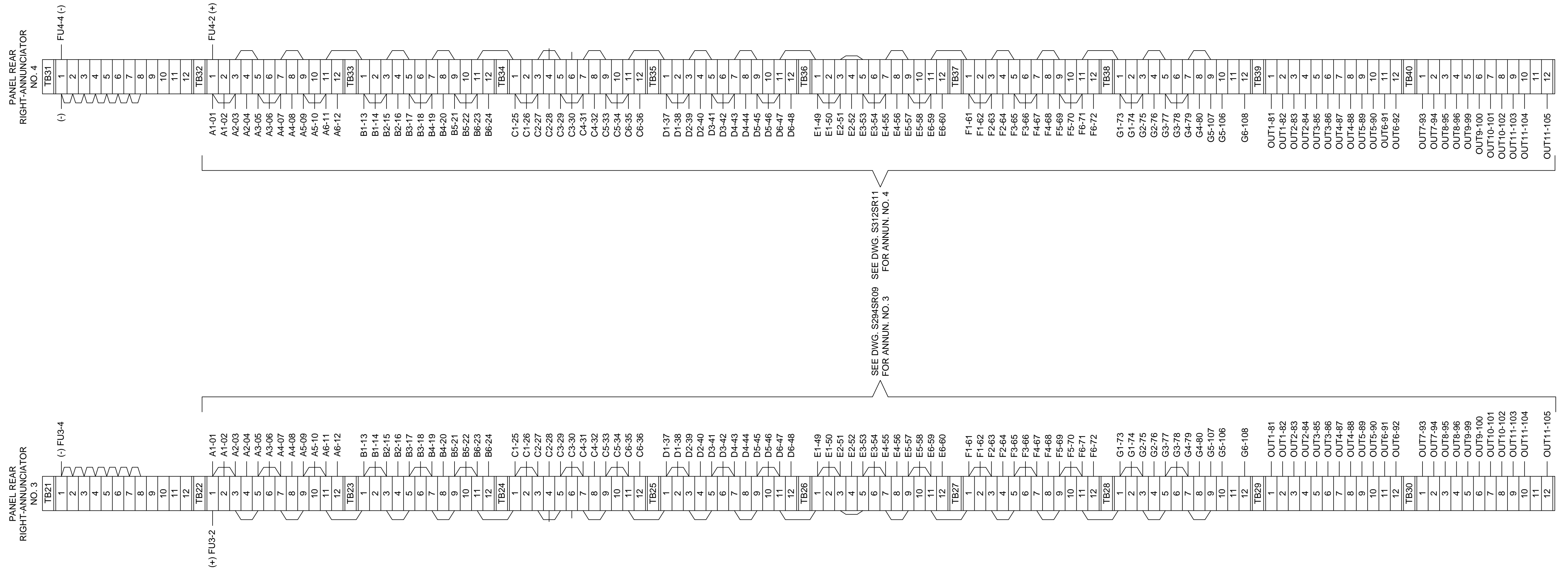
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GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
**ANNUNCIATOR TERMINATION DIAGRAM**

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CH: NN	DATE: 3/7/2011		
DRAWING No. S294SR13			REV. 0

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG



SEE DWG. S294SR09 SEE DWG. S312SR11  
 FOR ANNUN. NO. 3 FOR ANNUN. NO. 4

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
**ANNUNCIATOR TERMINATION DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: BDM	APPD: BA
CH: NN		DATE: 3/7/2011	
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**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

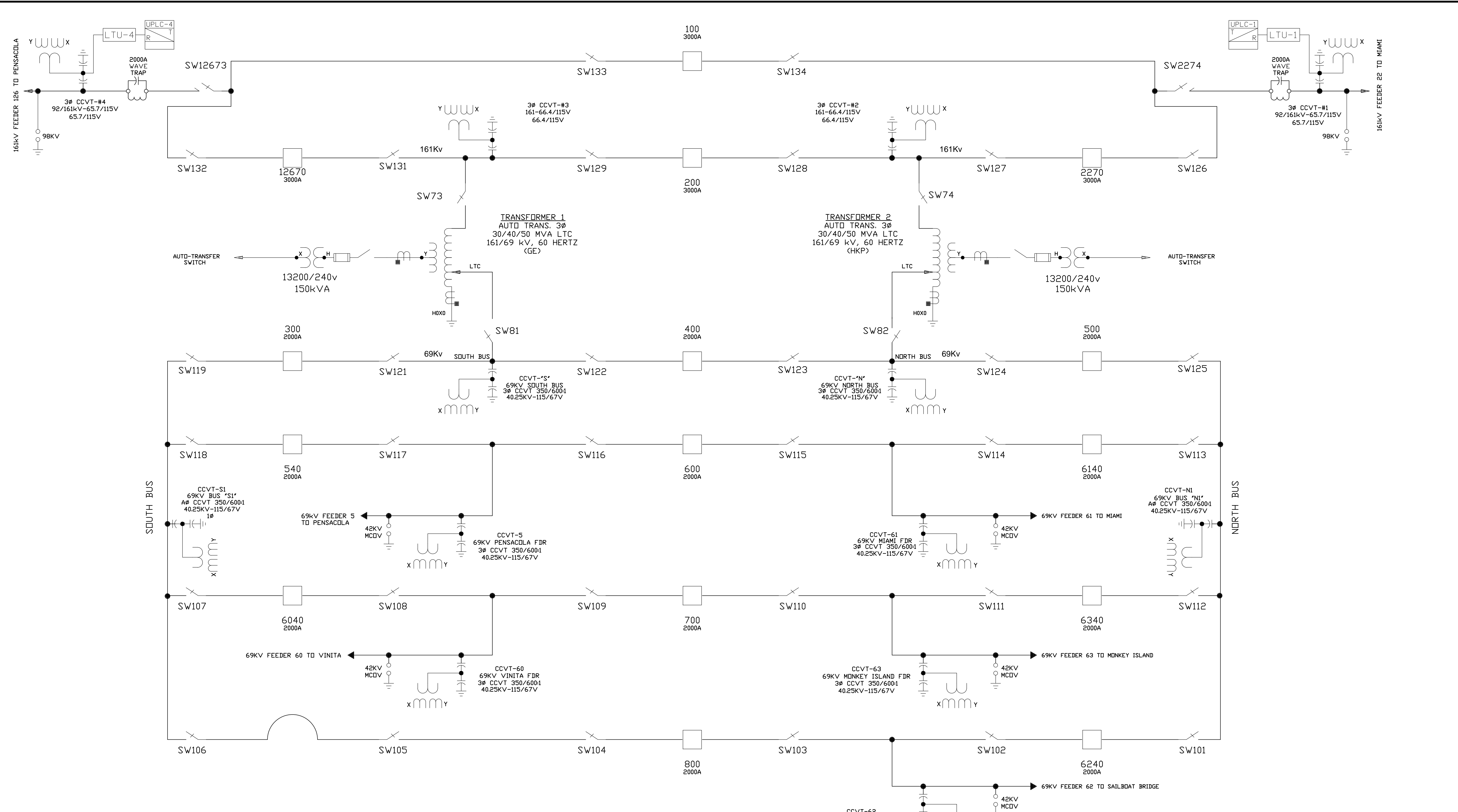
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## Afton Substation

S294SO001	ONE LINE
S294SO01	FDR 22 - MIAMI CIRCUIT - CARRIER SCHEMATIC
S294SO010	ONE LINE 161kV RING BUS
S294SO011	ONE LINE TRANSFORMERS T1 & T2 161/69kV
S294SO012	ONE LINE DIAGRAM - 69kV - BKR 540, 600 & 6140
S294SO013	ONE LINE DIAGRAM - 69kV - FDR 60 VINITA - FDR 63 MONKEY ISLAND
S294SO02	CARRIER SCHEMATIC - 161 kV FDR 126 PENSACOLA CIRCUIT

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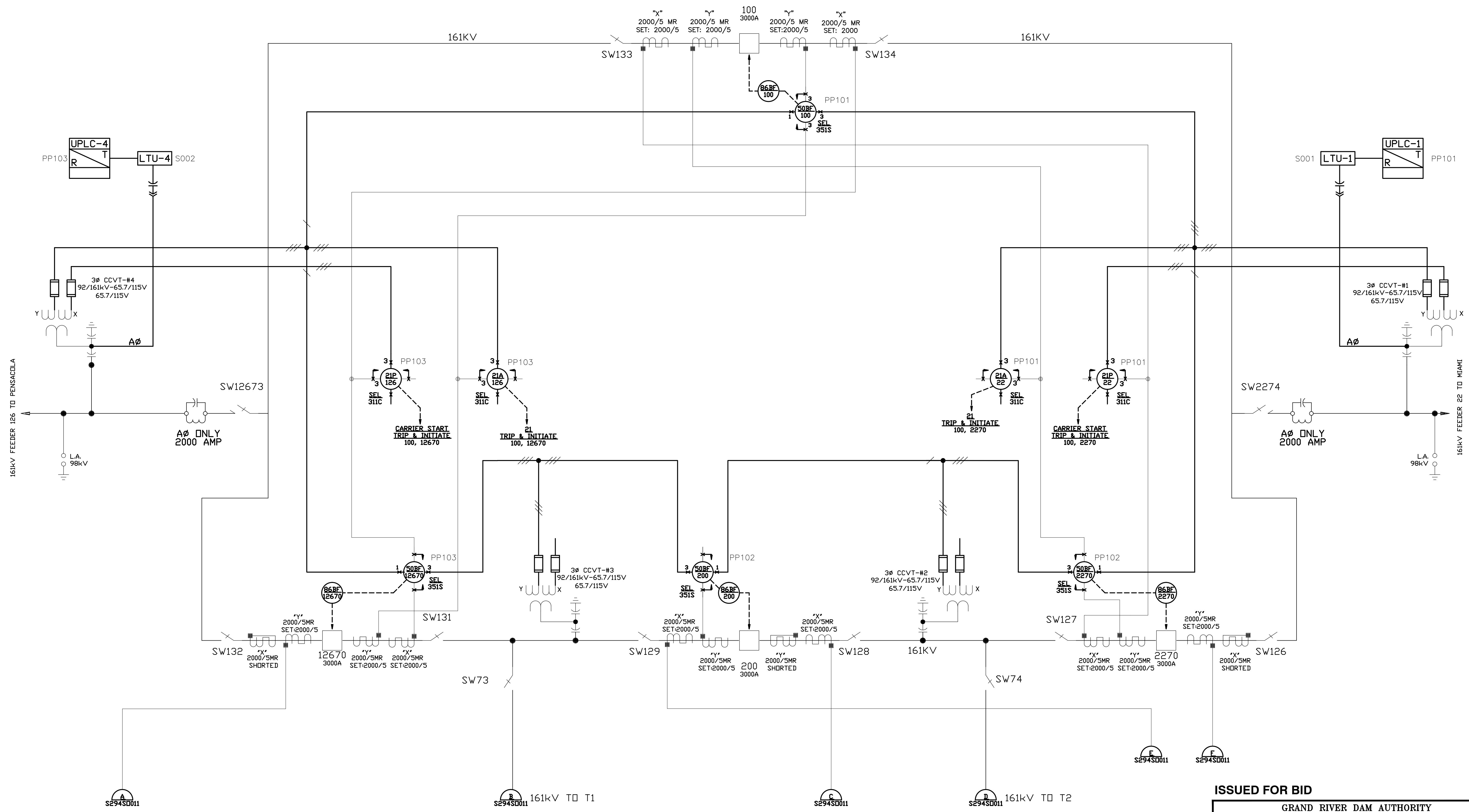
GRAND RIVER DAM AUTHORITY  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69kV  
**ONE-LINE**

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CH: NN		DATE: 3/7/2011	
DRAWING No. S294S0001		REV. 0	

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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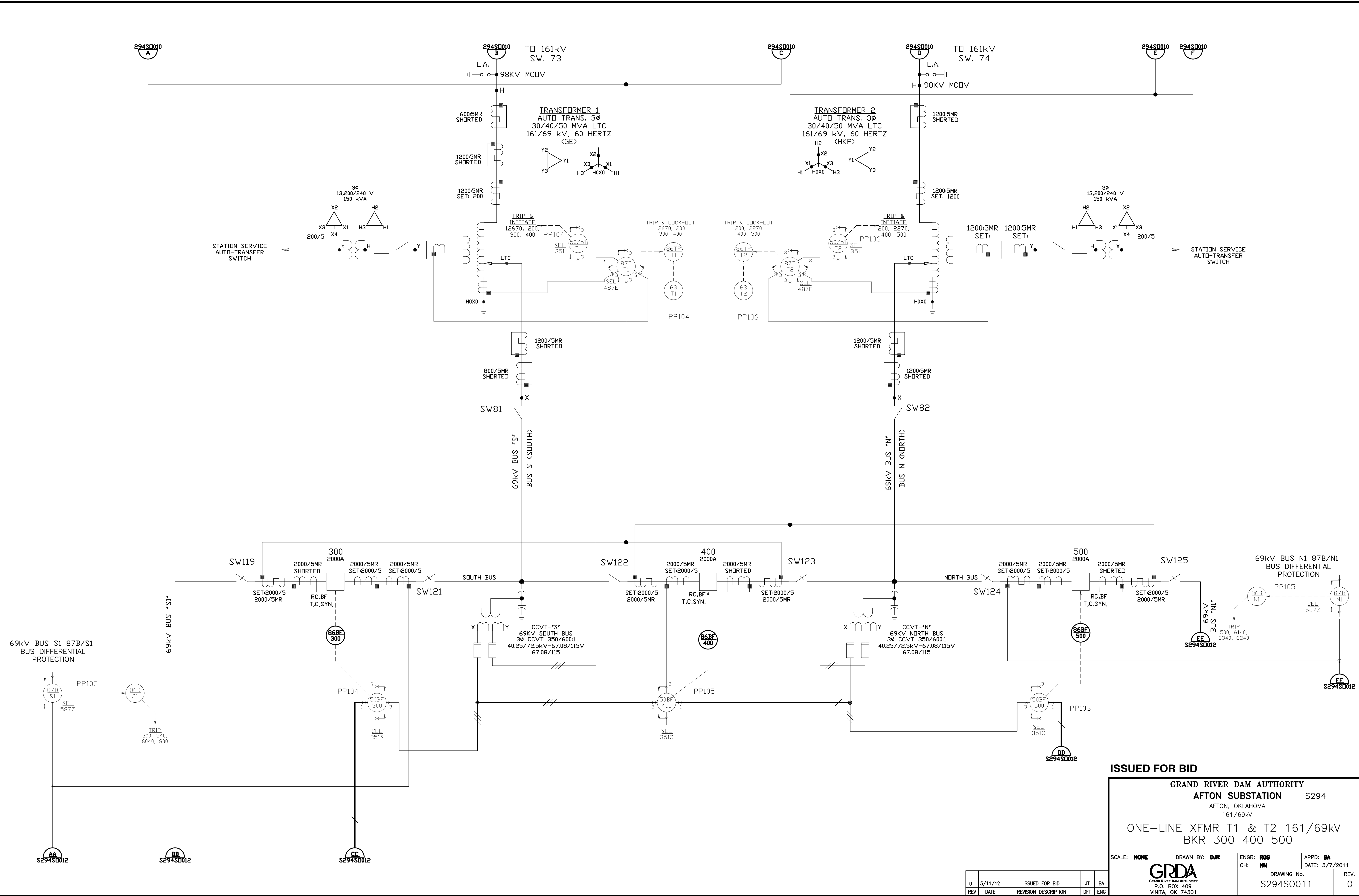
- S294S0001 ONE-LINE
- S294S0011 ONE-LINE TRANSFORMERS T1 & T2 161-69kV
- S294S0012 ONE-LINE DIAGRAM-69kV-BKR 540 600 & 6140
- S294S0013 ONE-LINE DIAGRAM-69kV-FDR 60 VINITA-FRD 63 MONKEY ISLAND

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION S294</b> AFTON, OKLAHOMA 161/69kV			
<b>ONE-LINE 161kV RING BUS</b> <b>BKR 100 200 2270 &amp; 12670</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294S0010	
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		REV. 0	DATE: 5/11/12 ISSUED FOR BID REV. DATE

REV	DATE	REVISION DESCRIPTION	JT	BA	ENG
0	5/11/12	ISSUED FOR BID			

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**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69KV

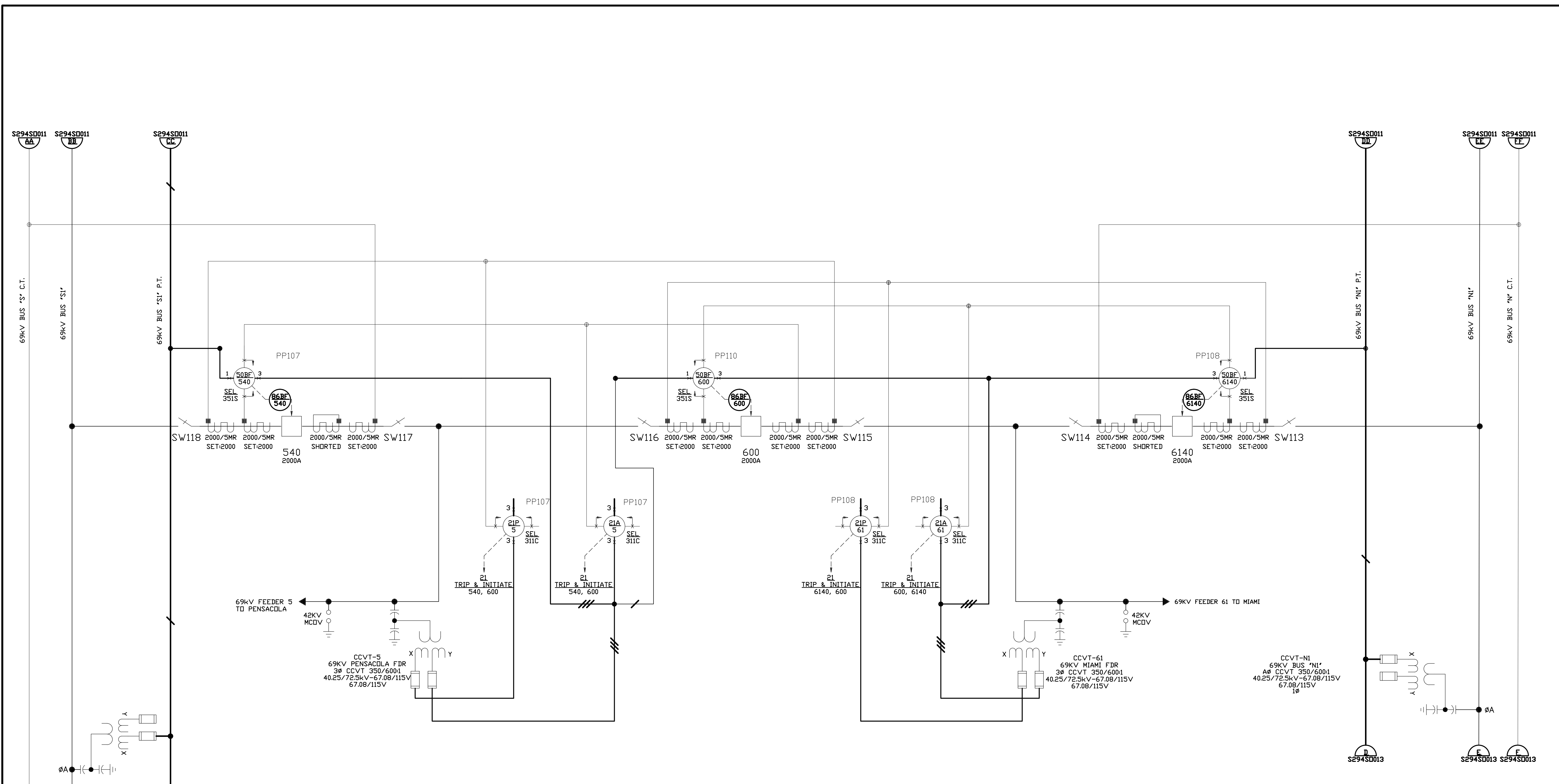
ONE-LINE XFMR T1 & T2 161/69KV  
 BKR 300 400 500

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CH: NI	DATE: 3/7/2011	DRAWING No. S294S0011	REV: 0

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA

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- REFERENCE DRAWINGS**
- S294S0001 ONE-LINE
  - S294S0010 ONE-LINE 161KV RING BUS
  - S294S0011 ONE-LINE TRANSFORMERS T1 & T2 161-69KV
  - S294S0013 ONE-LINE DIAGRAM-69KV-FDR 60 VINITA-FRD 63 MONKEY ISLAND

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION S294**  
 AFTON, OKLAHOMA  
 161/69 kv

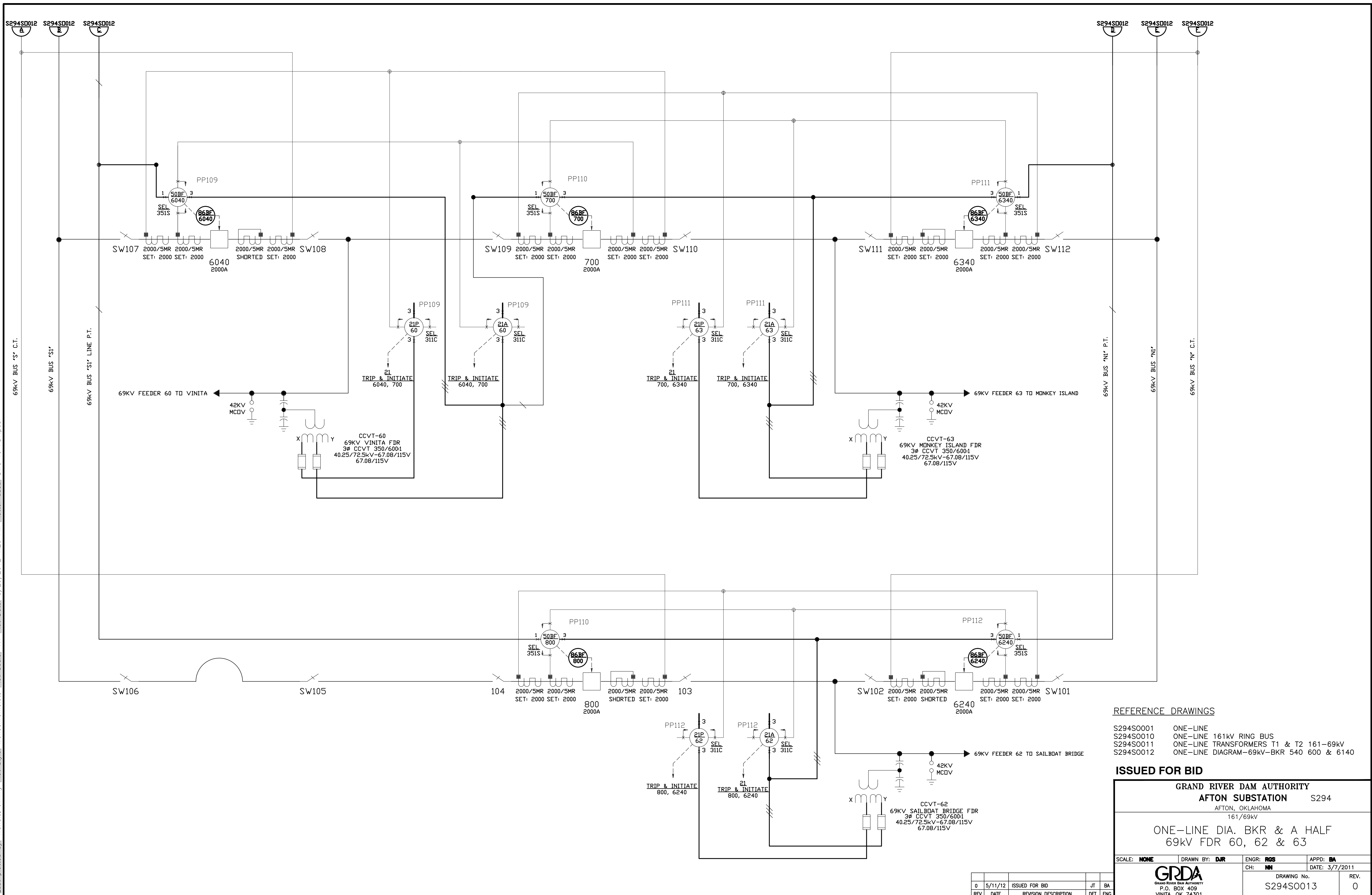
ONE-LINE DIA.-69KV-BKR 540 600 6140  
 FDR 5 PENSACOLA & FDR 61 MIAMI

SCALE: NONE	DRAWN BY: DAR	ENGR: RGS	APPD: BA
CH: NI		DATE: 3/7/2011	
DRAWING No. S294S0012		REV. 0	

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA

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- REFERENCE DRAWINGS**
- S294S0001 ONE-LINE
  - S294S0010 ONE-LINE 161KV RING BUS
  - S294S0011 ONE-LINE TRANSFORMERS T1 & T2 161-69KV
  - S294S0012 ONE-LINE DIAGRAM-69KV-BKR 540 600 & 6140

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294**

AFTON, OKLAHOMA  
 161/69KV

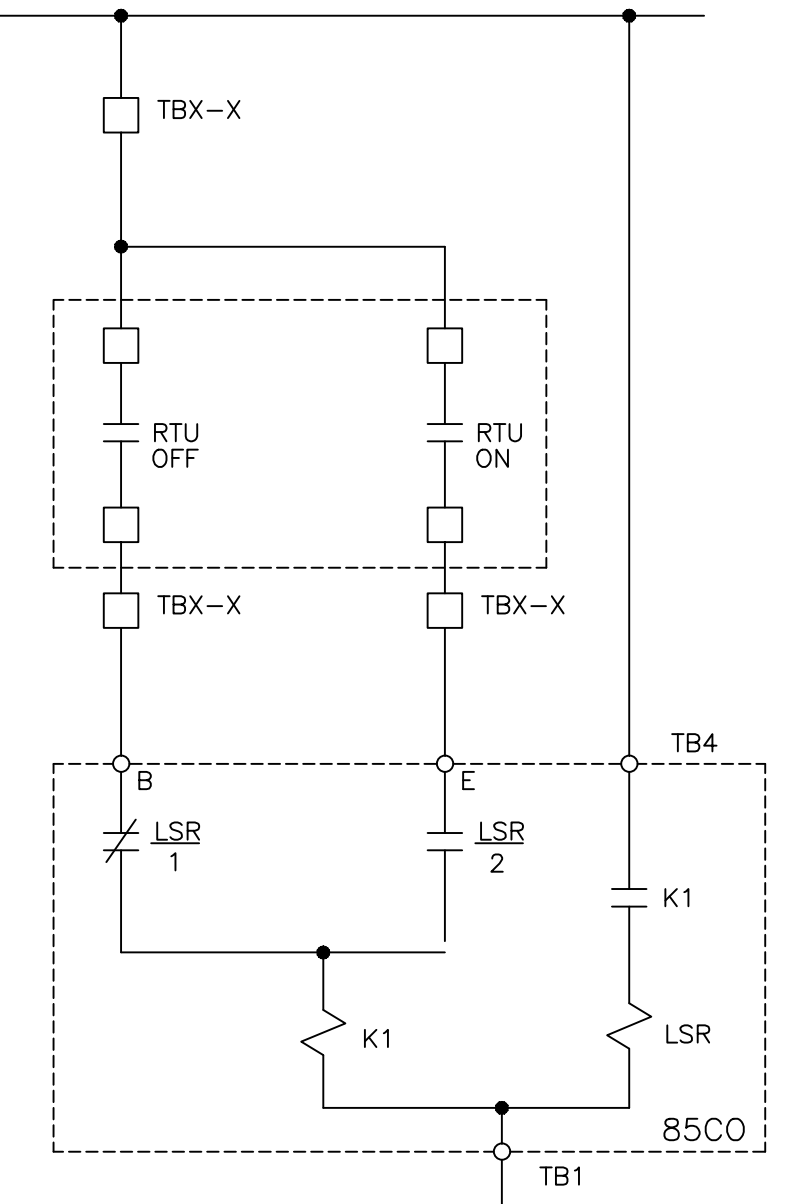
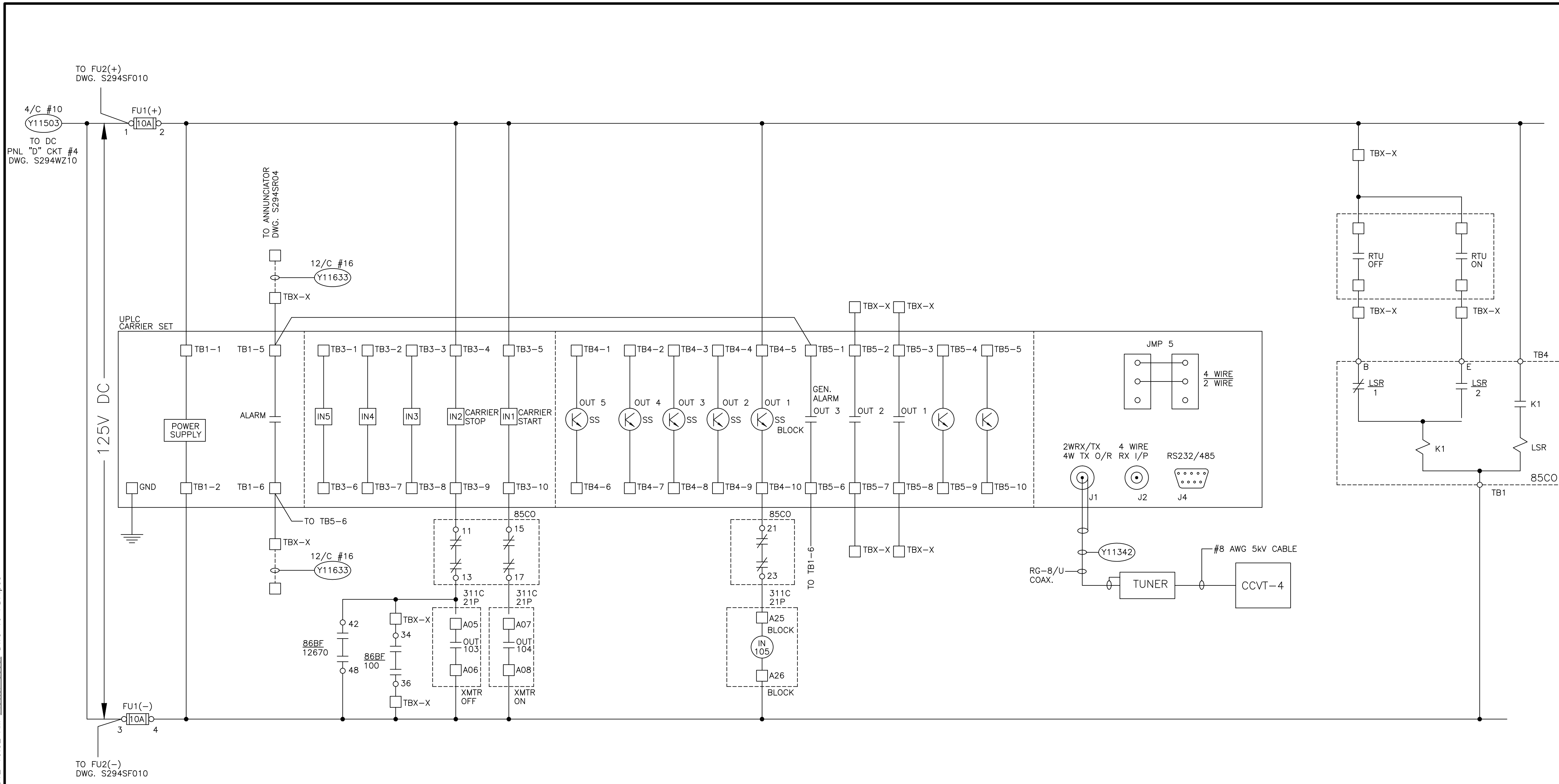
**ONE-LINE DIA. BKR & A HALF  
 69KV FDR 60, 62 & 63**

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CH: NI	DATE: 3/7/2011	DRAWING No. S294S0013	REV. 0

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	JT	BA
0	5/11/12	ISSUED FOR BID		

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 Plotter Used: DWG To PDF.pc3



**NOTES:**  
 1. ALL EQUIPMENT IS ON PANEL 103 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**  
 S294SF010 PRIMARY RELAYING FDR. 126  
 S294PP103 FDR. 126-161KV PENSACOLA PANEL 103-BKR. 12670  
 S294WZ10 CONTROL HOUSE PANEL "D" 125VDC WIRING DIAGRAM

ELECTROSWITCH  
85CO SERIES 31LSR  
CONTACT DIAGRAM

DECK	CONTACTS	POSITION	
		ON 1	OFF 2
1	11 O-H-O 13	X	
	12 O-H-O 14		X
	15 O-H-O 17	X	
	16 O-H-O 18		X
	21 O-H-O 23	X	
2	22 O-H-O 24		X
	25 O-H-O 27	X	
	26 O-H-O 28		X
	31 O-H-O 33	X	
3	32 O-H-O 34		X
	35 O-H-O 37	X	
	36 O-H-O 38		X

SHOWN IN CARRIER ON POSITION

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**CARRIER SCHEMATIC**  
 161KV FDR 126-PENSACOLA CIRCUIT

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN		DATE: 3/7/2011	
 <small>Grand River Dam Authority P.O. BOX 409 VINETA, OK 74301</small>		DRAWING No. <b>S294S002</b>	REV. <b>0</b>

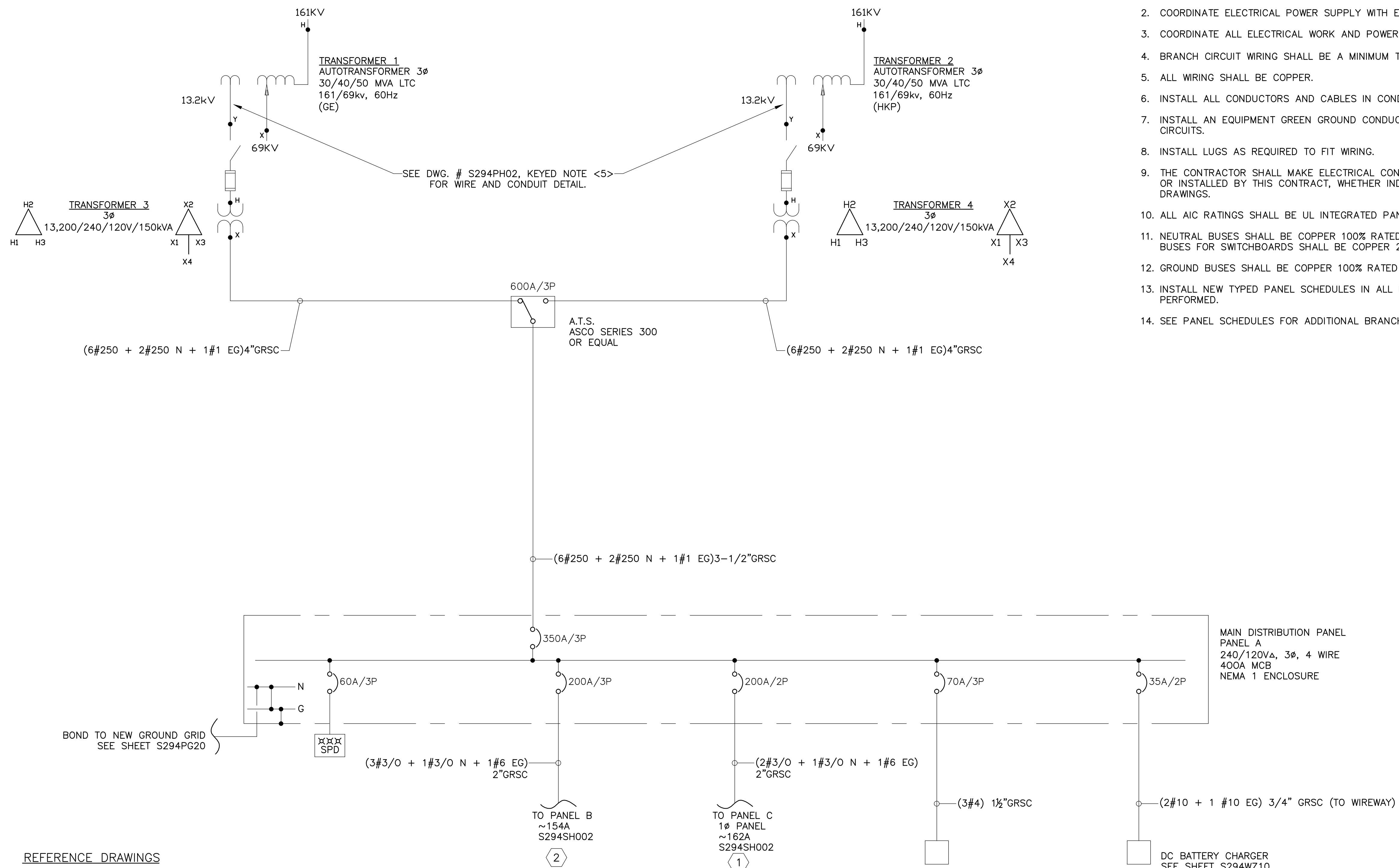
REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

Afton Substation

S294SH001	AC CONTROL HOUSE ONE-LINE
S294SH002	AC CONTROL HOUSE PANEL SCHEDULES



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**REFERENCE DRAWINGS**

- S294PG20 GROUNDING PLAN
- S294WZ10 CONTROL HOUSE PANEL D 125VDC WIRING DIAGRAM
- S294SH002 CONTROL HOUSE AC PANEL SCHEDULE
- S294PH02 CONTROL HOUSE LAYOUT

**KEYED NOTES:**

- ① ROUTE X1 AND X3 AND X4 TO SINGLE PHASE PANEL DO NOT ROUTE HIGH-LEG TO PANEL
- ② DO NOT CONNECT SINGLE PHASE LOADS TO PANEL. IF SINGLE PHASE LOADS ARE CONNECTED TO PANEL HIGH-LEG MUST BE IDENTIFIED AND MARKED ORANGE AS PER NEC 110.15, 2008 EDITION.

**GENERAL NOTES**

1. ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE CURRENT EDITIONS OF THE NFPA 70 (2011) NATIONAL ELECTRICAL CODE, NFPA 101 (2009) LIFE SAFETY CODE, STATE ELECTRICAL CODE, AND LOCAL ELECTRICAL CODE.
2. COORDINATE ELECTRICAL POWER SUPPLY WITH EQUIPMENT SUPPLIED.
3. COORDINATE ALL ELECTRICAL WORK AND POWER OUTAGES WITH OWNER.
4. BRANCH CIRCUIT WIRING SHALL BE A MINIMUM TYPE THHN/THWN.
5. ALL WIRING SHALL BE COPPER.
6. INSTALL ALL CONDUCTORS AND CABLES IN CONDUIT UNLESS NOTED OTHERWISE.
7. INSTALL AN EQUIPMENT GREEN GROUND CONDUCTOR IN ALL FEEDER AND BRANCH CIRCUITS.
8. INSTALL LUGS AS REQUIRED TO FIT WIRING.
9. THE CONTRACTOR SHALL MAKE ELECTRICAL CONNECTIONS TO EVERYTHING FURNISHED OR INSTALLED BY THIS CONTRACT, WHETHER INDICATED OR NOT ON THE ELECTRICAL DRAWINGS.
10. ALL AIC RATINGS SHALL BE UL INTEGRATED PANEL RATINGS.
11. NEUTRAL BUSES SHALL BE COPPER 100% RATED UNLESS NOTED OTHERWISE. NEUTRAL BUSES FOR SWITCHBOARDS SHALL BE COPPER 200% RATED.
12. GROUND BUSES SHALL BE COPPER 100% RATED UNLESS NOTED OTHERWISE.
13. INSTALL NEW TYPED PANEL SCHEDULES IN ALL ELECTRICAL PANELS INDICATING WORK PERFORMED.
14. SEE PANEL SCHEDULES FOR ADDITIONAL BRANCH CIRCUITS AND PANEL DETAILS.

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION S294</b> <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>CONTROL HOUSE</b> <b>AC ONE-LINE DIAGRAM</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294SH001</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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POWER PANEL PANEL A											
240/120 VOLTS 3Ø 4 W		350A MAIN 350 MCB		MINIMUM RATING 30,000A AIC RMS SYM.							
CIRCUIT NUMBER	SERVES	HP /kVA	NEC AMPS	OVERCURRENT			WIRE SIZE			RACEWAY TYPE	
				TRIP	POLE	FRAME	PHASE	NEUTRAL	GROUND		
Y11306(A,B,C,N,EG)	1 LP "PANEL B"	60.4	145.4	200	3		3#4/0	1#40	1#4EG	2" GRSC	
Y11307(A,C,N,EG)	2 LP "PANEL C"	39.0	93.70	200	2		2#4/0	1#4/0	1#4EG	2" GRSC	
Y11308(A,B,C,N,EG)	3 161KV TRANSFORMER 1	5.0	24.00	40	3		3#4			2" GRSC	
Y11309(A,C,EG)	4 DC BATTERY CHARGER	6	25.00	80	2		3#4			1.5" GRSC	
5											
6											
7											
8											
9											
10											
TOTAL CONNECTED LOAD		90.50 kVA		CALCULATED DESIGN LOAD		113.13 kVA		DESIGN LOAD 272.15 A			

PANEL LCP		LOCATION		BLDG. CONTROL HOUSE							
240 VOLTS 1 PHASE 2 WIRE		MTG.		MIN. INT. CAPACITY AIC (U.L. RATING)							
AMP MAIN											
DESCRIPTION	LOAD (VA)	WIRE AWG	BREAKER	PHASE	BREAKER	WIRE AWG	LOAD (VA)	DESCRIPTION			
Y11335	161KV SW LIGHTS	1000	4#10	20/2	1	2	20/2	4#10	161KV NE LIGHTS		
	161KV SW LIGHTS	1000	4#10		3	4		4#10	1000		
Y11337	161KV CENTER LIGHTS	550	4#10	20/2	5	6	20/2	4#10	1200		
	161KV CENTER LIGHTS	550	4#10		7	8		4#10	1200		
Y11339	69KV CENTER LIGHTS	800	4#10	20/2	9	10	20/2	4#10	800		
	69KV CENTER LIGHTS	800	4#10		11	12		4#10	800		
					13	14					
					15	16					
					17	18					
					19	20					
TOTAL CONNECTED LOAD		10.70 kVA		CALCULATED DESIGN LOAD		13.38 kVA		DESIGN LOAD 55.73 A			

- NOTES:**
- DESIGN LOAD IS 1.25 THE VALUE OF FLA.
  - ALL CIRCUITS THAT ARE INSTALLED IN THE EXISTING AC PANELBOARD SHALL BE RECONNECTED TO THE NEW PANELBOARDS, A, B, OR C; DEPENDING ON THE VOLTAGE AND PHASE OF THE LOAD: A FOR 240V, 3Ø; B FOR 240V, 1Ø; C FOR 120V, 1Ø.

LIGHTING CONTACTOR PANEL

PANEL PANEL B											
240 VOLTS 3 PHASE 3 WIRE		200 AMP MAIN 200		MIN. INT. CAPACITY 30,000A AIC (U.L. RATING)							
DESCRIPTION	LOAD (VA)	WIRE AWG	BREAKER	PHASE			BREAKER	WIRE AWG	LOAD (VA)	DESCRIPTION	
				A	B	C					
Y11310	1/2 HP SUMP PUMP	588	4#12	20/2	1	2	30/2	4#10	2880	#7 1/2 KW UNIT HTR	
	1/2 HP SUMP PUMP	588			3	4			2880	#7 1/2 KW UNIT HTR	
Y11312	EQUIP COND HEATERS	3840	4#8	40/2	5	6	30/2	4#10	2880	HEAT PUMP	
	EQUIP COND HEATERS	3840			7	8			2880	HEAT PUMP	
Y11314B, Y11314C, Y11314EG	IN DOOR-AIR HANDLER	8640	2#3	90/2	9	10	70/2	2#6	5350	LIGHTING CONTACTOR(LCP)*	
	IN DOOR-AIR HANDLER	8640			11	12			5350	LIGHTING CONTACTOR(LCP)*	
Y11341	LTU 1 HEATER	10	2#12	20/2	13	14					
	LTU 1 HEATER	10			15	16					
Y11344	LTU 4 HEATER	10	2#12	20/2	17	18					
	LTU 4 HEATER	10			19	20					
TOTAL CONNECTED LOAD		48.36 kVA		CALCULATED DESIGN LOAD		60.44 kVA		DESIGN LOAD 145.41 A			

REFERENCE DRAWINGS

- S294PG20 GROUNDING PLAN
- S294WZ10 CONTROL HOUSE PANEL D 125VDC WIRING DIAGRAM
- S294WZ11 CONTROL HOUSE PANEL E 125VDC WIRING DIAGRAM
- S294WZ12 CONTROL HOUSE PANEL F 125VDC WIRING DIAGRAM
- S294DT301 CABLE SCHEDULE AC
- S294DT302 CABLE SCHEDULE AC
- S294DT303 CABLE SCHEDULE AC

\* USE EXISTING CONTACTOR PANEL. REFEED FROM PANEL B. ADD CIRCUIT BREAKERS AS NEEDED AND CONNECT NEW SUBSTATION AREA LIGHTING PER SCHEDULE THIS SHEET.

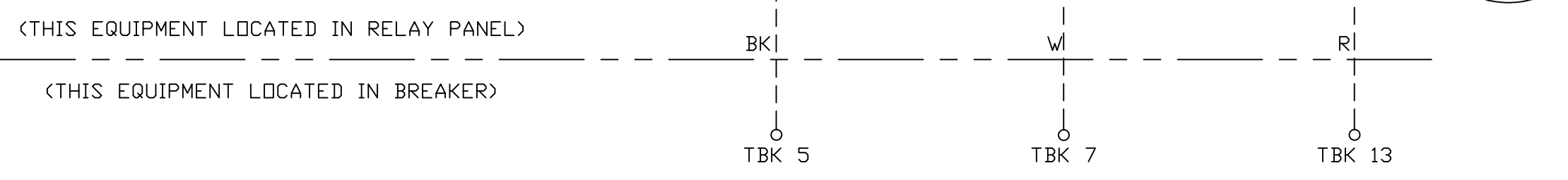
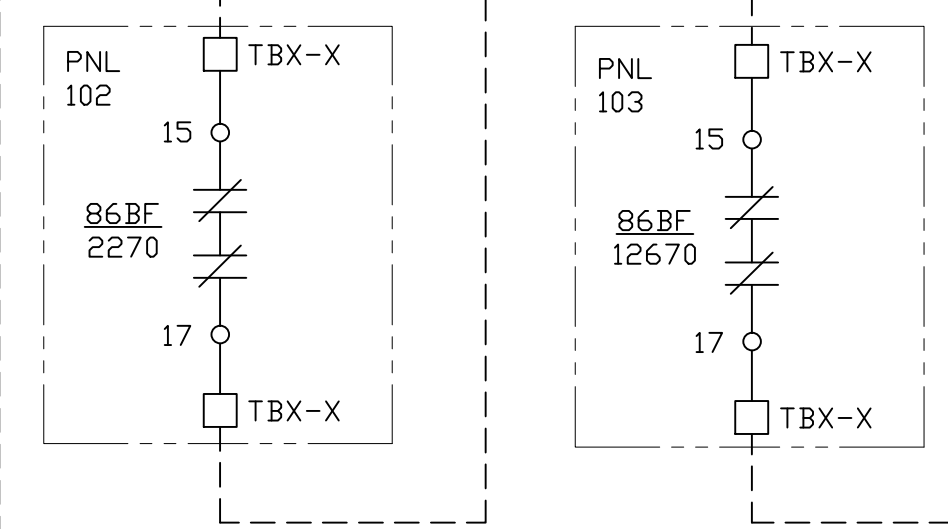
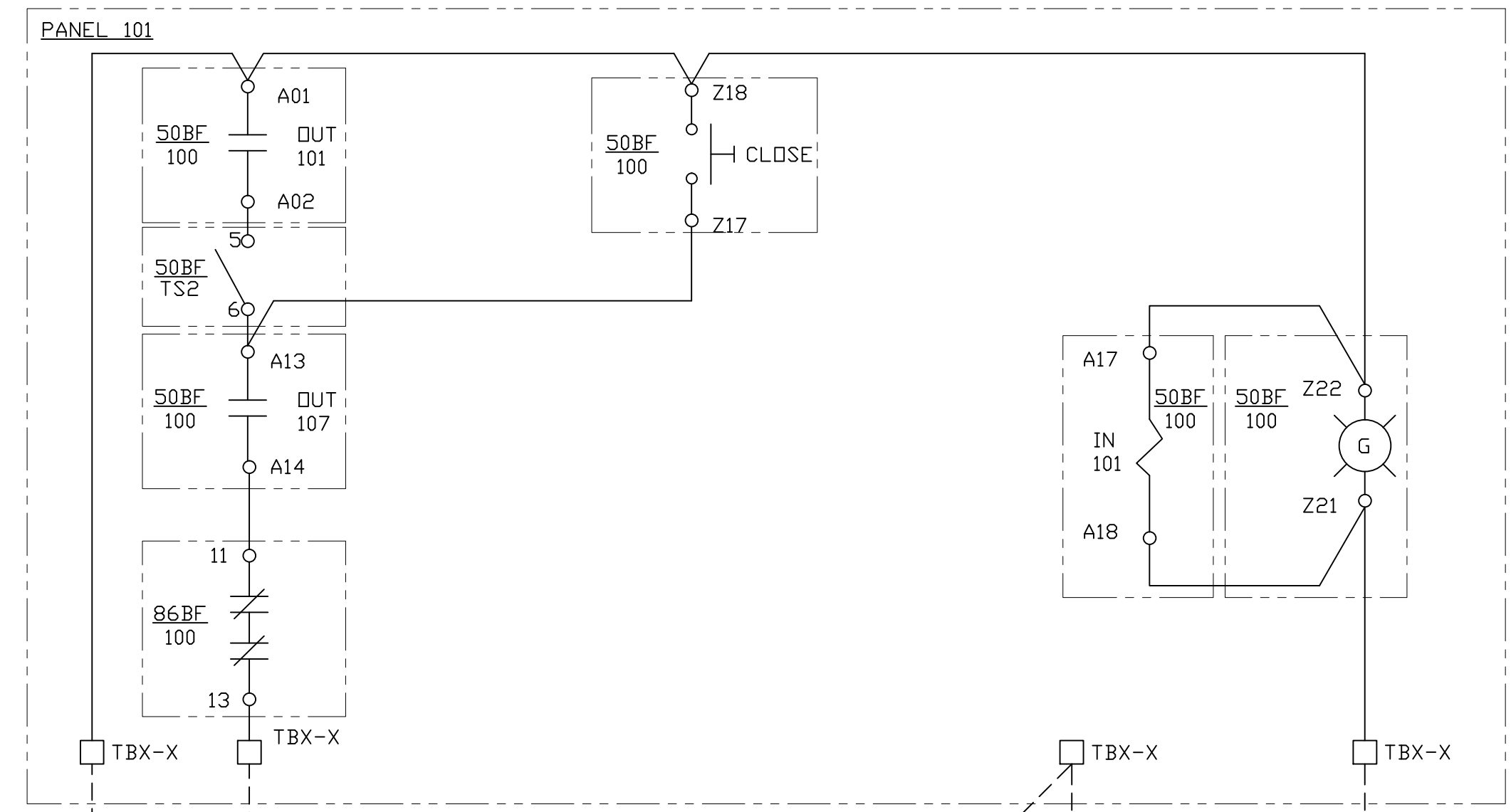
PANEL PANEL C											
240/120 VOLTS 1 PHASE 3 WIRE		200 AMP MAIN 200		MIN. INT. CAPACITY 30,000A AIC (U.L. RATING)							
DESCRIPTION	LOAD (VA)	WIRE AWG	BREAKER	PHASE		BREAKER	WIRE AWG	LOAD (VA)	DESCRIPTION		
				L1	L2						
Y11316A, Y11316N, Y11316EG	MAIN BLDG LIGHTS SW1	1080	3#12	20/1	1	2	20/1	3#12	1080	MAIN BLDG LIGHTS SW2	
Y11318C, Y11318N, Y11318EG	RECEPTACLE INSIDE	1920	3#12	20/1	3	4	20/1	3#12	1920	RECEPTACLE OUTSIDE	
Y11320A, Y11320N, Y11320EG	CUBICLE LIGHTS	1920	3#12	20/1	5	6	20/1	3#12	1920	OUTSIDE DOOR LIGHT	
Y11322C, Y11322N, Y11322EG	TO PANEL 4F,N17&N18	1920	3#12	20/1	7	8	20/1	4#8	1410	69KV BKR 300,400,500	
Y11324	69KV BKR 540,600,6140	1410	4#8	20/1	9	10	20/1	4#8	1410	69KV BKR 6040,700,6340	
Y11326	69KV BKR 800,6240	1410	4#8	20/1	11	12	30/1	4#8	2000	161KV BKR 100	
Y11328	161KV BKR 200	2000	4#8	30/1	13	14	30/1	4#8	2000	161KV BKR 12670	
Y11330	161KV BKR 2270	2000	4#8	30/1	15	16	20/1	3#12	1920	TRANSFORMER 1	
Y11332	PANELS 101-106	1920	3#12	20/1	17	18	20/1	3#12	1920	PANELS 107-112	
Y11334	BATTERY EXHAUST FAN	45	3#12	20/1	19	20	20/1			SPARE	
TOTAL CONNECTED LOAD		31.21 kVA		CALCULATED DESIGN LOAD		39.01 kVA		DESIGN LOAD 162.54 A			

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69KV			
CONTROL HOUSE			
AC PANEL SCHEDULES			
SCALE: NONE	DRAWN BY: BDC	ENGR: MJR	APPD: BA
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REV	DATE	ISSUED FOR BID	JT BA
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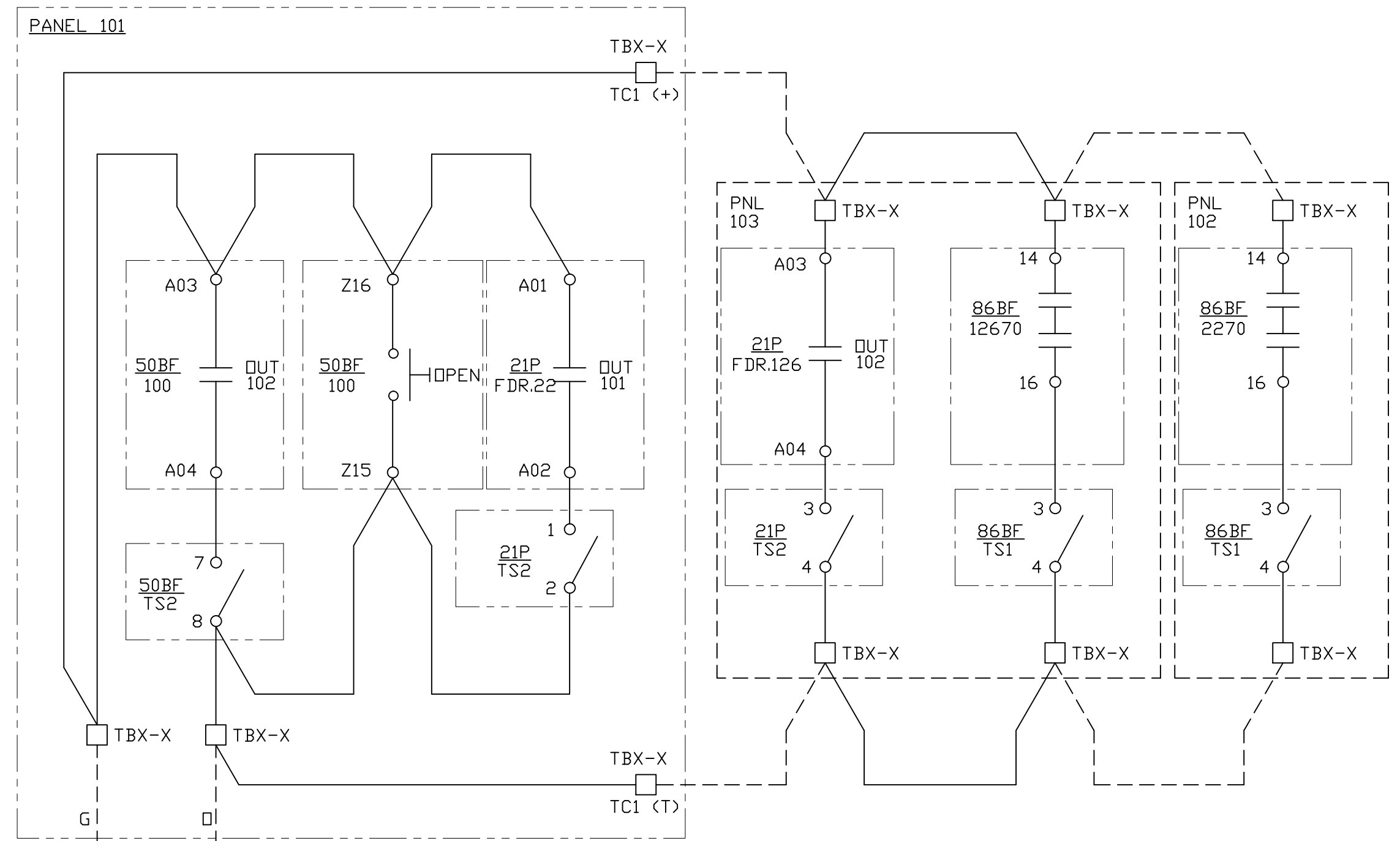
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DC CLOSE CIRCUIT

TO BREAKER 100  
DWG. S294SB100a

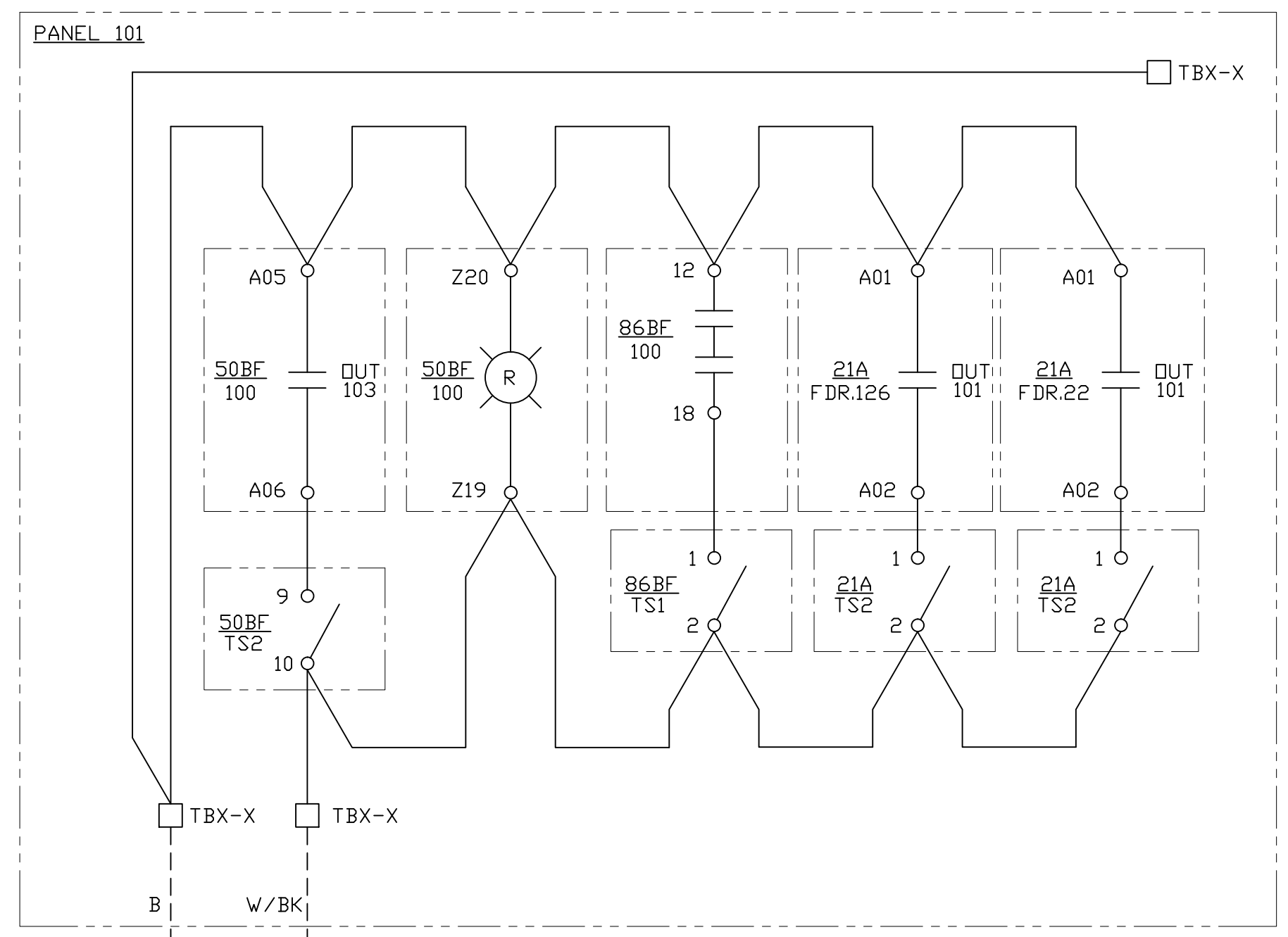


(THIS EQUIPMENT LOCATED IN RELAY PANEL)

(THIS EQUIPMENT LOCATED IN BREAKER)

DC TRIP CIRCUIT 1

TO BREAKER 100  
DWG. S294SB100a

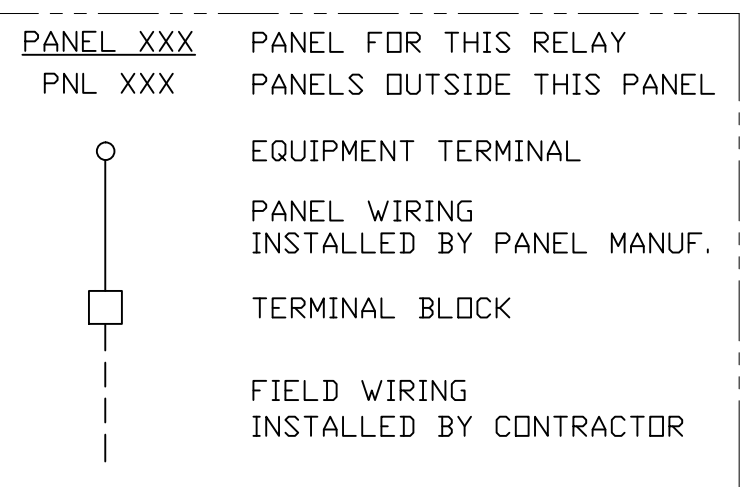


(THIS EQUIPMENT LOCATED IN RELAY PANEL)

(THIS EQUIPMENT LOCATED IN BREAKER)

DC TRIP CIRCUIT 2

NOTE: SEE DRAWING S294SB100a FOR CIRCUIT BREAKER DC SCHEMATIC.



EQUIPMENT SHOWN INSIDE BOX LOCATED IN PANEL NUMBER DESIGNATED AT TOP LEFT

REFERENCE DRAWINGS

- S294SB100a BKR 100 ACDC SCHEMATIC DIAGRAM
- S294PP101 FDR 22-161kV MIAMI PANEL 101-BREAKER 100
- S294PP102 FDR 22-161kV MIAMI & BKR 2270
- S294PP103 FDR 126-161kV PENSACOLA

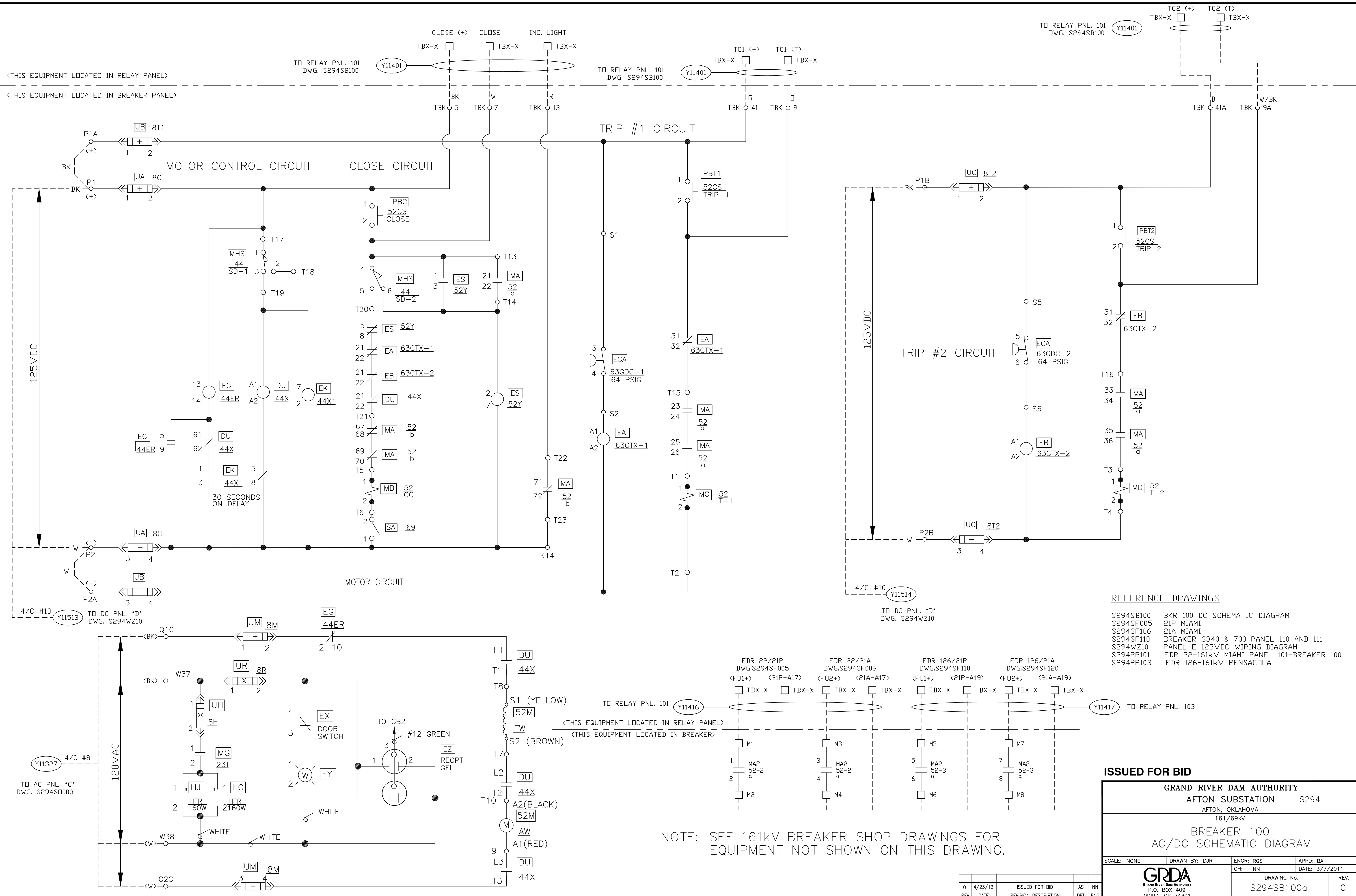
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION S294**  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 100**  
**DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No. <b>S294SB100</b>	
REV	DATE	REVISION DESCRIPTION	DFT ENG
0	4/23/12	ISSUED FOR BID	AS NN

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 Last Plotted by: Shults, Arlene  
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 Plotter used: DWG To PDF.pc3



NOTE: SEE 161KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

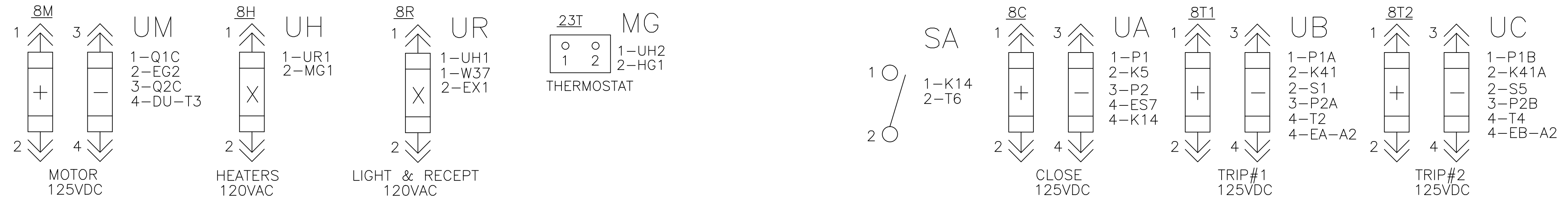
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69kV

**BREAKER 100**  
 AC/DC SCHEMATIC DIAGRAM

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No.	REV.
		S294SB100a	0

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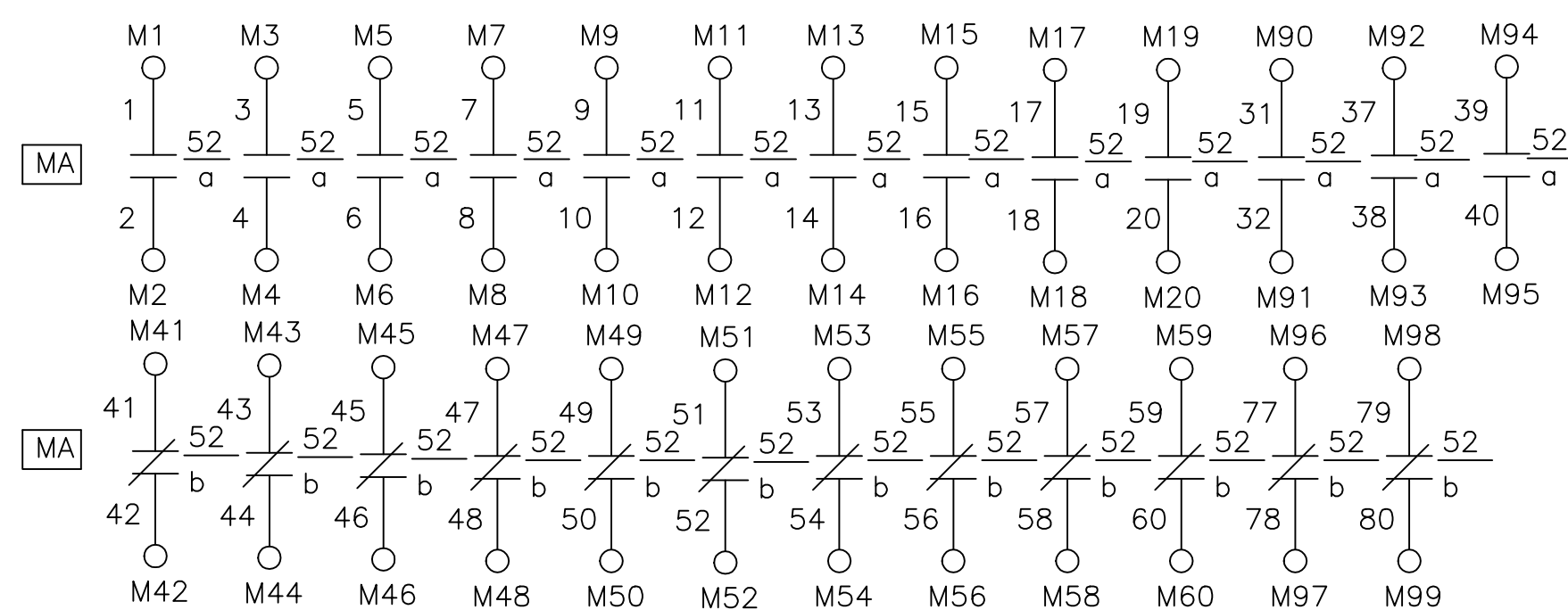
NOTE: SEE 161KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

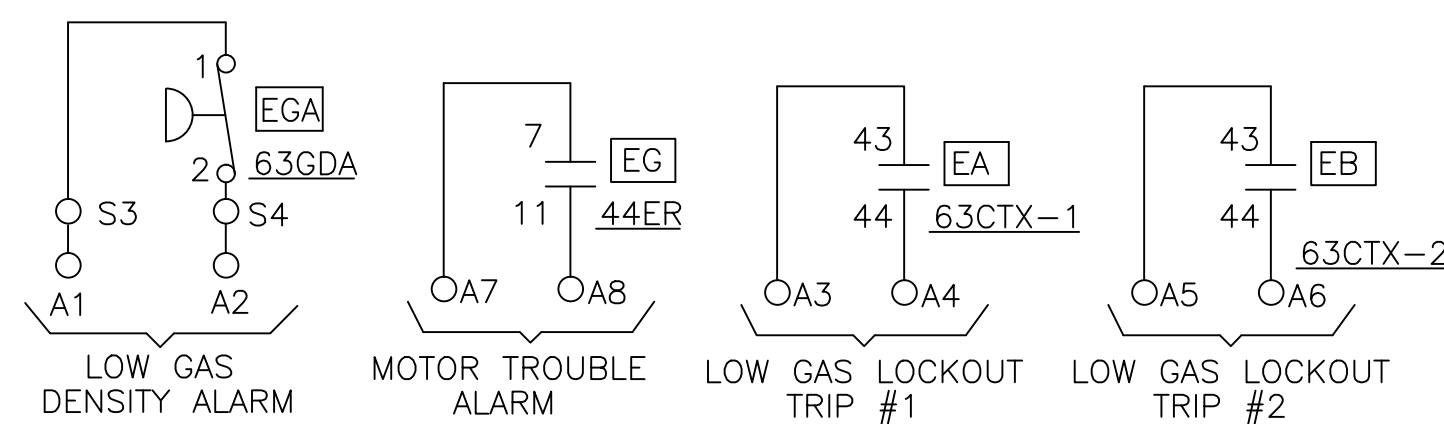
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



REFERENCE DRAWINGS

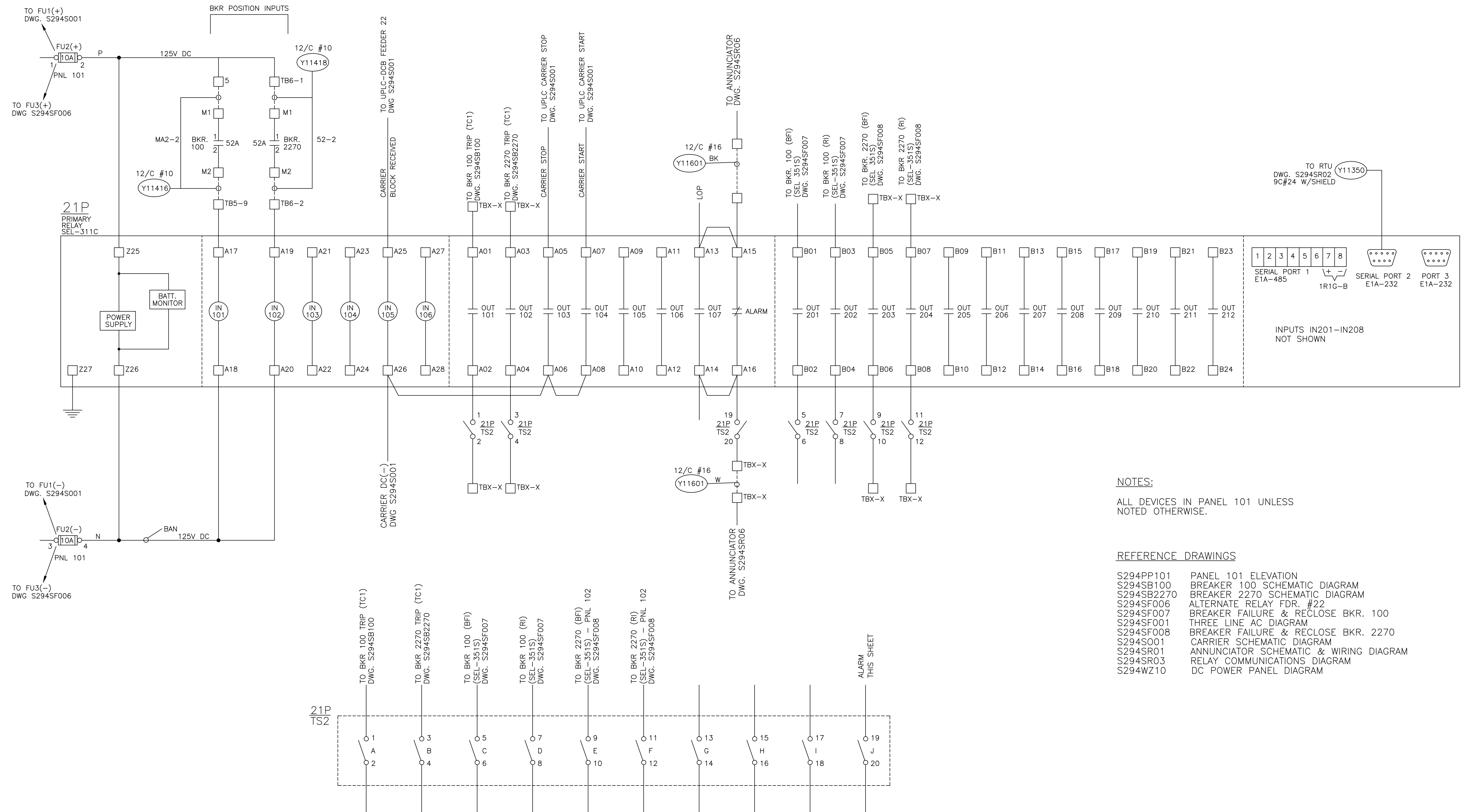
- S294SB100 BKR 100 DC SCHEMATIC DIAGRAM  
 S294SB100a BKR 100 AC/DC SCHEMATIC DIAGRAM

ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
<b>BREAKER 100</b> <b>BREAKER AUXILIARIES</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN		DATE: 3/7/2011	
		DRAWING No.	REV.
		S294SB100b	0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

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**NOTES:**

ALL DEVICES IN PANEL 101 UNLESS NOTED OTHERWISE.

**REFERENCE DRAWINGS**

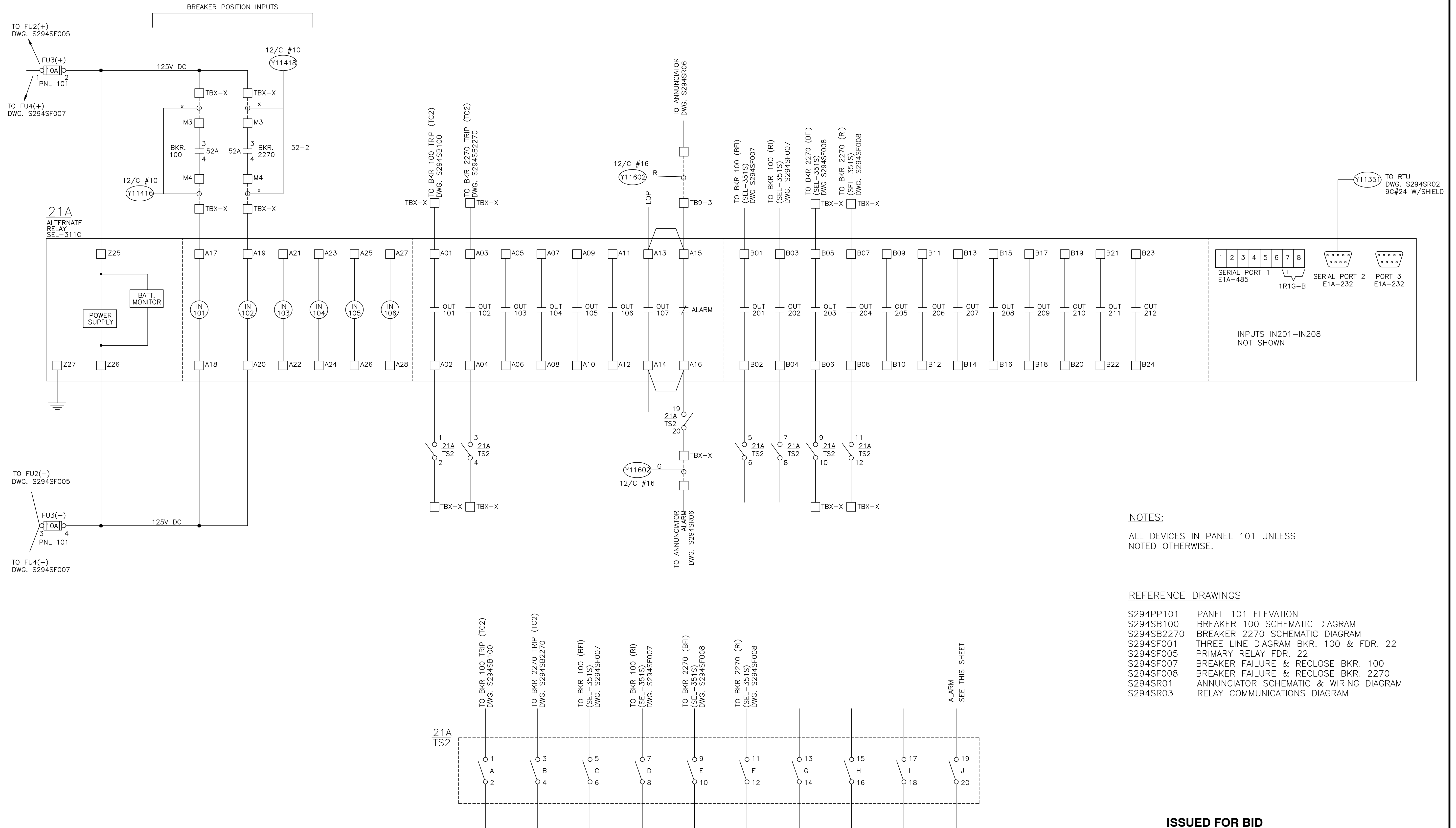
- S294PP101 PANEL 101 ELEVATION
- S294SB100 BREAKER 100 SCHEMATIC DIAGRAM
- S294SB2270 BREAKER 2270 SCHEMATIC DIAGRAM
- S294SF006 ALTERNATE RELAY FDR. #22
- S294SF007 BREAKER FAILURE & RECLOSE BKR. 100
- S294SF001 THREE LINE AC DIAGRAM
- S294SF008 BREAKER FAILURE & RECLOSE BKR. 2270
- S294S001 CARRIER SCHEMATIC DIAGRAM
- S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294WZ10 DC POWER PANEL DIAGRAM

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV <b>21P</b> 161KV FEEDER 22-MIAMI CIRCUIT			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294SF005</b>	REV. <b>0</b>
CH: NN DATE: 3/7/2011			

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

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**NOTES:**

ALL DEVICES IN PANEL 101 UNLESS NOTED OTHERWISE.

**REFERENCE DRAWINGS**

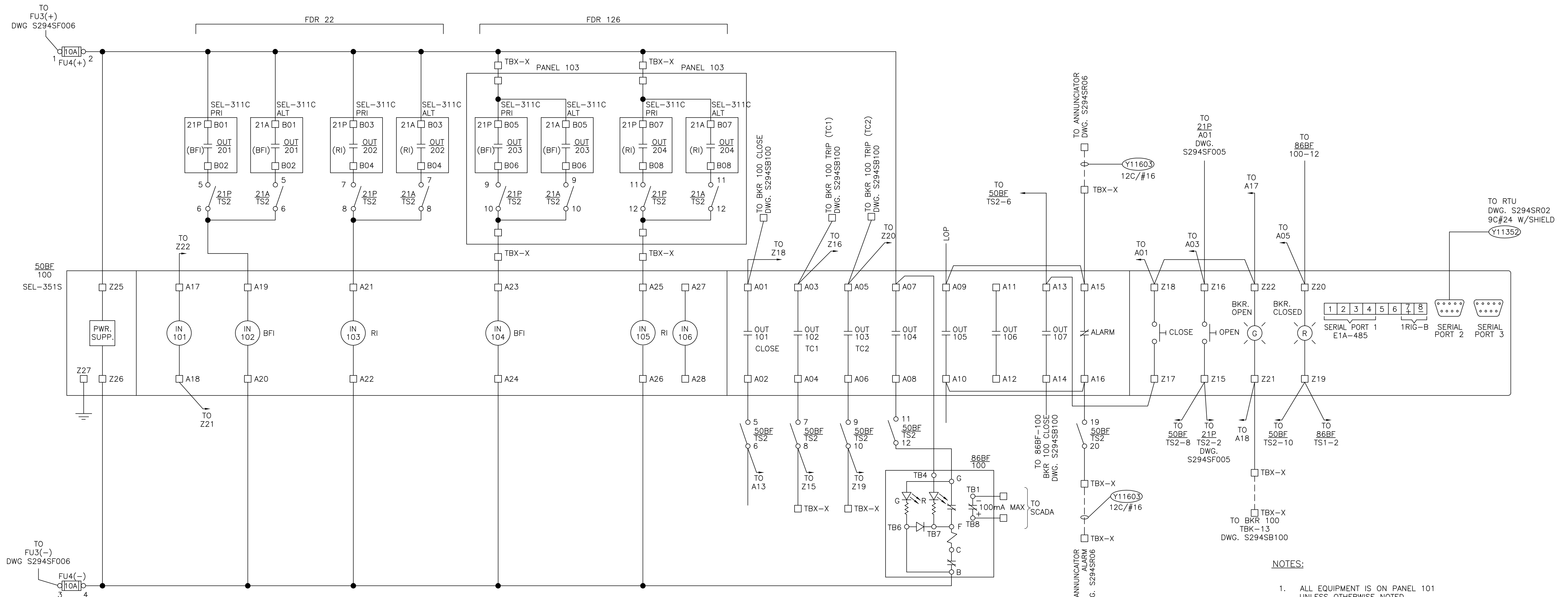
- S294PP101 PANEL 101 ELEVATION
- S294SB100 BREAKER 100 SCHEMATIC DIAGRAM
- S294SB2270 BREAKER 2270 SCHEMATIC DIAGRAM
- S294SF001 THREE LINE DIAGRAM BKR. 100 & FDR. 22
- S294SF005 PRIMARY RELAY FDR. 22
- S294SF007 BREAKER FAILURE & RECLOSE BKR. 100
- S294SF008 BREAKER FAILURE & RECLOSE BKR. 2270
- S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV <b>21A</b> 161KV FEEDER 22-MIAMI CIRCUIT			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN		DATE: 3/7/2011	
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294SF006	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

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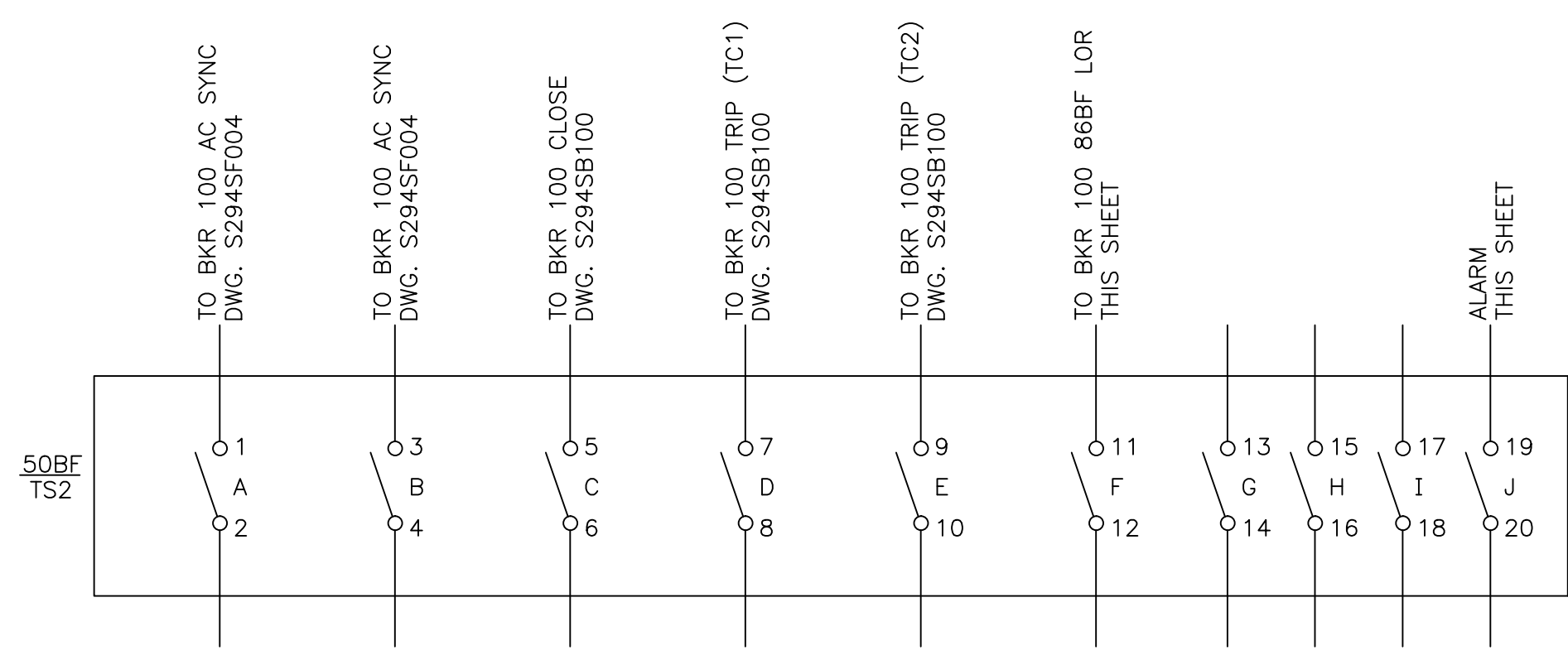
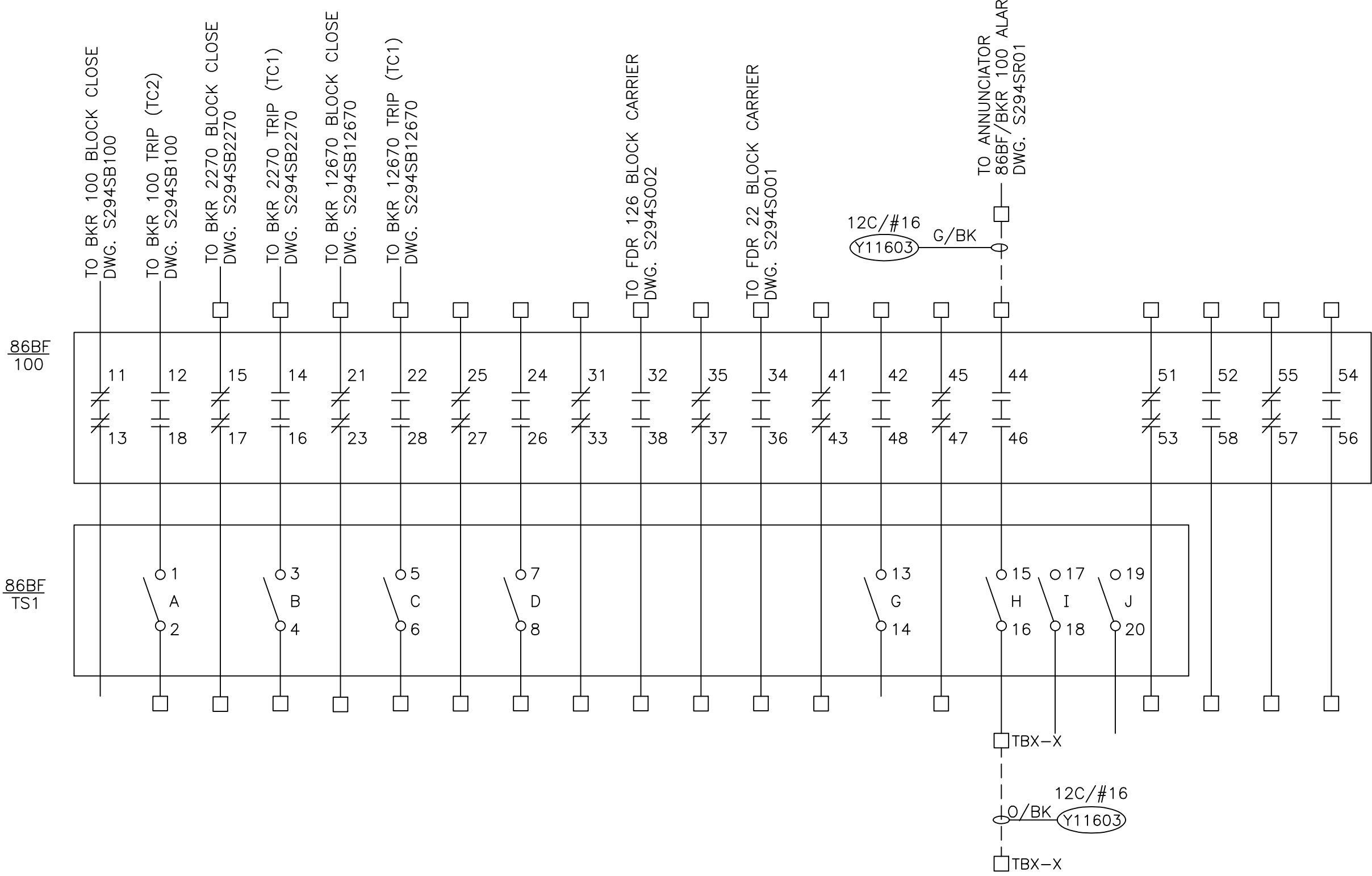


- NOTES:**
1. ALL EQUIPMENT IS ON PANEL 101 UNLESS OTHERWISE NOTED.
  2. BFI - BREAKER FAILURE INITIATION.
  3. RI - RECLOSING INITIATION.

- REFERENCE DRAWINGS**
- S294SB100 BREAKER 100 SCHEMATIC DIAGRAM
  - S294SF005 PRIMARY RELAY FEEDER #22
  - S294SF006 ALTERNATE RELAY FEEDER #22
  - S294SF008 BREAKER FAILURE & RECLOSE BKR 2270
  - S294SF001 THREE LINE AC DIAGRAM BREAKER 100 & FDR. 22
  - S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM

**86BF CONTACT DIAGRAM**

DECK	CONTACTS		POSITION	
	TRIP	RESET		
1	11 0H-1H 13	X		
	12 0H-1H 18	X		
	15 0H-1H 17	X		
	14 0H-1H 16	X		
	21 0H-1H 23	X		
2	22 0H-1H 28	X		
	25 0H-1H 27	X		
	24 0H-1H 26	X		
	31 0H-1H 33	X		
3	32 0H-1H 38	X		
	35 0H-1H 37	X		
	34 0H-1H 36	X		
	41 0H-1H 43	X		
4	42 0H-1H 48	X		
	45 0H-1H 47	X		
	44 0H-1H 46	X		
	51 0H-1H 53	X		
	52 0H-1H 58	X		
5	55 0H-1H 57	X		
	54 0H-1H 56	X		
	61 0H-1H 63	X		
	62 0H-1H 68	X		
6	65 0H-1H 67	X		
	64 0H-1H 66	X		
	71 0H-1H 73	X		
	72 0H-1H 78	X		
7	75 0H-1H 77	X		
	74 0H-1H 76	X		
	81 0H-1H 83	X		
	82 0H-1H 88	X		
8	85 0H-1H 87	X		
	84 0H-1H 86	X		



0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

**ISSUED FOR BID**

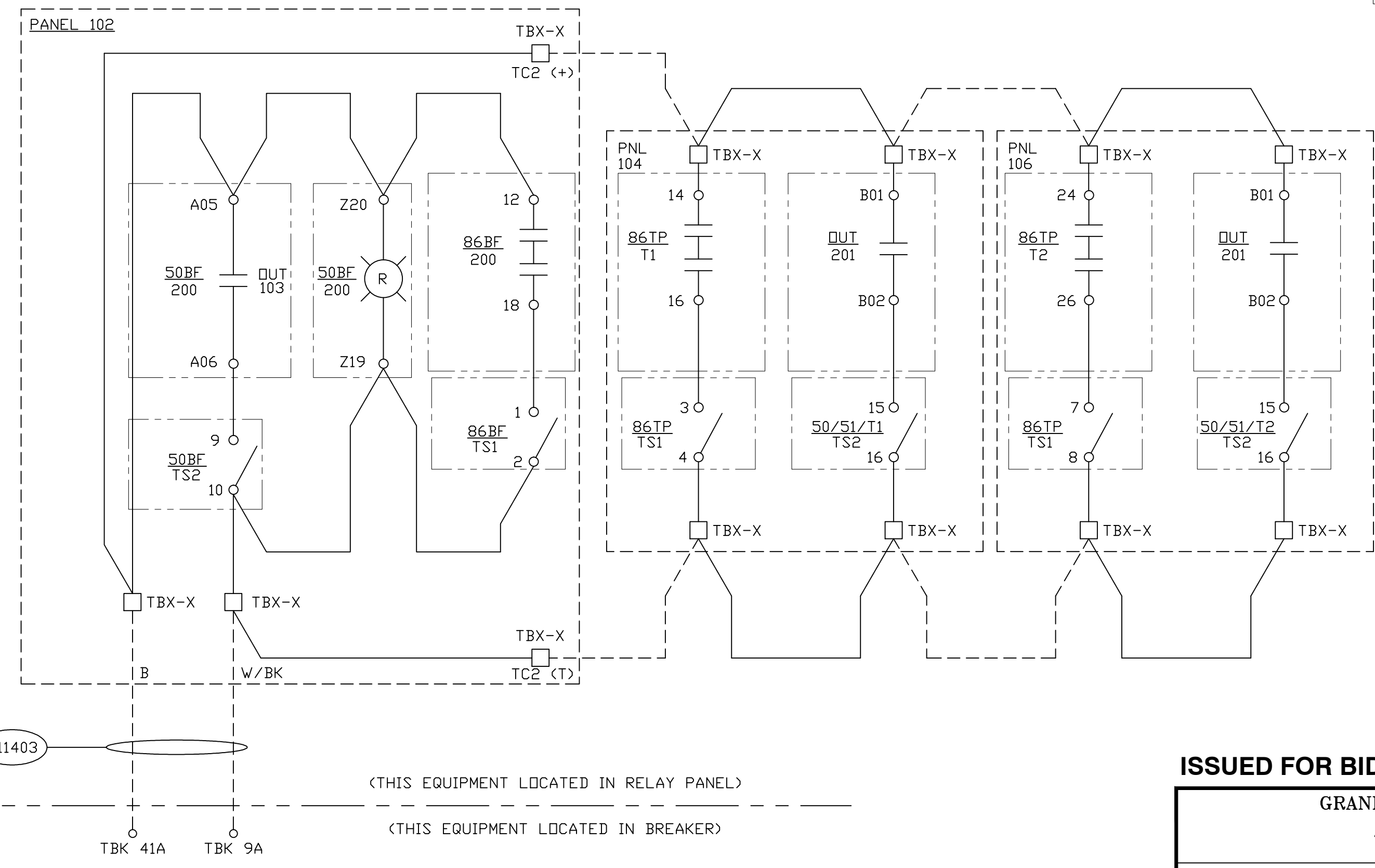
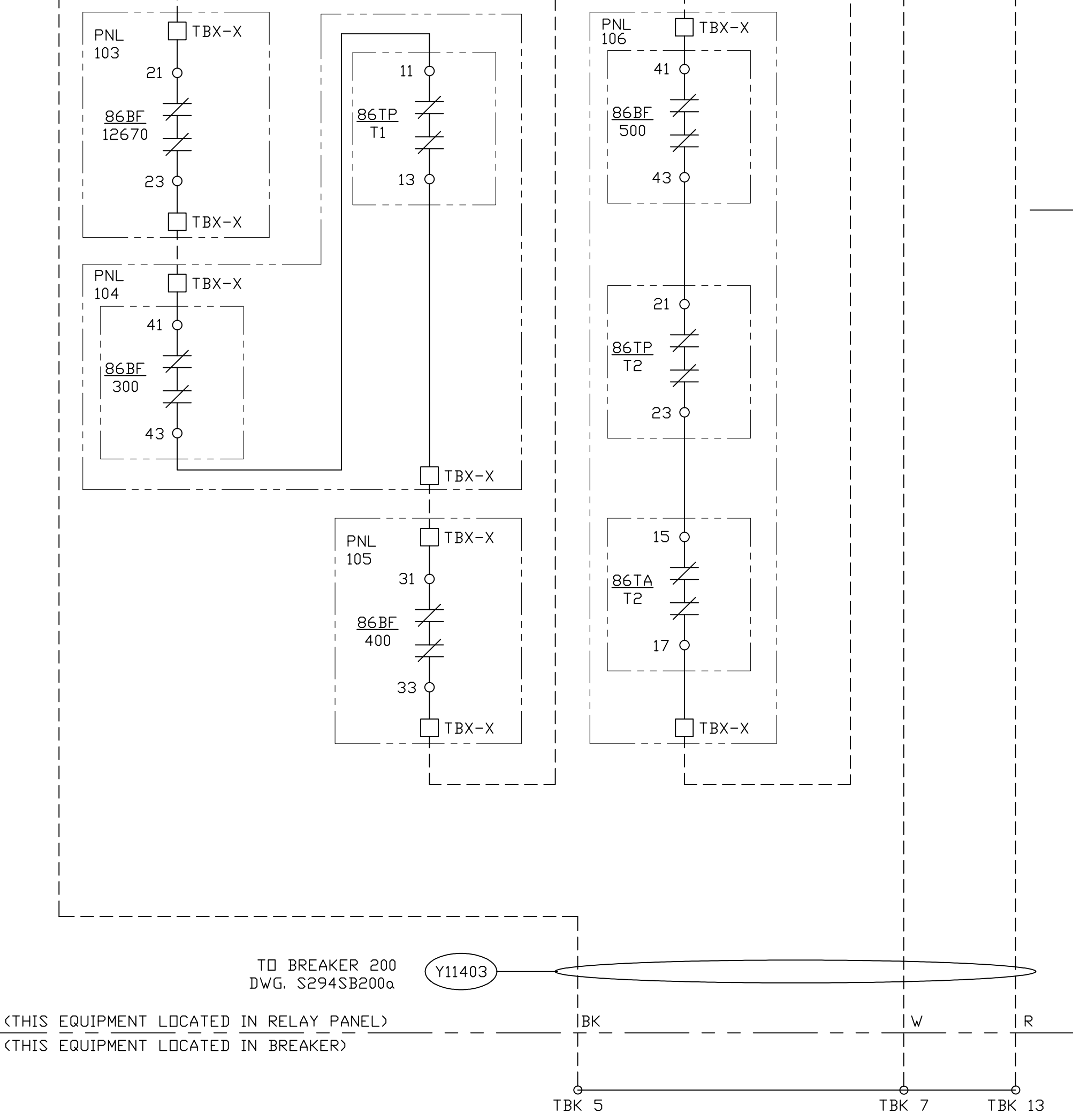
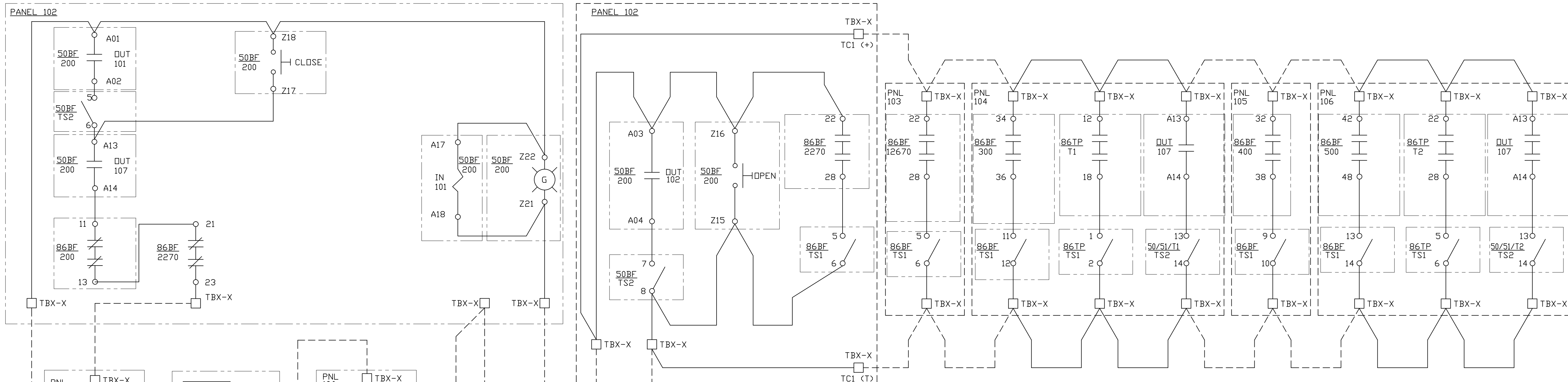
**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**BKR 100 FAILURE & CONTROL**  
 161KV FEEDER 22-MIAMI CIRCUIT

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SF007	
REV. 0		P.O. BOX 409 VINITA, OK 74301	



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Last plotted by: Shultz, Aylene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/23/2012 10:23 AM Plotter used: DWG To PDF.pc3



NOTE: SEE DRAWING S294SB200a FOR CIRCUIT BREAKER DC SCHEMATIC.

PANEL XXX PANEL FOR THIS RELAY  
PNL XXX PANELS OUTSIDE THIS PANEL

○ EQUIPMENT TERMINAL  
□ PANEL WIRING INSTALLED BY PANEL MANUF.  
□ TERMINAL BLOCK  
□ FIELD WIRING INSTALLED BY CONTRACTOR

EQUIPMENT SHOWN INSIDE BOX LOCATED IN PANEL NUMBER DESIGNATED AT TOP LEFT

NOTES:  
1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION  
2) BREAKER SHOWN IN OPEN POSITION  
3) SF6 SHOWN AT ZERO PRESSURE  
4) CLOSING SPRING SHOWN IN CHARGED POSITION  
5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR  
6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

REFERENCE DRAWINGS

S294SB200a	BKR 200 ACDC SCHEMATIC DIAGRAM
S294SB200b	BKR 200 BREAKER AUXILIARIES
S294PP102	FDR 22-161kV MIAMI & BKR 2270
S294PP103	FDR 126-161kV PENSACOLA
S294PP104	TRANSFORMER NO 1 & BKR 300
S294PP105	BKR 400 & 69kV BUS DIFF ZONE SOUTH S1 & NORTH N1
S294PP106	TRANSFORMER NO 2 & BKR 500

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

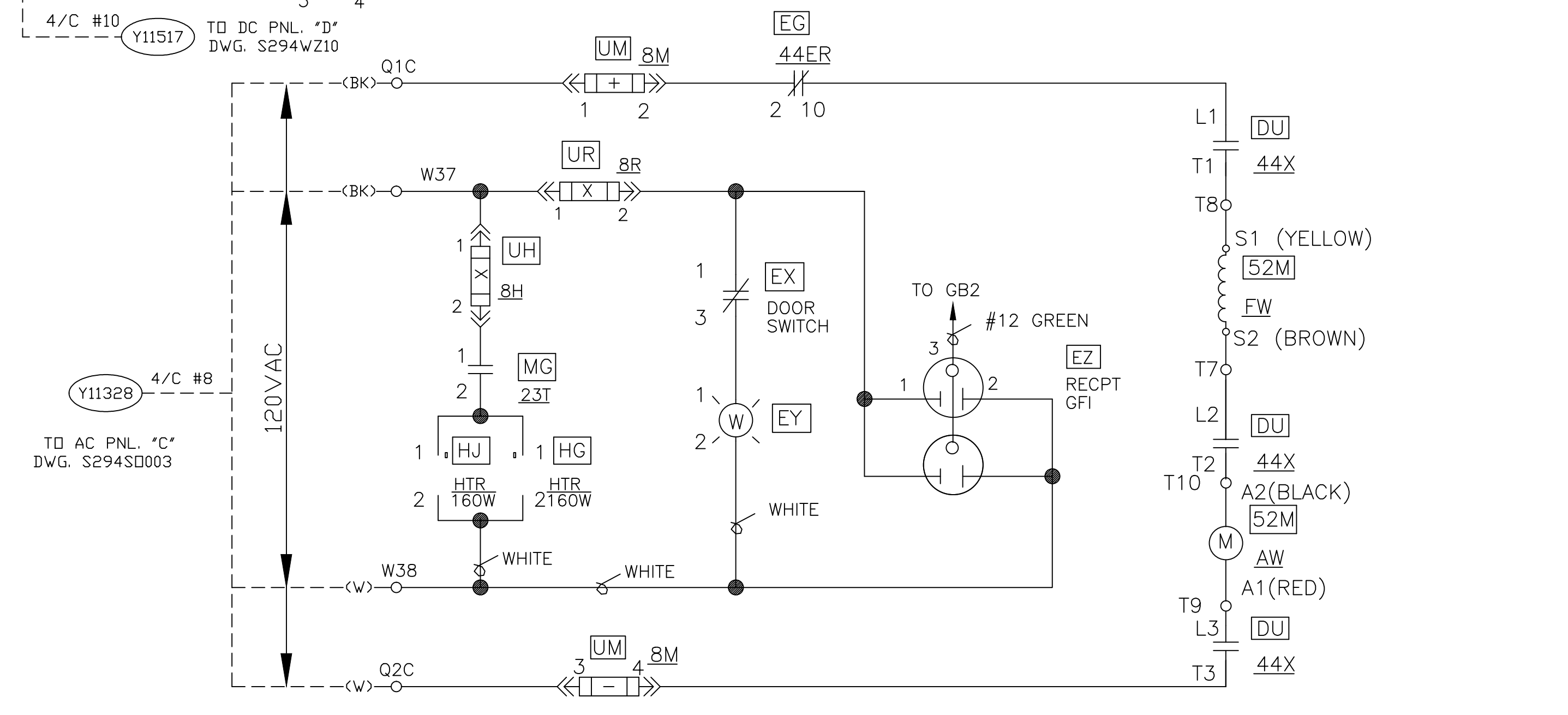
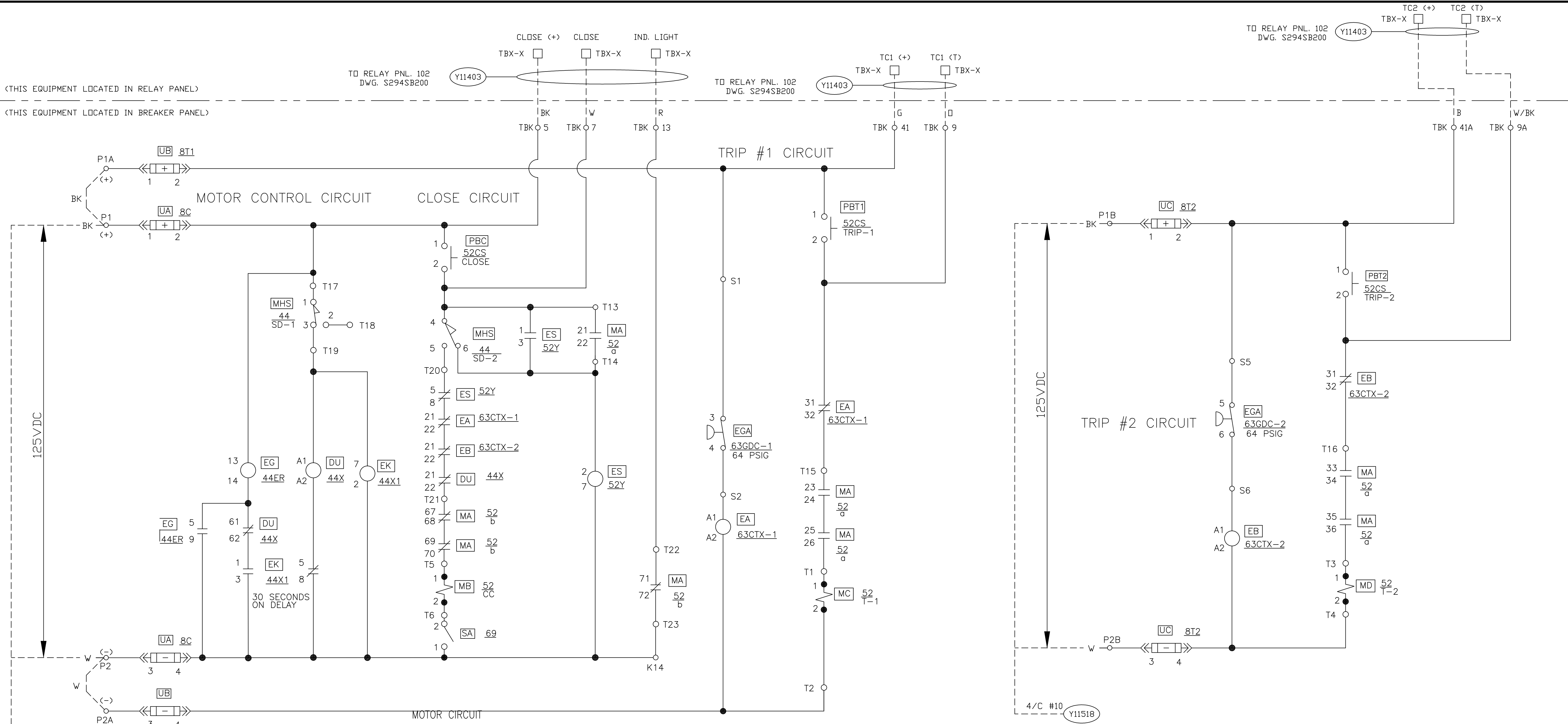
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69kV

**BREAKER 200  
DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB200	
REV. 0		P.O. BOX 409 VINITA, OK 74301	

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NOTE: SEE 161kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- REFERENCE DRAWINGS**
- S294SB200 BKR 200 DC SCHEMATIC DIAGRAM
  - S294SBPP102 FDR 22-161kV MIAMI & BKR 2270
  - S294SBWZ10 PANEL D 125VDC WIRING DIAGRAM

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 BREAKER 200  
 AC/DC SCHEMATIC DIAGRAM

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB200a	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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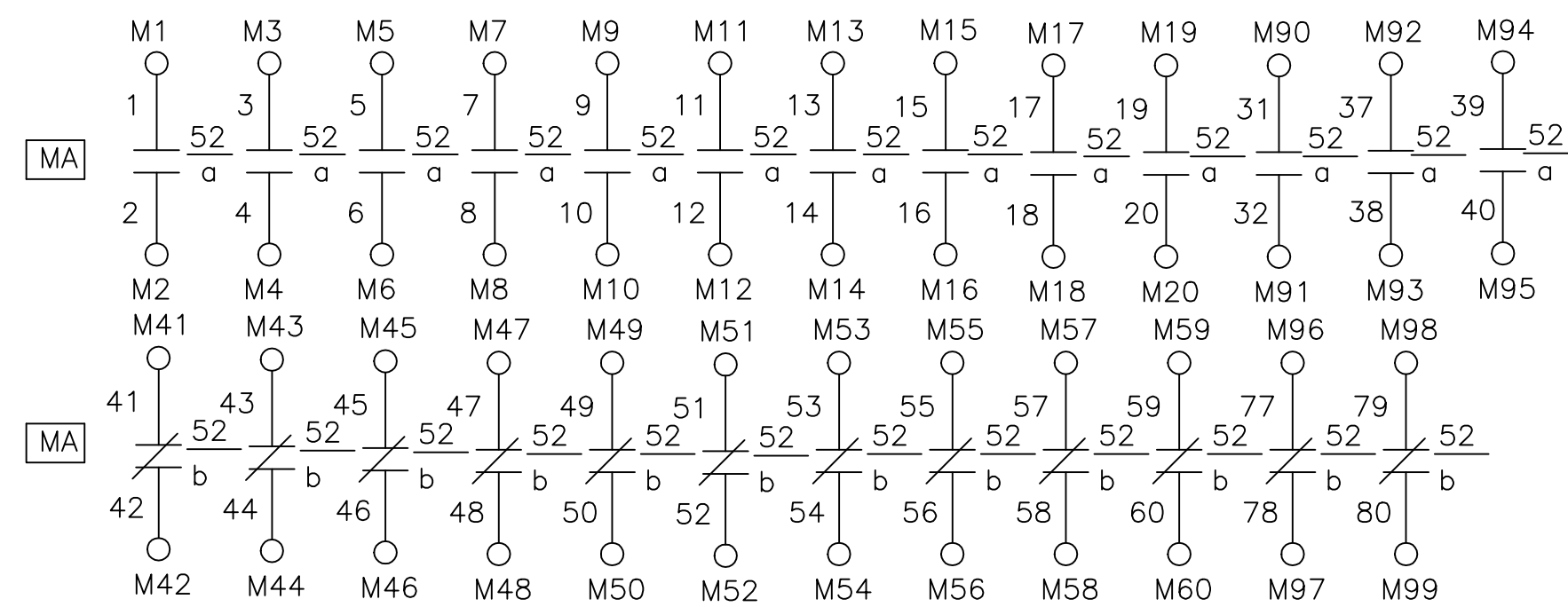


NOTE: SEE 161kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

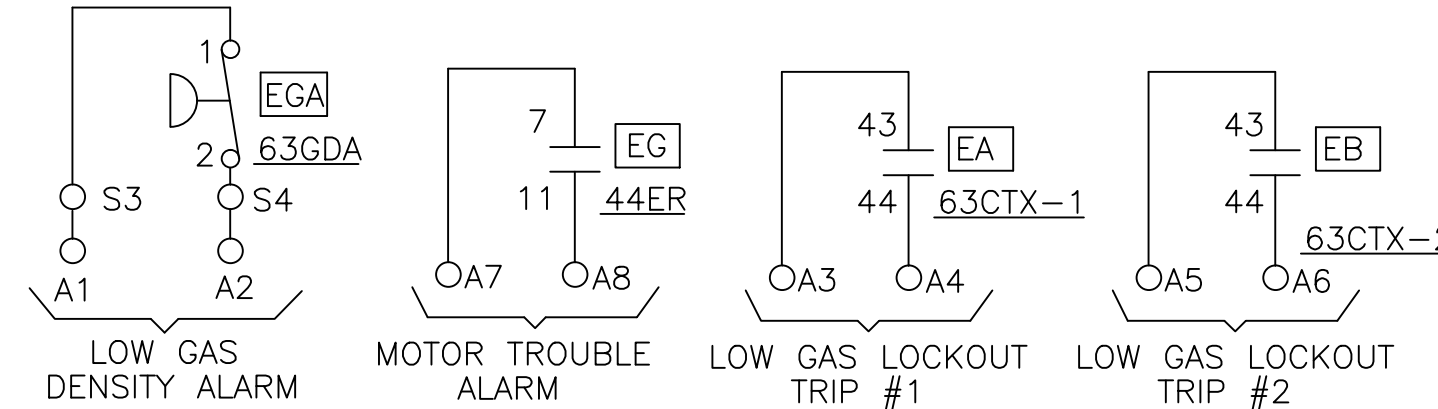
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

REFERENCE DRAWINGS

- S294SB200 BKR 200 DC SCHEMATIC DIAGRAM  
 S294SB200a BKR 200 AC/DC SCHEMATIC DIAGRAM

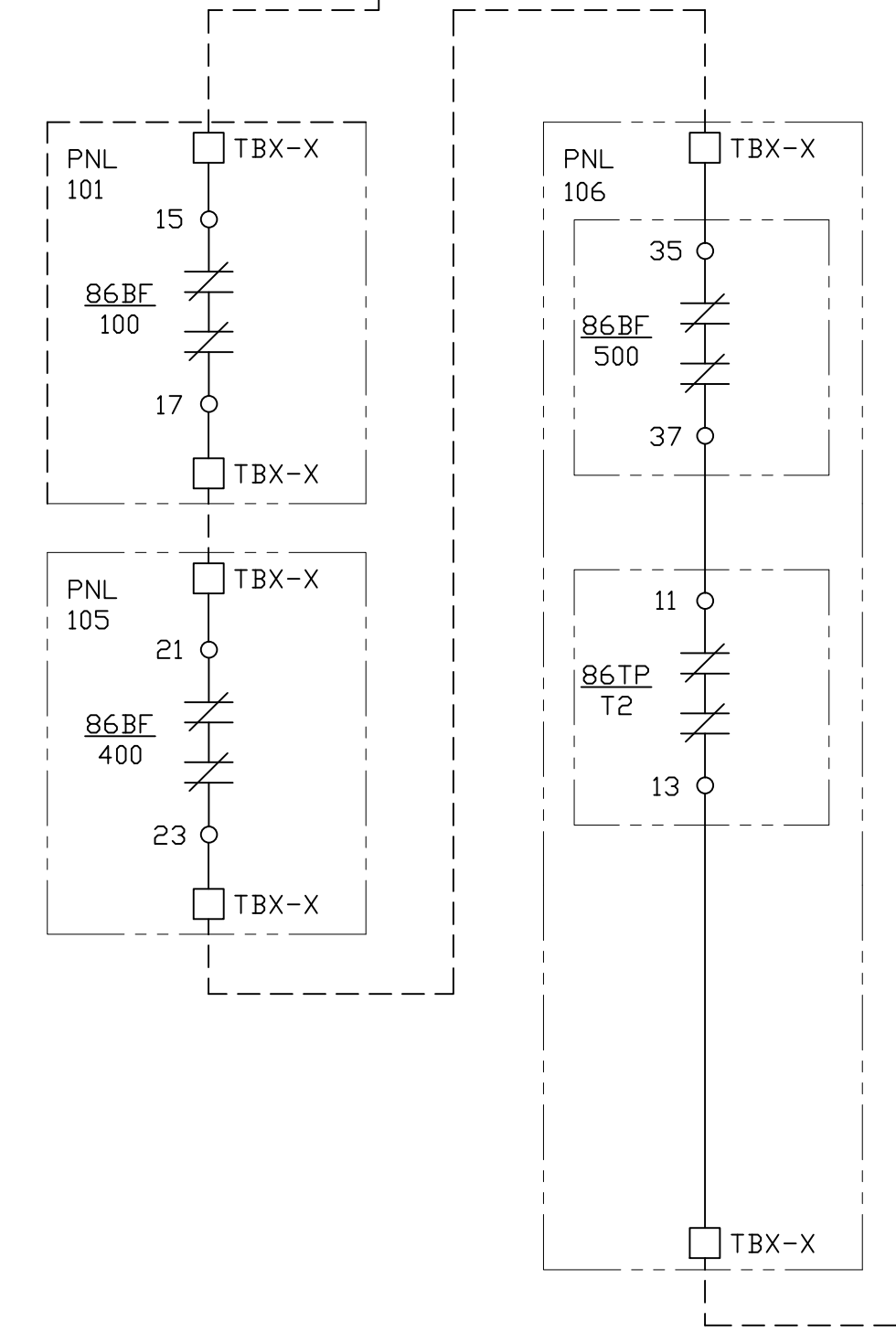
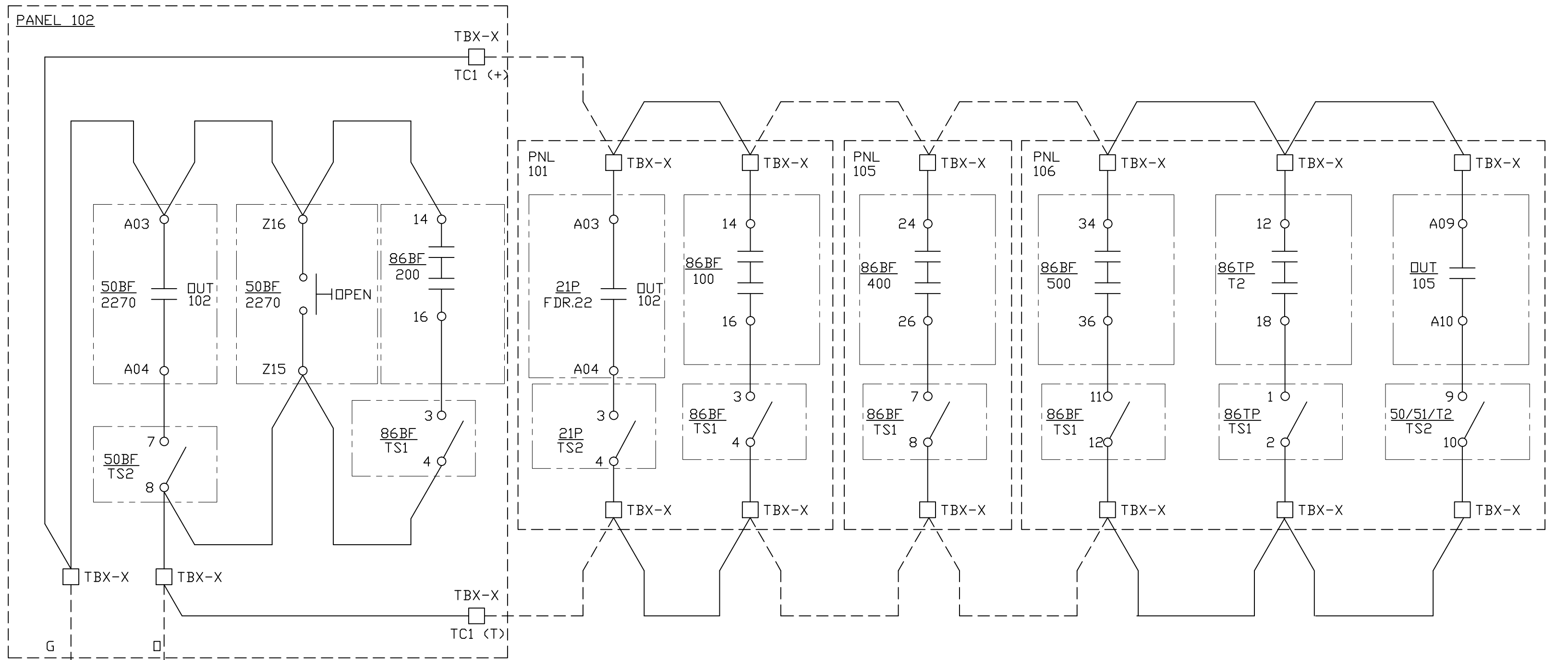
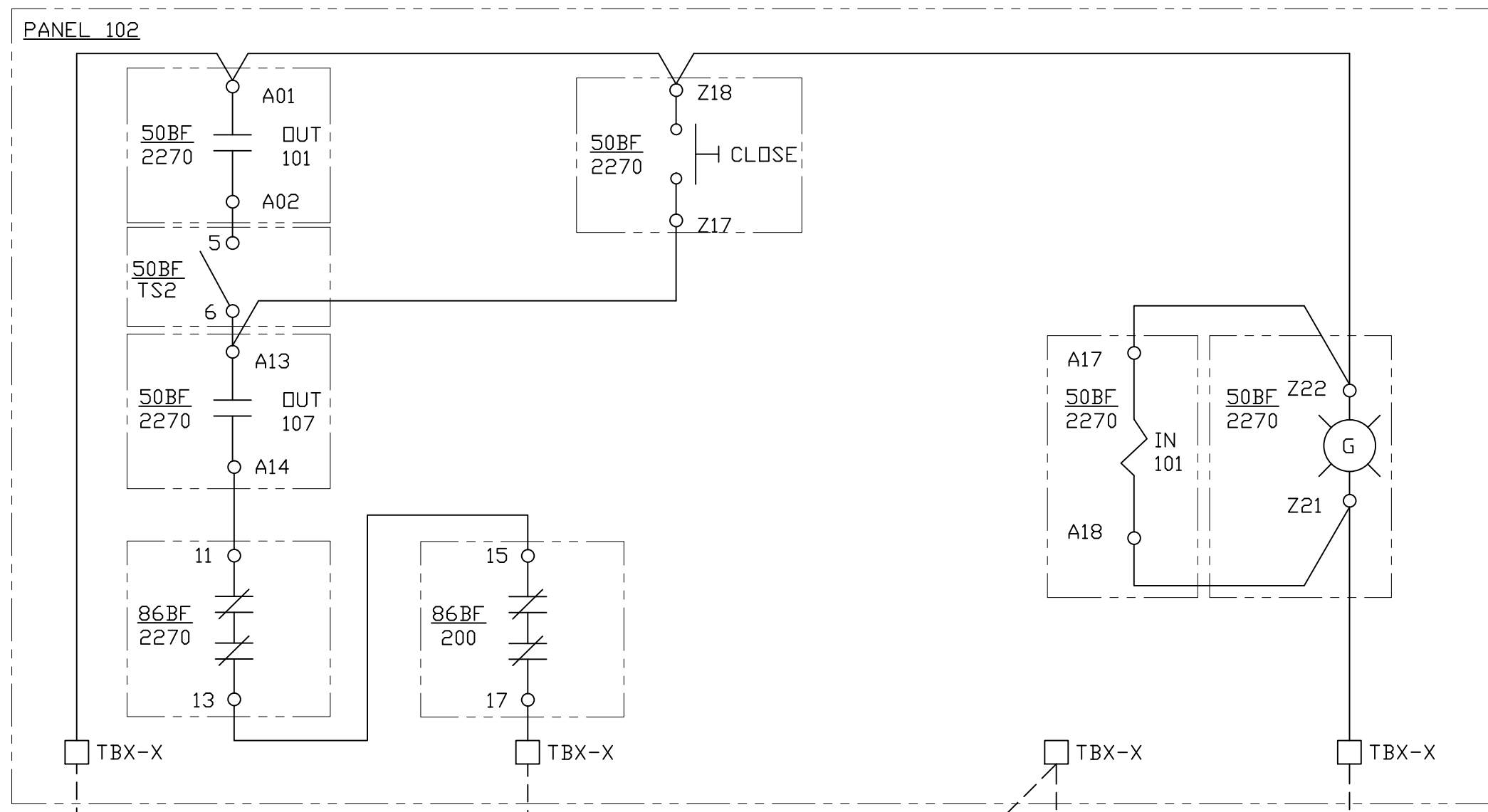
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 BREAKER 200  
 BREAKER AUXILIARIES

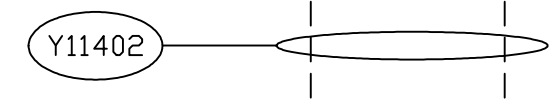
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REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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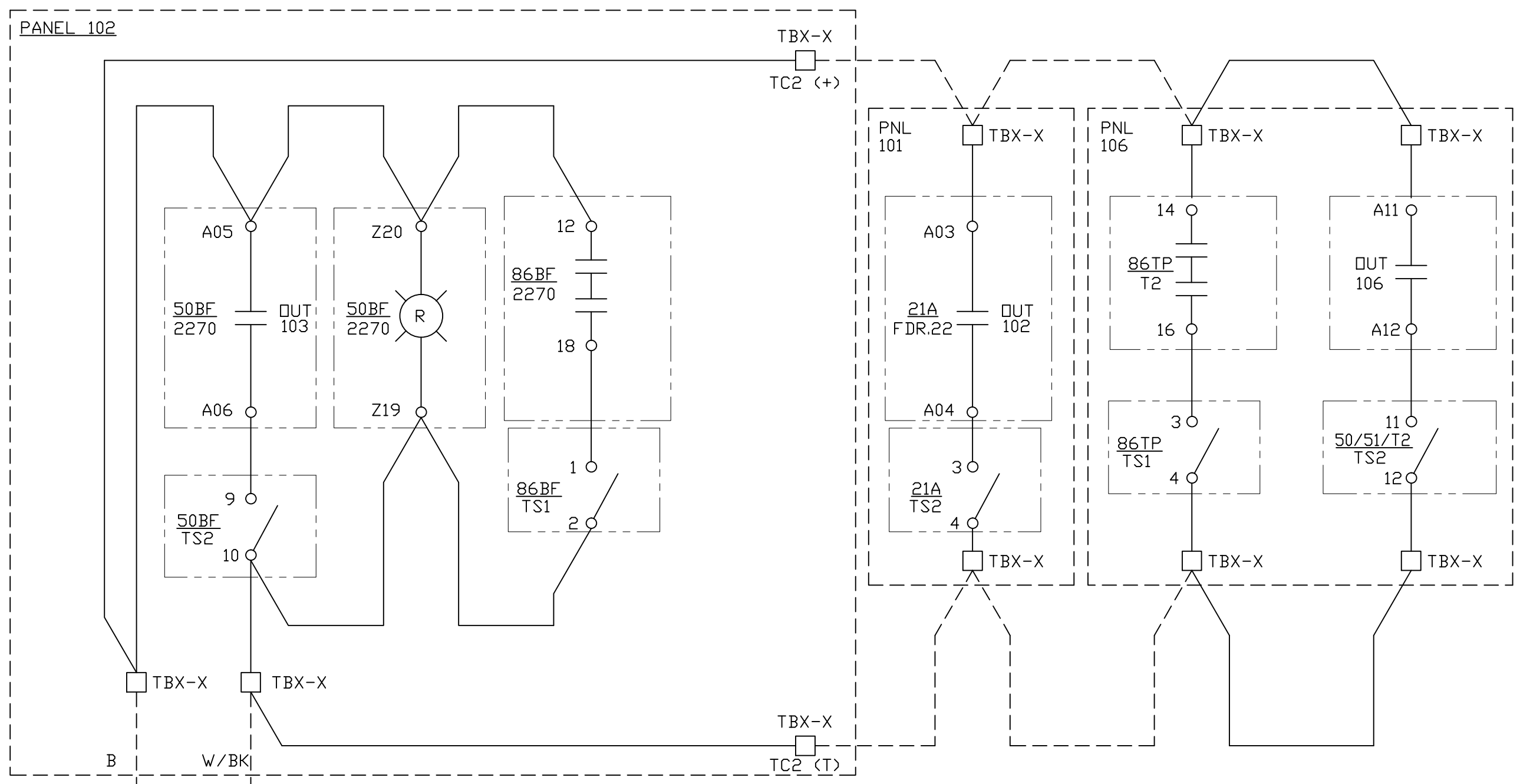
TO BREAKER 2270  
DWG. S294SB2270a



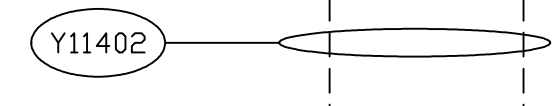
<THIS EQUIPMENT LOCATED IN RELAY PANEL>

<THIS EQUIPMENT LOCATED IN BREAKER>

**DC TRIP CIRCUIT 1**



TO BREAKER 2270  
DWG. S294SB2270a



<THIS EQUIPMENT LOCATED IN RELAY PANEL>

<THIS EQUIPMENT LOCATED IN BREAKER>

**DC TRIP CIRCUIT 2**

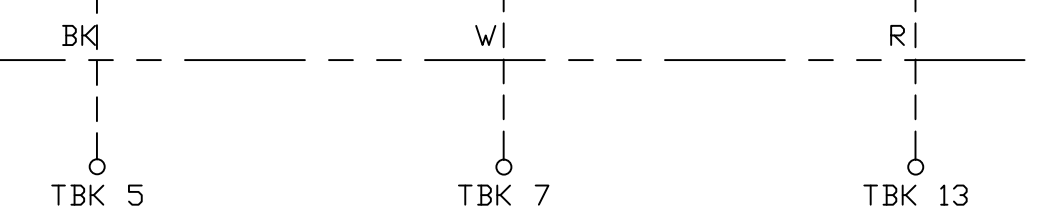
NOTE: SEE DRAWING  
S294SB2270a FOR CIRCUIT  
BREAKER DC SCHEMATIC.  
EQUIPMENT SHOWN INSIDE BOX  
LOCATED IN PANEL NUMBER  
DESIGNATED AT TOP LEFT

PANEL XXX	PANEL FOR THIS RELAY
PNL XXX	PANELS OUTSIDE THIS PANEL
	EQUIPMENT TERMINAL
	PANEL WIRING INSTALLED BY PANEL MANUF.
	TERMINAL BLOCK
	FIELD WIRING INSTALLED BY CONTRACTOR

<THIS EQUIPMENT LOCATED IN RELAY PANEL>

<THIS EQUIPMENT LOCATED IN BREAKER>

**DC CLOSE CIRCUIT**



TO BREAKER 2270  
DWG. S294SB2270a

**REFERENCE DRAWINGS**

- S294SB2270a BKR 2270 ACDC SCHEMATIC DIAGRAM
- S294SB2270b BKR 2270 BREAKER AUXILIARIES
- S294PP101 FDR 22-161kV MIAMI PANEL 101-BREAKER 100
- S294PP102 FDR 22-161kV MIAMI & BKR 2270
- S294PP105 BKR 400 & 69kV BUS DIFF ZONE SOUTH S1 & NORTH N1
- S294PP106 TRANSFORMER NO 2 & BKR 500

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SFC SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

**ISSUED FOR BID**

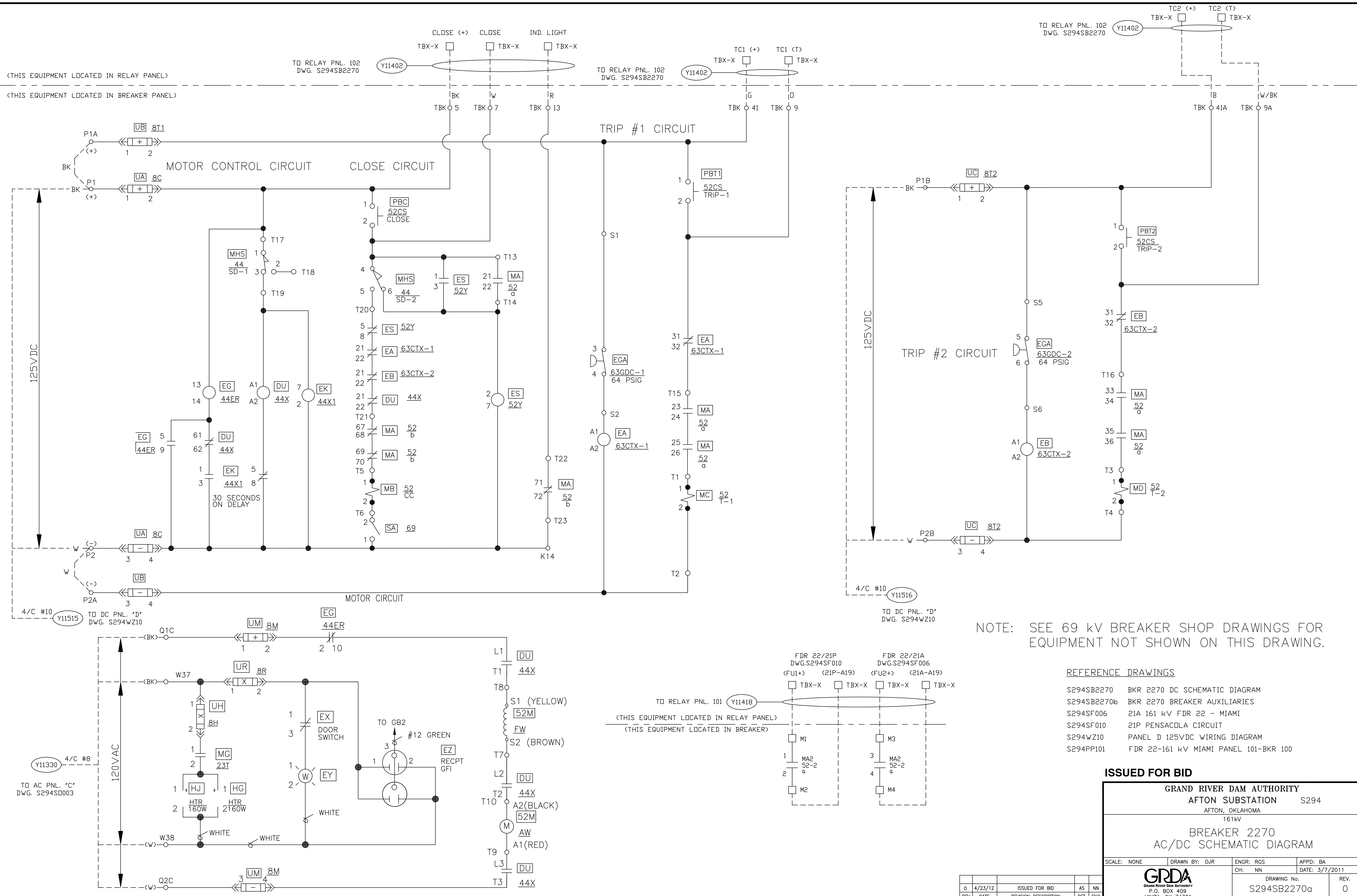
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

**BREAKER 2270  
DC SCHEMATIC DIAGRAM**

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CH: NN	DATE: 3/7/2011		
		DRAWING No.	REV.
		S294SB2270	0

REV	DATE	REVISION DESCRIPTION	DFT	ENG

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- REFERENCE DRAWINGS**
- S294SB2270 BKR 2270 DC SCHEMATIC DIAGRAM
  - S294SB2270b BKR 2270 BREAKER AUXILIARIES
  - S294SF006 21A 161 kV FDR 22 - MIAMI
  - S294SF010 21P PENSACOLA CIRCUIT
  - S294WZ10 PANEL D 125VDC WIRING DIAGRAM
  - S294PP101 FDR 22-161 kV MIAMI PANEL 101-BKR 100

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA 161KV

**BREAKER 2270**  
 AC/DC SCHEMATIC DIAGRAM

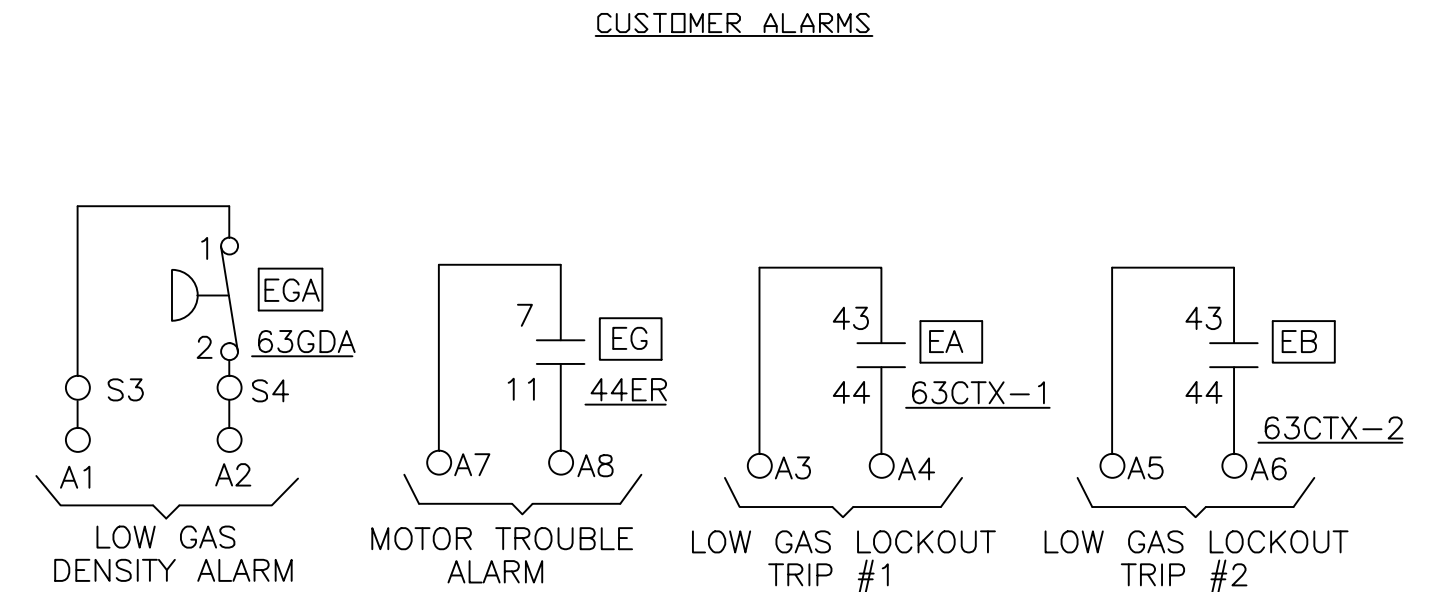
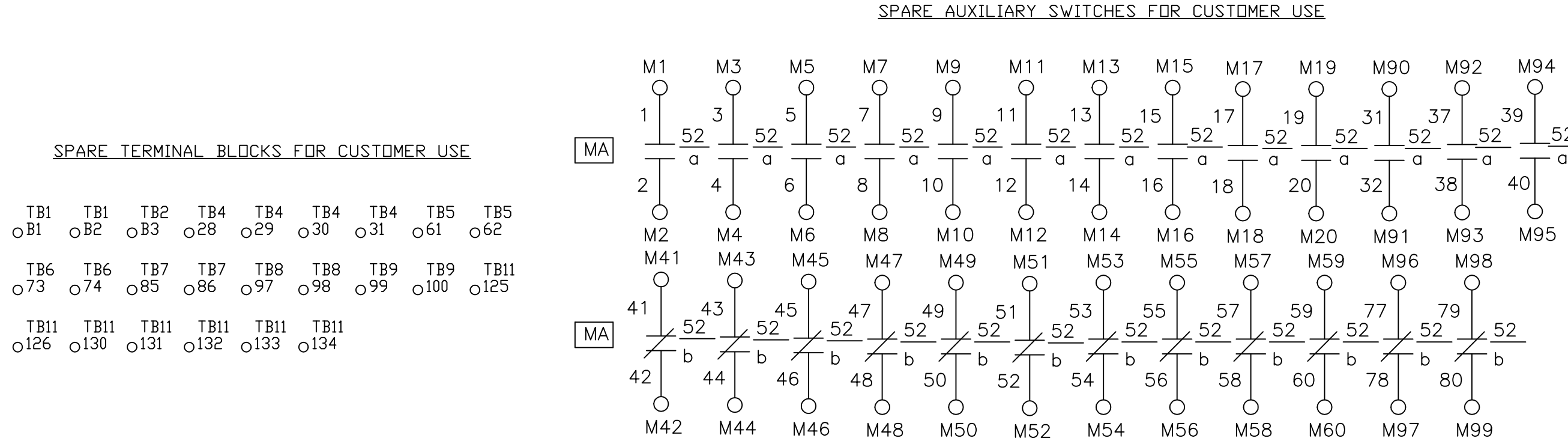
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REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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NOTE: SEE 161kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.



- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

REFERENCE DRAWINGS

S294SB2270 BKR 2270 DC SCHEMATIC DIAGRAM  
 S294SB2270b BKR 2270 BREAKER AUXILIARIES

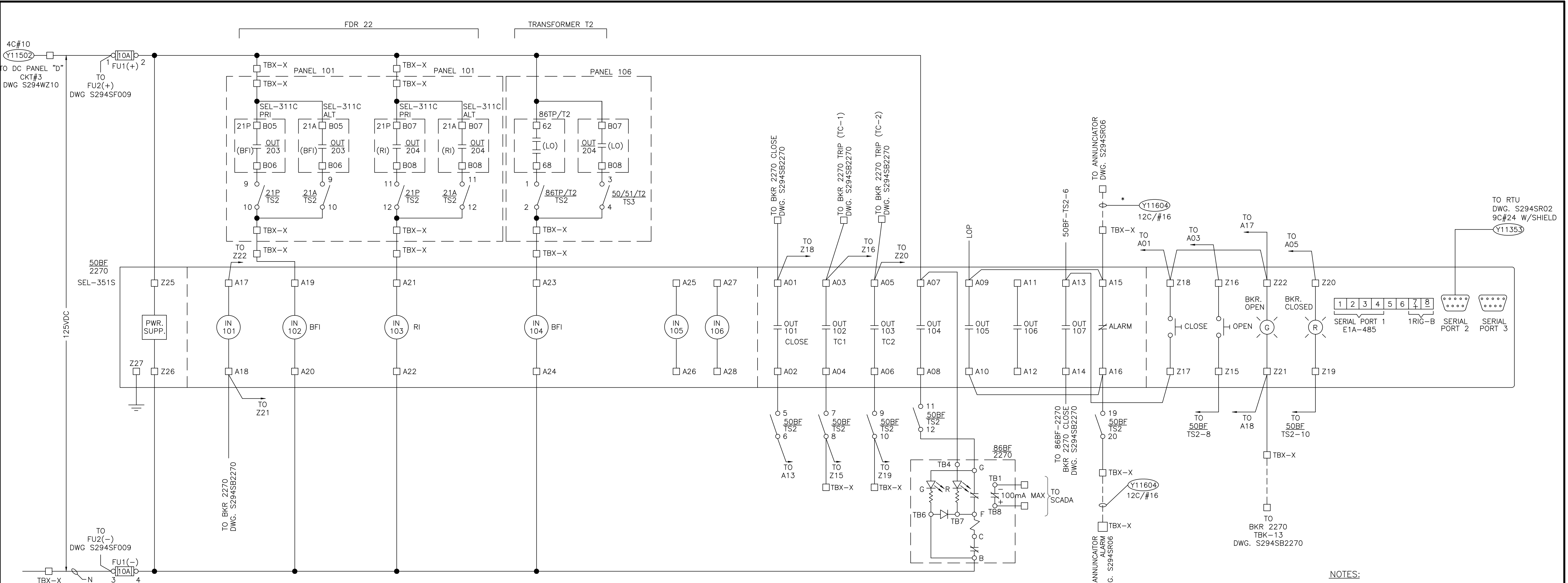
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

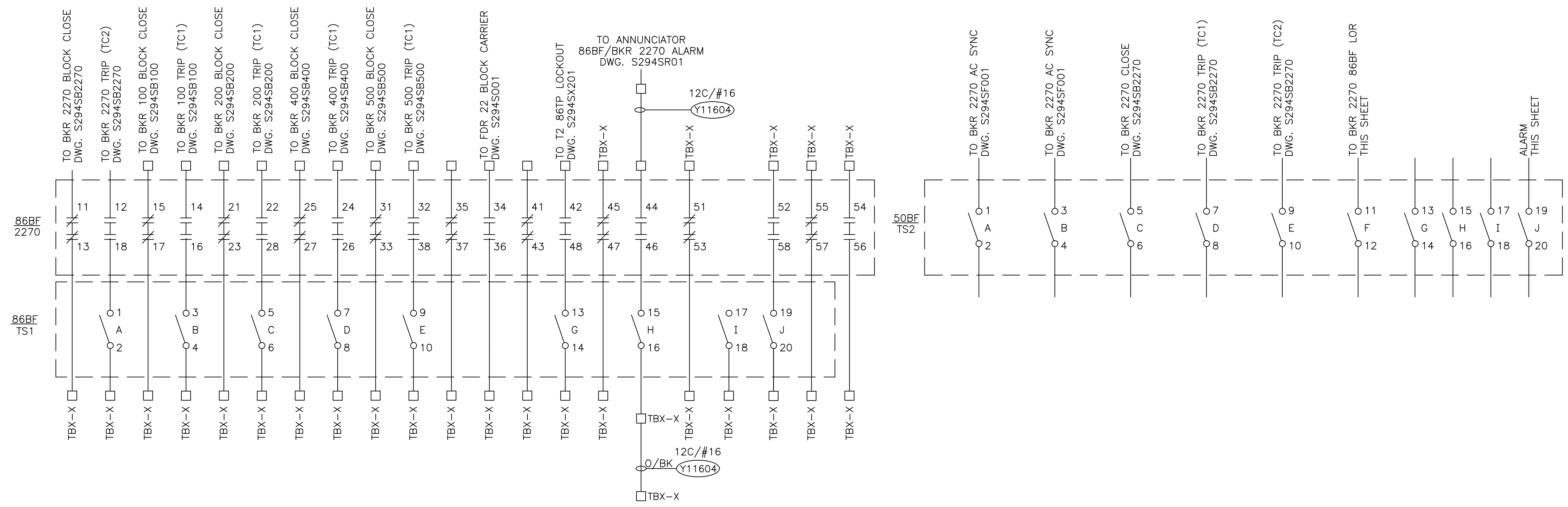
**BREAKER 2270**  
**BREAKER AUXILIARIES**

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GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		CH: NN DATE: 3/7/2011	DRAWING No. S294SB2270b
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- NOTES:**
1. ALL EQUIPMENT IS ON PANEL 102 UNLESS OTHERWISE NOTED.
  2. BFI - BREAKER FAILURE INITIATION.
  3. RI - RECLOSING INITIATION.



**86BF CONTACT DIAGRAM**

DECK	CONTACTS	POSITION	
		TRIP	RESET
1	11	OH	HO
	12	OH	HO
	13	OH	HO
	14	OH	HO
	15	OH	HO
2	16	OH	HO
	17	OH	HO
	18	OH	HO
	19	OH	HO
	20	OH	HO
3	21	OH	HO
	22	OH	HO
	23	OH	HO
	24	OH	HO
	25	OH	HO
4	26	OH	HO
	27	OH	HO
	28	OH	HO
	29	OH	HO
	30	OH	HO
5	31	OH	HO
	32	OH	HO
	33	OH	HO
	34	OH	HO
	35	OH	HO
6	36	OH	HO
	37	OH	HO
	38	OH	HO
	39	OH	HO
	40	OH	HO
7	41	OH	HO
	42	OH	HO
	43	OH	HO
	44	OH	HO
	45	OH	HO
8	46	OH	HO
	47	OH	HO
	48	OH	HO
	49	OH	HO
	50	OH	HO

- REFERENCE DRAWINGS**
- S294SB2270 BREAKER 2270 SCHEMATIC DIAGRAM
  - S294SF005 PRIMARY RELAY FEEDER #22
  - S294SF006 ALTERNATE RELAY FEEDER #22
  - S294SF002 THREE LINE AC DIAGRAM BREAKER 2270 & FDR. 22
  - S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM
  - S294SX002 TRANSFORMER SCHEMATIC DIAGRAM
  - S294SB100 BREAKER 100 SCHEMATIC DIAGRAM
  - S294SB200 BREAKER 200 SCHEMATIC DIAGRAM

**ISSUED FOR BID**

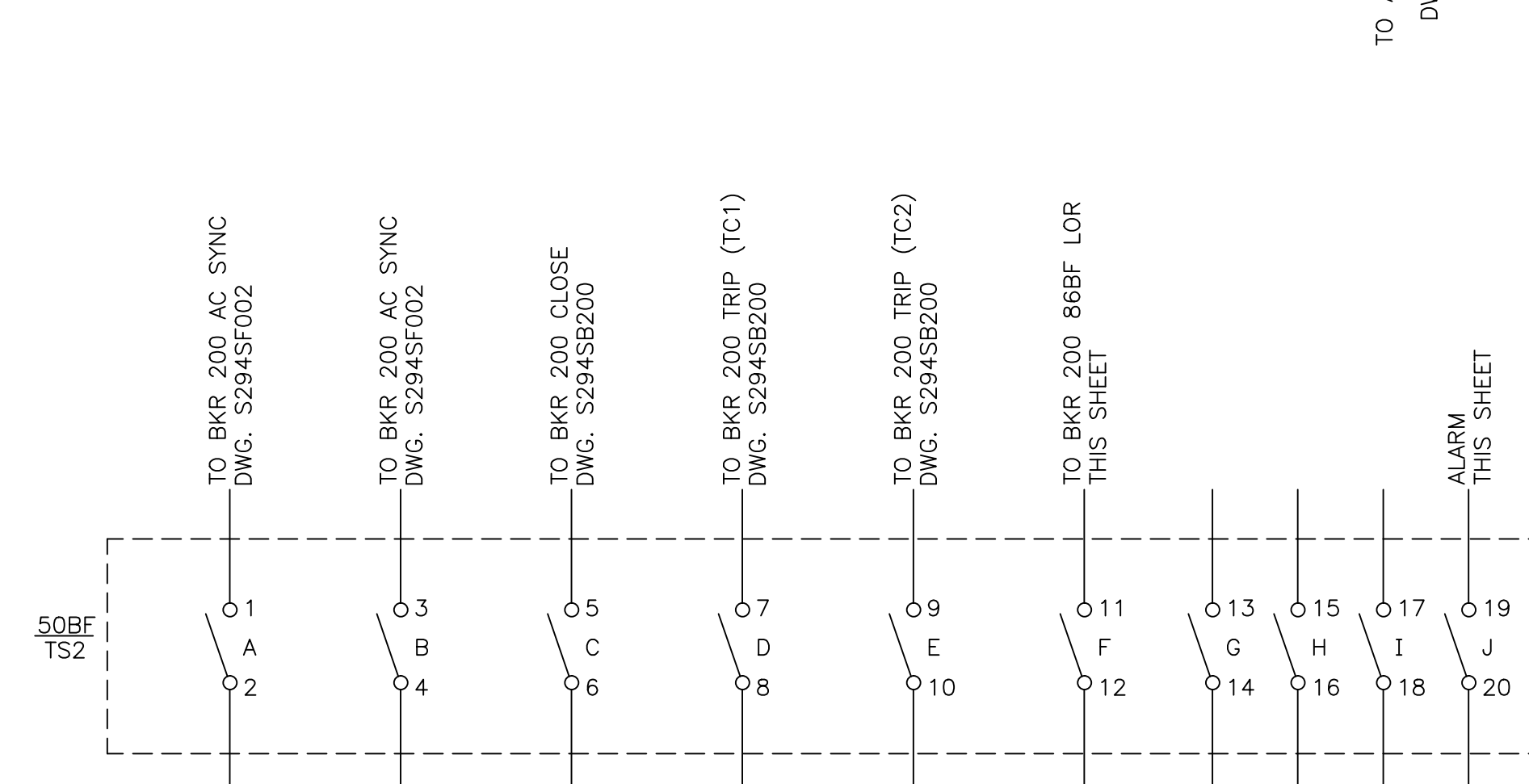
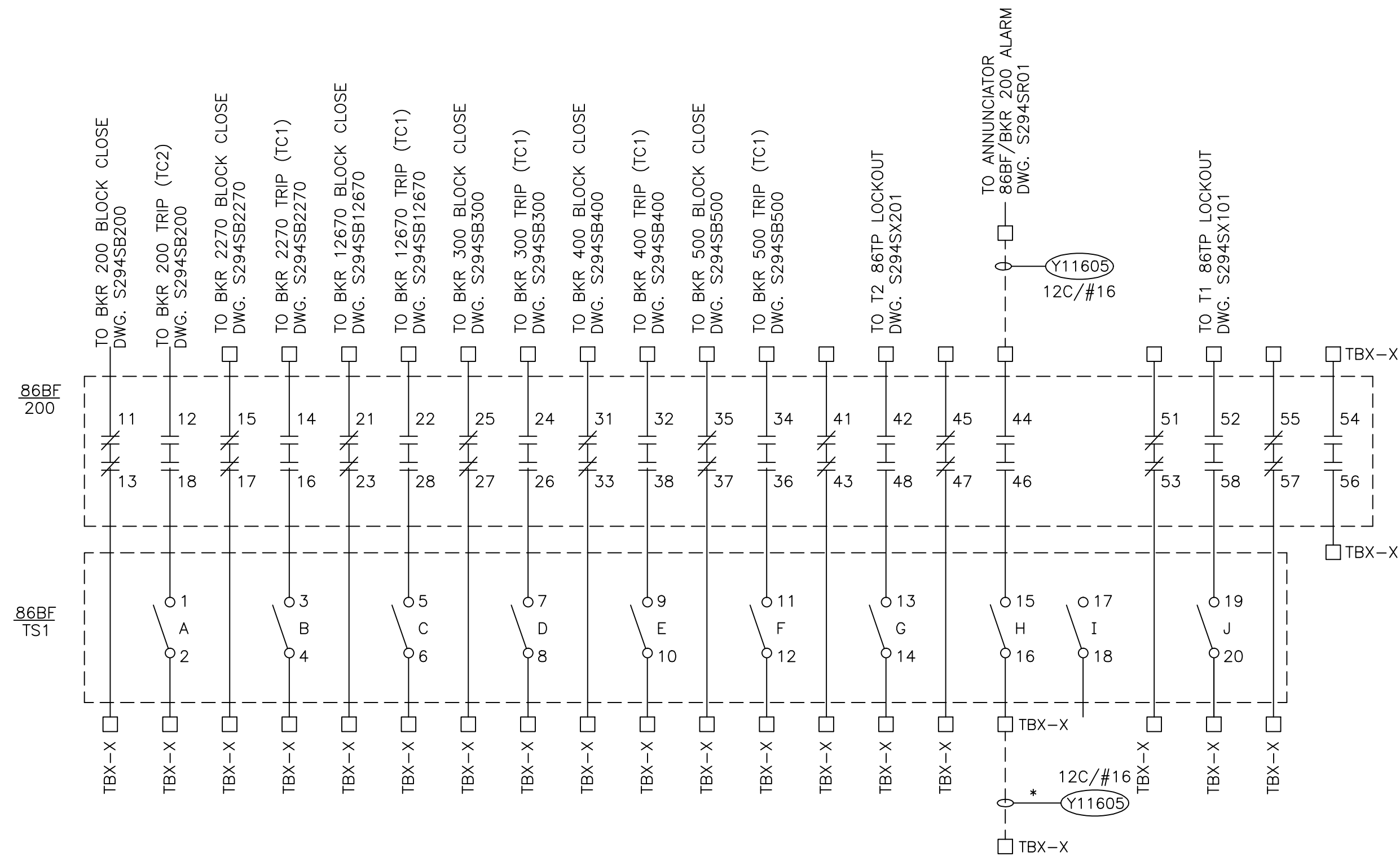
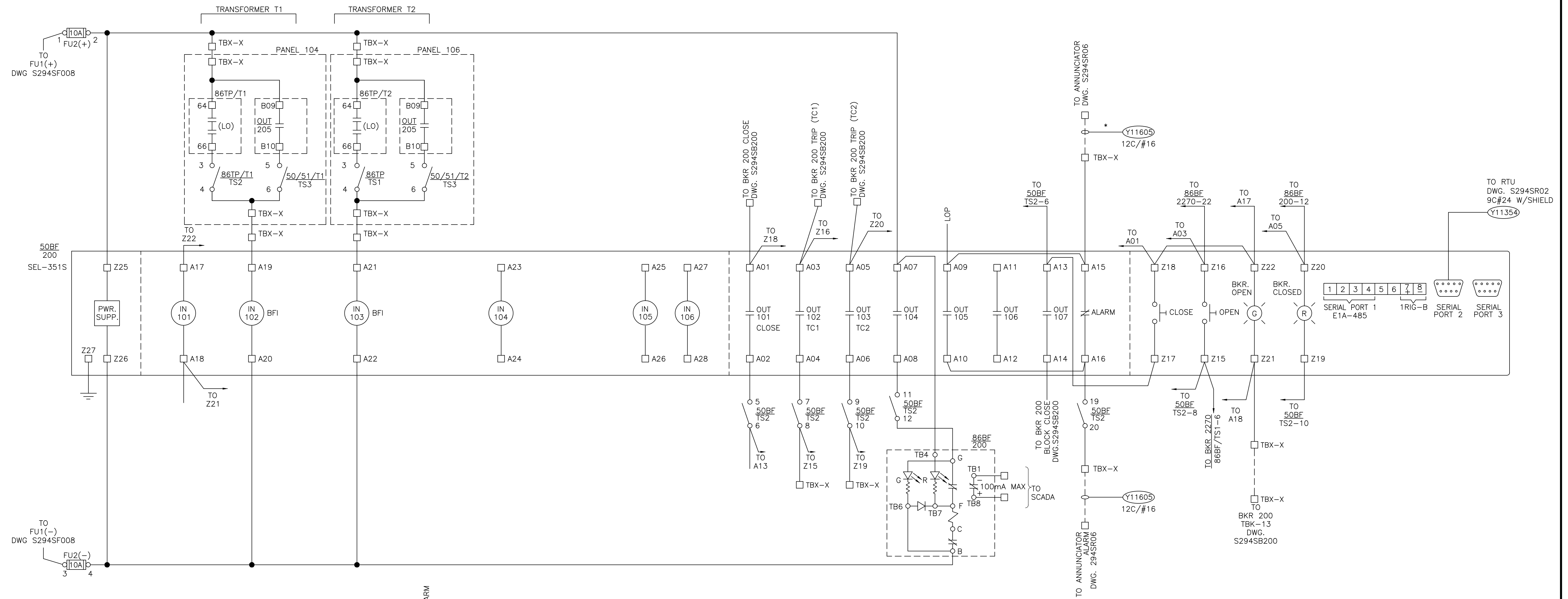
**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**BKR 2270 FAILURE & CONTROL**

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SF008	
REV 0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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 Last plotted by: Shuats, Arlene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/23/2012 1:06 PM Plotter used: DWG To PDF.pc3



86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION	
		TRIP	RESET
1	11	OH	HO
	12	OH	HO
	13	HO	HO
	14	OH	HO
	15	OH	HO
2	21	OH	HO
	22	OH	HO
	23	HO	HO
	24	OH	HO
	25	OH	HO
3	31	OH	HO
	32	OH	HO
	33	HO	HO
	34	OH	HO
	35	OH	HO
4	41	OH	HO
	42	OH	HO
	43	HO	HO
	44	OH	HO
	45	OH	HO
5	51	OH	HO
	52	OH	HO
	53	HO	HO
	54	OH	HO
	55	OH	HO
6	61	OH	HO
	62	OH	HO
	63	HO	HO
	64	OH	HO
	65	OH	HO
7	71	OH	HO
	72	OH	HO
	73	HO	HO
	74	OH	HO
	75	OH	HO
8	81	OH	HO
	82	OH	HO
	83	HO	HO
	84	OH	HO
	85	OH	HO

NOTES:  
 1. ALL EQUIPMENT IS ON PANEL 102 UNLESS OTHERWISE NOTED

- REFERENCE DRAWINGS
- S294SB200 BKR 200 SCHEMATIC DIAGRAM
  - S294SB300 BKR 300 DC SCHEMATIC DIAGRAM
  - S294SB400 BKR 400 DC SCHEMATIC DIAGRAM
  - S294SB500 BKR 500 DC SCHEMATIC DIAGRAM
  - S294SB2270 BKR 2270 DC SCHEMATIC
  - S294SB12670 BKR 12670 DC SCHEMATIC
  - S294SF002 BKR 2270 & 200 PNL 102 TREE LINE AC DIAGRAM
  - S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM
  - S294SX002 TRANSFORMER T2 THREE LINE
  - S294SX001 TRANSFORMER T1 THREE LINE

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 69/161KV

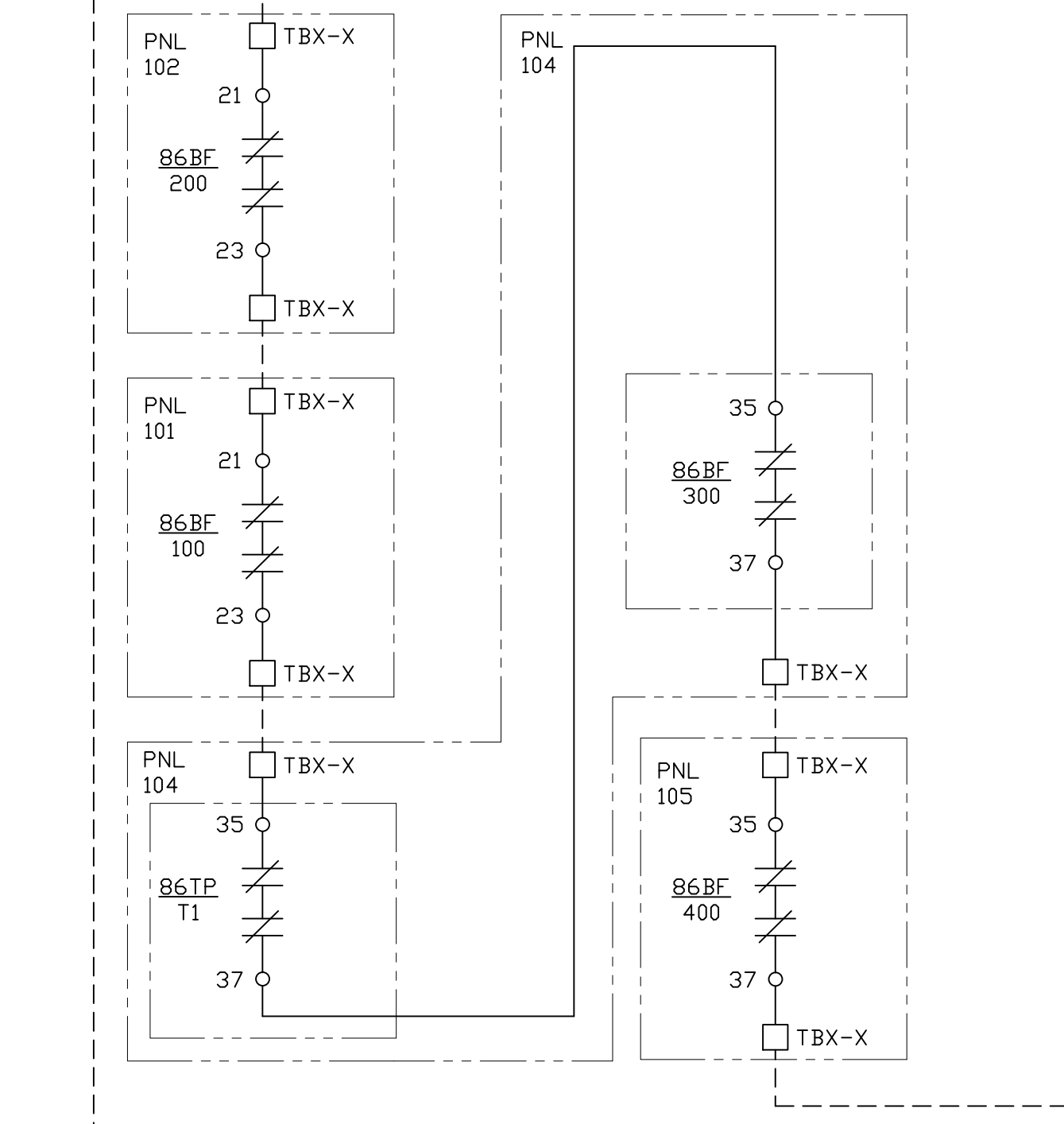
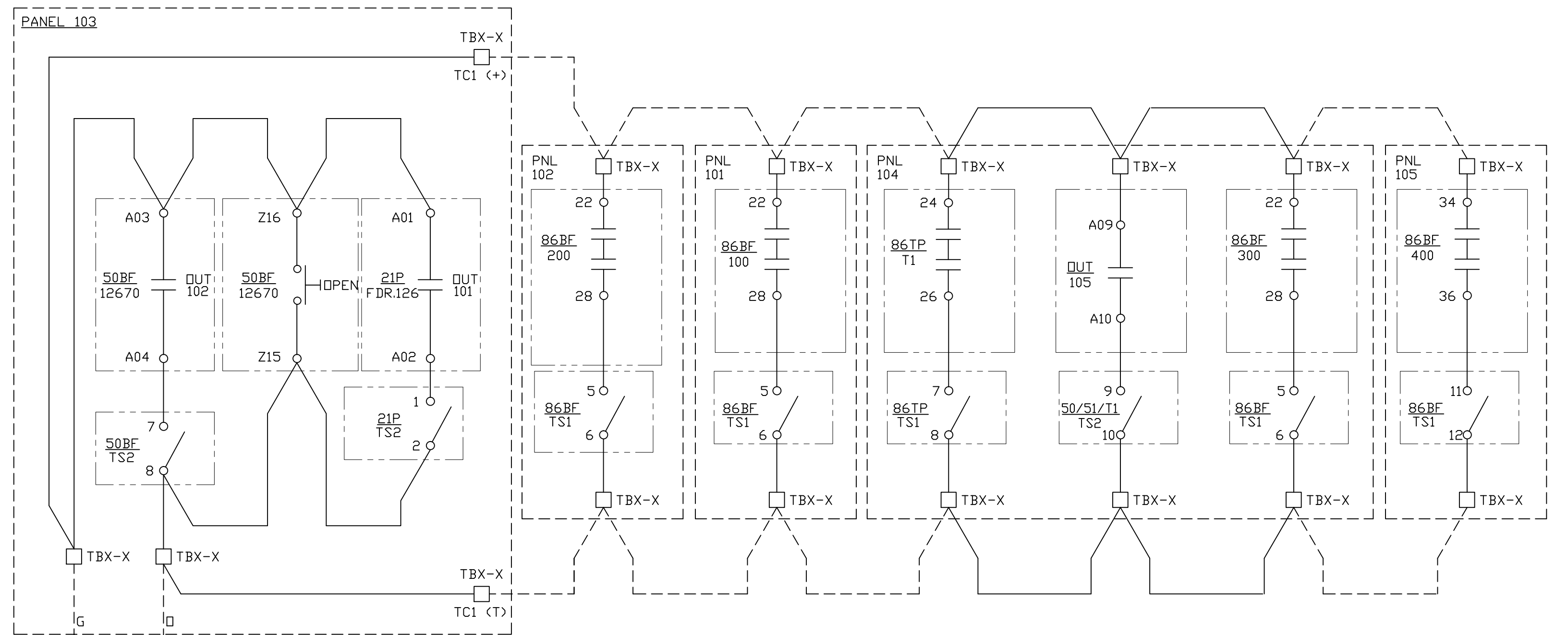
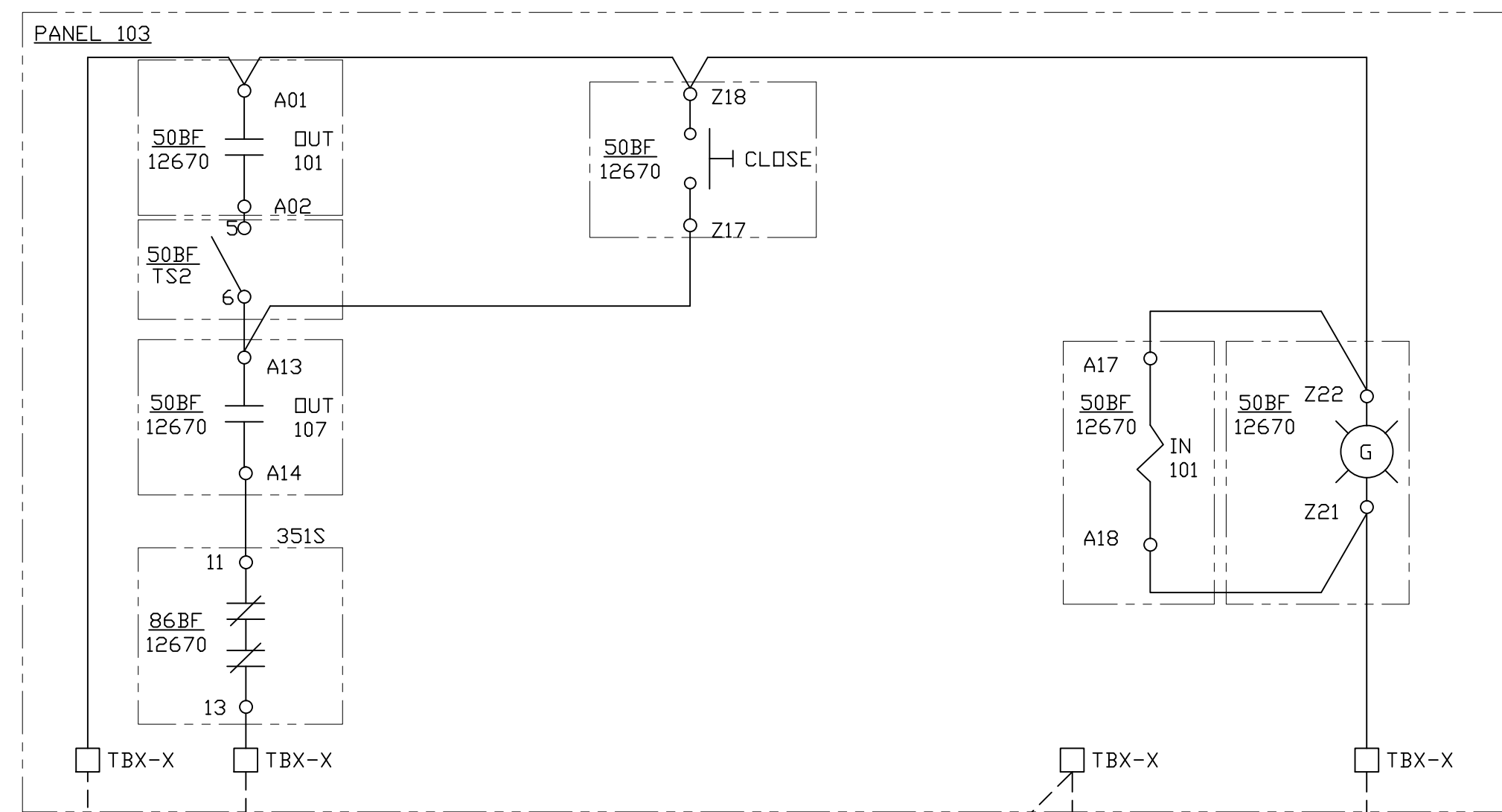
**BKR 200 FAILURE & CONTROL**

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REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

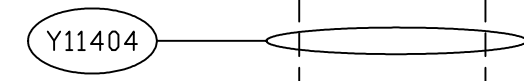
GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301



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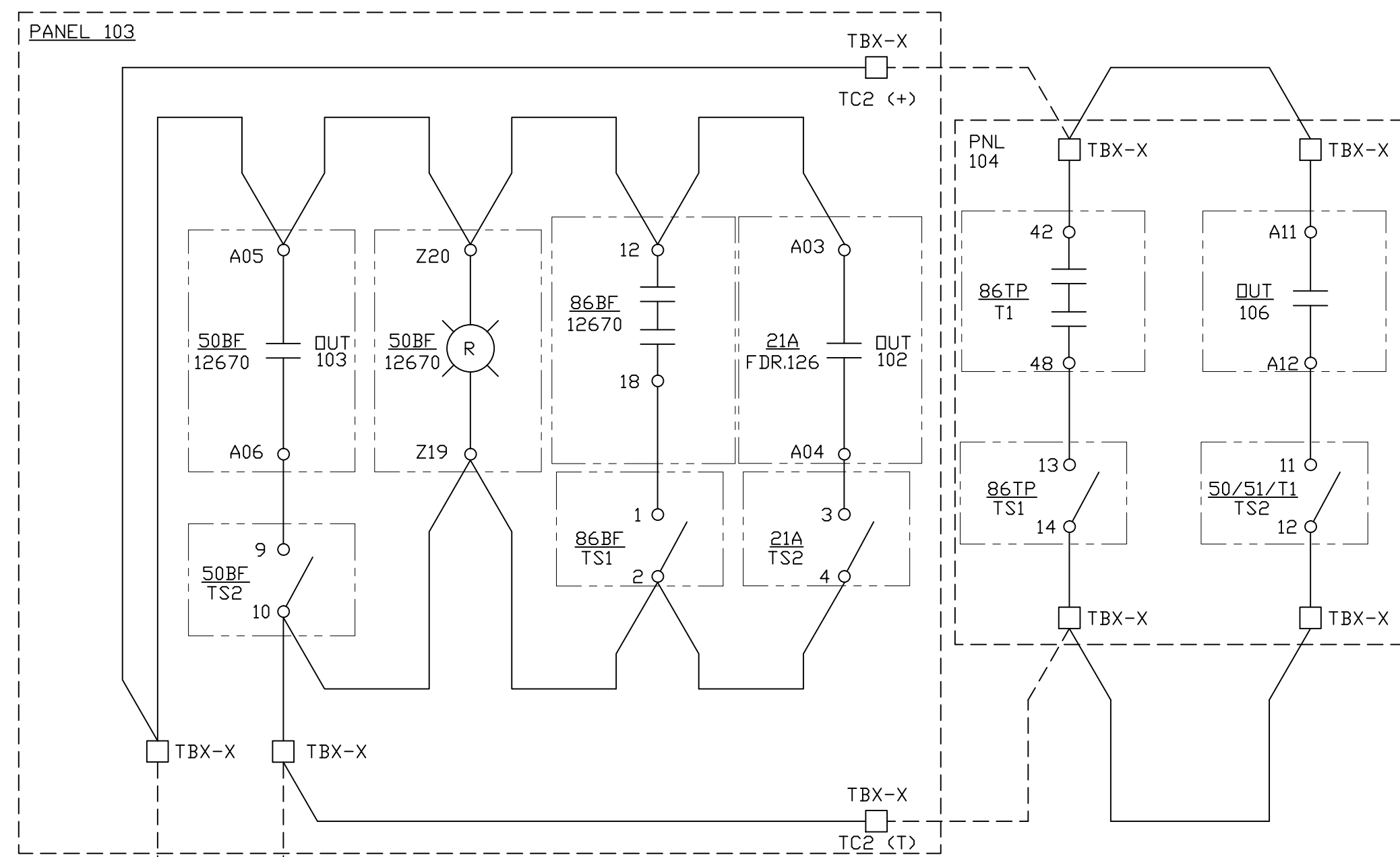
TO BREAKER 12670  
DWG. S294SB12670a



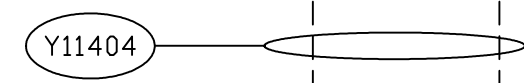
(THIS EQUIPMENT LOCATED IN RELAY PANEL)

(THIS EQUIPMENT LOCATED IN BREAKER)

**DC TRIP CIRCUIT 1**



TO BREAKER 12670  
DWG. S294SB12670a

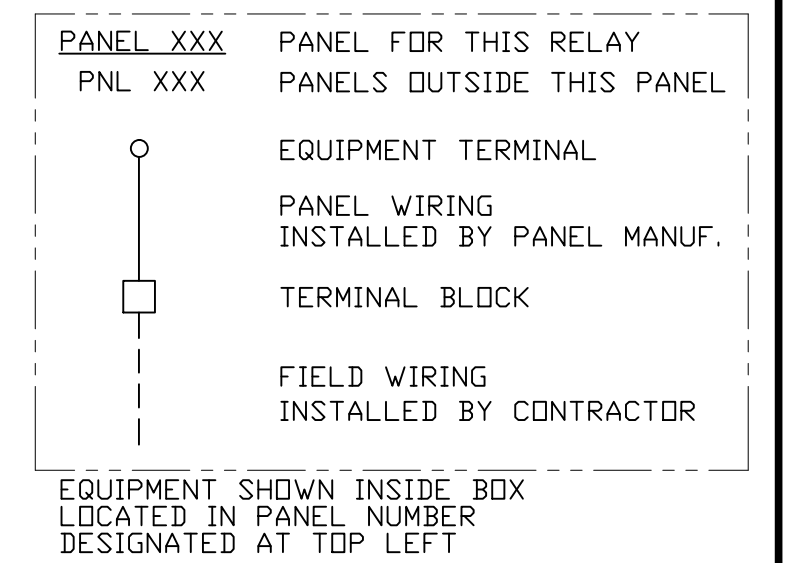


(THIS EQUIPMENT LOCATED IN RELAY PANEL)

(THIS EQUIPMENT LOCATED IN BREAKER)

**DC TRIP CIRCUIT 2**

NOTE: SEE DRAWING  
S294SB12670a FOR CIRCUIT  
BREAKER DC SCHEMATIC.



**REFERENCE DRAWINGS**

- S294SB12670a BKR 12670 AC/DC SCHEMATIC DIAGRAM
- S294PP101 FDR 22-161 kV MIAMI PANEL 101-BREAKER 100
- S294PP102 FDR 22-161 kV MIAMI & BKR 2270
- S294PP103 FDR 126-161 kV PENSACOLA
- S294PP104 TRANSFORMER NO 1 & BKR 300
- S294PP105 BKR 400 & 69kV BUS DIFF ZONE S1 & N1

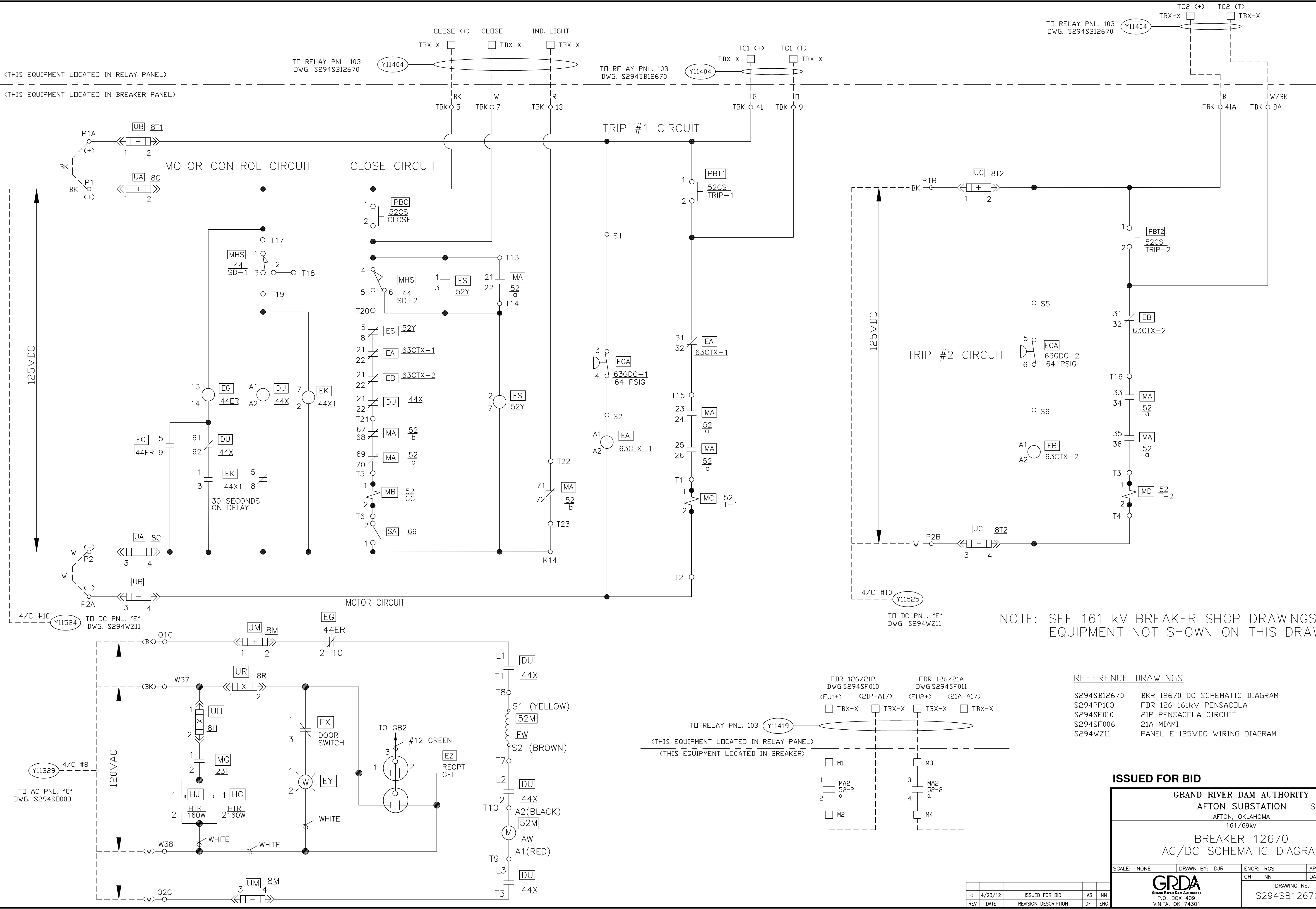
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
<b>BREAKER 12670</b> <b>DC SCHEMATIC DIAGRAM</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No. S294SB12670	REV. 0

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

REV	DATE	REVISION DESCRIPTION	DFT	ENG

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Last Plotted by: Shults, Aylene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/26/2012 7:57 AM Plotter Used: DWG To PDF.pc3



NOTE: SEE 161 kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

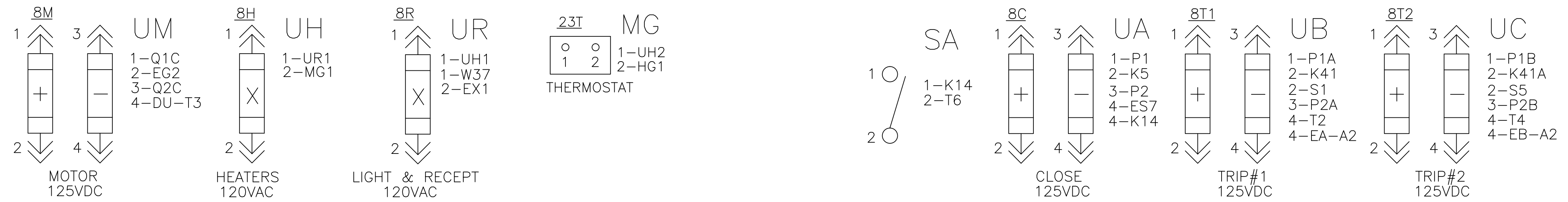
- REFERENCE DRAWINGS**
- S294SB12670 BKR 12670 DC SCHEMATIC DIAGRAM
  - S294PP103 FDR 126-161kV PENSACOLA
  - S294SF010 21P PENSACOLA CIRCUIT
  - S294SF006 21A MIAMI
  - S294WZ11 PANEL E 125VDC WIRING DIAGRAM

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
BREAKER 12670 AC/DC SCHEMATIC DIAGRAM			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No.	REV.
0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG
		S294SB12670a	0

GRDA  
Grand River Dam Authority  
P.O. BOX 409  
VINITA, OK 74301

0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG



NOTE: SEE 161kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

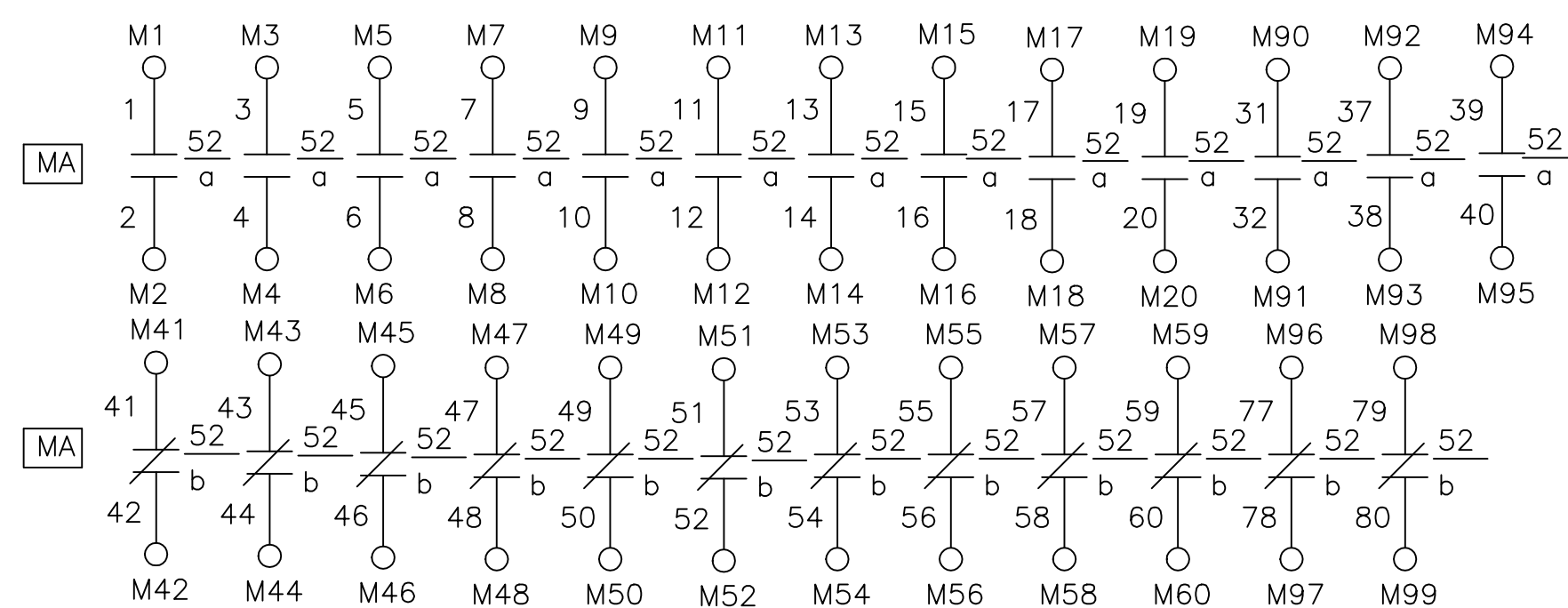
REFERENCE DRAWINGS

- S294SB12670 BKR 12670 DC SCHEMATIC DIAGRAM
- S294SB12670a BKR 12670 AC/DC SCHEMATIC DIAGRAM

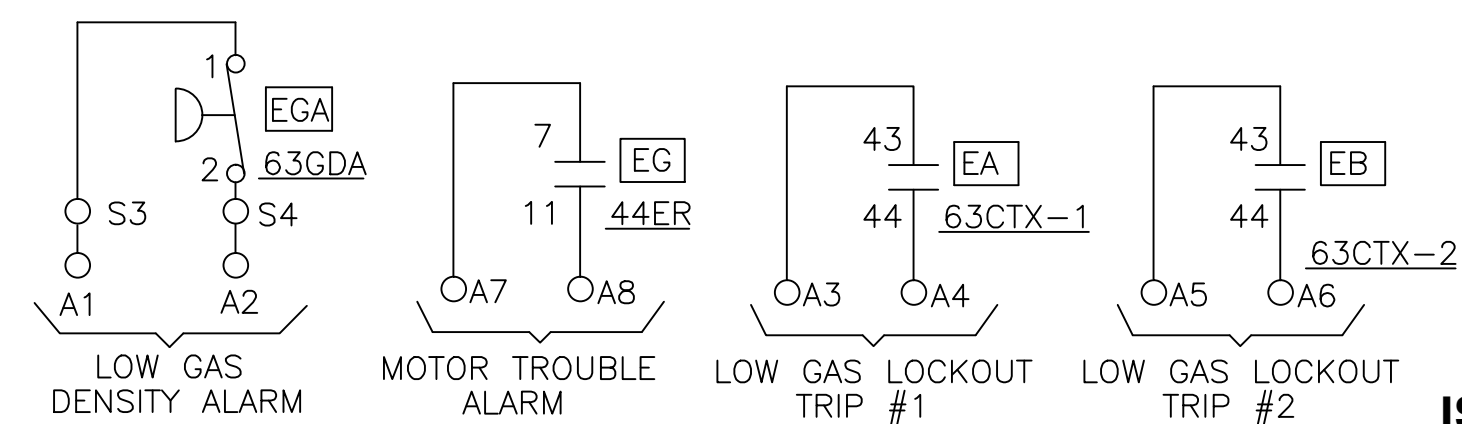
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



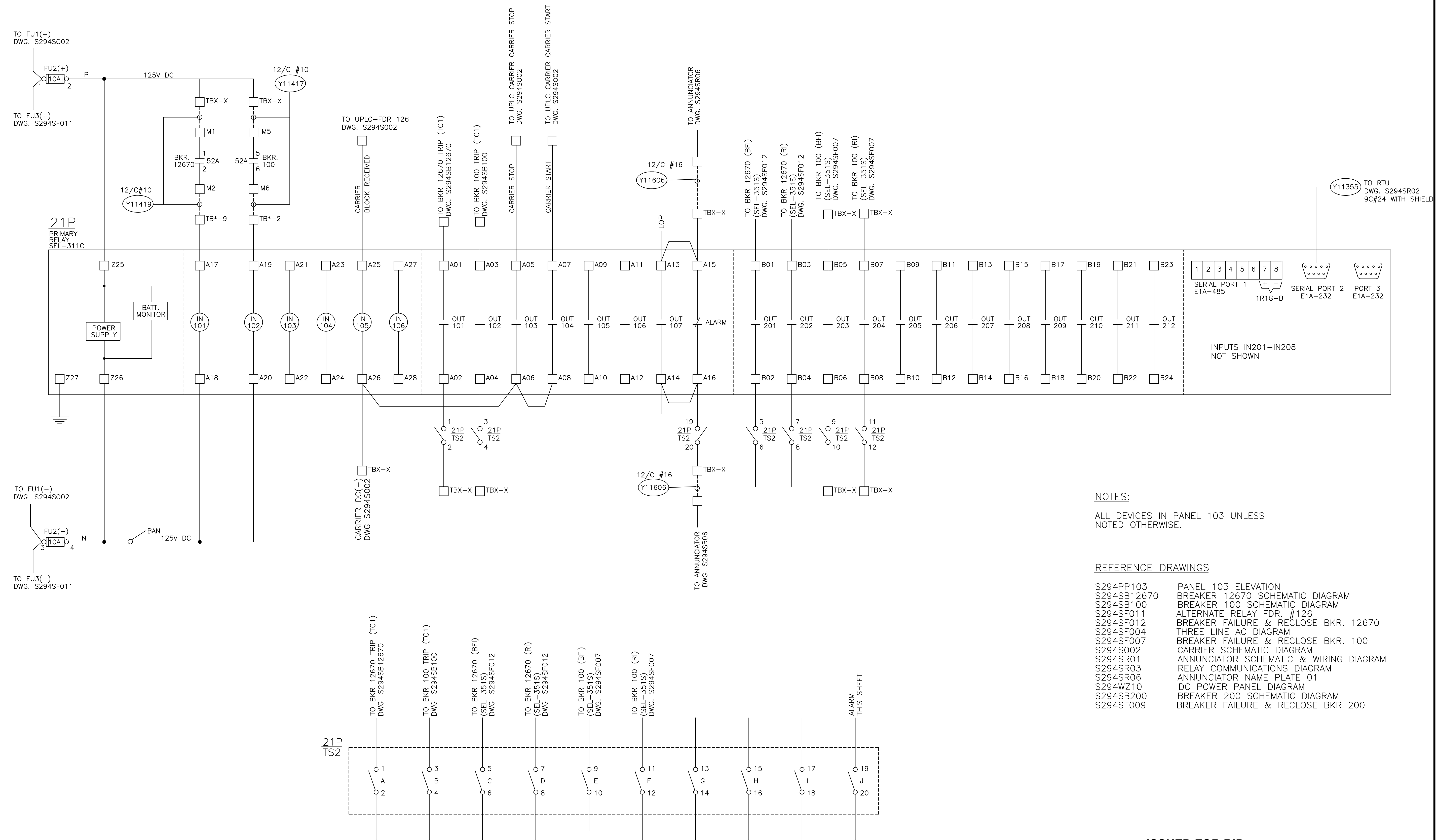
CUSTOMER ALARMS



ISSUED FOR BID

<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			
<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 161/69KV <b>BREAKER 12670</b> <b>BREAKER AUXILIARIES</b>		DATE: 3/7/2011 REV. 0	
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DRAWING No. S294SB12670b		REV. 0

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**NOTES:**

ALL DEVICES IN PANEL 103 UNLESS NOTED OTHERWISE.

**REFERENCE DRAWINGS**

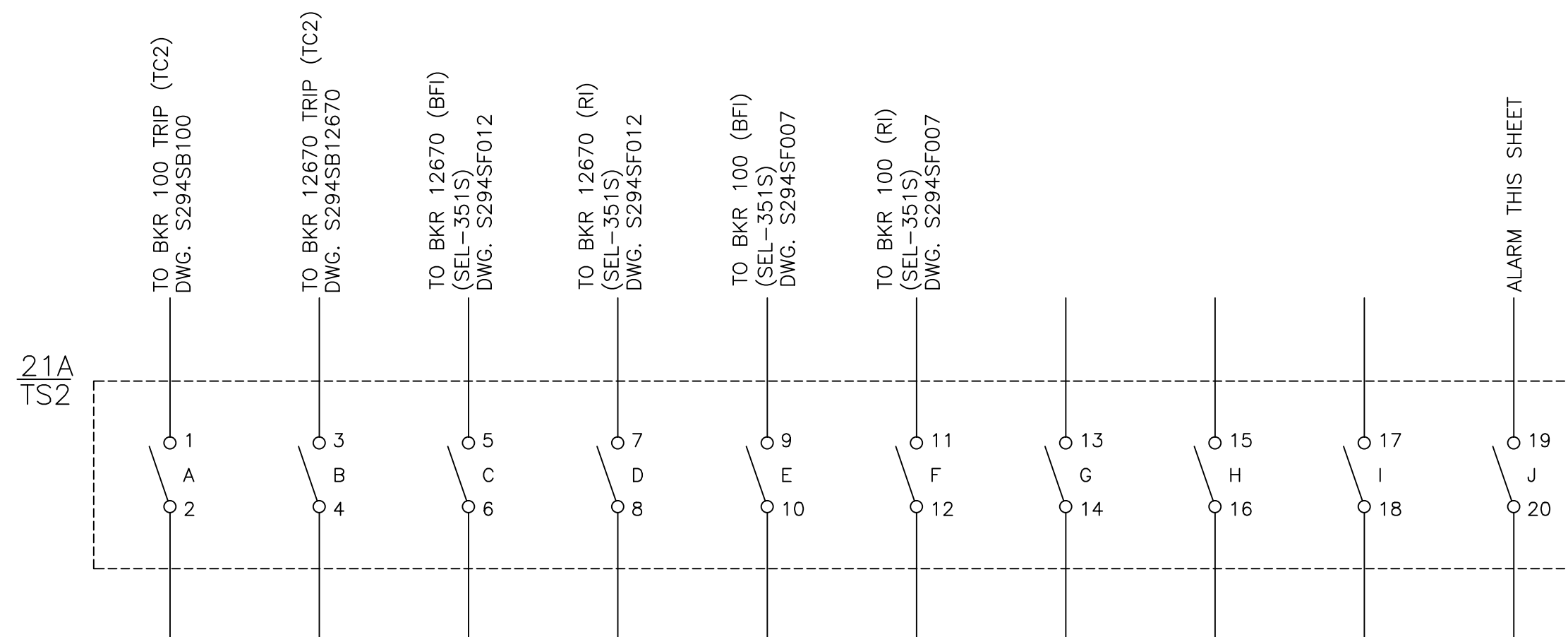
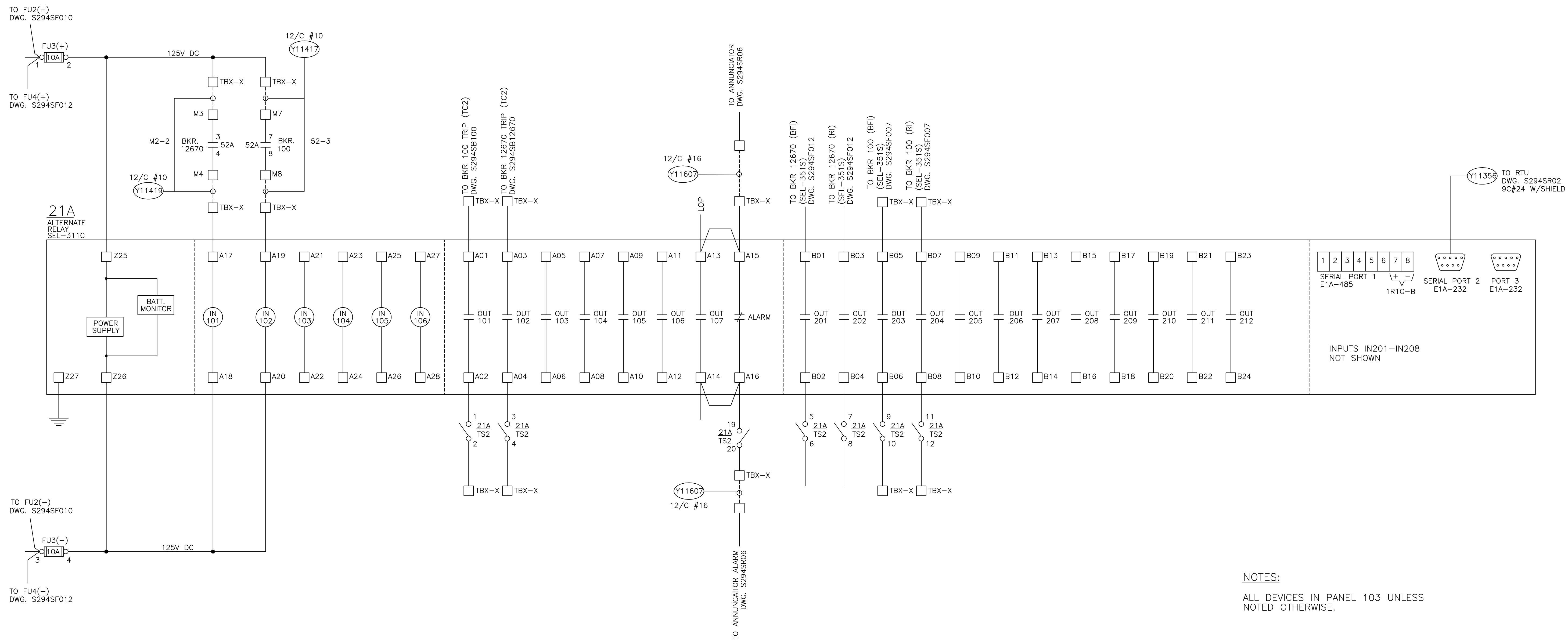
- |             |  |
|-------------|--|
| S294PP103   | PANEL 103 ELEVATION                    |
| S294SB12670 | BREAKER 12670 SCHEMATIC DIAGRAM        |
| S294SB100   | BREAKER 100 SCHEMATIC DIAGRAM          |
| S294SF011   | ALTERNATE RELAY FDR. #126              |
| S294SF012   | BREAKER FAILURE & RECLOSE BKR. 12670   |
| S294SF004   | THREE LINE AC DIAGRAM                  |
| S294SF007   | BREAKER FAILURE & RECLOSE BKR. 100     |
| S294S002    | CARRIER SCHEMATIC DIAGRAM              |
| S294SR01    | ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM |
| S294SR03    | RELAY COMMUNICATIONS DIAGRAM           |
| S294SR06    | ANNUNCIATOR NAME PLATE 01              |
| S294WZ10    | DC POWER PANEL DIAGRAM                 |
| S294SB200   | BREAKER 200 SCHEMATIC DIAGRAM          |
| S294SF009   | BREAKER FAILURE & RECLOSE BKR 200      |

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 161/69KV 21P 161 KV FDR 126-PENSACOLA CIRCUIT			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN		DATE: 3/7/2011	
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294SF010</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

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**NOTES:**

ALL DEVICES IN PANEL 103 UNLESS NOTED OTHERWISE.

**REFERENCE DRAWINGS**

- S294PP103 PANEL 103 ELEVATION
- S294SB12670 BREAKER 12670 SCHEMATIC DIAGRAM
- S294SB100 BREAKER 100 SCHEMATIC DIAGRAM
- S294SF003 THREE LINE DIAGRAM BKR. 12670 & FDR. 45
- S294SF009 BREAKER FAILURE AND RECLOSURE BKR 200
- S294SF010 PRIMARY RELAY FDR. 126
- S294SF012 BREAKER FAILURE & RECLOSE BKR. 12670
- S294SF007 BREAKER FAILURE & RECLOSE BKR. 100
- S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM

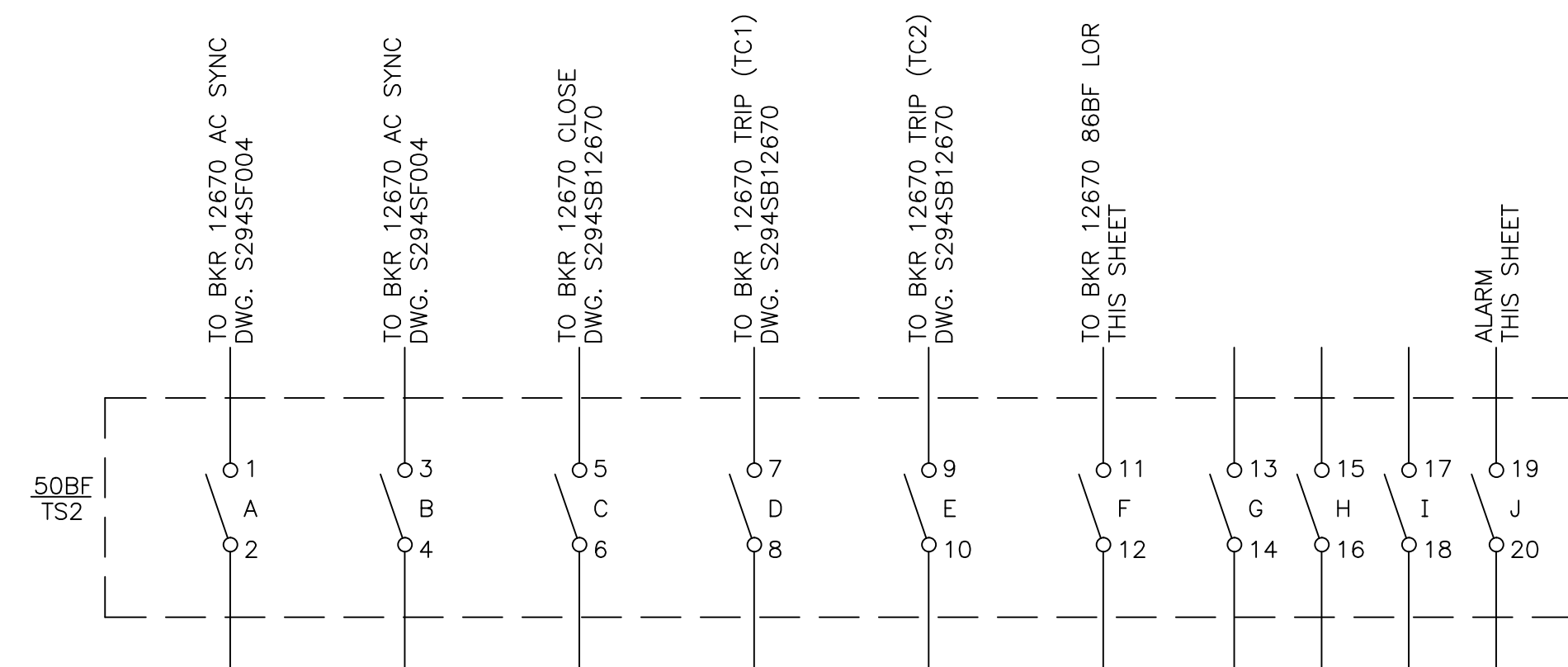
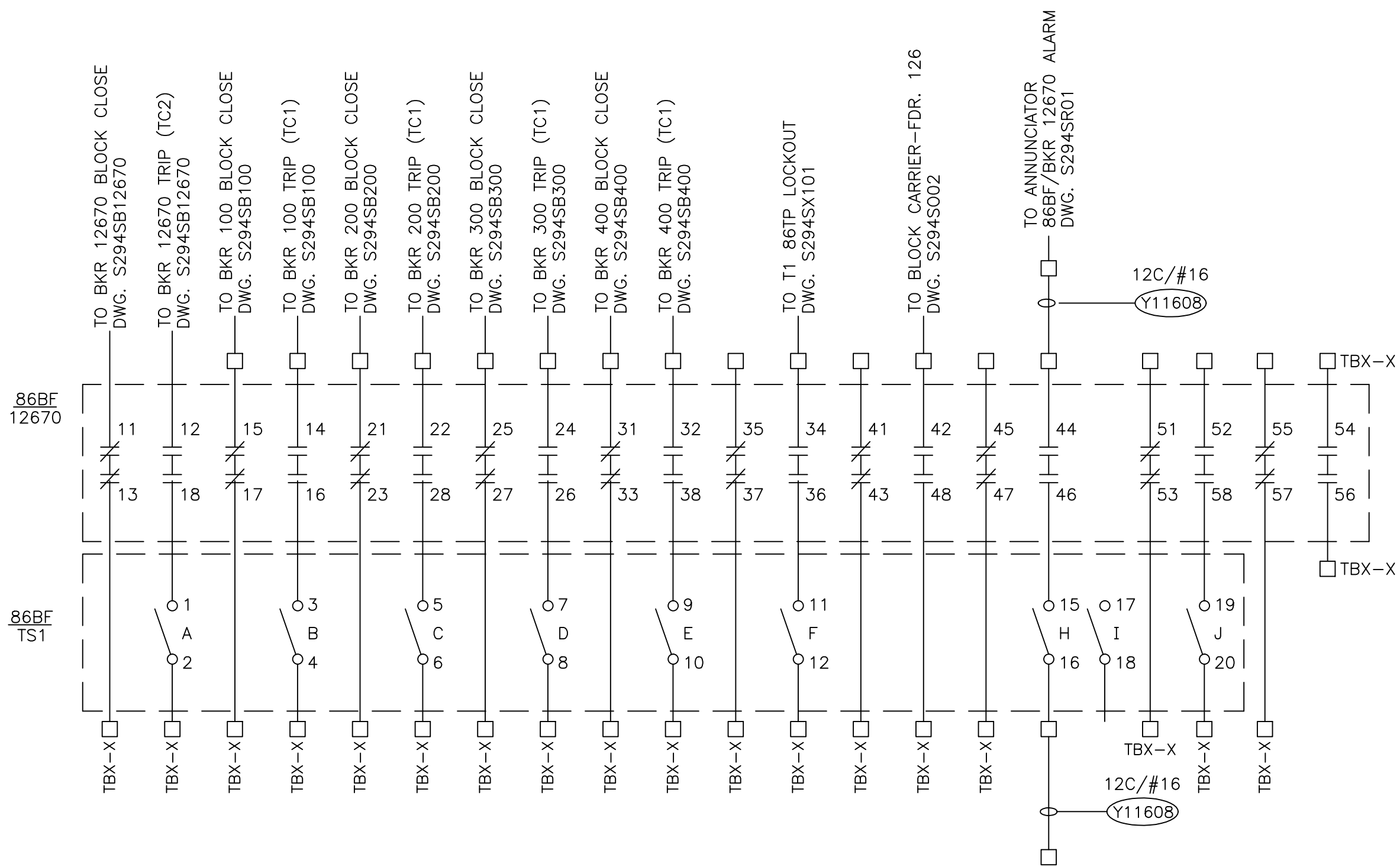
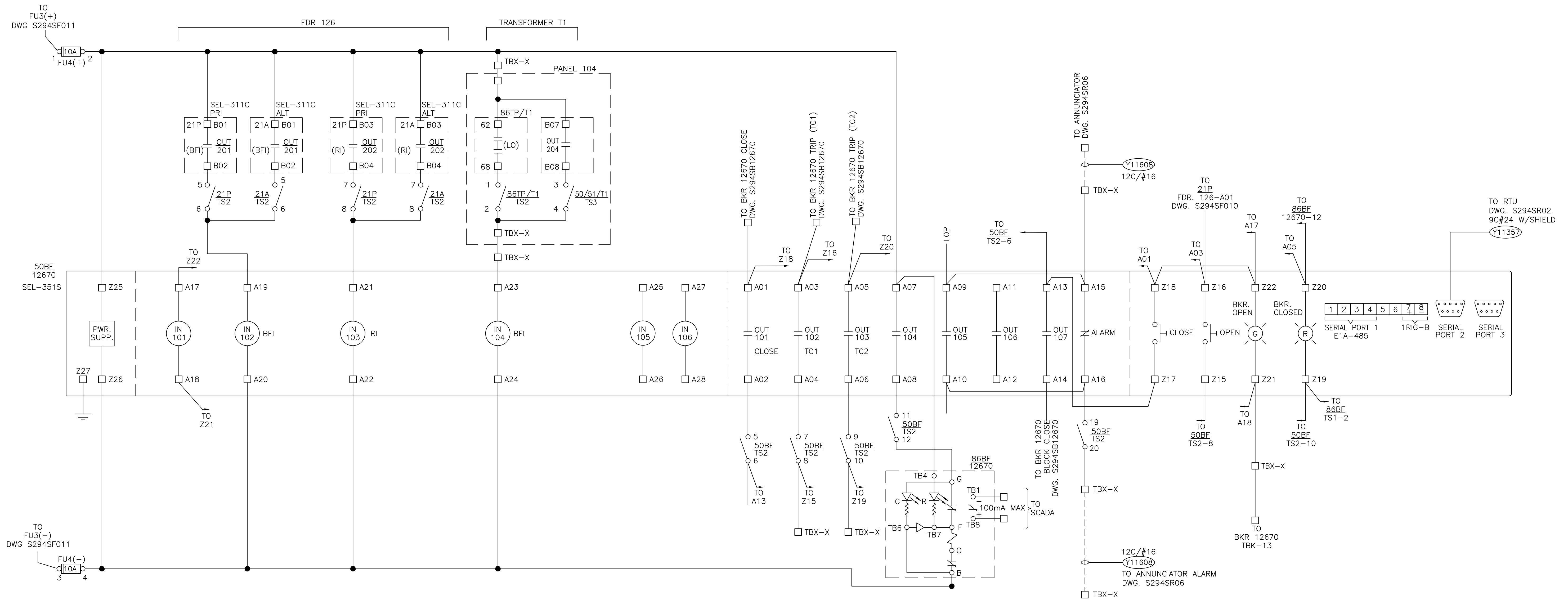
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REV	DATE	REVISION DESCRIPTION	DFT	ENG

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
**21A**  
 161 KV FDR 126-PENSACOLA CIRCUIT

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN		DATE: 3/7/2011	
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294SF011	REV. 0

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86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION	
		TRIP	RESET
1	11 OH-IHO 13		X
	12 OH-IHO 18	X	
	15 OH-IHO 17	X	
2	14 OH-IHO 16	X	
	21 OH-IHO 23	X	
	22 OH-IHO 28	X	
3	25 OH-IHO 27	X	
	24 OH-IHO 26	X	
	31 OH-IHO 33	X	
4	32 OH-IHO 38	X	
	35 OH-IHO 37	X	
	34 OH-IHO 36	X	
5	41 OH-IHO 43	X	
	42 OH-IHO 48	X	
	45 OH-IHO 47	X	
6	44 OH-IHO 46	X	
	51 OH-IHO 53	X	
	52 OH-IHO 58	X	
7	55 OH-IHO 57	X	
	54 OH-IHO 56	X	
	61 OH-IHO 63	X	
8	62 OH-IHO 68	X	
	65 OH-IHO 67	X	
	64 OH-IHO 66	X	
9	71 OH-IHO 73	X	
	72 OH-IHO 78	X	
	75 OH-IHO 77	X	
10	74 OH-IHO 76	X	
	81 OH-IHO 83	X	
	82 OH-IHO 88	X	
11	85 OH-IHO 87	X	
	84 OH-IHO 86	X	

NOTES:  
 1. ALL EQUIPMENT IS ON PANEL 103 UNLESS OTHERWISE NOTED

REFERENCE DRAWINGS  
 S294SB12670 BREAKER 12670 SCHEMATIC DIAGRAM  
 S294SF010 PRIMARY RELAY FEEDER #126  
 S294SF011 ALTERNATE RELAY FEEDER #126  
 S294SF004 THREE LINE AC DIAGRAM BREAKER 12670 & FDR. 126  
 S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM  
 S294SR03 RELAY COMMUNICATIONS DIAGRAM

**ISSUED FOR BID**

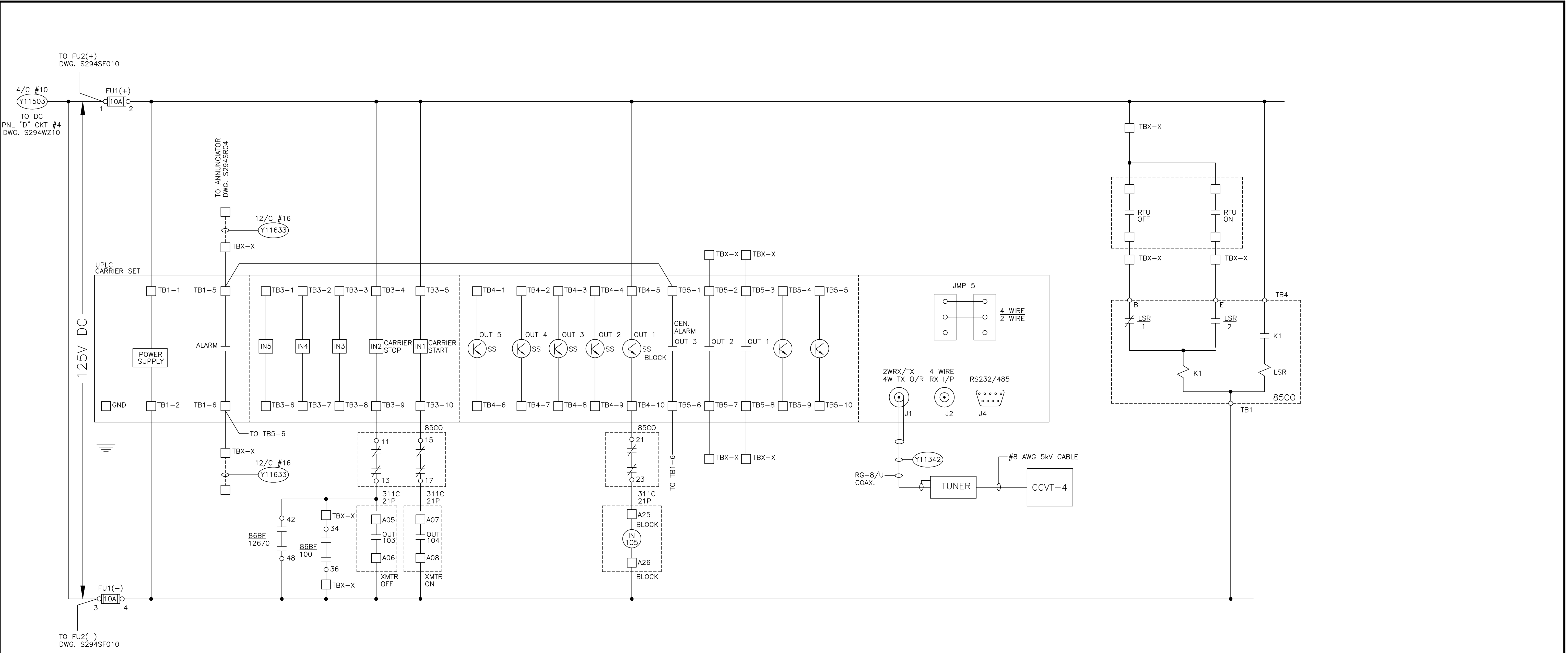
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

BREAKER 12670 FAILURE & CONTROL  
 161 KV FDR 126-PENSACOLA CIRCUIT

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SF012	
REV 0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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**NOTES:**  
 1. ALL EQUIPMENT IS ON PANEL 103 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**  
 S294SF010 PRIMARY RELAYING FDR. 126  
 S294PP103 FDR. 126-161KV PENSACOLA PANEL 103-BKR. 12670  
 S294WZ10 CONTROL HOUSE PANEL "D" 125VDC WIRING DIAGRAM

ELECTROSWITCH  
 85CO SERIES 31LSR  
 CONTACT DIAGRAM

DECK	CONTACTS	POSITION	
		ON 1	OFF 2
1	11 ON-13	X	
	12 ON-14		X
	15 ON-17	X	
	16 ON-18		X
2	21 ON-23	X	
	22 ON-24		X
	25 ON-27	X	
	26 ON-28		X
3	31 ON-33	X	
	32 ON-34		X
	35 ON-37	X	
	36 ON-38		X

SHOWN IN CARRIER ON POSITION

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

CARRIER SCHEMATIC  
 161KV FDR 126-PENSACOLA CIRCUIT

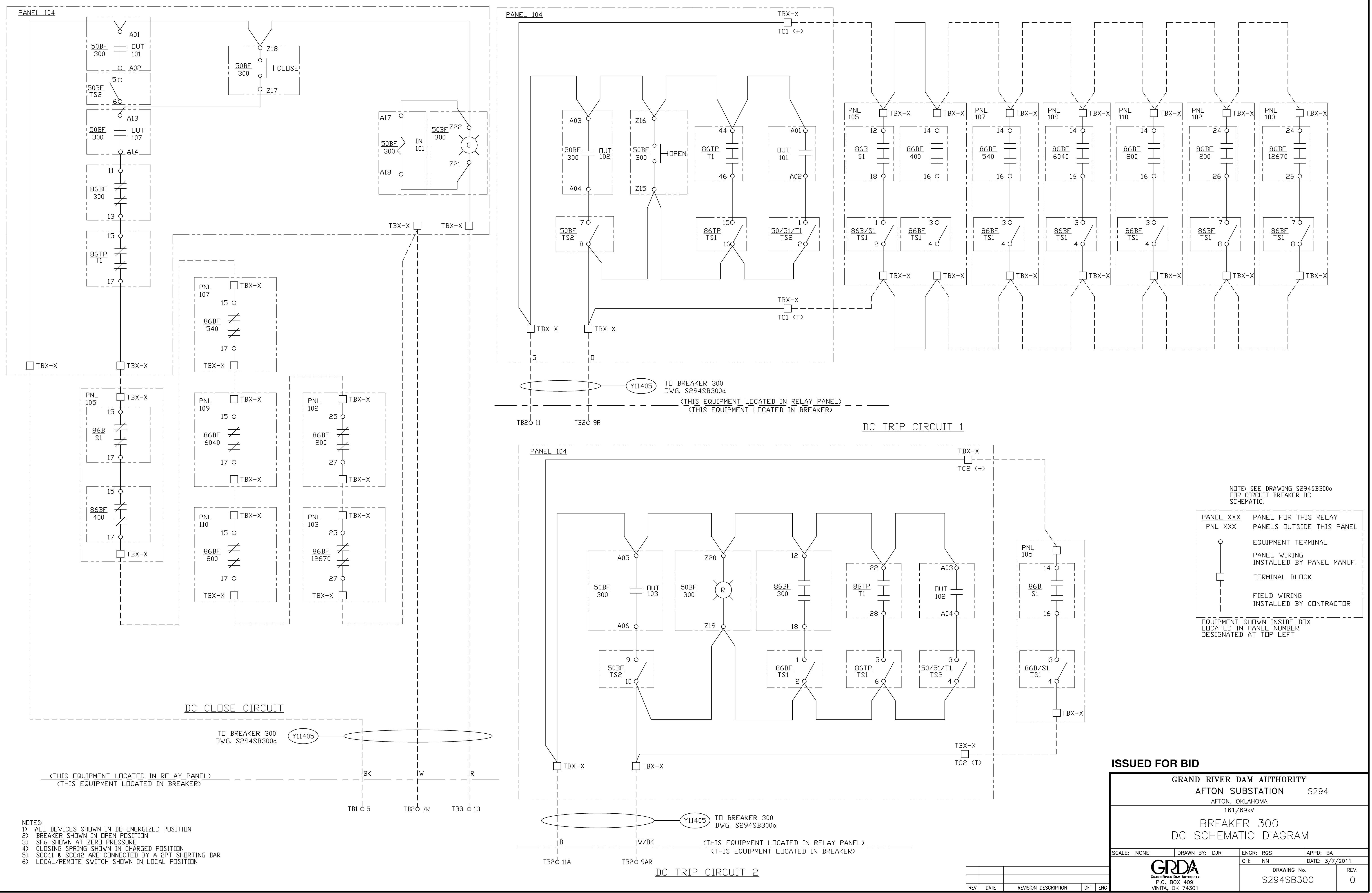
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 CH: NN DATE: 3/7/2011

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

DRAWING No.  
 S294S002

REV.  
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**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

**BREAKER 300  
DC SCHEMATIC DIAGRAM**

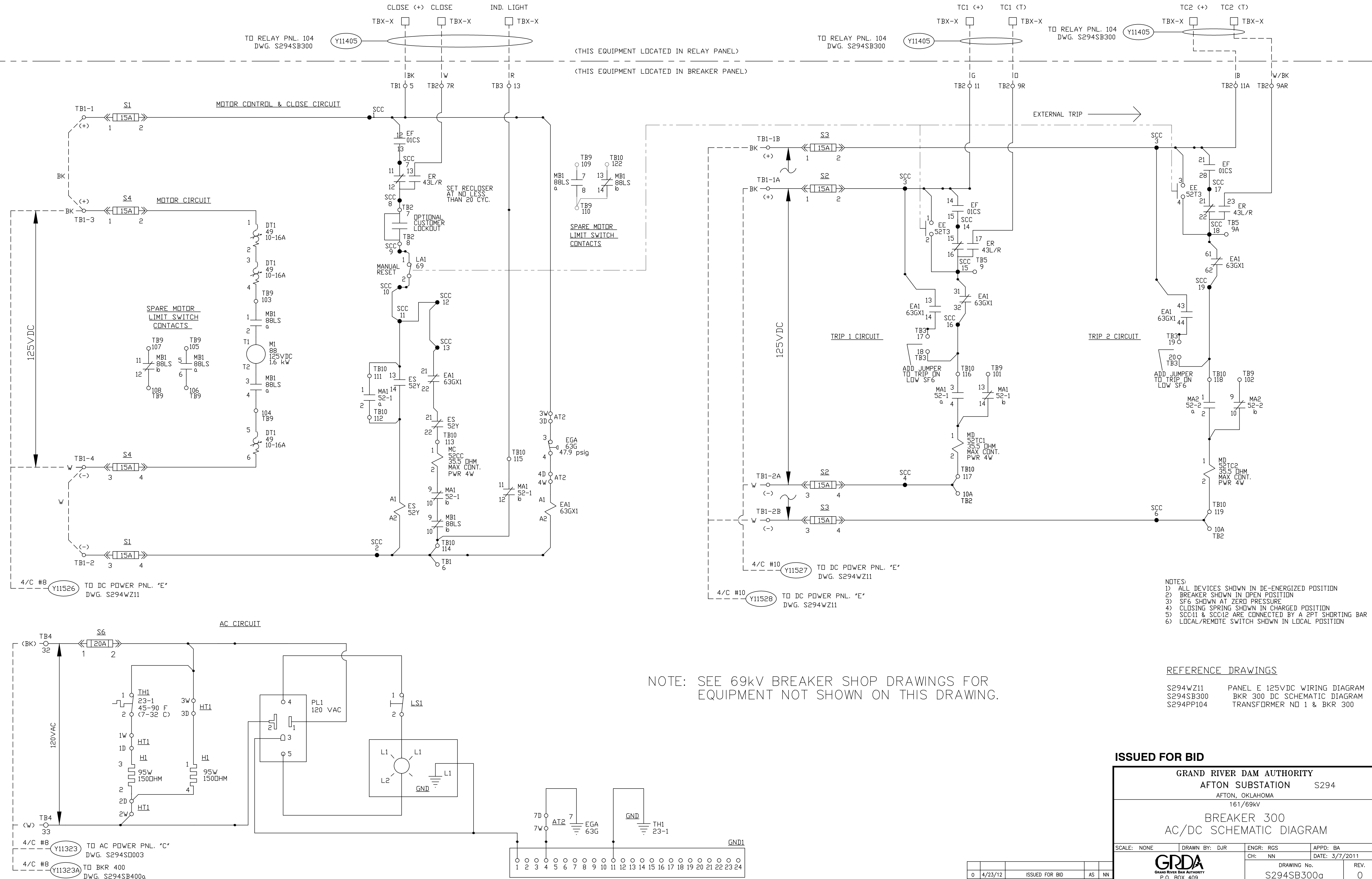
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CH: NN	DATE: 3/7/2011	DRAWING No. S294SB300	
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

REV. 0



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 Last Plotted by: Shultz, Aylene  
 Plot Style: Monochrome.ctb  
 Plot Scale: 1:1  
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(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
 (THIS EQUIPMENT LOCATED IN BREAKER PANEL)

NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC-11 & SCC-12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

REFERENCE DRAWINGS

S294WZ11	PANEL E 125VDC WIRING DIAGRAM
S294SB300	BKR 300 DC SCHEMATIC DIAGRAM
S294PP104	TRANSFORMER NO 1 & BKR 300

**ISSUED FOR BID**

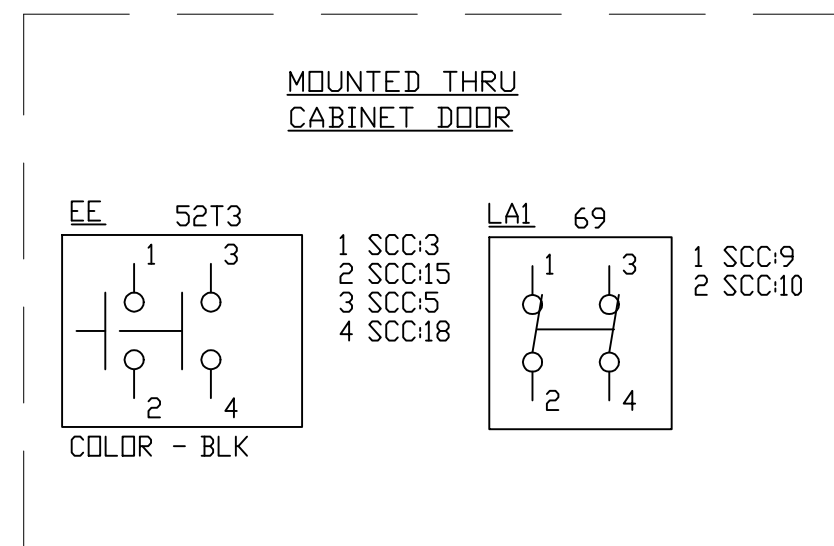
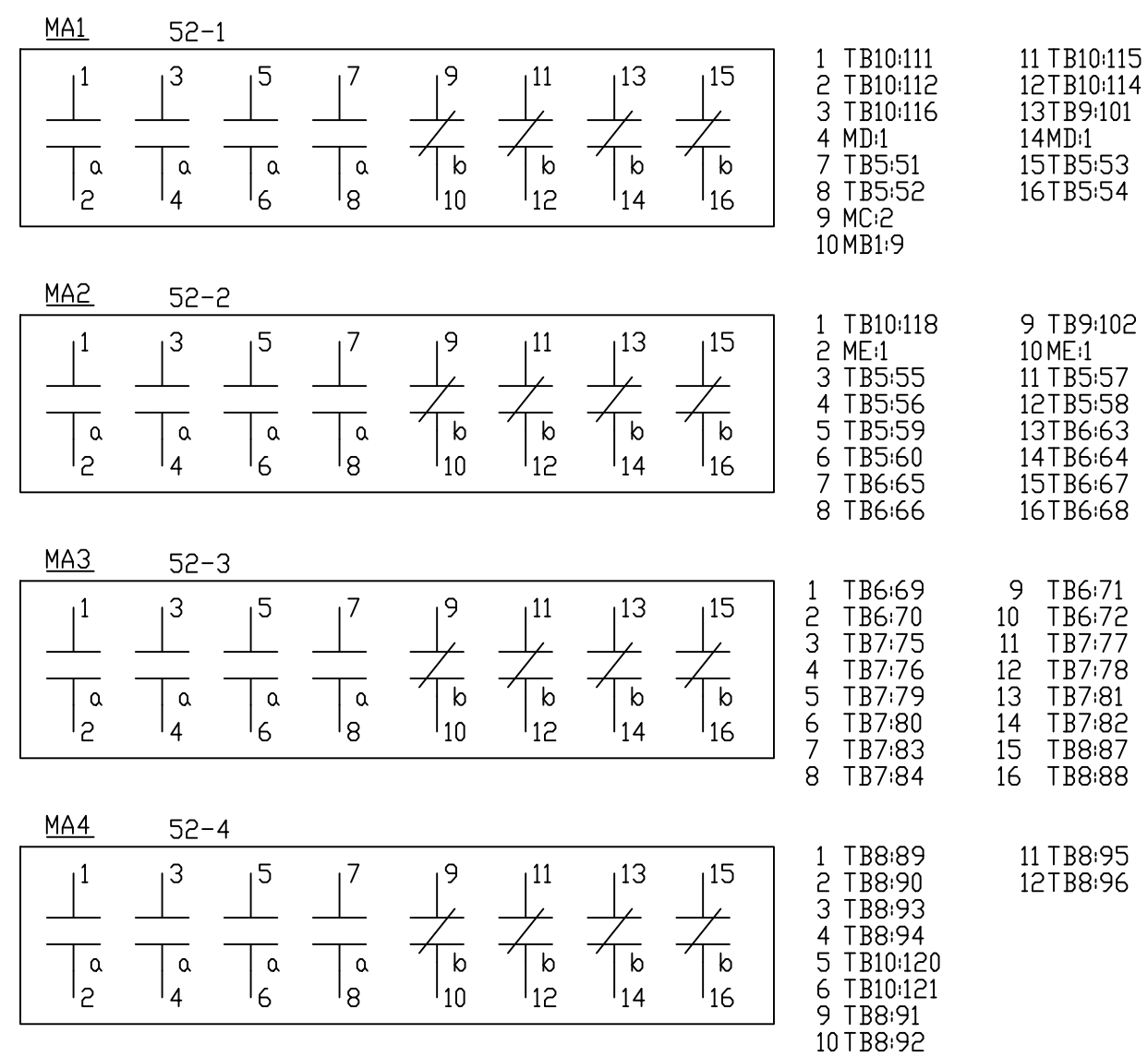
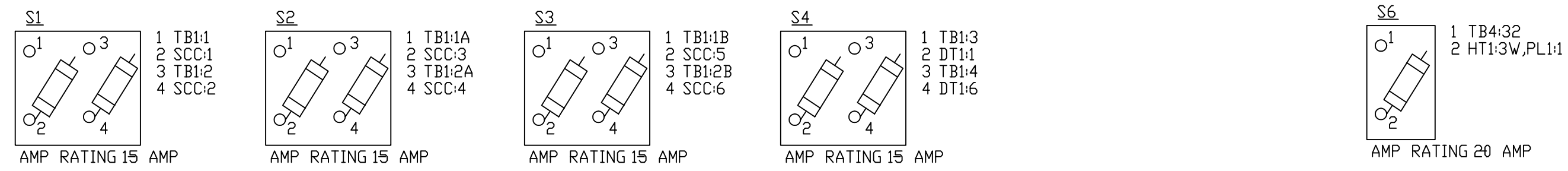
**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 300**  
**AC/DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. REV.	
S294SB300a		0	

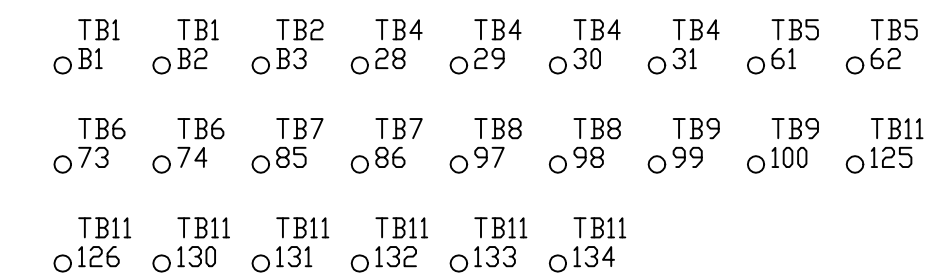
**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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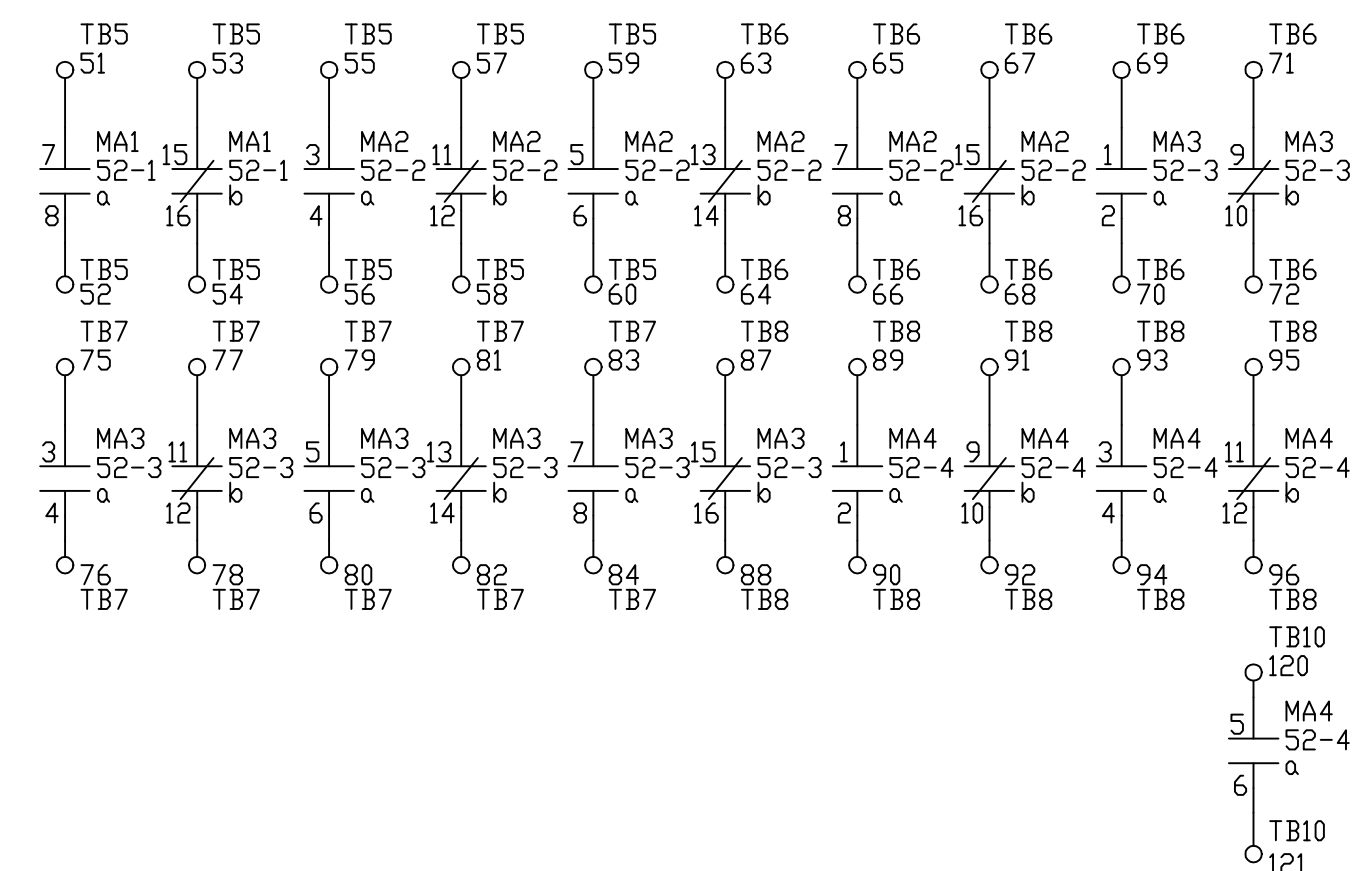
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



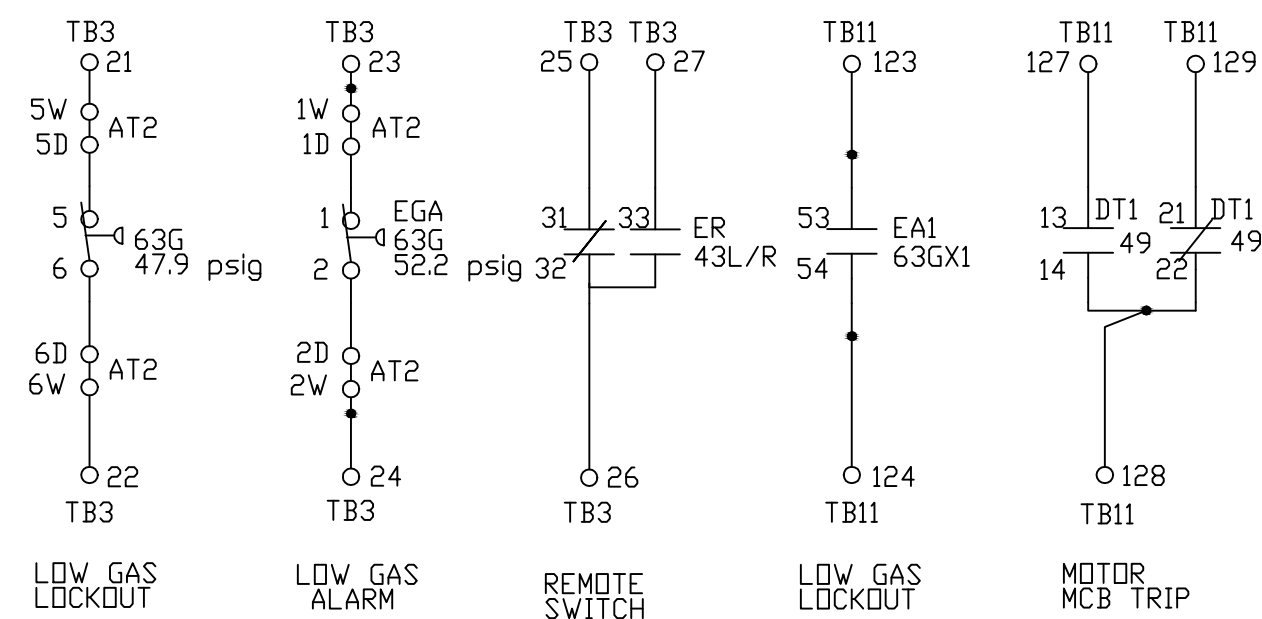
- NOTES:**
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



REFERENCE DRAWINGS

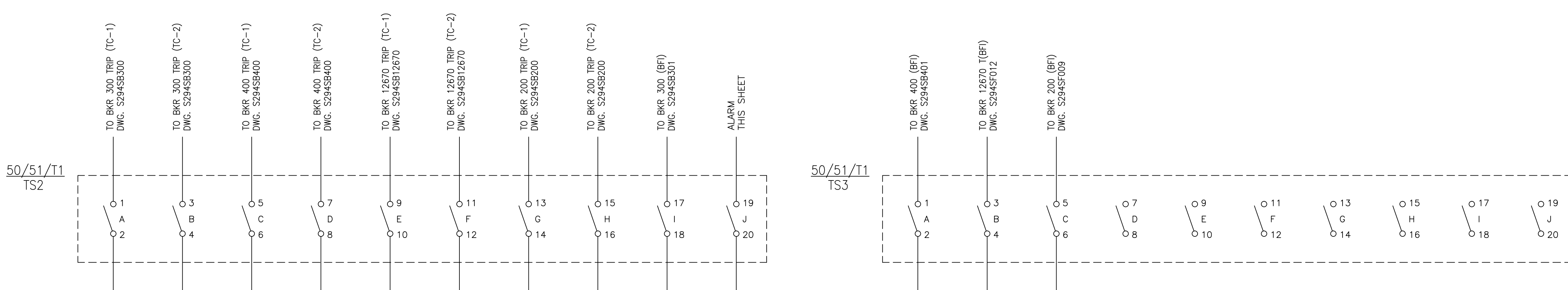
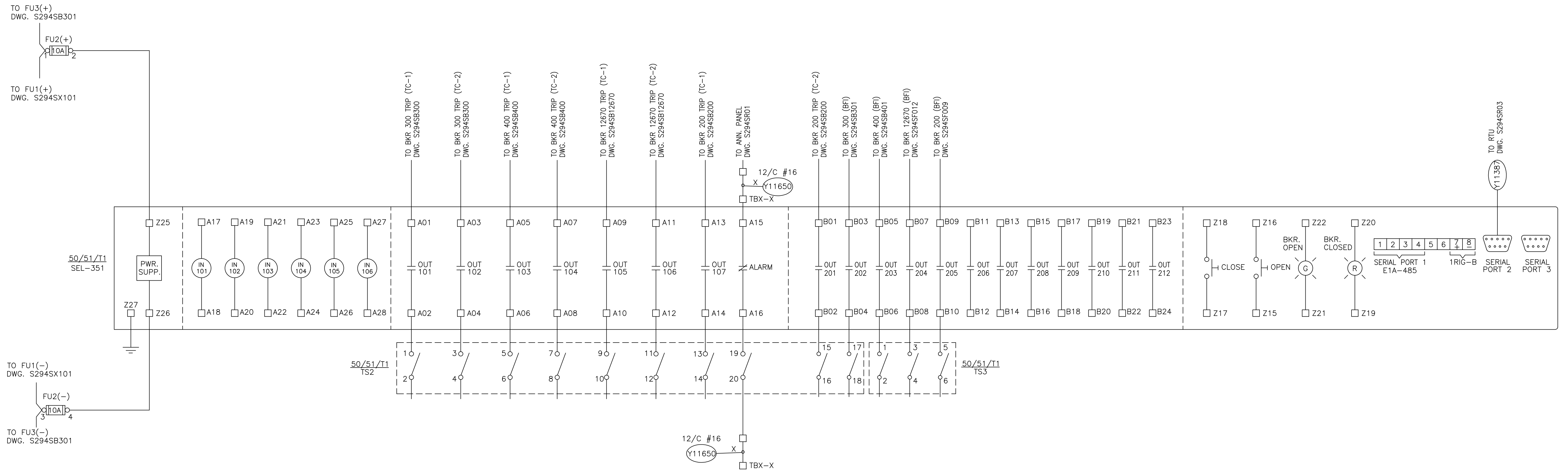
- S294SB300 BKR 12670 ACDC SCHEMATIC DIAGRAM
- S294SB300a BKR 12670 DC SCHEMATIC DIAGRAM

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69 kV			
<b>BREAKER 300</b> <b>BREAKER AUXILIARIES</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. <b>S294SB300b</b>	
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0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

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 Plotter Used: DWG To PDF.pc3



**NOTES**  
 ALL EQUIPMENT ON PANEL 104  
 UNLESS OTHERWISE NOTED

- REFERENCE DRAWINGS**
- S294PP104 PANEL 104 ELEVATION
  - S294SB12670 BKR. #12670 SCHEMATIC DIAGRAM
  - S294SF012 BKR. #12670 FAILURE & CONTROL
  - S294SB200 BKR. #200 SCHEMATIC DIAGRAM
  - S294SF009 BKR. #200 FAILURE & CONTROL
  - S294SB300 BKR. #300 SCHEMATIC DIAGRAM
  - S294SB301 BKR. #300 FAILURE & CONTROL
  - S294SB400 BKR. #400 SCHEMATIC DIAGRAM
  - S294SB401 BKR. #400 FAILURE & CONTROL
  - S294SX001 THREE LINE AC DIAGRAM TRANS. #1
  - S294SR03 RELAY COMMUNICATION DIAGRAM
  - S294WZ10 DC POWER PANEL

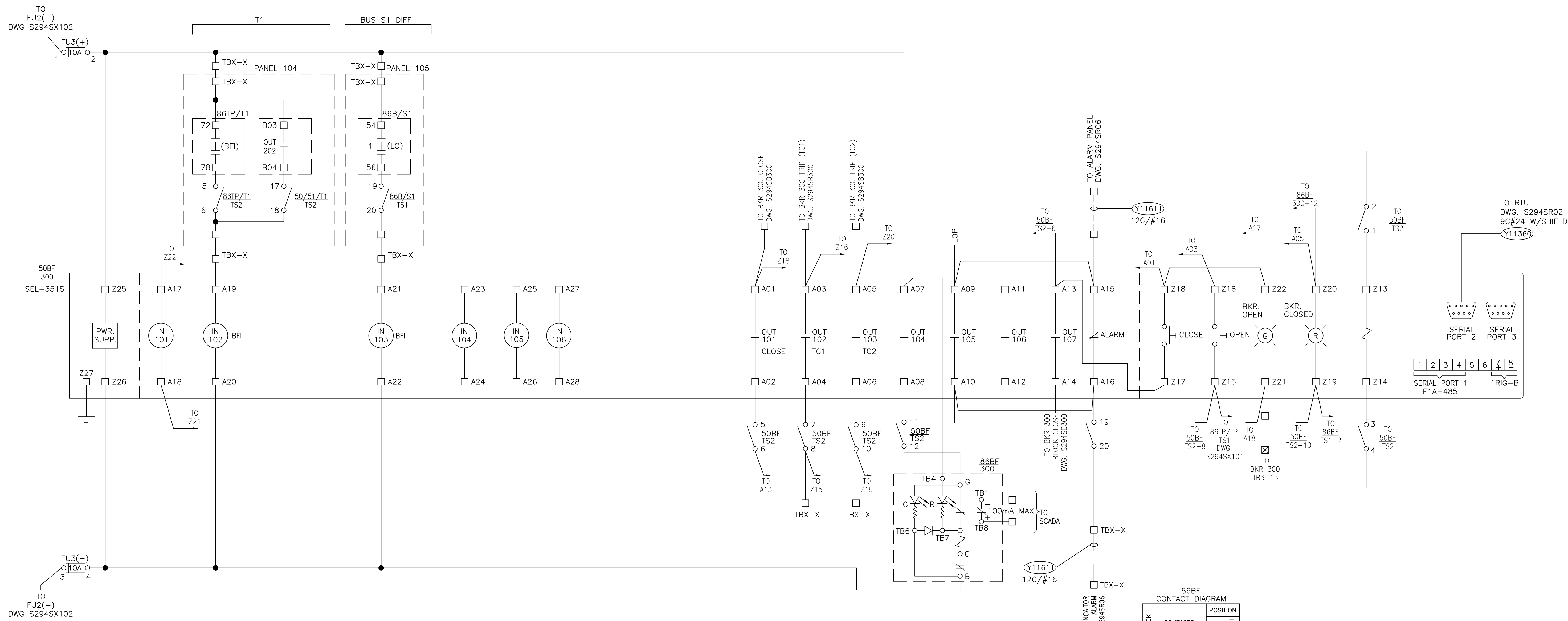
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 TRANSFORMER NO.1 DC SCHEMATIC-ALT.  
 50/51/T1

SCALE: NONE	DRAWN BY: DJR	ENGR: BDM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SX102	
REV	DATE	REVISION DESCRIPTION	DFT ENG
0	4/23/12	ISSUED FOR BID	
			REV. 0

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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 Plotter Used: DWG To PDF.pc3  
 Last Saved By: Ashulis



**NOTES:**

- ALL EQUIPMENT IS ON PANEL 104 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**

- S294PP104 PANEL 104 ELEVATION
- S294SB300 BREAKER 300 SCHEMATIC DIAGRAM
- S294SX101 TRANSFORMER #1 PRIMARY DIFF RELAY
- S294SX102 TRANSF. #1 ALTERNATE OVERCURRENT RELAY
- S294SR02 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM

☒ TERMINAL BLOCK LOCATED IN THIS PANEL

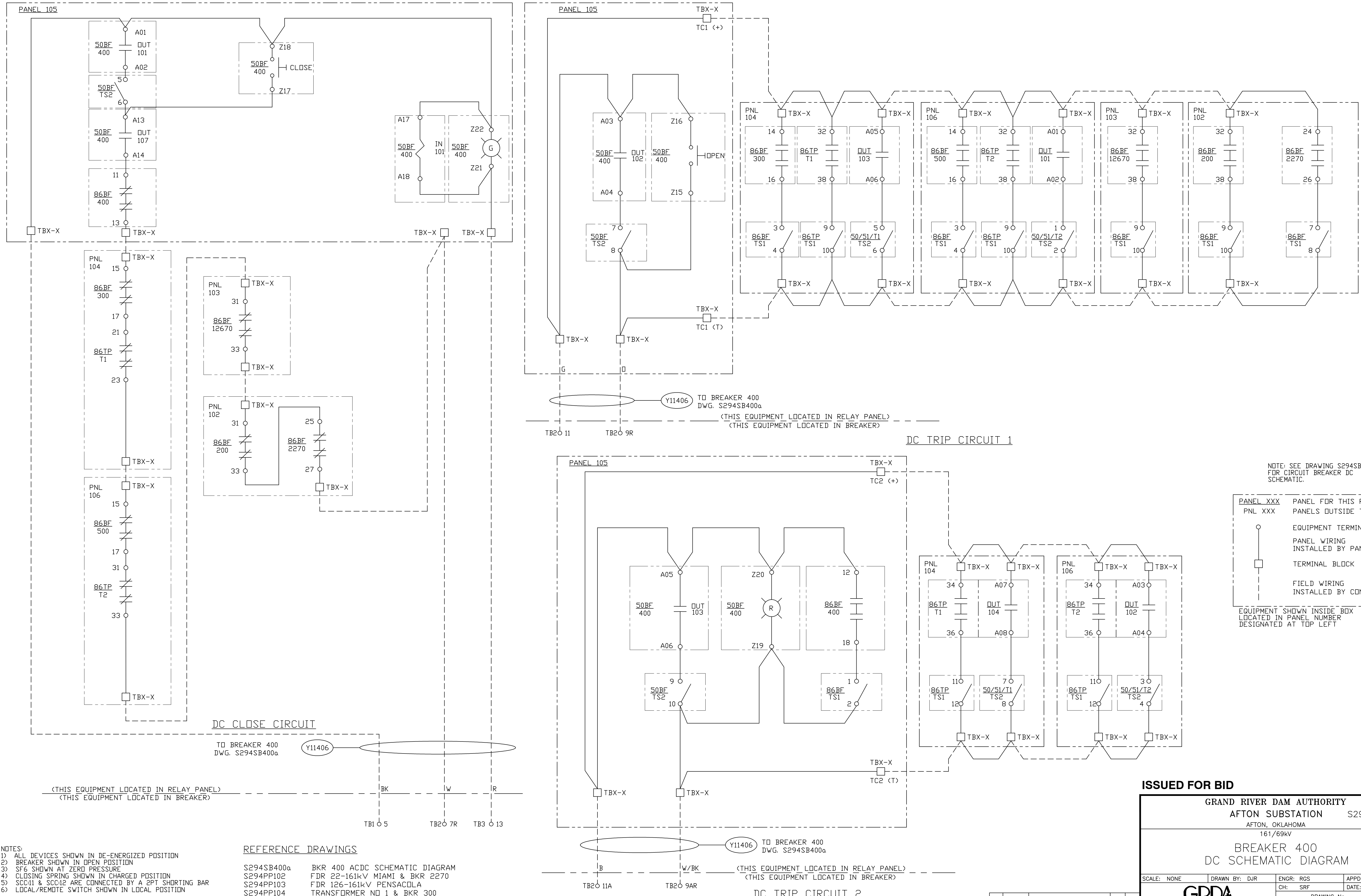
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 300 FAILURE AND CONTROL**  
**69KV BUS SOUTH S**

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB301	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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- NOTES:**
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

**REFERENCE DRAWINGS**

S294SB400a	BKR 400 ACDC SCHEMATIC DIAGRAM
S294PP102	FDR 22-161kV MIAMI & BKR 2270
S294PP103	FDR 126-161kV PENSACOLA
S294PP104	TRANSFORMER NO 1 & BKR 300
S294PP105	BKR 400 & 69kV BUS DIFF ZONE SOUTH S1 & NORTH N1
S294PP106	TRANSFORMER NO 2 & BKR 500

**ISSUED FOR BID**

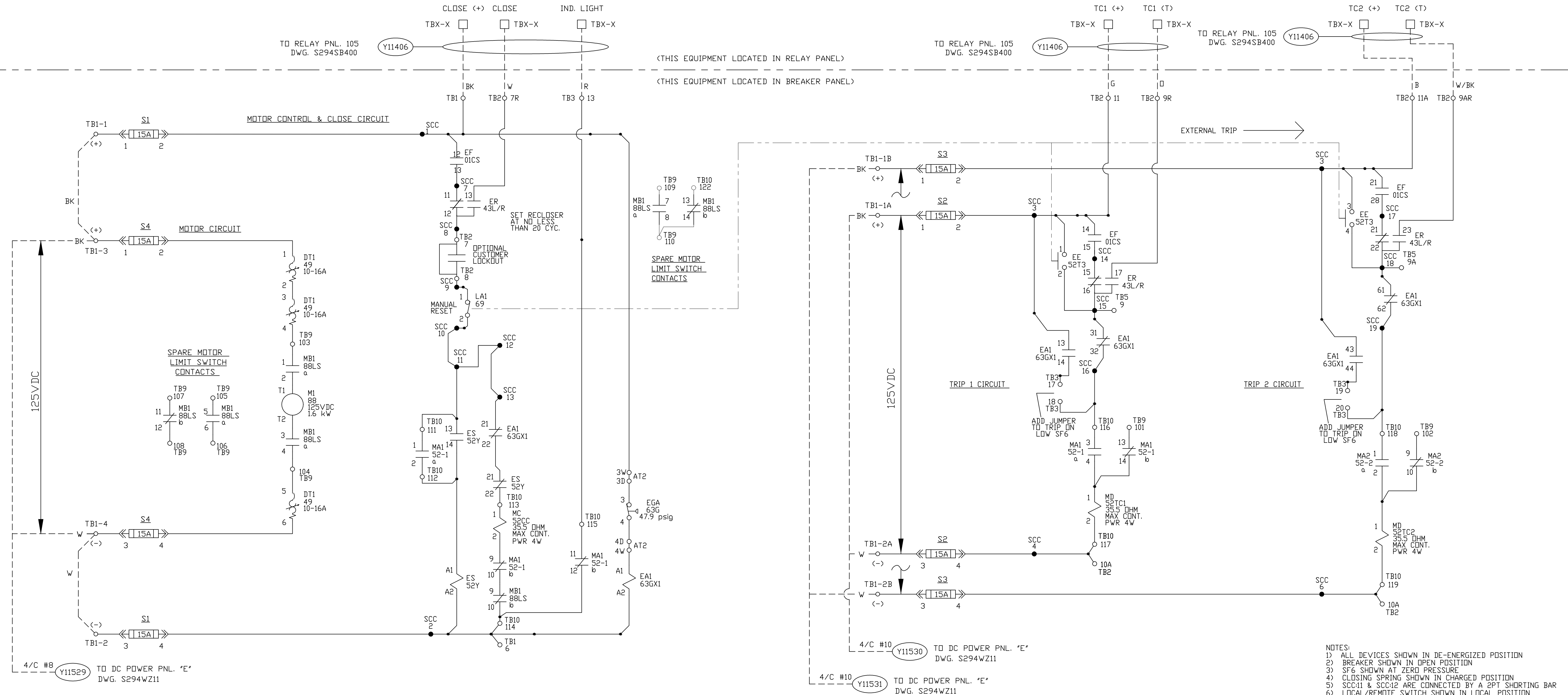
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

**BREAKER 400  
DC SCHEMATIC DIAGRAM**

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CH: SRF	DATE: 3/7/2011	DRAWING No. S294SB400	
REV: 0	DATE: 4/23/12	ISSUED FOR BID	AS NN
REV: 1	DATE:	REVISION DESCRIPTION	DFT ENG

GRDA  
GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

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 Last Plotted by: Shultz, Aylene  
 Plot Style: Monochrome.ctb  
 Plot Scale: 1:1  
 Plot Date: 4/24/2012 1:55 PM  
 Plotter User: DWG To PDF.pc3



(THIS EQUIPMENT LOCATED IN RELAY PANEL)

(THIS EQUIPMENT LOCATED IN BREAKER PANEL)

NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

REFERENCE DRAWINGS

S294SB400 BKR 400 DC SCHEMATIC DIAGRAM  
 S294WZ11 PANEL E 125VDC WIRING DIAGRAM  
 S294PP105 BKR 400 & 69kV BUS DIFF ZONE SOUTH S1 & NORTH N1

**ISSUED FOR BID**

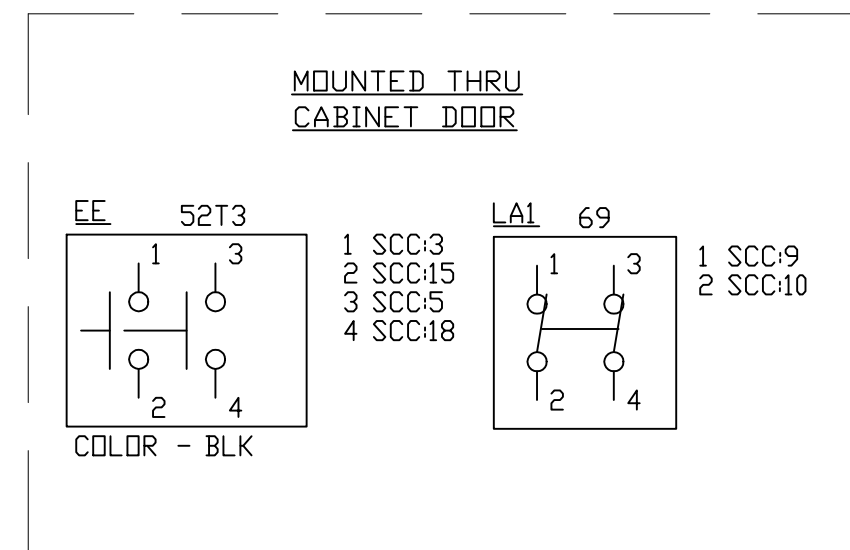
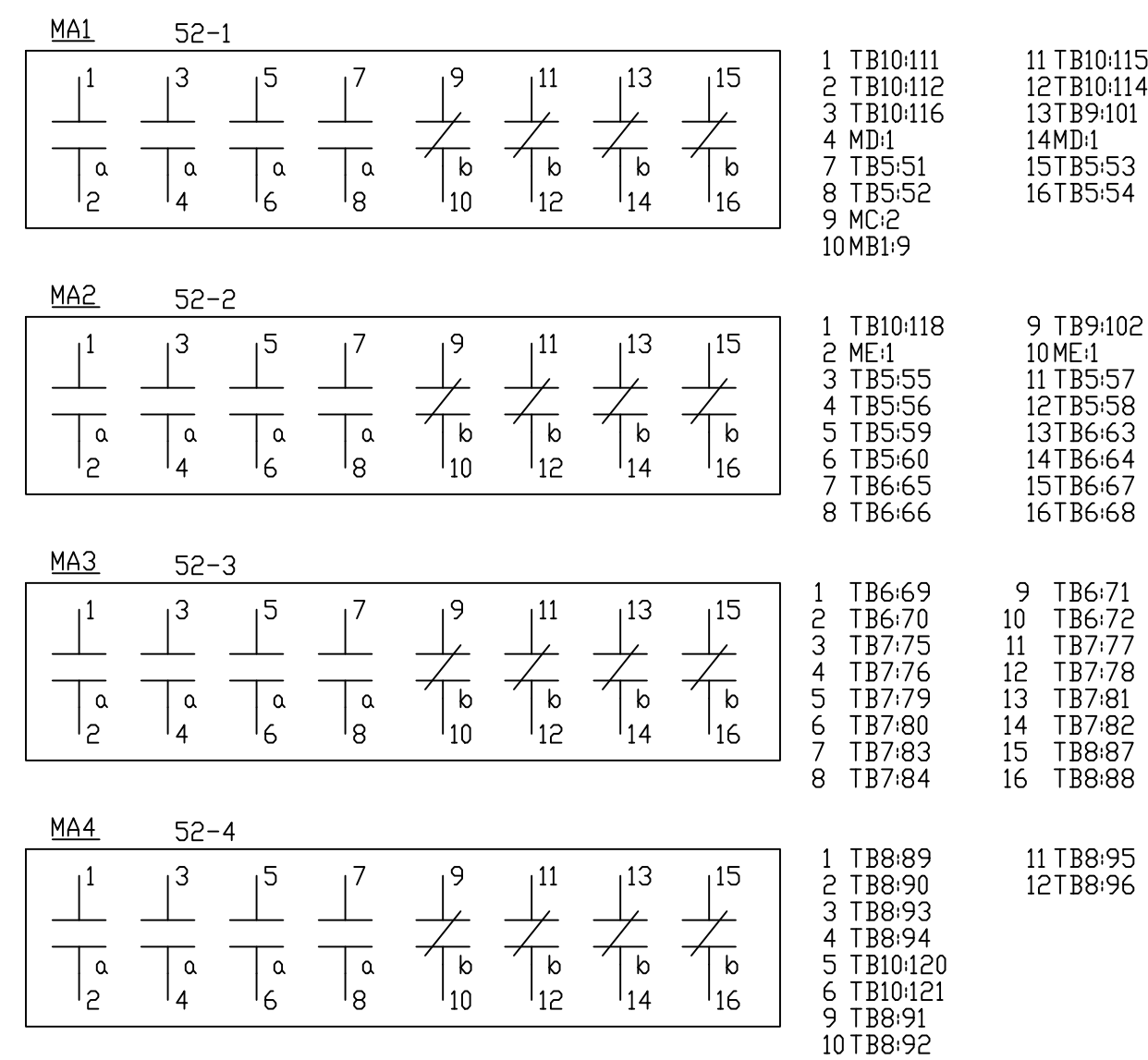
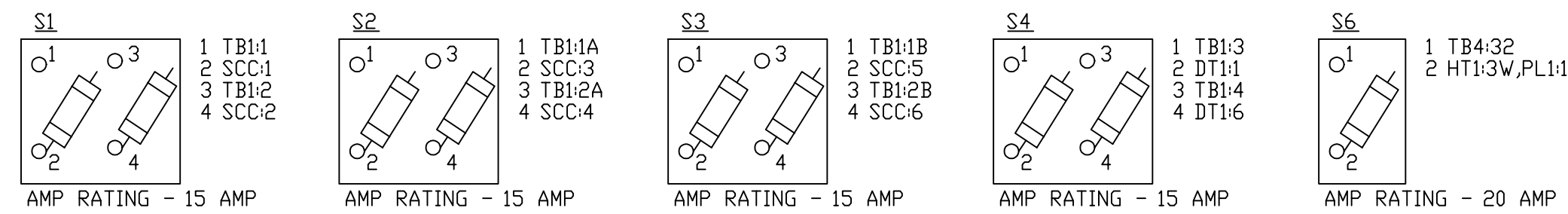
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**BREAKER 400  
 AC/DC SCHEMATIC DIAGRAM**

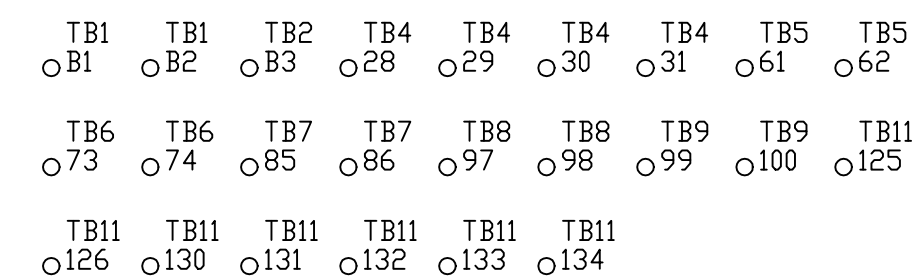
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REV	DATE	REVISION DESCRIPTION	DFT	ENG

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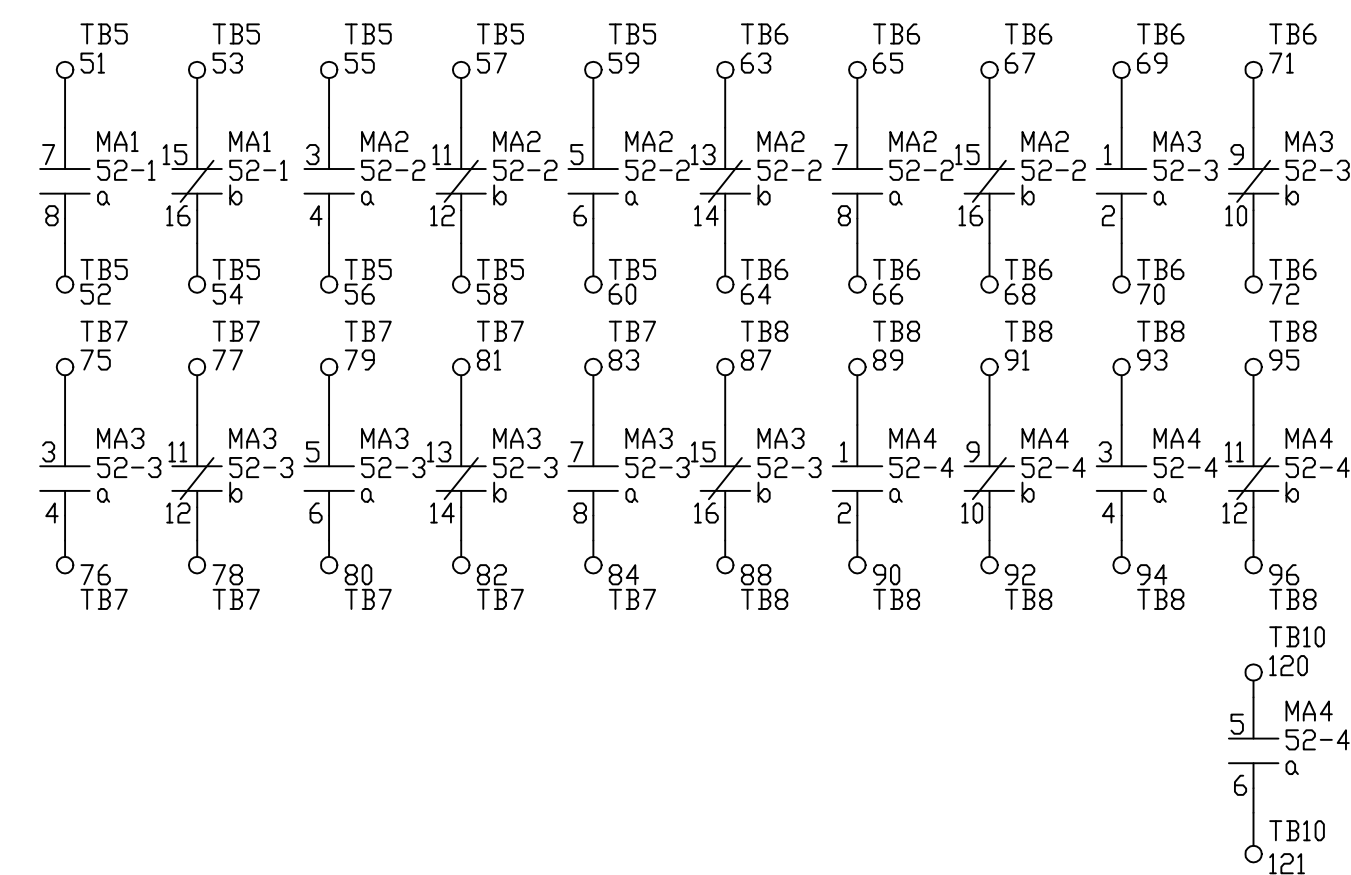
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



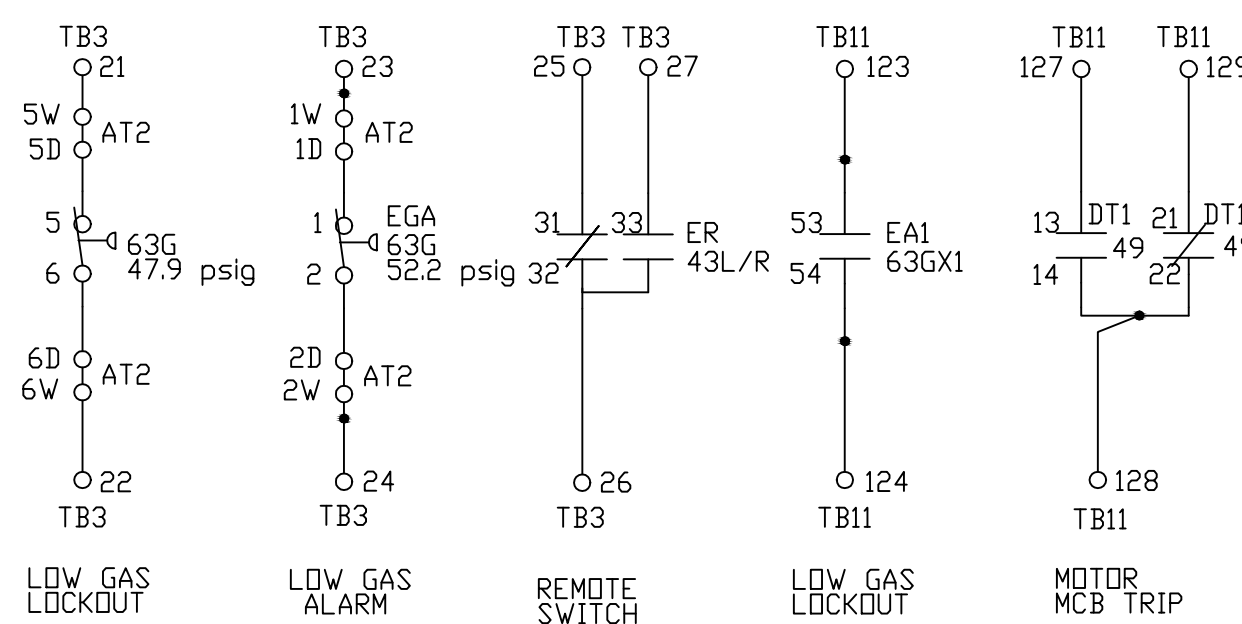
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



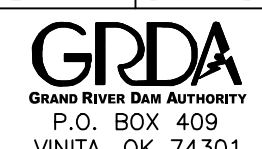
CUSTOMER ALARMS



REFERENCE DRAWINGS

- S294SB400 BKR 400 DC SCHEMATIC DIAGRAM  
 S294SB400a BKR 400 AC/DC SCHEMATIC DIAGRAM

ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV <b>BREAKER 400</b> <b>BREAKER AUXILIARIES</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
		CH: NN	DATE: 3/7/2011
DRAWING No. <b>S294SB400b</b>		REV.	0

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

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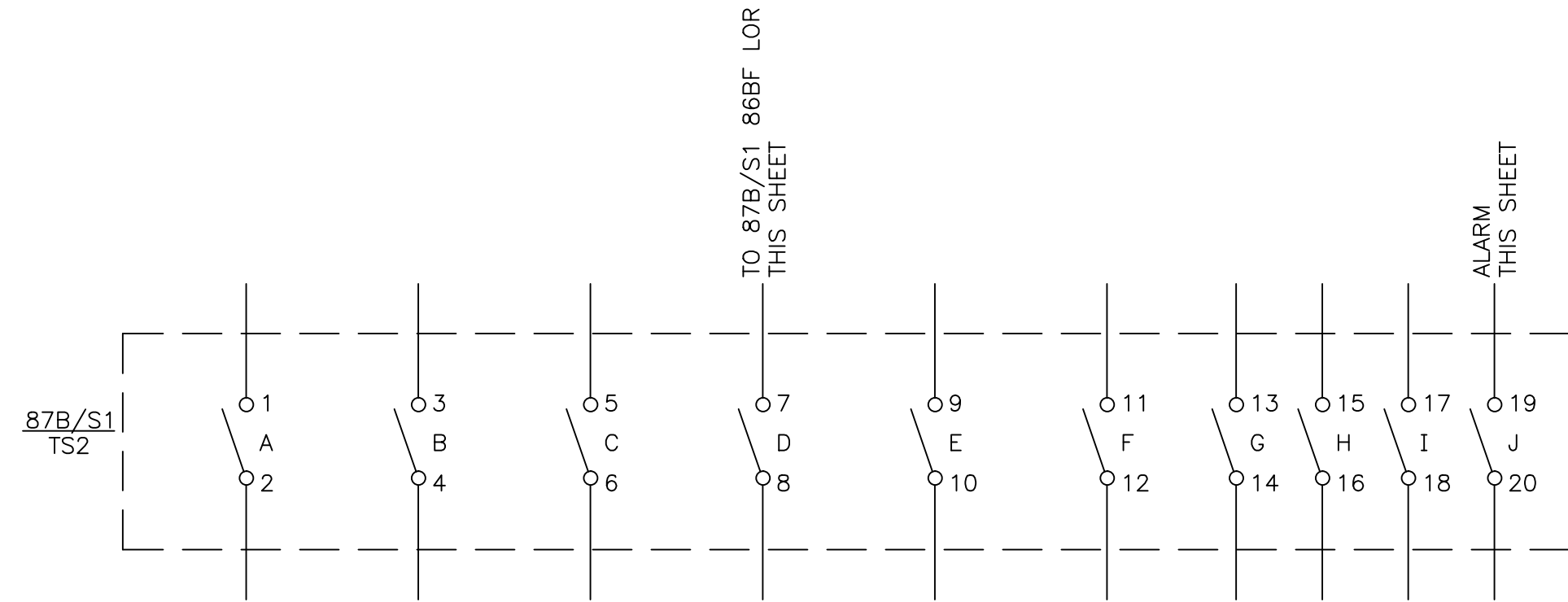
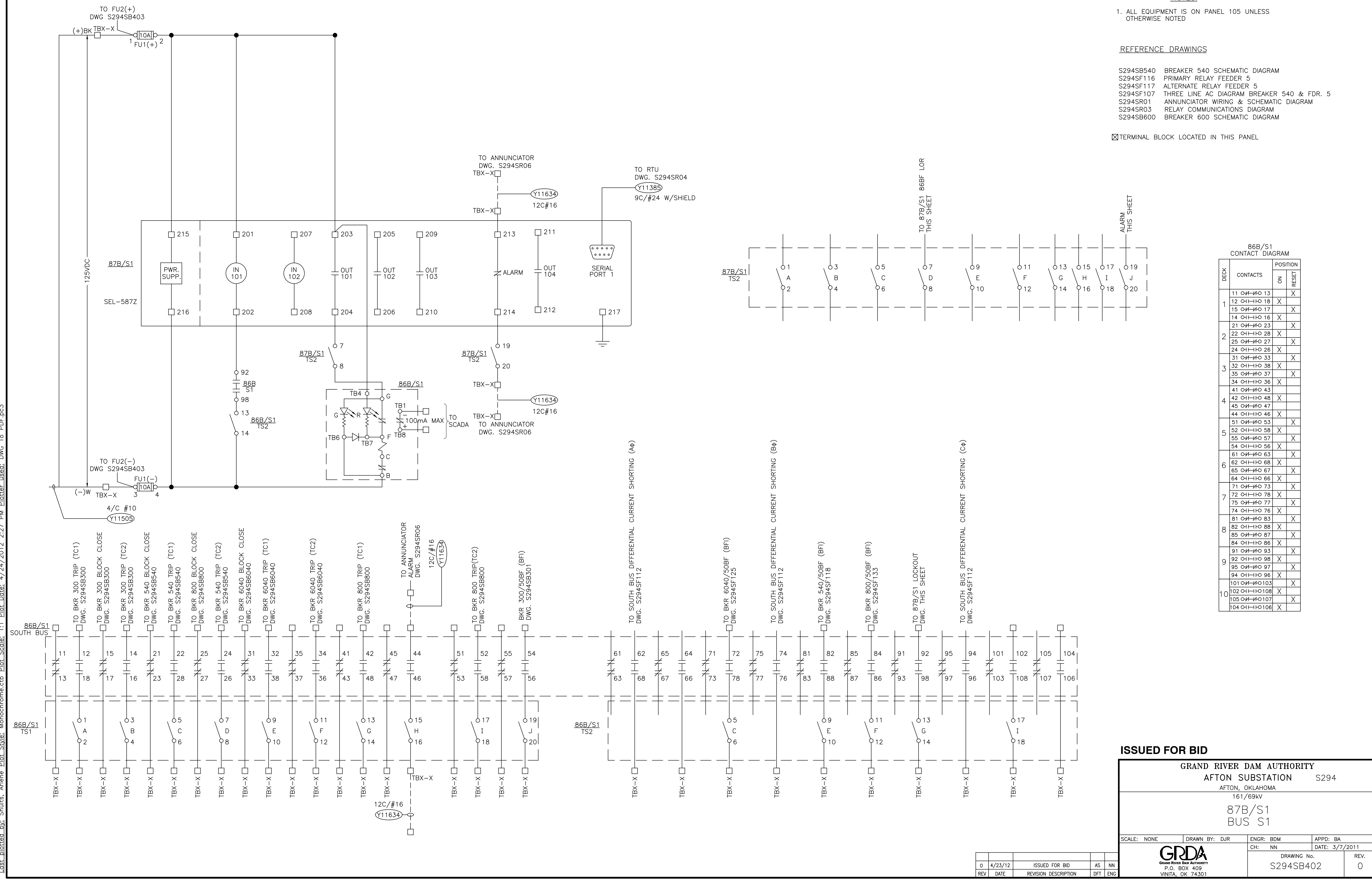
**NOTES:**

- ALL EQUIPMENT IS ON PANEL 105 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**

- S294SB540 BREAKER 540 SCHEMATIC DIAGRAM
- S294SF116 PRIMARY RELAY FEEDER 5
- S294SF117 ALTERNATE RELAY FEEDER 5
- S294SF107 THREE LINE AC DIAGRAM BREAKER 540 & FDR. 5
- S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SB600 BREAKER 600 SCHEMATIC DIAGRAM

☒ TERMINAL BLOCK LOCATED IN THIS PANEL



86B/S1 CONTACT DIAGRAM

DECK	CONTACTS	POSITION	
		ON	RESET
1	11 ON-NO 13		X
	12 ON-NO 18	X	
	15 ON-NO 17	X	
	14 ON-NO 16	X	
2	21 ON-NO 23	X	
	22 ON-NO 28	X	
	25 ON-NO 27	X	
	24 ON-NO 26	X	
3	31 ON-NO 33	X	
	32 ON-NO 38	X	
	35 ON-NO 37	X	
	34 ON-NO 36	X	
4	41 ON-NO 43	X	
	42 ON-NO 48	X	
	45 ON-NO 47	X	
	44 ON-NO 46	X	
5	51 ON-NO 53	X	X
	52 ON-NO 58	X	X
	55 ON-NO 57	X	X
	54 ON-NO 56	X	X
6	61 ON-NO 63	X	X
	62 ON-NO 68	X	X
	65 ON-NO 67	X	X
	64 ON-NO 66	X	X
7	71 ON-NO 73	X	X
	72 ON-NO 78	X	X
	75 ON-NO 77	X	X
	74 ON-NO 76	X	X
8	81 ON-NO 83	X	X
	82 ON-NO 88	X	X
	85 ON-NO 87	X	X
	84 ON-NO 86	X	X
9	91 ON-NO 93	X	X
	92 ON-NO 98	X	X
	95 ON-NO 97	X	X
	94 ON-NO 96	X	X
10	101 ON-NO 103	X	X
	102 ON-NO 108	X	X
	105 ON-NO 107	X	X
	104 ON-NO 106	X	X

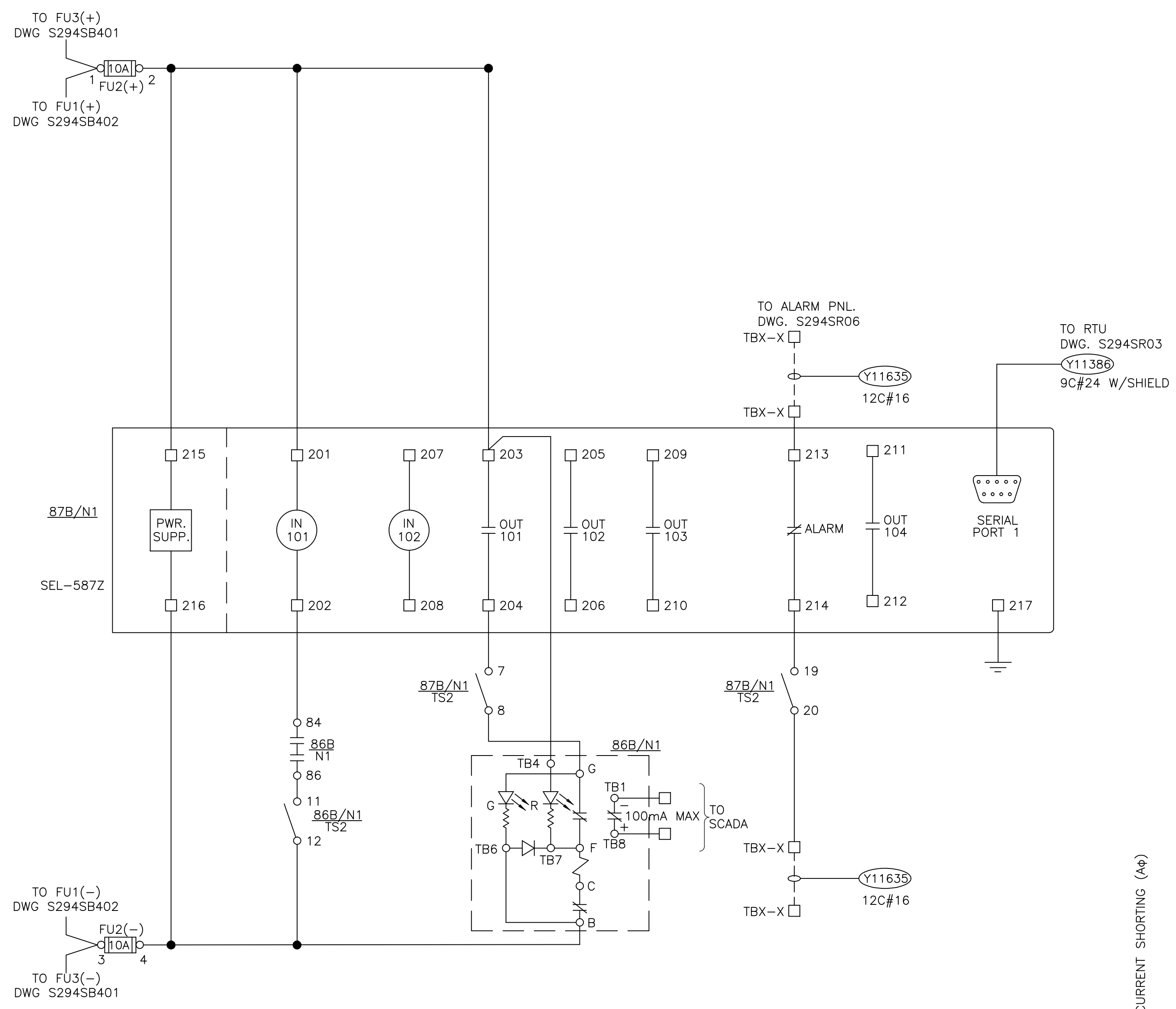
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV 87B/S1 BUS S1			
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		CH: NN	DATE: 3/7/2011
DRAWING No. S294SB402		REV.	0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN



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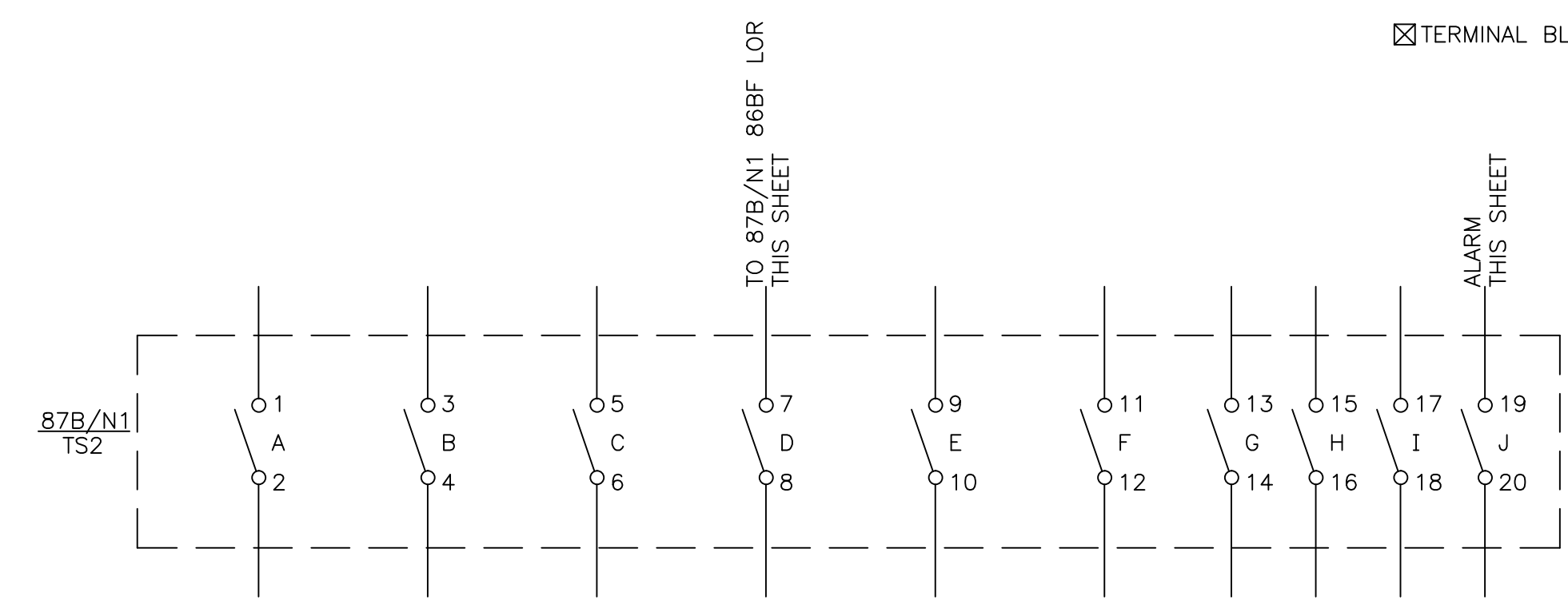


**NOTES:**  
 1. ALL EQUIPMENT IS ON PANEL 105 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**

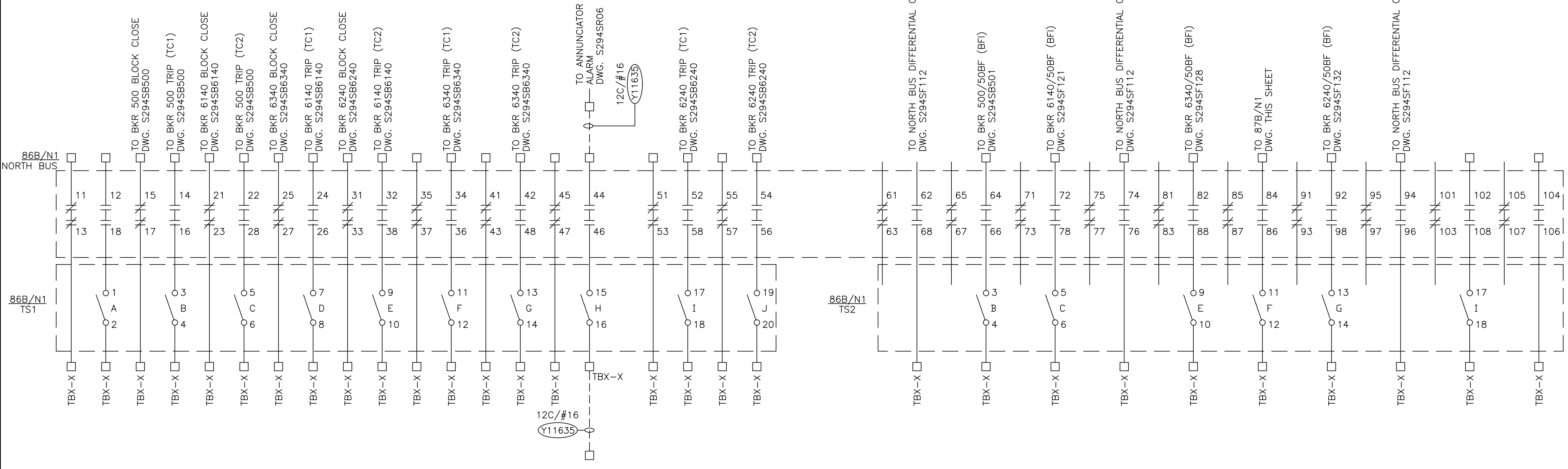
- S294SB540 BREAKER 540 SCHEMATIC DIAGRAM
- S294SF116 PRIMARY RELAY FEEDER 5
- S294SF117 ALTERNATE RELAY FEEDER 5
- S294SF107 THREE LINE AC DIAGRAM BREAKER 540 & FDR. 5
- S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SB600 BREAKER 600 SCHEMATIC DIAGRAM

☒ TERMINAL BLOCK LOCATED IN THIS PANEL



86B/N1 CONTACT DIAGRAM

DECK	CONTACTS	POSITION	
		ON	RESET
1	11 ON-NO 13		X
	12 ON-NO 18	X	
	15 ON-NO 17		X
	14 ON-NO 16	X	
2	21 ON-NO 23		X
	22 ON-NO 28	X	
	25 ON-NO 27		X
	24 ON-NO 26	X	
3	31 ON-NO 33		X
	32 ON-NO 38	X	
	35 ON-NO 37		X
	34 ON-NO 36	X	
4	41 ON-NO 43		X
	42 ON-NO 48	X	
	45 ON-NO 47		X
	44 ON-NO 46	X	
5	51 ON-NO 53		X
	52 ON-NO 58	X	
	55 ON-NO 57		X
	54 ON-NO 56	X	
6	61 ON-NO 63		X
	62 ON-NO 68	X	
	65 ON-NO 67		X
	64 ON-NO 66	X	
7	71 ON-NO 73		X
	72 ON-NO 78	X	
	75 ON-NO 77		X
	74 ON-NO 76	X	
8	81 ON-NO 83		X
	82 ON-NO 88	X	
	85 ON-NO 87		X
	84 ON-NO 86	X	
9	91 ON-NO 93		X
	92 ON-NO 98	X	
	95 ON-NO 97		X
	94 ON-NO 96	X	
10	101 ON-NO 103		X
	102 ON-NO 108	X	
	105 ON-NO 107		X
	104 ON-NO 106	X	



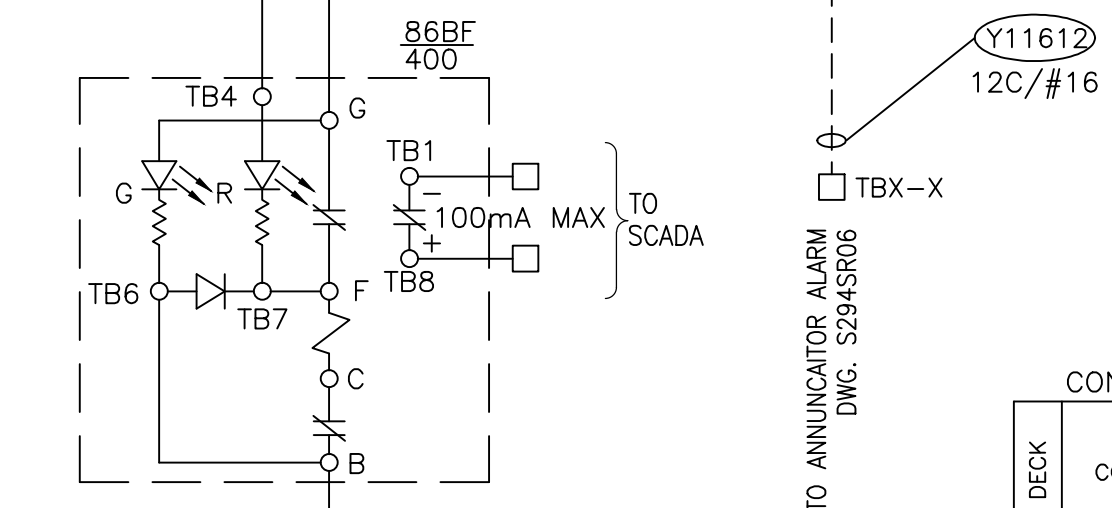
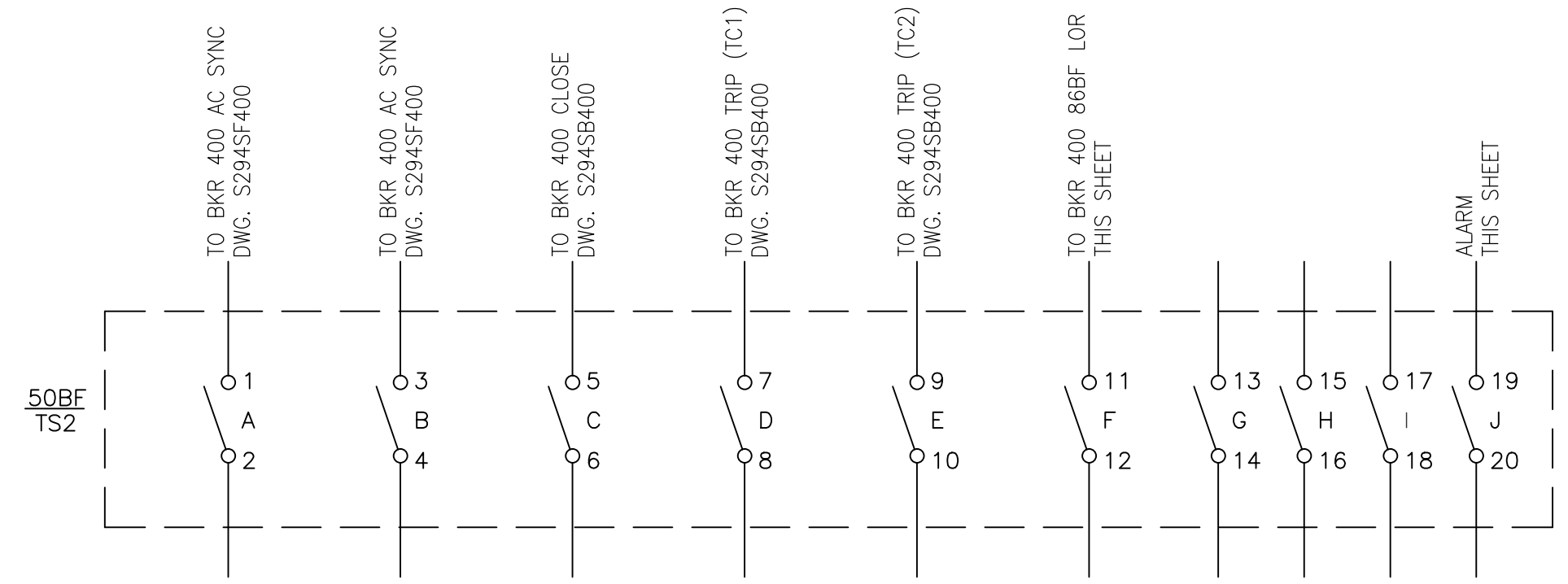
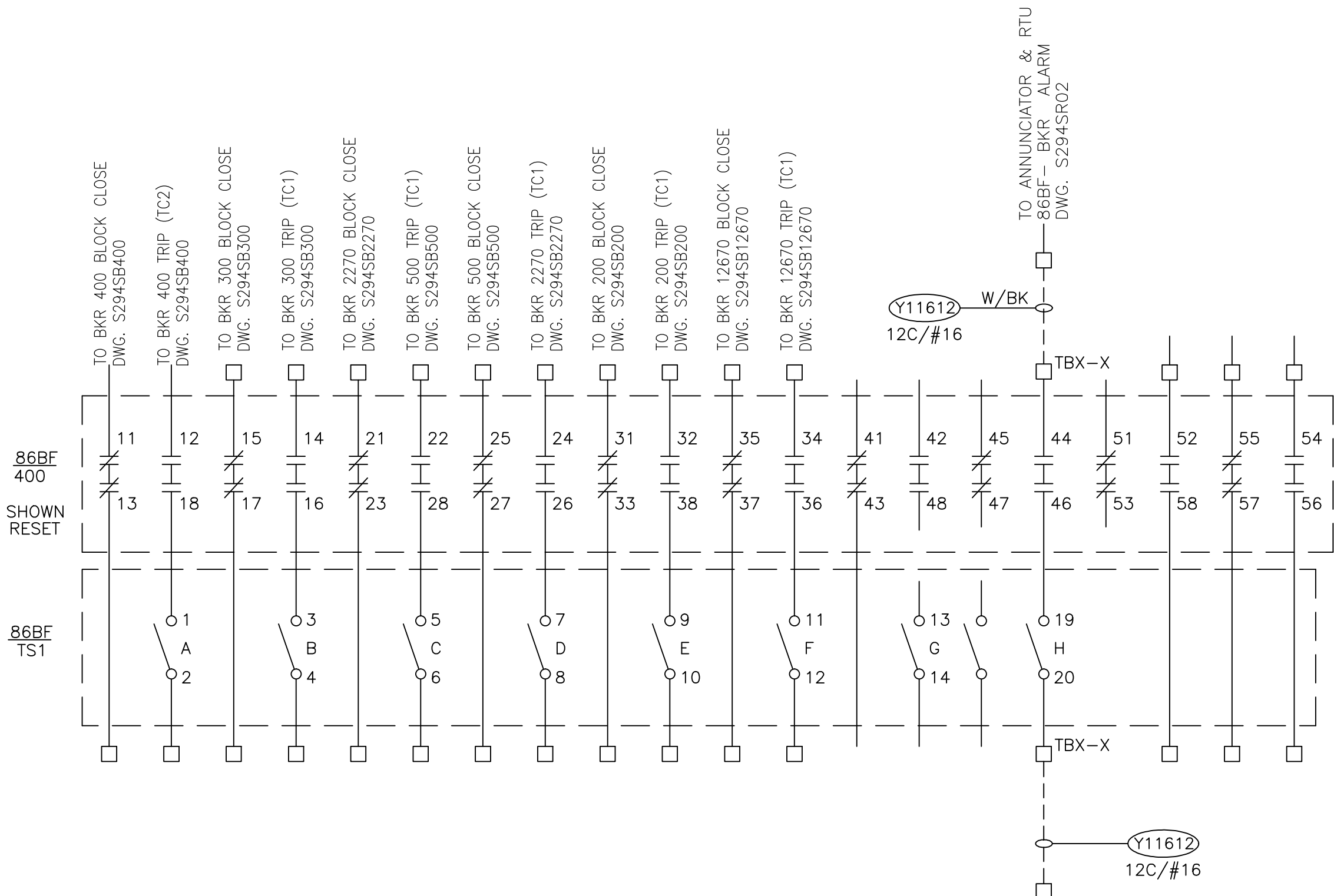
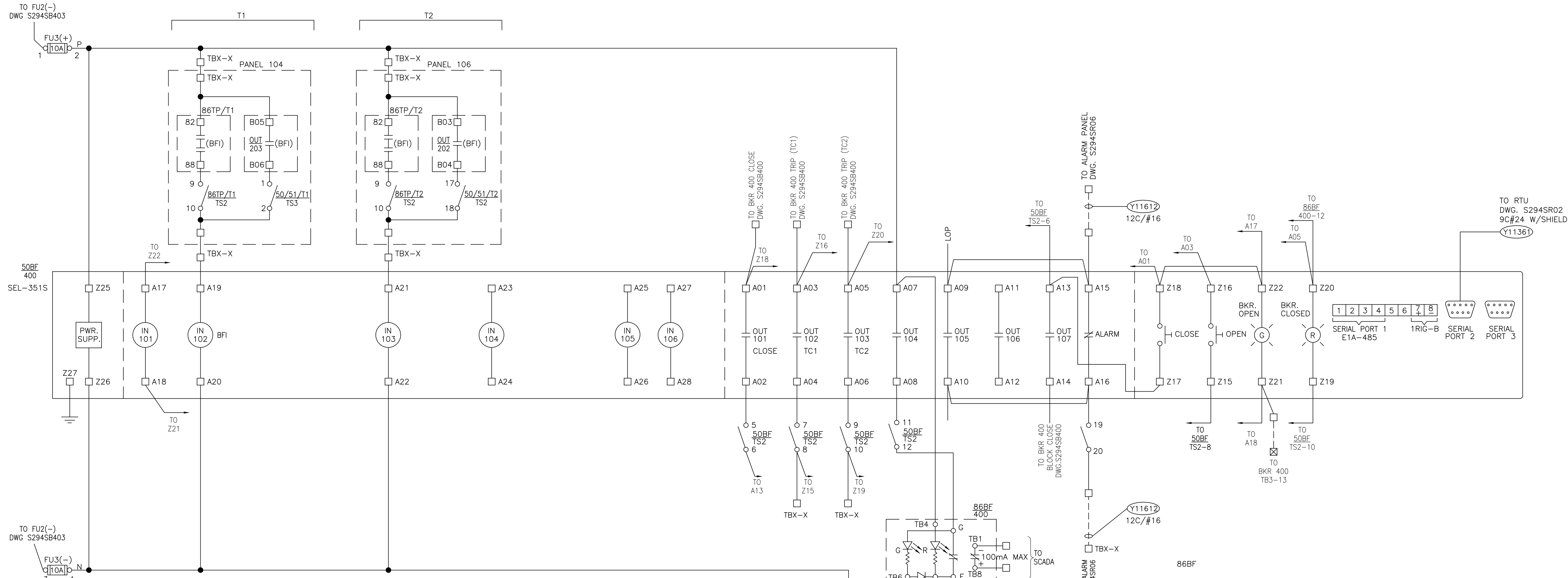
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 87B-N1  
 BUS N1

SCALE: NONE	DRAWN BY: DJR	ENGR: BDM	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No. S294SB403	REV. 0

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

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 Last Saved By: Ashults  
 Last Date: 4/26/2012 8:09 AM  
 Plot Date: 4/26/2012 8:09 AM  
 Plotter Used: DWG To PDF.pc3



86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION	
		TRIP	RESET
1	11 OH-HO 13		X
	12 OH-HO 18	X	
	15 OH-HO 17		X
	14 OH-HO 16	X	
2	21 OH-HO 23		X
	22 OH-HO 28	X	
	25 OH-HO 27		X
	24 OH-HO 26	X	
3	31 OH-HO 33		X
	32 OH-HO 38	X	
	35 OH-HO 37		X
	34 OH-HO 36	X	
4	41 OH-HO 43		X
	42 OH-HO 48	X	
	45 OH-HO 47		X
	44 OH-HO 46	X	
5	51 OH-HO 53		X
	52 OH-HO 58	X	
	55 OH-HO 57		X
	54 OH-HO 56	X	
6	61 OH-HO 63		X
	62 OH-HO 68	X	
	65 OH-HO 67		X
	64 OH-HO 66	X	
7	71 OH-HO 73		X
	72 OH-HO 78	X	
	75 OH-HO 77		X
	74 OH-HO 76	X	
8	81 OH-HO 83		X
	82 OH-HO 88	X	
	85 OH-HO 87		X
	84 OH-HO 86	X	

**NOTES:**  
 1. ALL EQUIPMENT IS ON PANEL 105 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**  
 S294PP105 PANEL 105 ELEVATION  
 S294SB400 BREAKER 400 SCHEMATIC DIAGRAM  
 S294SB401 BREAKER FAILURE & CONTROL BKR. 400  
 S294SB300 BREAKER FAILURE & CONTROL BKR. 300  
 S294SB500 BREAKER FAILURE & CONTROL BKR. 500  
 S294SR02 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM  
 S294SR03 RELAY COMMUNICATIONS DIAGRAM

☒ TERMINAL BLOCK LOCATED IN THIS PANEL

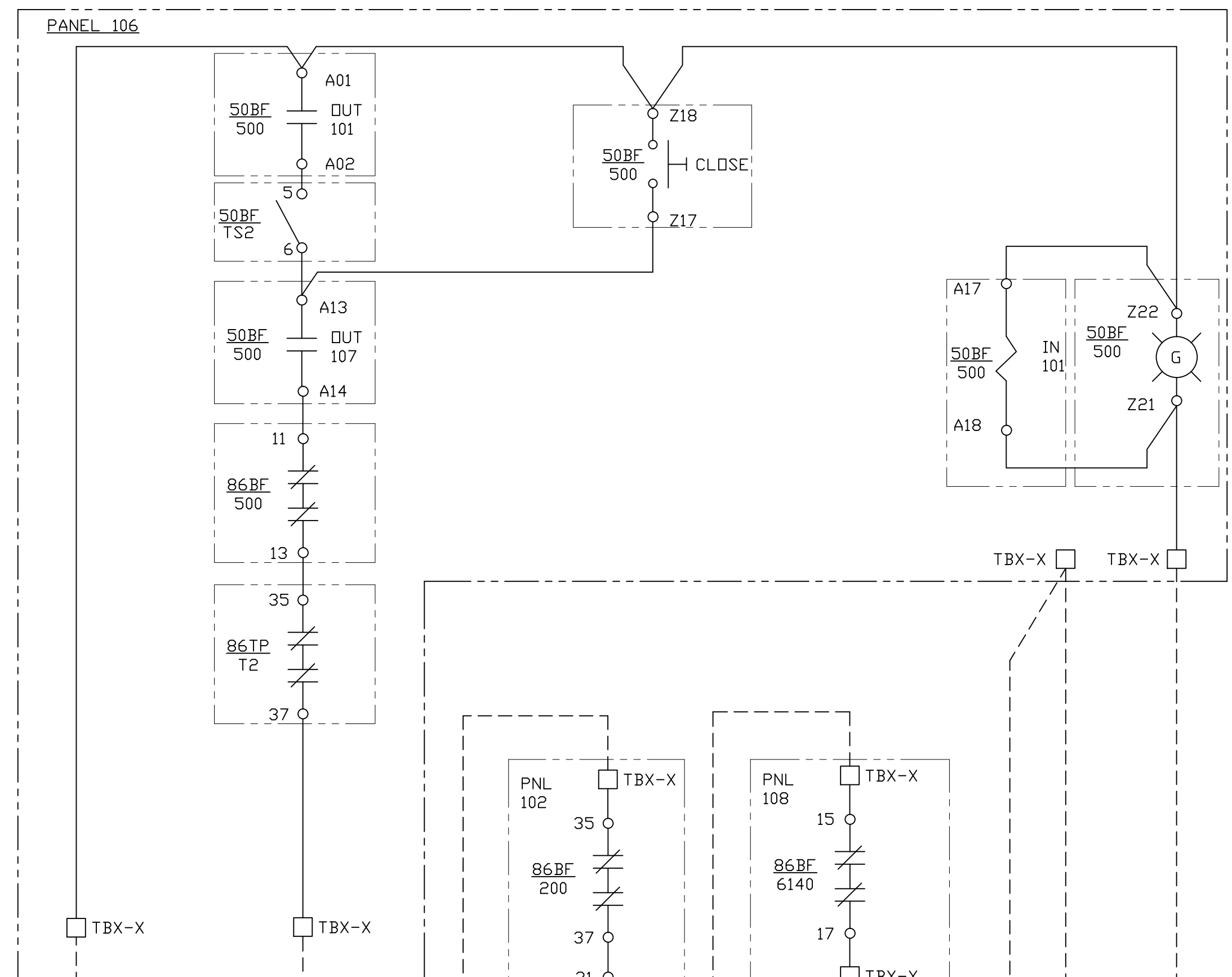
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

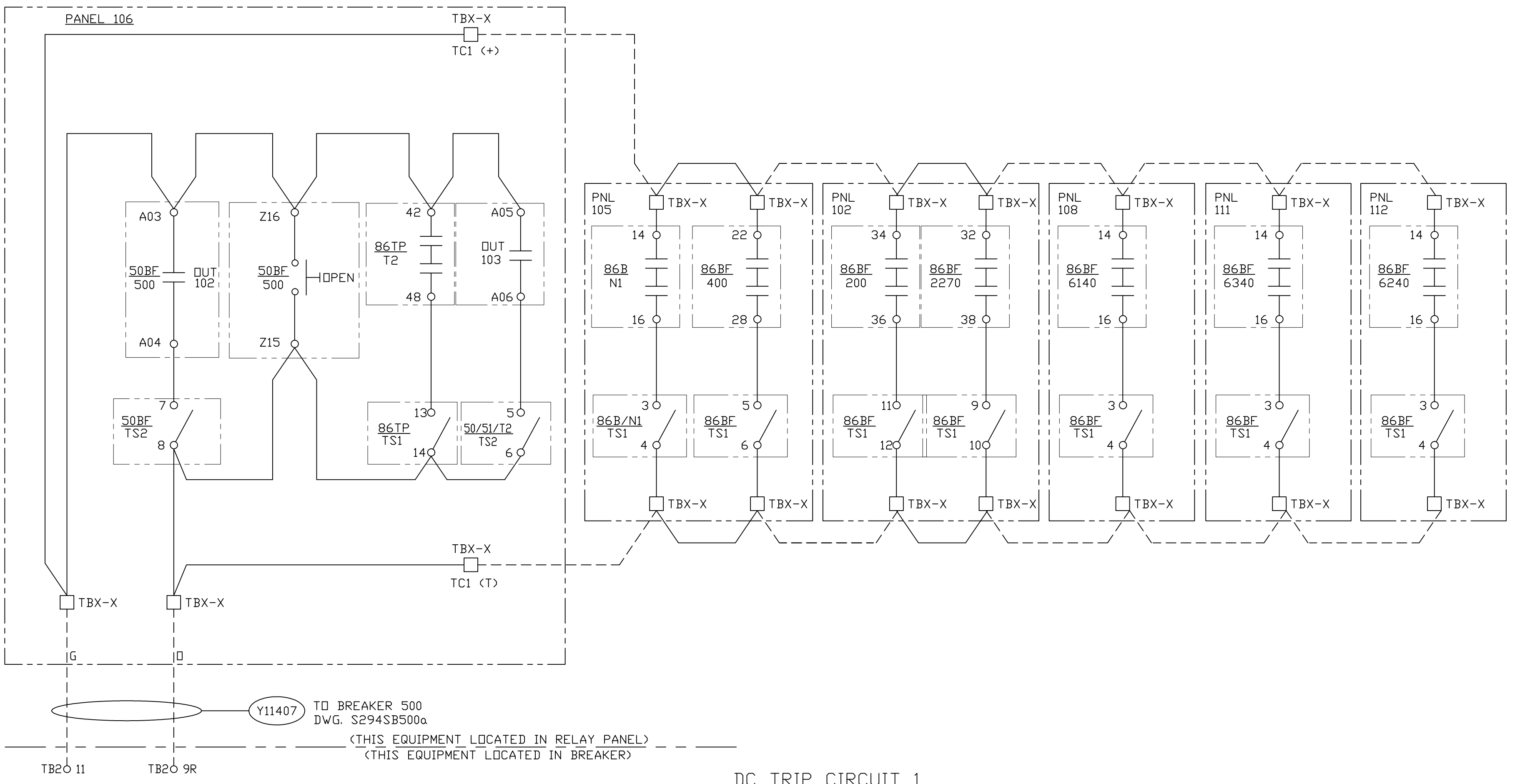
**BREAKER 400 FAILURE AND CONTROL  
 69KV BUS-MAIN-HALF BREAKER**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No. S294SB401	
0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

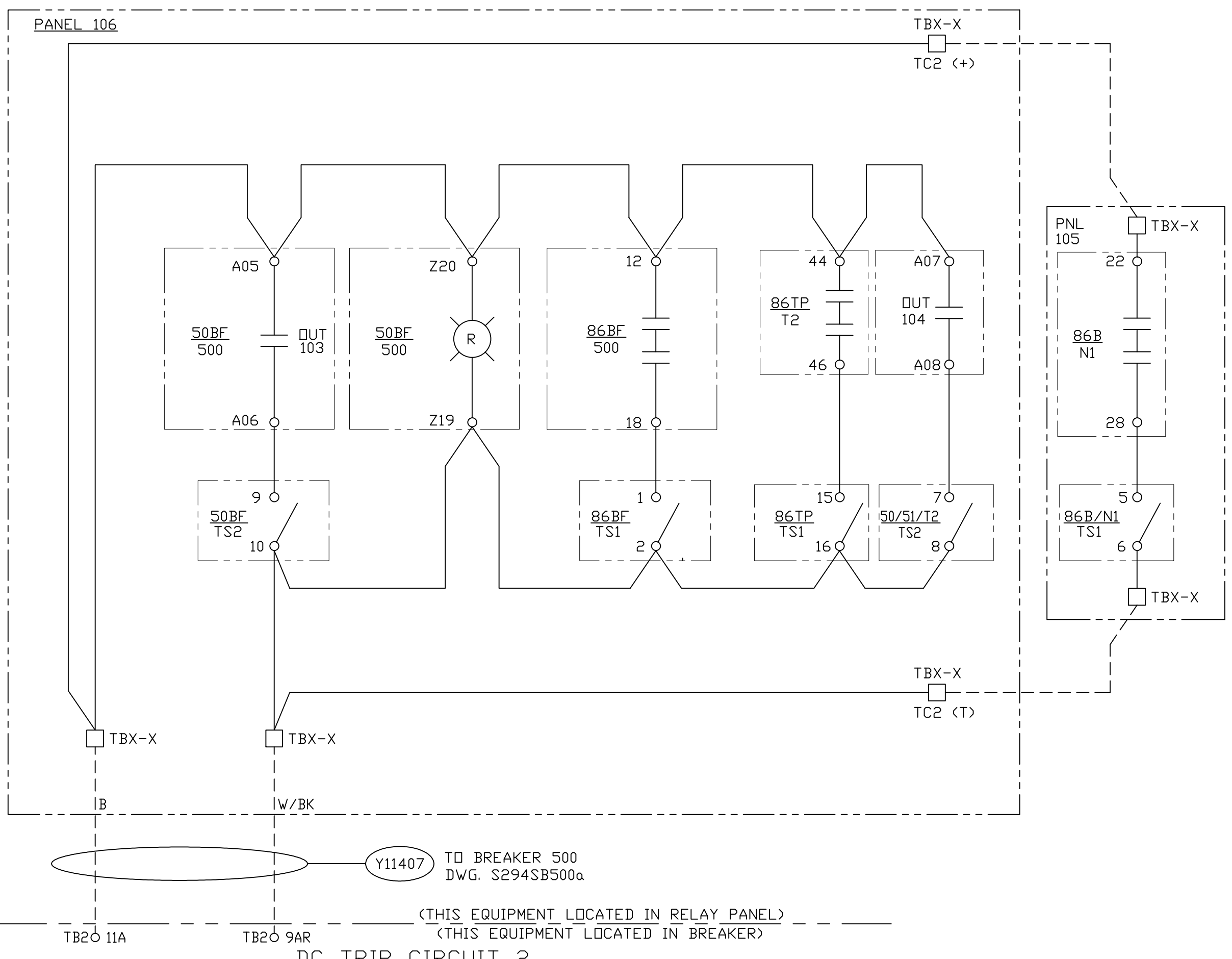
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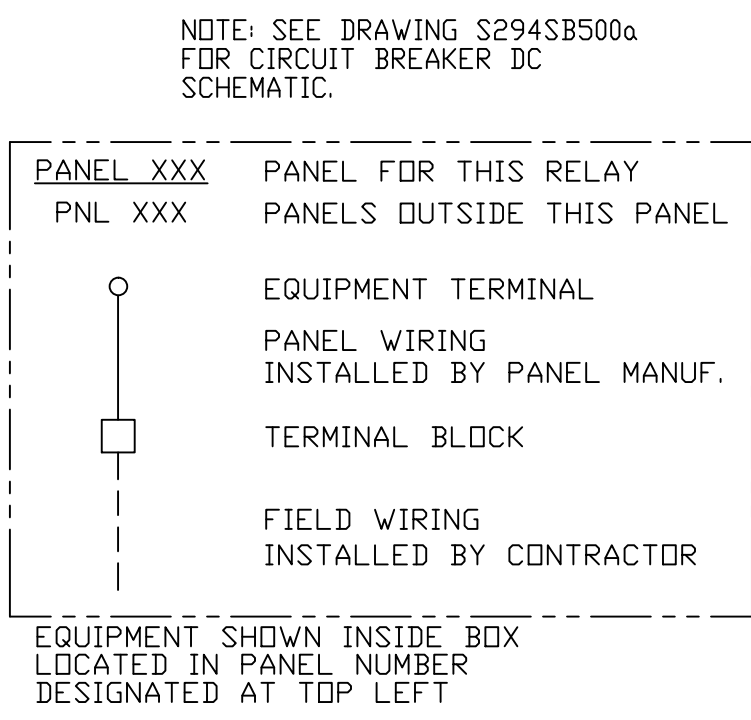
DC CLOSE CIRCUIT



DC TRIP CIRCUIT 1



DC TRIP CIRCUIT 2



REFERENCE DRAWINGS

- S294SB500a BKR 500 DC SCHEMATIC DIAGRAM
- S294PP102 FDR 22-161kV MIAMI & BKR 2270
- S294PP105 BKR 400 & 69kV BUS DIFF ZONE SOUTH S1 & NORTH N1
- S294PP108 FDR 5-69kV PENSACOLA
- S294PP111 111 FDR 62-69kV SAILBOAT BRIDGE
- S294PP112 FDR 62-69kV SAILBOAT BRIDGE

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

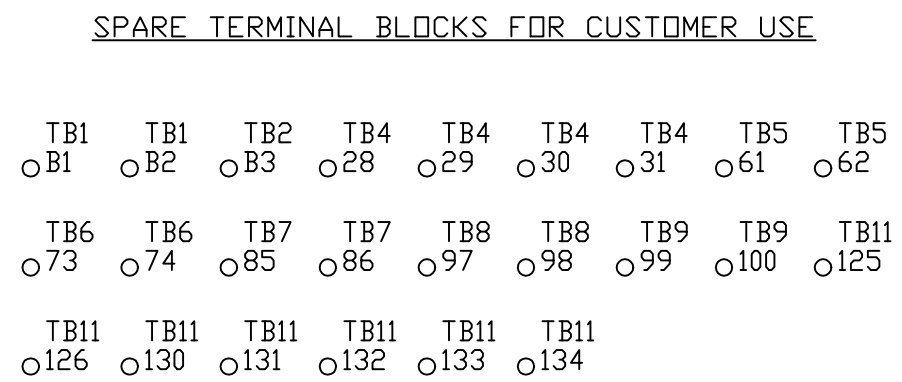
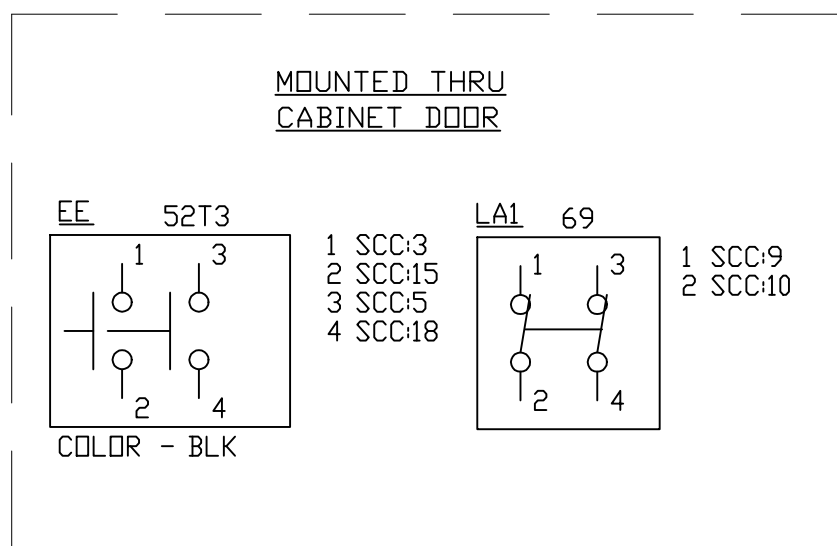
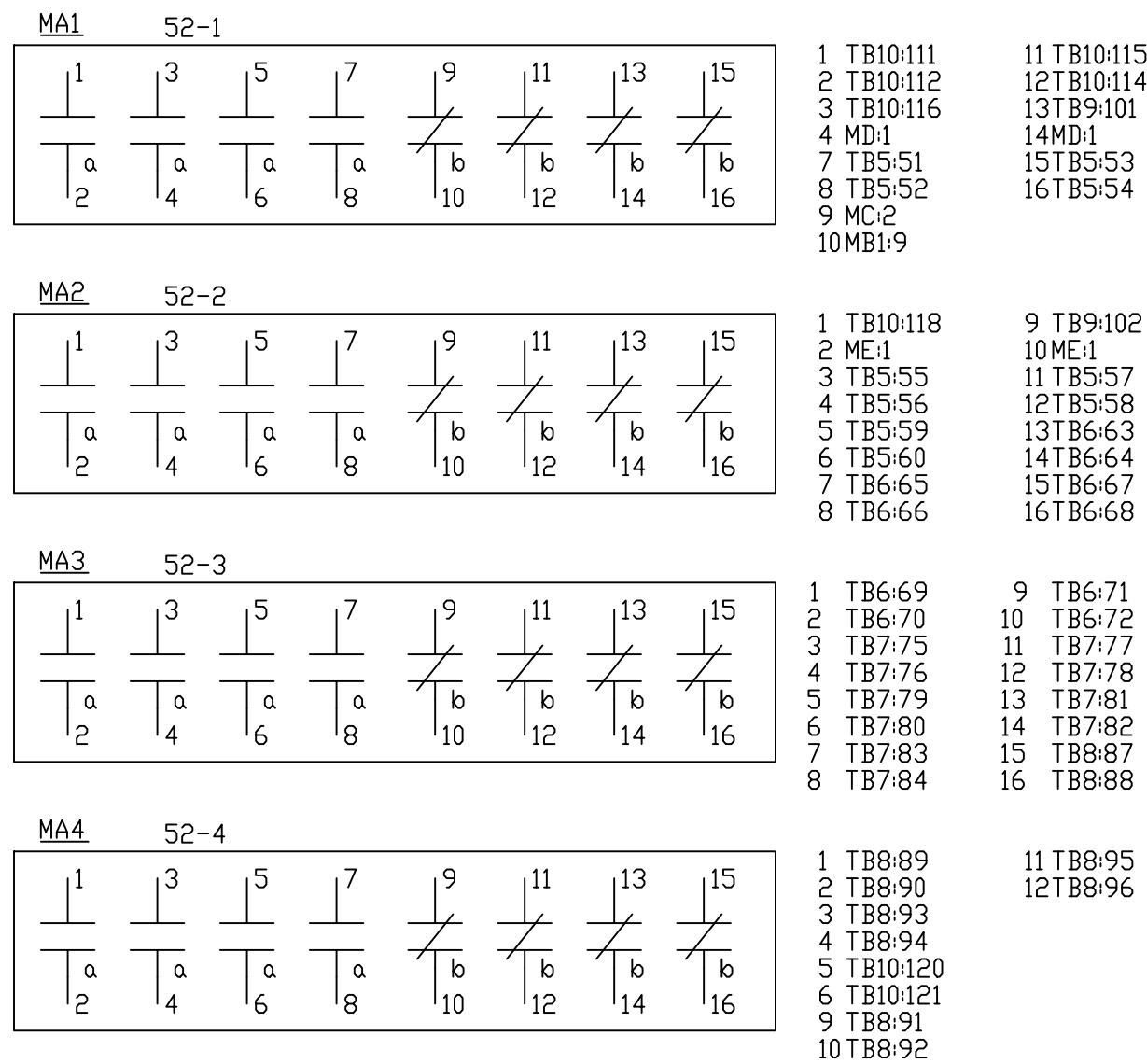
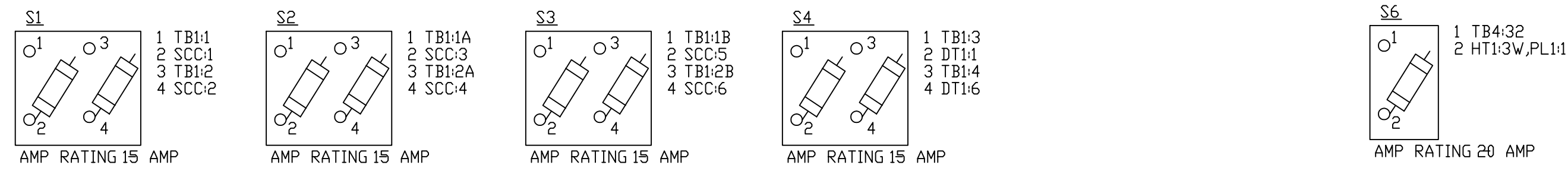
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 500**  
**DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No.	REV.
		S294SB500	0

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

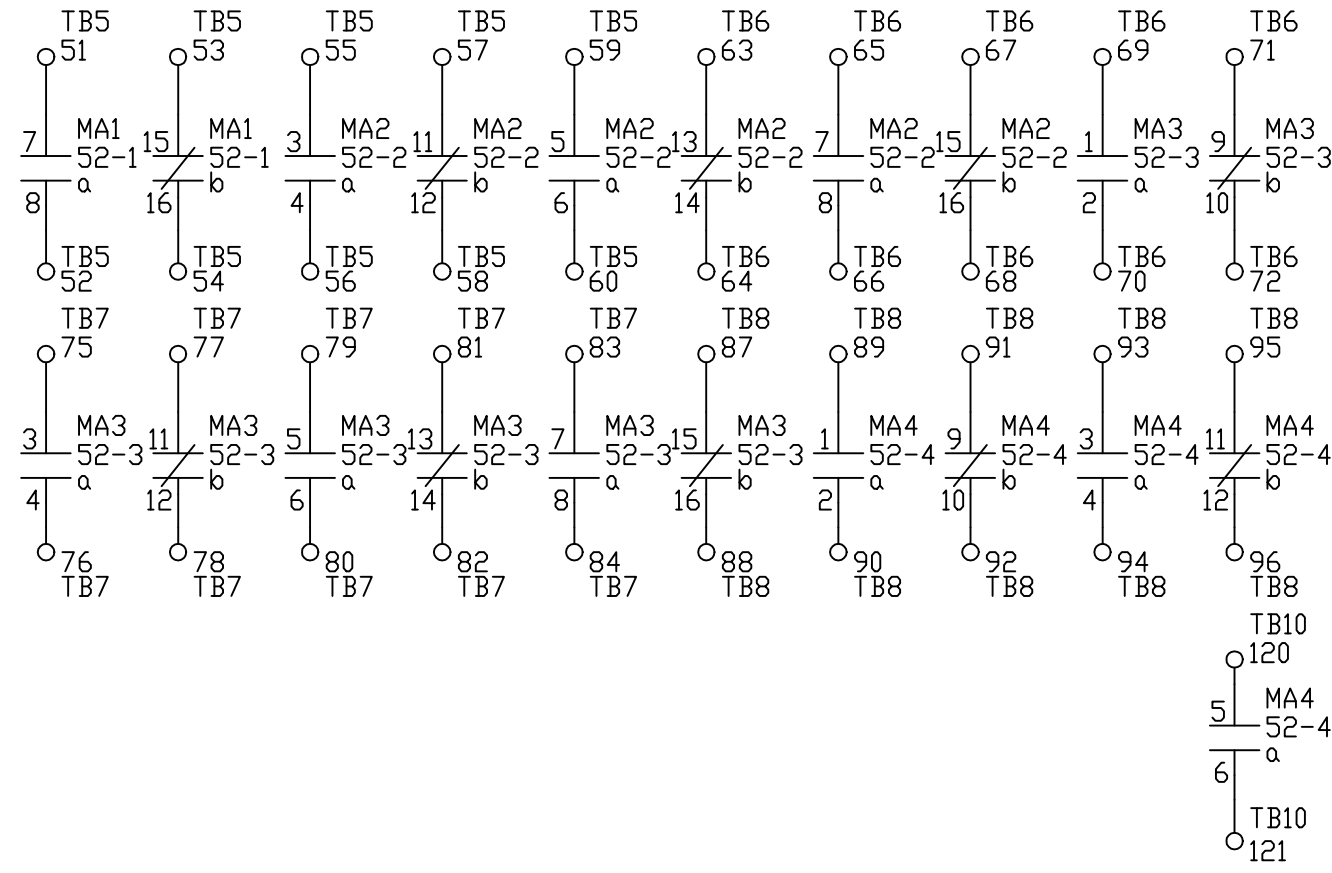
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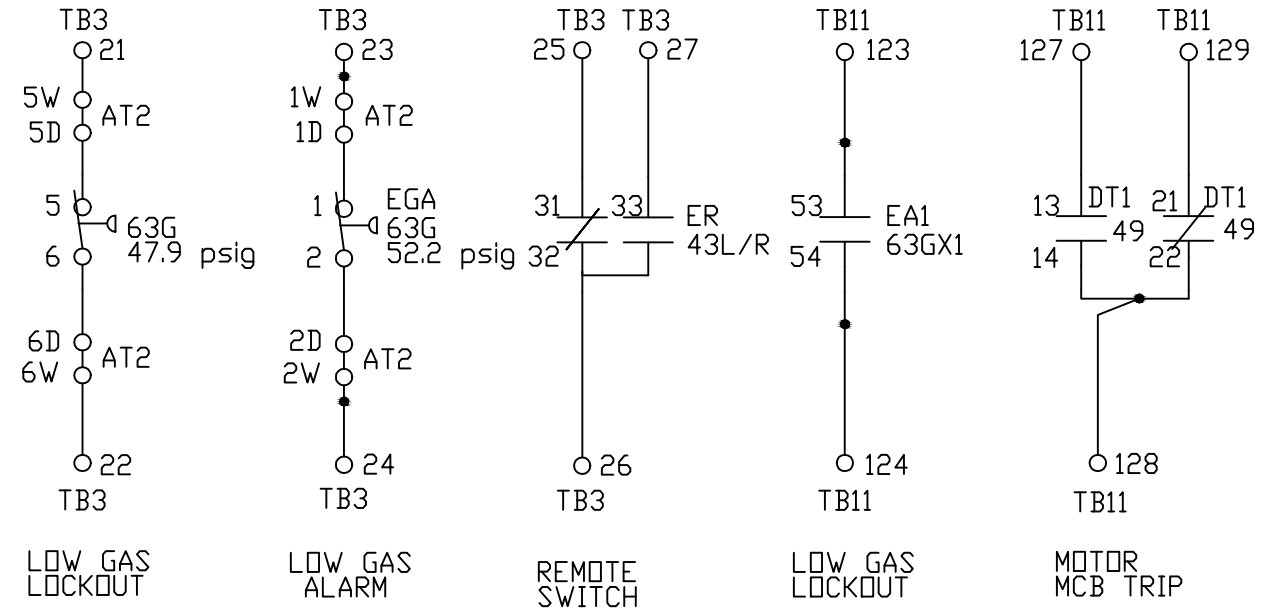
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



- REFERENCE DRAWINGS
- S294SB500 BKR 500 DC SCHEMATIC DIAGRAM
  - S294SB500a BKR 500 ACDC SCHEMATIC DIAGRAM

**ISSUED FOR BID**

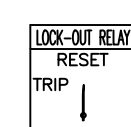
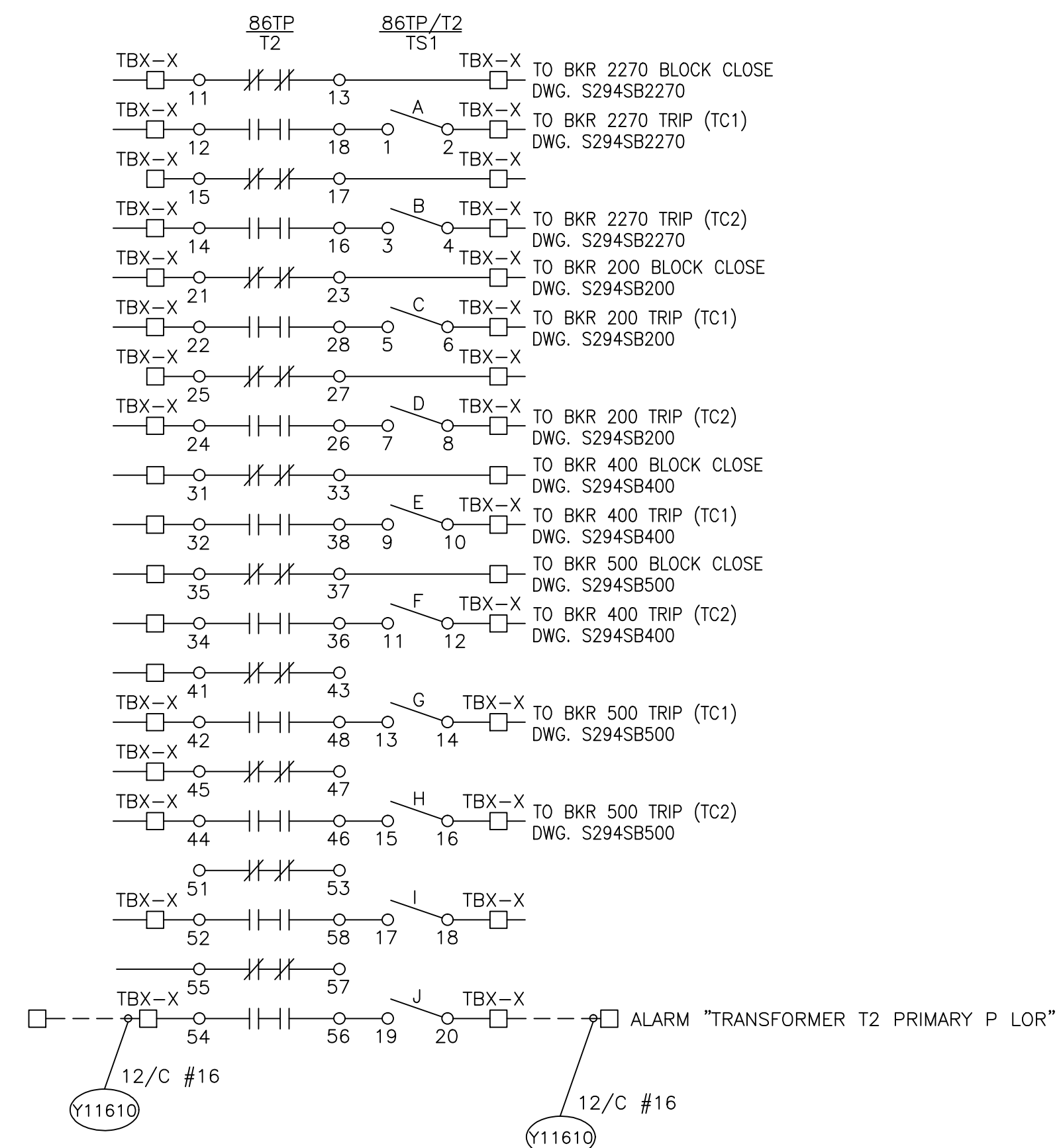
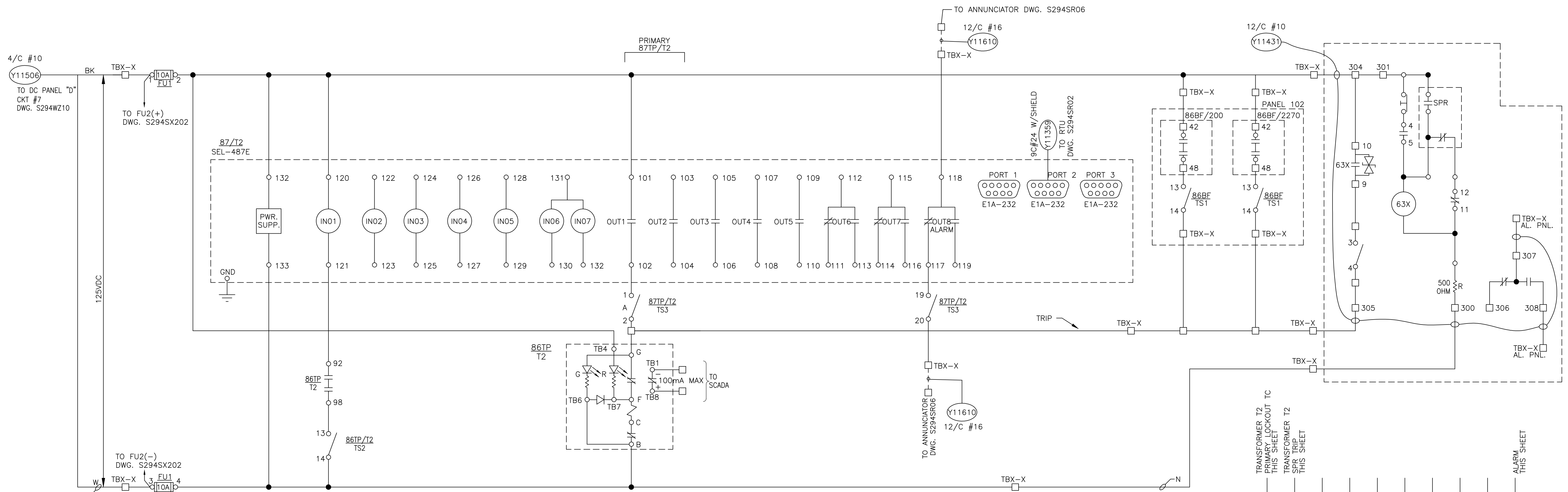
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**BREAKER 500  
 BREAKER AUXILIARIES**

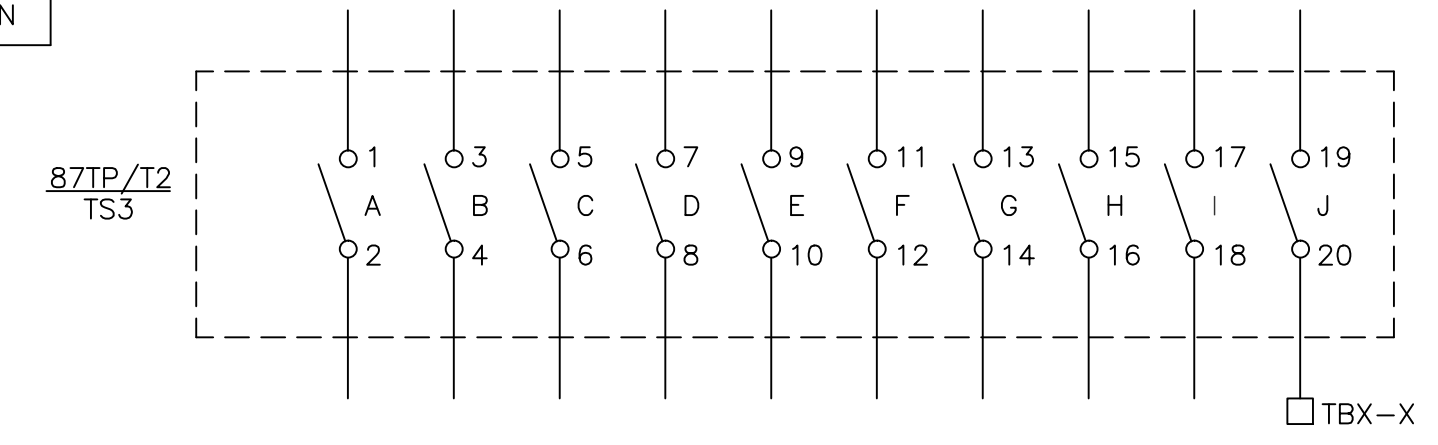
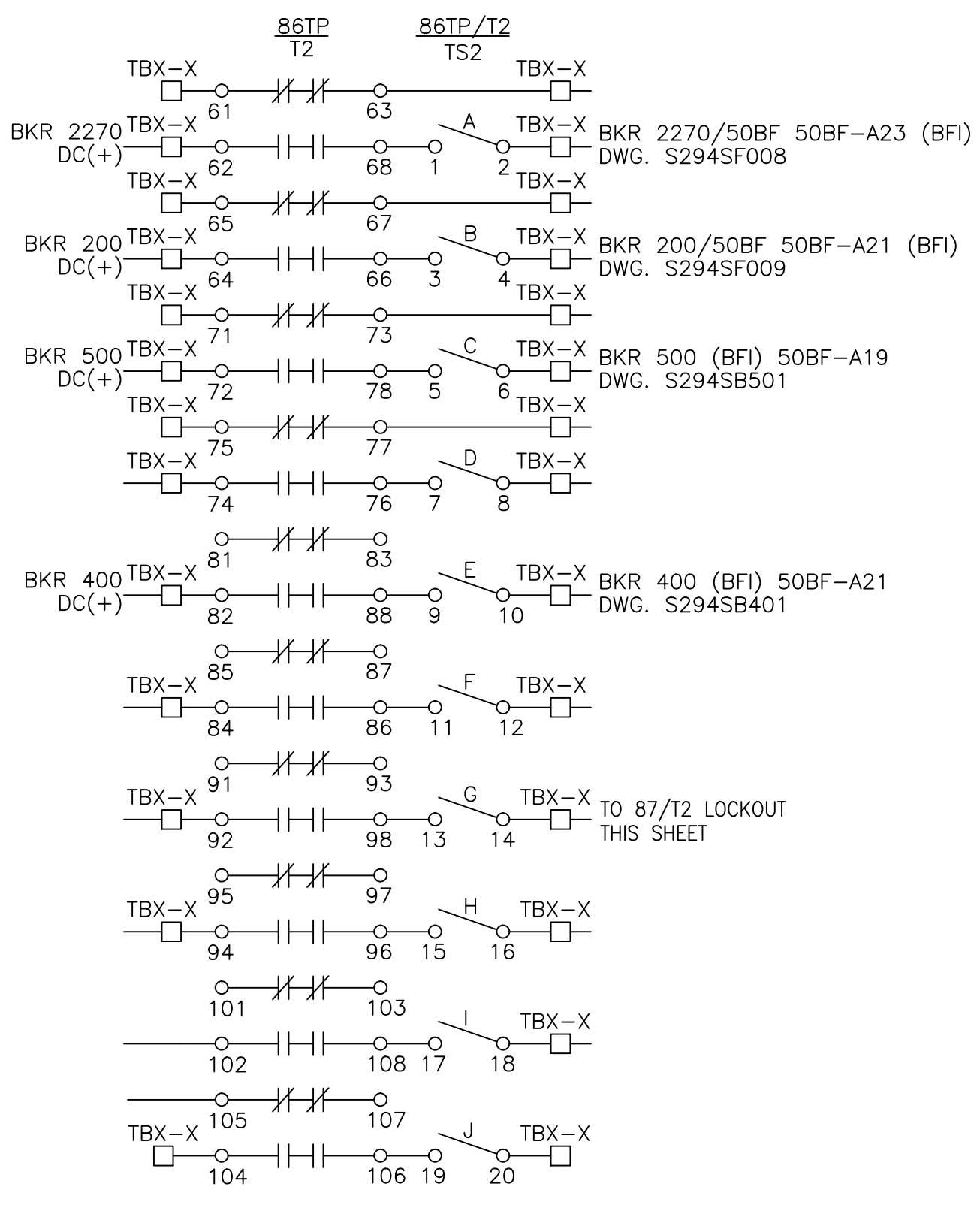
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REV	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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 Last Saved By: Ashulis



DECK	CONTACTS	POSITION	
		0	RESET
1	11 01-10 13	X	
1	12 01-10 18		X
1	15 01-10 17		X
1	14 01-10 16	X	
2	21 01-10 23		X
2	22 01-10 28	X	
2	25 01-10 27		X
2	24 01-10 26	X	
3	31 01-10 33		X
3	32 01-10 38	X	
3	35 01-10 37		X
3	34 01-10 36	X	
4	41 01-10 43		X
4	42 01-10 48	X	
4	45 01-10 47		X
4	44 01-10 46	X	
5	51 01-10 53		X
5	52 01-10 58	X	
5	55 01-10 57		X
5	54 01-10 56	X	
5	61 01-10 63	X	
6	62 01-10 68	X	
6	65 01-10 67		X
6	64 01-10 66	X	
6	71 01-10 73	X	
7	72 01-10 78	X	
7	75 01-10 77	X	
7	74 01-10 76	X	
7	81 01-10 83	X	
8	82 01-10 88	X	
8	85 01-10 87	X	
8	84 01-10 86	X	
8	91 01-10 93	X	
9	92 01-10 98	X	
9	95 01-10 97	X	
9	94 01-10 96	X	
10	101 01-10 103	X	
10	102 01-10 108	X	
10	105 01-10 107	X	
10	104 01-10 106	X	



**LEGEND:**

- ∅ TERMINAL POINT IN CONTROL CABINET
- TERMINAL POINT IN LTC DRIVE MECHANISM (DM)
- 63PR-1X AUXILIARY ALARM RELAY, PRESSURE RELIEF DEVICE MAIN TANK
- 63PR-2X AUXILIARY ALARM RELAY, PRESSURE RELIEF DEVICE LTC TANK

ALL EQUIPMENT ON PANEL 106 UNLESS OTHERWISE NOTED.

**REFERENCE DRAWINGS**

- |            |                                  |
|------------|----------------------------------|
| S294PP104  | PANEL 106 ELEVATION              |
| S294SB2270 | BKR. #2270 SCHEMATIC DIAGRAM     |
| S294SF008  | BKR. #2270 FAILURE & CONTROL     |
| S294SB200  | BKR. #200 SCHEMATIC DIAGRAM      |
| S294SF009  | BKR. #200 FAILURE & CONTROL      |
| S294SB500  | BKR. #500 SCHEMATIC DIAGRAM      |
| S294SB501  | BKR. #500 FAILURE & CONTROL      |
| S294SB400  | BKR. #400 SCHEMATIC DIAGRAM      |
| S294SB401  | BKR. #400 FAILURE & CONTROL      |
| S294SX002  | THREE LINE AC DIAGRAM TRANSF. #2 |
| S294SR03   | RELAY COMMUNICATION DIAGRAM      |
| S294WZ10   | DC POWER PANEL                   |

**ISSUED FOR BID**

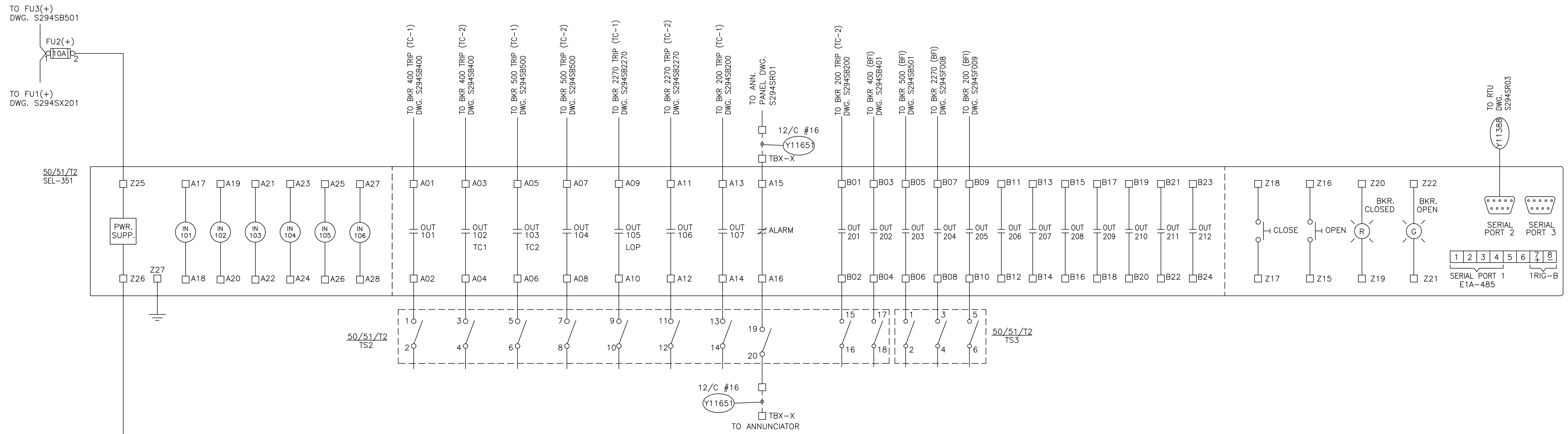
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**TRANSFORMER NO.2 DC SCHEM.-PRIMARY  
 87/T2 DIFF RELAY**

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CH: NN	DATE: 3/7/2011	DRAWING No. S294SX201	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

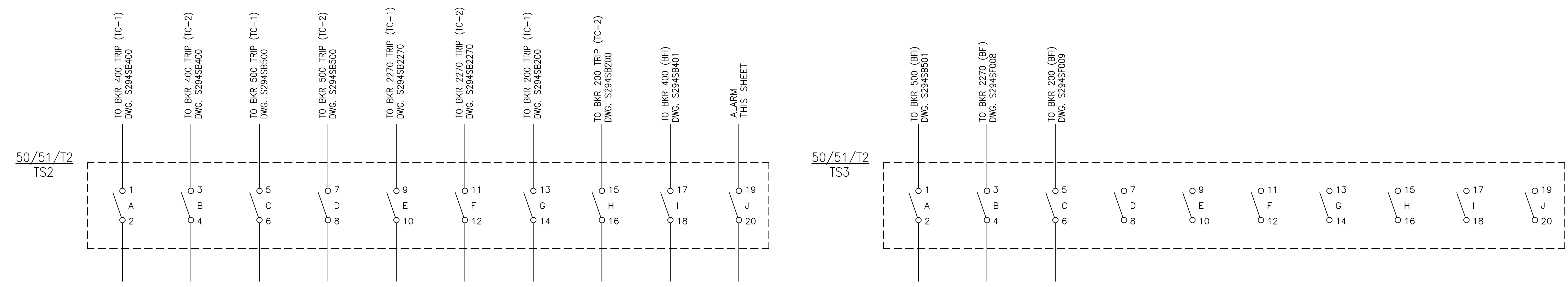
**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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**NOTES**  
 ALL EQUIPMENT ON PANEL 106  
 UNLESS OTHERWISE NOTED

- REFERENCE DRAWINGS**
- |            |                                  |
|------------|----------------------------------|
| S294PP106  | PANEL 106 ELEVATION              |
| S294SB2270 | BKR. #2270 SCHEMATIC DIAGRAM     |
| S294SF008  | BKR. #2270 FAILURE & CONTROL     |
| S294SB200  | BKR. #200 SCHEMATIC DIAGRAM      |
| S294SF009  | BKR. #200 FAILURE & CONTROL      |
| S294SB500  | BKR. #500 SCHEMATIC DIAGRAM      |
| S294SB501  | BKR. #500 FAILURE & CONTROL      |
| S294SB400  | BKR. #400 SCHEMATIC DIAGRAM      |
| S294SB401  | BKR. #400 FAILURE & CONTROL      |
| S294SX002  | THREE LINE AC DIAGRAM TRANSF. #2 |
| S294SR03   | RELAY COMMUNICATION DIAGRAM      |
| S294WZ10   | DC POWER PANEL                   |



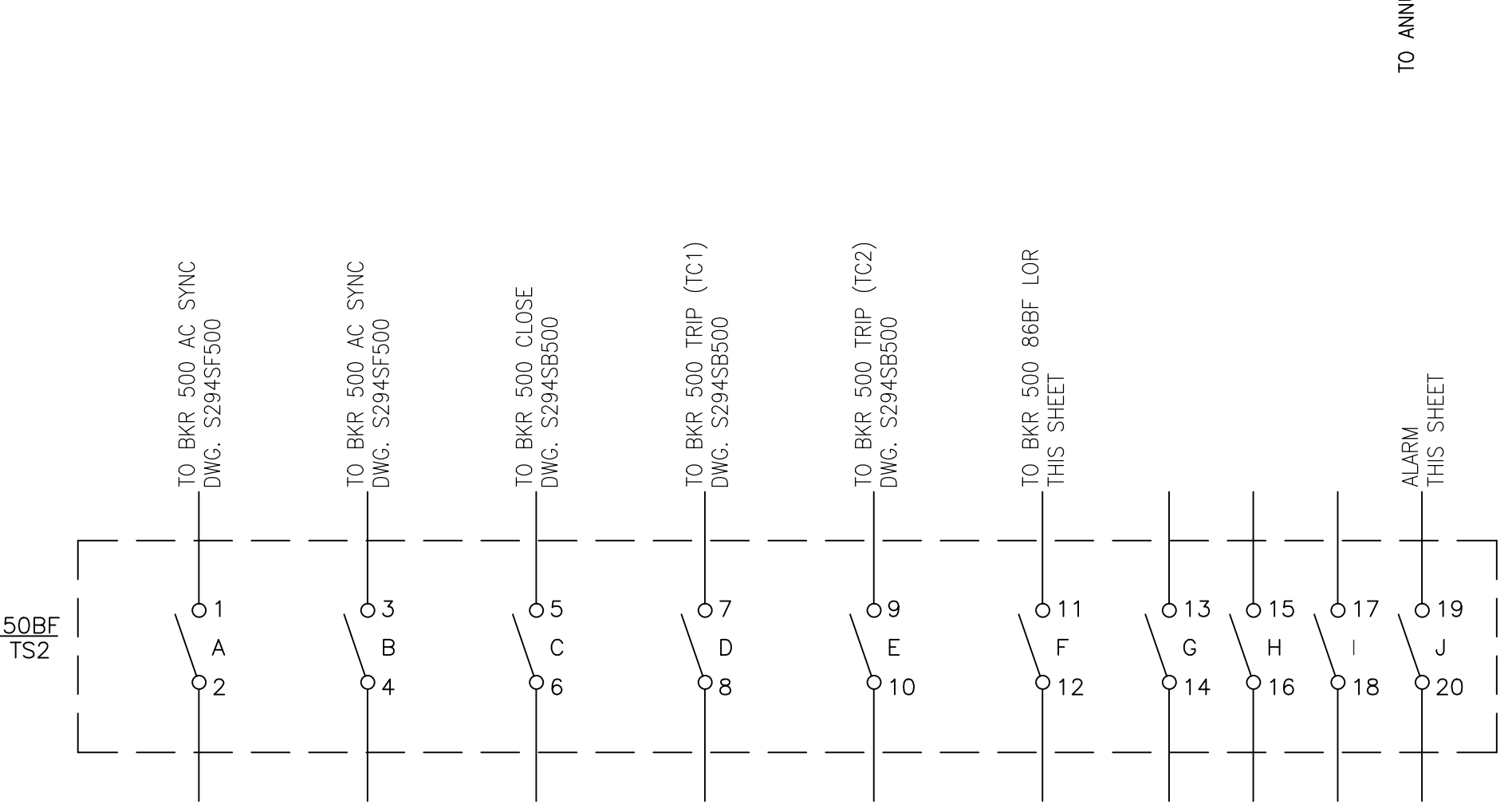
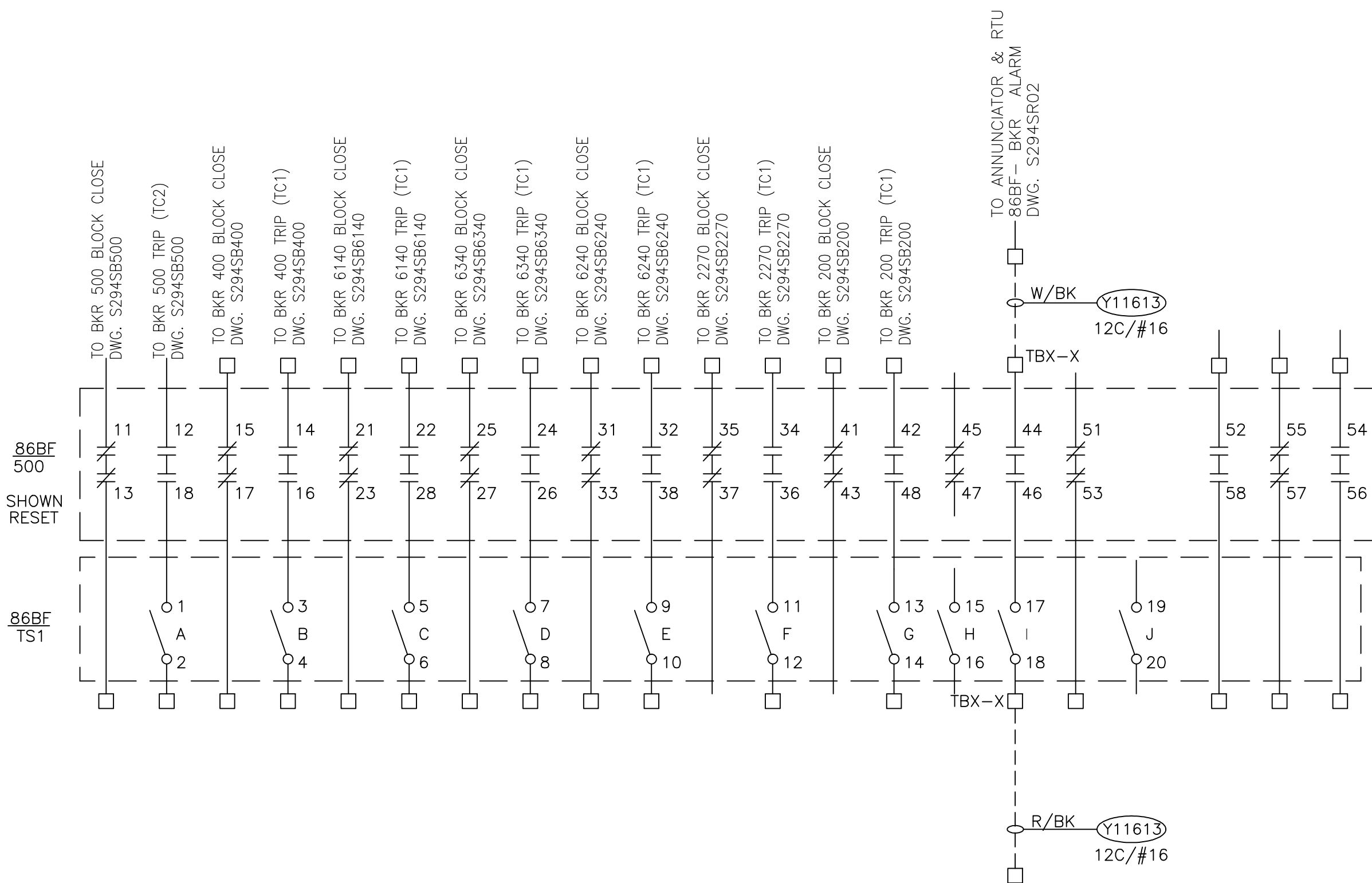
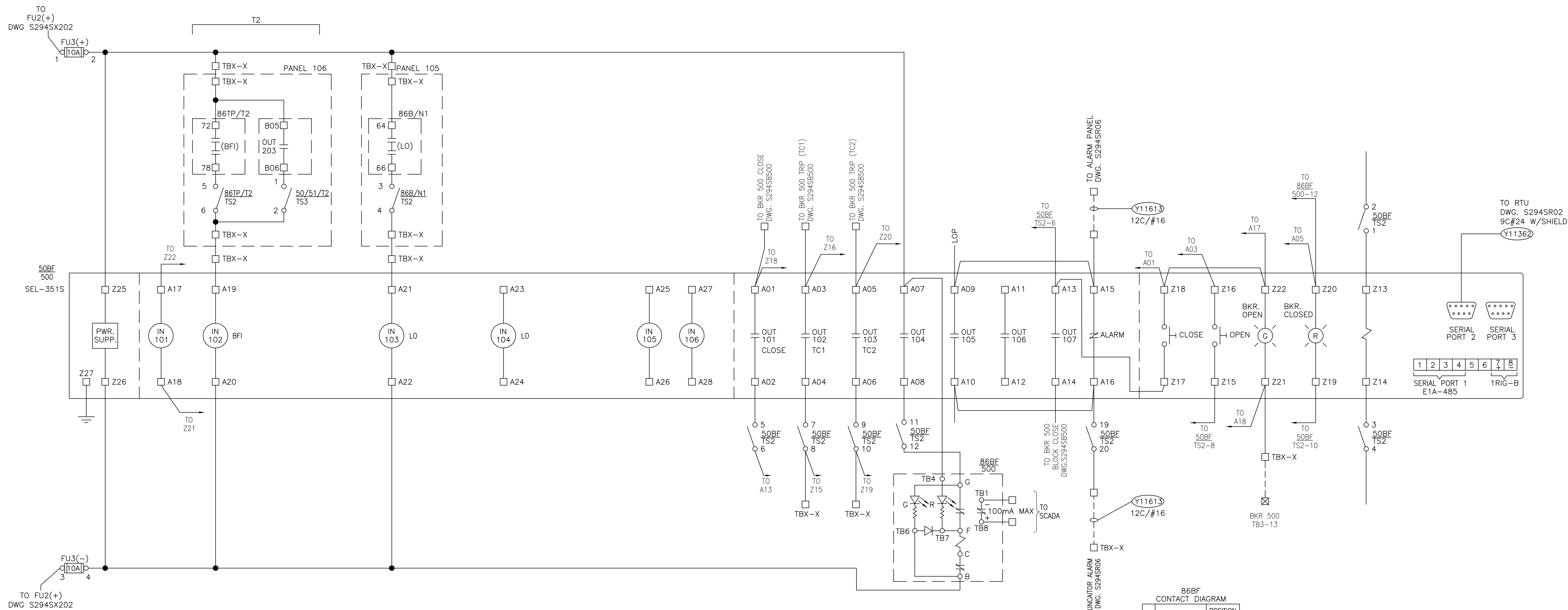
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 TRANSFORMER NO.2 DC SCHEMATIC-ALT.  
 50/51/T2

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CH: NN	DATE: 3/7/2011	DRAWING No. S294SX202	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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**86BF CONTACT DIAGRAM**

DECK	CONTACTS	POSITION	
		TRIP	RESET
1	11 OH-HO 13		X
	12 OH-HO 18	X	
	15 OH-HO 17		X
	14 OH-HO 16	X	
	21 OH-HO 23		X
2	22 OH-HO 28	X	
	25 OH-HO 27		X
	24 OH-HO 26	X	
	31 OH-HO 33		X
	32 OH-HO 38	X	
3	35 OH-HO 37		X
	34 OH-HO 36	X	
	41 OH-HO 43		X
	42 OH-HO 48	X	
	45 OH-HO 47		X
4	44 OH-HO 46	X	
	51 OH-HO 53		X
	52 OH-HO 58	X	
	55 OH-HO 57		X
	54 OH-HO 56	X	
5	61 OH-HO 63		X
	62 OH-HO 68	X	
	65 OH-HO 67		X
	64 OH-HO 66	X	
	71 OH-HO 73		X
6	72 OH-HO 78	X	
	75 OH-HO 77		X
	74 OH-HO 76	X	
	81 OH-HO 83		X
	82 OH-HO 88	X	
7	85 OH-HO 87		X
	84 OH-HO 86	X	
	83 OH-HO 89		X
	86 OH-HO 90	X	

**NOTES:**

- ALL EQUIPMENT IS ON PANEL 106 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**

S294PP106 PANEL 106 ELEVATION  
 S294SB500 BREAKER 500 SCHEMATIC DIAGRAM  
 S294SX201 TRANSFORMER #2 PRIMARY DIFF. RELAY  
 S294SX202 TRANSFORMER #2 ALTERNATE OVERCURRENT RELAY  
 S294SR02 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM  
 S294SR03 RELAY COMMUNICATIONS DIAGRAM

TERMINAL BLOCK LOCATED IN THIS PANEL

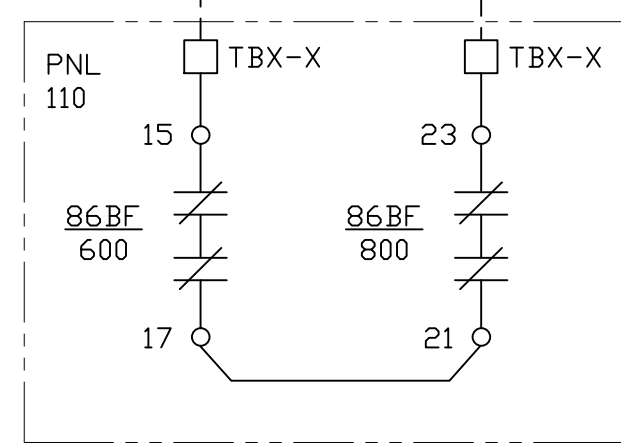
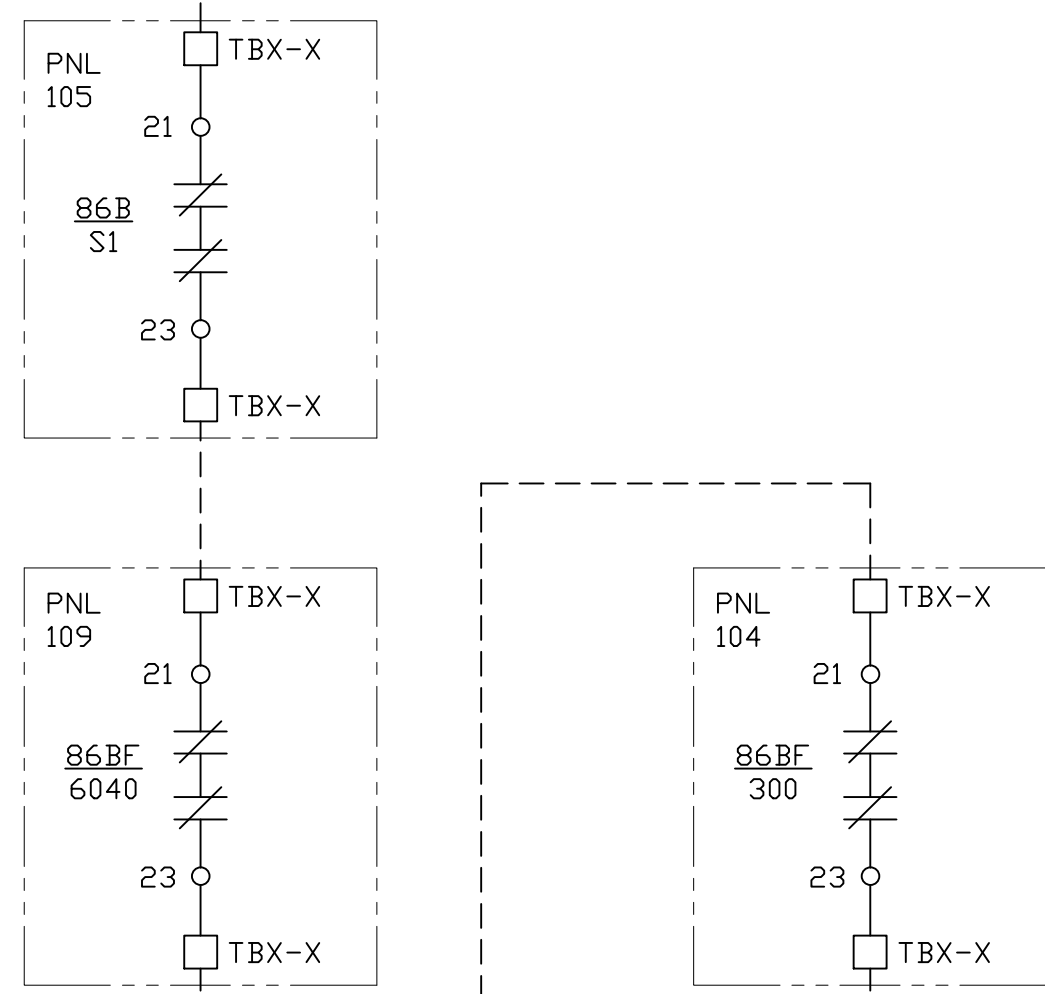
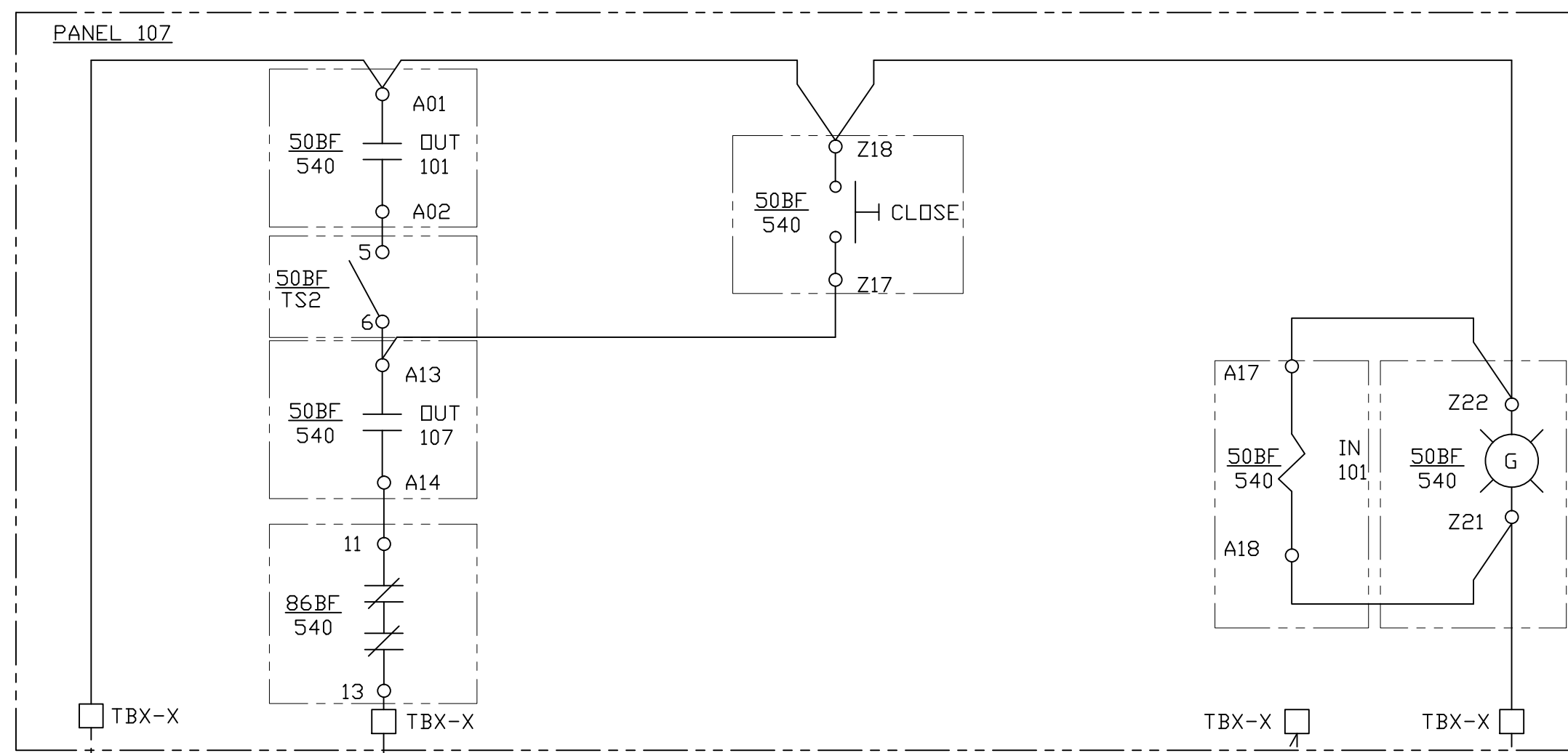
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 500 FAILURE AND CONTROL**  
**69KV BUS NORTH N**

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB501	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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DC CLOSE CIRCUIT

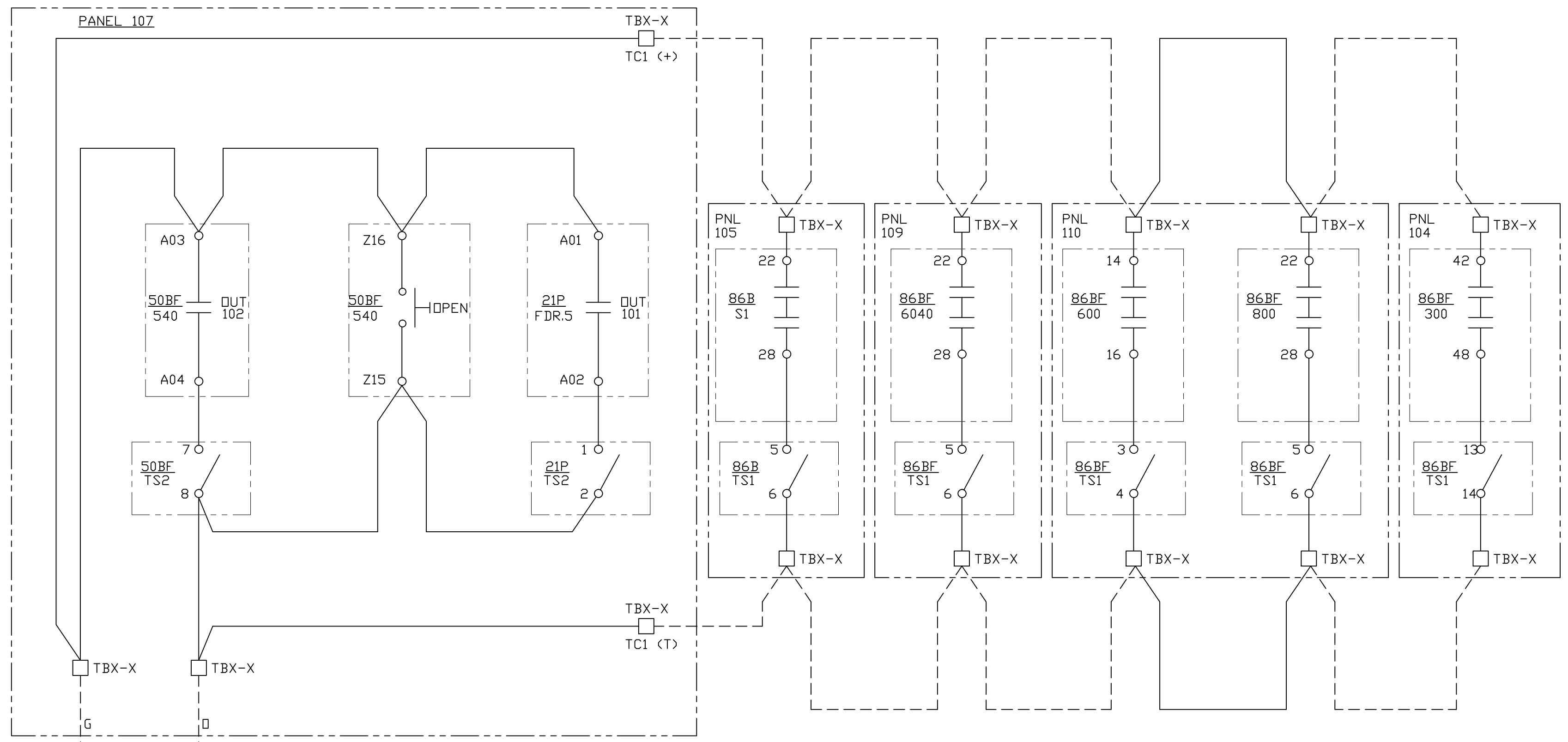
TO BREAKER 540  
DWG. S294SB540a

Y11408

THIS EQUIPMENT LOCATED IN RELAY PANEL  
THIS EQUIPMENT LOCATED IN BREAKER

TB1 05 TB2 7R TB3 13

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

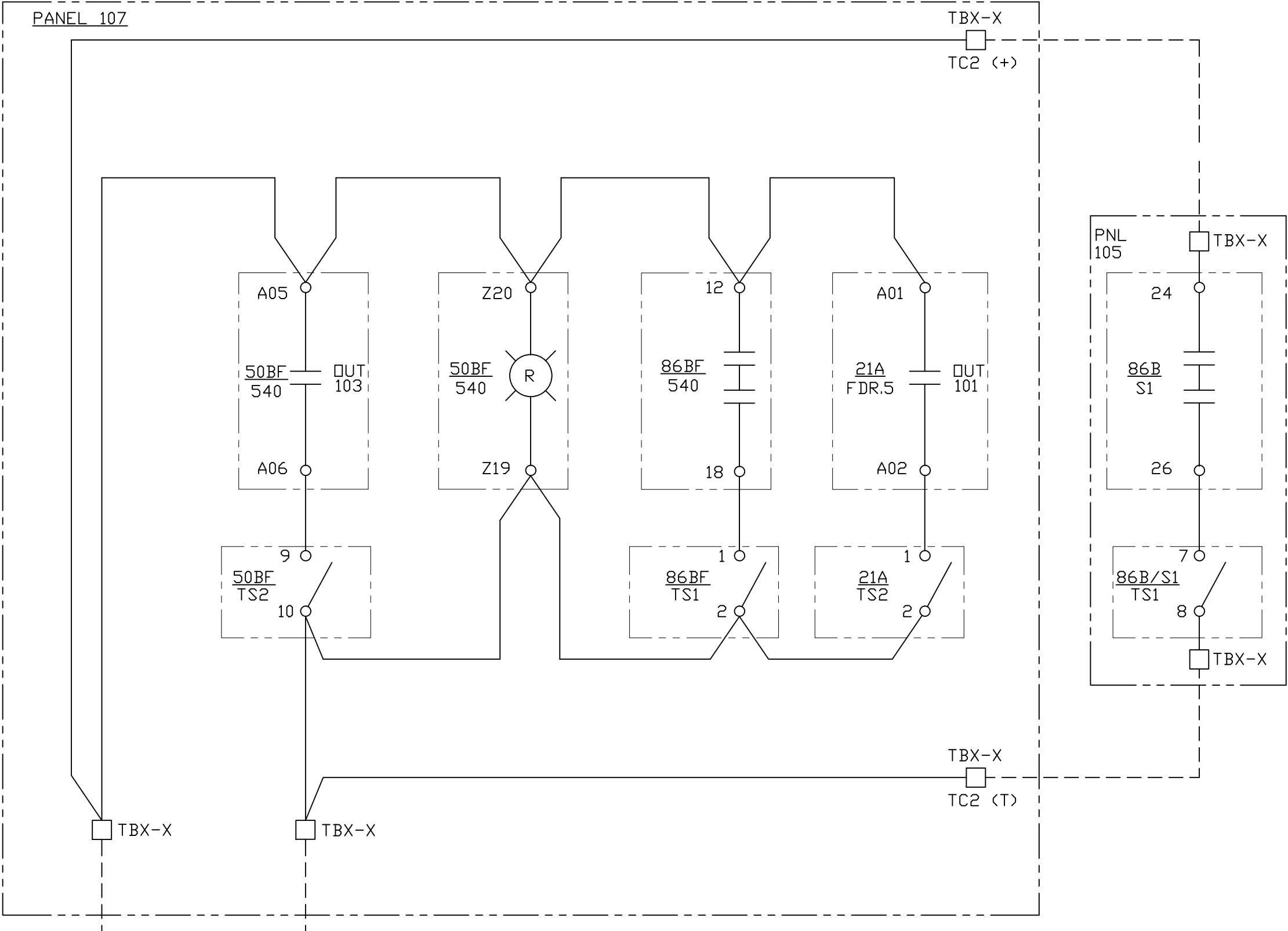


Y11408 TO BREAKER 540  
DWG. S294SB540a

THIS EQUIPMENT LOCATED IN RELAY PANEL  
THIS EQUIPMENT LOCATED IN BREAKER

TB2 11 TB2 9R

DC TRIP CIRCUIT 1



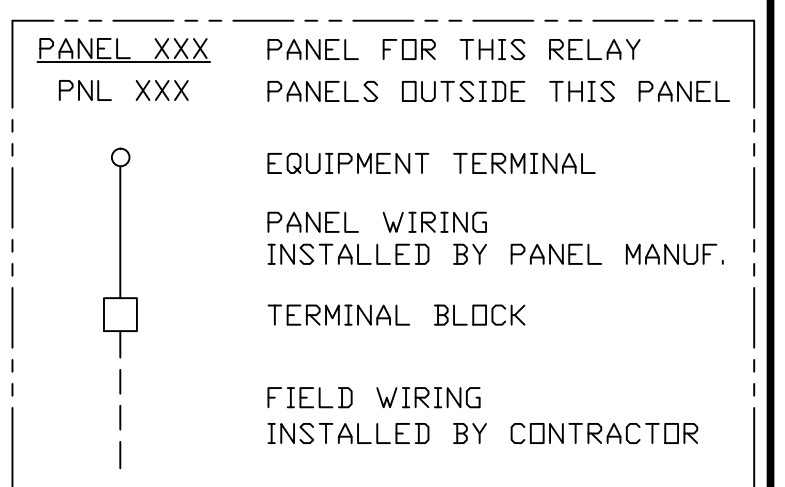
Y11408 TO BREAKER 540  
DWG. S294SB540a

THIS EQUIPMENT LOCATED IN RELAY PANEL  
THIS EQUIPMENT LOCATED IN BREAKER

TB2 11A TB2 9AR

DC TRIP CIRCUIT 2

NOTE: SEE DRAWING S294SB540a FOR CIRCUIT BREAKER DC SCHEMATIC.



EQUIPMENT SHOWN INSIDE BOX LOCATED IN PANEL NUMBER DESIGNATED AT TOP LEFT

REFERENCE DRAWINGS

- |            |                                |
|------------|--------------------------------|
| S294SB540a | BKR 540 ACDC SCHEMATIC DIAGRAM |
| S294PP104  | TRANSFORMER NO 1 & BKR 300     |
| S294PP105  | BKR 400 & 69kV BUS DIFF ZONE   |
| S294PP107  | SOUTH S1 & NORTH N1            |
| S294PP109  | FDR 5-69kV PENSACOLA           |
| S294PP110  | 109 FDR 60-69kV VINITA         |
|            | FDR 63-69kV MONKEY ISLAND      |

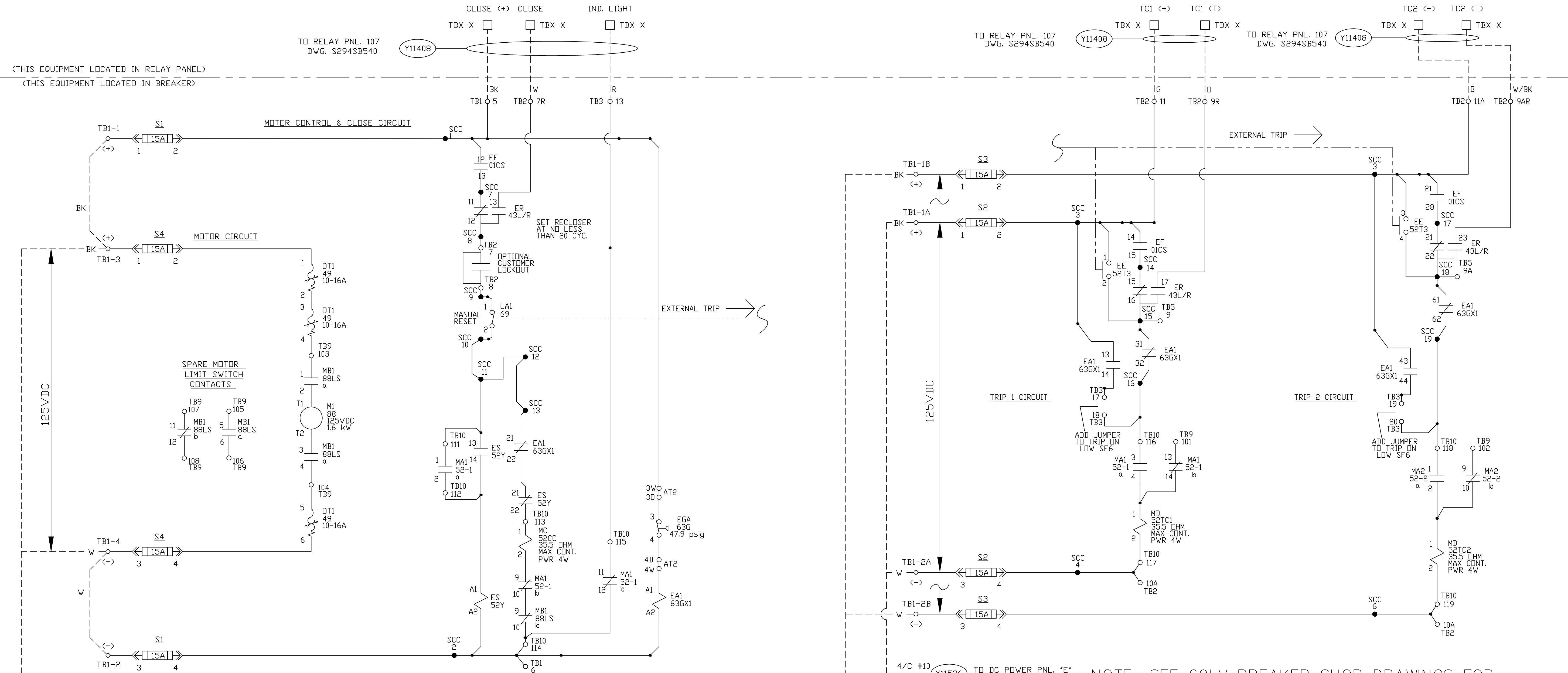
ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
<b>BREAKER 540</b> DC SCHEMATIC DIAGRAM			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294SB540</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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4/C #8 Y11535 TO DC POWER PNL. 'E'  
DWG. S294WZ11

4/C #10 Y11536 TO DC POWER PNL. 'E'  
DWG. S294WZ11

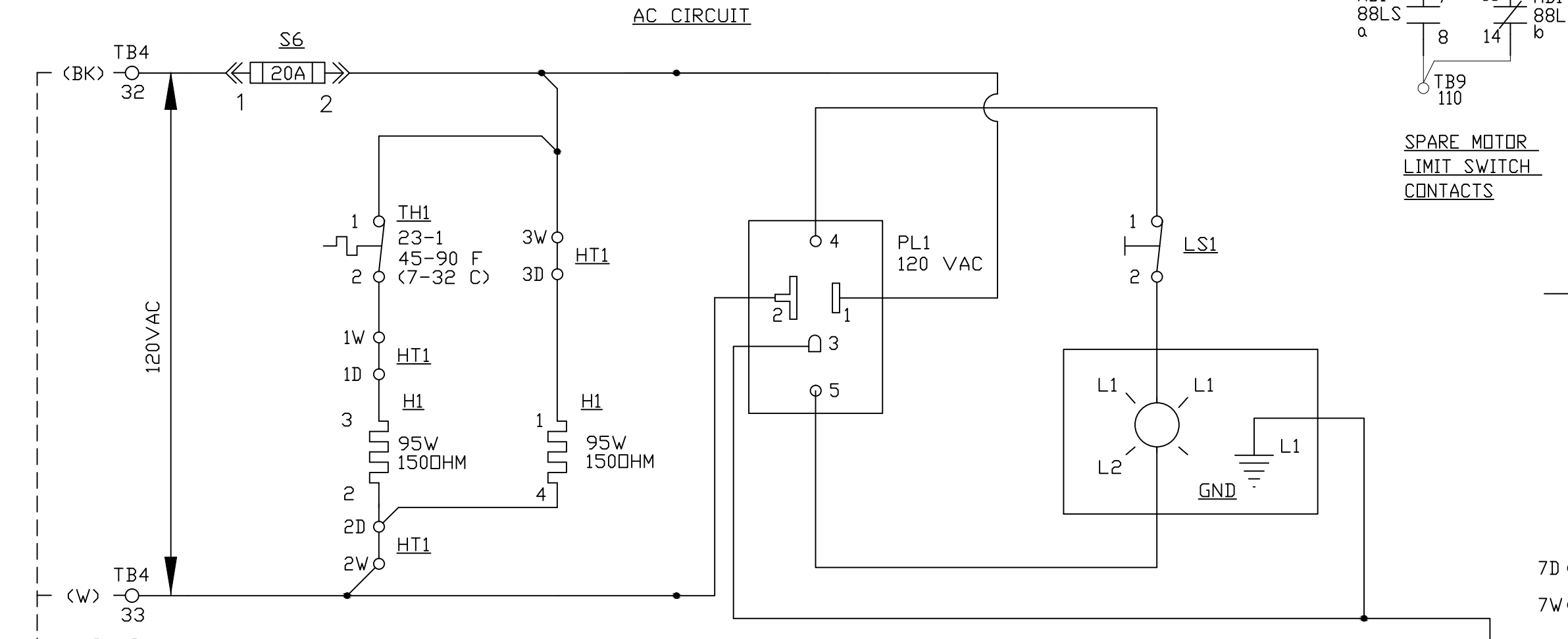
4/C #10 Y11537 TO DC POWER PNL. 'E'  
DWG. S294WZ11

NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

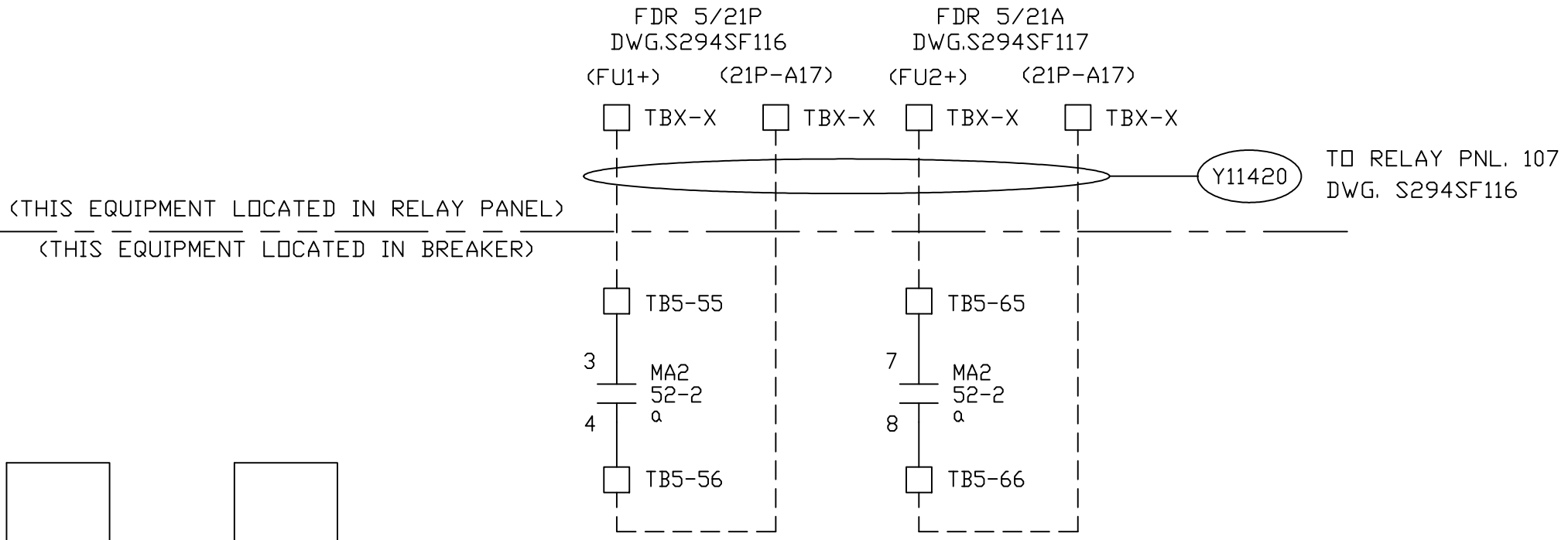
REFERENCE DRAWINGS

- S294SB540 BKR 540 DC SCHEMATIC DIAGRAM
- S294PP107 FDR 5-69 kV PENSACOLA
- S294SF116 116 21P FDR 5-PENSACOLA 69kV CIRCUIT
- S294PP117 117 21A FDR 5-PENSACOLA 69kV CIRCUIT

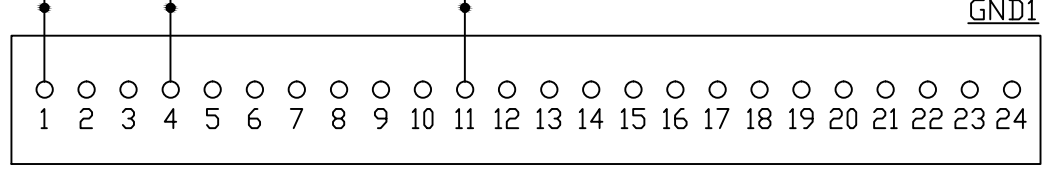


4/C #8 Y11324 TO AC POWER PNL. 'C'  
DWG. S294SD003

4/C #8 Y11324A TO BKR 600  
DWG. S294SB600a



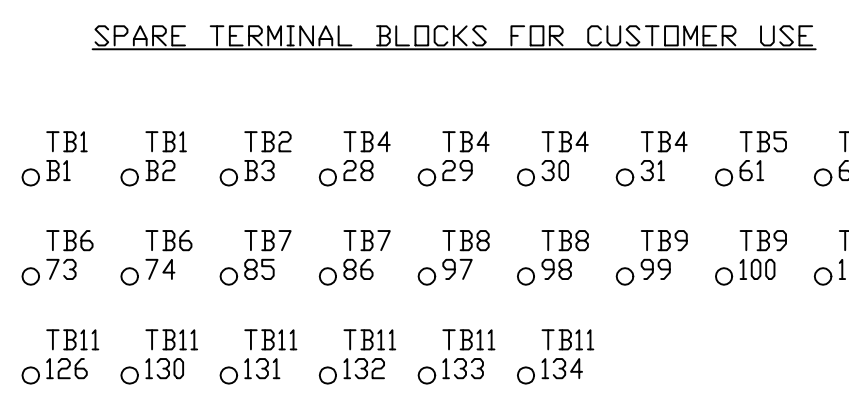
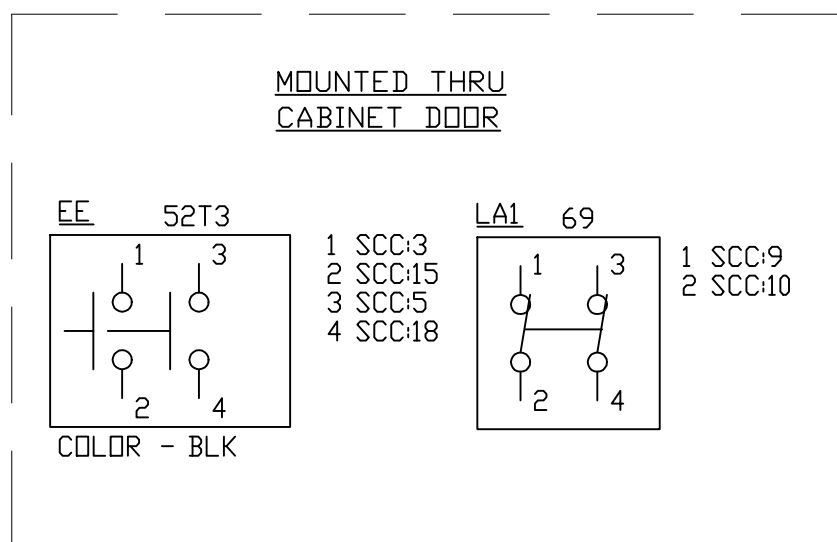
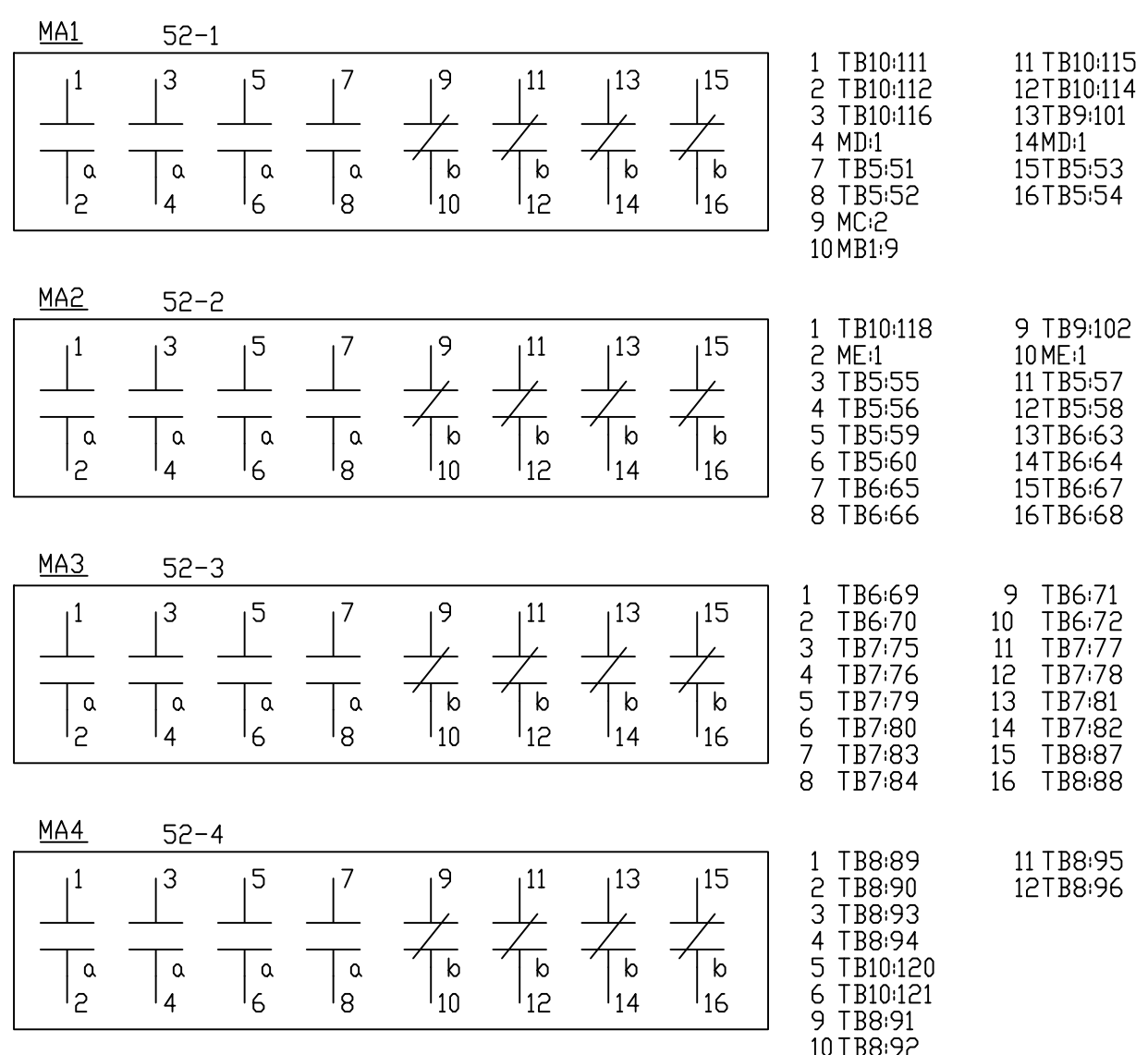
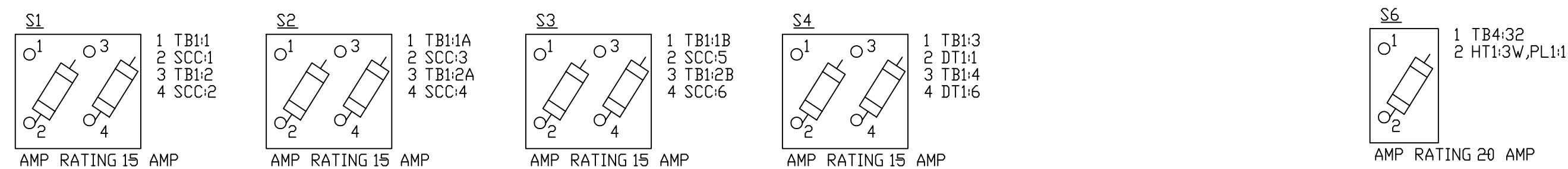
(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)



REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 16/691KV <b>BREAKER 540</b> <b>AC/DC SCHEMATIC DIAGRAM</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB540a	
REV: 0	DATE: 4/23/12	ISSUED FOR BID	AS NN

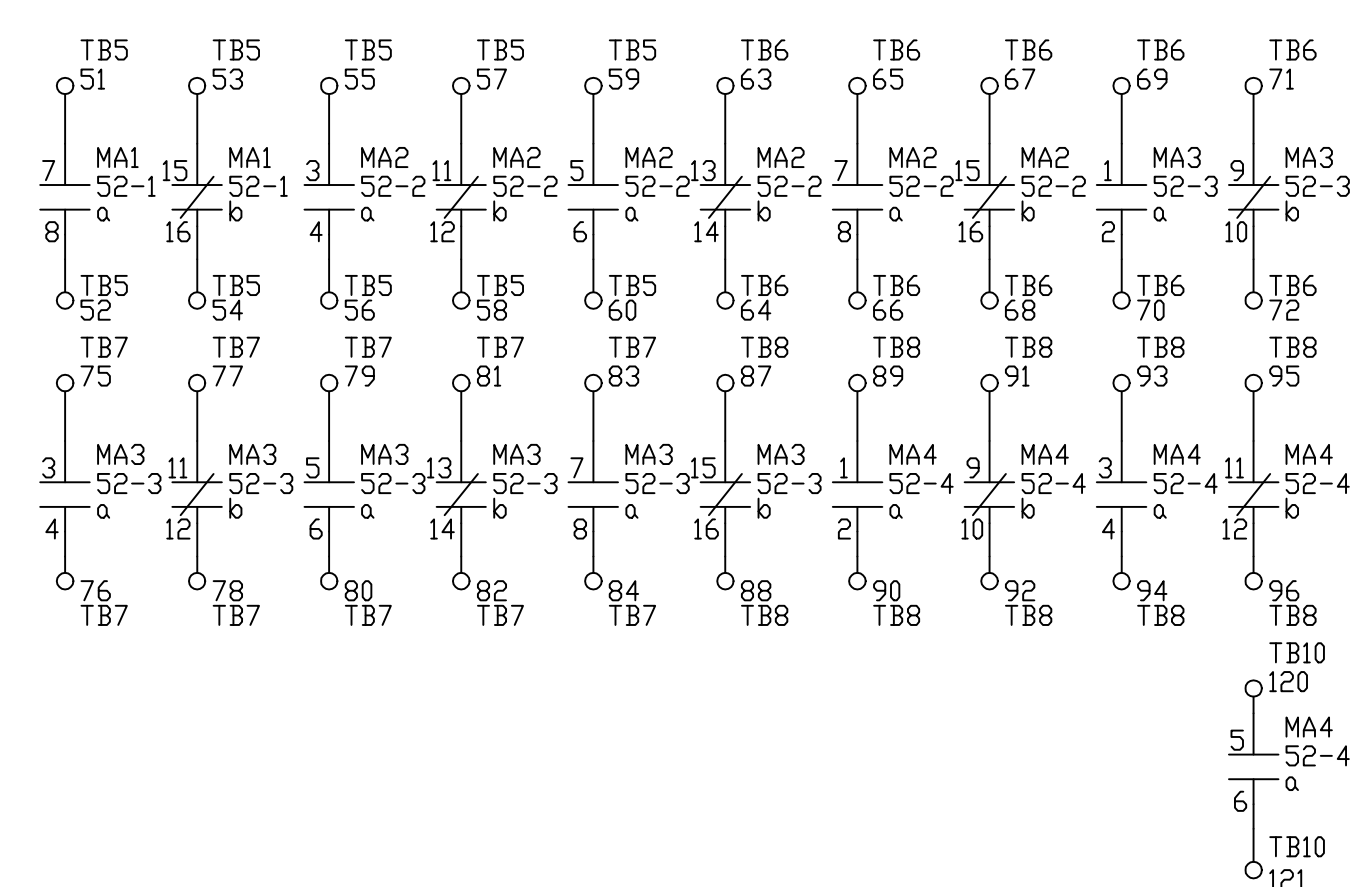
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 Last Plotted by: Shultz, Arlene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/24/2012 7:00 AM Plotter used: DWG To PDF.pc3



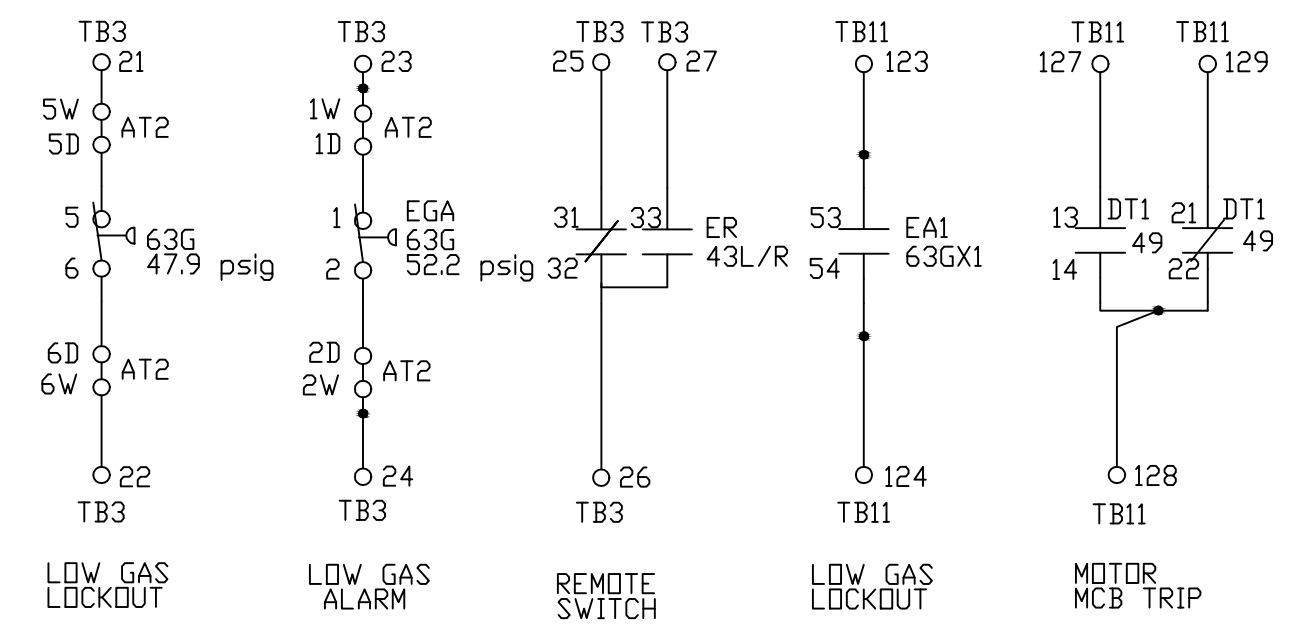
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



REFERENCE DRAWINGS  
 S294SB540 BKR 540 DC SCHEMATIC DIAGRAM  
 S294SB2270a BKR 540 ACDC BREAKER AUXILIARIES

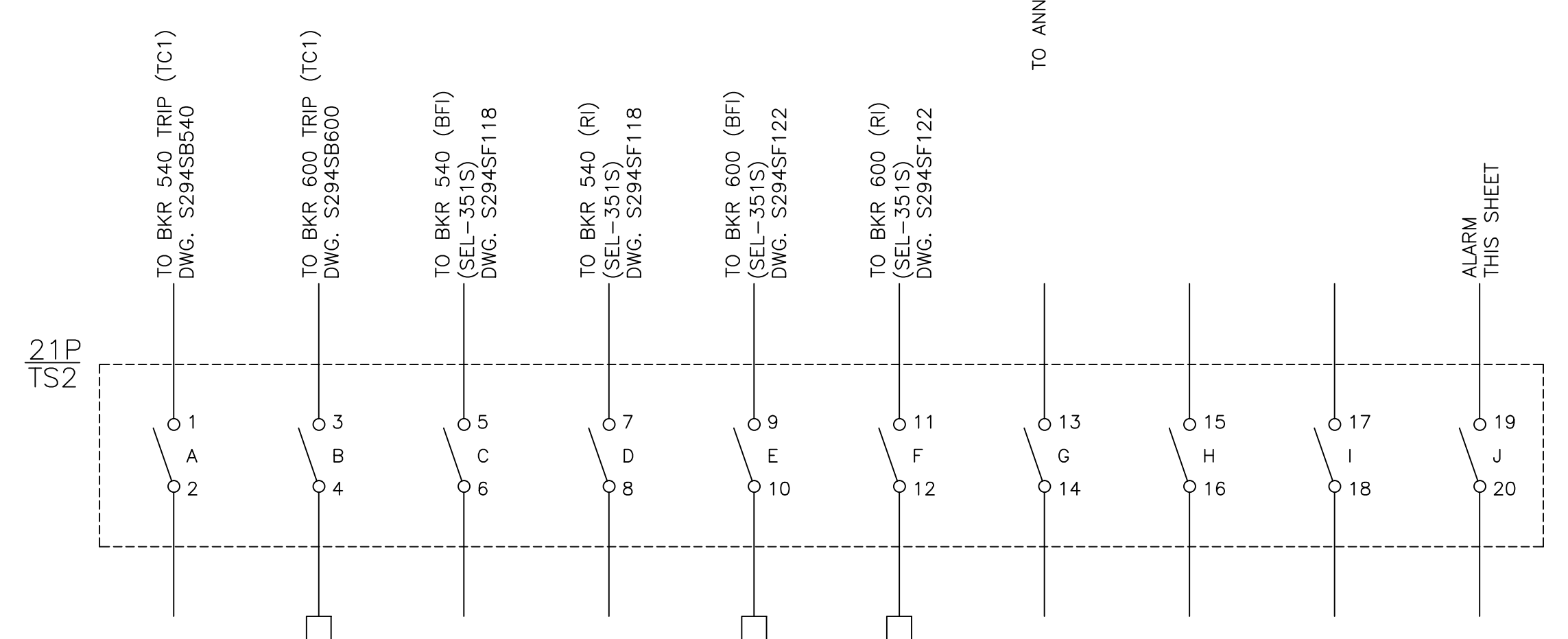
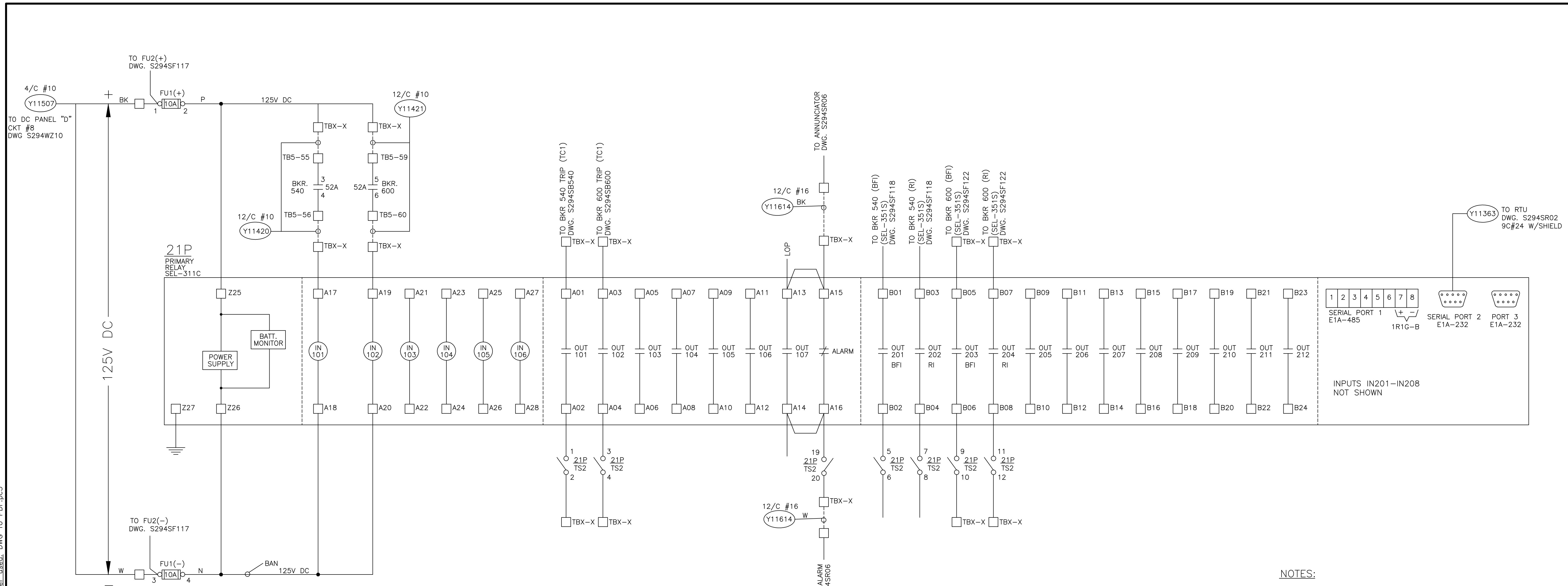
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 540**  
**BREAKER AUXILIARIES**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN		DATE: 3/7/2011	
		DRAWING No.	REV.
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		S294SB540b	0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

File: W:\Drafting\Drawings\Substation\AFTON\Garver CAD Drawings 2-16-12\GRDA\_E646\_S294SF116\_21P\_FDR 5-PENSACOLA 69kV CIRCUIT.dwg Last\_Save: 4/24/2012 7:12 AM Last\_saved\_by: Ashultz  
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NOTES:  
 ALL DEVICES IN PANEL 107 UNLESS NOTED OTHERWISE.

- REFERENCE DRAWINGS
- S294PP107 PANEL 107 ELEVATION
  - S294SB540 BREAKER 540 SCHEMATIC DIAGRAM
  - S294SB600 BREAKER 600 SCHEMATIC DIAGRAM
  - S294SF117 ALTERNATE RELAY FDR. #5
  - S294SF118 BREAKER FAILURE & RECLOSE BKR. 540
  - S294SF107 THREE LINE AC DIAGRAM
  - S294SF122 BREAKER FAILURE & RECLOSE BKR. 600
  - S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM
  - S294SR06 ANNUNCIATOR NAME PLATE 01
  - S294WZ10 DC POWER PANEL DIAGRAM

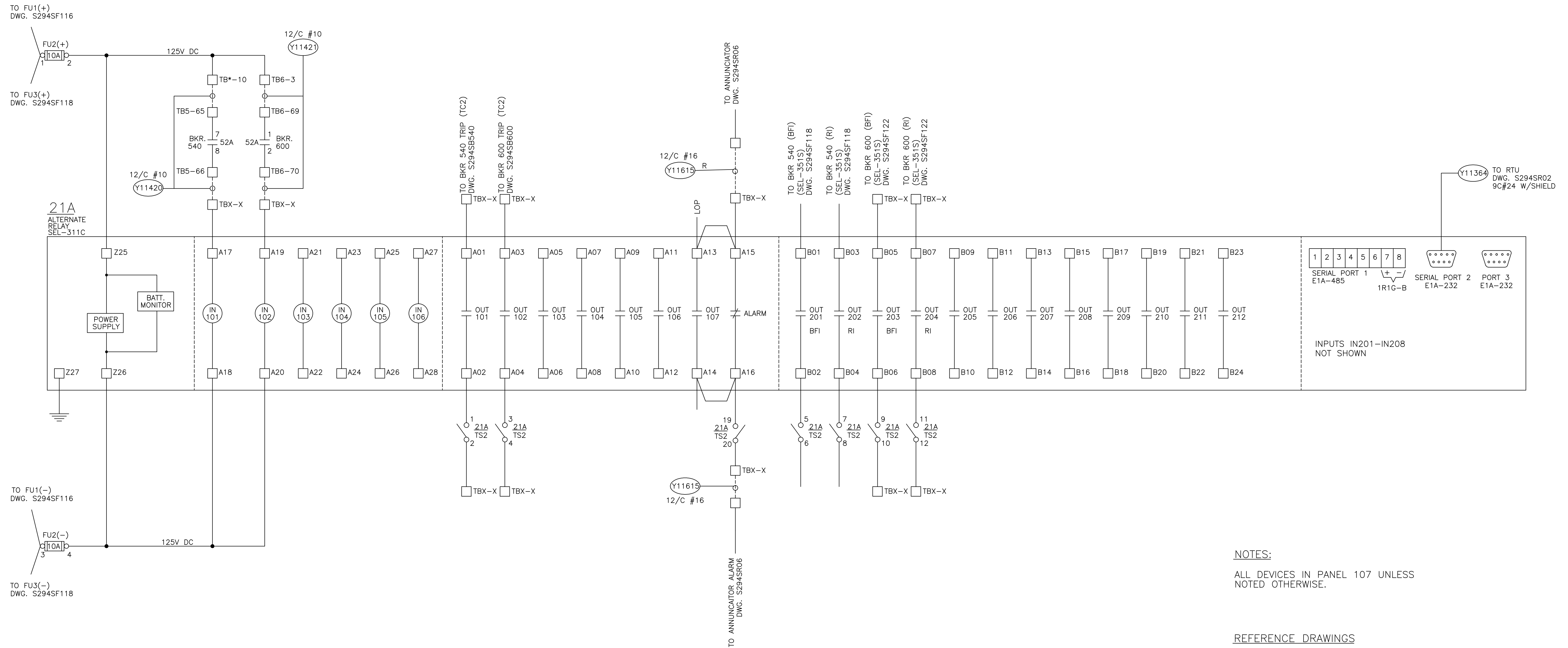
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 161/69KV  
 21P  
 69KV FDR 5-PENSACOLA CIRCUIT

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN		DATE: 3/7/2011	
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294SF116	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

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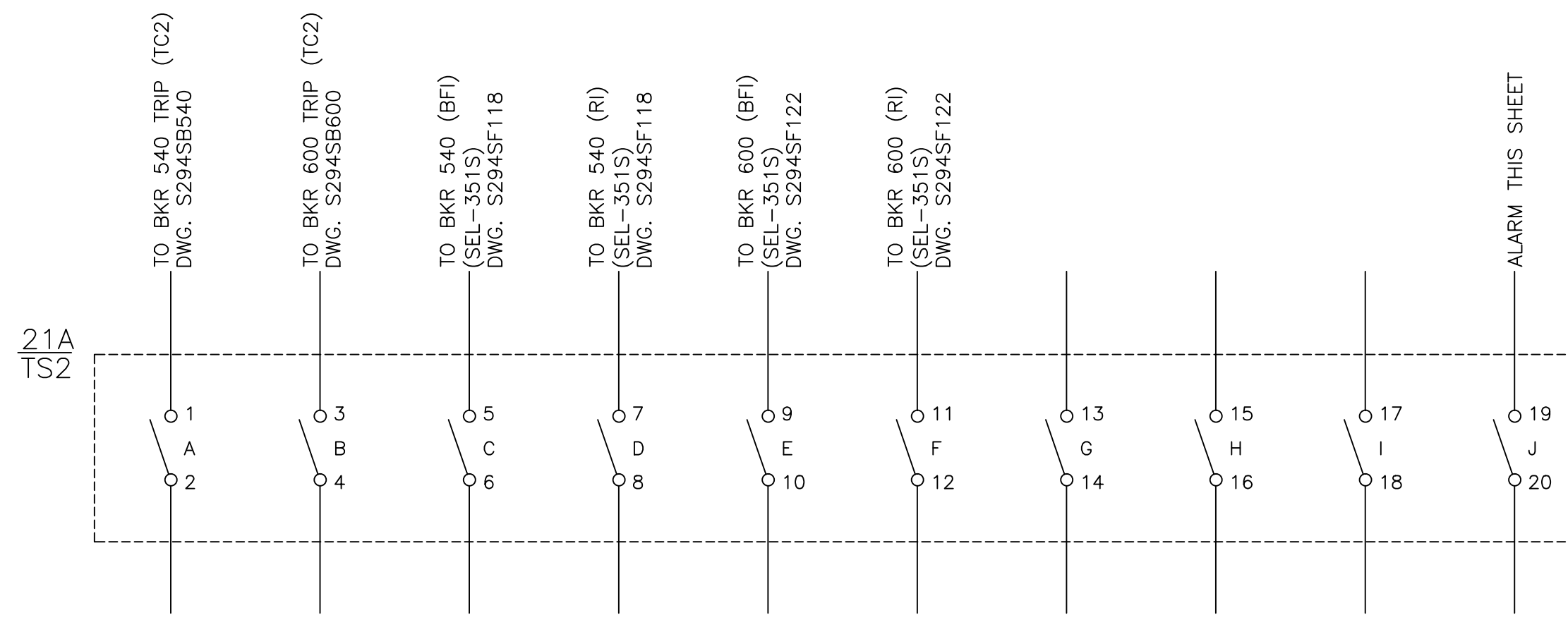


**NOTES:**

ALL DEVICES IN PANEL 107 UNLESS NOTED OTHERWISE.

**REFERENCE DRAWINGS**

- S294PP107 PANEL 107 ELEVATION
- S294SB540 BREAKER 540 SCHEMATIC DIAGRAM
- S294SB600 BREAKER 600 SCHEMATIC DIAGRAM
- S294SF107 THREE LINE DIAGRAM BKR. 540 & FDR. 5
- S294SF116 PRIMARY RELAY FDR. 5
- S294SF118 BREAKER FAILURE & RECLOSE BKR. 540
- S294SF122 BREAKER FAILURE & RECLOSE BKR. 600
- S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SR06 ANNUNCIATOR NAME PLATE 01



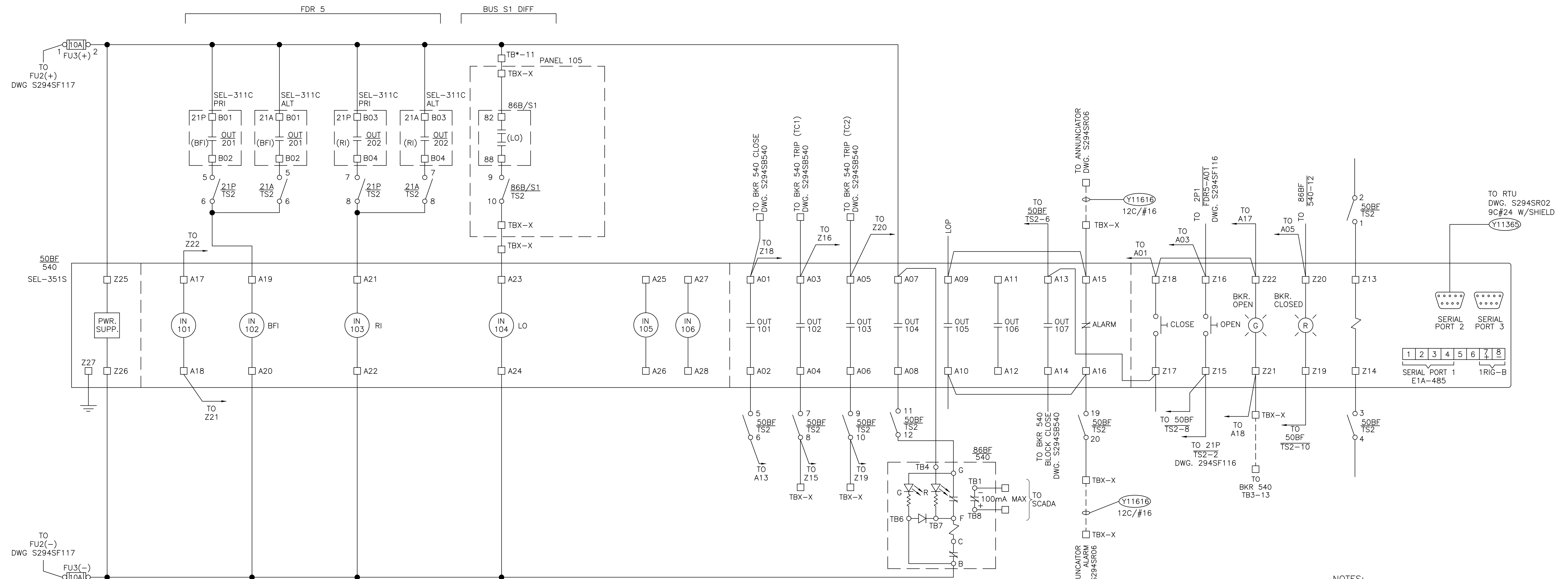
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REV	DATE	REVISION DESCRIPTION	DFT	ENG

**ISSUED FOR BID**

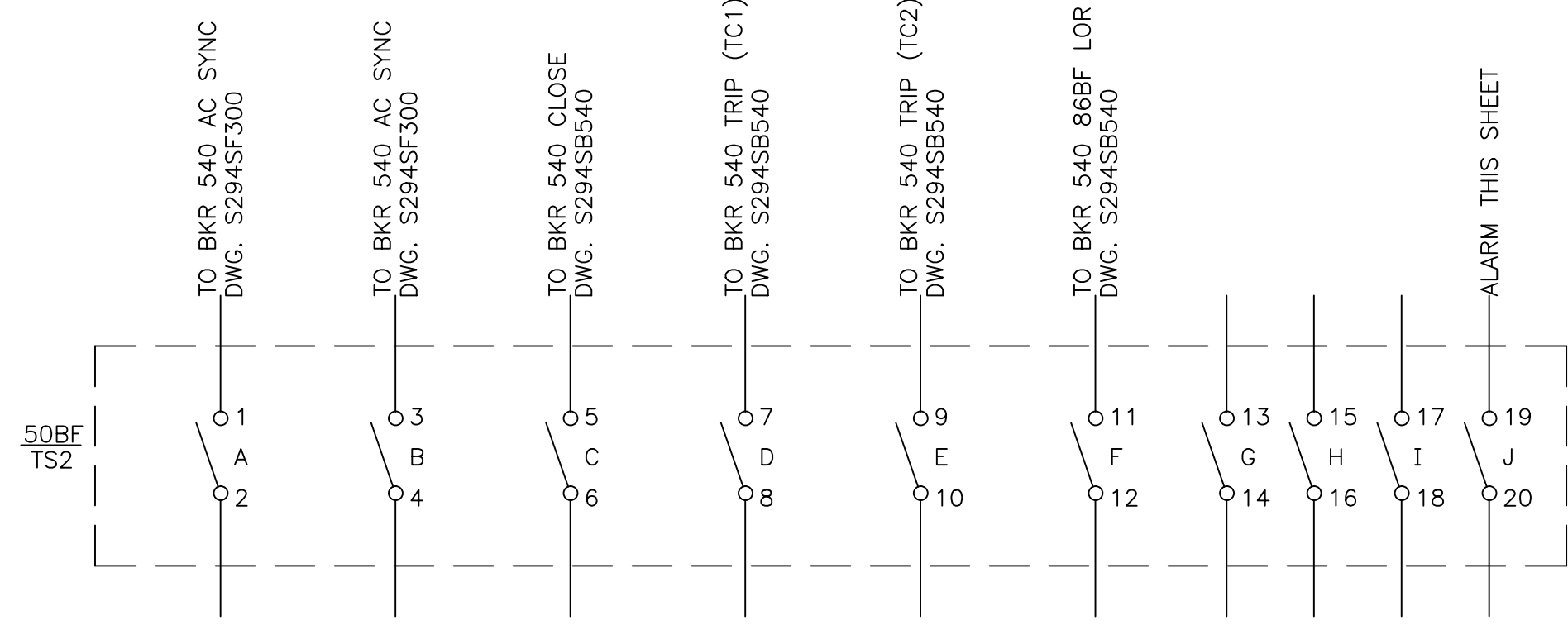
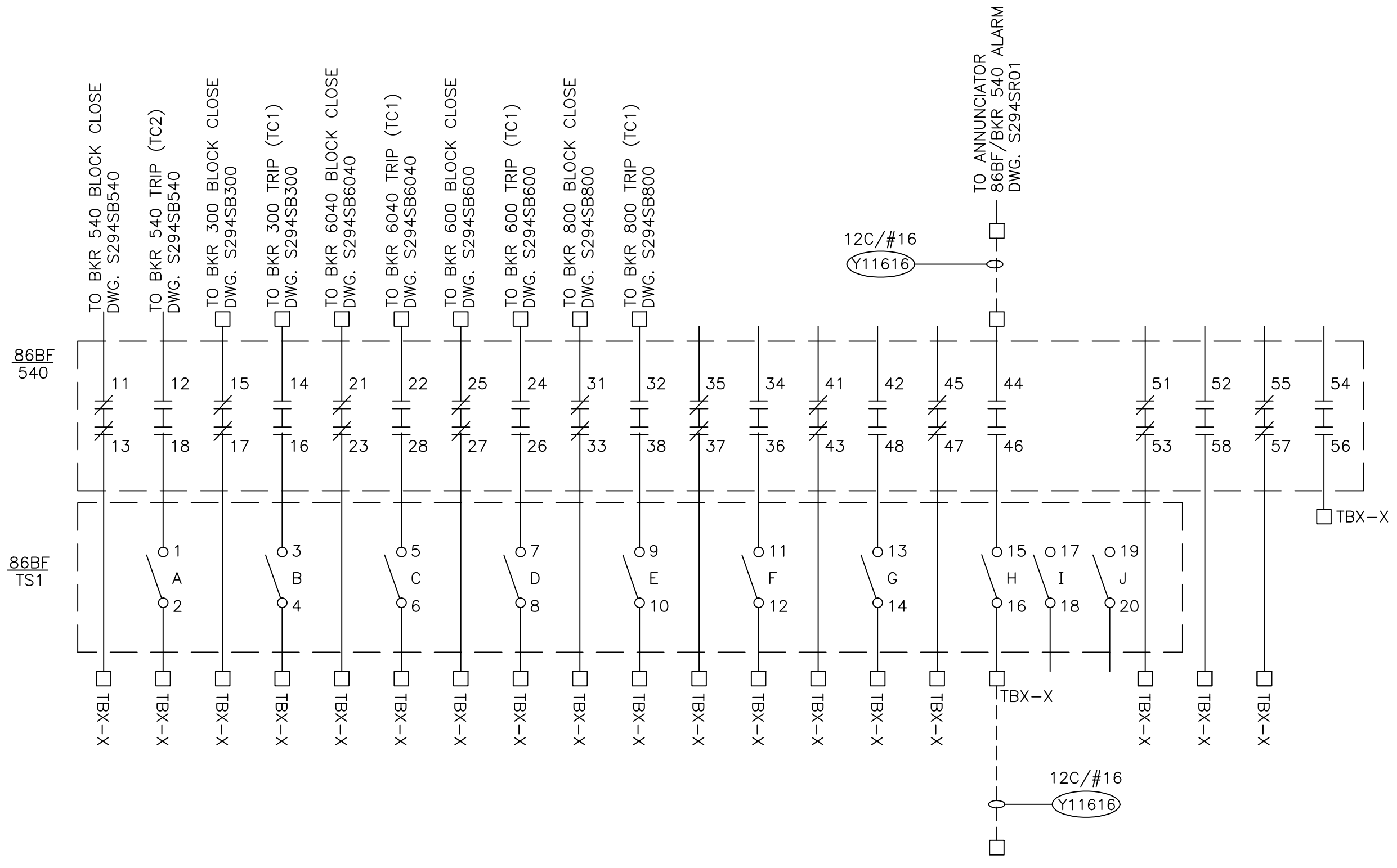
**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
**21A**  
 FDR 5-PENSACOLA 69KV CIRCUIT

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
		CH: NN	DATE: 3/7/2011
<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. S294SF117	REV. 0

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NOTES:  
 1. ALL EQUIPMENT IS ON PANEL 107 UNLESS OTHERWISE NOTED



86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION
		TRIP RESET
1	11 01-10 13	X
1	12 01-10 18	X
1	15 01-10 17	X
1	14 01-10 16	X
2	21 01-10 23	X
2	22 01-10 28	X
2	25 01-10 27	X
2	24 01-10 26	X
3	31 01-10 33	X
3	32 01-10 38	X
3	35 01-10 37	X
3	34 01-10 36	X
4	41 01-10 43	X
4	42 01-10 48	X
4	45 01-10 47	X
4	44 01-10 46	X
5	51 01-10 53	X
5	52 01-10 58	X
5	55 01-10 57	X
5	54 01-10 56	X
6	61 01-10 63	X
6	62 01-10 68	X
6	65 01-10 67	X
6	64 01-10 66	X
7	71 01-10 73	X
7	72 01-10 78	X
7	75 01-10 77	X
7	74 01-10 76	X
8	81 01-10 83	X
8	82 01-10 88	X
8	85 01-10 87	X
8	84 01-10 86	X

- REFERENCE DRAWINGS
- S294SB540 BREAKER 540 SCHEMATIC DIAGRAM
  - S294SF116 PRIMARY RELAY FEEDER 5
  - S294SF117 ALTERNATE RELAY FEEDER 5
  - S294SF107 THREE LINE AC DIAGRAM BREAKER 540 & FDR. 5
  - S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM
  - S294SR06 ANNUNCIATOR NAME PLATE 01
  - S294SB600 BREAKER 600 SCHEMATIC DIAGRAM
- ☒ TERMINAL BLOCK LOCATED IN THIS PANEL

ISSUED FOR BID

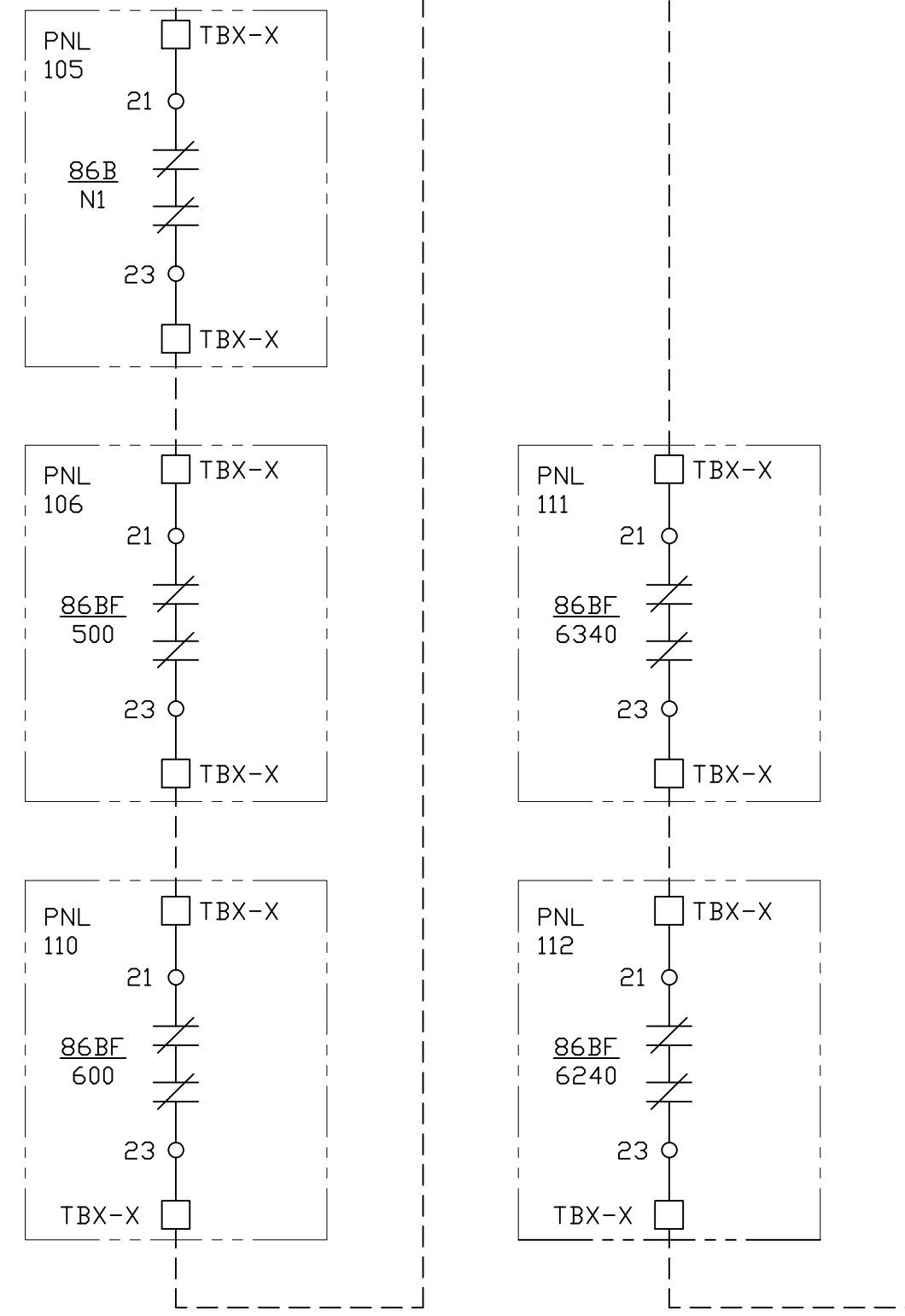
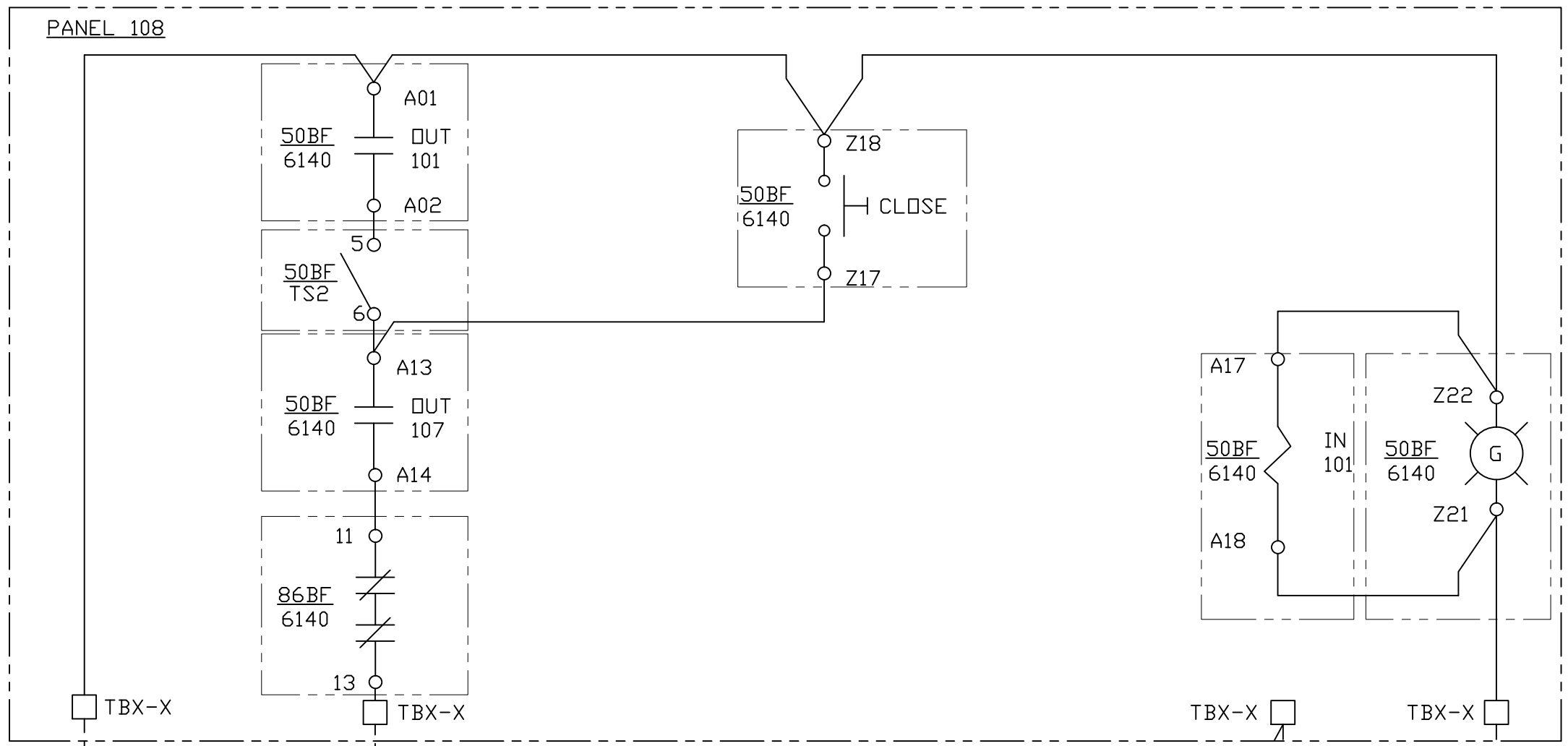
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

BKR 540 FAILURE & CONTROL  
 FDR 5-PENSACOLA 69KV CIRCUIT

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SF118	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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DC CLOSE CIRCUIT

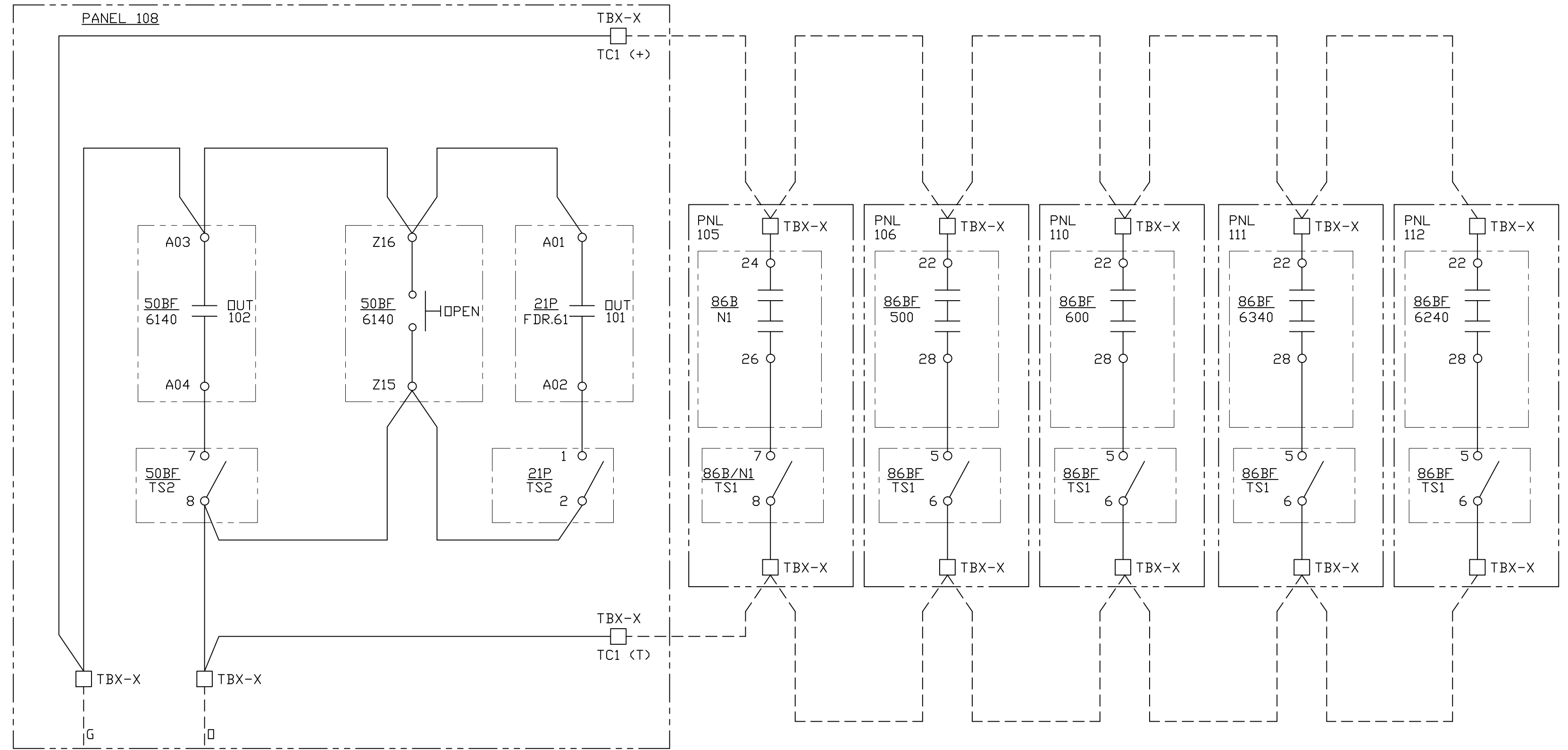
TO BREAKER 6140  
DWG. S294SB6140a



(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

TB1 0 5 TB2 0 7R TB3 0 13

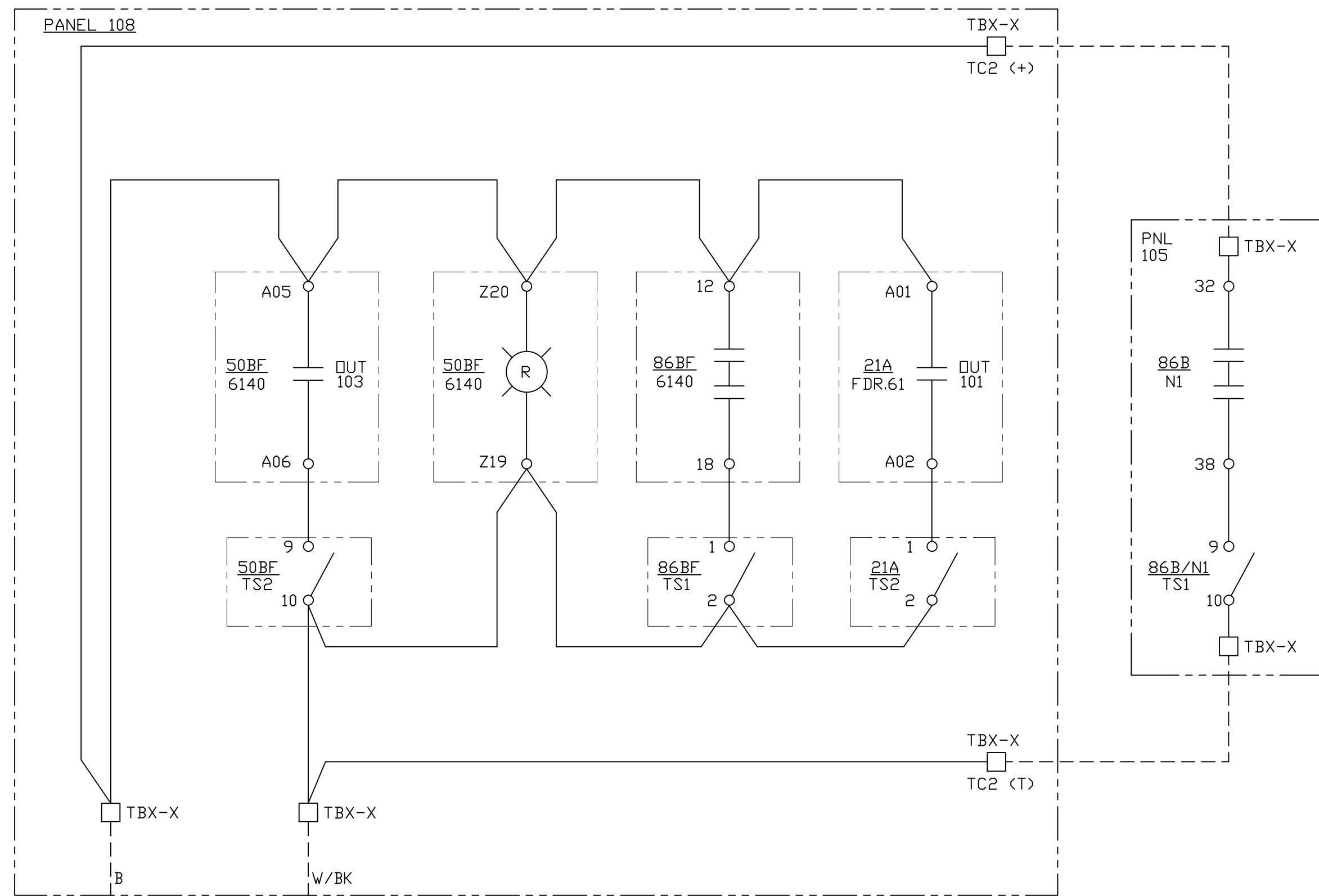
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION



Y11410 TO BREAKER 6140  
DWG. S294SB6140a  
(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

TB2 0 11 TB2 0 9R

DC TRIP CIRCUIT 1

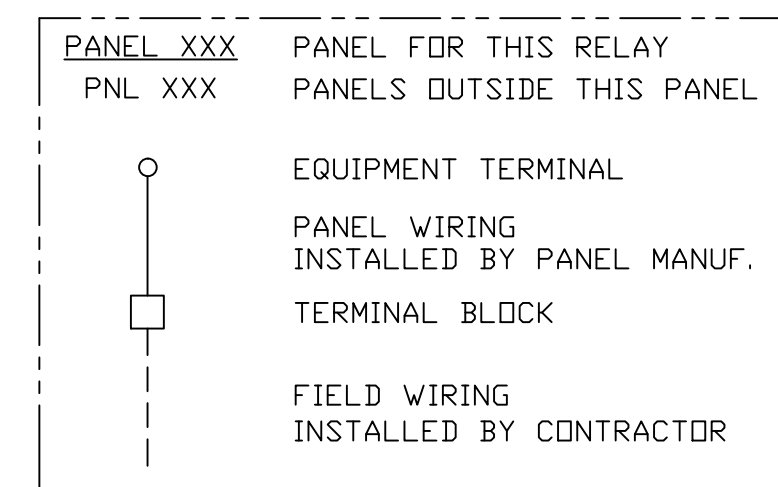


Y11410 TO BREAKER 6140  
DWG. S294SB6140a  
(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

TB2 0 11A TB2 0 9AR

DC TRIP CIRCUIT 2

NOTE: SEE DRAWING S294SB6140a  
FOR CIRCUIT BREAKER DC  
SCHEMATIC.



EQUIPMENT SHOWN INSIDE BOX  
LOCATED IN PANEL NUMBER  
DESIGNATED AT TOP LEFT

REFERENCE DRAWINGS

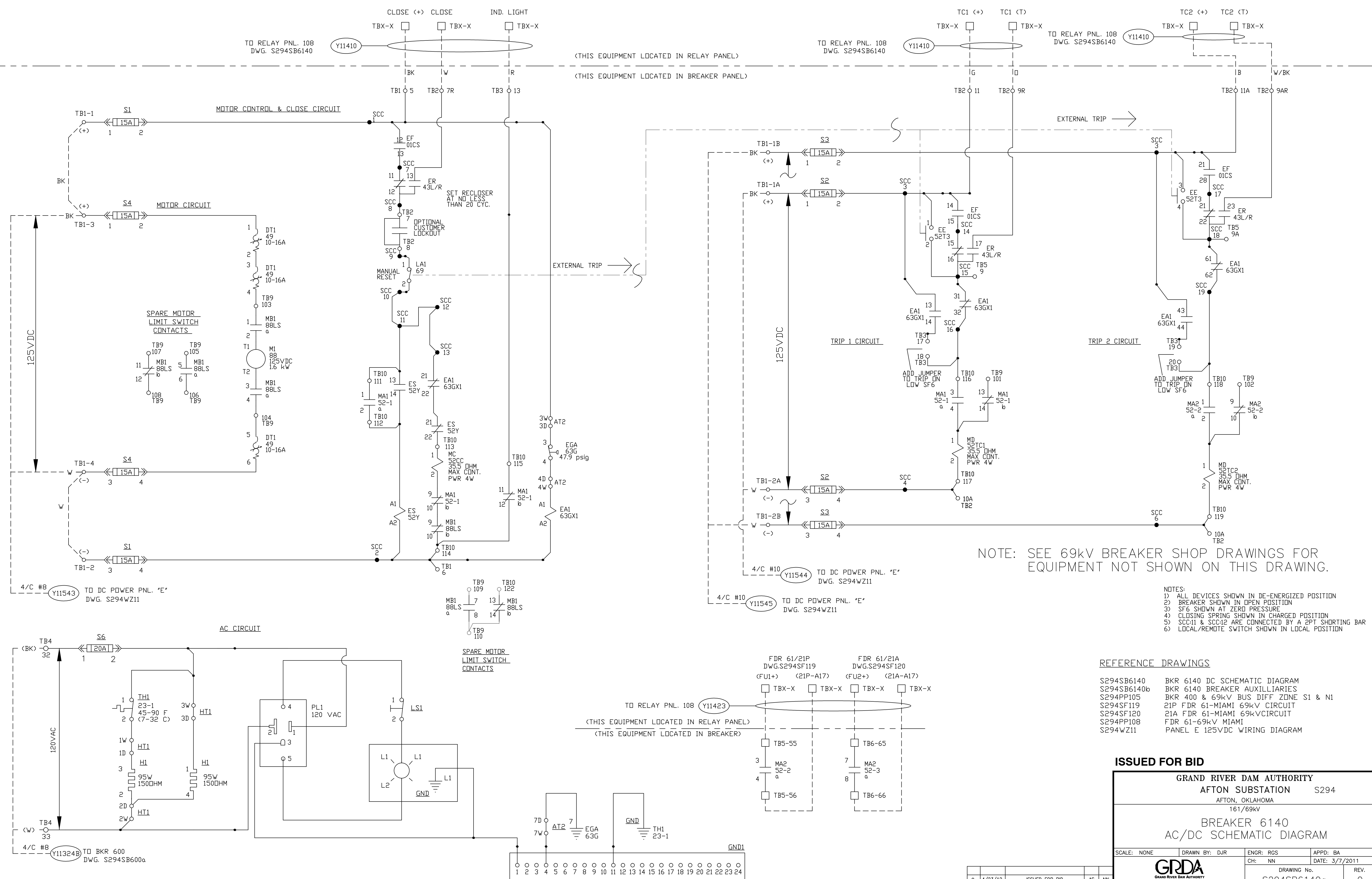
- S294SB6140a BKR 6140 AC/DC SCHEMATIC DIAGRAM
- S294SB6140b BKR 6140 BREAKER AUXILIARIES
- S294PP105 BKR 400 & 69kV BUS DIFF S1 & N1
- S294PP106 TRANSFORMER ND 2 & BKR 500
- S294PP108 FDR 61-69kV MIAMI
- S294PP110 FDR 63-69kV MONKEY ISLAND
- S294PP111 FDR 62-69kV SAILBOAT BRIDGE
- S294PP112 FDR 62-69kV SAILBOAT BRIDGE

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
BREAKER 6140 DC SCHEMATIC DIAGRAM			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. REV.	
S294SB6140		0	
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINETA, OK 74301			

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

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NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

REFERENCE DRAWINGS

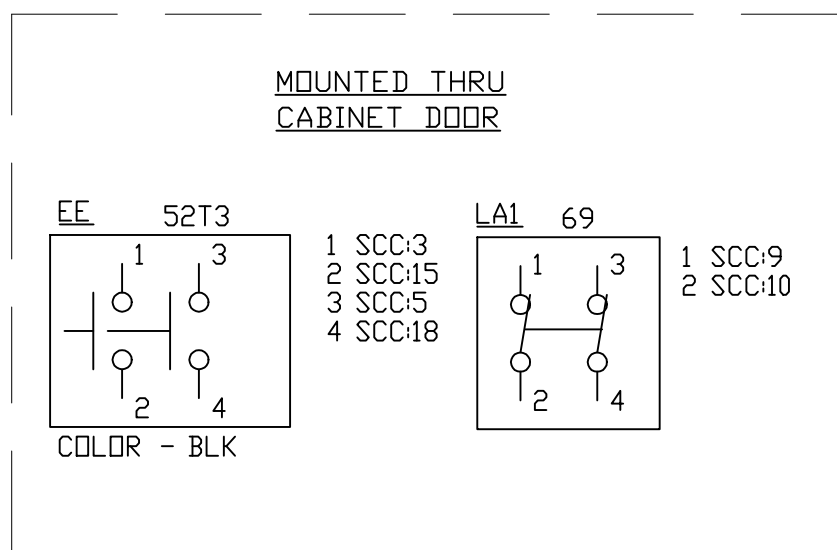
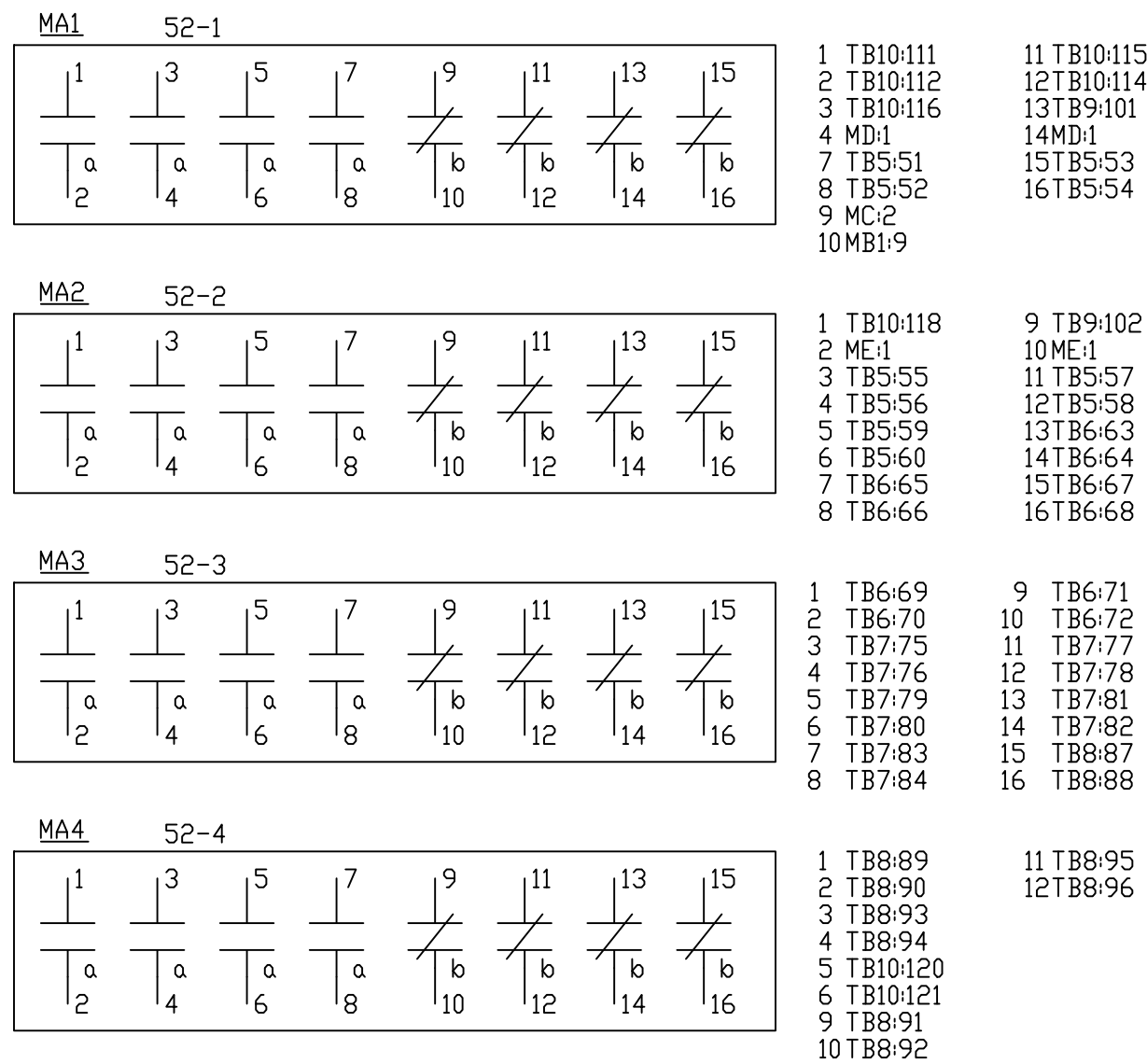
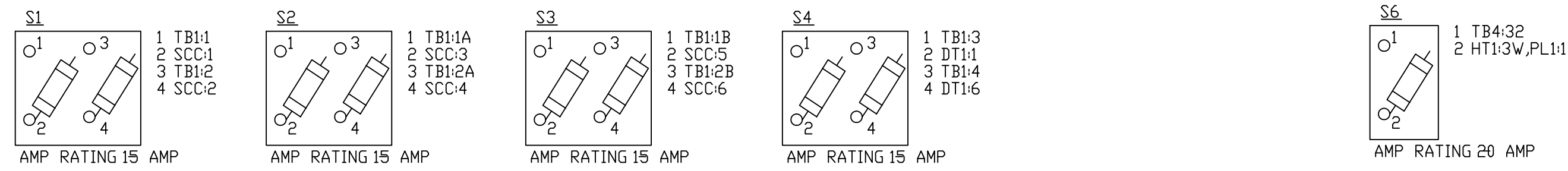
- |             |                                      |
|-------------|--------------------------------------|
| S294SB6140  | BKR 6140 DC SCHEMATIC DIAGRAM        |
| S294SB6140b | BKR 6140 BREAKER AUXILIARIES         |
| S294PP105   | BKR 400 & 69kV BUS DIFF ZONE S1 & N1 |
| S294SF119   | 21P FDR 61-MIAMI 69kV CIRCUIT        |
| S294SF120   | 21A FDR 61-MIAMI 69kV CIRCUIT        |
| S294PP108   | FDR 61-69kV MIAMI                    |
| S294WZ11    | PANEL E 125VDC WIRING DIAGRAM        |

ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION S294</b> AFTON, OKLAHOMA 161/69KV			
<b>BREAKER 6140</b> <b>AC/DC SCHEMATIC DIAGRAM</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294SB6140a</b>	
REV	DATE	REVISION DESCRIPTION	DFT ENG
0	4/23/12	ISSUED FOR BID	AS NN

0	4/23/12	ISSUED FOR BID	AS	NN

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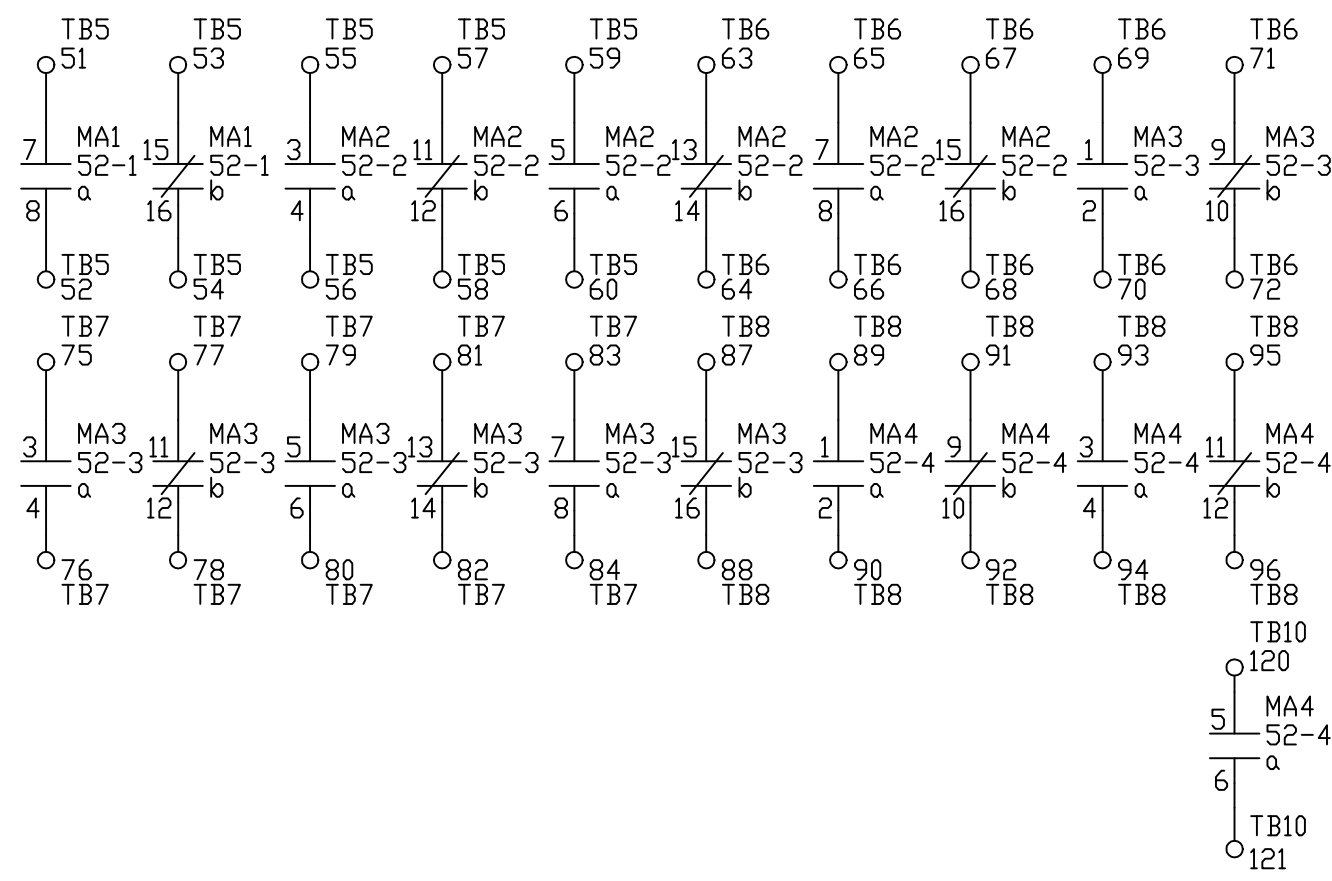
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



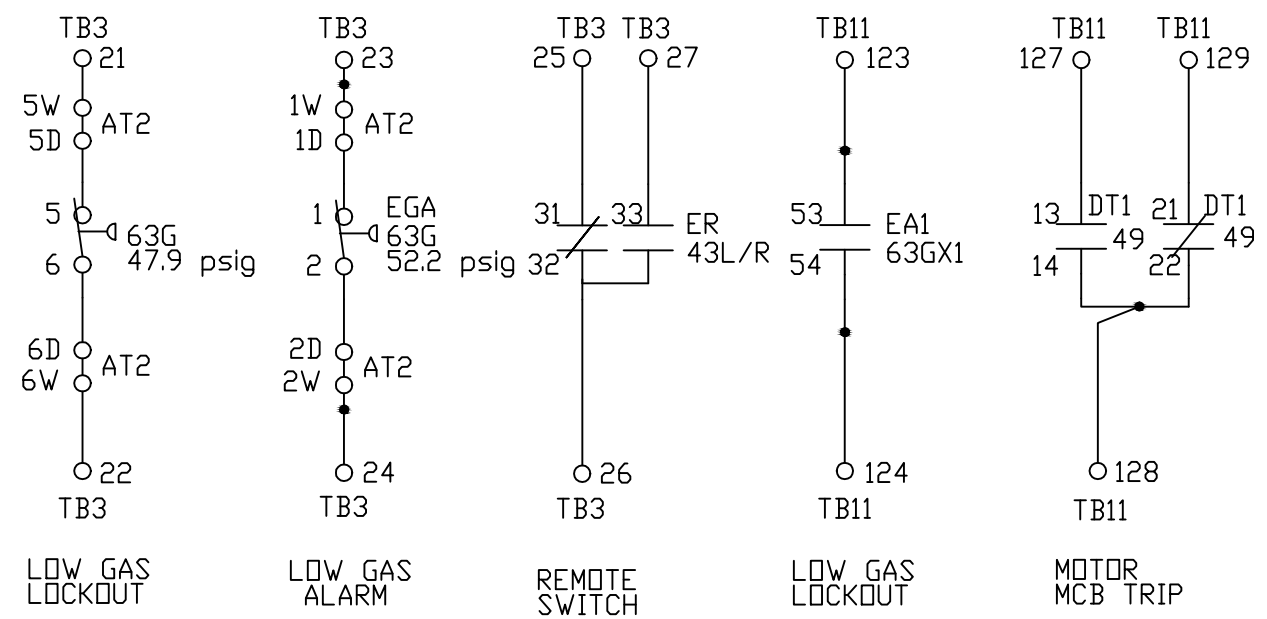
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



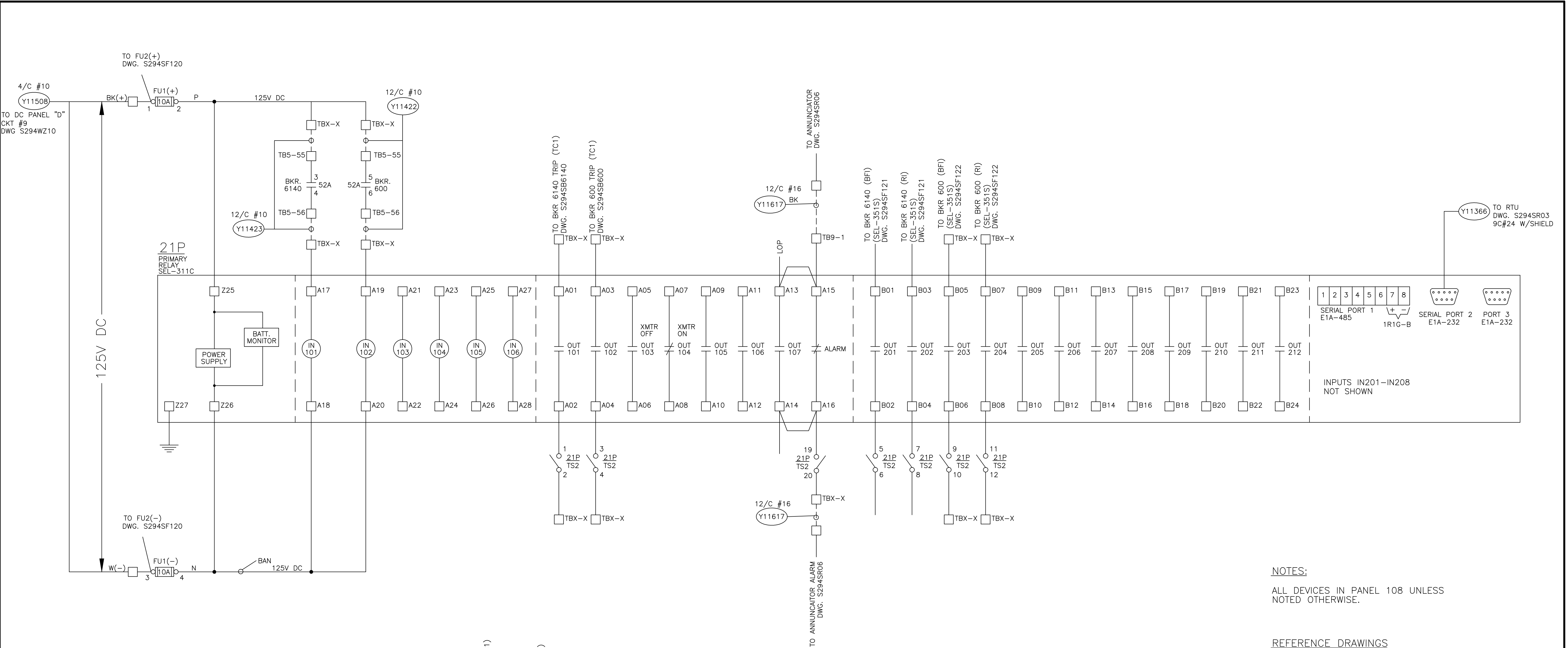
REFERENCE DRAWINGS

- S294SB6140 BKR 6140 DC SCHEMATIC DIAGRAM
- S294SB6140a BKR 6140 ACDC SCHEMATIC DIAGRAM
- S294SB6140b BKR 6140 BREAKER AUXILIARIES

<b>ISSUED FOR BID</b>			
<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
<b>BREAKER 6140</b> <b>BREAKER AUXILIARIES</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294SB6140b</b>	REV. <b>0</b>
0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

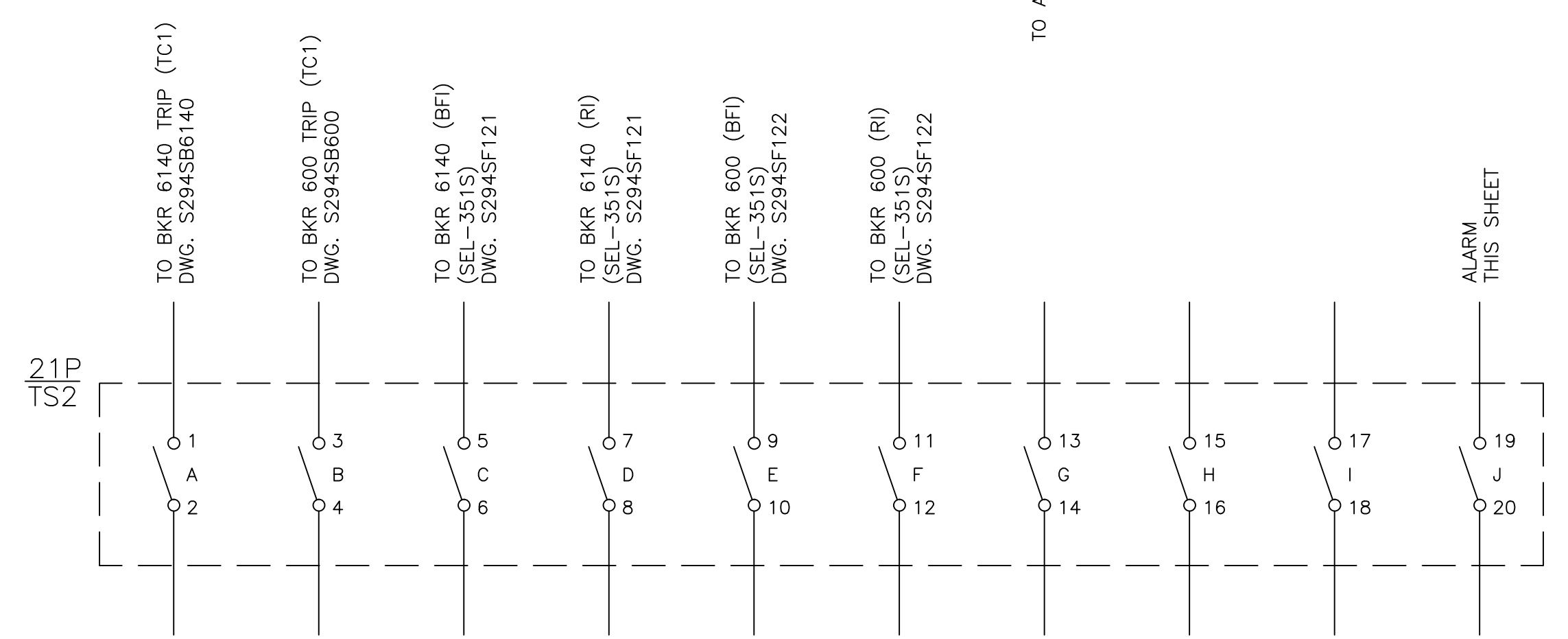


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NOTES:  
 ALL DEVICES IN PANEL 108 UNLESS NOTED OTHERWISE.

- REFERENCE DRAWINGS
- S294PP108 PANEL 108 ELEVATION
  - S294SB600 BREAKER 600 SCHEMATIC DIAGRAM
  - S294SB6140 BREAKER 6140 SCHEMATIC DIAGRAM
  - S294SF120 ALTERNATE RELAY FDR. 61
  - S294SF121 BREAKER FAILURE & RECLOSE BKR. 6140
  - S294SF108 THREE LINE AC DIAGRAM
  - S294SF124 BREAKER FAILURE & RECLOSE BKR. 600
  - S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM
  - S294SR06 ANNUNCIATOR NAME PLATE 01
  - S294WZ10 DC POWER PANEL DIAGRAM



0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

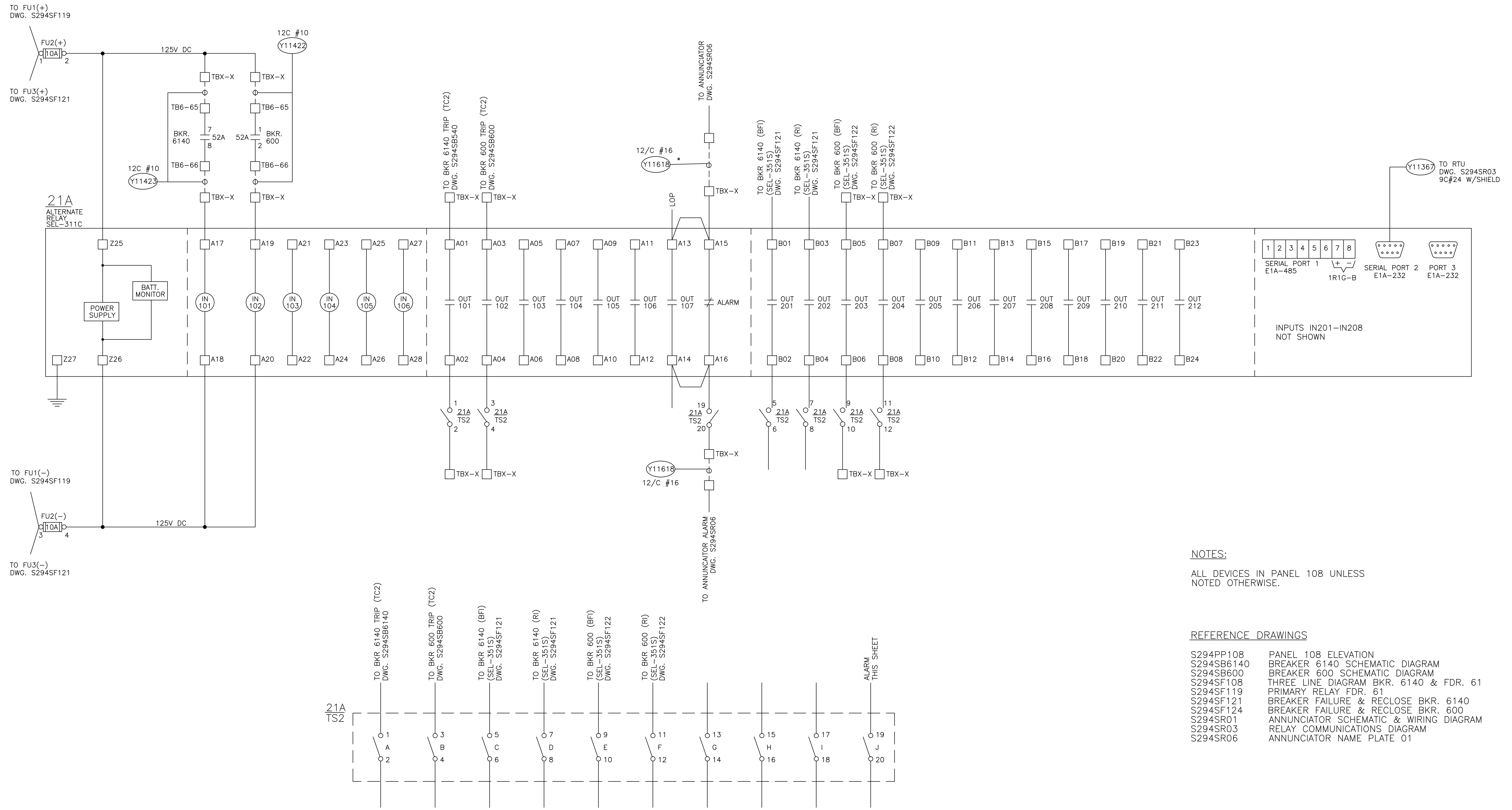
**ISSUED FOR BID**

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 21P  
 69kV FDR 61-MIAMI CIRCUIT

SCALE: NONE DRAWN BY: DJR ENGR: BM APPD: BA  
 CH: NN DATE: 3/7/2011  
 DRAWING No. S294SF119 REV. 0

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 Last plotted by: Shults, Ariene  
 Plot Date: 4/24/2012 11:06 AM  
 Plotter used: DWG To PDF.pc3  
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 Plot Style: Monochrome.ctb



**NOTES:**

ALL DEVICES IN PANEL 108 UNLESS NOTED OTHERWISE.

**REFERENCE DRAWINGS**

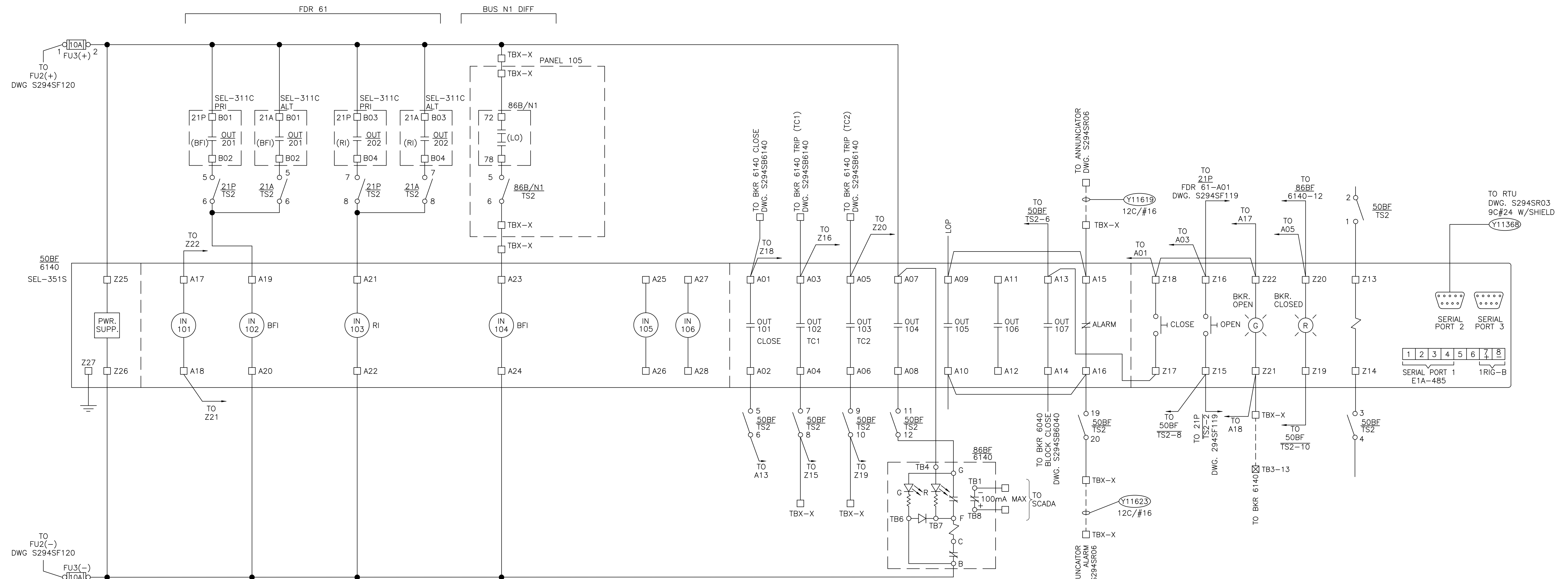
- S294PP108 PANEL 108 ELEVATION
- S294SB6140 BREAKER 6140 SCHEMATIC DIAGRAM
- S294SB600 BREAKER 600 SCHEMATIC DIAGRAM
- S294SF108 THREE LINE DIAGRAM BKR. 6140 & FDR. 61
- S294SF119 PRIMARY RELAY FDR. 61
- S294SF121 BREAKER FAILURE & RECLOSE BKR. 6140
- S294SF124 BREAKER FAILURE & RECLOSE BKR. 600
- S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SR06 ANNUNCIATOR NAME PLATE 01

**ISSUED FOR BID**

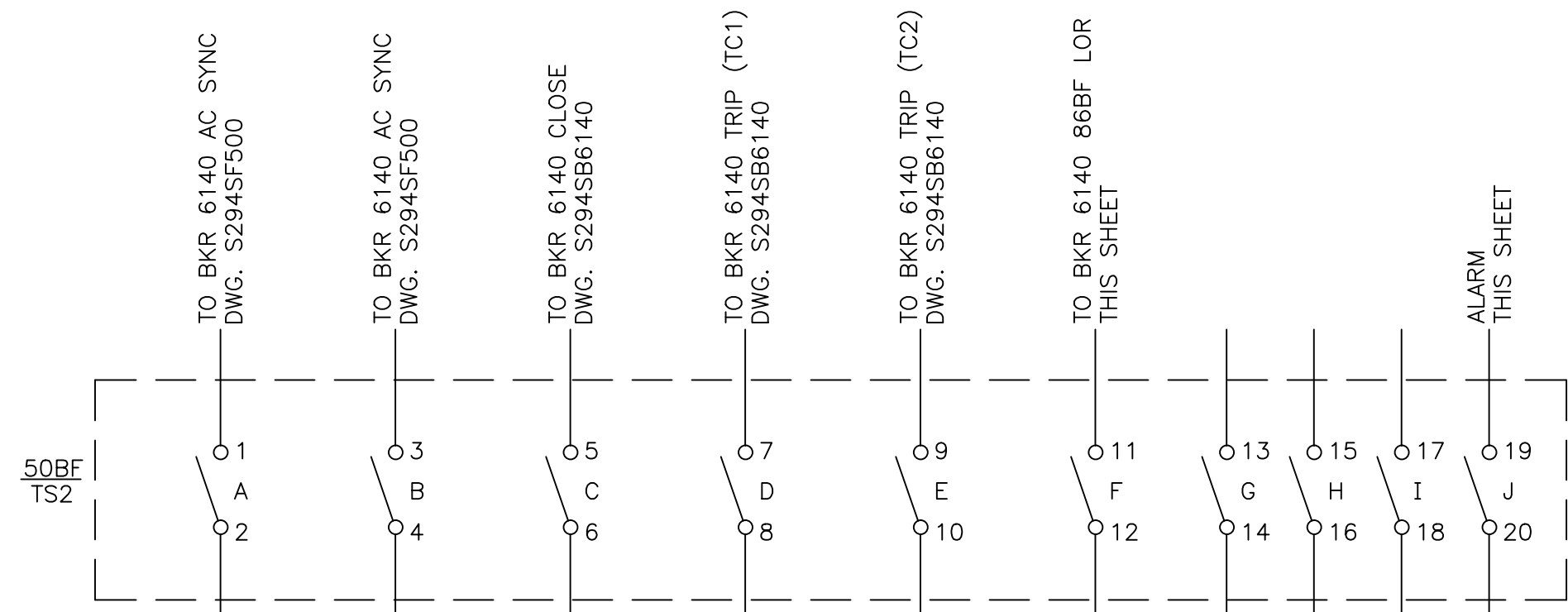
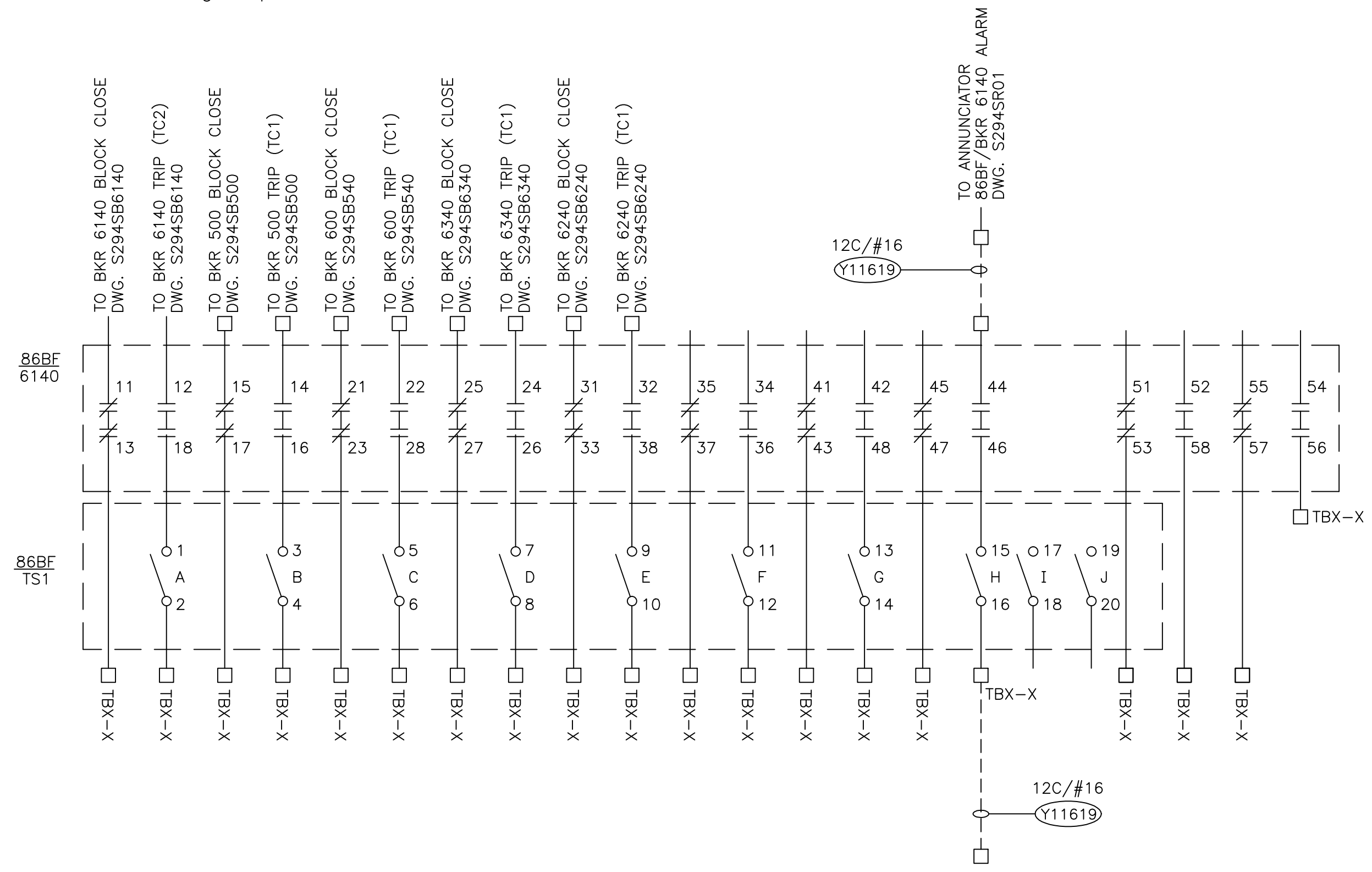
<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV <b>21A</b> FDR 61-MIAMI 69KV CIRCUIT			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
 <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. <b>S294SF120</b>	REV. <b>0</b>
CH: NN	DATE: 3/7/2011		

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

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 Last plotted by: Shultz, Arlene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/24/2012 11:08 AM Plotter used: DWG To PDF.pc3



1. ALL EQUIPMENT IS ON PANEL 108 UNLESS OTHERWISE NOTED



86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION
		TRIP RESET
1	11 NO-13	X
1	12 NO-18	X
1	15 NO-17	X
1	14 NO-16	X
2	21 NO-23	X
2	22 NO-28	X
2	25 NO-27	X
2	24 NO-26	X
3	31 NO-33	X
3	32 NO-38	X
3	35 NO-37	X
3	34 NO-36	X
4	41 NO-43	X
4	42 NO-48	X
4	45 NO-47	X
4	44 NO-46	X
5	51 NO-53	X
5	52 NO-58	X
5	55 NO-57	X
5	54 NO-56	X
6	61 NO-63	X
6	62 NO-68	X
6	65 NO-67	X
6	64 NO-66	X
7	71 NO-73	X
7	72 NO-78	X
7	75 NO-77	X
7	74 NO-76	X
8	81 NO-83	X
8	82 NO-88	X
8	85 NO-87	X
8	84 NO-86	X

REFERENCE DRAWINGS

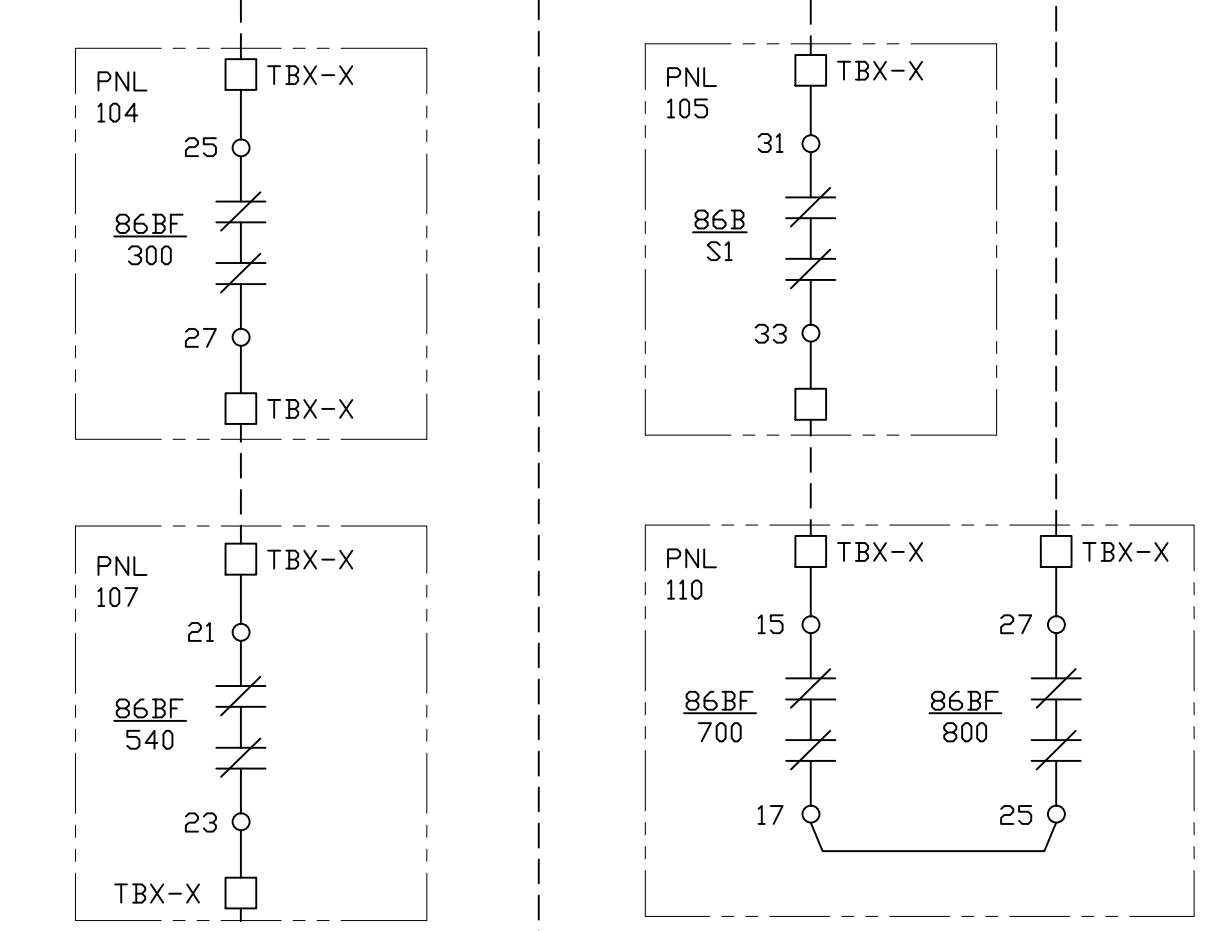
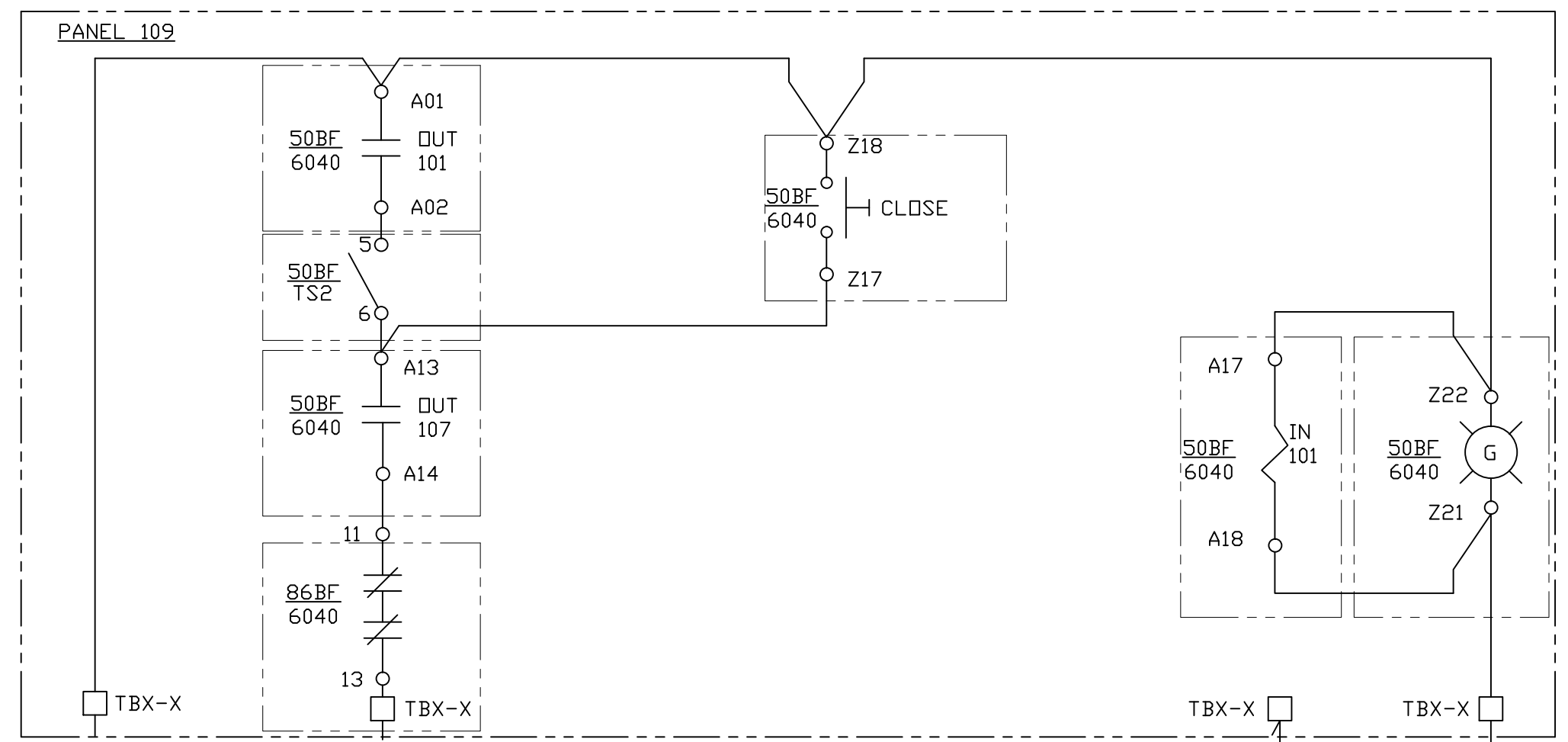
- S294SB6140 BREAKER 6140 SCHEMATIC DIAGRAM
- S294SF119 PRIMARY RELAY FEEDER 61
- S294SF120 ALTERNATE RELAY FEEDER 61
- S294SF108 THREE LINE AC DIA. BREAKER 6140 & FDR. 61
- S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SR06 ANNUNCIATOR NAME PLATE 01
- S294SB600 BREAKER 600 SCHEMATIC DIAGRAM
- S294SF122 BREAKER 600 FAILURE & CONTROL

☒ TERMINAL BLOCK LOCATED IN THIS PANEL

ISSUED FOR BID

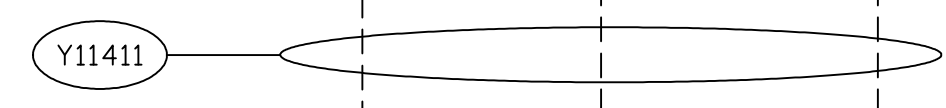
<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
<b>BKR 6140 FAILURE &amp; CONTROL</b> FDR 61-MIAMI 69KV CIRCUIT			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SF121	
0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG
		GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301	
		REV. 0	

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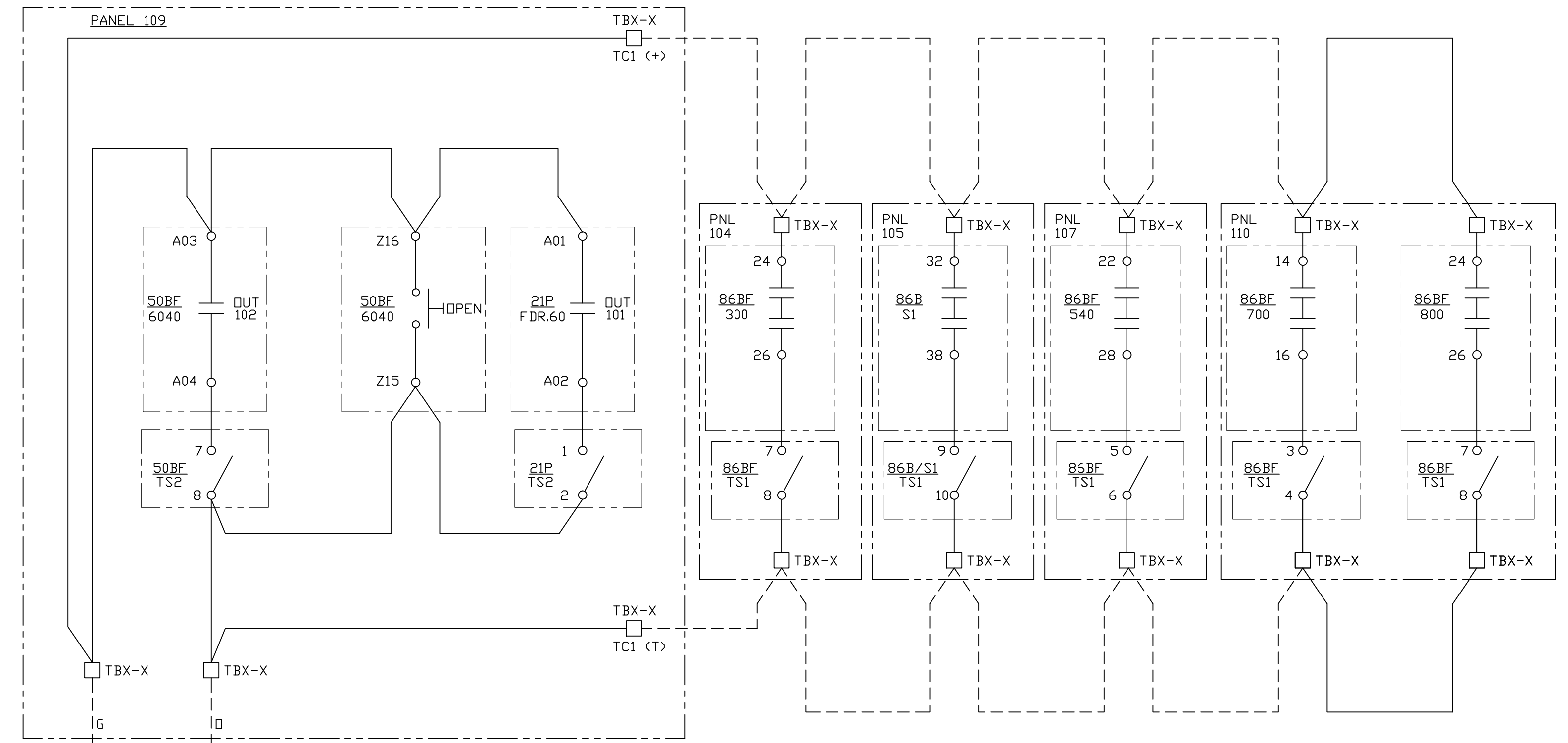
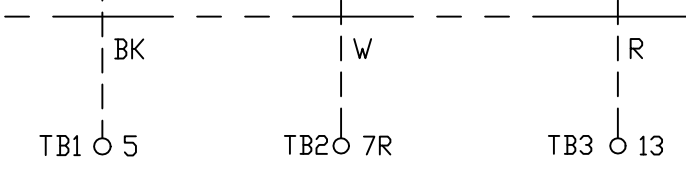


DC CLOSE CIRCUIT

TO BREAKER 6040  
DWG. S294SB6040a

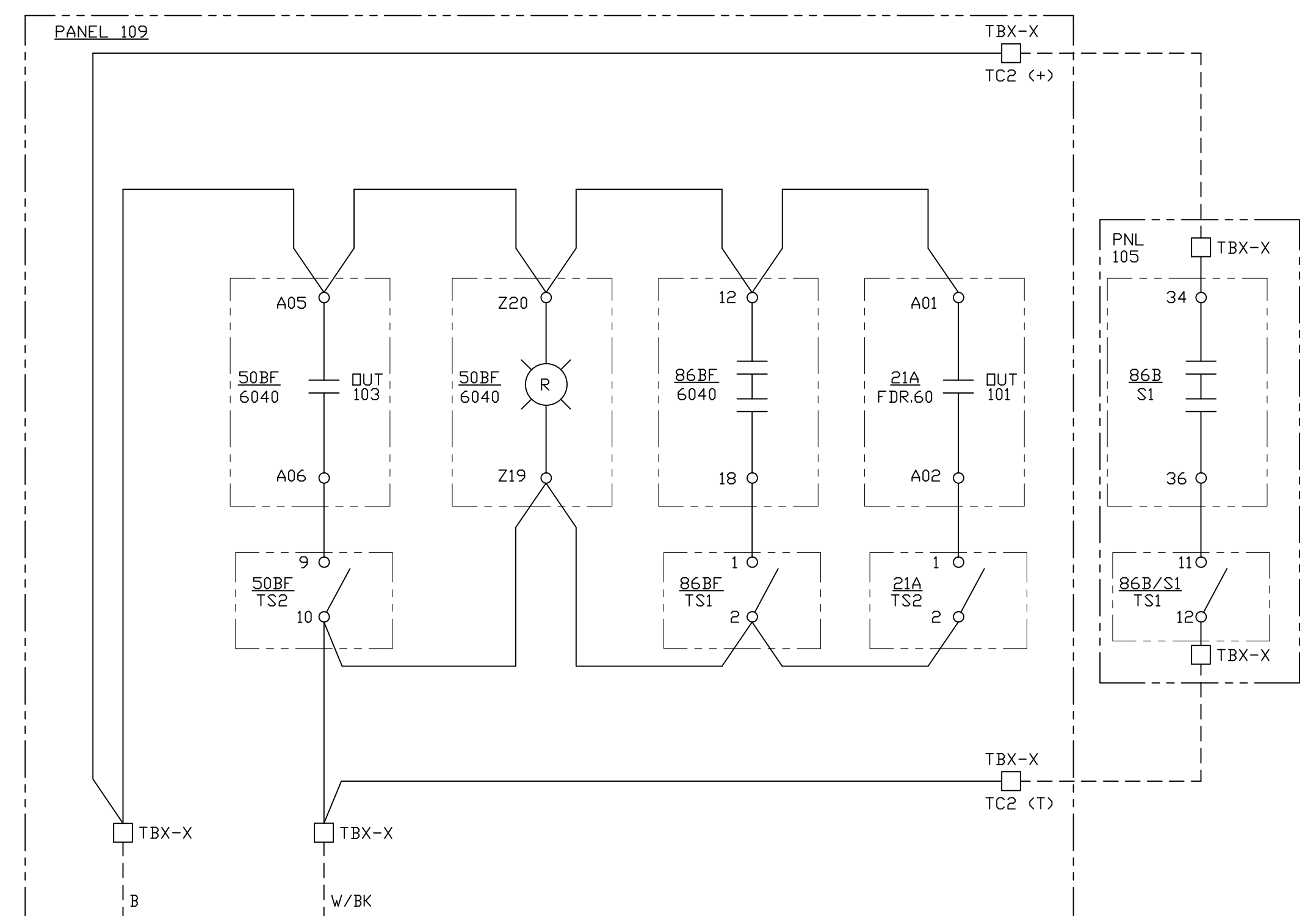


(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)



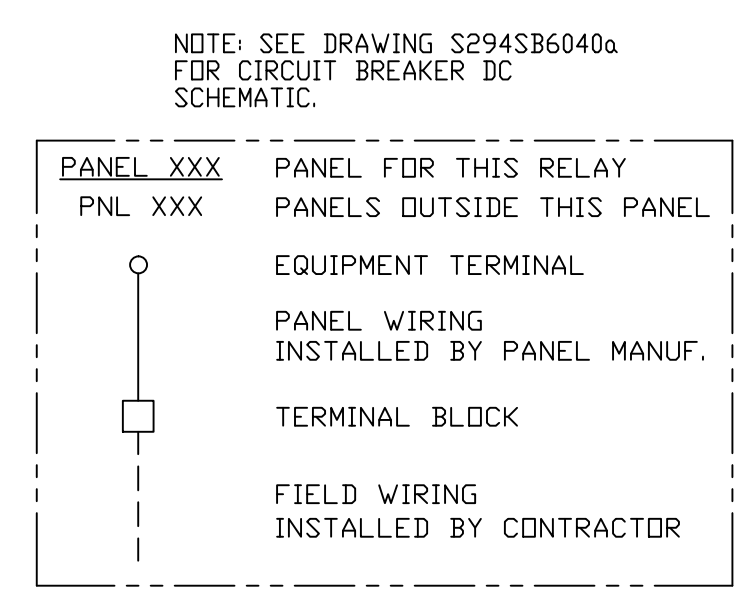
TO BREAKER 6040  
DWG. S294SB6040a  
(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

DC TRIP CIRCUIT 1



TO BREAKER 6040  
DWG. S294SB6040a  
(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

DC TRIP CIRCUIT 2



EQUIPMENT SHOWN INSIDE BOX  
LOCATED IN PANEL NUMBER  
DESIGNATED AT TOP LEFT

REFERENCE DRAWINGS

- S294SB6040a BKR 6040 ACDC SCHEMATIC DIAGRAM
- S294SB6040b BKR 6040 BREAKER AUXILIARIES
- S294SB6140b BKR 6140 BREAKER AUXILIARIES
- S294PP104 TRANSFORMER NO 1 & BKR 300
- S294PP105 BKR 400 & 69kV BUS DIFF ZONE SOUTH S1 & NORTH N1
- S294PP107 FDR 5-69kV PENSACOLA
- S294PP109 FDR 60-69kV VINITA
- S294PP110 FDR 63-69kV MONKEY ISLAND

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

**ISSUED FOR BID**

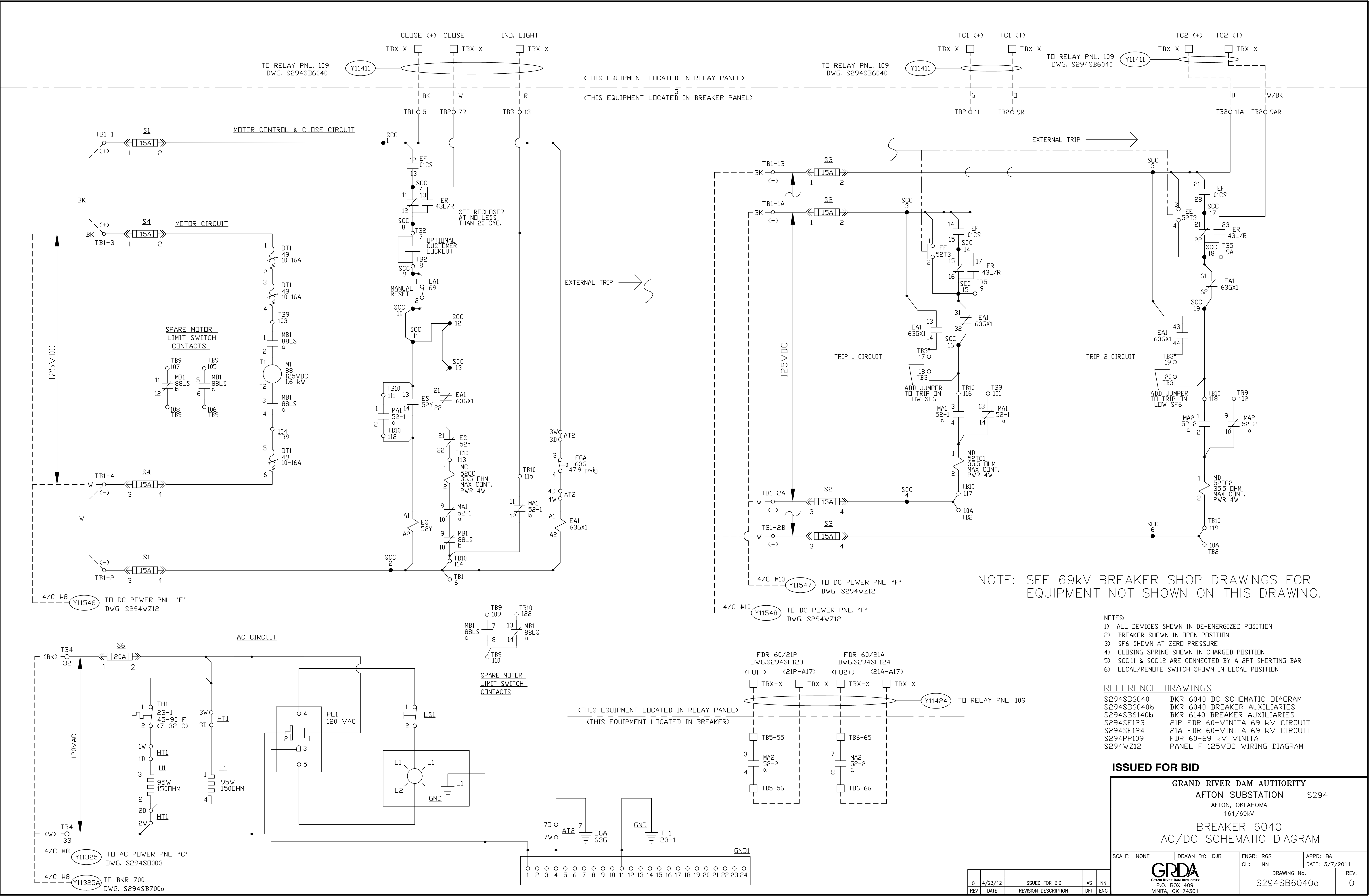
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

**BREAKER 6040  
DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB6040	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

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 Last Saved by: Ashulis Last Save: 4/24/2012 7:55 AM Last saved by: Ashulis



NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:1 & SCC:2 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

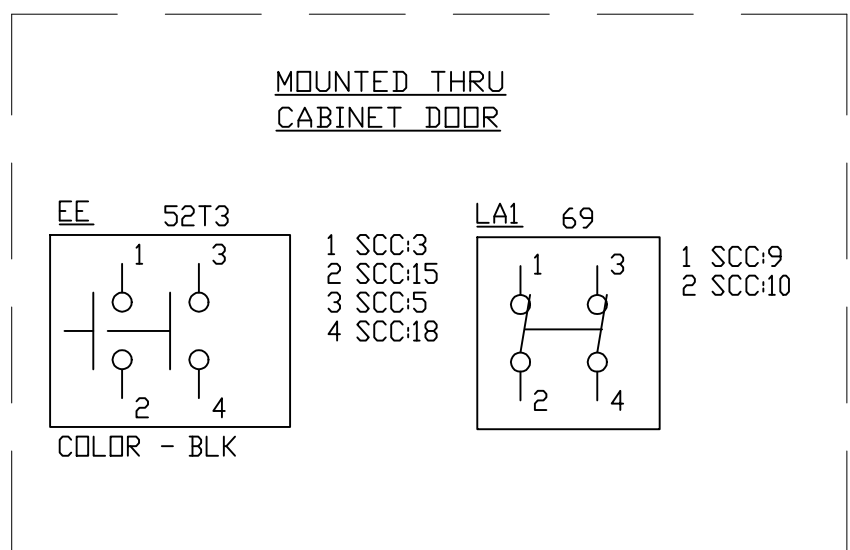
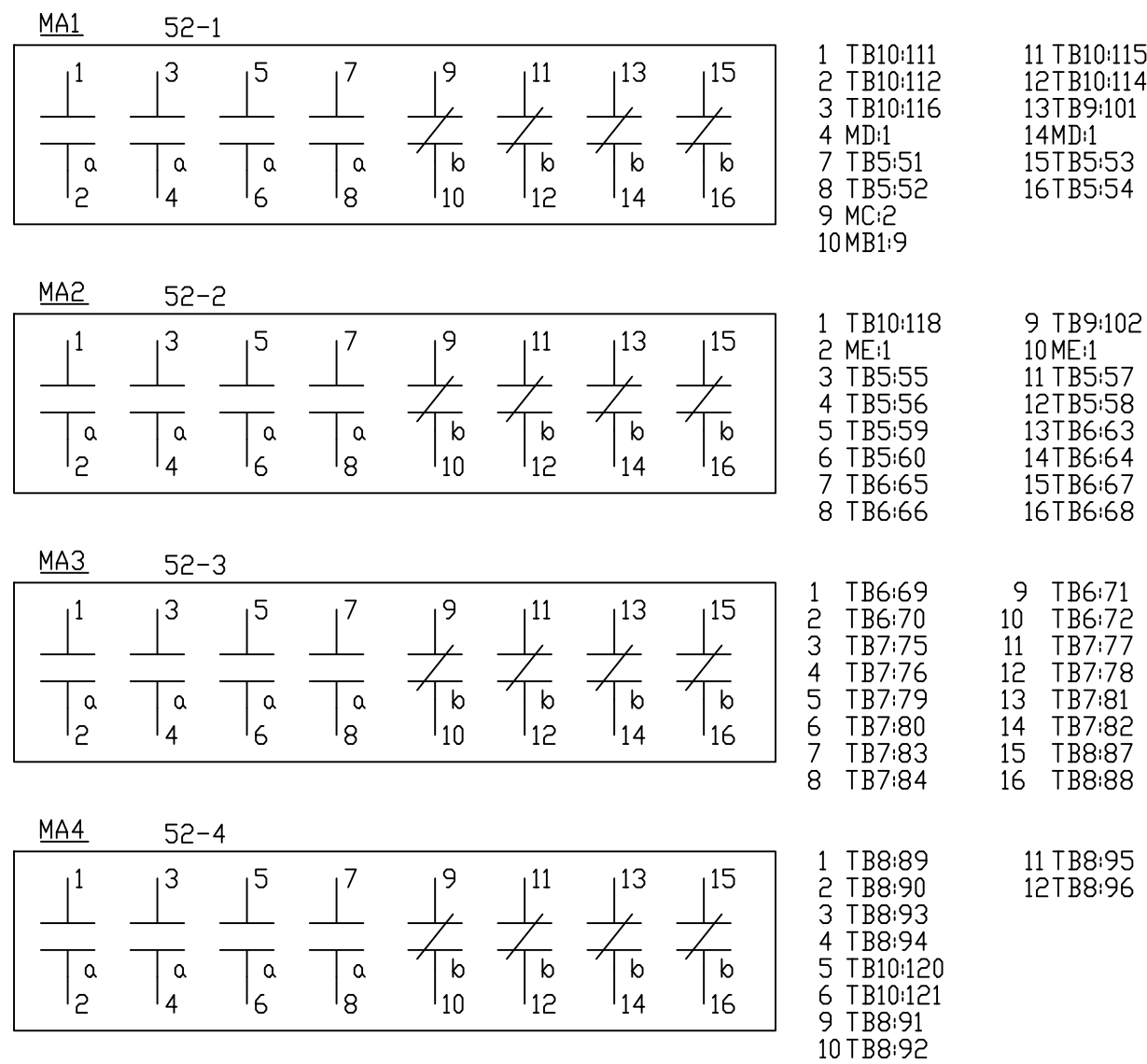
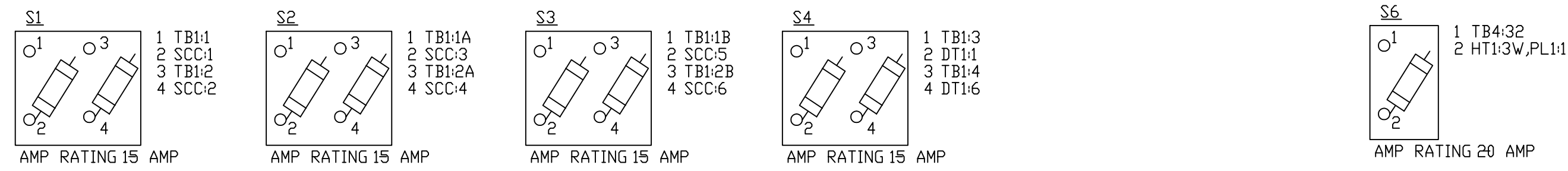
- REFERENCE DRAWINGS
- |             |                                 |
|-------------|---------------------------------|
| S294SB6040  | BKR 6040 DC SCHEMATIC DIAGRAM   |
| S294SB6040b | BKR 6040 BREAKER AUXILIARIES    |
| S294SB6140b | BKR 6140 BREAKER AUXILIARIES    |
| S294SF123   | 21P FDR 60-VINITA 69 kV CIRCUIT |
| S294SF124   | 21A FDR 60-VINITA 69 kV CIRCUIT |
| S294PP109   | FDR 60-69 kV VINITA             |
| S294WZ12    | PANEL F 125VDC WIRING DIAGRAM   |

**ISSUED FOR BID**

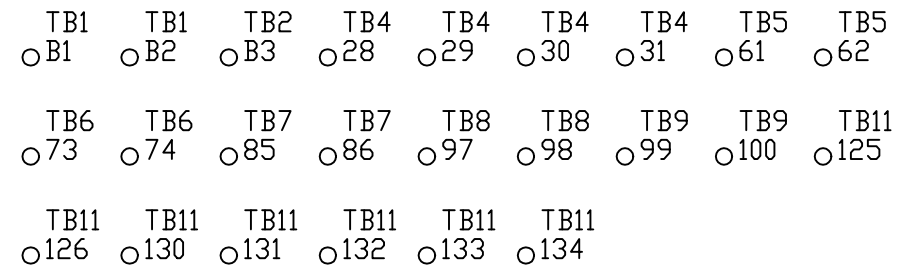
**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 6040**  
**AC/DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No. <b>S294SB6040a</b>	
REV	DATE	REVISION DESCRIPTION	DFT ENG
0	4/23/12	ISSUED FOR BID	AS NN

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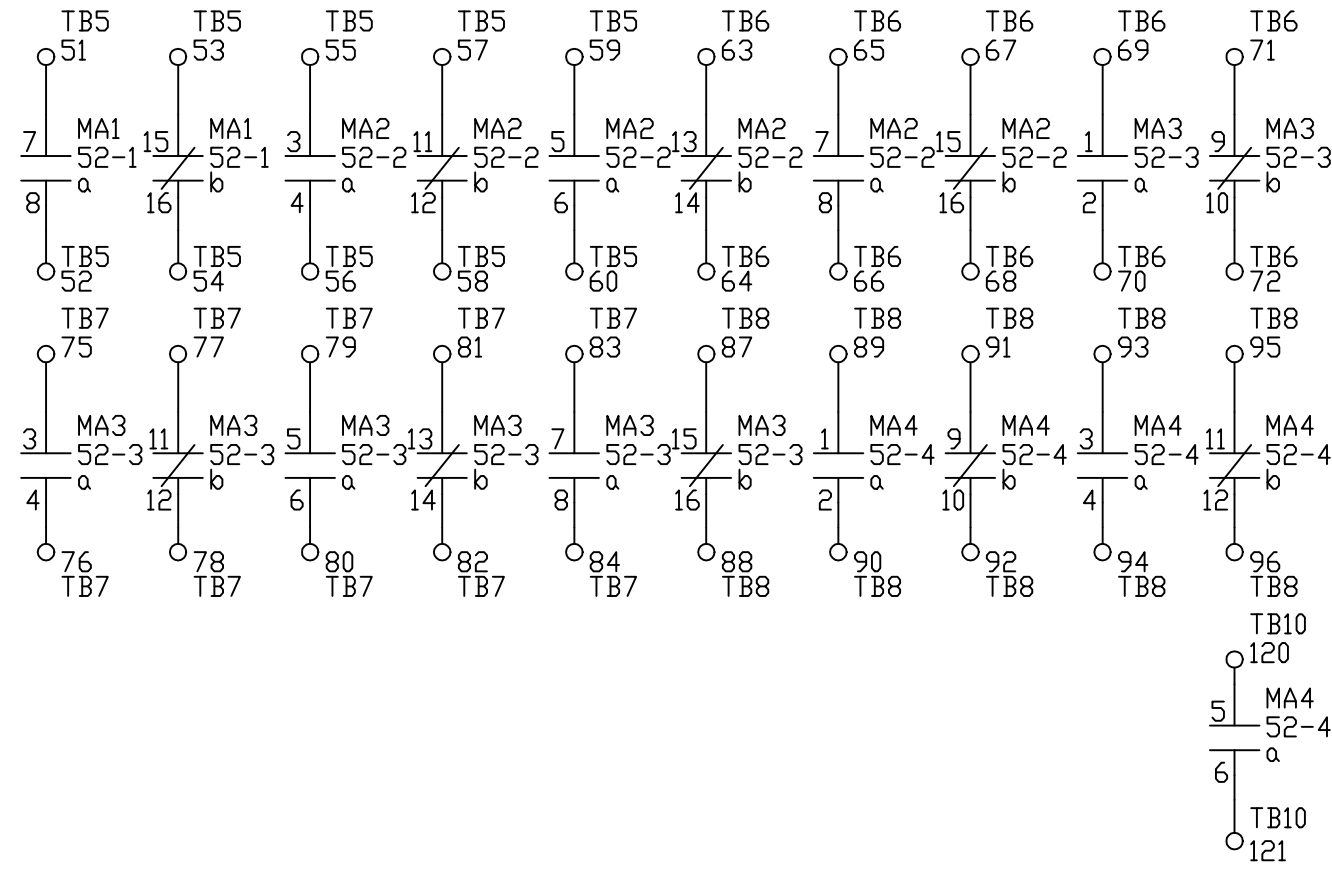
**SPARE TERMINAL BLOCKS FOR CUSTOMER USE**



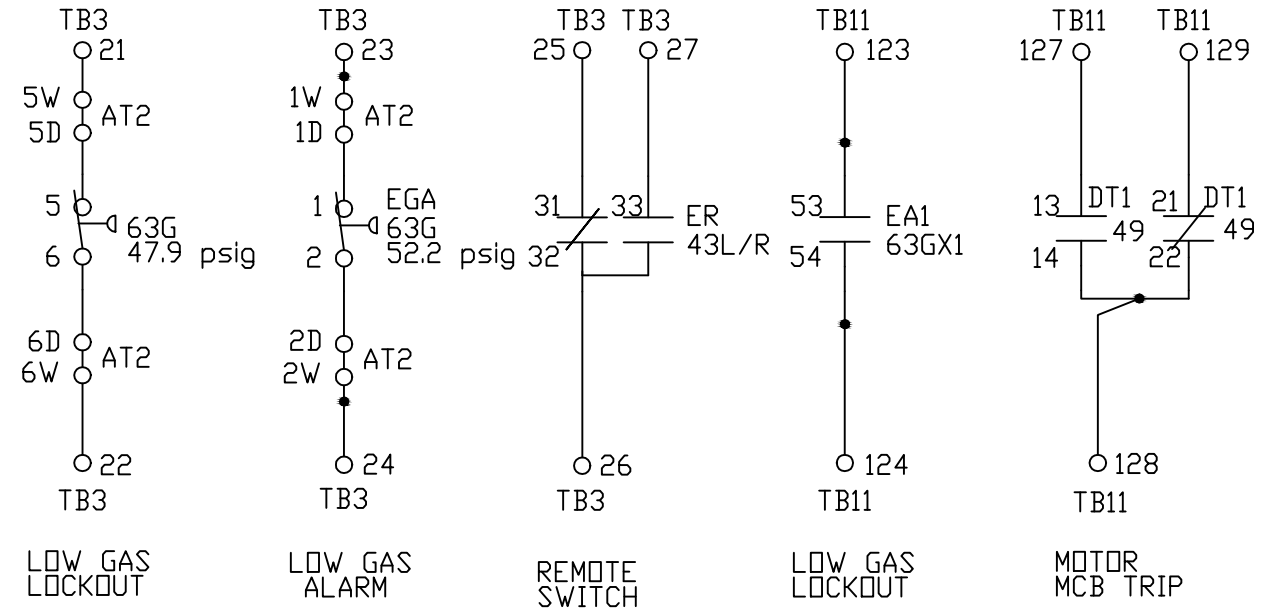
- NOTES:**
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

**SPARE AUXILIARY SWITCHES FOR CUSTOMER USE**



**CUSTOMER ALARMS**



**REFERENCE DRAWINGS**

- S294SB6040 BKR 6040 DC SCHEMATIC DIAGRAM
- S294SB6040a BKR 6040 AC/DC SCHEMATIC DIAGRAM

**ISSUED FOR BID**

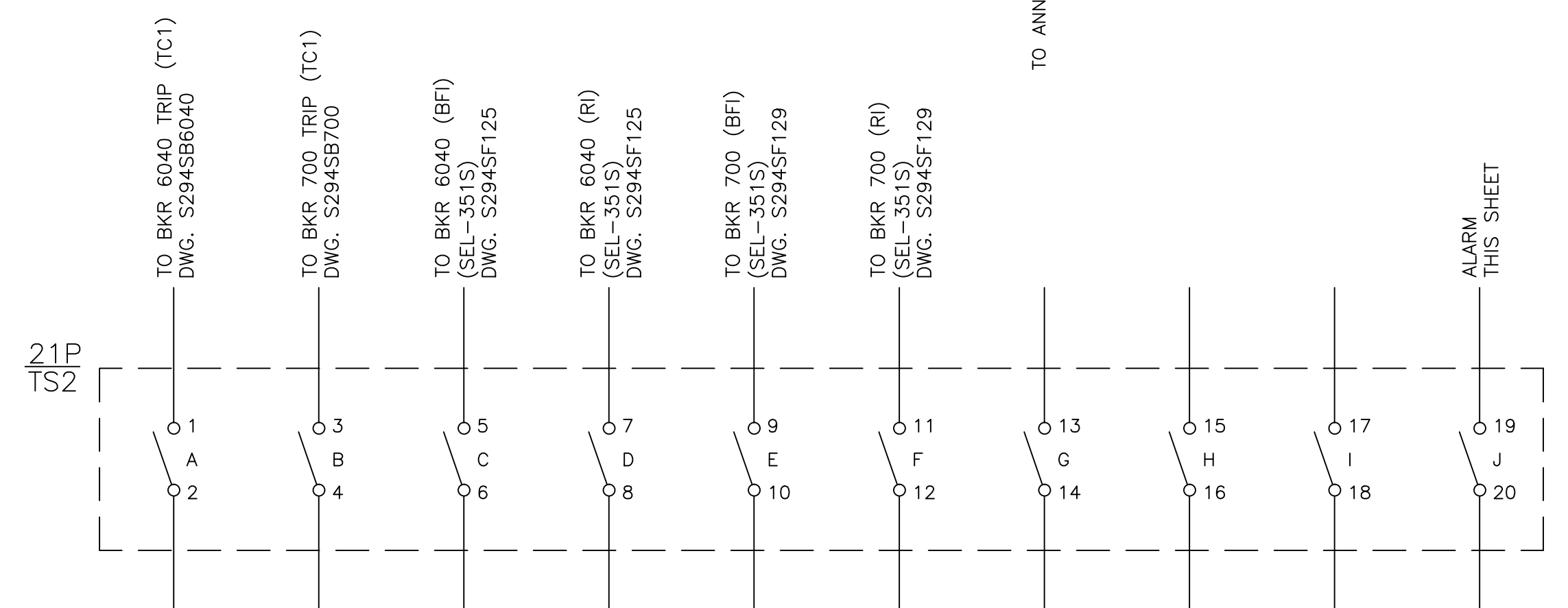
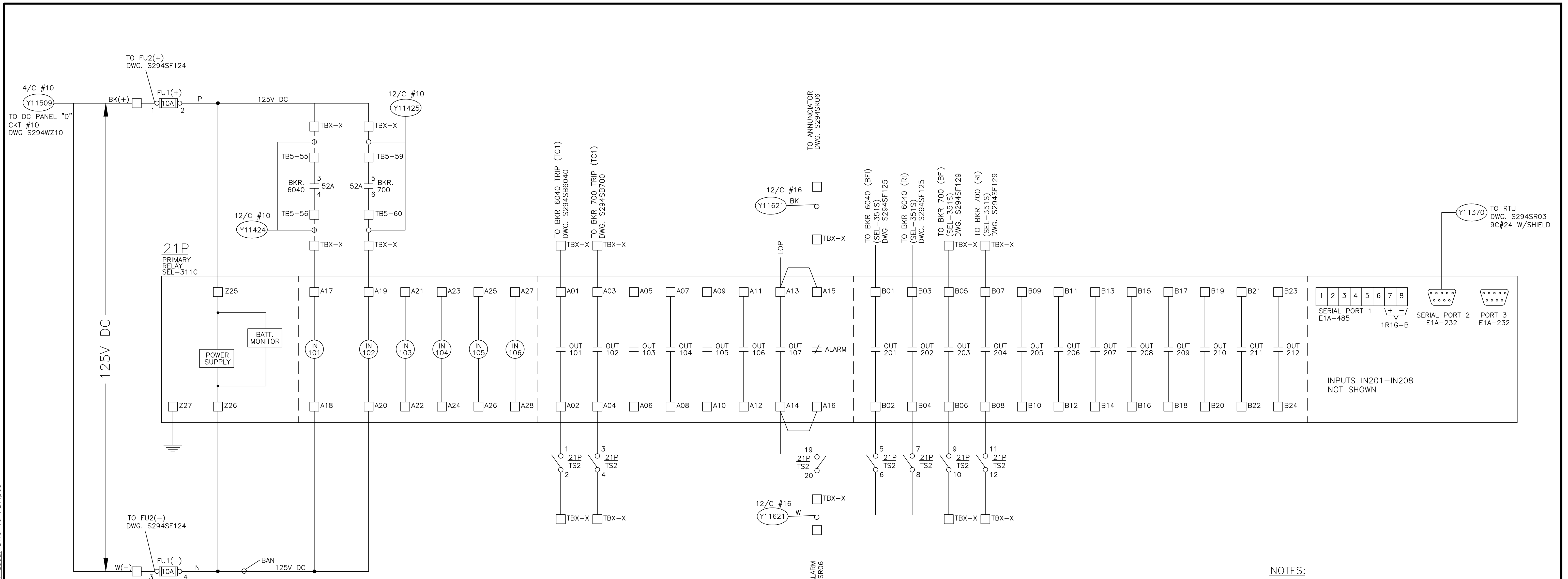
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 6040**  
**BREAKER AUXILIARIES**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
DRAWING No. S294SB6040b		REV. 0	

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

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 Last saved by: Ashultz  
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NOTES:  
 ALL DEVICES IN PANEL 109 UNLESS NOTED OTHERWISE.

- REFERENCE DRAWINGS
- S294PP109 PANEL 109 ELEVATION
  - S294SB6040 BREAKER 6040 SCHEMATIC DIAGRAM
  - S294SB700 BREAKER 700 SCHEMATIC DIAGRAM
  - S294SF124 ALTERNATE RELAY FDR. 60
  - S294SF125 BREAKER FAILURE & RECLOSE BKR. 6040
  - S294SF109 THREE LINE AC DIAGRAM
  - S294SF129 BREAKER FAILURE & RECLOSE BKR. 700
  - S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM
  - S294SR06 ANNUNCIATOR NAME PLATE 01
  - S294WZ10 DC POWER PANEL DIAGRAM

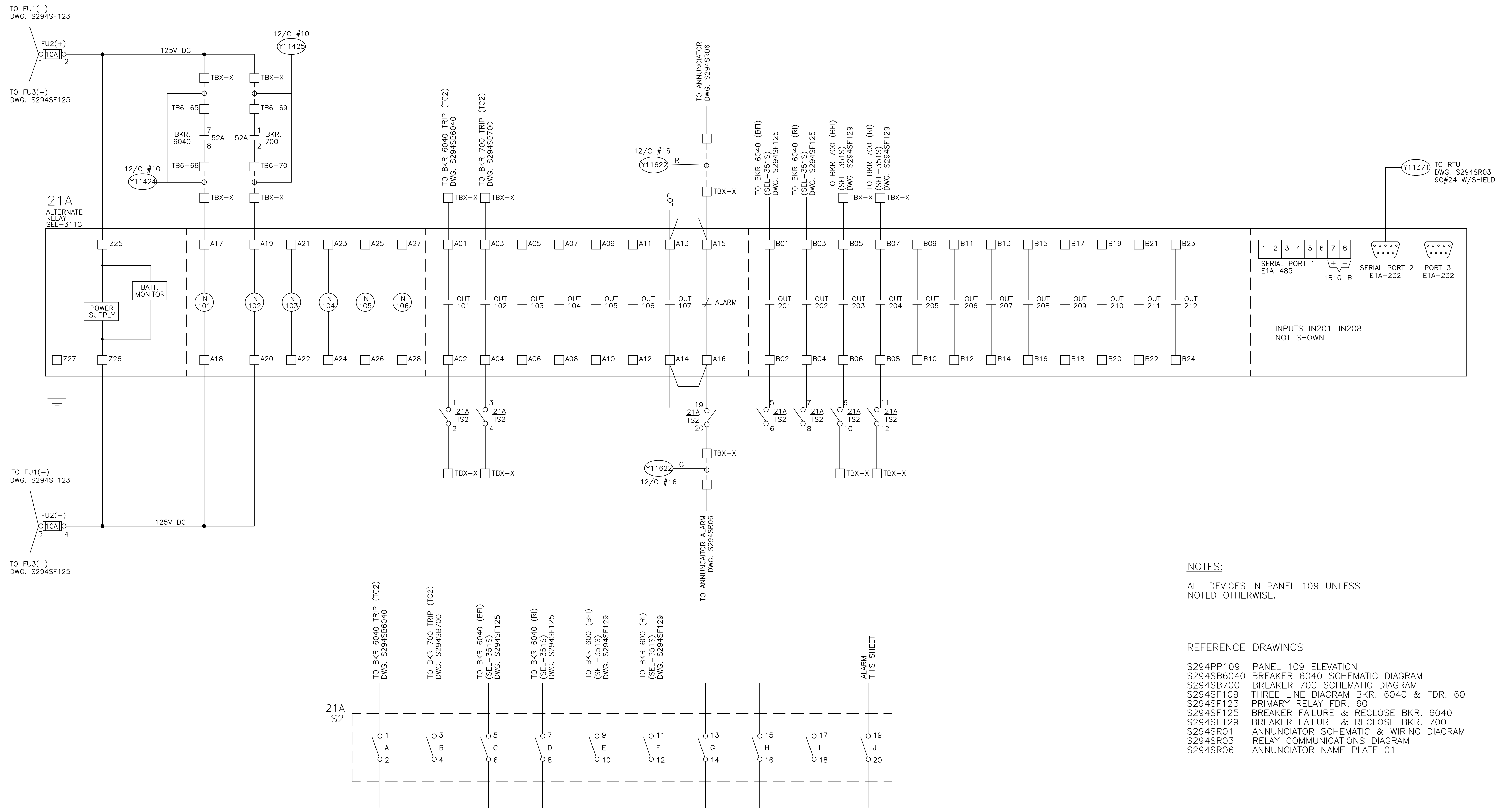
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 21P  
 69kV FDR 60-VINITA CIRCUIT

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SF123	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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 Plot Style: Monochrome.ctb



**NOTES:**

ALL DEVICES IN PANEL 109 UNLESS NOTED OTHERWISE.

**REFERENCE DRAWINGS**

- S294PP109 PANEL 109 ELEVATION
- S294SB6040 BREAKER 6040 SCHEMATIC DIAGRAM
- S294SB700 BREAKER 700 SCHEMATIC DIAGRAM
- S294SF109 THREE LINE DIAGRAM BKR. 6040 & FDR. 60
- S294SF123 PRIMARY RELAY FDR. 60
- S294SF125 BREAKER FAILURE & RECLOSE BKR. 6040
- S294SF129 BREAKER FAILURE & RECLOSE BKR. 700
- S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SR06 ANNUNCIATOR NAME PLATE 01

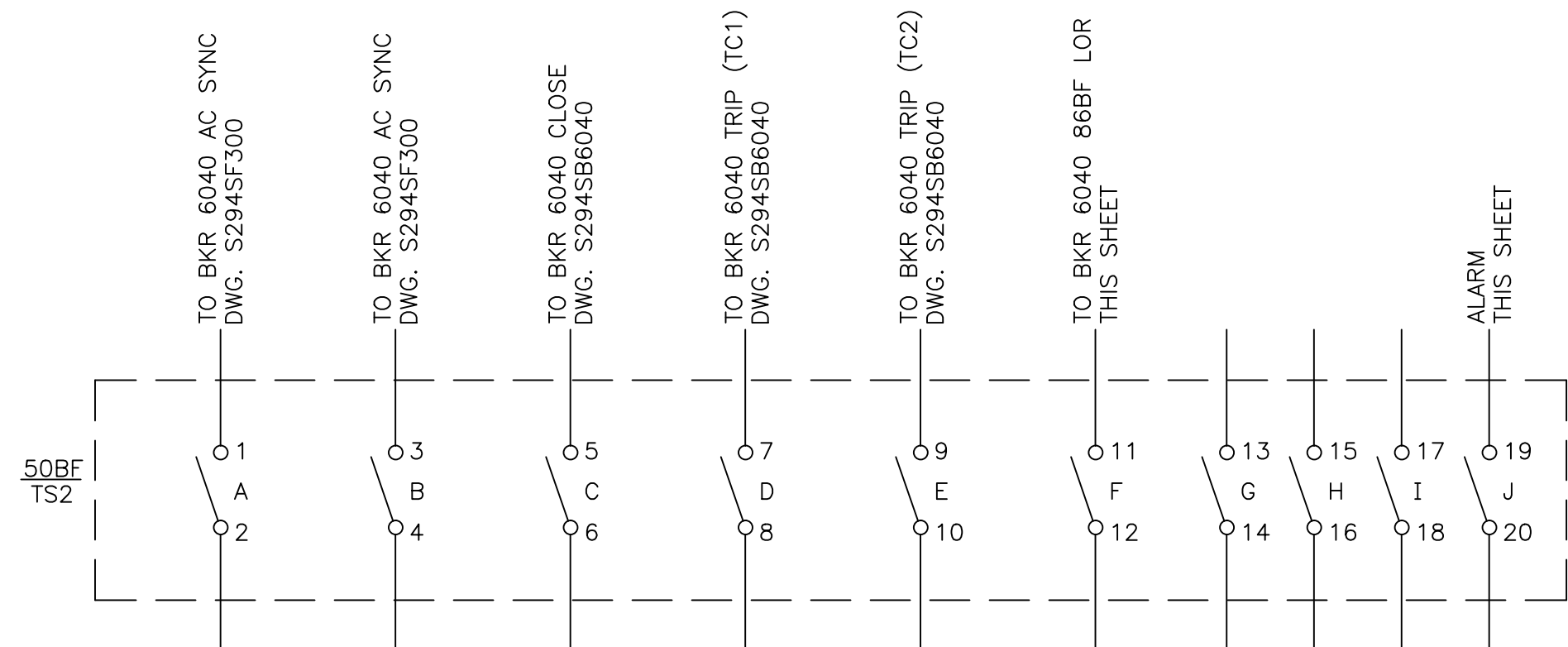
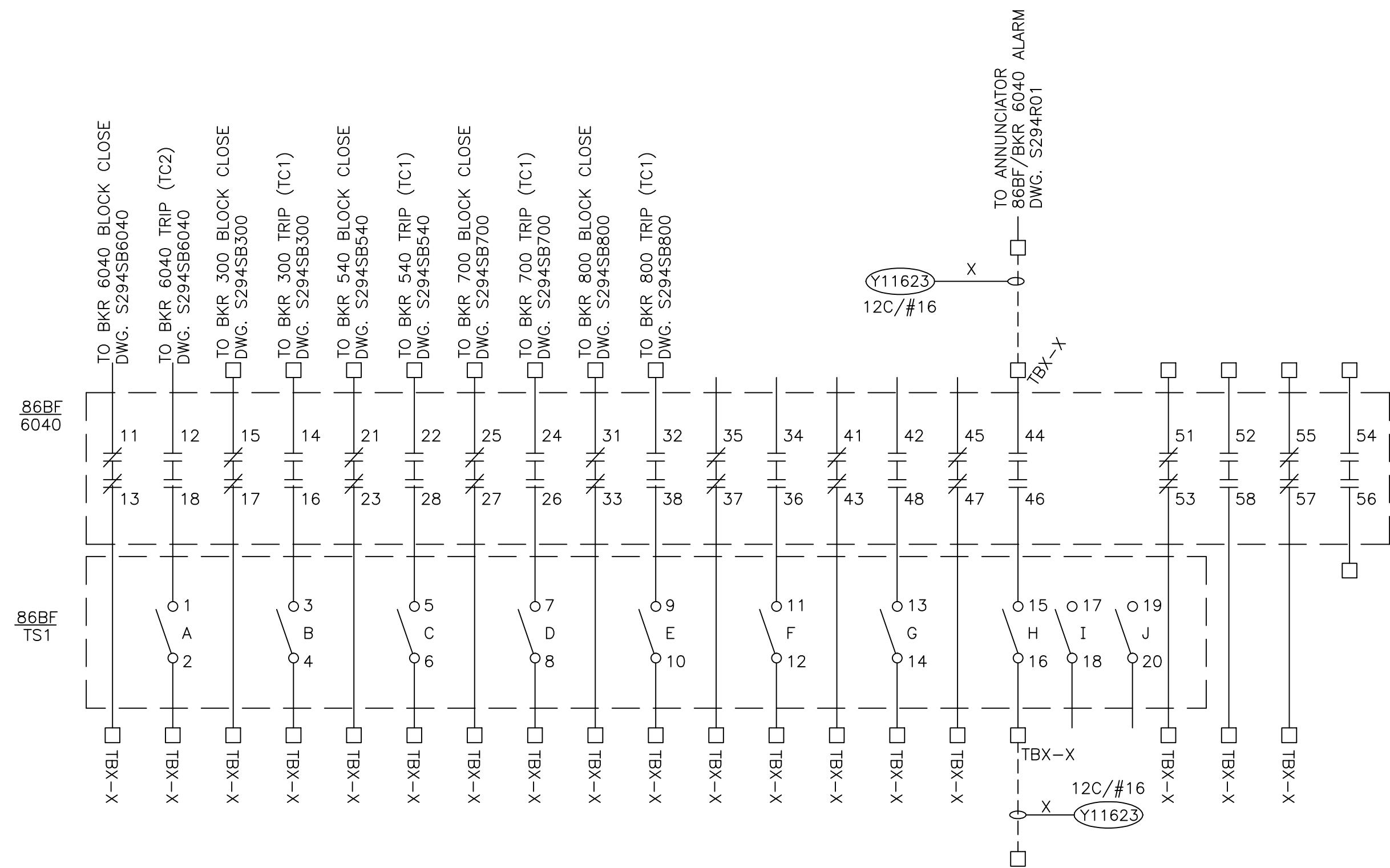
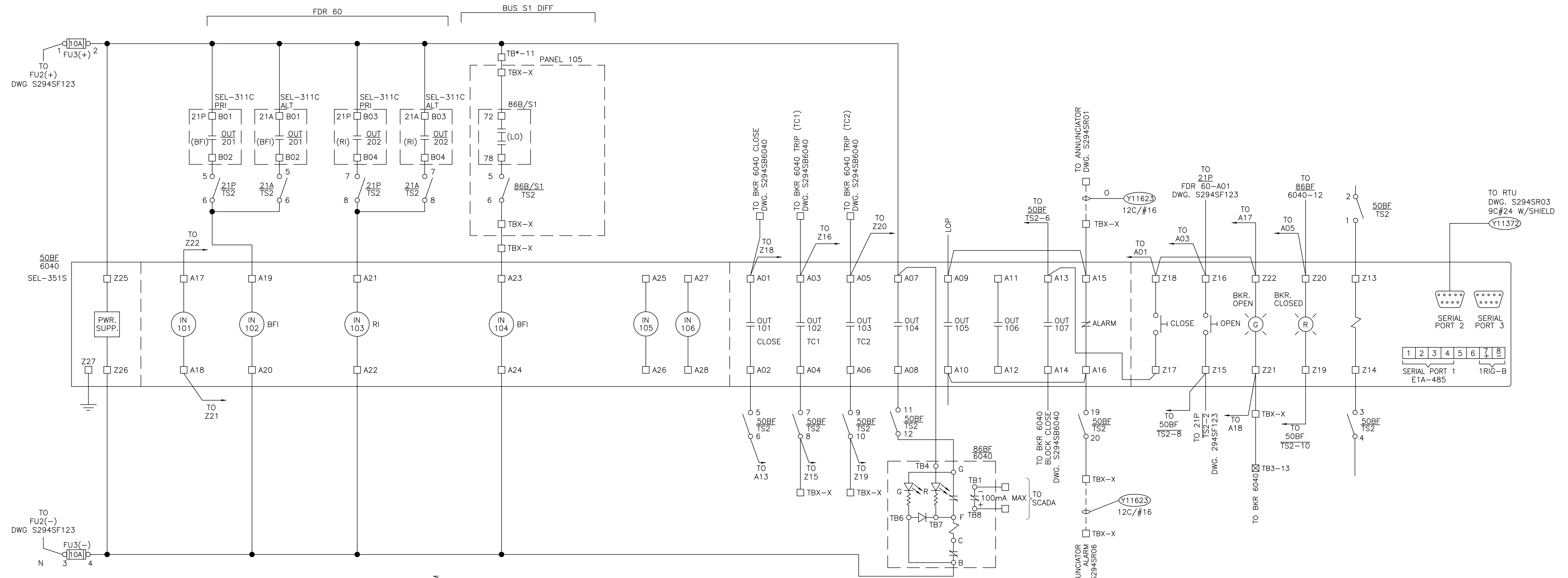
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 161/69KV <b>21A</b> FDR 60-VINITA 69KV CIRCUIT			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
 <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. <b>S294SF124</b>	DATE: 3/7/2011 REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN



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 Last plotted by: Shultz, Arlene  
 Plot Date: 4/24/2012 8:10 AM  
 Plotter used: DWG To PDF.pc3



86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION
		TRIP RESET
1	11 01-13	X
1	12 01-18	X
1	15 01-17	X
1	14 01-16	X
2	21 01-23	X
2	22 01-28	X
2	25 01-27	X
2	24 01-26	X
3	31 01-33	X
3	32 01-38	X
3	35 01-37	X
3	34 01-36	X
4	41 01-43	X
4	42 01-48	X
4	45 01-47	X
4	44 01-46	X
5	51 01-53	X
5	52 01-58	X
5	55 01-57	X
5	54 01-56	X
6	61 01-63	X
6	62 01-68	X
6	65 01-67	X
6	64 01-66	X
7	71 01-73	X
7	72 01-78	X
7	75 01-77	X
7	74 01-76	X
8	81 01-83	X
8	82 01-88	X
8	85 01-87	X
8	84 01-86	X

**NOTES:**  
 1. ALL EQUIPMENT IS ON PANEL 109 UNLESS OTHERWISE NOTED

- REFERENCE DRAWINGS**
- S294SB6040 BREAKER 6040 SCHEMATIC DIAGRAM
  - S294SF125 PRIMARY RELAY FEEDER 60
  - S294SF124 ALTERNATE RELAY FEEDER 60
  - S294SF109 THREE LINE AC DIAGRAM BREAKER 6040 & FDR. 60
  - S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM

☒ TERMINAL BLOCK LOCATED IN THIS PANEL

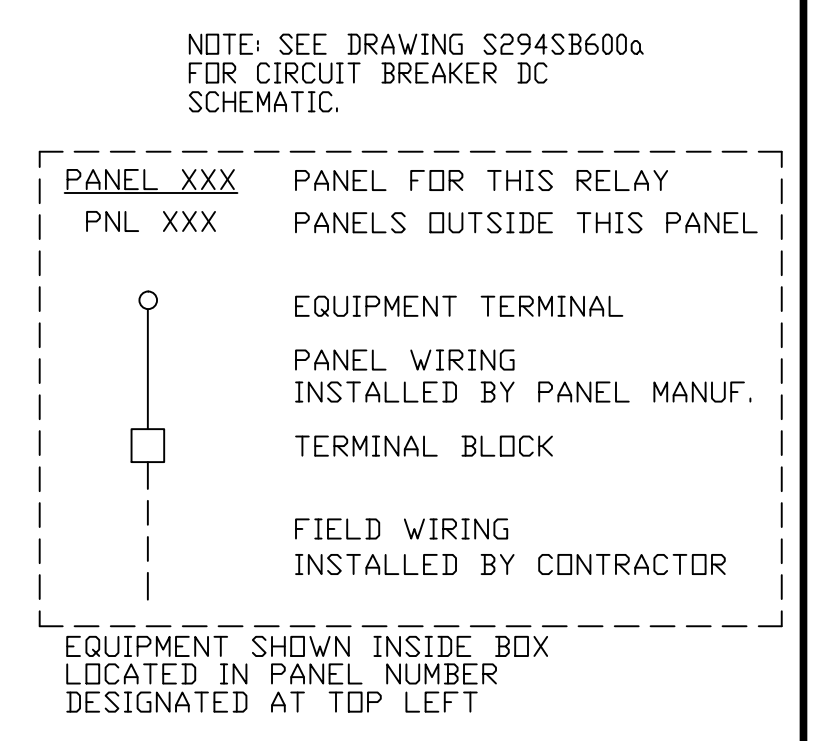
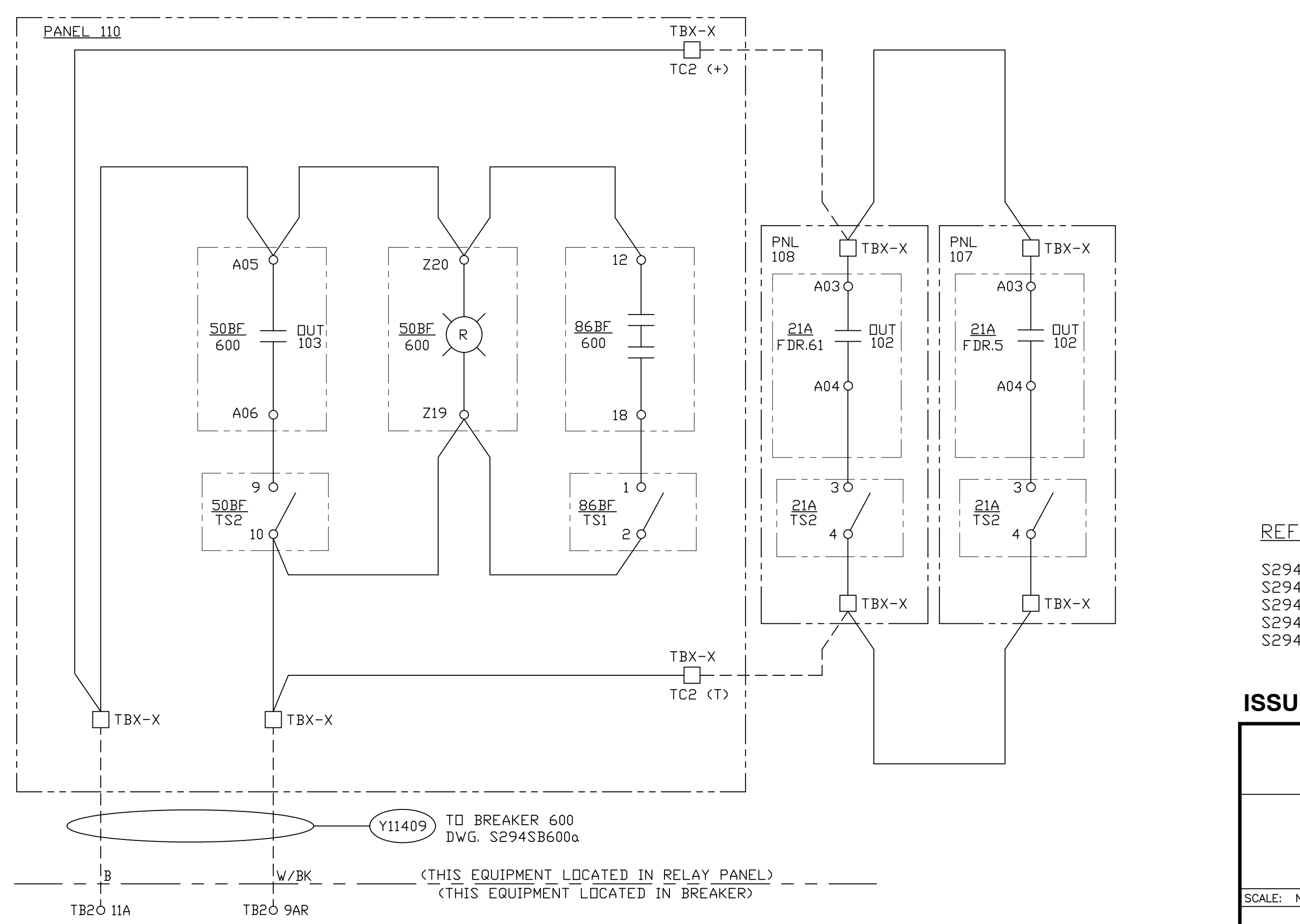
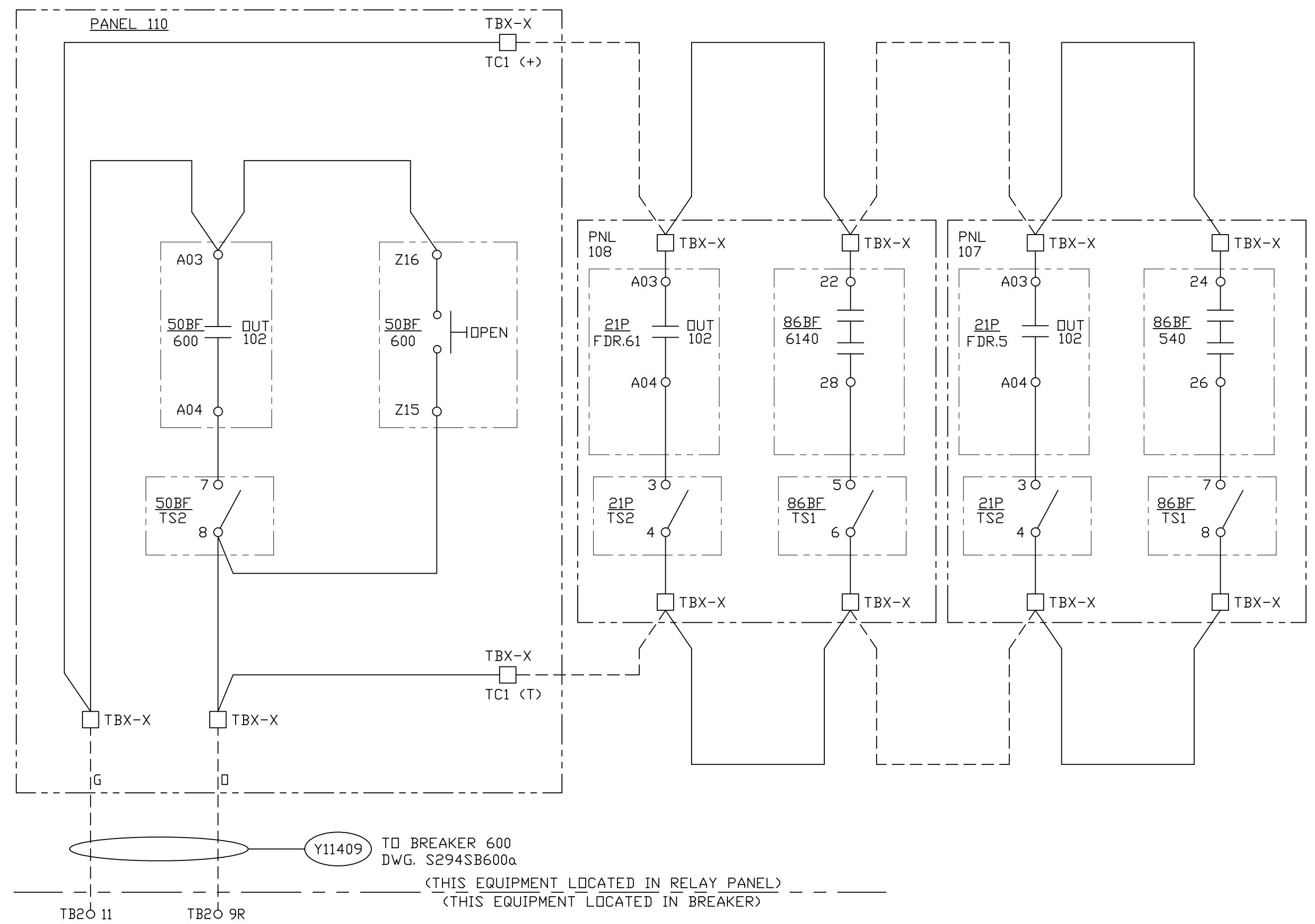
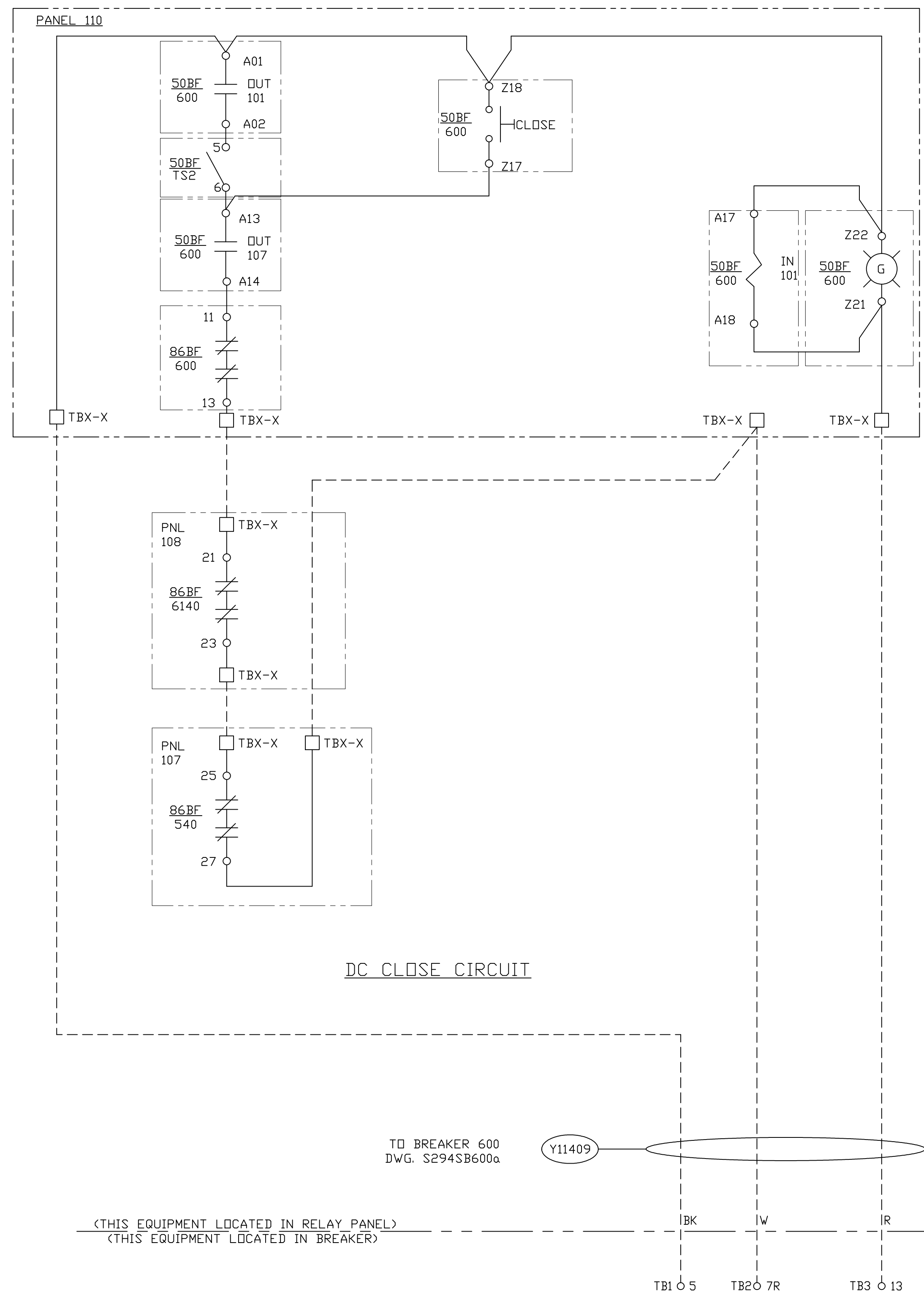
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION S294**  
 AFTON, OKLAHOMA  
 161/69KV  
**BKR 6040 FAILURE & CONTROL**  
**FDR 60-VINITA 69KV CIRCUIT**

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SF125	
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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- REFERENCE DRAWINGS**
- |            |                                |
|------------|--------------------------------|
| S294SB600a | BKR 600 ACDC SCHEMATIC DIAGRAM |
| S294SB600b | BKR 600 BREAKER AUXILIARIES    |
| S294PP107  | FDR 5-69kV PENSACOLA           |
| S294PP108  | FDR 61-69kV MIAMI              |
| S294PP110  | FDR 63-69kV MONKEY ISLAND      |

- NOTES:**
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

**ISSUED FOR BID**

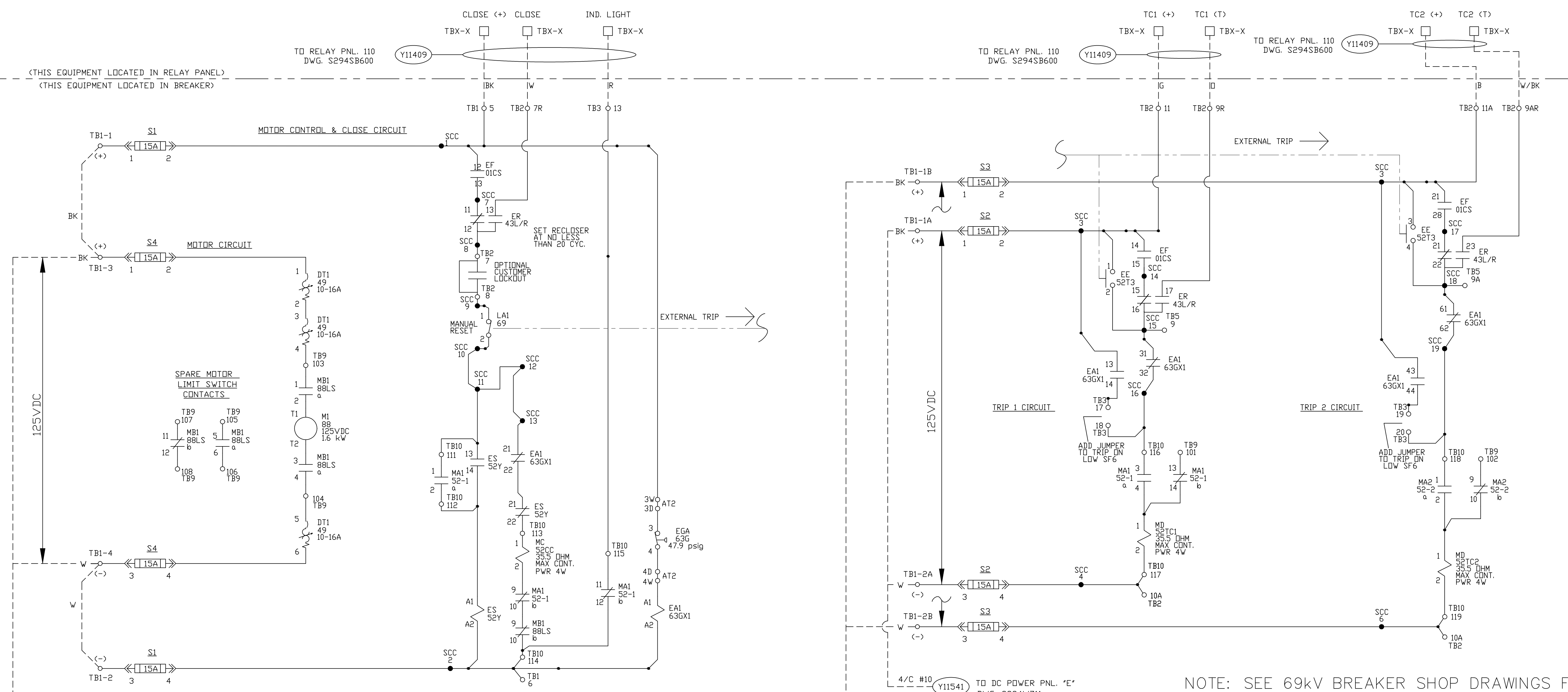
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

**BREAKER 600  
DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No. S294SB600	
		REV. 0	

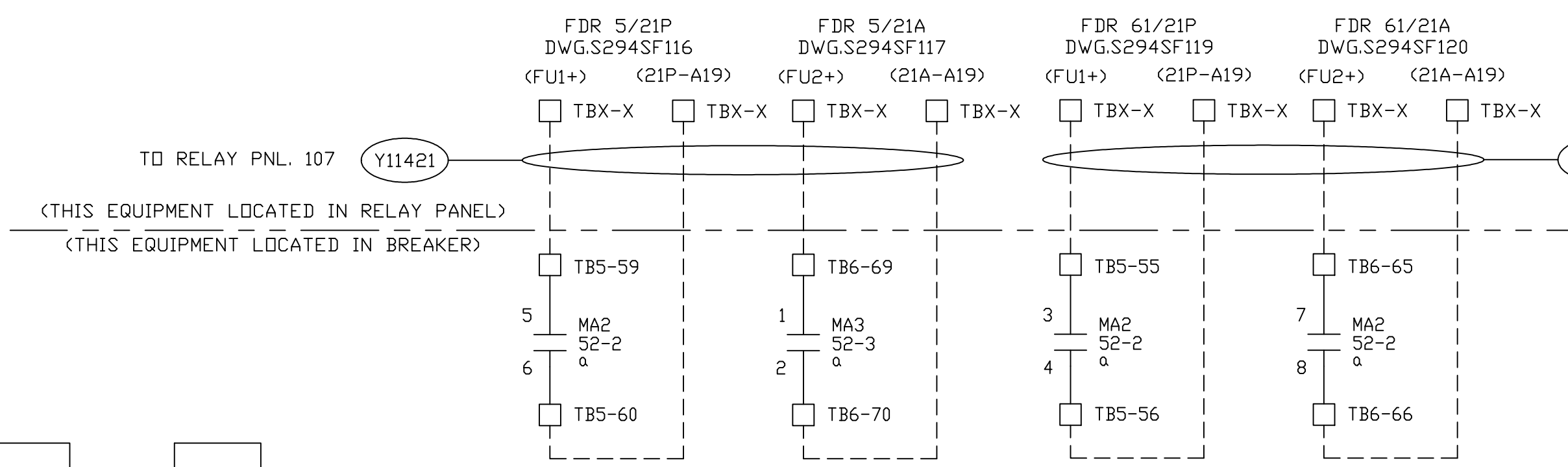
GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

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NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

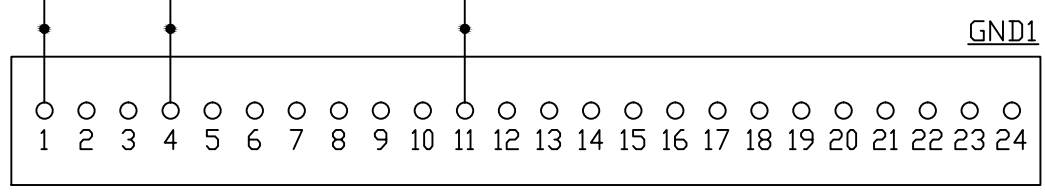


**REFERENCE DRAWINGS**  
 S294SB600 BKR 600 DC SCHEMATIC DIAGRAM  
 S294SB600b BKR 600 BREAKER AUXILIARIES  
 S294WZ11 PANEL E 125VDC WIRING DIAGRAM

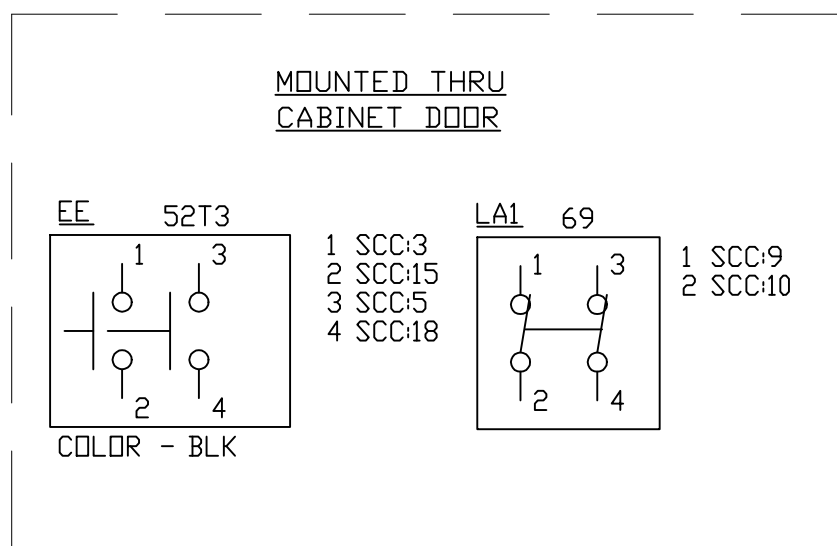
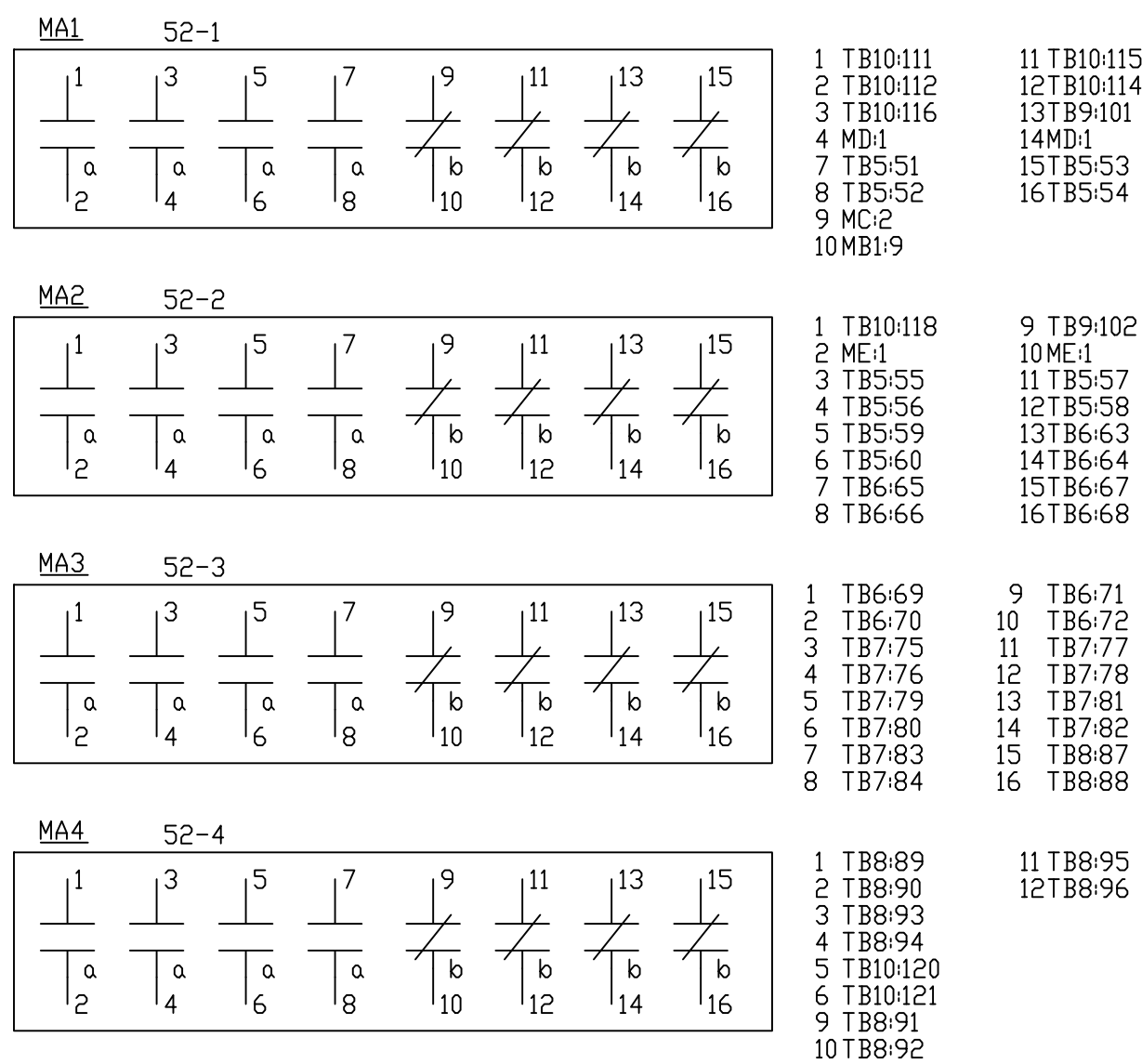
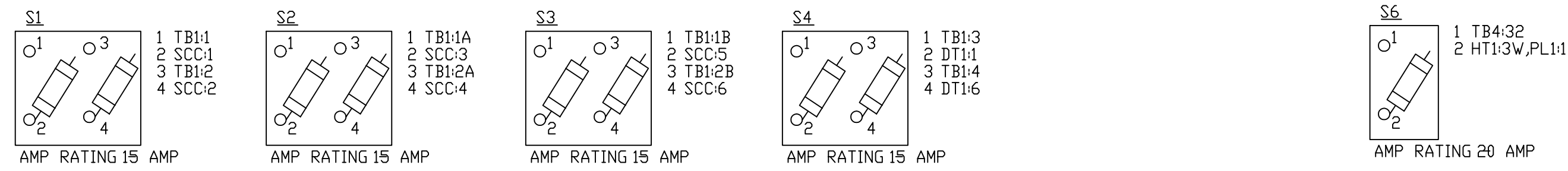
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA 161/69KV  
**BREAKER 600**  
 AC/DC SCHEMATIC DIAGRAM

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB600a	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG



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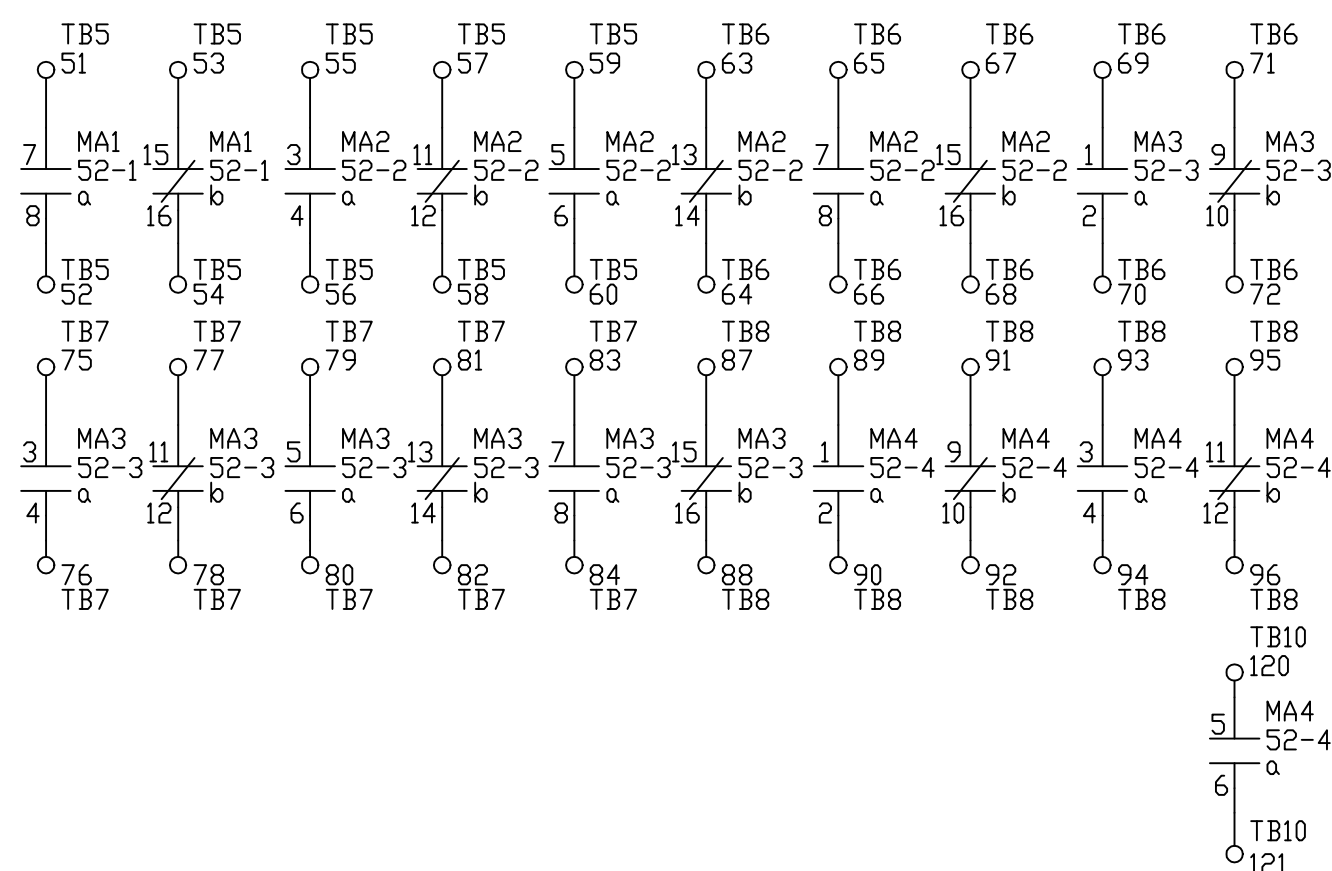
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



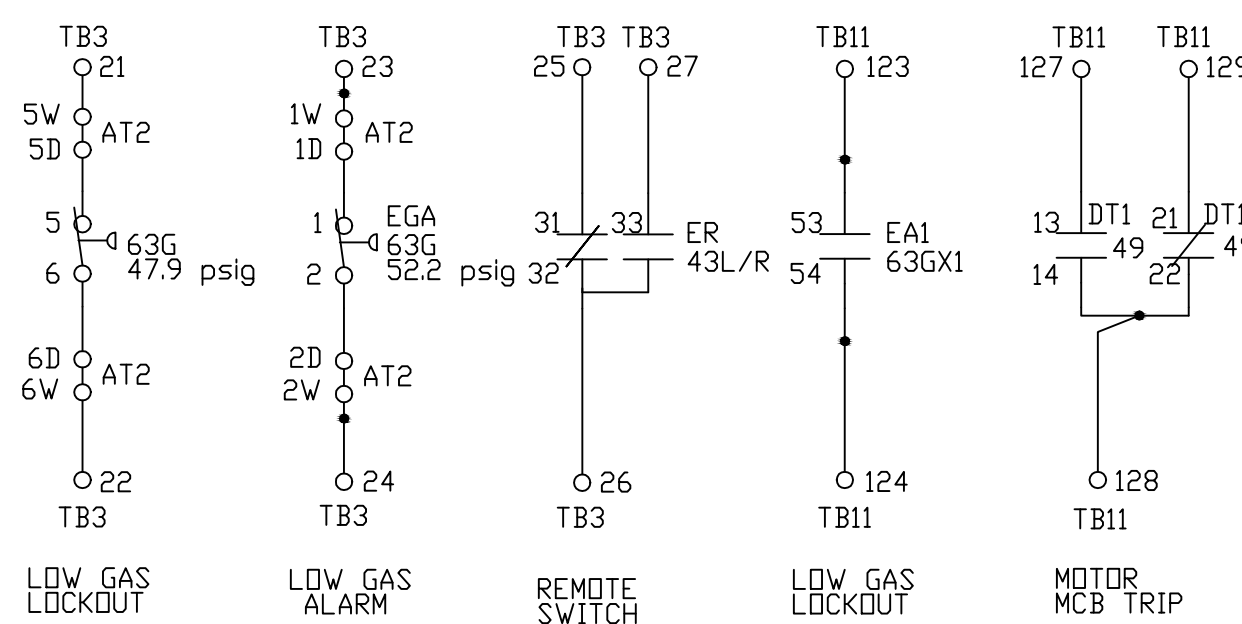
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



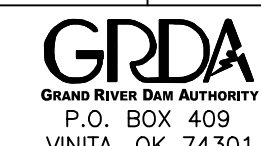
REFERENCE DRAWINGS

- S294SB600 BKR 600 DC SCHEMATIC DIAGRAM
- S294SB600a BKR 600 AC/DC SCHEMATIC DIAGRAM
- S294SB600b BKR 600 BREAKER AUXILIARIES

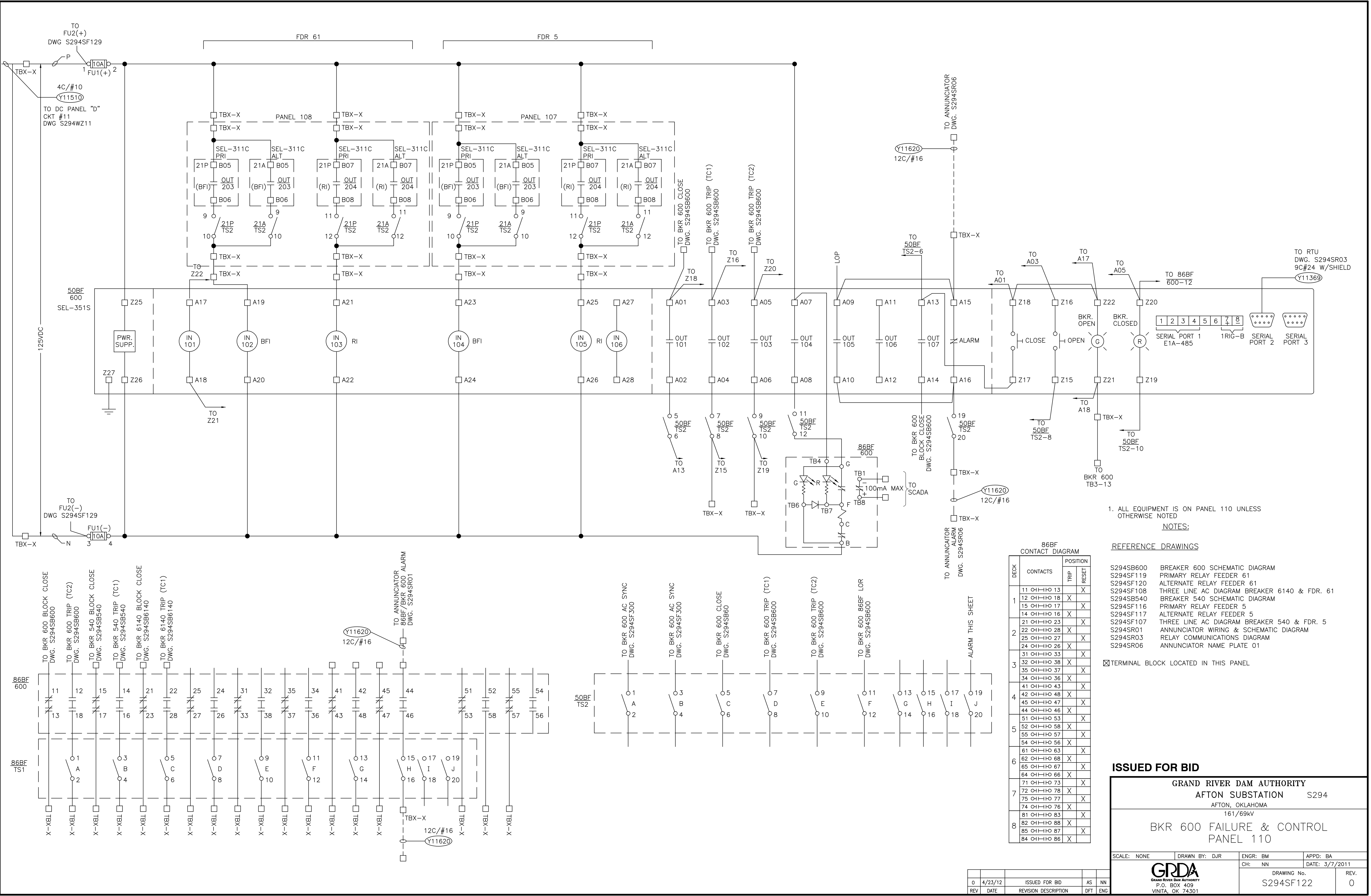
ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
<b>BREAKER 600</b> <b>BREAKER AUXILIARIES</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB600b	
REV 0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG



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86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION
1	11 0-H-10 13	X
	12 0-H-10 18	X
	15 0-H-10 17	X
	14 0-H-10 16	X
	21 0-H-10 23	X
2	22 0-H-10 28	X
	25 0-H-10 27	X
	24 0-H-10 26	X
	31 0-H-10 33	X
3	32 0-H-10 38	X
	35 0-H-10 37	X
	34 0-H-10 36	X
	41 0-H-10 43	X
4	42 0-H-10 48	X
	45 0-H-10 47	X
	44 0-H-10 46	X
	51 0-H-10 53	X
	52 0-H-10 58	X
5	55 0-H-10 57	X
	54 0-H-10 56	X
	61 0-H-10 63	X
	62 0-H-10 68	X
6	65 0-H-10 67	X
	64 0-H-10 66	X
	71 0-H-10 73	X
	72 0-H-10 78	X
7	75 0-H-10 77	X
	74 0-H-10 76	X
	81 0-H-10 83	X
	82 0-H-10 88	X
8	85 0-H-10 87	X
	84 0-H-10 86	X

1. ALL EQUIPMENT IS ON PANEL 110 UNLESS OTHERWISE NOTED

REFERENCES DRAWINGS

- S294SB600 BREAKER 600 SCHEMATIC DIAGRAM
- S294SF119 PRIMARY RELAY FEEDER 61
- S294SF120 ALTERNATE RELAY FEEDER 61
- S294SF108 THREE LINE AC DIAGRAM BREAKER 6140 & FDR. 61
- S294SB540 BREAKER 540 SCHEMATIC DIAGRAM
- S294SF116 PRIMARY RELAY FEEDER 5
- S294SF117 ALTERNATE RELAY FEEDER 5
- S294SF107 THREE LINE AC DIAGRAM BREAKER 540 & FDR. 5
- S294SR01 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SR06 ANNUNCIATOR NAME PLATE 01

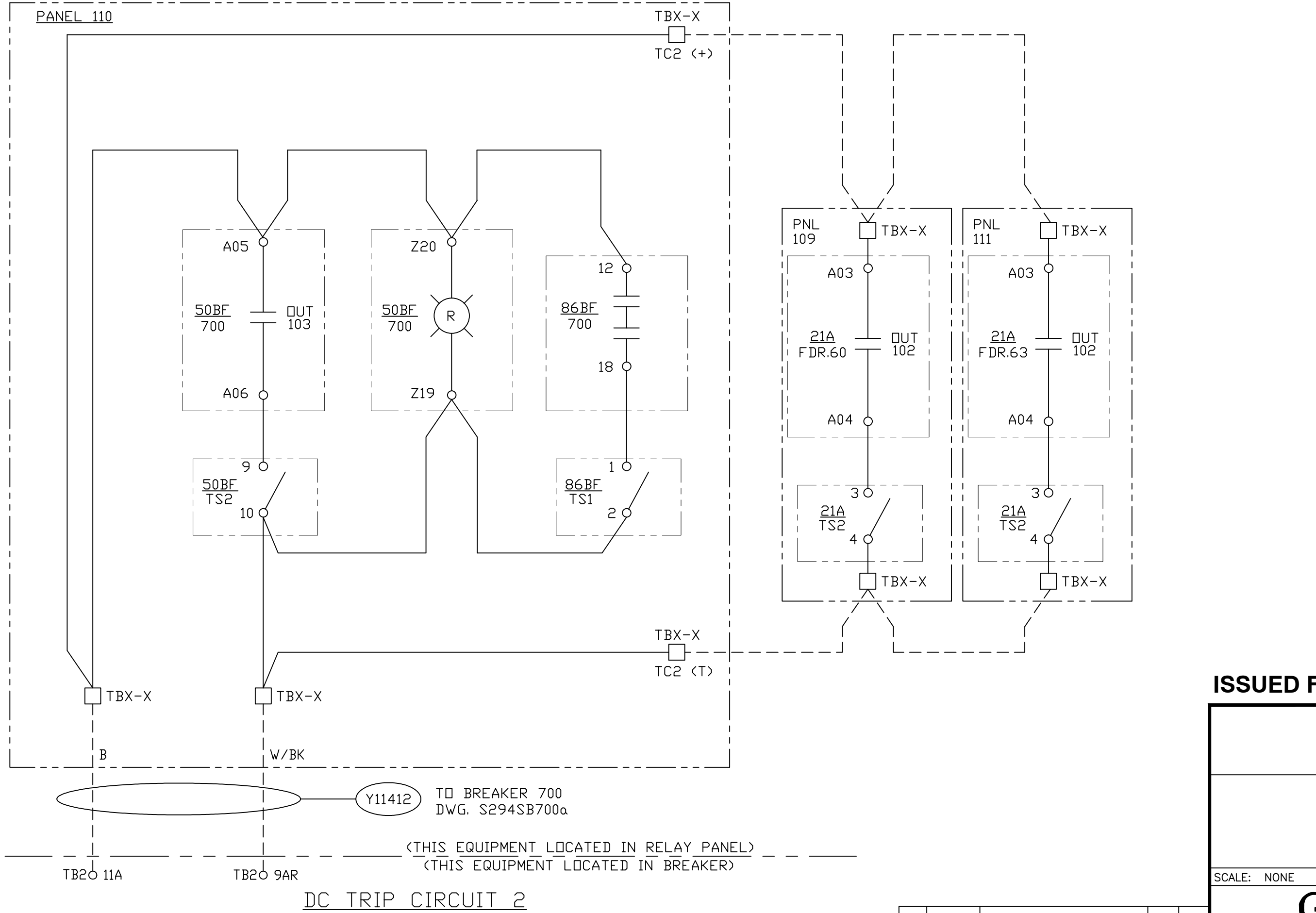
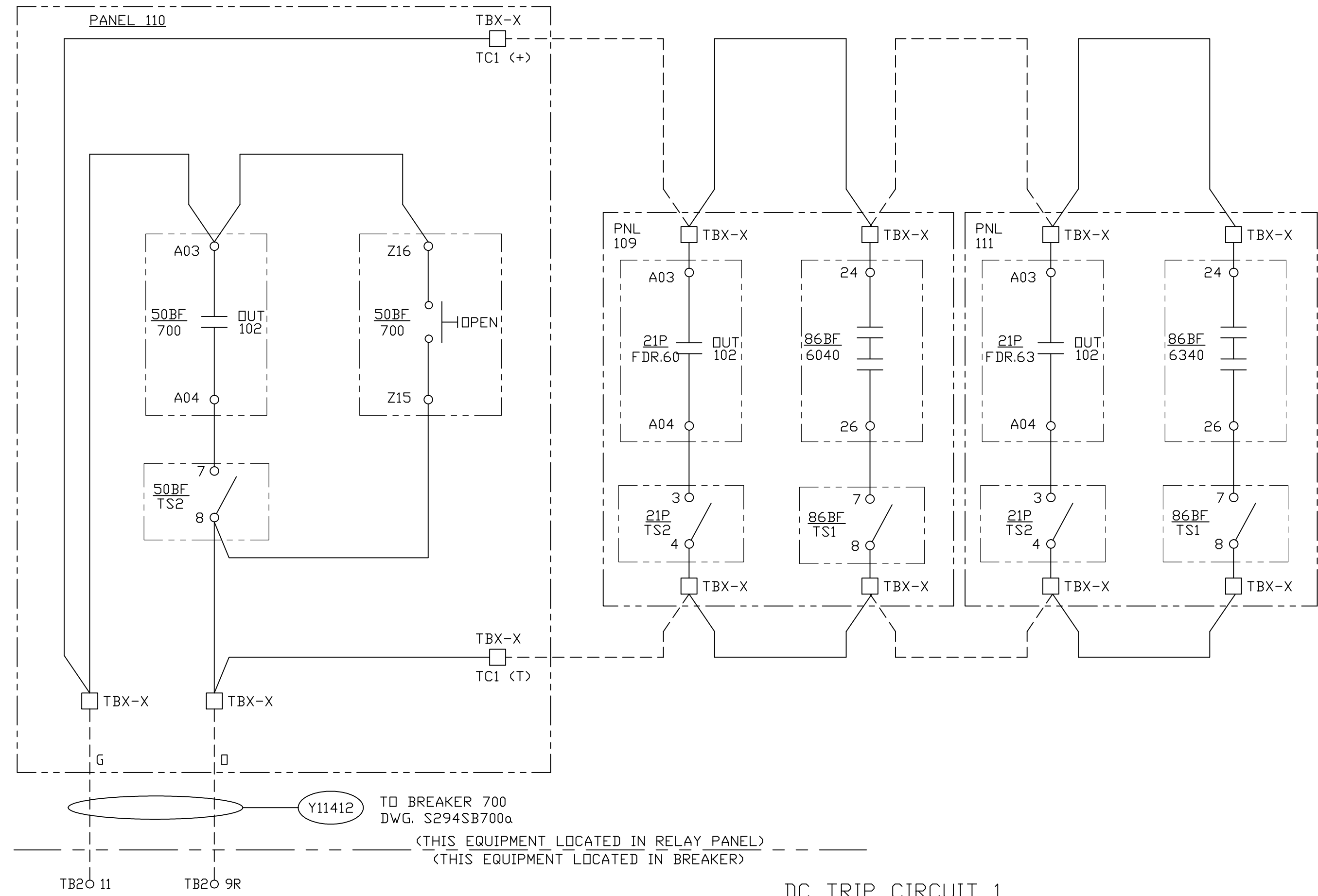
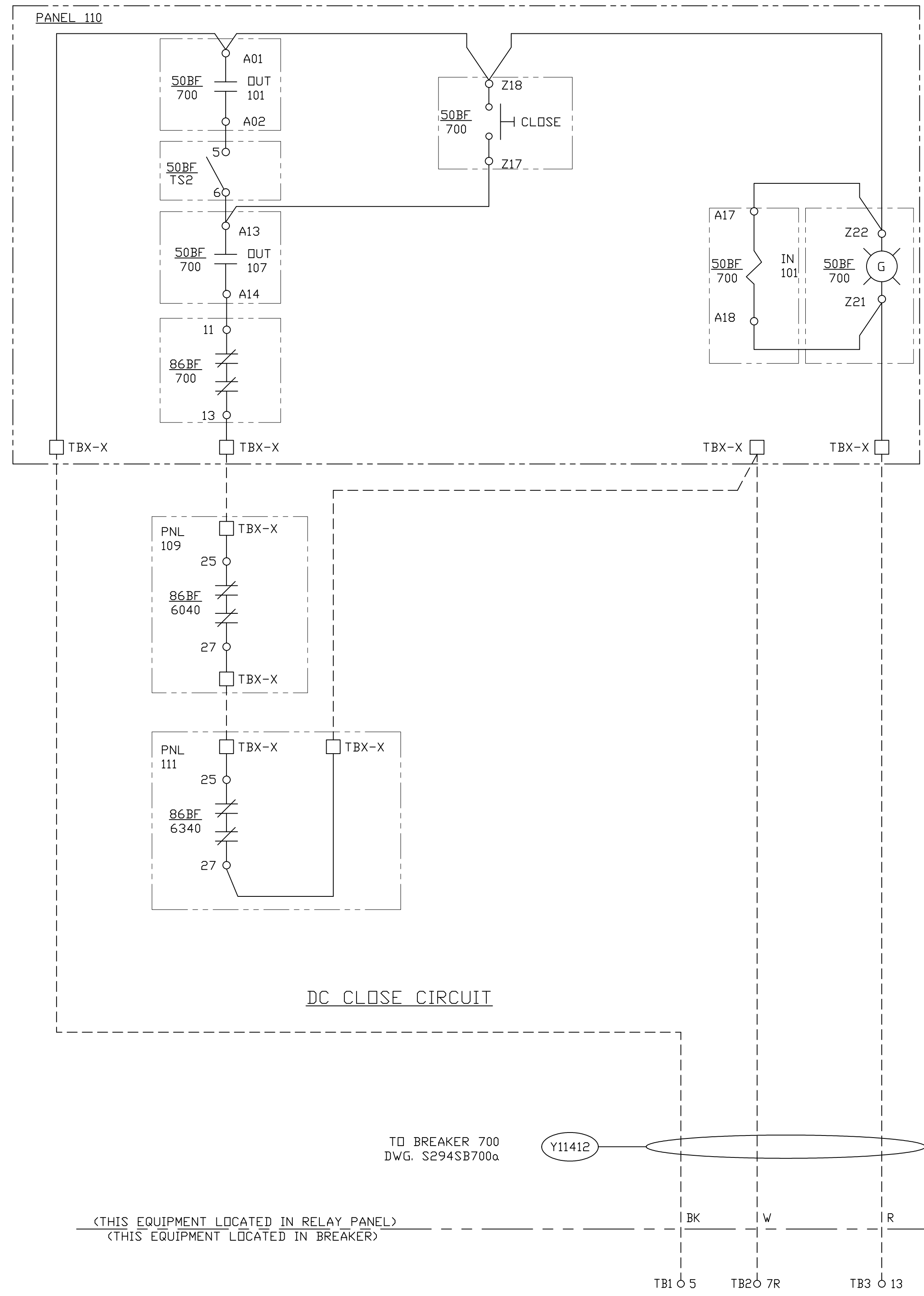
☒ TERMINAL BLOCK LOCATED IN THIS PANEL

ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
<b>BKR 600 FAILURE &amp; CONTROL</b> PANEL 110			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
		CH: NN	DATE: 3/7/2011
DRAWING No. <b>S294SF122</b>		REV.	0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

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 Last Saved by: Ashulis Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/24/2012 12:41 PM Last saved by: Ashulis



NOTE: SEE DRAWING S294SB700a FOR CIRCUIT BREAKER DC SCHEMATIC.

PANEL XXX PANEL FOR THIS RELAY PANELS OUTSIDE THIS PANEL

PNL XXX EQUIPMENT TERMINAL

— PANEL WIRING INSTALLED BY PANEL MANUF.

□ TERMINAL BLOCK

— FIELD WIRING INSTALLED BY CONTRACTOR

EQUIPMENT SHOWN INSIDE BOX LOCATED IN PANEL NUMBER DESIGNATED AT TOP LEFT

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

**ISSUED FOR BID**

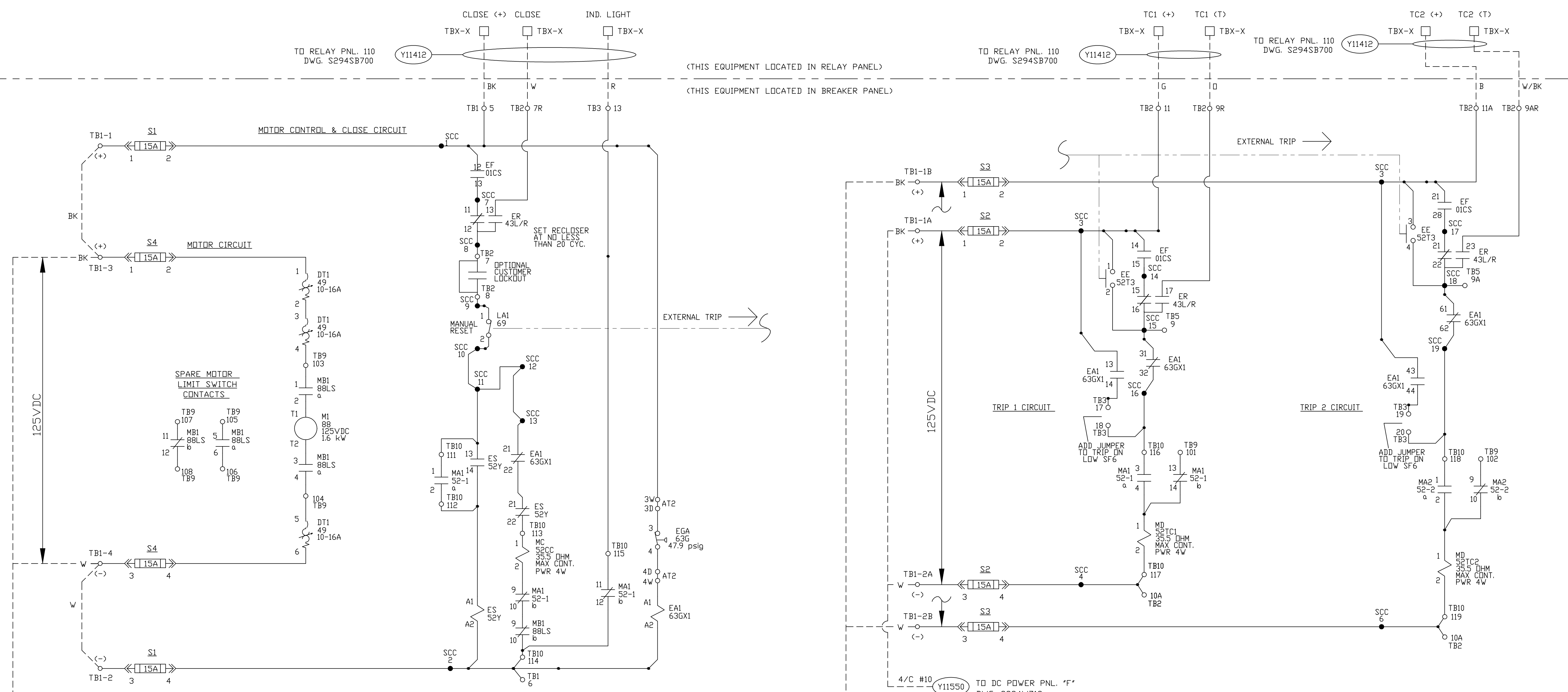
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

**BREAKER 700  
DC SCHEMATIC DIAGRAM**

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CH: NN	DATE: 3/7/2011	DRAWING No. S294SB700	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

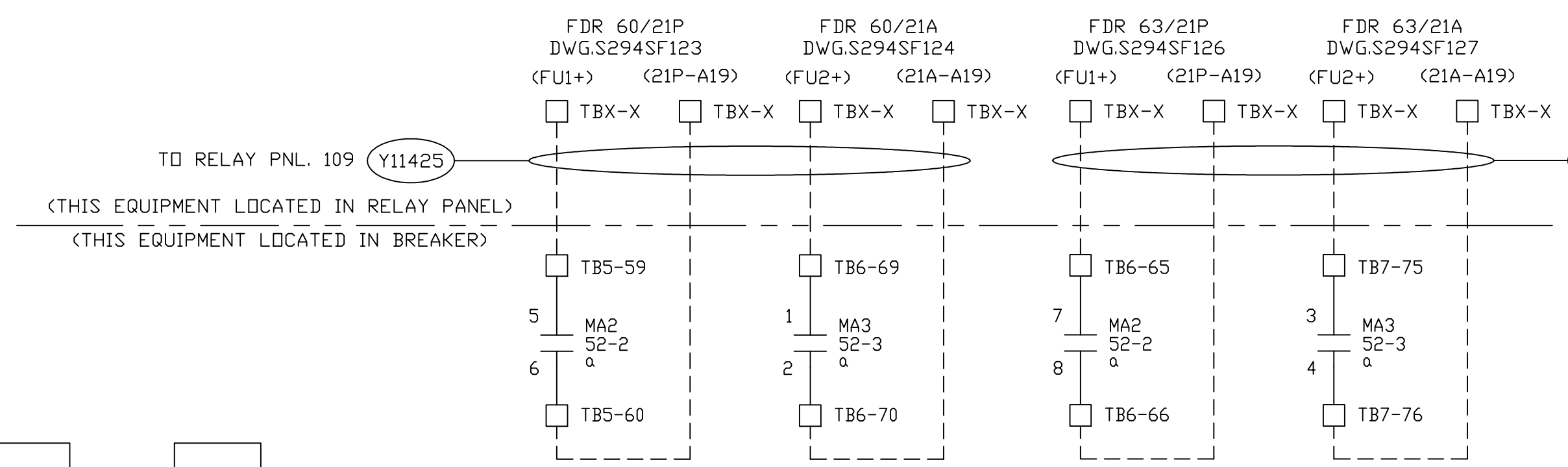
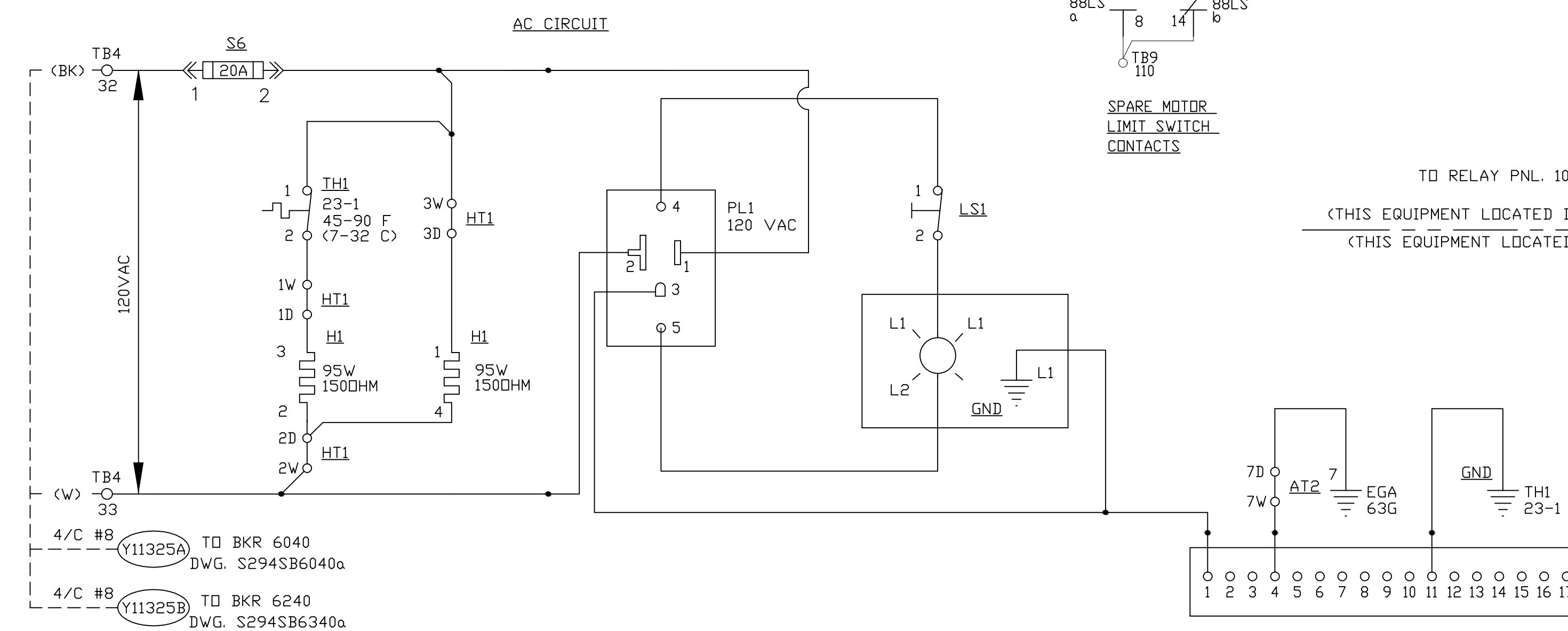
GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION



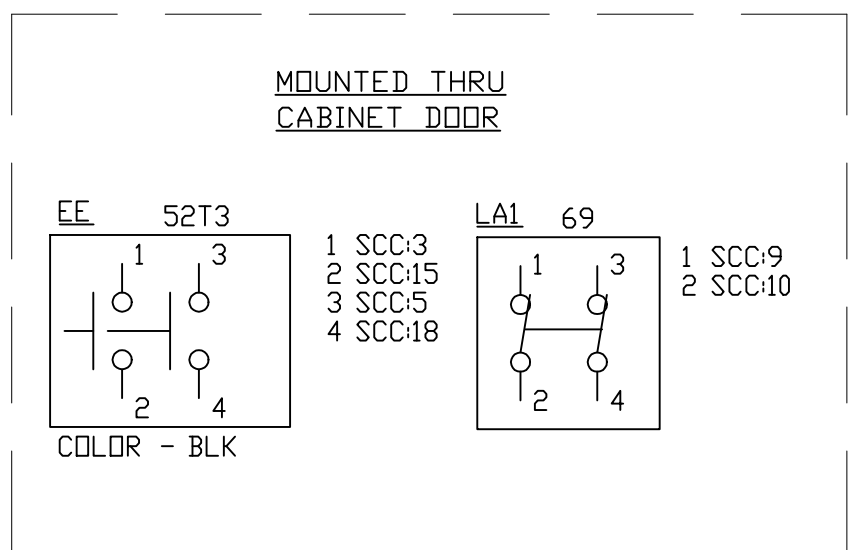
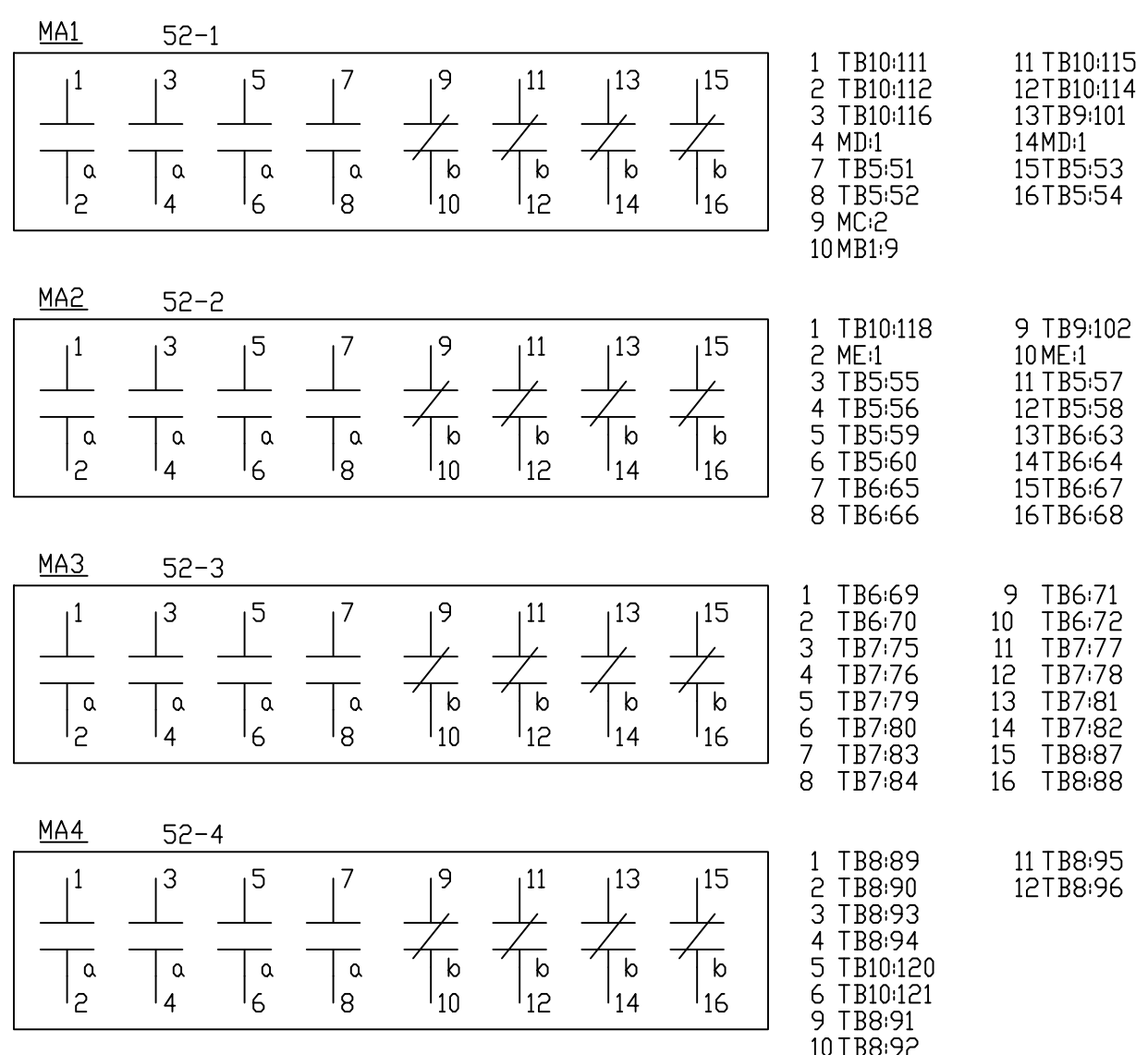
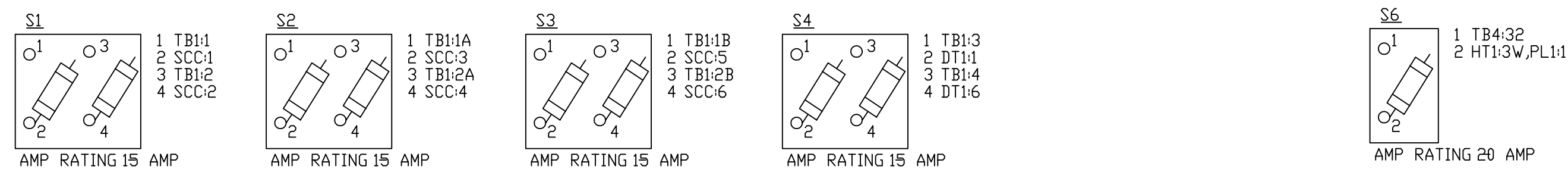
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 700**  
**AC/DC SCHEMATIC DIAGRAM**

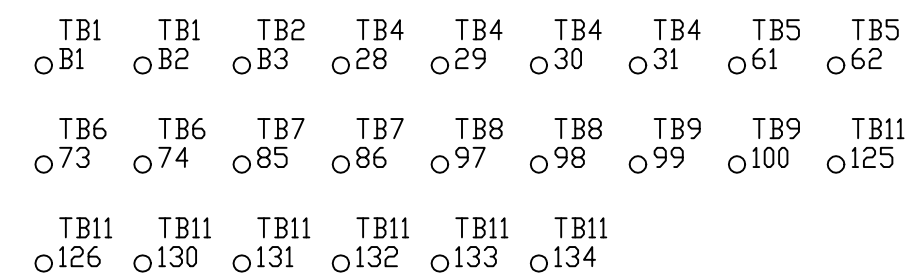
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REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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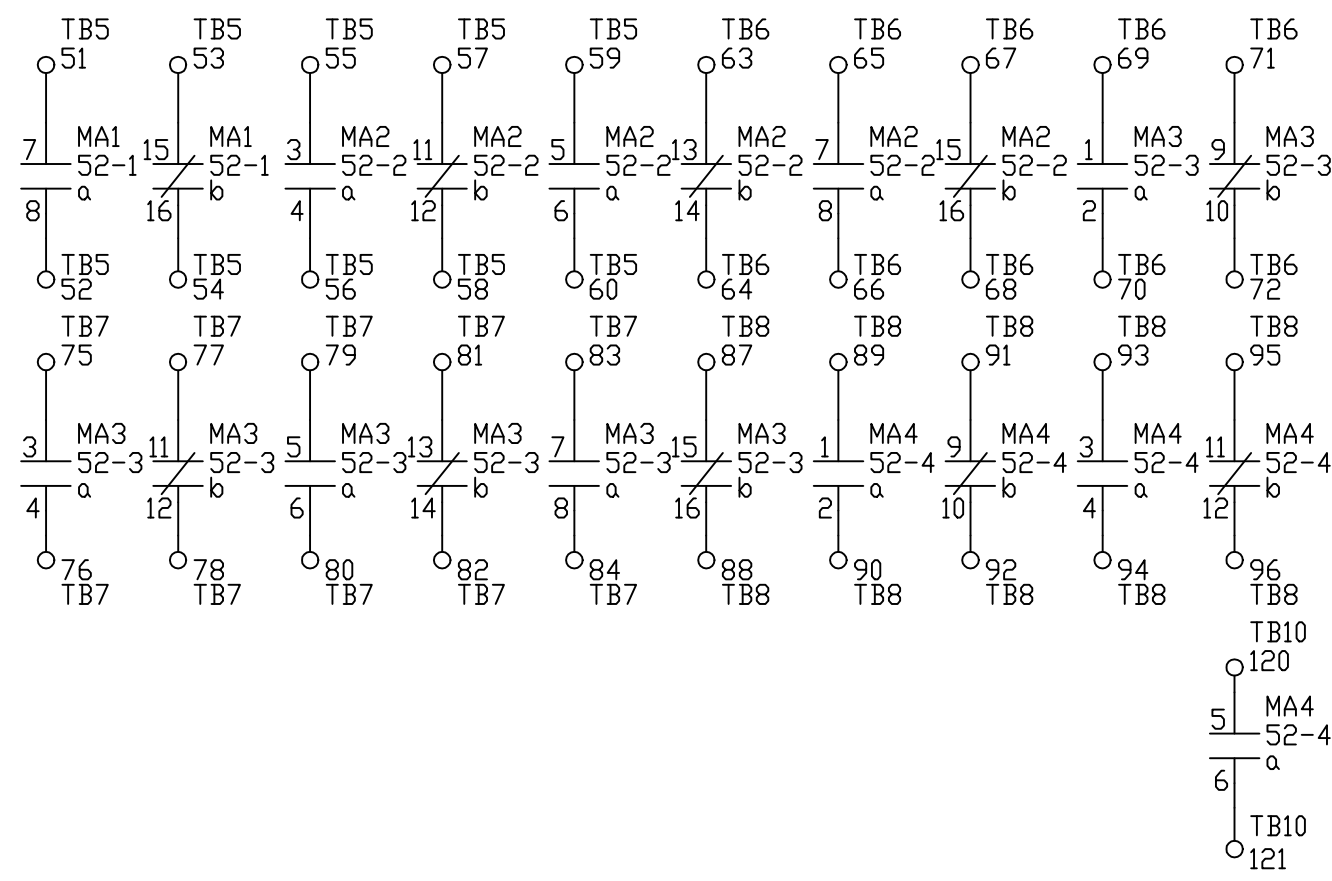
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



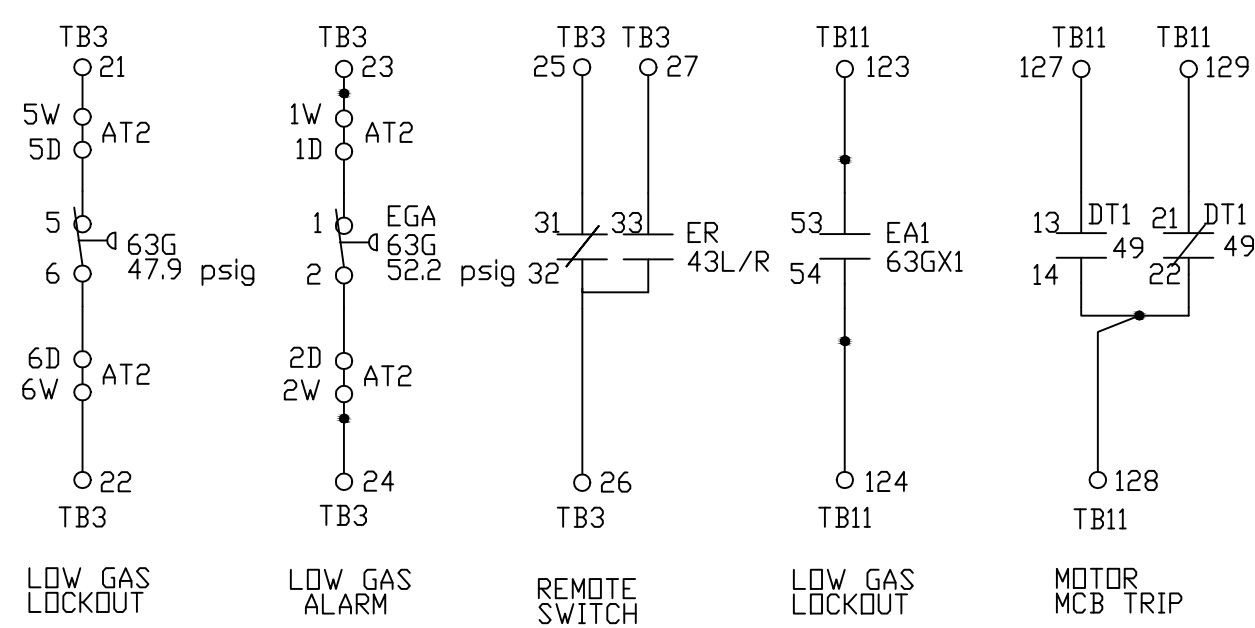
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



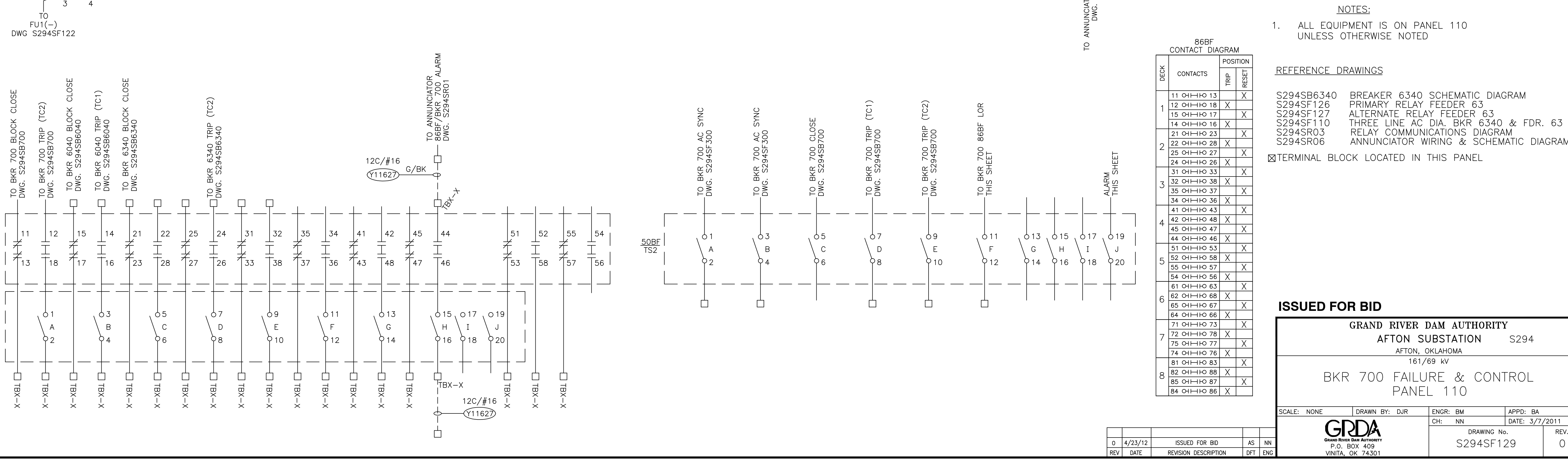
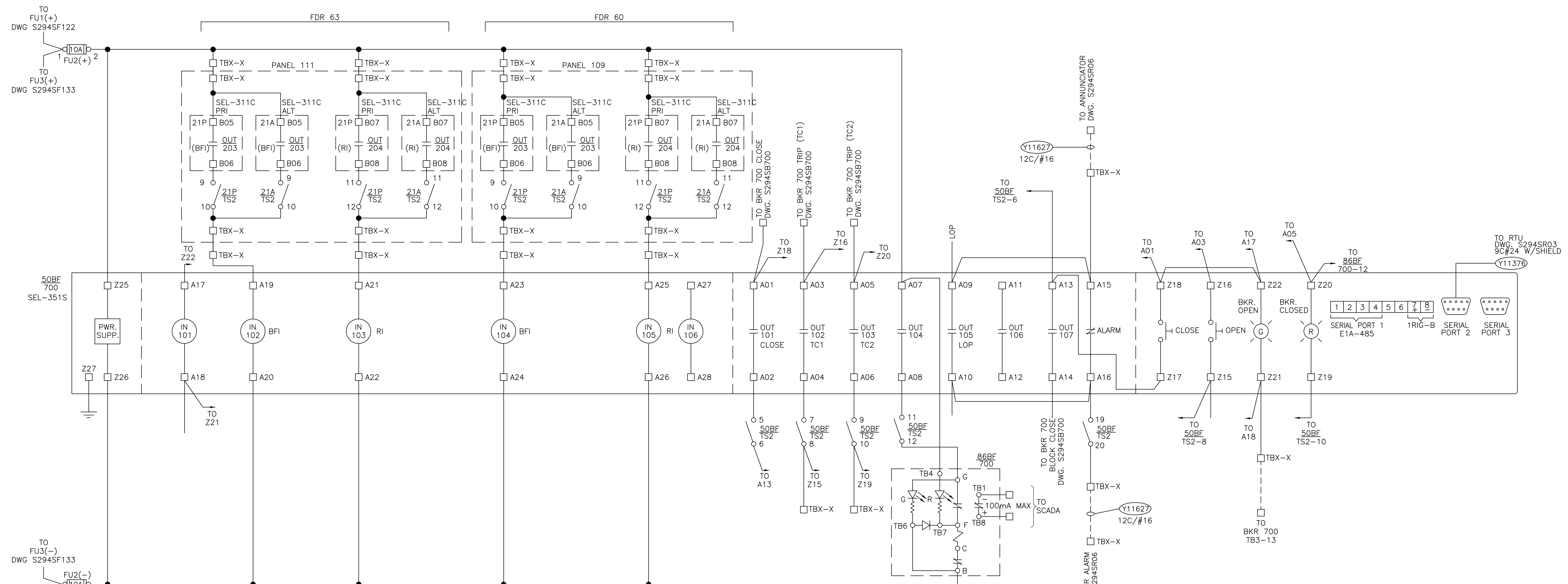
<b>ISSUED FOR BID</b>			
GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
<b>BREAKER 700</b> <b>BREAKER AUXILIARIES</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB700b	
REV 0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG





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 Plotter Used: DWG To PDF.pc3



**NOTES:**  
 1. ALL EQUIPMENT IS ON PANEL 110 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**

S294SB6340	BREAKER 6340 SCHEMATIC DIAGRAM
S294SF126	PRIMARY RELAY FEEDER 63
S294SF127	ALTERNATE RELAY FEEDER 63
S294SF110	THREE LINE AC DIA. BKR 6340 & FDR. 63
S294SR03	RELAY COMMUNICATIONS DIAGRAM
S294SR06	ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM

TERMINAL BLOCK LOCATED IN THIS PANEL

86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION
1	11 OH-HO 13	X
1	12 OH-HO 18	X
1	15 OH-HO 17	X
1	14 OH-HO 16	X
2	21 OH-HO 23	X
2	22 OH-HO 28	X
2	25 OH-HO 27	X
2	24 OH-HO 26	X
3	31 OH-HO 33	X
3	32 OH-HO 38	X
3	35 OH-HO 37	X
3	34 OH-HO 36	X
4	41 OH-HO 43	X
4	42 OH-HO 48	X
4	45 OH-HO 47	X
4	44 OH-HO 46	X
5	51 OH-HO 53	X
5	52 OH-HO 58	X
5	55 OH-HO 57	X
5	54 OH-HO 56	X
6	61 OH-HO 63	X
6	62 OH-HO 68	X
6	65 OH-HO 67	X
6	64 OH-HO 66	X
7	71 OH-HO 73	X
7	72 OH-HO 78	X
7	75 OH-HO 77	X
7	74 OH-HO 76	X
8	81 OH-HO 83	X
8	82 OH-HO 88	X
8	85 OH-HO 87	X
8	84 OH-HO 86	X

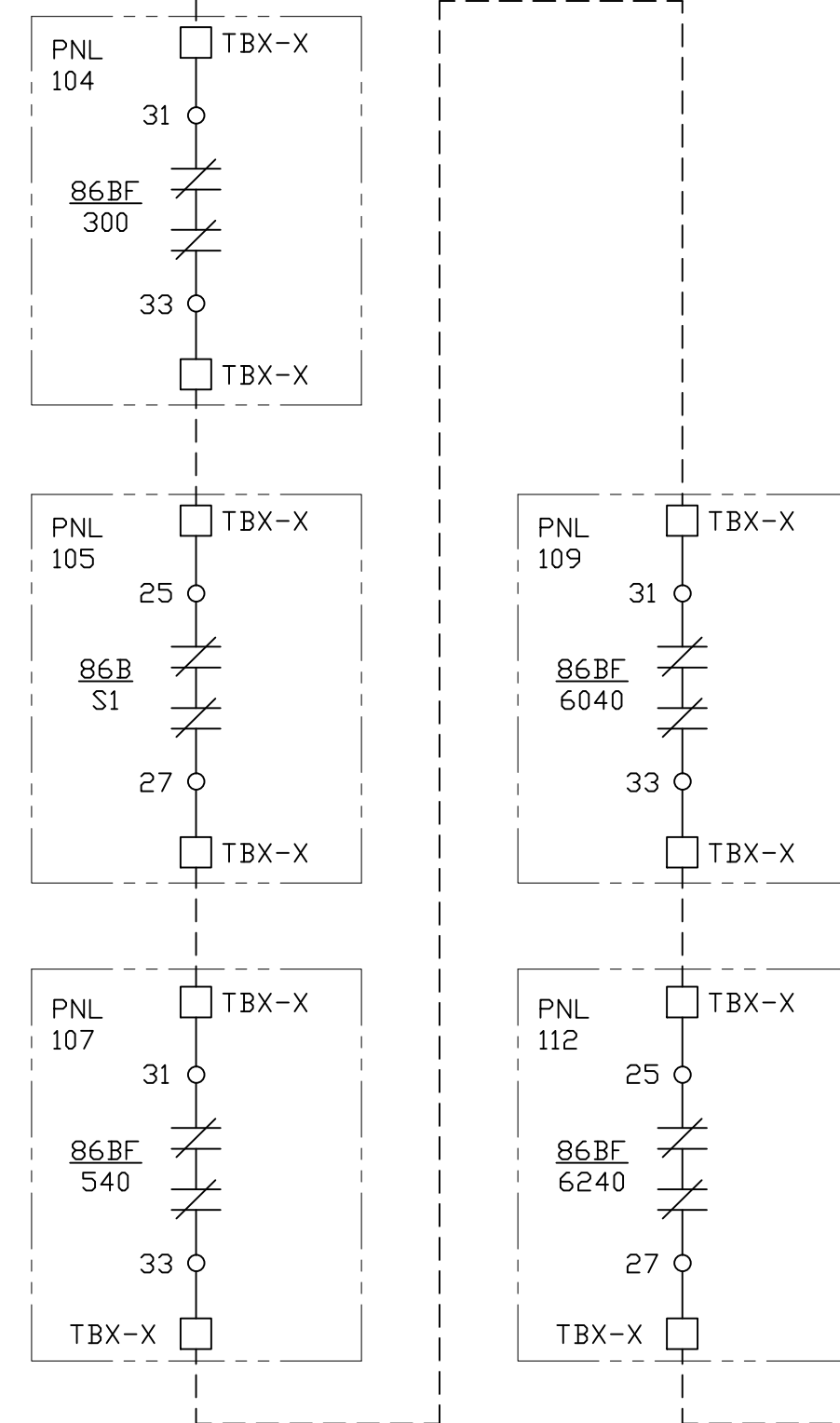
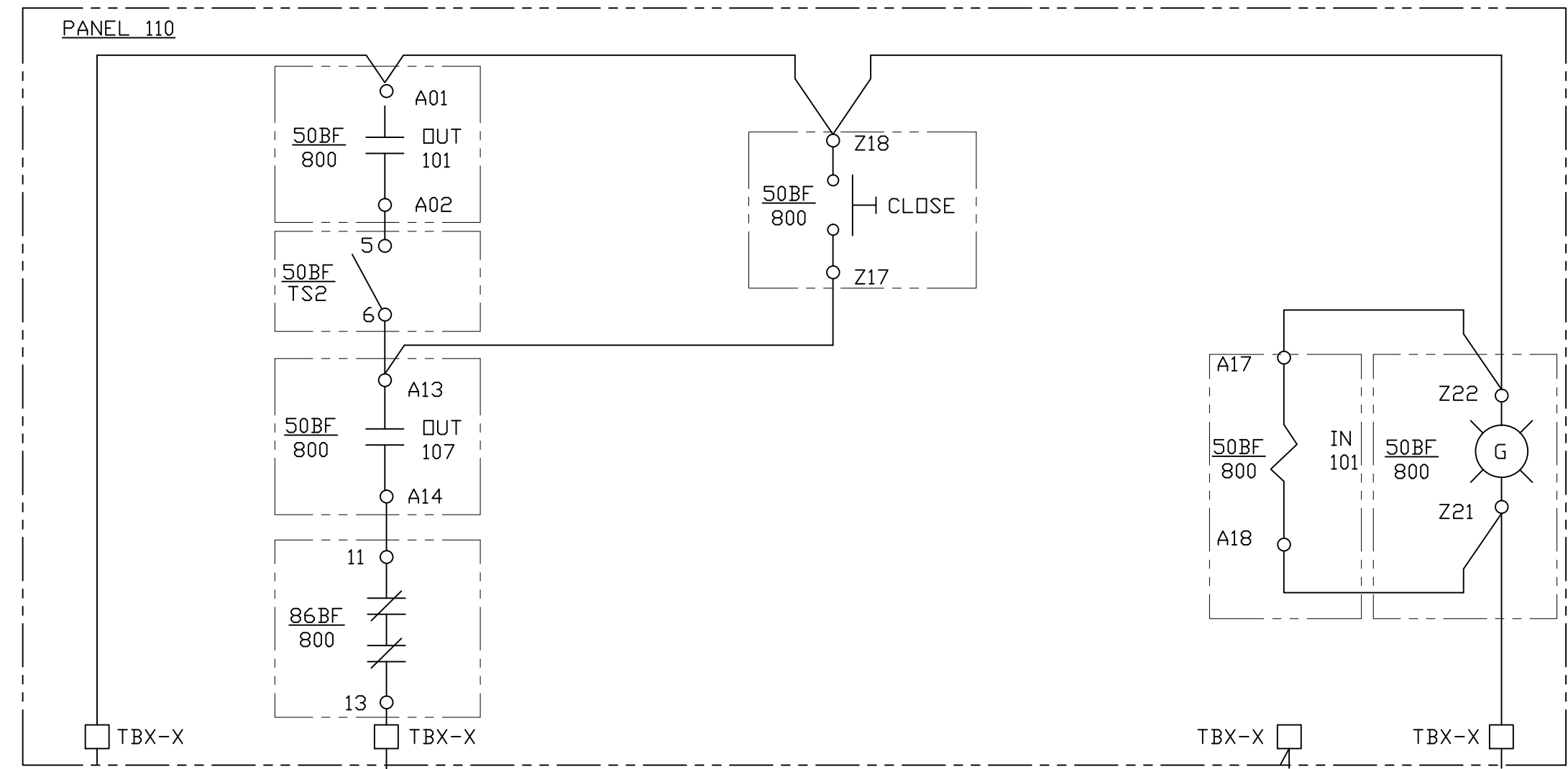
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69 kV

**BKR 700 FAILURE & CONTROL**  
 PANEL 110

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No. <b>S294SF129</b>	
0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

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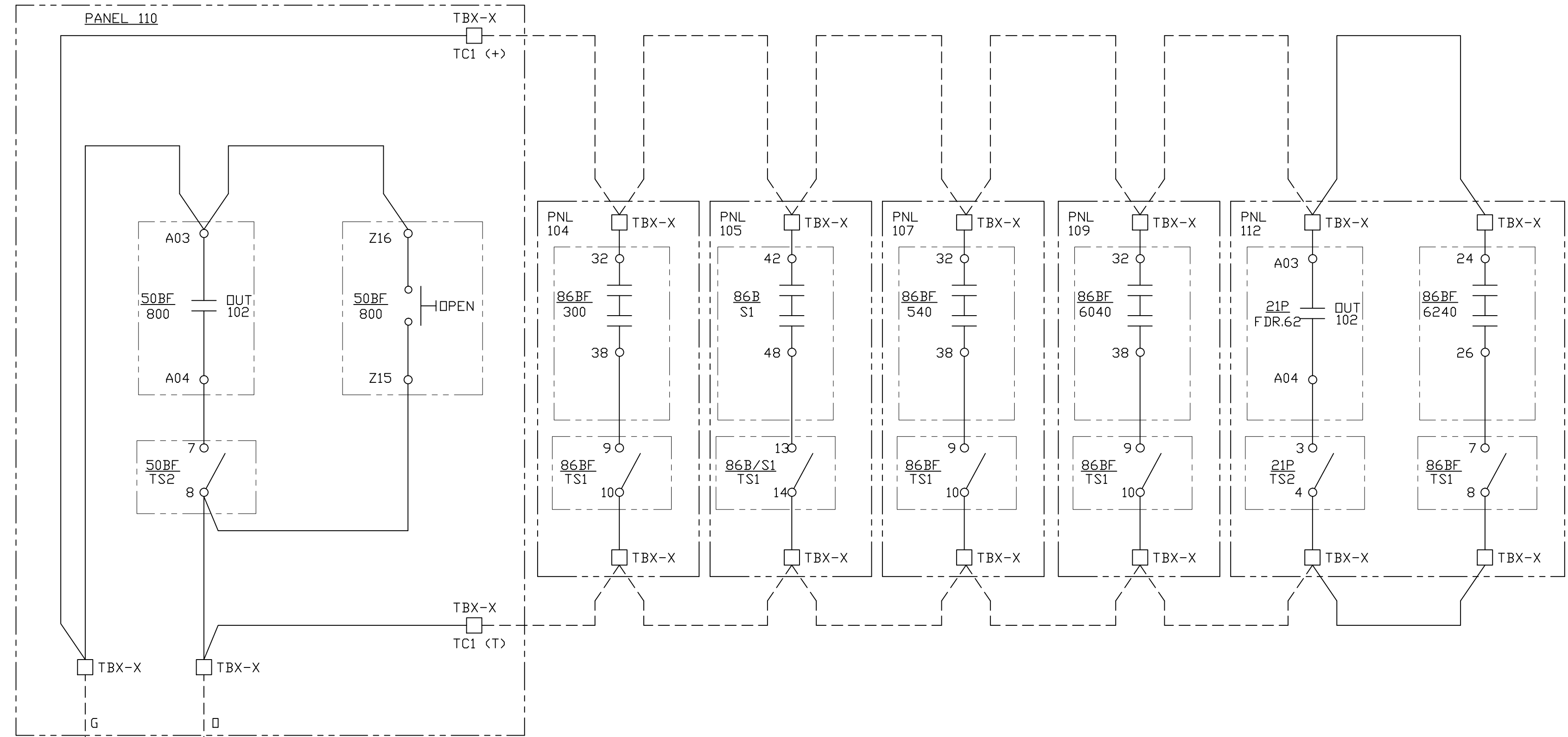
DC CLOSE CIRCUIT

TO BREAKER 800  
DWG. S294SB800a

Y11414

(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

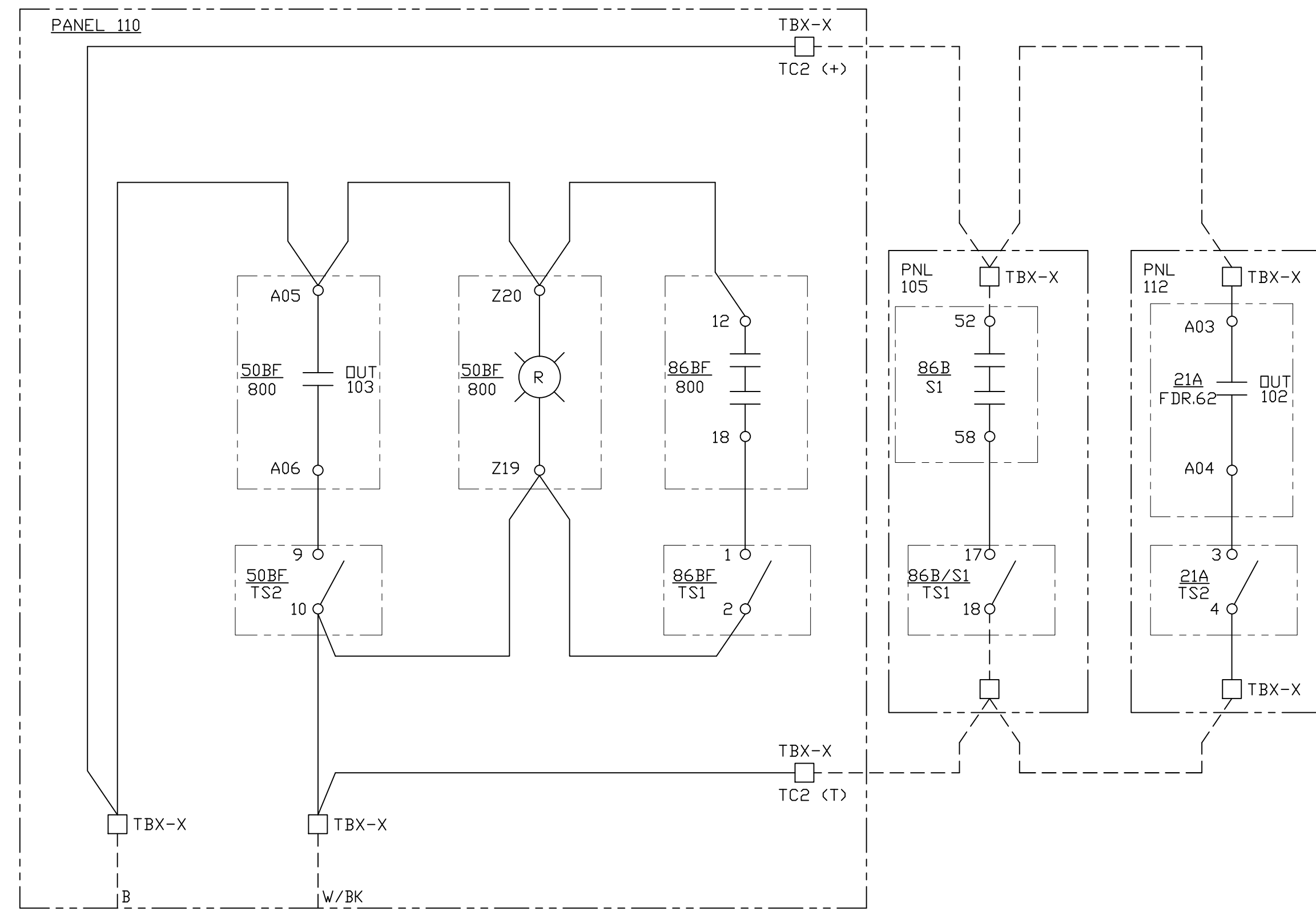
TB1 0 5    TB2 0 7R    TB3 0 13



DC TRIP CIRCUIT 1

Y11414 TO BREAKER 800  
DWG. S294SB800a  
(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

TB2 0 11    TB2 0 9R

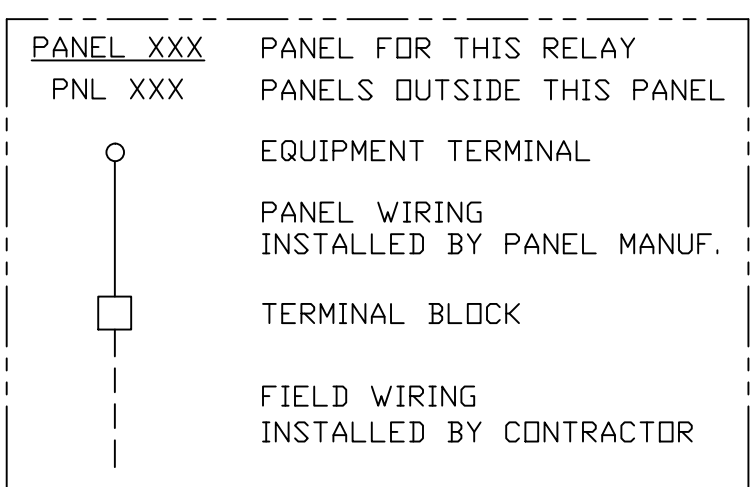


DC TRIP CIRCUIT 2

Y11414 TO BREAKER 800  
DWG. S294SB800a  
(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

TB2 0 11A    TB2 0 9AR

NOTE: SEE DRAWING S294SB800a  
FOR CIRCUIT BREAKER DC  
SCHEMATIC.



EQUIPMENT SHOWN INSIDE BOX  
LOCATED IN PANEL NUMBER  
DESIGNATED AT TOP LEFT

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SFG SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

**ISSUED FOR BID**

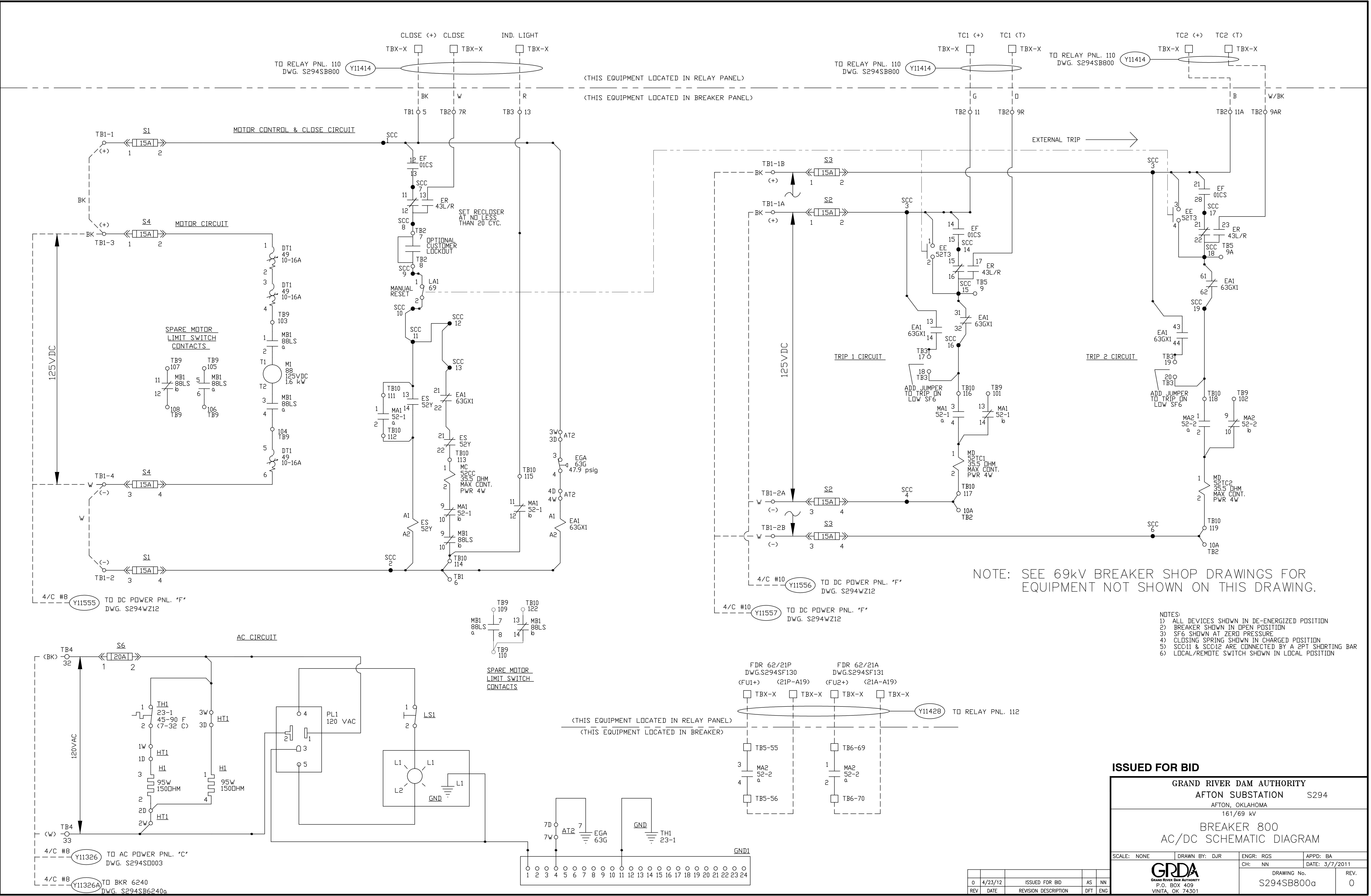
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

**BREAKER 800  
DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB800	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

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NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

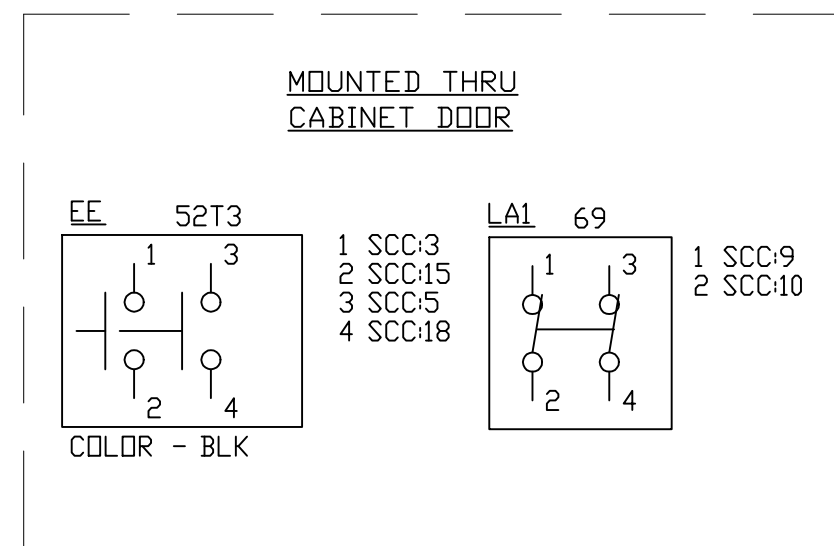
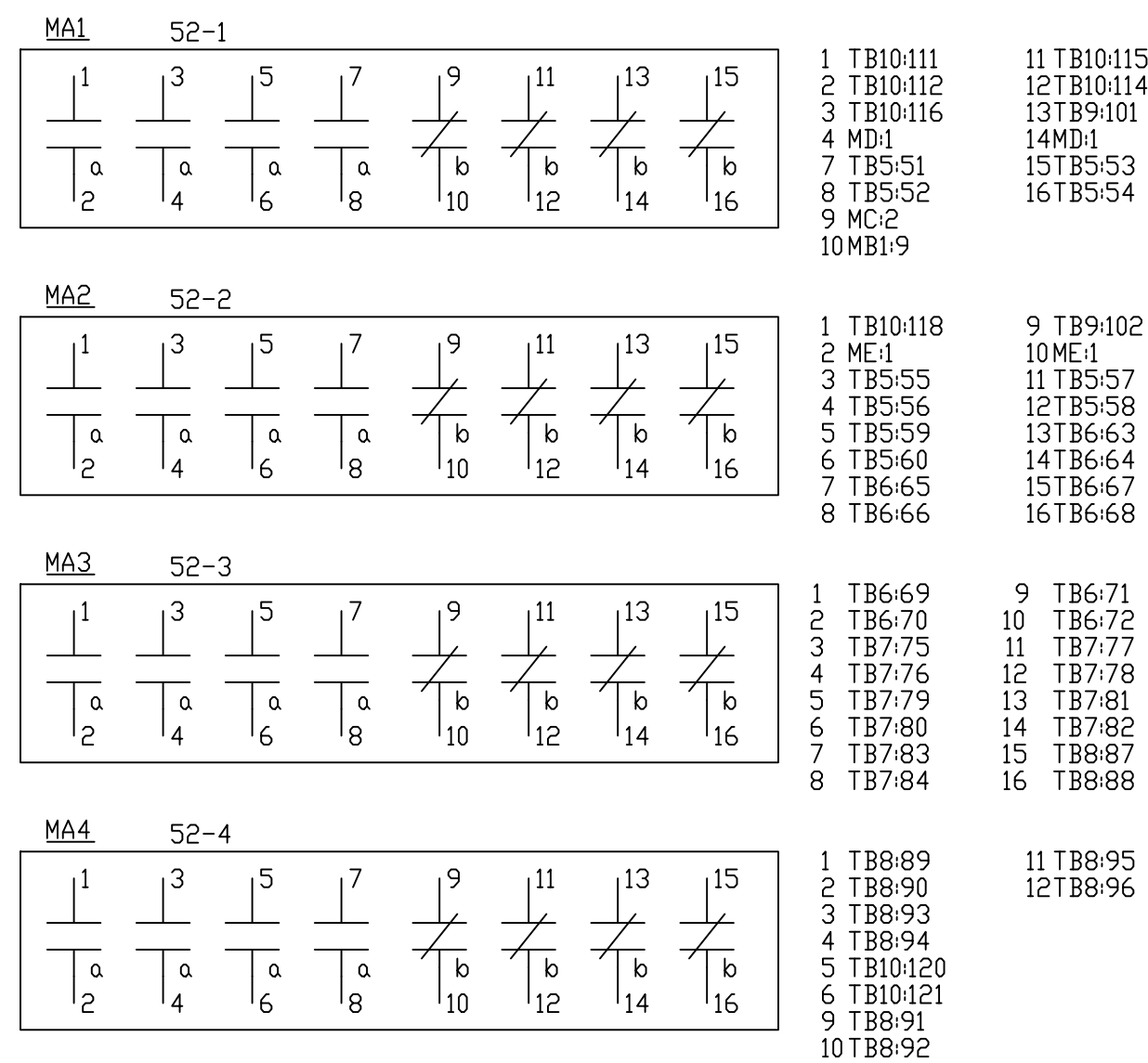
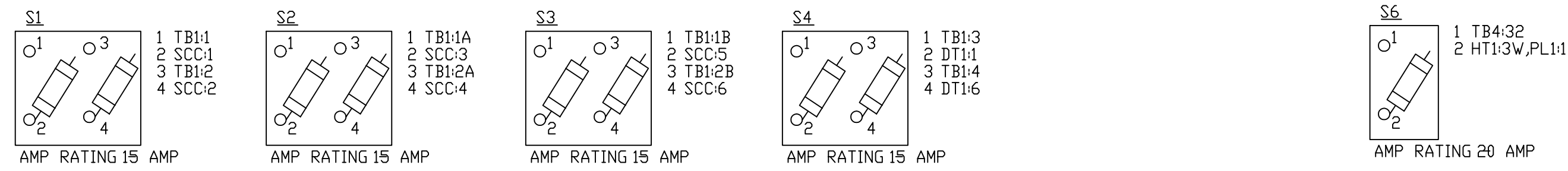
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69 kV  
**BREAKER 800**  
 AC/DC SCHEMATIC DIAGRAM

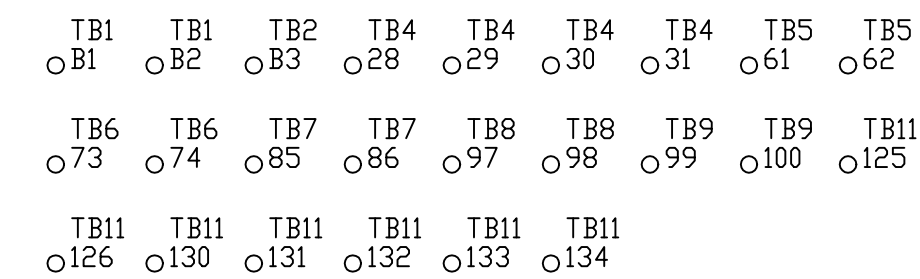
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REV 0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

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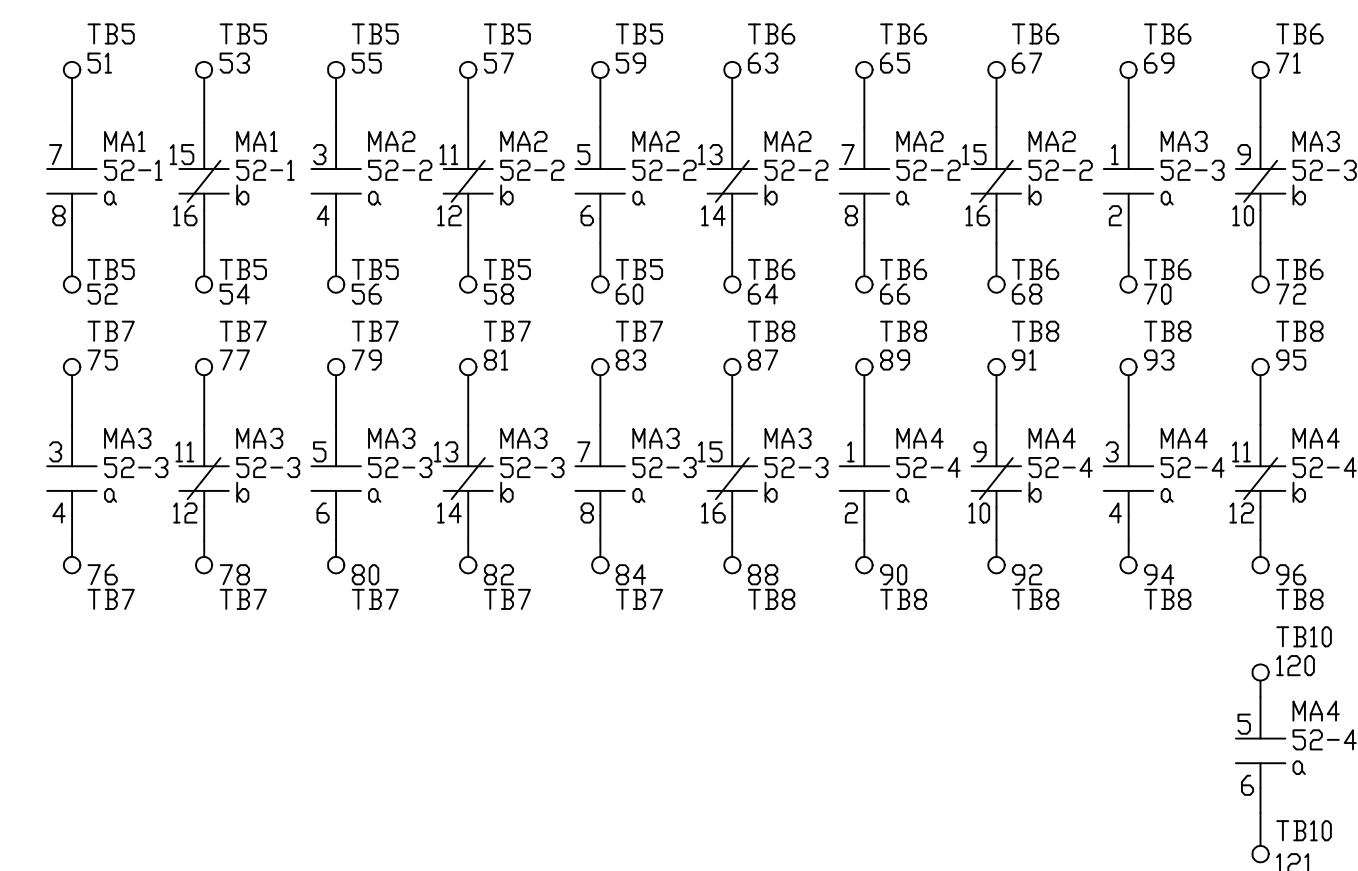
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



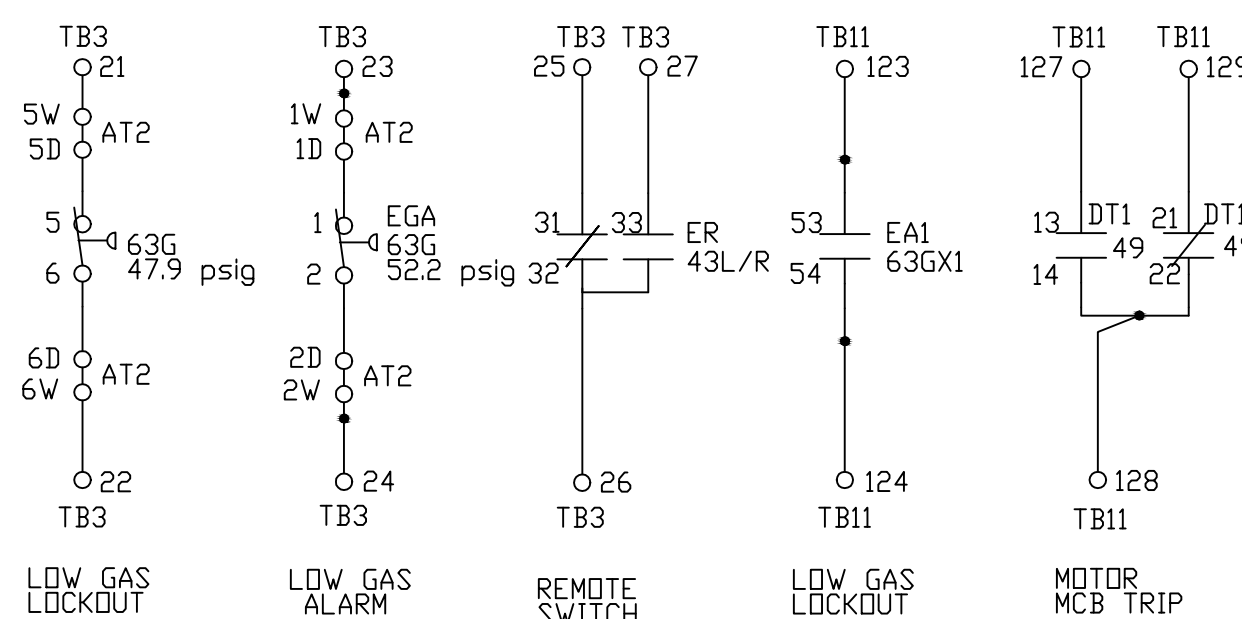
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS

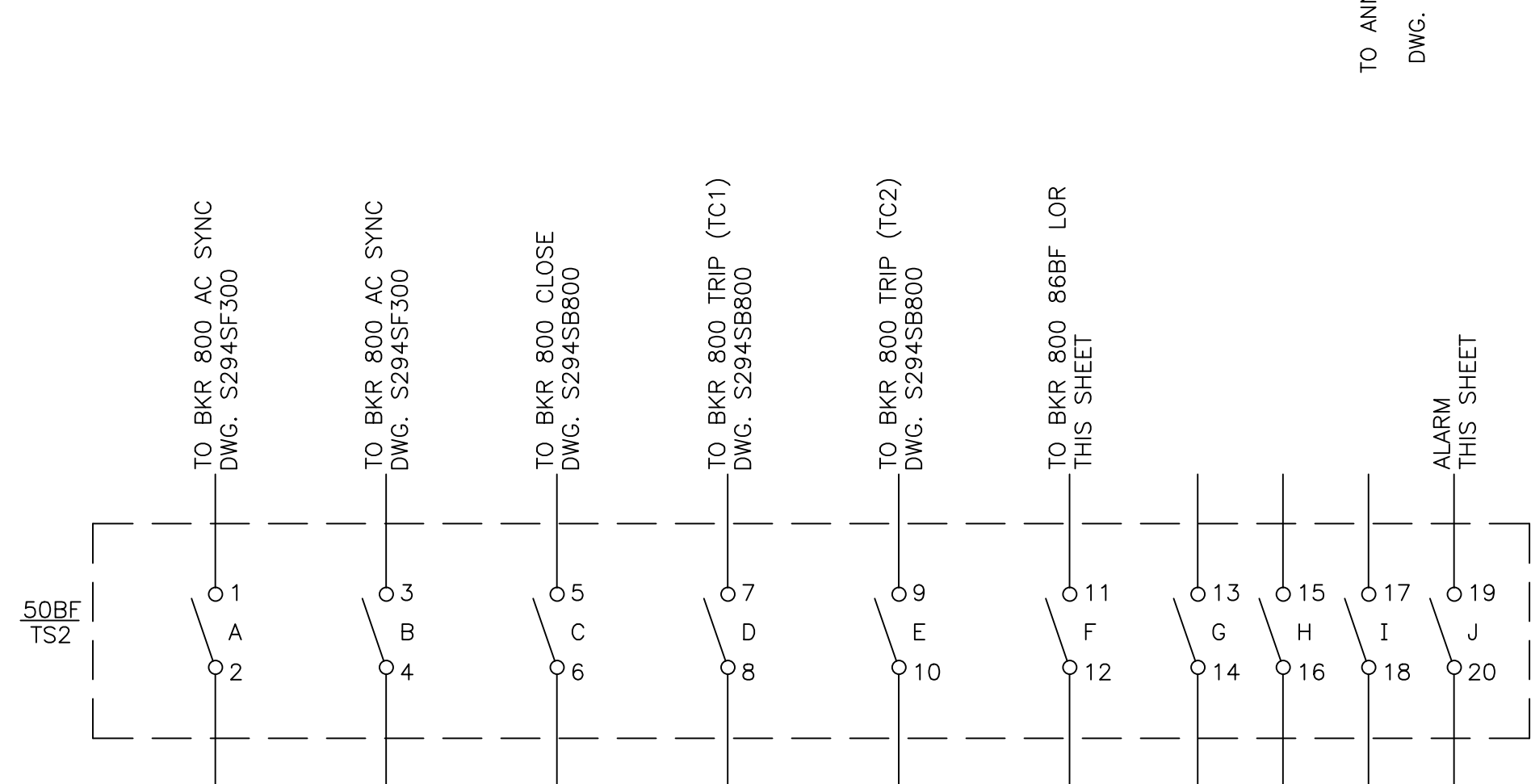
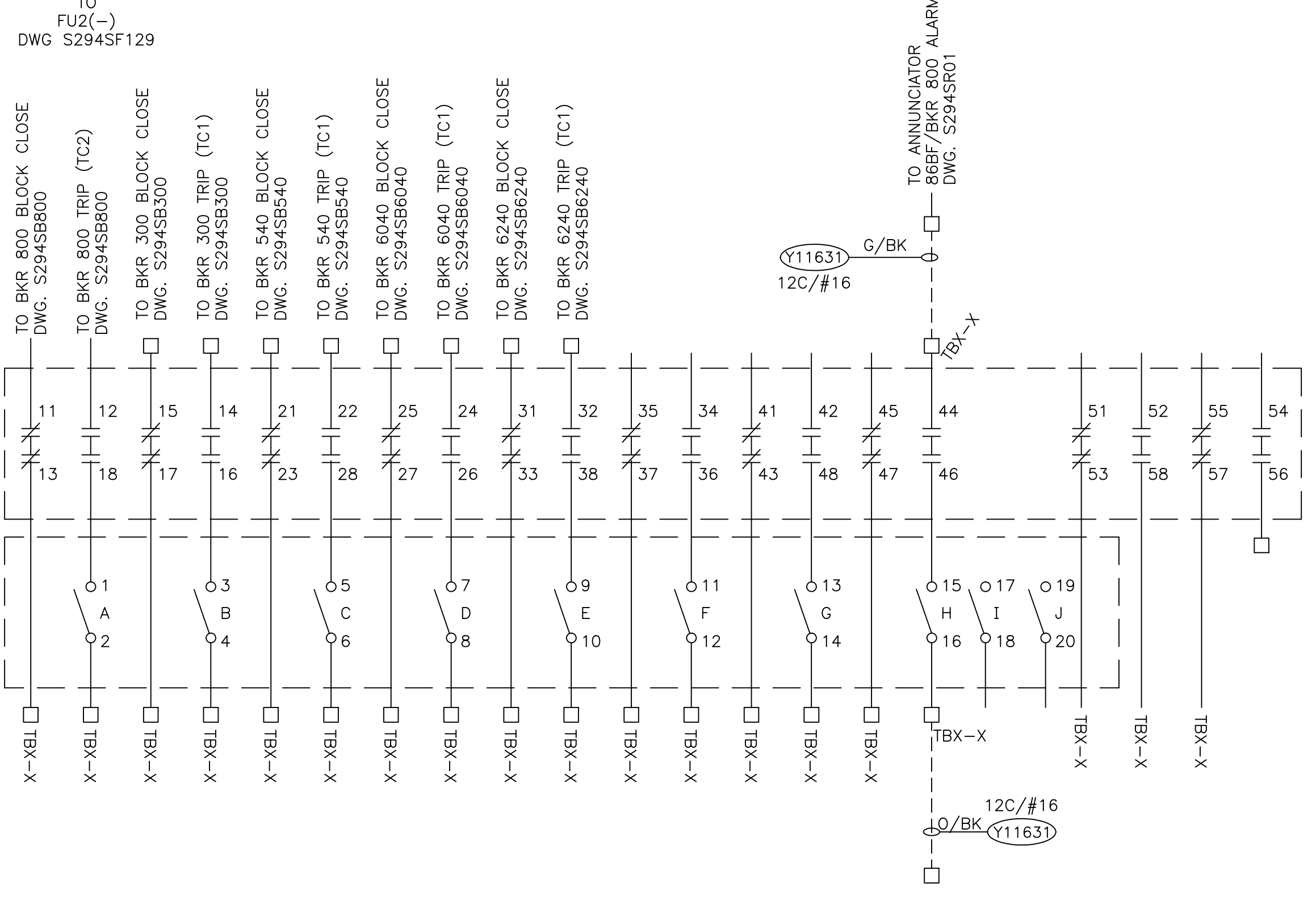
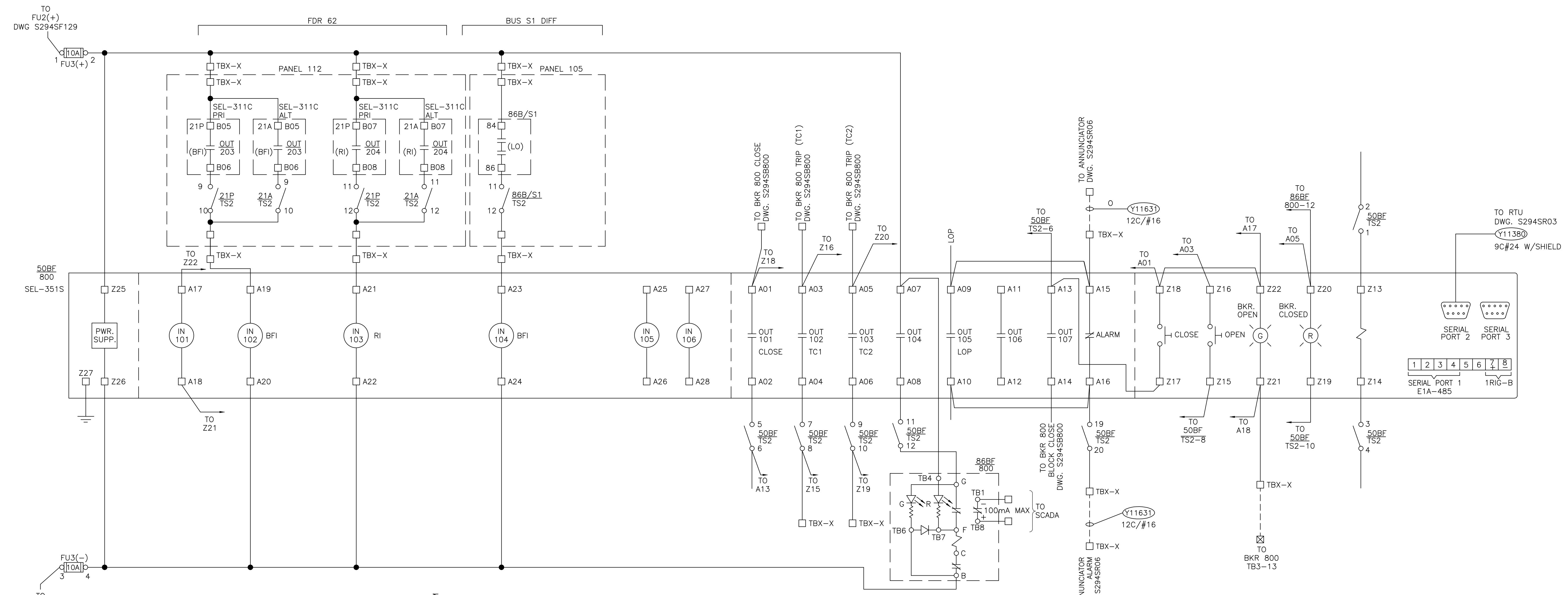


ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
<b>BREAKER 800</b> <b>BREAKER AUXILIARIES</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		REV. 0
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294SB800b</b>	

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

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 Plot Style: Monochrome.ctb



86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION
		TRIP RESET
1	11 OH-HO 13	X
1	12 OH-HO 18	X
1	15 OH-HO 17	X
1	14 OH-HO 16	X
2	21 OH-HO 23	X
2	22 OH-HO 28	X
2	25 OH-HO 27	X
2	24 OH-HO 26	X
3	31 OH-HO 33	X
3	32 OH-HO 38	X
3	35 OH-HO 37	X
3	34 OH-HO 36	X
4	41 OH-HO 43	X
4	42 OH-HO 48	X
4	45 OH-HO 47	X
4	44 OH-HO 46	X
5	51 OH-HO 53	X
5	52 OH-HO 58	X
5	55 OH-HO 57	X
5	54 OH-HO 56	X
6	61 OH-HO 63	X
6	62 OH-HO 68	X
6	65 OH-HO 67	X
6	64 OH-HO 66	X
7	71 OH-HO 73	X
7	72 OH-HO 78	X
7	75 OH-HO 77	X
7	74 OH-HO 76	X
8	81 OH-HO 83	X
8	82 OH-HO 88	X
8	85 OH-HO 87	X
8	84 OH-HO 86	X

NOTES:  
 1. ALL EQUIPMENT IS ON PANEL 110 UNLESS OTHERWISE NOTED

REFERENCE DRAWINGS

- S294SB800 BREAKER 800 SCHEMATIC DIAGRAM
- S294SF130 PRIMARY RELAY FEEDER 62
- S294SF131 ALTERNATE RELAY FEEDER 62
- S294SR01 COMMUNICATIONS AND ANNUNCIATOR PANEL
- S294SR06 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM

☒ TERMINAL BLOCK LOCATED IN THIS PANEL

**ISSUED FOR BID**

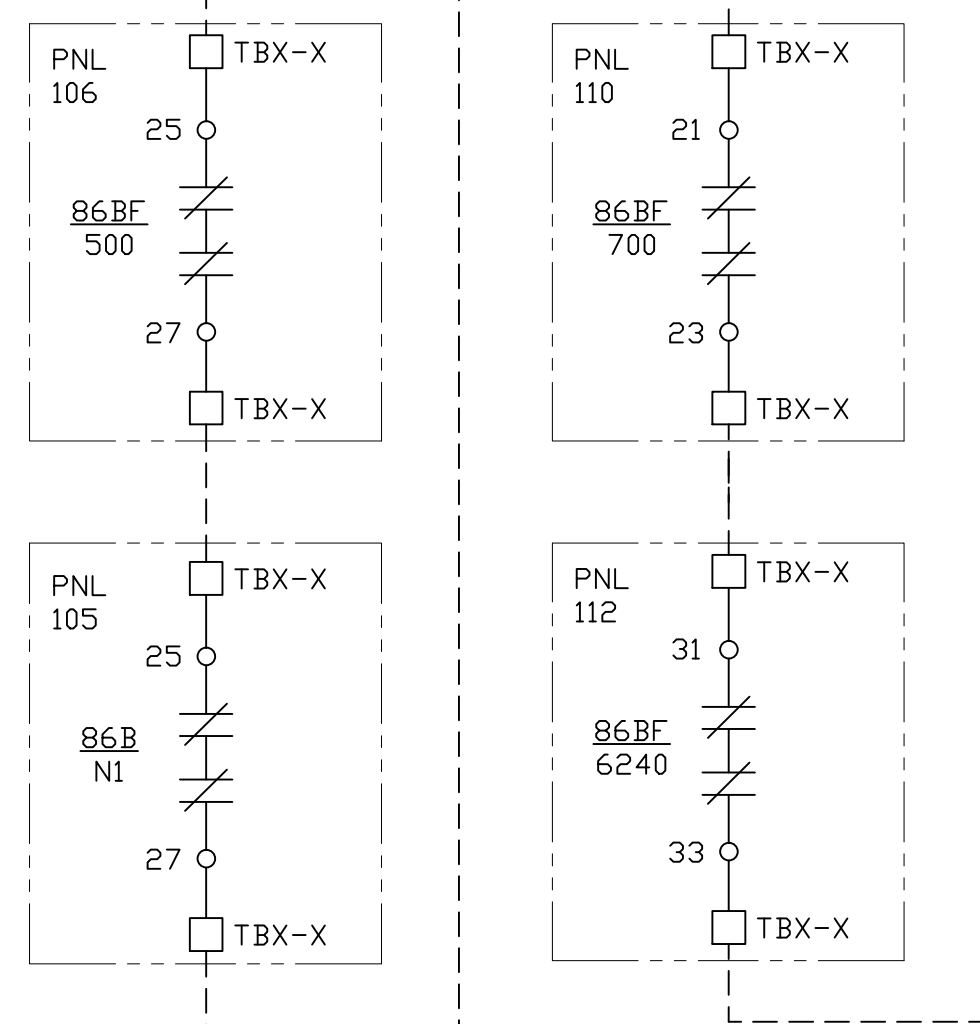
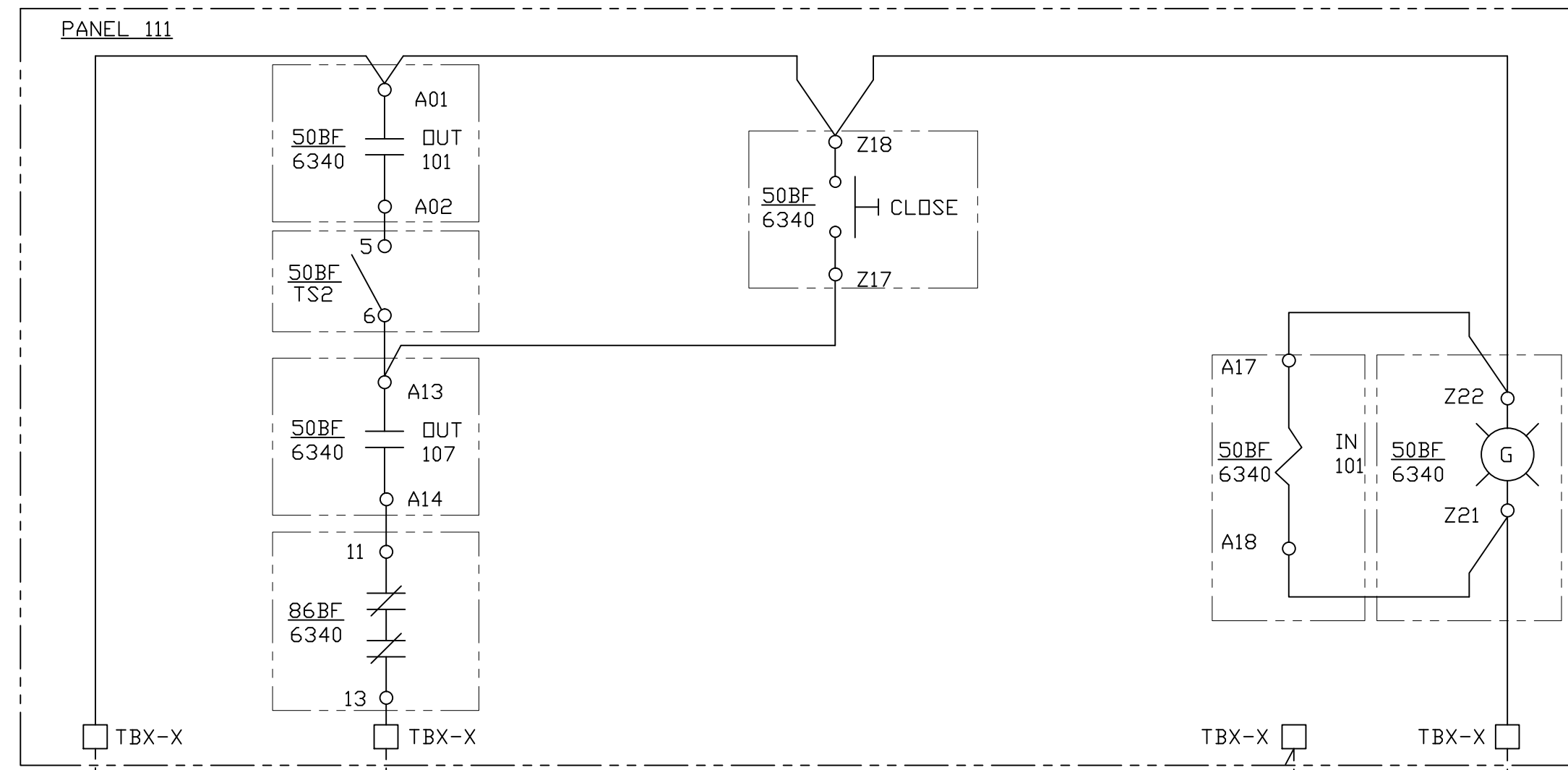
**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69KV

**BKR 800 FAILURE & CONTROL**  
**FDR 62-SAILBOAT BRIDGE 69KV CIRCUIT**

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SF133	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

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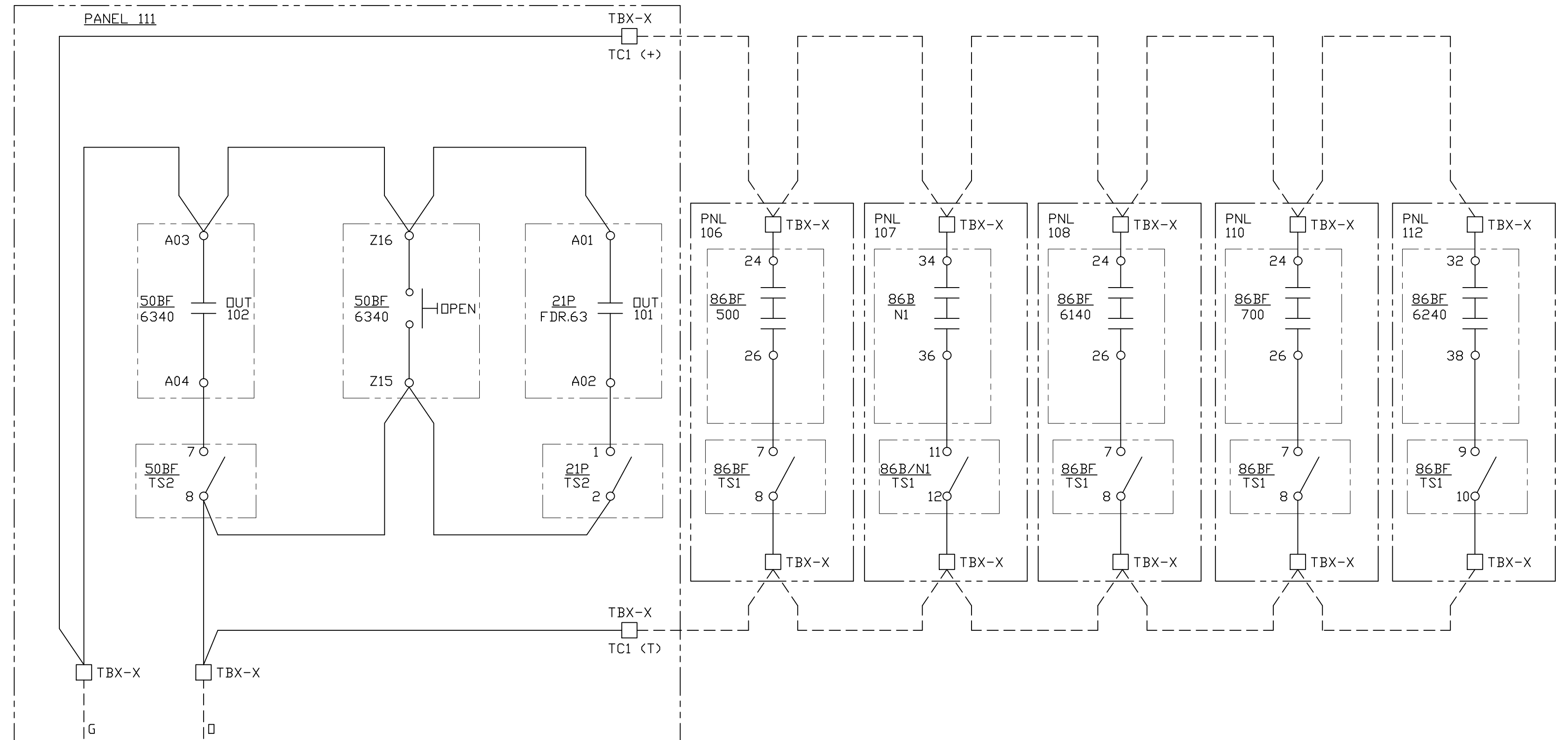
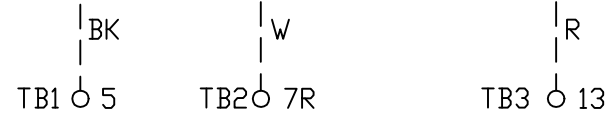


DC CLOSE CIRCUIT

TO BREAKER 6340  
DWG. S294SB6340a

Y11413

(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

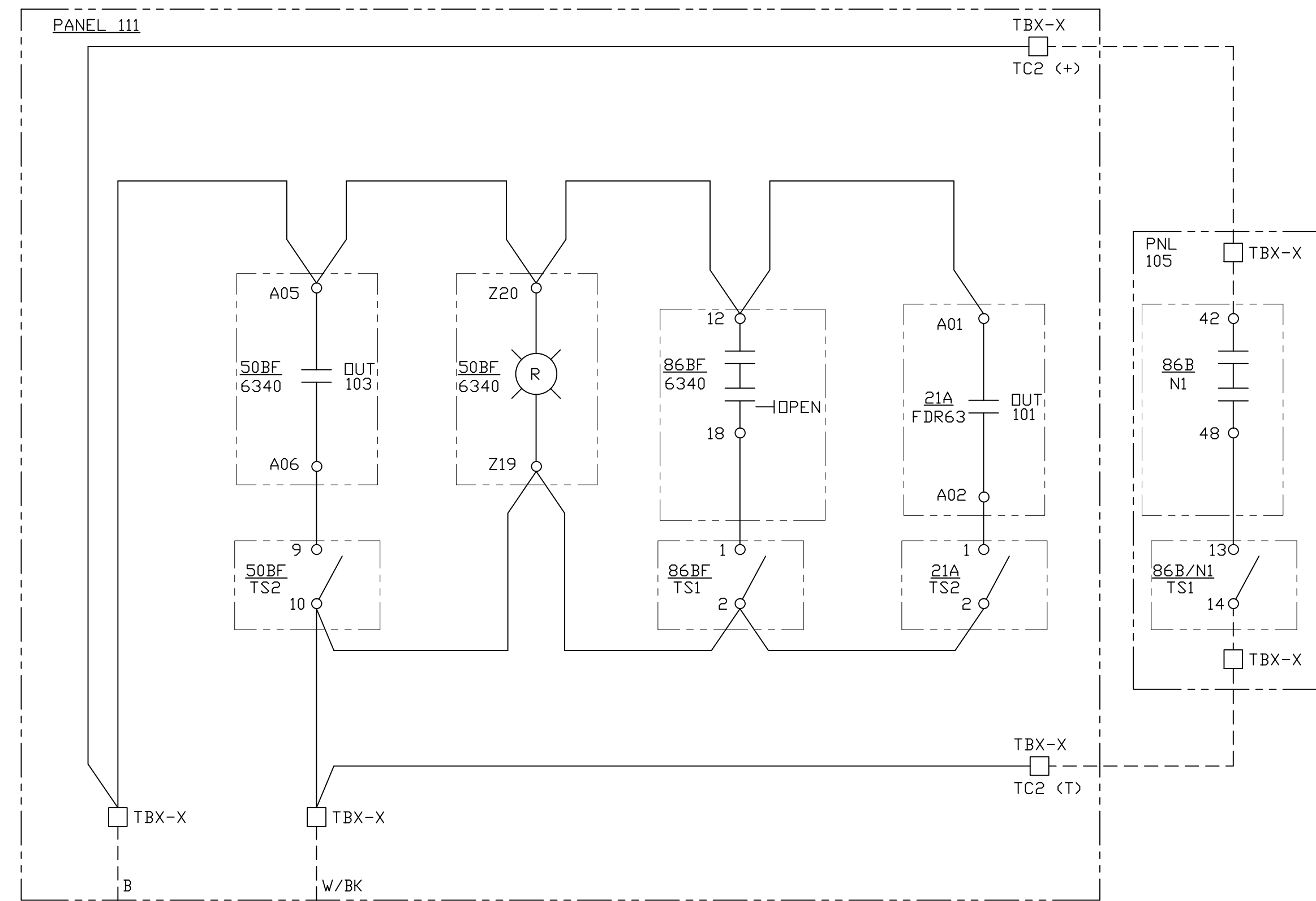


DC TRIP CIRCUIT 1

TO BREAKER 6340  
DWG. S294SB6340a

Y11413

(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

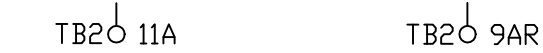


DC TRIP CIRCUIT 2

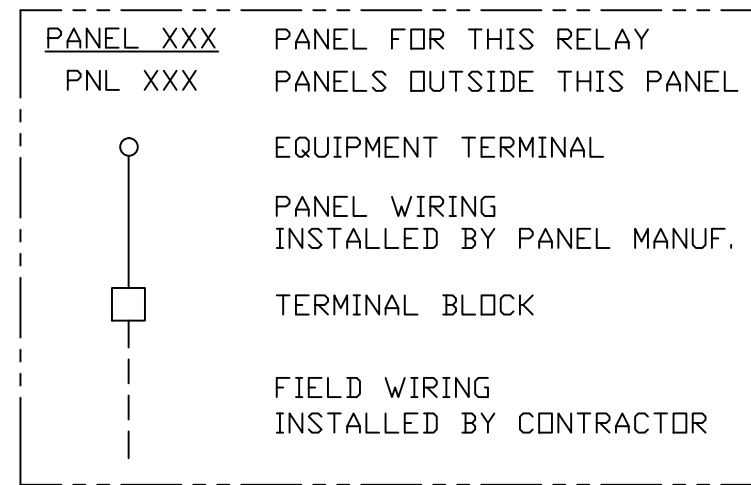
TO BREAKER 6340  
DWG. S294SB6340a

Y11413

(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)



NOTE: SEE DRAWING S294SB6340a FOR CIRCUIT BREAKER DC SCHEMATIC.



EQUIPMENT SHOWN INSIDE BOX LOCATED IN PANEL NUMBER DESIGNATED AT TOP LEFT

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC:11 & SCC:12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

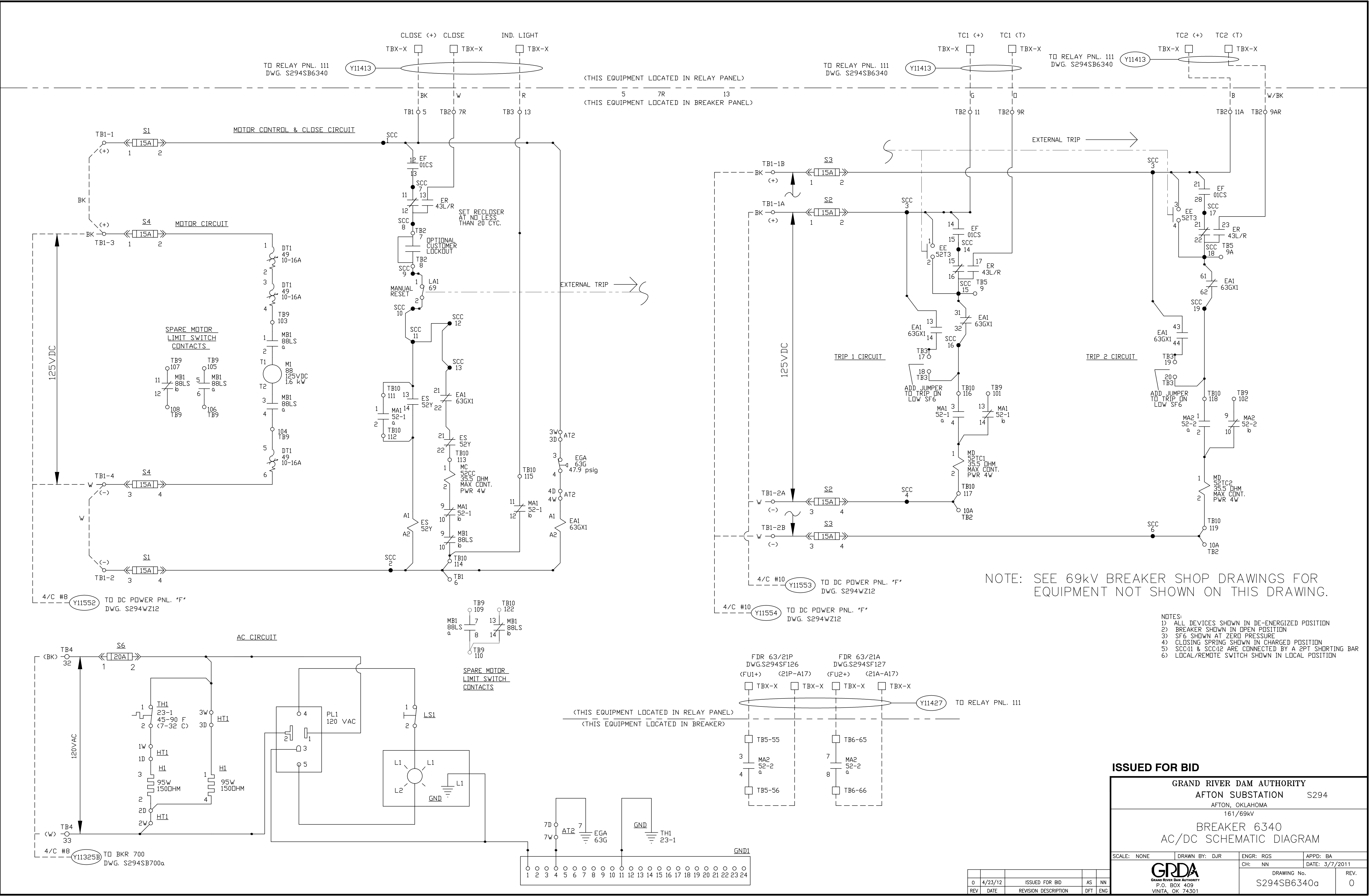
BREAKER 6340  
DC SCHEMATIC DIAGRAM

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CH: NN	DATE: 3/7/2011	DRAWING No. S294SB6340	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

DRAWING No. S294SB6340  
REV. 0

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NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC-11 & SCC-12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

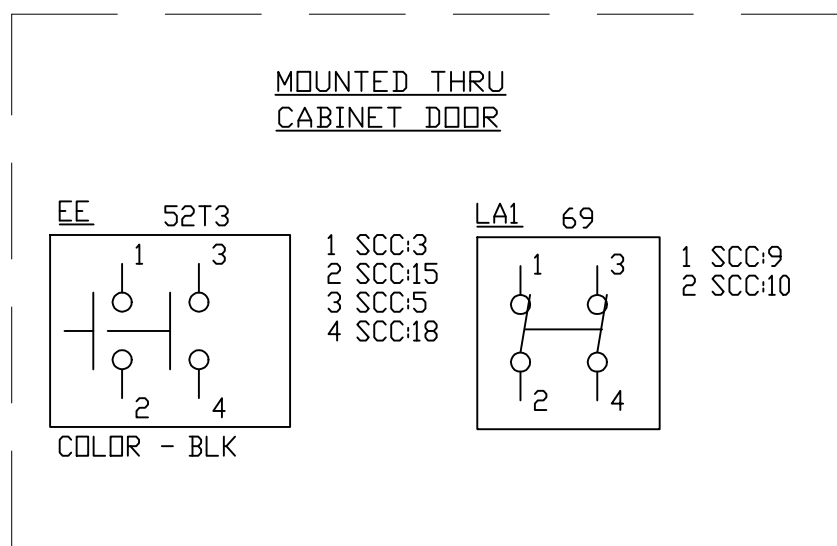
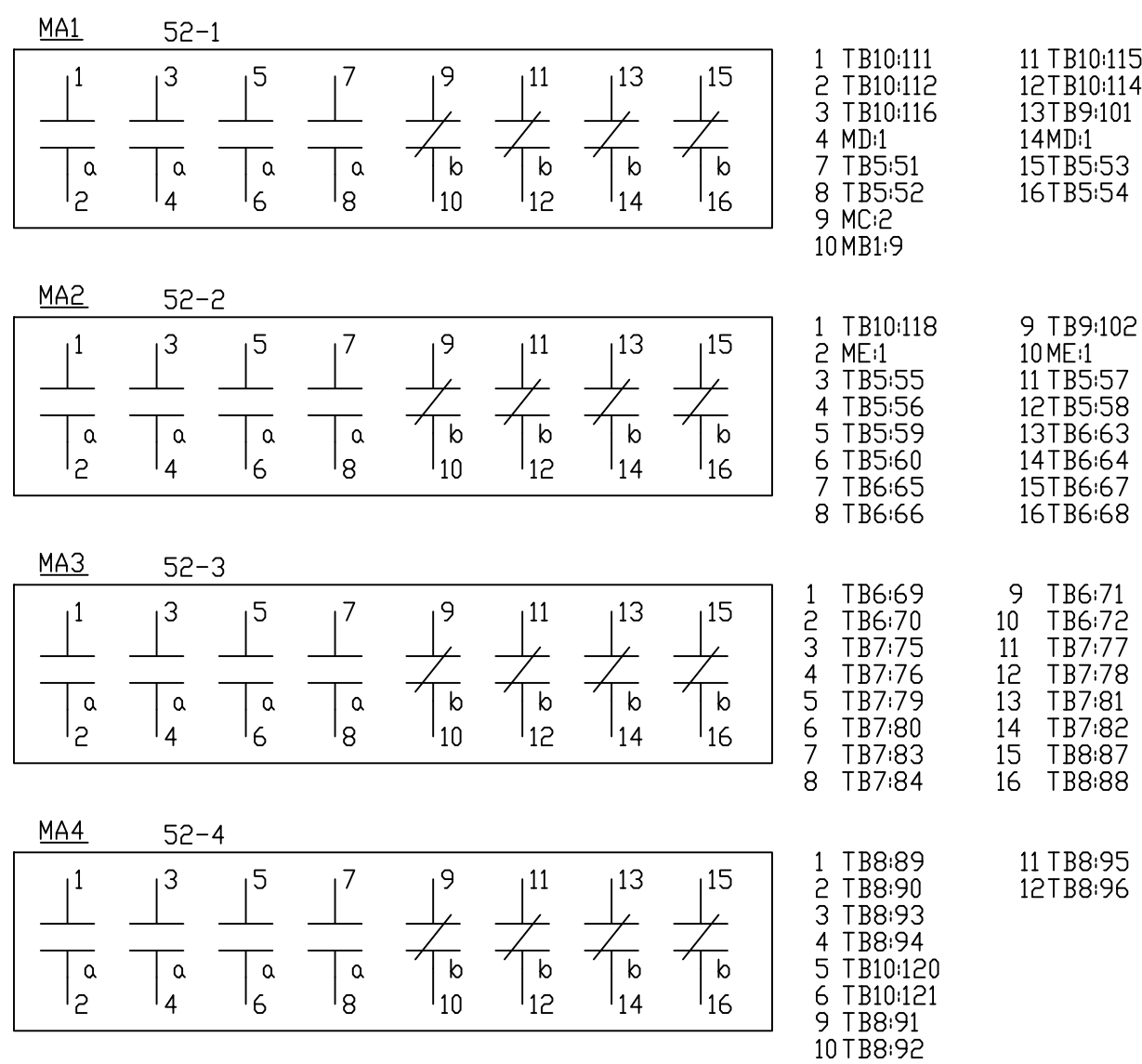
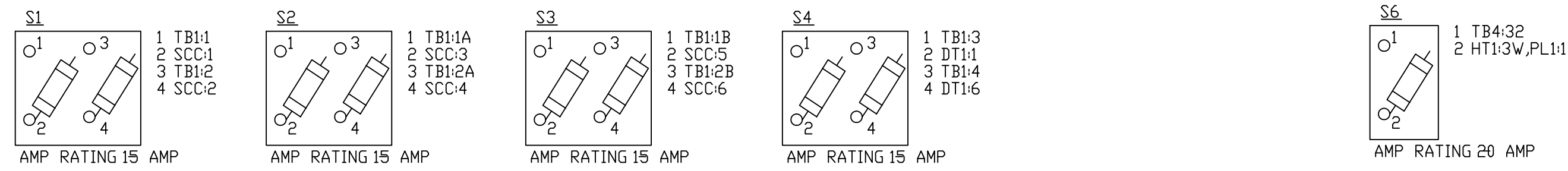
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**BREAKER 6340**  
 AC/DC SCHEMATIC DIAGRAM

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No. S294SB6340a	
0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

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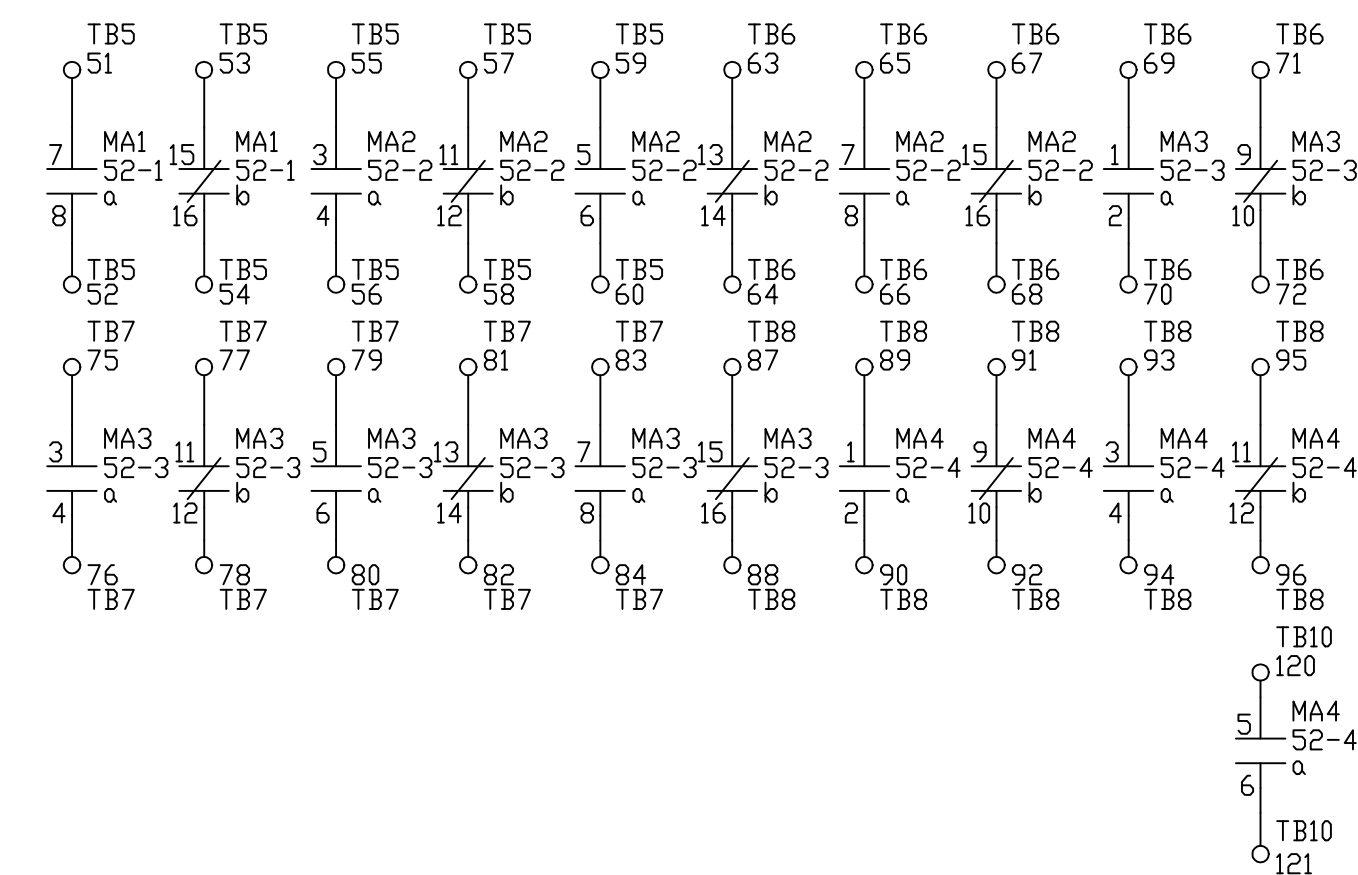
SPARE TERMINAL BLOCKS FOR CUSTOMER USE



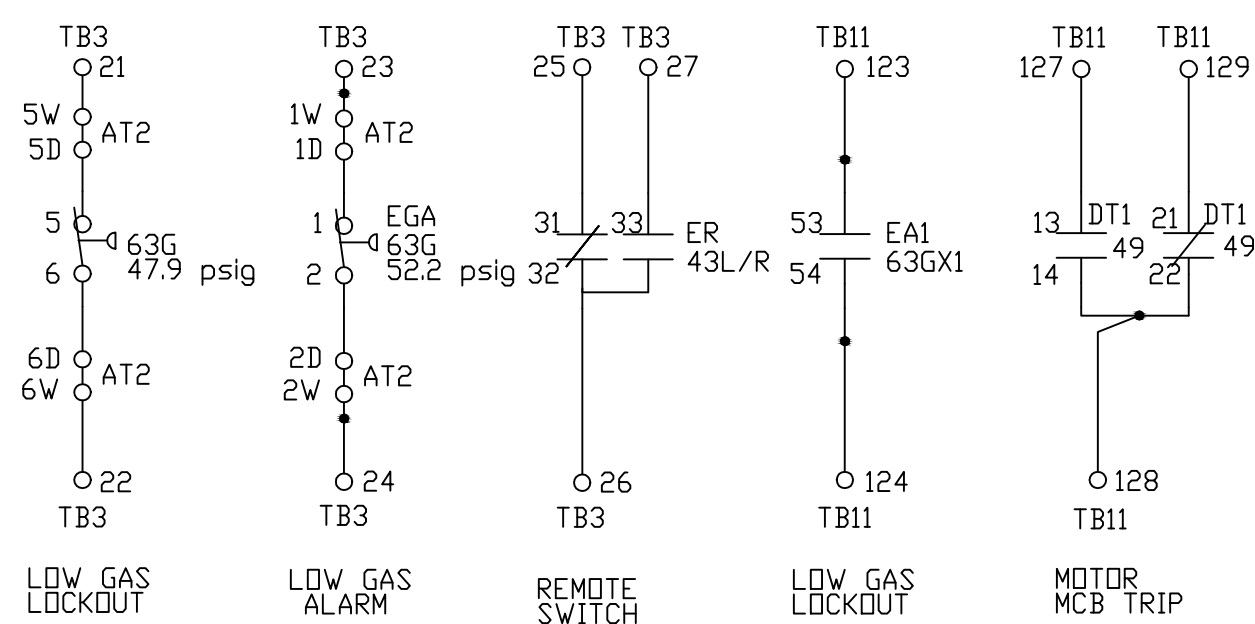
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



ISSUED FOR BID

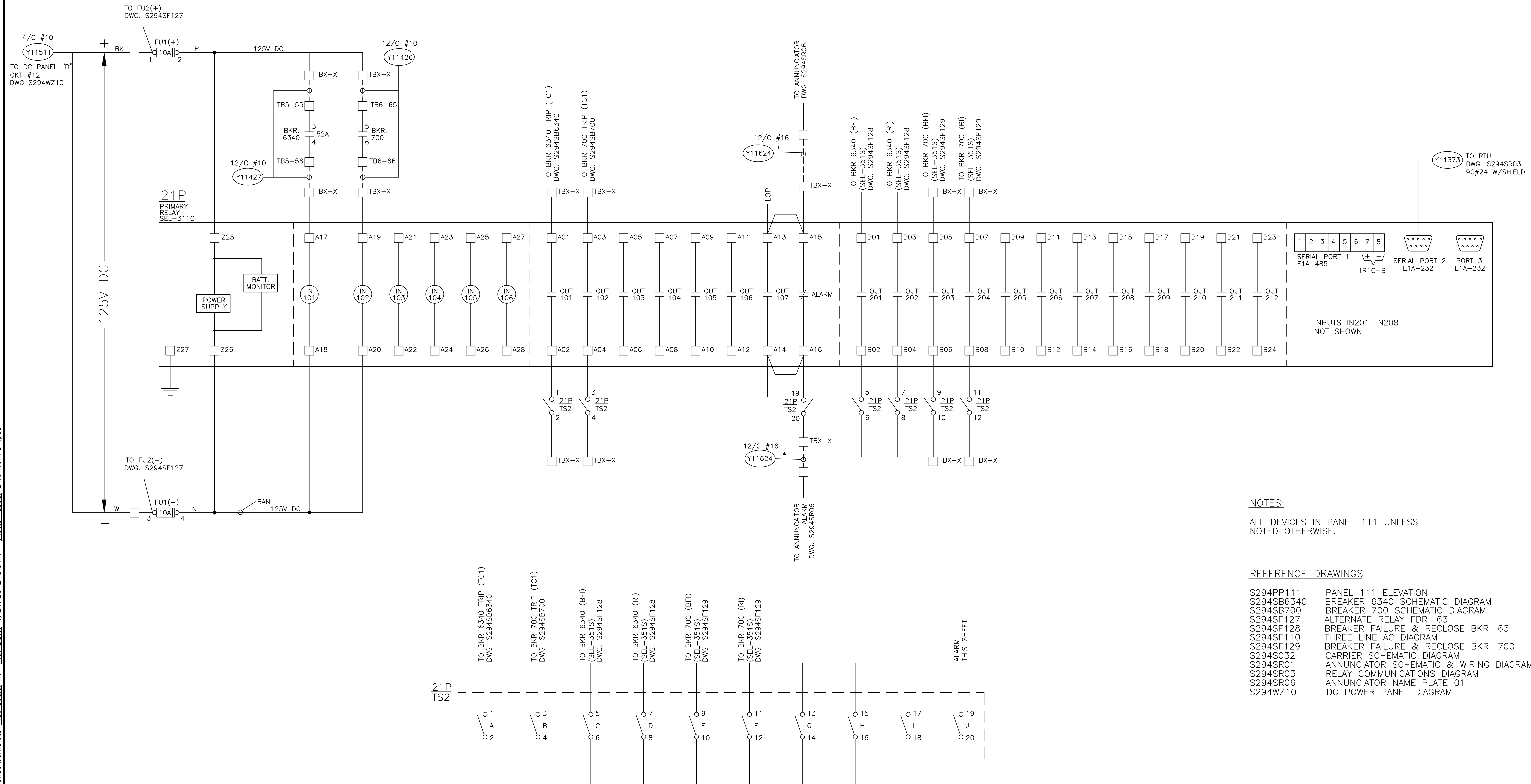
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<b>BREAKER 6340</b> <b>BREAKER AUXILIARIES</b>			
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REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG





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**NOTES:**

ALL DEVICES IN PANEL 111 UNLESS NOTED OTHERWISE.

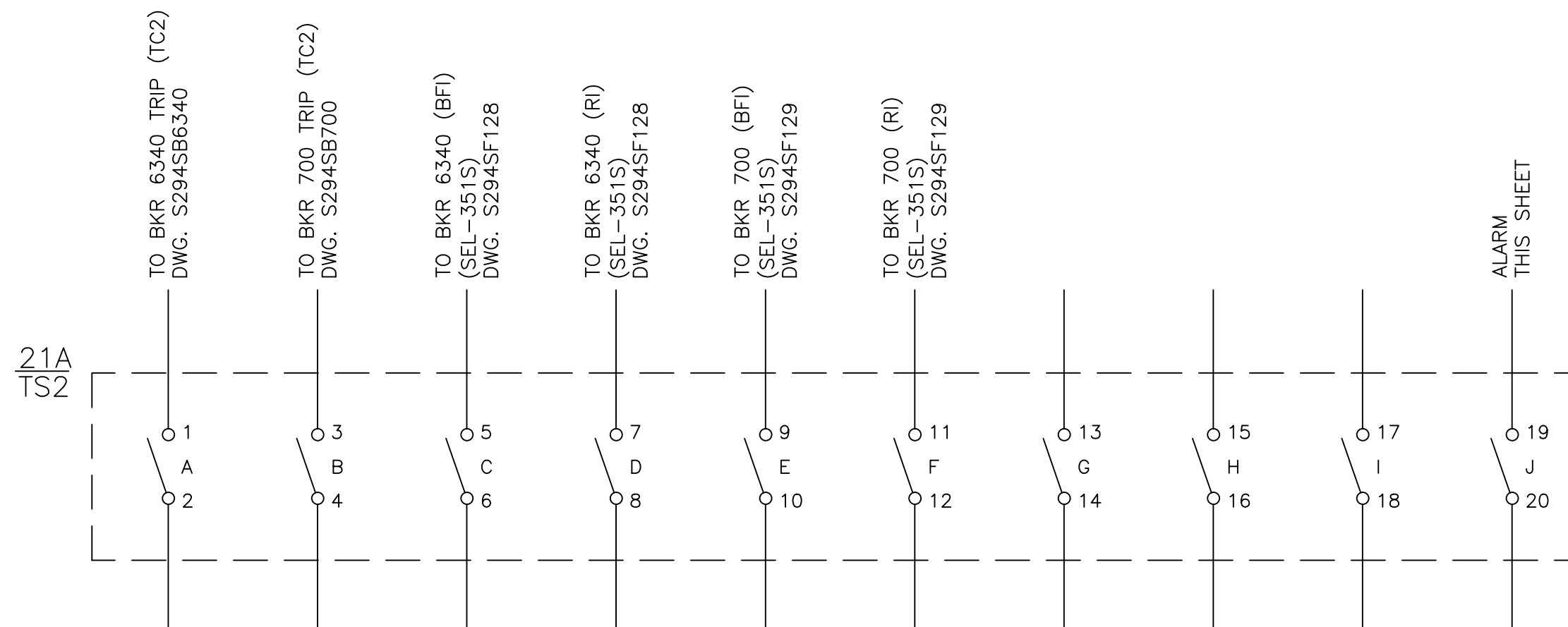
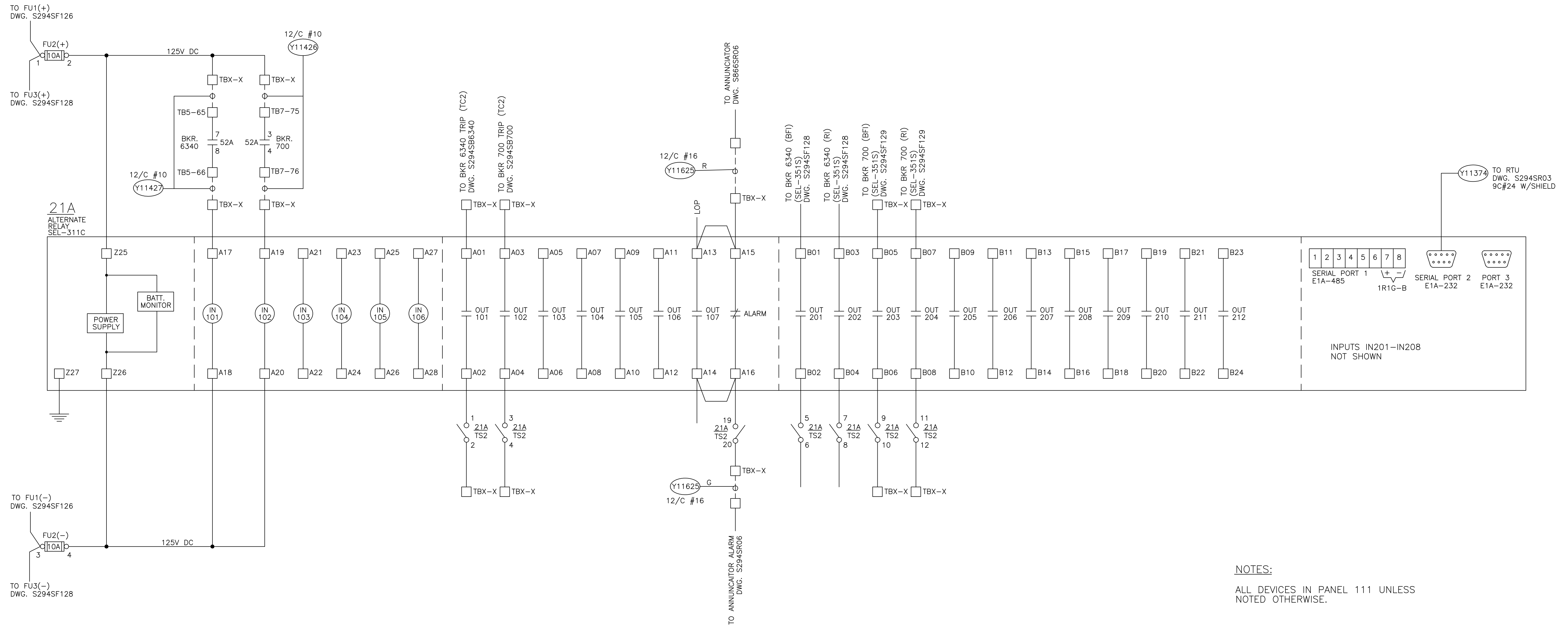
**REFERENCE DRAWINGS**

- S294PP111 PANEL 111 ELEVATION
- S294SB6340 BREAKER 6340 SCHEMATIC DIAGRAM
- S294SB700 BREAKER 700 SCHEMATIC DIAGRAM
- S294SF127 ALTERNATE RELAY FDR, 63
- S294SF128 BREAKER FAILURE & RECLOSE BKR. 63
- S294SF110 THREE LINE AC DIAGRAM
- S294SF129 BREAKER FAILURE & RECLOSE BKR. 700
- S294S032 CARRIER SCHEMATIC DIAGRAM
- S294SR01 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SR06 ANNUNCIATOR NAME PLATE 01
- S294WZ10 DC POWER PANEL DIAGRAM

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 161/69KV 21P 69KV FDR 63-MONKEY ISLAND CIRCUIT			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294SF126 REV. 0	
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REV	DATE	REVISION DESCRIPTION	DFT ENG

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**NOTES:**

ALL DEVICES IN PANEL 111 UNLESS NOTED OTHERWISE.

**REFERENCE DRAWINGS**

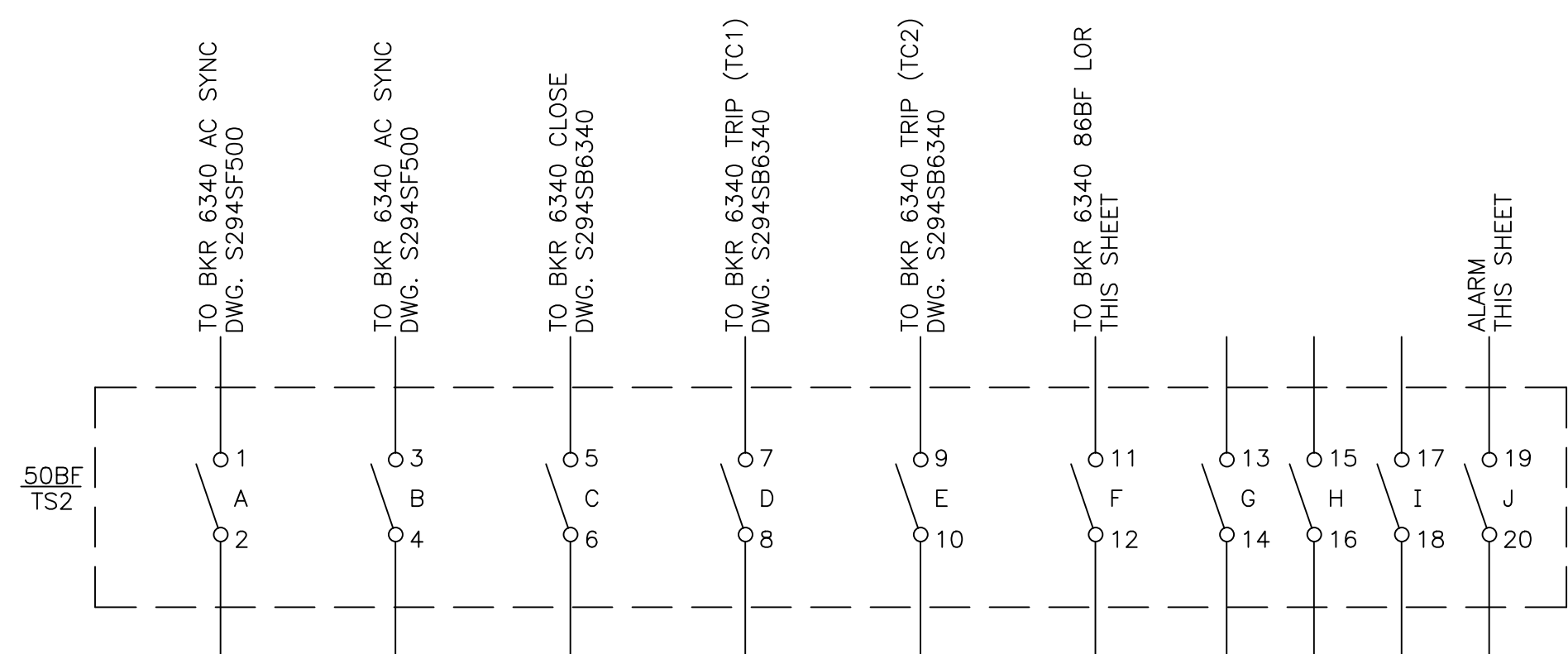
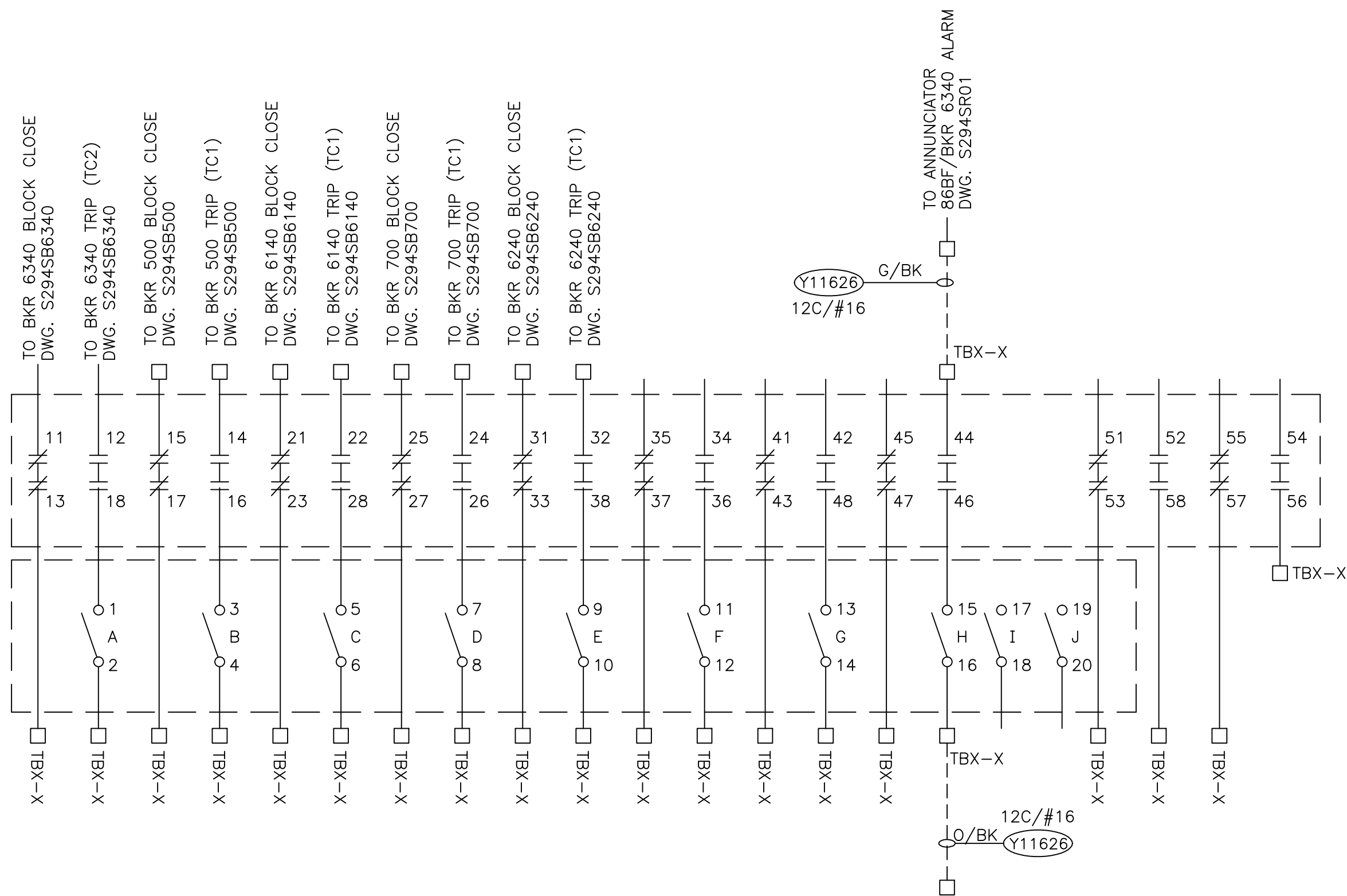
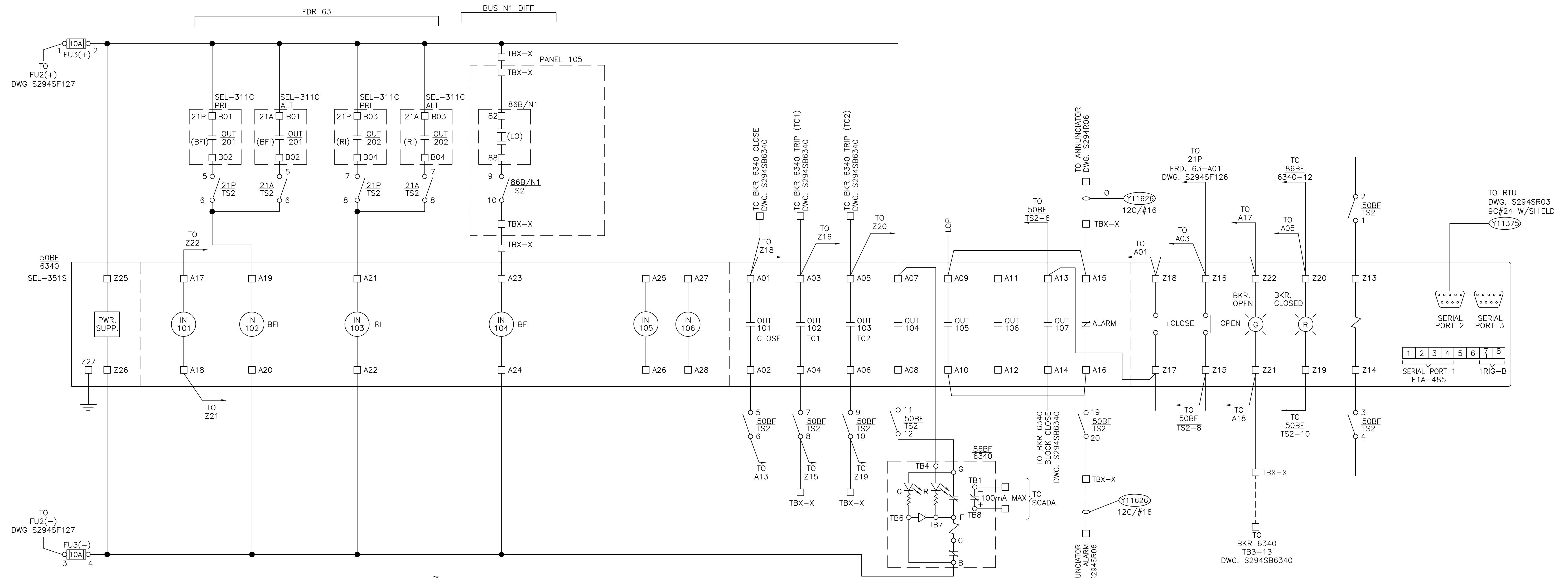
- S294PP111 PANEL 111 ELEVATION
- S294SB6340 BREAKER 6340 SCHEMATIC DIAGRAM
- S294SB700 BREAKER 700 SCHEMATIC DIAGRAM
- S294SF110 THREE LINE DIAGRAM BKR. 6340 & FDR. 63
- S294SF126 PRIMARY RELAY FDR. 60
- S294SF128 BREAKER FAILURE & RECLOSE BKR. 6340
- S294SF129 BREAKER FAILURE & RECLOSE BKR. 700
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SR06 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 161/69KV			
21A FDR 63-MONKEY ISLAND 69KV CIRCUIT			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011		
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294SF127	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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 Last saved by: Ashultz  
 Plot Date: 4/24/2012 9:25 AM



86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION
		TRIP RESET
1	11 01-10 13	X
1	12 01-10 18	X
1	15 01-10 17	X
1	14 01-10 16	X
2	21 01-10 23	X
2	22 01-10 28	X
2	25 01-10 27	X
2	24 01-10 26	X
3	31 01-10 33	X
3	32 01-10 38	X
3	35 01-10 37	X
3	34 01-10 36	X
4	41 01-10 43	X
4	42 01-10 48	X
4	45 01-10 47	X
4	44 01-10 46	X
5	51 01-10 53	X
5	52 01-10 58	X
5	55 01-10 57	X
5	54 01-10 56	X
6	61 01-10 63	X
6	62 01-10 68	X
6	65 01-10 67	X
6	64 01-10 66	X
7	71 01-10 73	X
7	72 01-10 78	X
7	75 01-10 77	X
7	74 01-10 76	X
8	81 01-10 83	X
8	82 01-10 88	X
8	85 01-10 87	X
8	84 01-10 86	X

**NOTES:**  
 1. ALL EQUIPMENT IS ON PANEL 111 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**

- S294SB6340 BREAKER 6340 SCHEMATIC DIAGRAM
- S294SF126 PRIMARY RELAY FDR 6340
- S294SF127 ALTERNATE RELAY FDR 63
- S294SF110 THREE LINE AC DIA. BKR 6340 & FDR 63
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SR06 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM

TERMINAL BLOCK LOCATED IN THIS PANEL

**ISSUED FOR BID**

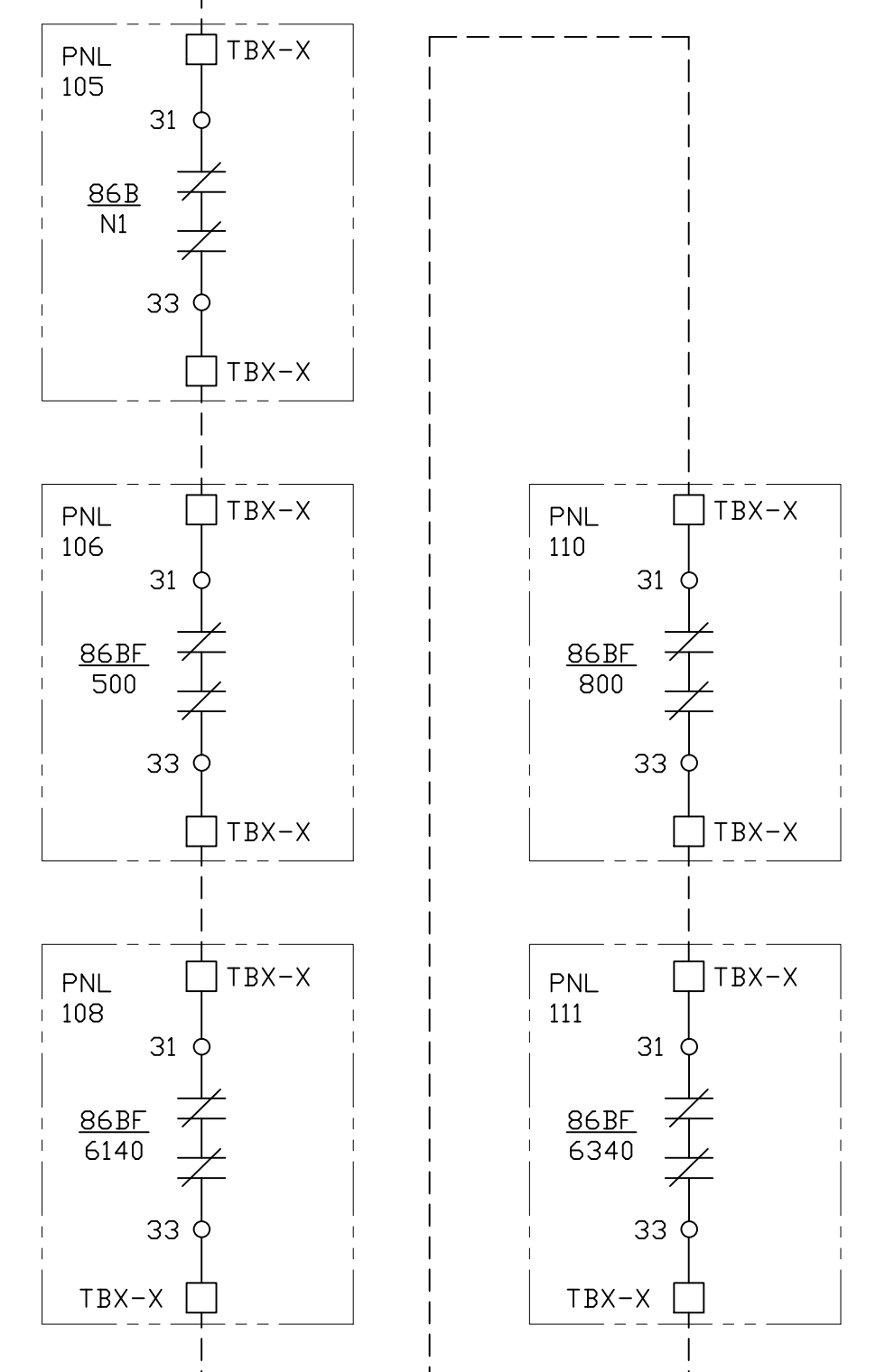
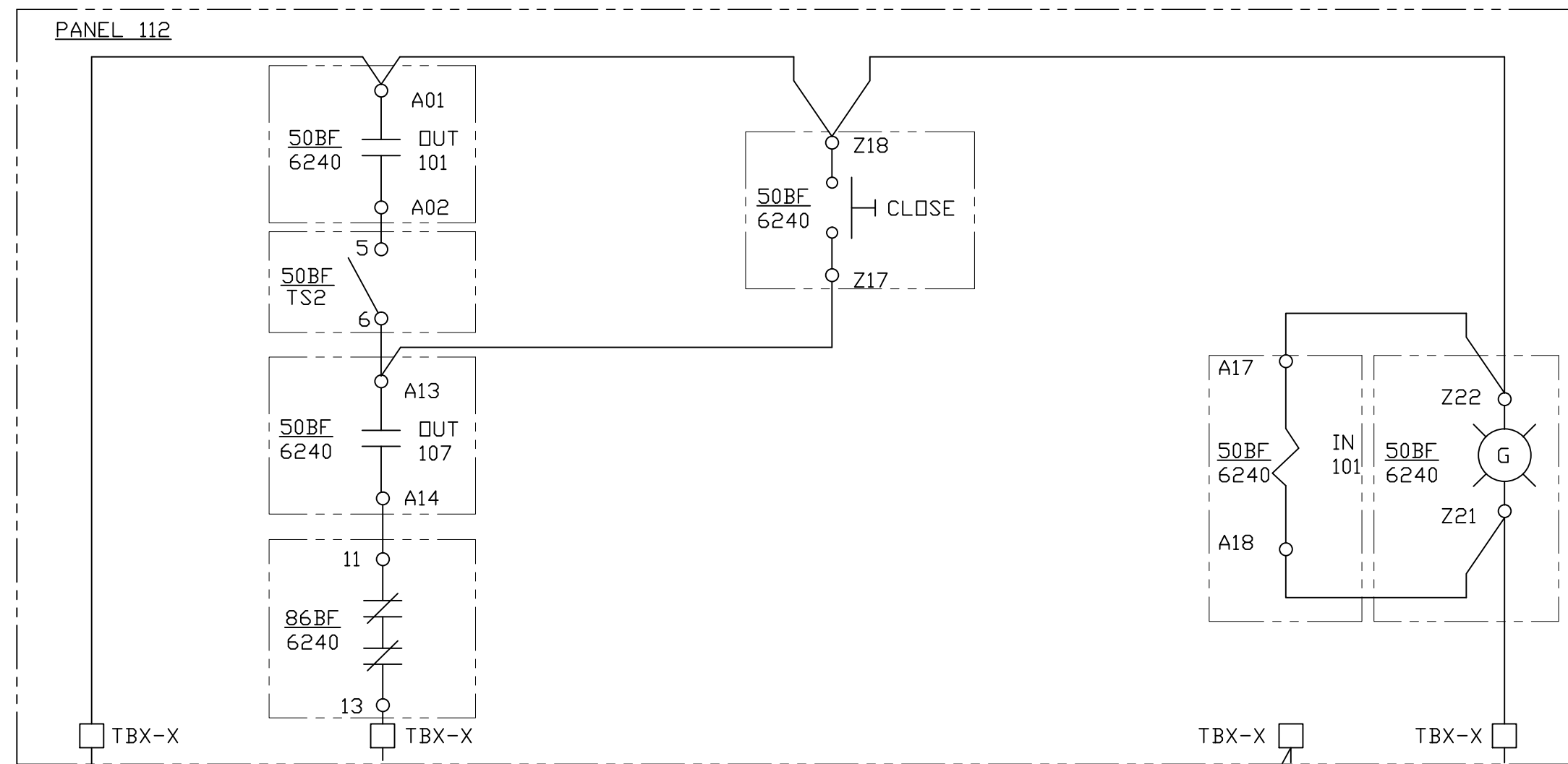
**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION S294**  
 AFTON, OKLAHOMA  
 161/69KV

**BKR 6340 FAILURE & CONTROL**  
**FDR 63-MONKEY ISLAND 69KV CIRCUIT**

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011		
<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294SF128</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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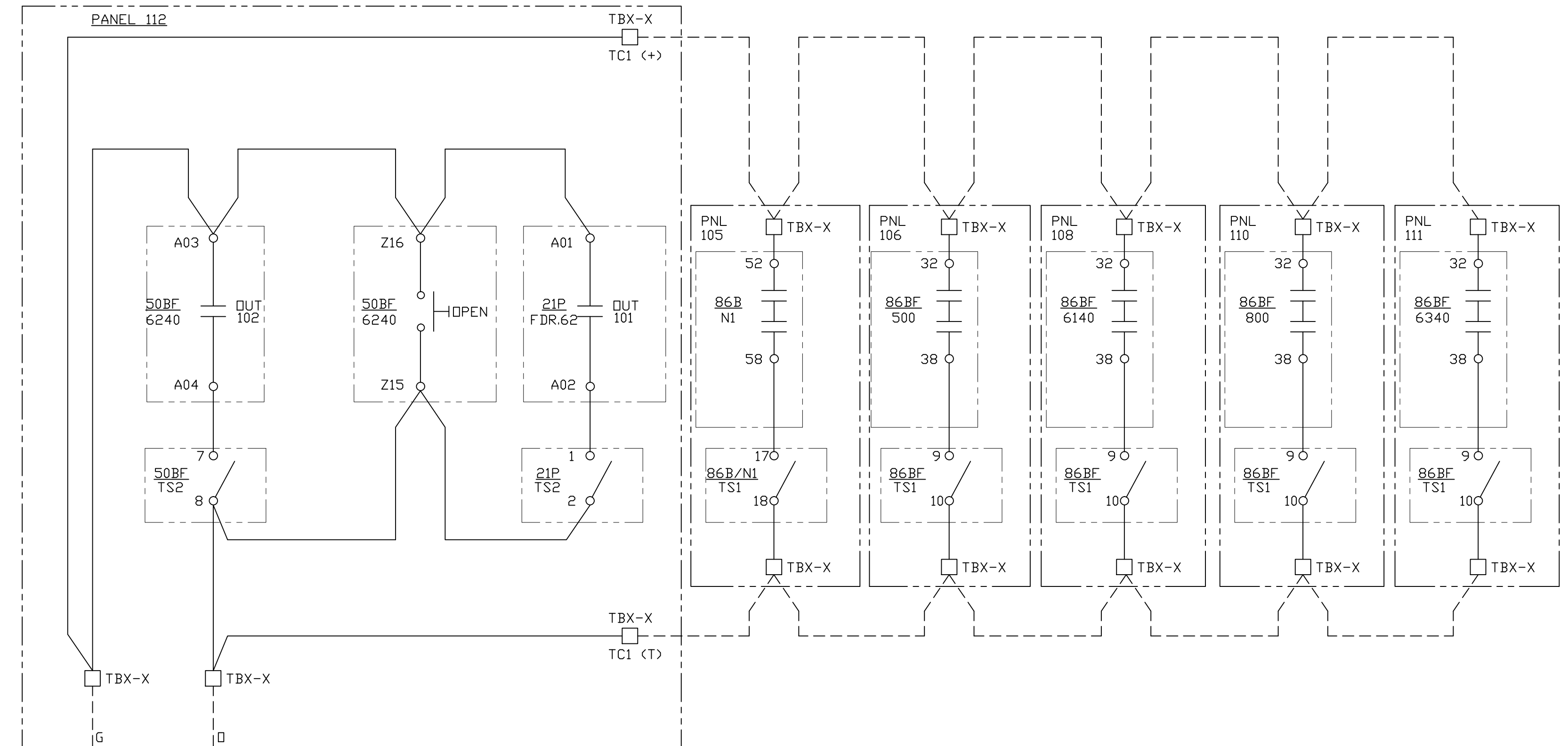
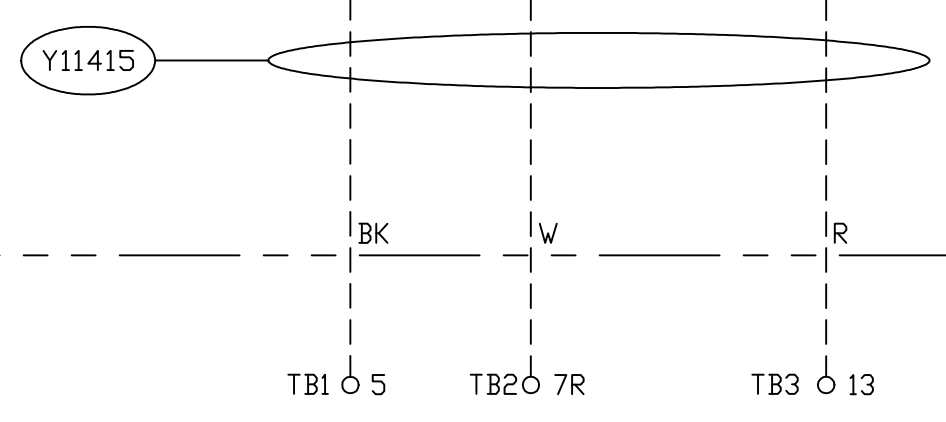
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 Last Modified by: Shultz, Aylene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/24/2012 9:41 AM Plotter Used: DWG To PDF.pc3  
 Last Saved by: Aestuffs Last Save: 4/24/2012 9:40 AM



DC CLOSE CIRCUIT

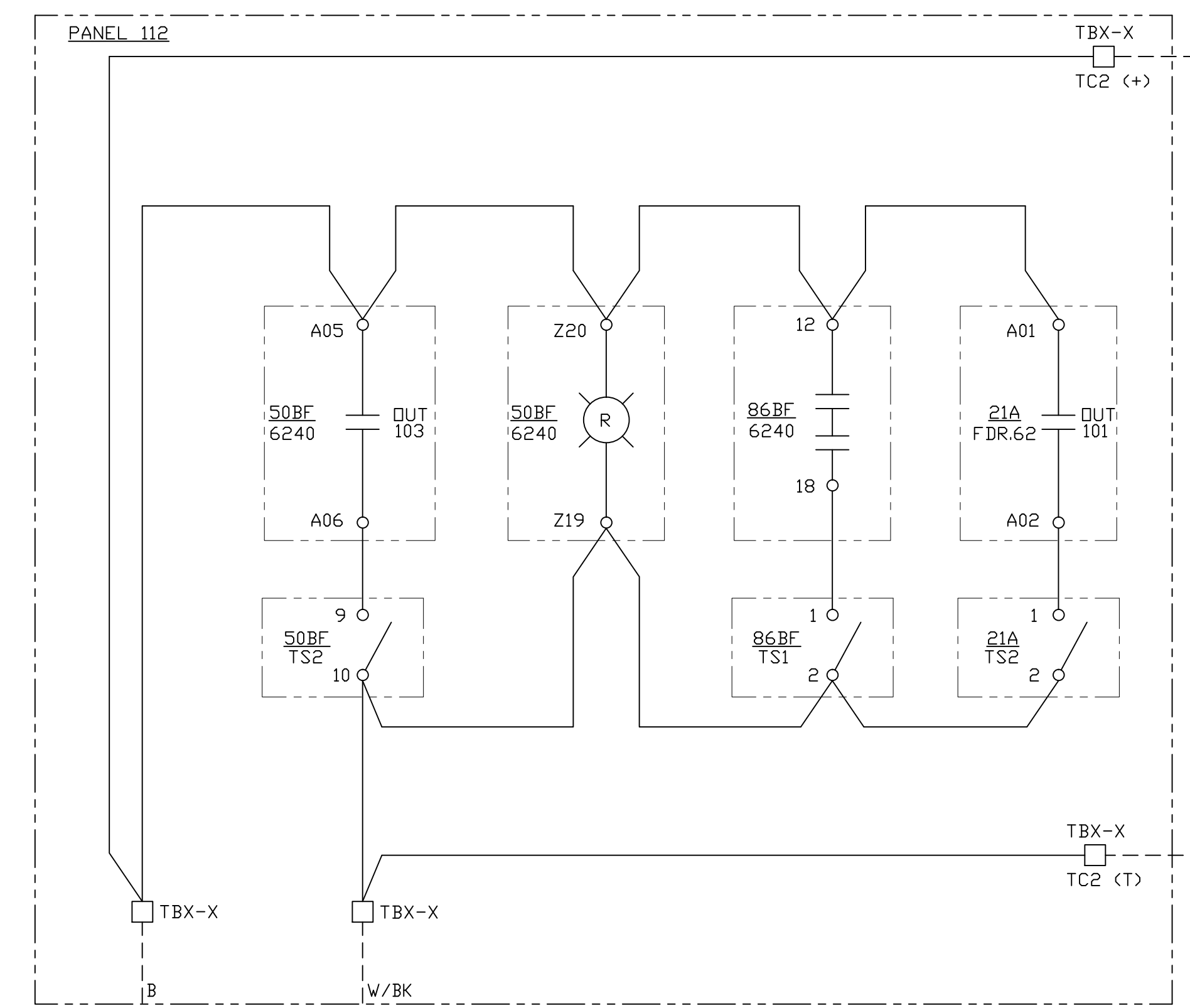
TO BREAKER 6240  
DWG. S294SB6240a

(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)



TO BREAKER 6240  
DWG. S294SB6240a  
(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

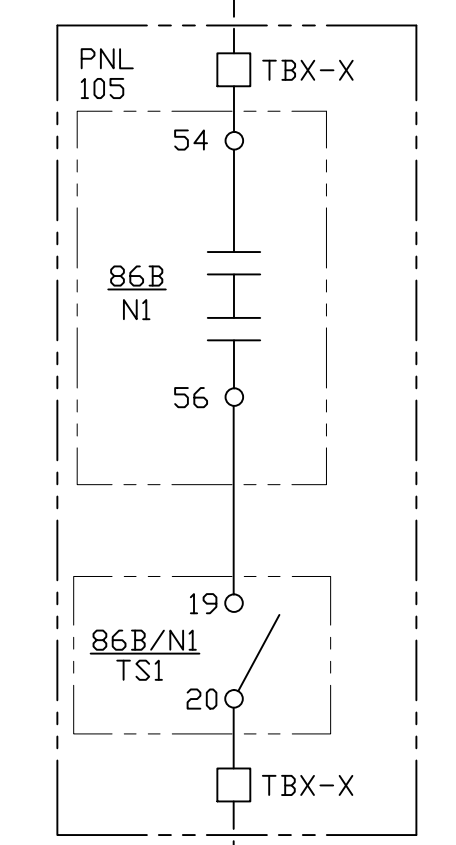
DC TRIP CIRCUIT 1



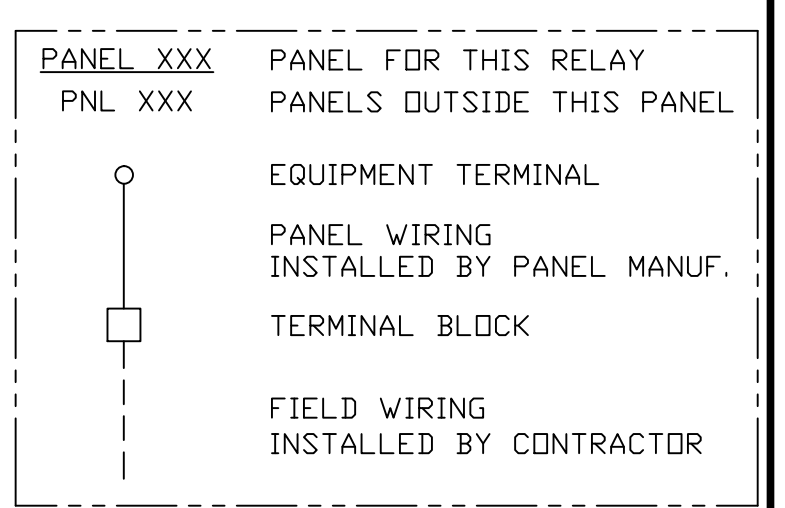
TO BREAKER 6240  
DWG. S294SB6240a

(THIS EQUIPMENT LOCATED IN RELAY PANEL)  
(THIS EQUIPMENT LOCATED IN BREAKER)

DC TRIP CIRCUIT 2



NOTE: SEE DRAWING S294SB6240a FOR CIRCUIT BREAKER DC SCHEMATIC.



EQUIPMENT SHOWN INSIDE BOX LOCATED IN PANEL NUMBER DESIGNATED AT TOP LEFT

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC-11 & SCC-12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

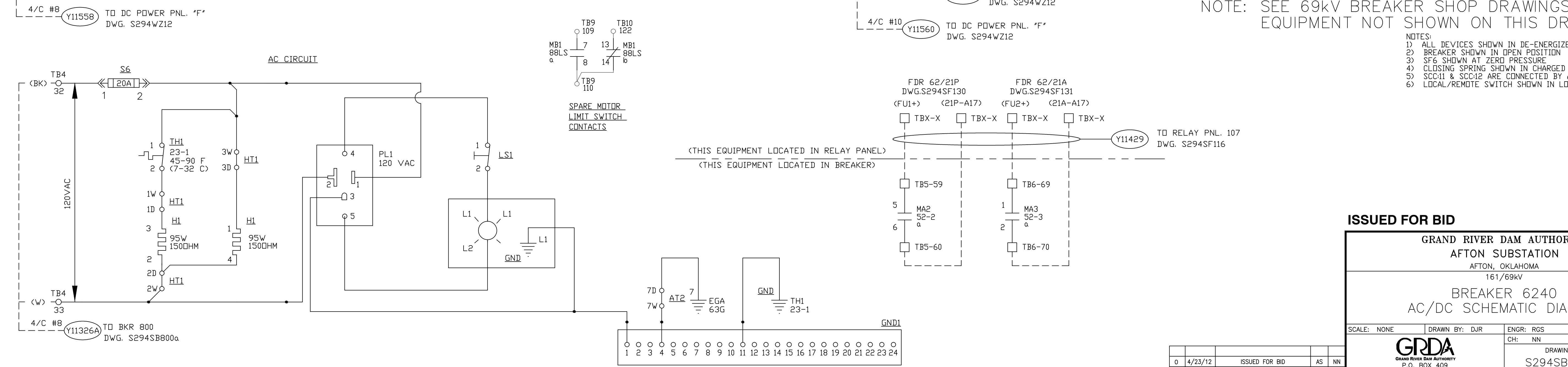
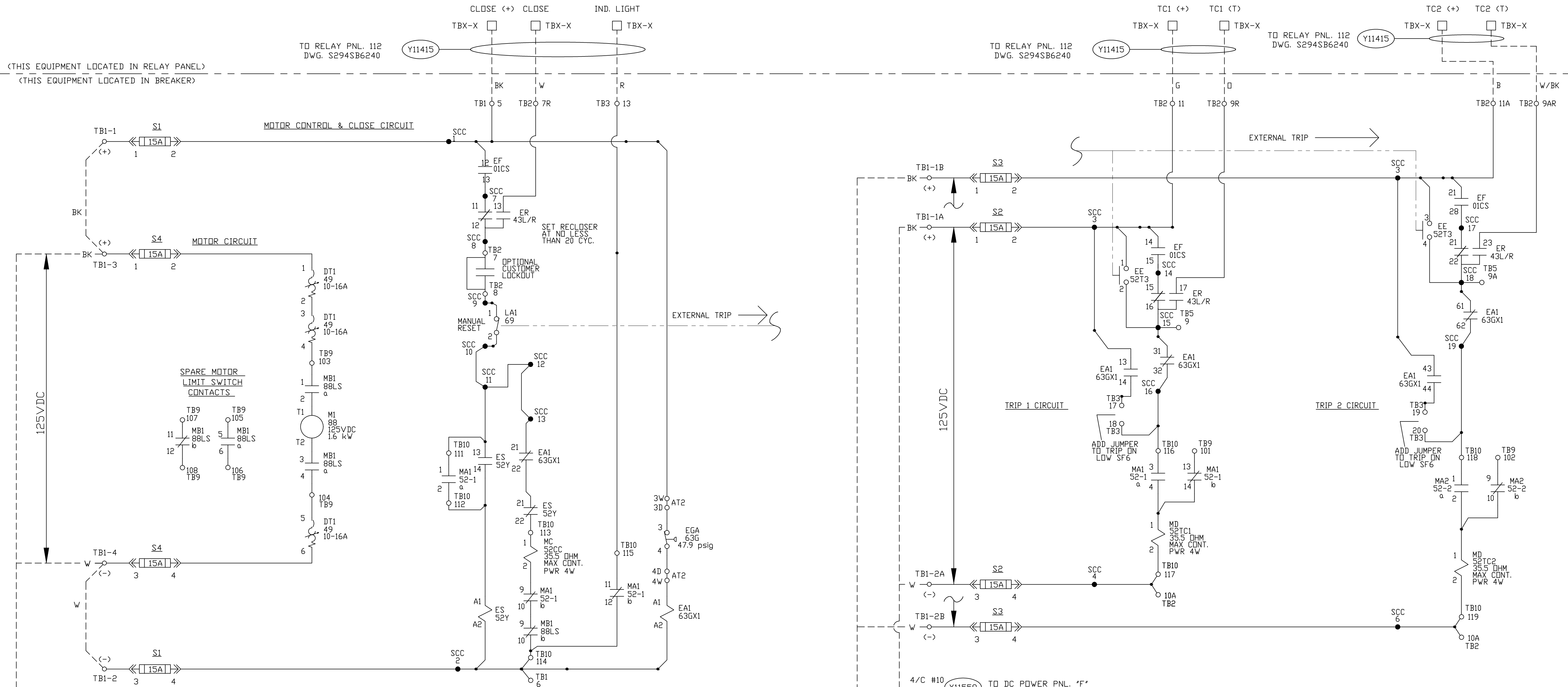
**BREAKER 6240  
DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
DRAWING No. S294SB6240		REV. 0	

GRDA  
GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

File: W:\Drawing\Drawings\Substation\AFTON\Converter CAD Drawings 2-16-12\GRDA\_E564\_S294SB6240a\_BKR\_6240\_ACDC SCHEMATIC DIAGRAM.dwg  
 Last Modified by: Shultz, Andrew Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/24/2012 9:44 AM Plotter Used: DWG to PDF.pc3  
 Last Saved by: Ashulis  
 Last Save: 4/24/2012 9:44 AM Last Saved by: Ashulis



NOTE: SEE 69kV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

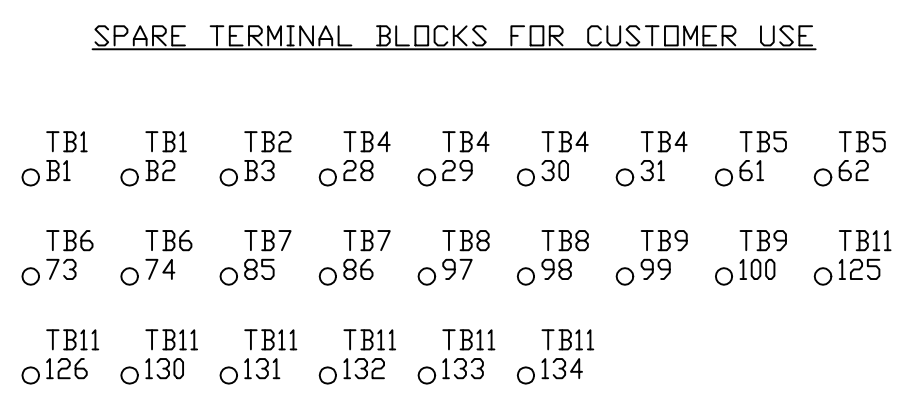
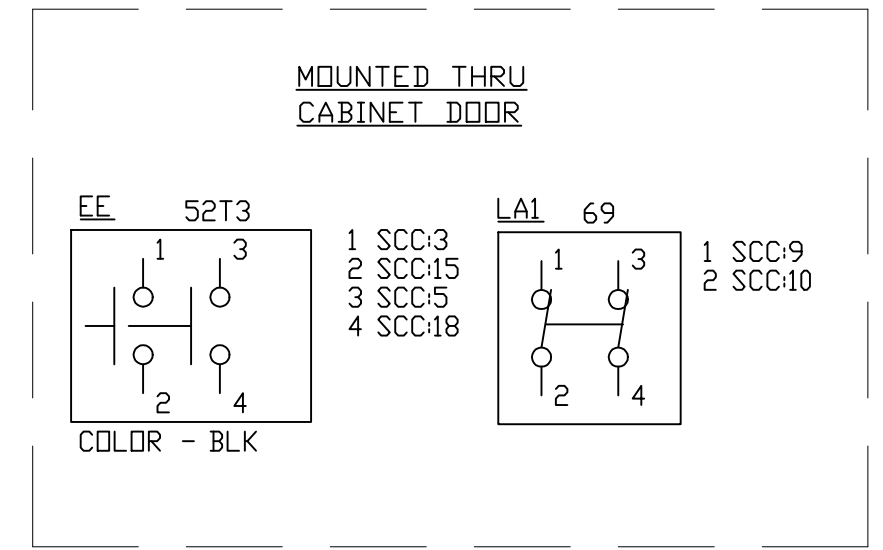
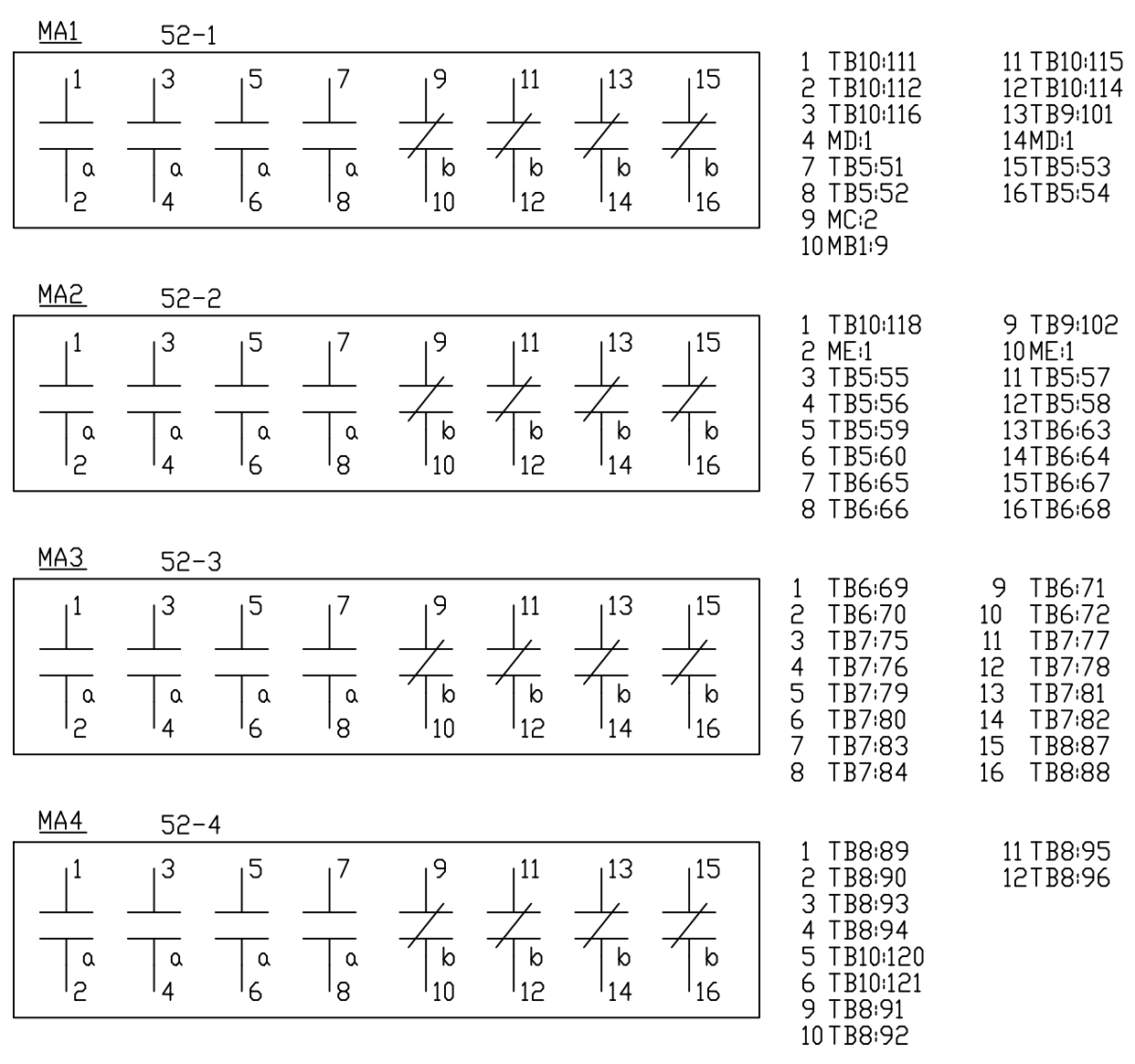
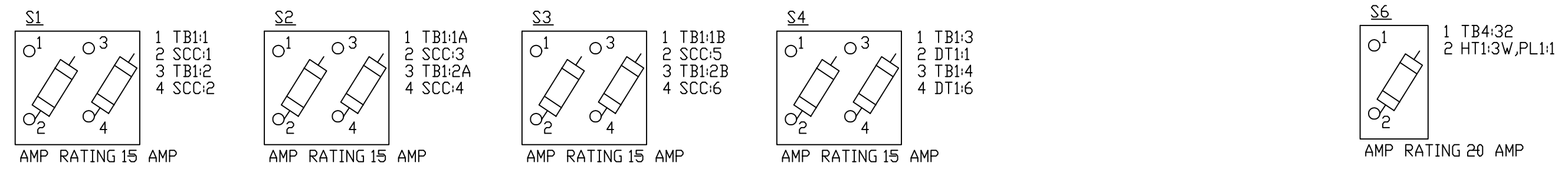
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69KV  
**BREAKER 6240**  
**AC/DC SCHEMATIC DIAGRAM**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011		
		DRAWING No. <b>S294SB6240a</b>	
REV 0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

REV 0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

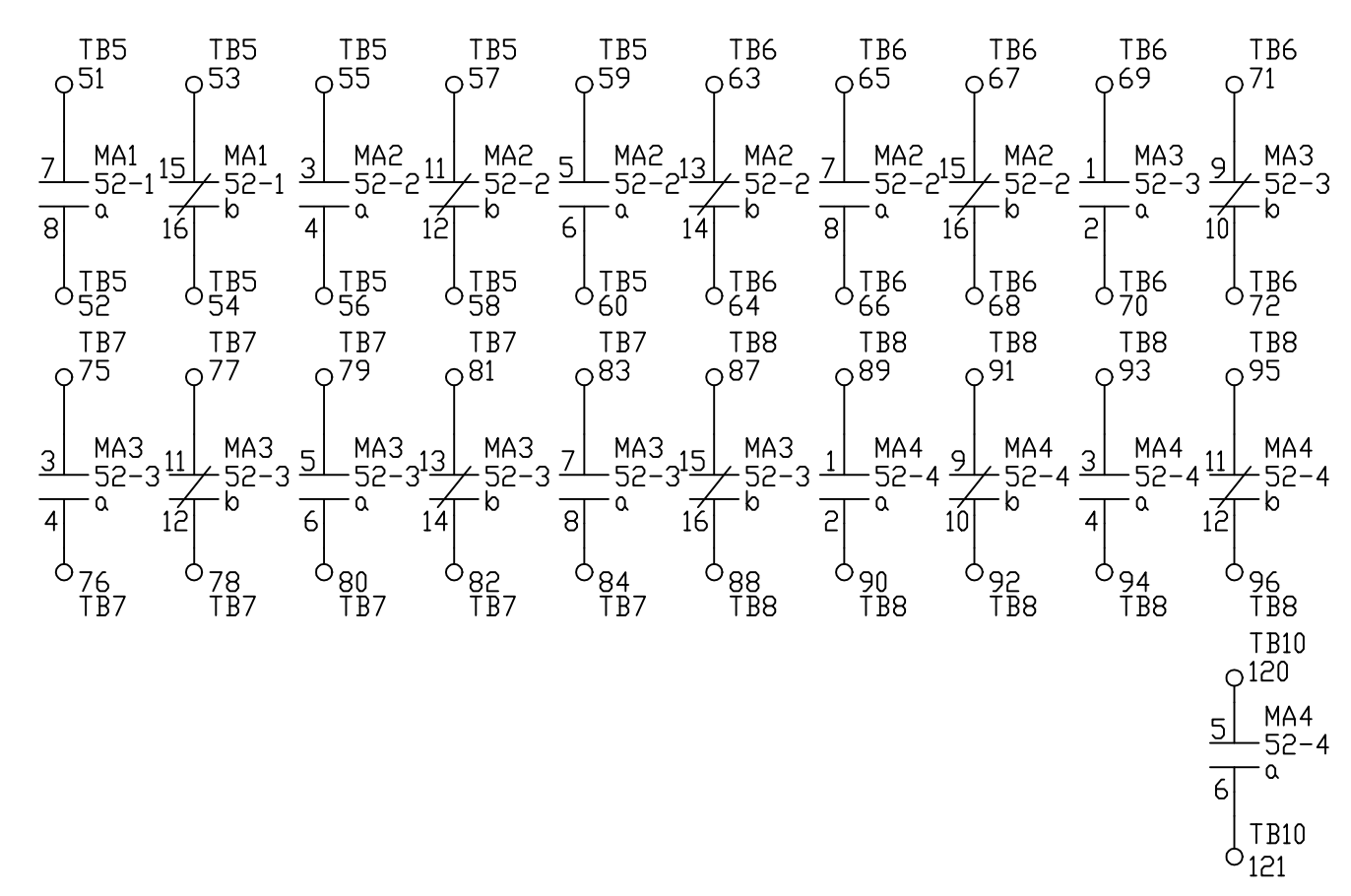
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 Last Saved by: Shultz, Arlene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/24/2012 9:47 AM Plotter Used: DWG To PDF.pc3  
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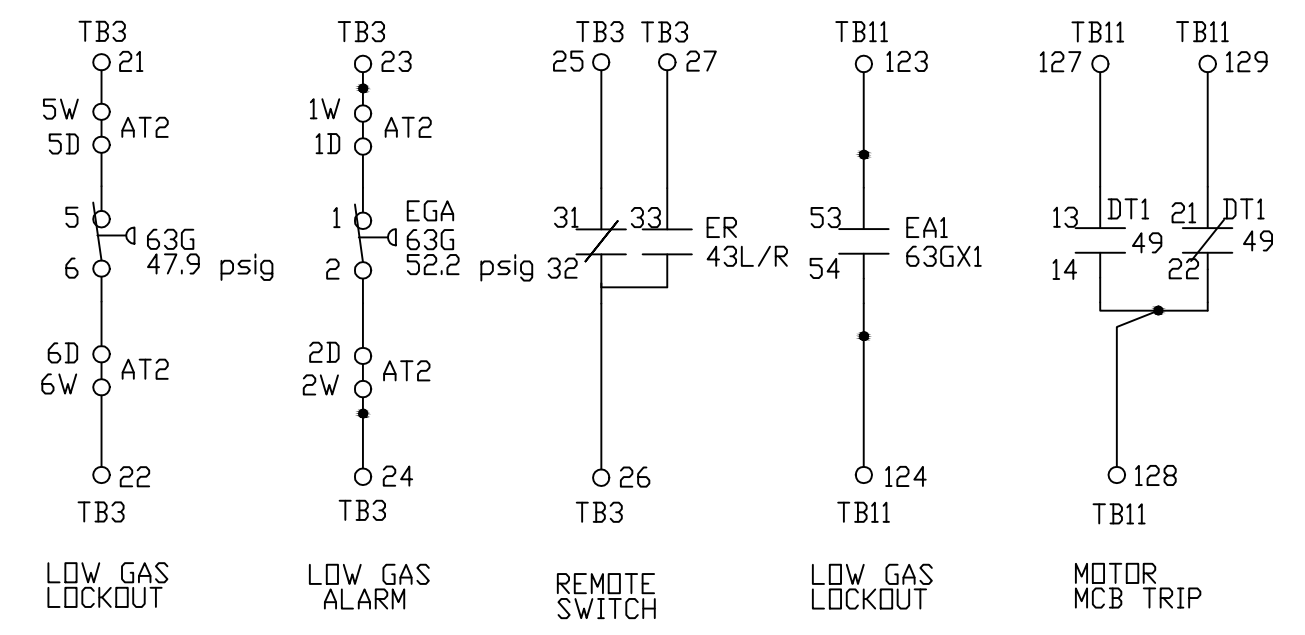
- NOTES:
- 1) ALL DEVICES SHOWN IN DE-ENERGIZED POSITION
  - 2) BREAKER SHOWN IN OPEN POSITION
  - 3) SF6 SHOWN AT ZERO PRESSURE
  - 4) CLOSING SPRING SHOWN IN CHARGED POSITION
  - 5) SCC11 & SCC12 ARE CONNECTED BY A 2PT SHORTING BAR
  - 6) LOCAL/REMOTE SWITCH SHOWN IN LOCAL POSITION

NOTE: SEE 69KV BREAKER SHOP DRAWINGS FOR EQUIPMENT NOT SHOWN ON THIS DRAWING.

SPARE AUXILIARY SWITCHES FOR CUSTOMER USE



CUSTOMER ALARMS



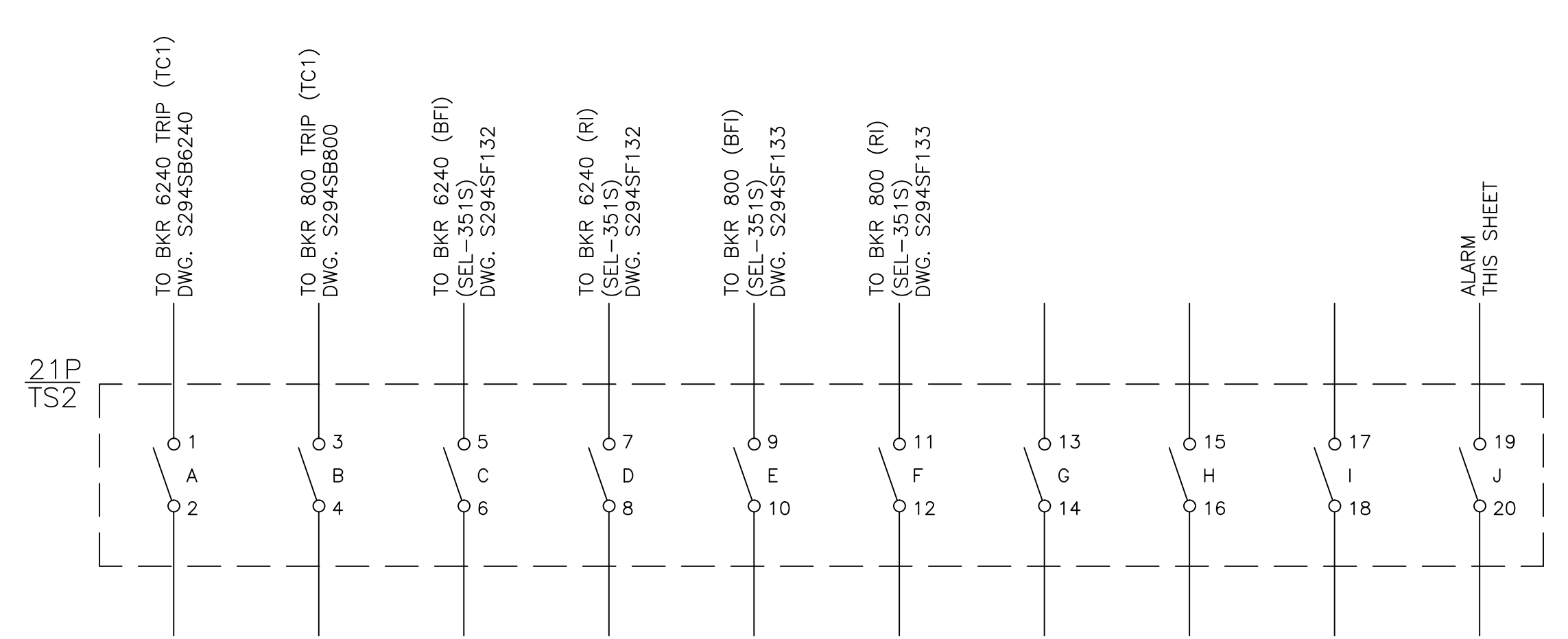
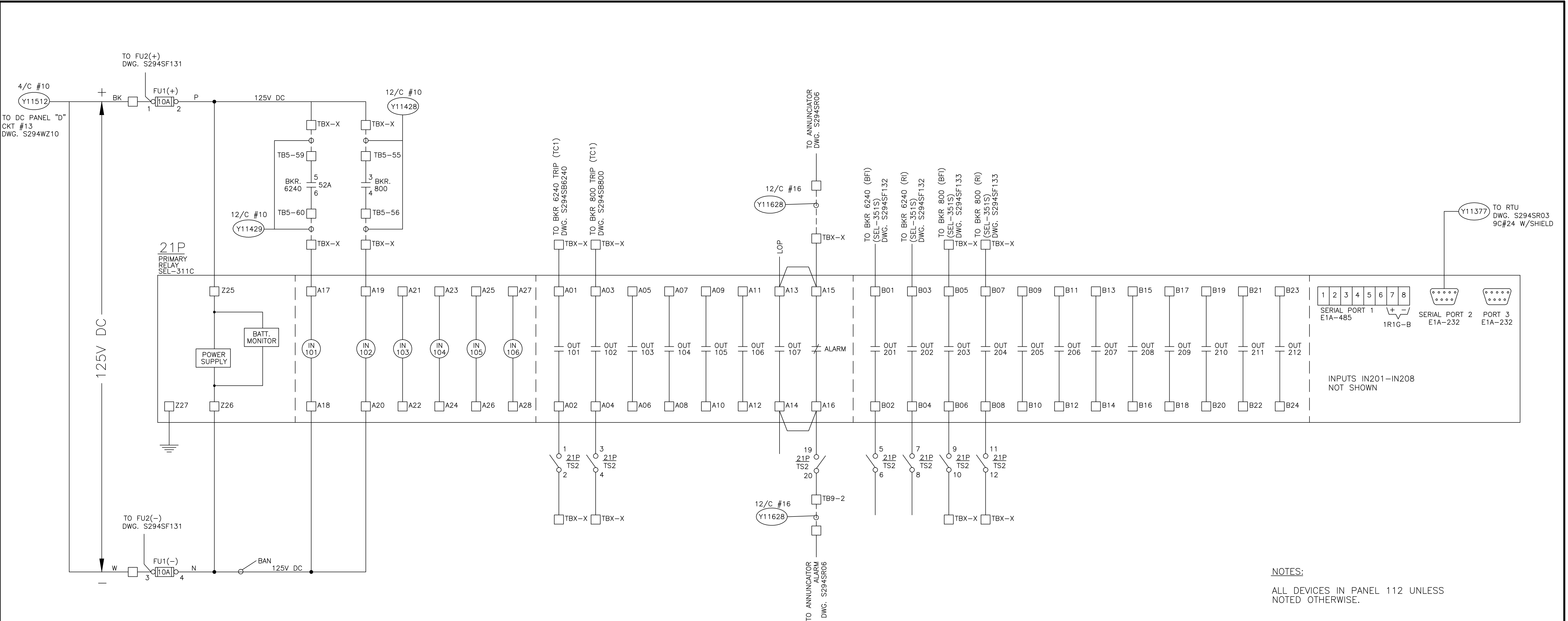
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 BREAKER 6240  
 BREAKER AUXILIARIES

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SB6240b	
REV 0	DATE 4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

File: W:\Drafting\Drawings\Substation\AFTON\Garver CAD Drawings 2-16-12\GRDA\_E664\_S294SF130\_21P\_FDR\_62-SAILBOAT BRIDGE 69kV CIRCUIT.dwg  
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**NOTES:**  
 ALL DEVICES IN PANEL 112 UNLESS NOTED OTHERWISE.

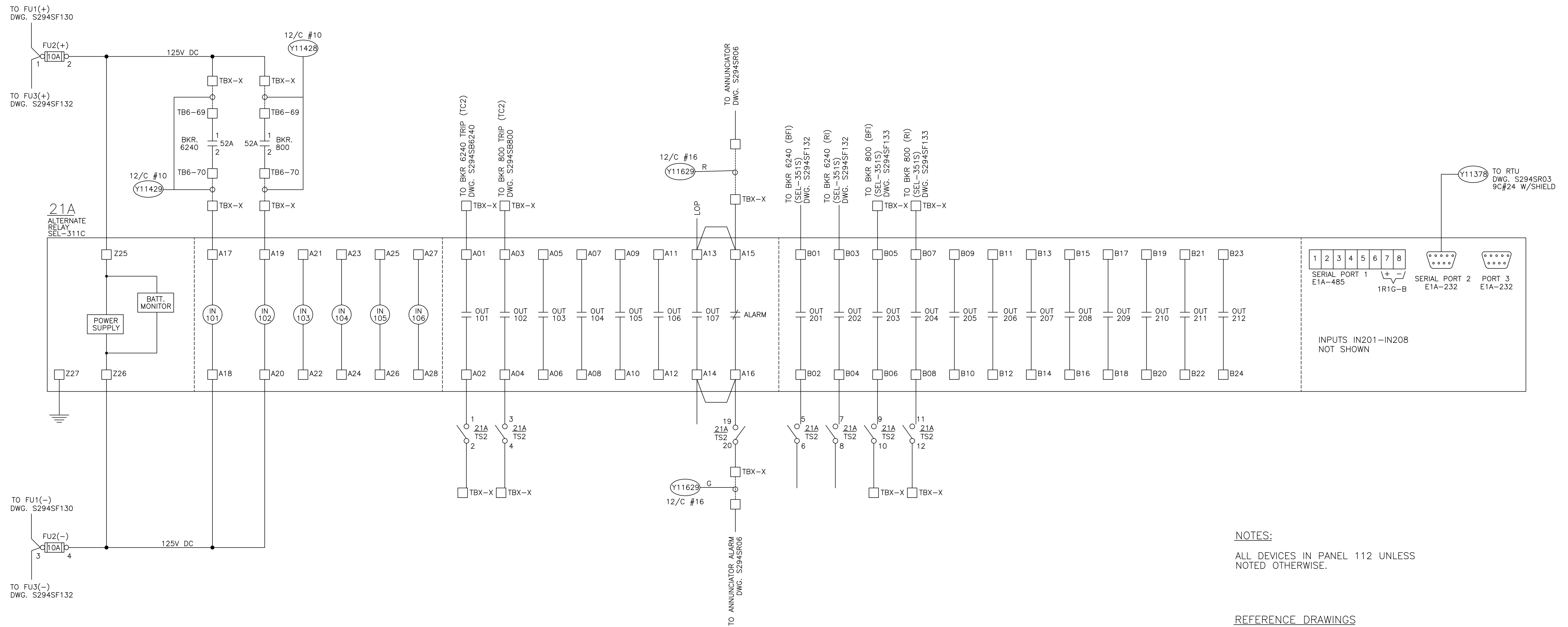
- REFERENCE DRAWINGS**
- S294PP112 PANEL 112 ELEVATION
  - S294SB6240 BREAKER 6240 SCHEMATIC DIAGRAM
  - S294SB800 BREAKER 800 SCHEMATIC DIAGRAM
  - S294SF131 ALTERNATE RELAY FDR. 62
  - S294SF132 BREAKER FAILURE & RECLOSE BKR. 6240
  - S294SF111 THREE LINE AC DIAGRAM
  - S294SF133 BREAKER FAILURE & RECLOSE BKR. 800
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM
  - S294SR06 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV <b>21P</b> 69KV FDR 62-SAILBOAT BRIDGE CIRCUIT			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
 <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. <b>S294SF130</b>	
CH: NN	DATE: 3/7/2011	REV. 0	

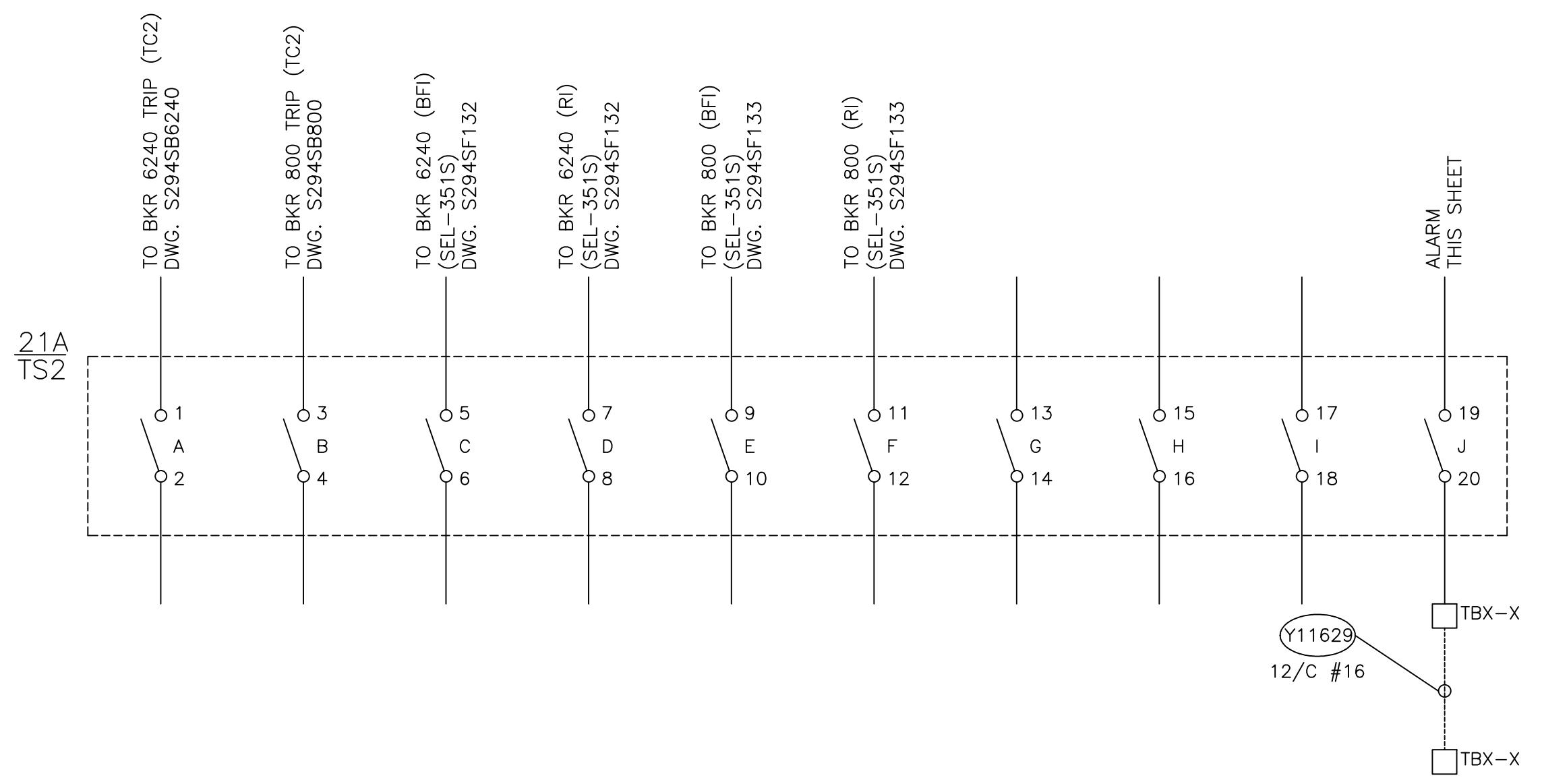
REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

File: W:\Drafting\Drawings\Substation\AFTON\Garver CAD Drawings 2-16-12\GRDA\_E665\_S294SF131\_21A\_FDR\_62-SAILBOAT BRIDGE 69KV CIRCUIT.dwg Last Saved by: Ashults  
 Last Plotted by: Shults, Arlene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/24/2012 10:00 AM Plotter Used: DWG To PDF.pc3



**NOTES:**  
 ALL DEVICES IN PANEL 112 UNLESS NOTED OTHERWISE.

- REFERENCE DRAWINGS**
- S294PP111 PANEL 111 ELEVATION
  - S294SB240 BREAKER 6240 SCHEMATIC DIAGRAM
  - S294SB800 BREAKER 800 SCHEMATIC DIAGRAM
  - S294SF111 THREE LINE DIAGRAM BKR. 6240 & FDR. 62
  - S294SF130 PRIMARY RELAY FDR. 62
  - S294SF132 BREAKER FAILURE & RECLOSE BKR. 6240
  - S294SF133 BREAKER FAILURE & RECLOSE BKR. 800
  - S294SR03 RELAY COMMUNICATIONS DIAGRAM
  - S294SR06 ANNUNCIATOR SCHEMATIC & WIRING DIAGRAM



**ISSUED FOR BID**

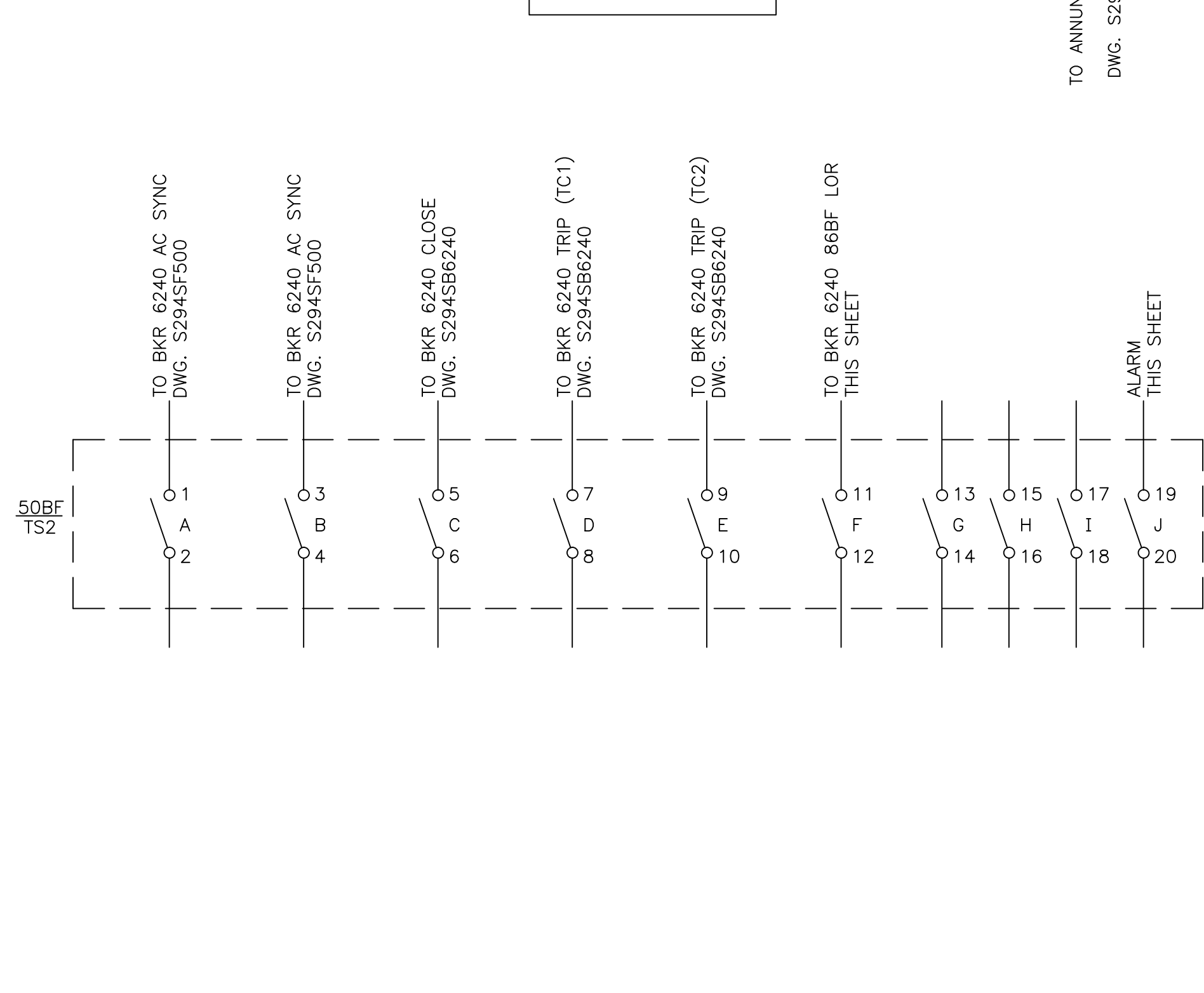
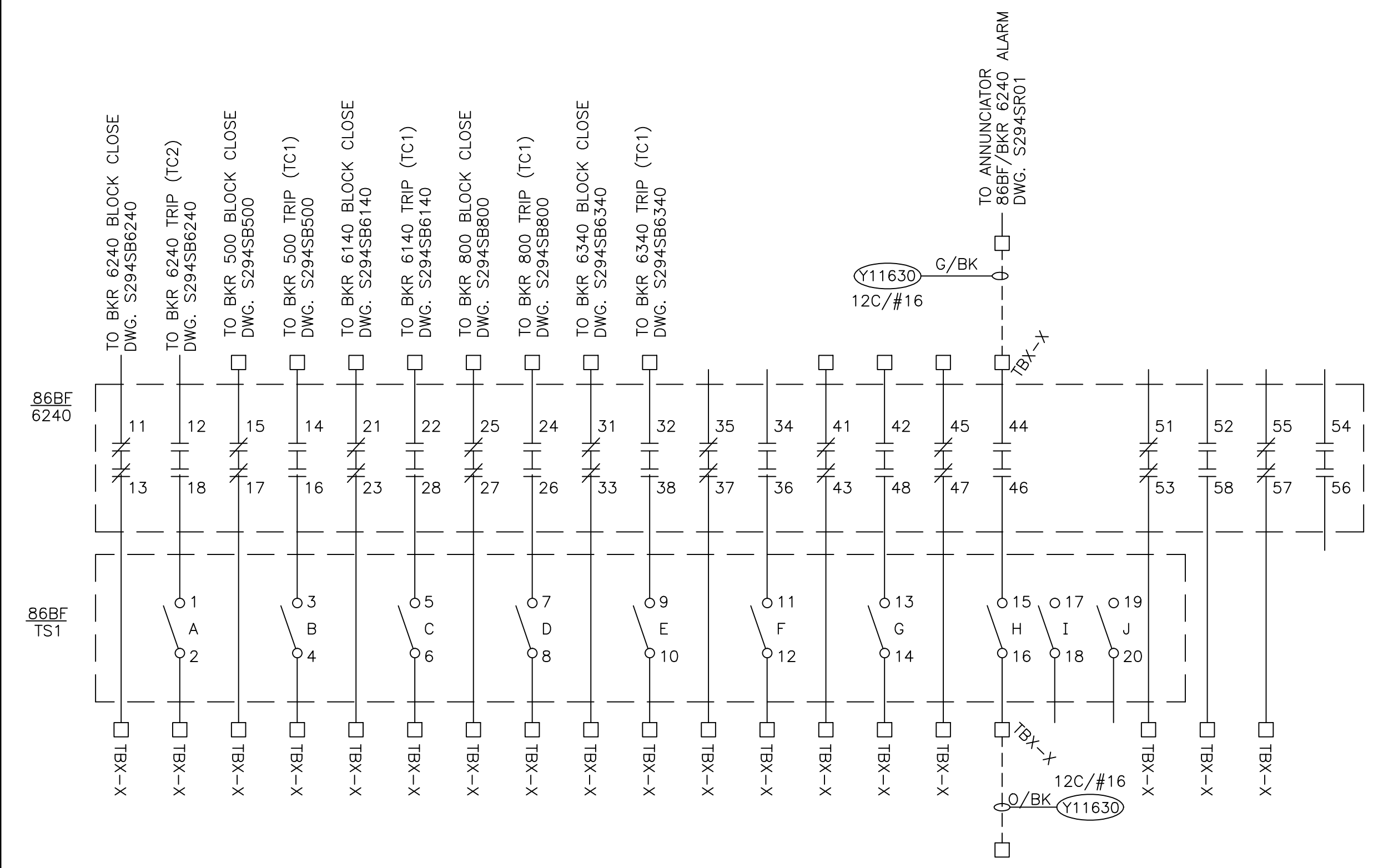
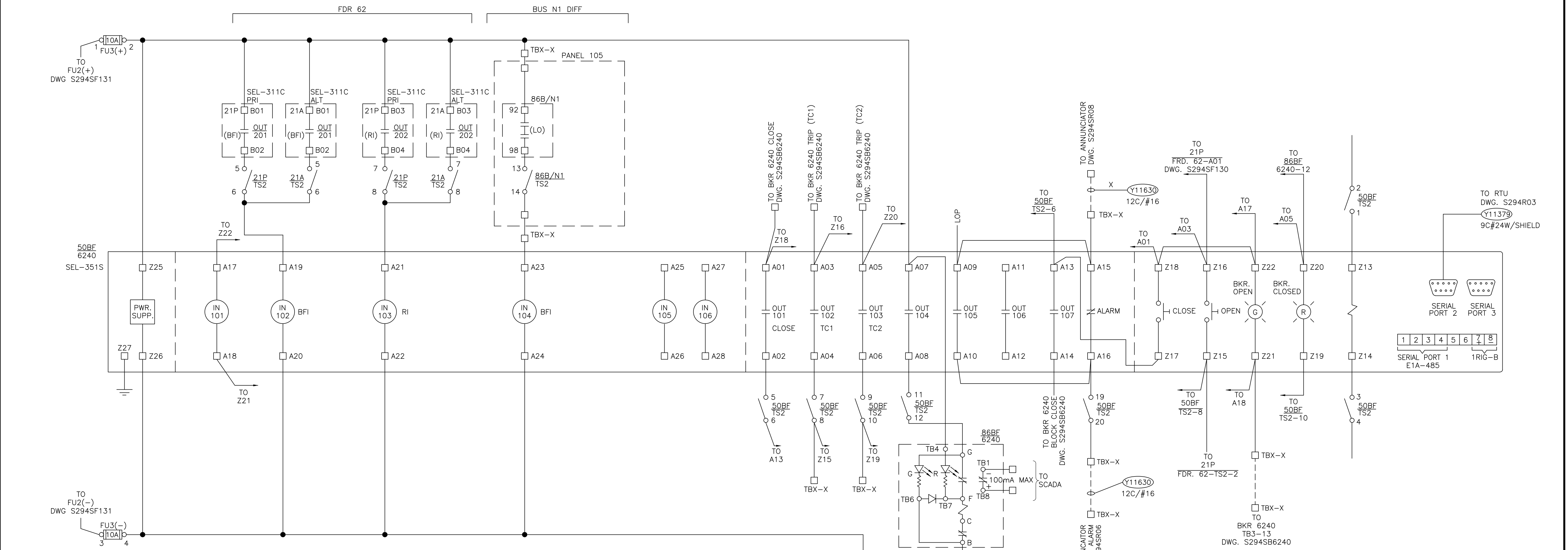
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 21A  
 FDR 62-SAILBOAT BRIDGE 69KV CIRCUIT

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011	DRAWING No. S294SF131	
REV	DATE	REVISION DESCRIPTION	DFT ENG
0	4/23/12	ISSUED FOR BID	AS NN

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301



File: W:\Drafting\Drawings\Substation\AFTON\Garver CAD Drawings 2-16-12\GRDA\_E666\_S294SF132 BREAKER 6240 FAILURE AND CONTROL.dwg Last Saved: 4/24/2012 10:03 AM Last saved by: Ashultz  
 Last plotted by: Shults, Ariene Plot Style: Monochrome.ctb Plot Scale: 1:1 Plot Date: 4/24/2012 10:03 AM Plotter used: DWG To PDF.pc3



86BF CONTACT DIAGRAM

DECK	CONTACTS	POSITION
		TRIP RESET
1	11 OH-HO 13	X
1	12 OH-HO 18	X
1	15 OH-HO 17	X
1	14 OH-HO 16	X
2	21 OH-HO 23	X
2	22 OH-HO 28	X
2	25 OH-HO 27	X
2	24 OH-HO 26	X
3	31 OH-HO 33	X
3	32 OH-HO 38	X
3	35 OH-HO 37	X
3	34 OH-HO 36	X
4	41 OH-HO 43	X
4	42 OH-HO 48	X
4	45 OH-HO 47	X
4	44 OH-HO 46	X
5	51 OH-HO 53	X
5	52 OH-HO 58	X
5	55 OH-HO 57	X
5	54 OH-HO 56	X
6	61 OH-HO 63	X
6	62 OH-HO 68	X
6	65 OH-HO 67	X
6	64 OH-HO 66	X
7	71 OH-HO 73	X
7	72 OH-HO 78	X
7	75 OH-HO 77	X
7	74 OH-HO 76	X
8	81 OH-HO 83	X
8	82 OH-HO 88	X
8	85 OH-HO 87	X
8	84 OH-HO 86	X

**NOTES:**  
 1. ALL EQUIPMENT IS ON PANEL 112 UNLESS OTHERWISE NOTED

**REFERENCE DRAWINGS**

- S294SB6240 BREAKER 6240 SCHEMATIC DIAGRAM
- S294SF130 PRIMARY RELAY FEEDER 62
- S294SF131 ALTERNATE RELAY FEEDER 62
- S294SF111 THREE LINE AC DIAGRAM BREAKER 6240 & FDR. 62
- S294SR01 COMMUNICATIONS AND ANNUNCIATOR PANEL
- S294SR03 RELAY COMMUNICATIONS DIAGRAM
- S294SR08 ANNUNCIATOR WIRING & SCHEMATIC DIAGRAM

TERMINAL BLOCK LOCATED IN THIS PANEL

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**BKR 6240 FAILURE & CONTROL**  
 FDR 62-SAILBOAT BRIDGE 69KV CIRCUIT

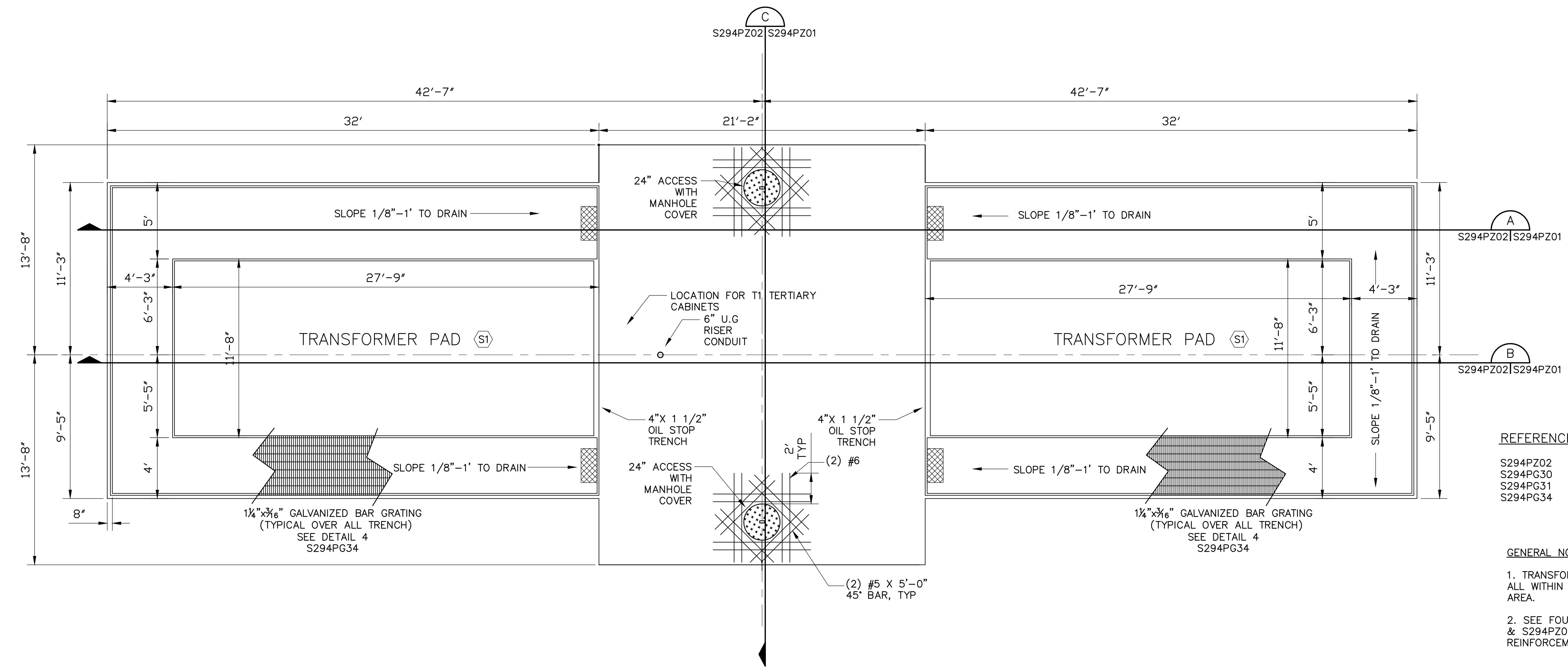
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CH: NN	DATE: 3/7/2011	DRAWING No. S294SF132	
REV 0	4/23/12	ISSUED FOR BID	AS NN
REV	DATE	REVISION DESCRIPTION	DFT ENG

GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

Afton Substation

S294PZ01	OIL CONTAINMENT TANK
S294PZ02	OIL CONTAINMENT TANK DETAILS

File: W:\Drafting\Drawings\Substation\AFTON\Corner CAD Drawings 2-16-12\S294PZ01 OIL CONTAINMENT PLAN.dwg Last Save: 5/29/2012 8:45 AM Last saved by: Ashults  
 Last plotted by: Shults, Arlene Plot Style: Conter Standard Full.ctb Plot Date: 5/29/2012 8:45 AM Plotter used: DWG To PDF.pc3

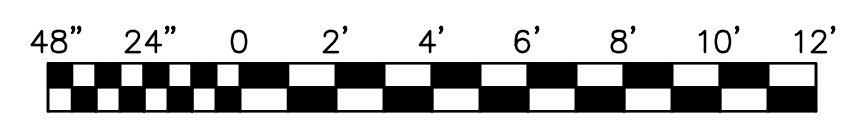


- REFERENCE DRAWINGS**
- S294PZ02 OIL CONTAINMENT DETAILS
  - S294PG30 161KV FOUNDATION PLAN
  - S294PG31 69KV FOUNDATION PLAN
  - S294PG34 TYPICAL FOUNDATION DETAILS

- GENERAL NOTES:**
1. TRANSFORMER AND RADIATORS ALL WITHIN DRAINAGE CONTAINMENT AREA.
  2. SEE FOUNDATION DWG. S294PG34 & S294PZ02 FOR SIZE & REINFORCEMENT STEEL.

**1 OIL CONTAINMENT SYSTEM**  
S294PZ01 SCALE: NONE

**LEGEND:**  
 REFER TO EQUIPMENT PAD SCHEDULE AND DETAILS SHEET S294PG34



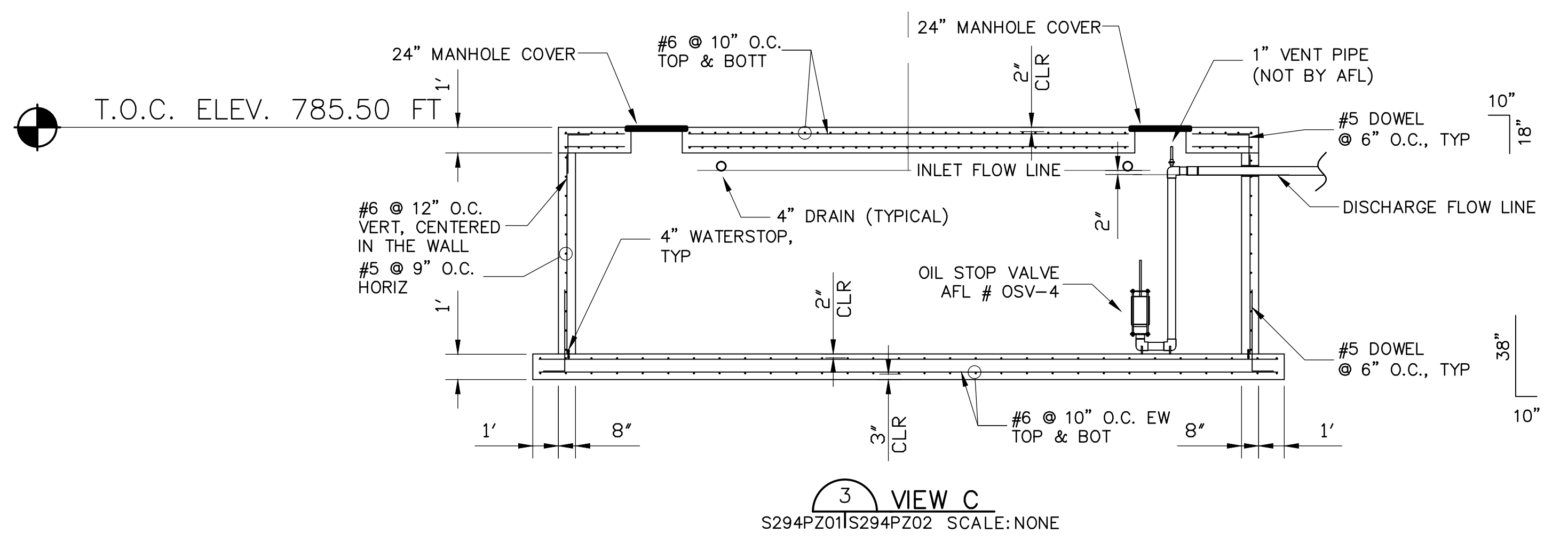
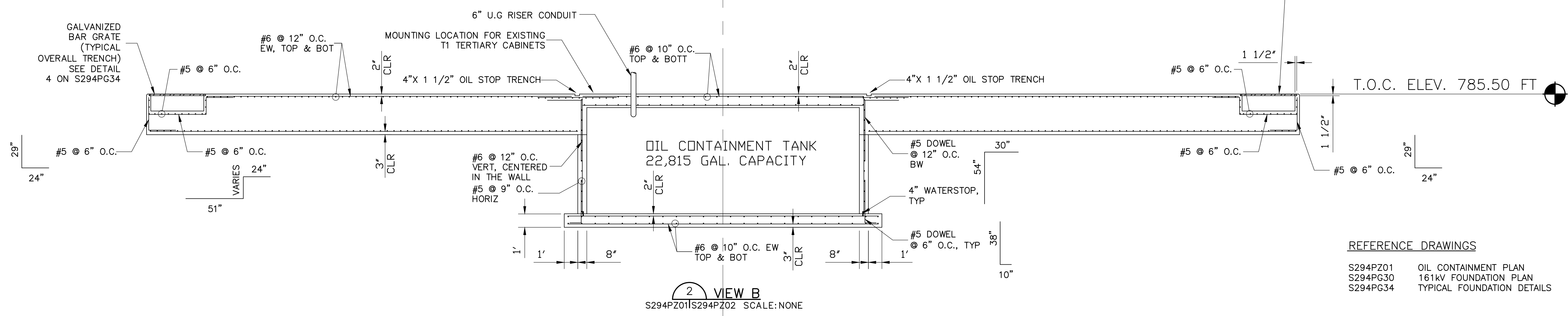
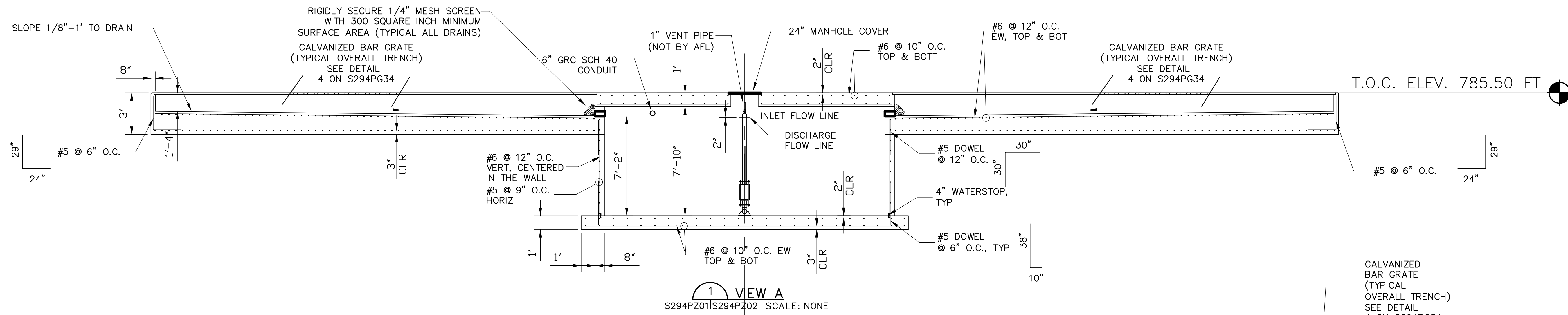
**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION S294**  
 AFTON, OKLAHOMA  
 161/69KV  
**OIL CONTAINMENT PLAN**

SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294PZ01</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	AS	BA

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 Last plotted by: Shults, Arlene Plot Style: Conner Standard Full.ctb Plot Date: 5/29/2012 9:19 AM Plotter used: DWG To PDF.pc3



- REFERENCE DRAWINGS**
- S294PZ01 OIL CONTAINMENT PLAN
  - S294PG30 161KV FOUNDATION PLAN
  - S294PG34 TYPICAL FOUNDATION DETAILS

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION S294**  
 AFTON, OKLAHOMA  
 161/69KV

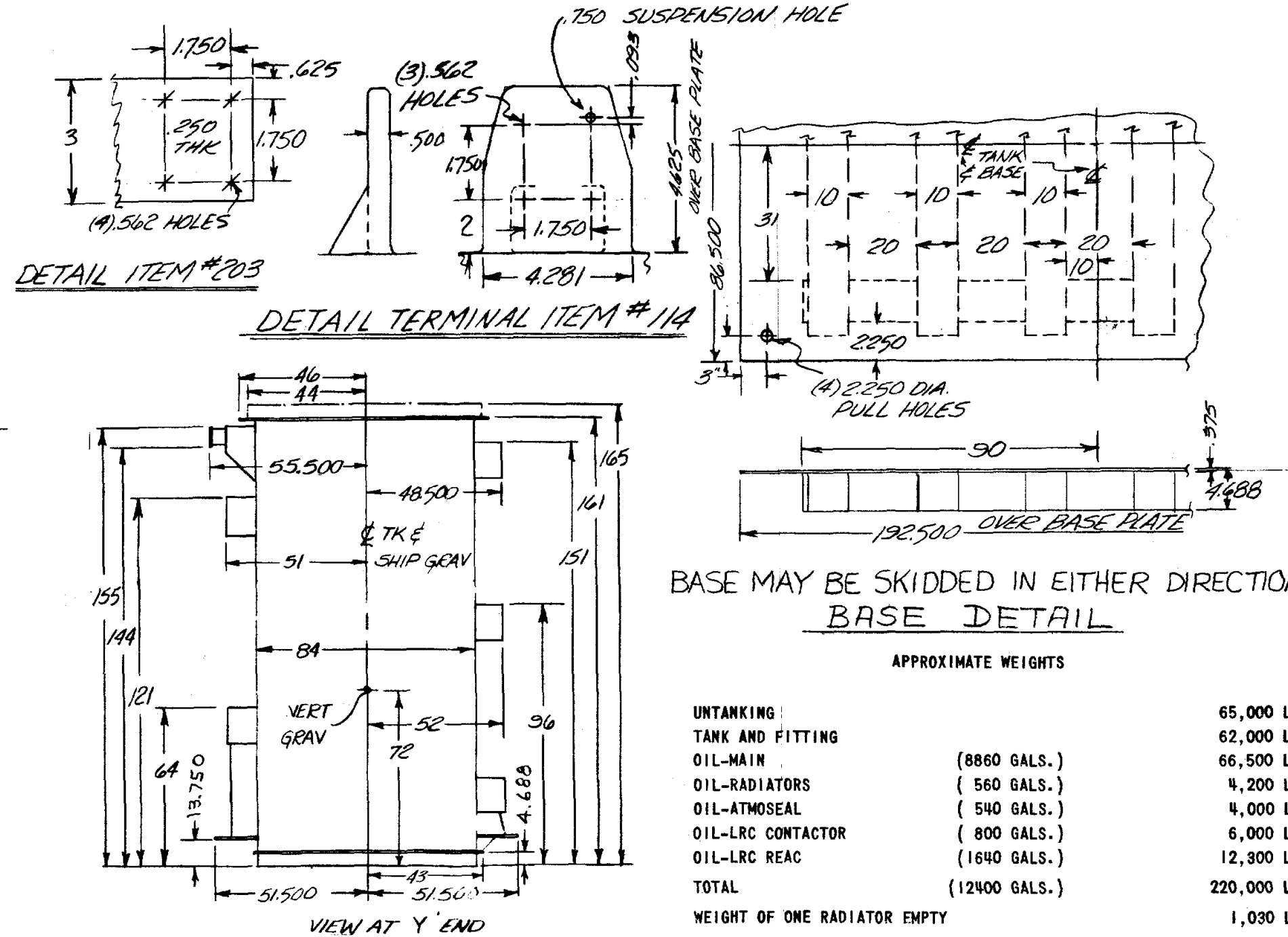
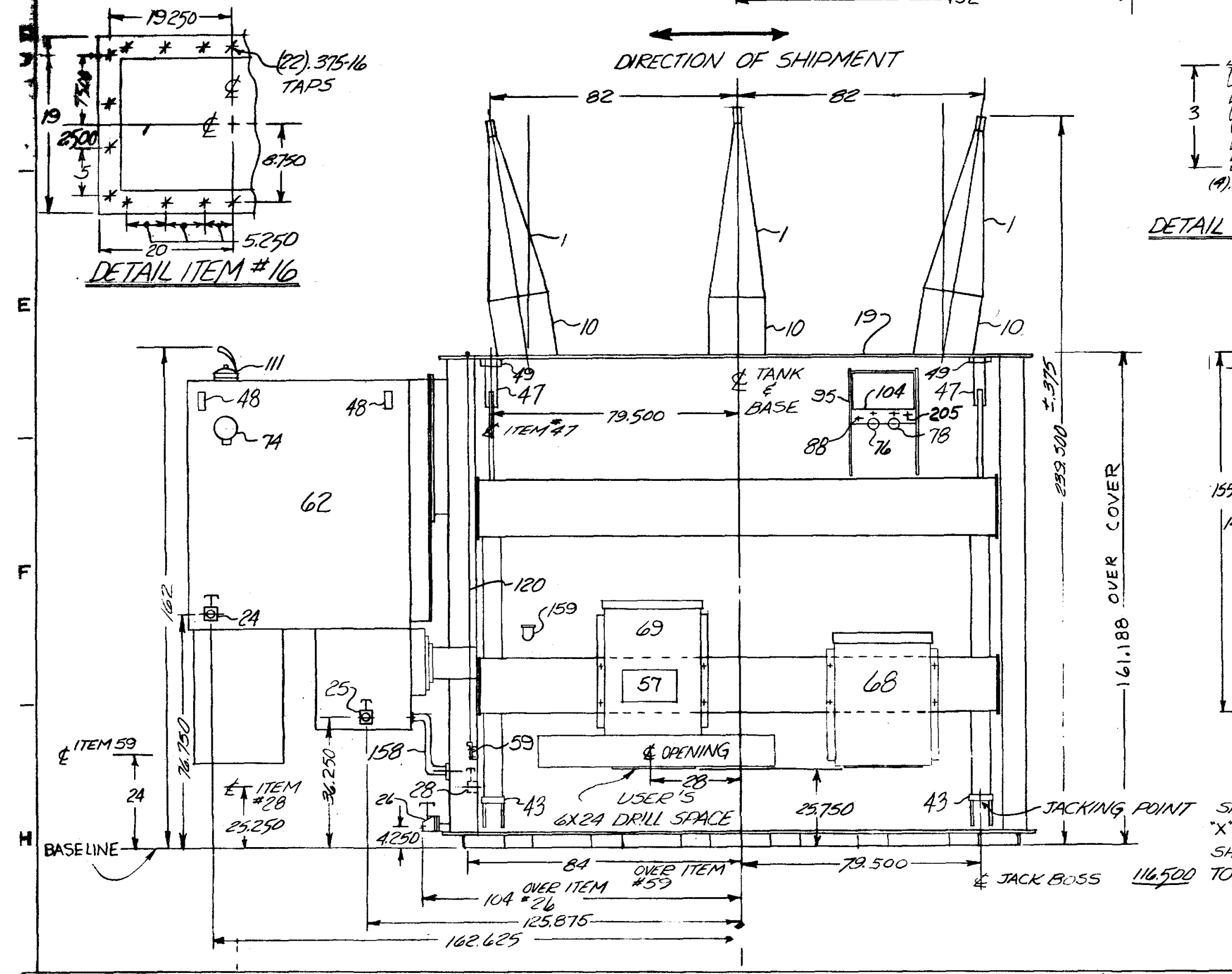
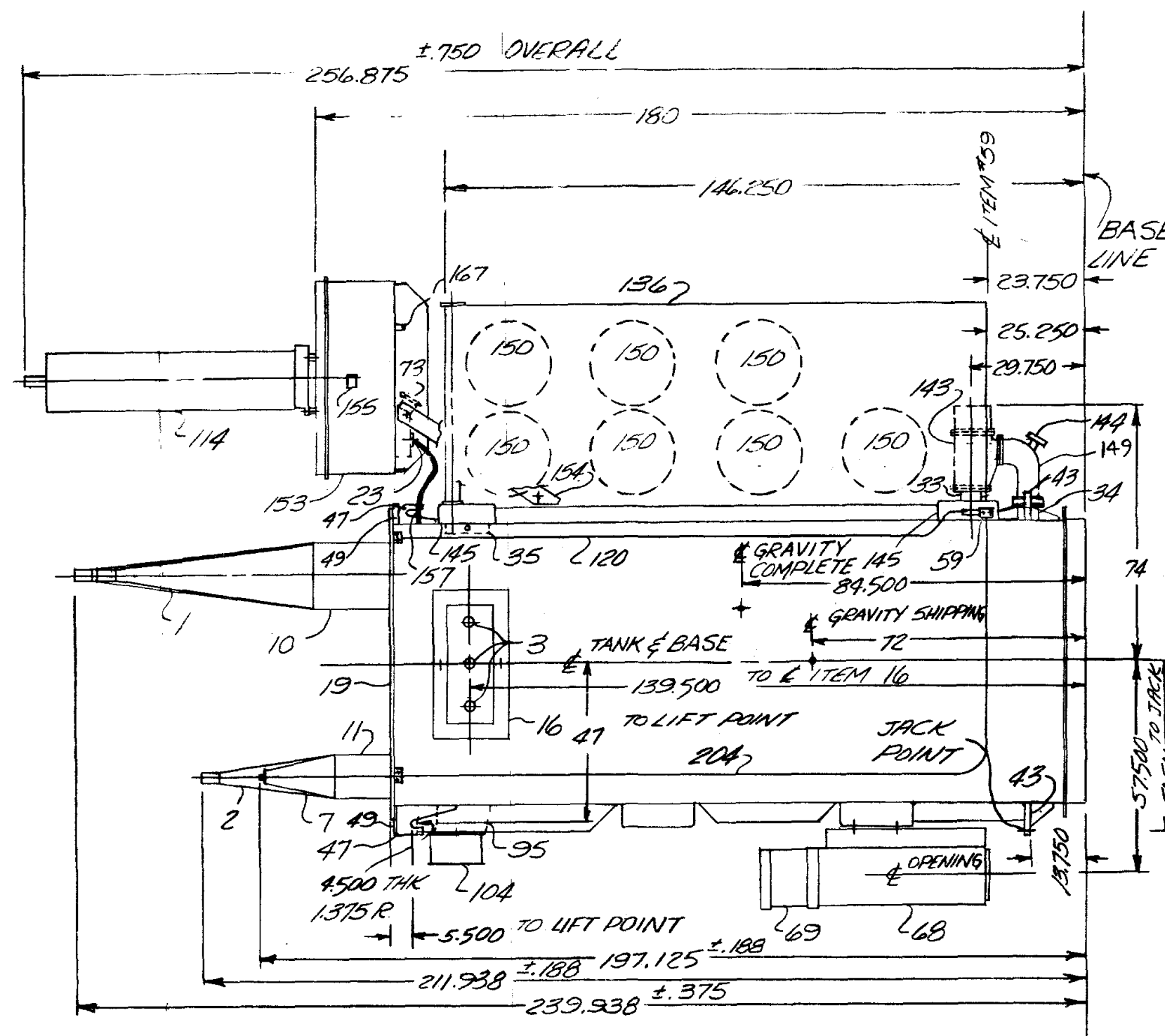
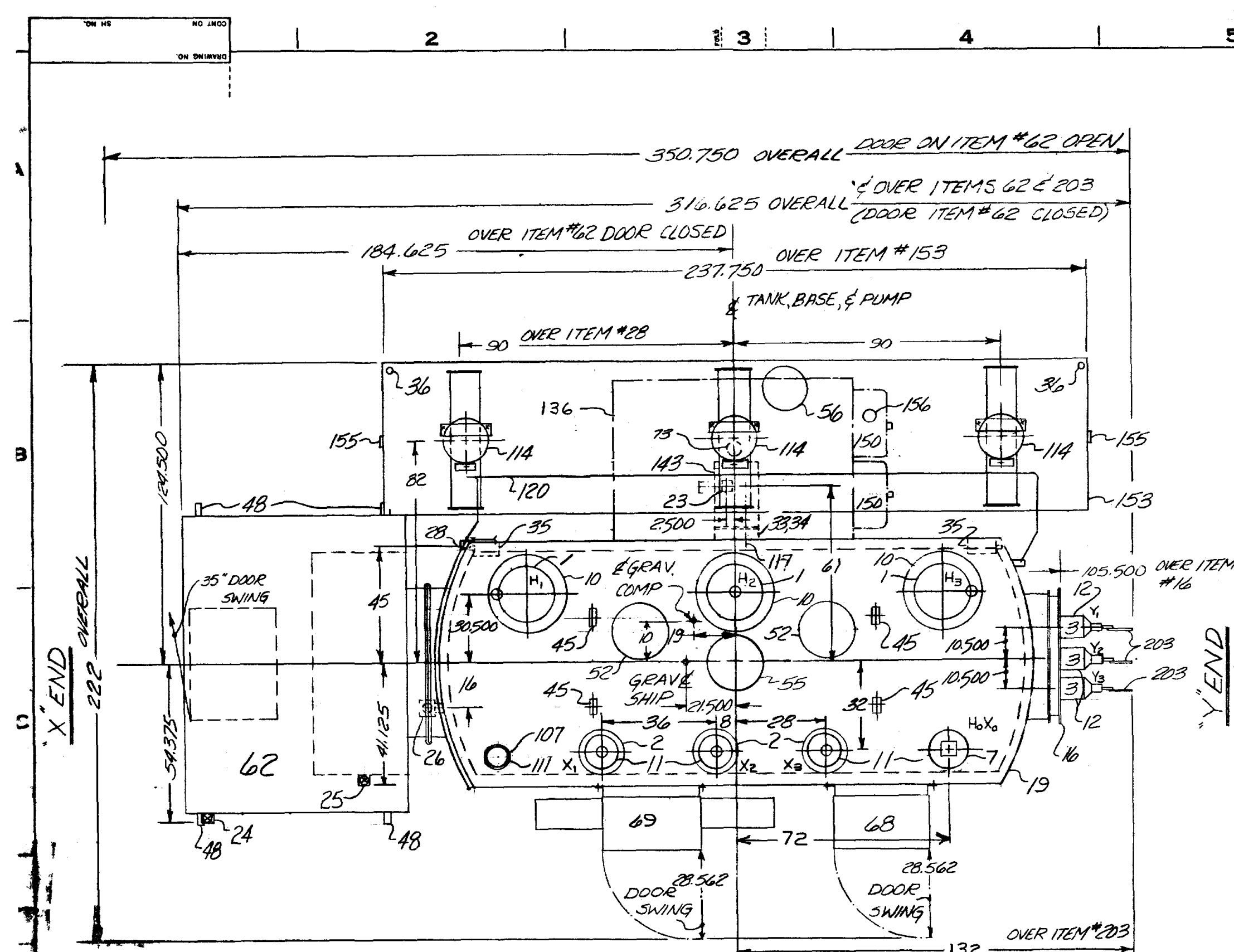
**OIL CONTAINMENT DETAILS**

SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
		DRAWING No.	REV.
<small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		S294PZ02	0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

## Afton Substation

S294PX01	TRANSFORMER #1 OUTLINE
S294PX02	TRANSFORMER #2 OUTLINE
S294PX03	TRANSFORMER #1 OUTLINE (INSTALLATION)
S294PX04	TRANSFORMER #1 - BUSHING OUTLINES
S294PX05	TRANSFORMER #1 MISCELLANEOUS DETAILS
S294PX06	TRANSFORMER #1
S294PX07	TRANSFORMER #1 -
S294PX08	
S294PX09	NOT USED
S294PX10	69kV CCVT MANUFACTURERS DRAWINGS
S294PX11	161kV CCVTs MANUFACTURERS DRAWINGS
S294PX12	161kV WAVE TRAP
S294PX13	69kV SWITCH MANUFACTURERS DRAWINGS -1
S294PX14	69kV SWITCH MANUFACTURERS DRAWINGS -2
S294PX15	69kV SWITCH MANUFACTURERS DRAWINGS -3
S294PX16	69kV SWITCH MANUFACTURERS DRAWINGS -4
S294PX17	NOT USED
S294PX18	NOT USED
S294PX19	NOT USED
S294PX20	TRANSFORMER #2 - ORIGINAL OUTLINE



APPROXIMATE WEIGHTS

UNTANKING	65,000 LBS.
TANK AND FITTING	62,000 LBS.
OIL-MAIN (8860 GALS.)	66,500 LBS.
OIL-RADIATORS (560 GALS.)	4,200 LBS.
OIL-ATMOSREAL (500 GALS.)	4,000 LBS.
OIL-LRC CONTACTOR (800 GALS.)	6,000 LBS.
OIL-LRC REAC (1600 GALS.)	12,300 LBS.
TOTAL (12400 GALS.)	220,000 LBS.
WEIGHT OF ONE RADIATOR EMPTY	1,030 LBS.

VIEW AT Y END  
 SHIPPED GAS FILLED 11000 LBS.  
 SHIPPING LENGTH 202 BELOW HIGH 84 TO X END 118 TO Y END FROM GRAVITY.  
 SHIPPING LENGTH 305.500 ABOVE 28 HIGH TO X END 142 TO Y END FROM GRAVITY.

**SHIPPING DIMENSIONS**

GENERAL ELECTRIC 3913D344  
 TITLE: OUTLINE (TRANSFORMER-ATMOSREAL)  
 FIRST MADE FOR: OAJ/FA/FOA-T-60-30000/150000 (OUT.)  
 65°C - 161000 GRV/92956 - 69000 GRV/92956 - 19200

- | ITEM NO. | QTY FOR SHIP | DESCRIPTION  |
|----------|--------------|--|
| 1        | 3            | BUSHING FOR "M" WDG. CAT. 118631 WITH 1.500-12 STUD 2.125 THREADED LENGTH BUSHING OUTLINE 3912C274 (138KV1600 AMP, TYPE "U" BUSHING).  |
| 2        | 3            | BUSHING FOR "X" WDG. CAT. 78500 WITH 1.500-12 STUD 2.125 THREADED LENGTH BUSHING OUTLINE 3912B392 (69KV1200 AMP, TYPE "M" BUSHING).  |
| 3        | 3            | BUSHING FOR "M" WDG. CAT. 18054 WITH 1.125-12 STUD 2.125 THREADED LENGTH AND WITH BLADE-TYPE CONNECTOR (SEE SKETCH) BUSHING OUTLINE 4818584 (25KV900 AMP, TYPE "A" BUSHING). |
| 7        | 1            | NEUTRAL BUSHING FOR "M" WDG. CAT. 78522 WITH 1.500-12 STUDS, 2.125 THREADED LENGTH. BUSHING OUTLINE 3918B56 (23KV1200 AMP, TYPE "U" BUSHING).                                |
| 10       | 3            | BUSHING ADAPTER (REMOVABLE) WITH .125" AIR VENT FOR ITEM #1  |
| 11       | 4            | BUSHING ADAPTER (REMOVABLE) WITH .125" AIR VENT FOR ITEMS #2 & #7  |
| 16       | 1            | BUS DUCT FLANGE (SEE DETAIL)   |
| 19       | 1            | VALVE DRAIN 1" GLOBE NPT FEMALE FOR EXPANSION TANK   |
| 23       | 1            | VALVE DRAIN 1" GLOBE NPT FEMALE WITH .375" SAMPLING VALVE FOR TAP SELECTOR COMPARTMENT   |
| 24       | 1            | VALVE DRAIN 1" GLOBE NPT FEMALE WITH .375" SAMPLING VALVE FOR REACTOR COMPARTMENT  |
| 25       | 1            | VALVE COMPLETE DRAIN AND OUTLET FOR FILTER PRESS CONNECTION 2" GLOBE VALVE NPT FEMALE WITH .375" SAMPLING VALVE  |
| 28       | 1            | VALVE FOR FILTER PRESS CONNECTION 1" GLOBE VALVE NPT FEMALE AND DRAIN VALVE FOR COMPLETE COOLING EQUIPMENT   |
| 33       | 1            | VALVE SHUT-OFF FOR ITEM #13 TO MANIFOLD  |
| 34       | 1            | VALVE SHUT-OFF FOR ITEM #13 TO TANK  |
| 35       | 2            | VALVE SHUT-OFF FOR ITEM #14 TO TANK  |
| 36       | 2            | VERT VALVE (.125")   |
| 43       | 4            | JACK BOSS  |
| 45       | 4            | LIFTING BAR FOR LIFTING COVER (2" HOLE)  |
| 47       | 4            | LIFTING LUG FOR LIFTING COMPLETELY FILLED TRANSFORMER (FOR VERTICAL LIFT ONLY)   |
| 48       | 4            | LIFTING LUG FOR LIFTING LOAD TAP CHANGER   |
| 49       | 2            | ROPE GUIDE EXPOSE VERTICAL LIFT ON ITEM #47  |
| 52       | 2            | MANHOLE (18" OPENING)  |
| 53       | 1            | MANHOLE (18" OPENING) ACCESS TO CORE GROUND  |
| 56       | 1            | MANHOLE (15" OPENING) EXPANSION TANK   |
| 57       | 1            | MAGNETIC LIQUID LEVEL GAGE WITH LOW LEVEL ALARM (250 VOLTS MAX) FOR TAP SELECTOR COMPARTMENT   |
| 58       | 2            | GROUND BLOCK WITH (2) .500-13 TAPS .625 DEEP 1.750 BETWEEN CENTERS IN A 2 X 4 COPPER MOUNTING SURFACE  |
| 62       | 1            | LOAD TAP CHANGER (SEE OUTLINE 3916C909)  |
| 64       | 1            | CONTROL HOUSING (16 X 32 X 45)   |
| 69       | 1            | TERMINAL BOX (16 X 32 X 45) WITH SPLIT-TYPE ENTRANCE BOX WITH 6 X 24 DRILL SPACE FOR USER'S CONDUIT  |
| 73       | 1            | MAGNETIC LIQUID LEVEL GAGE WITH LOW LEVEL ALARM (250 VOLTS MAX)  |
| 74       | 1            | MAGNETIC LIQUID LEVEL GAGE WITH LOW LEVEL ALARM (250 VOLTS MAX) FOR TAP SELECTOR COMPARTMENT   |
| 76       | 1            | TOP LIQUID TEMPERATURE INDICATOR WITH ALARM CONTACTS (250 VOLTS MAX) TYPE AL   |
| 78       | 1            | INDICATING THERMAL RELAY WITH ALARM CONTACTS (250 VOLTS MAX) TYPE AMR USED WITH C.T. "A"   |
| 88       | 1            | SEALED WELL FOR REMOTE WINDING TEMPERATURE INDICATOR TYPE AM USED WITH C.T. "A"  |
| 95       | 1            | THERMAL DEVICE WELL HOUSING  |
| 104      | 1            | OUTLET HOUSING FOR CURRENT TRANSFORMER LEADS AND THERMAL EQUIPMENT   |
| 107      | 1            | PRESSURE RELIEF ADAPTER (REMOVABLE) WITH .125" AIR VENT  |
| 111      | 2            | MECHANICAL PRESSURE RELIEF (REMOVABLE) WITH ALARM TARGET AND CONTACTS (250 VOLTS MAX)  |
| 114      | 3            | LIGHTNING ARRESTER (REMOVABLE) CAT. NO. 91118A144 FOR ITEM #1 (SEE OUTLINE 3125D1180L004)  |
| 120      | 1            | LIGHTNING ARRESTER GROUND CABLE (#2 AWG BARE CONDUCTOR)  |
| 136      | 1            | RADIATOR BANK WITH (10) RADIATORS (REMOVABLE)  |
| 143      | 1            | PUMP (5 HP 240 VOLT THREE PHASE)   |
| 144      | 1            | LIQUID FLOW GAGE FOR ITEM #13 WITH ALARM CONTACTS (250 VOLTS MAX)  |
| 145      | 2            | MANIFOLD   |
| 149      | 1            | PIPE CONNECTING PUMP #34   |
| 150      | 7            | FAN 24", 240 VOLT, THREE PHASE   |
| 153      | 1            | EXPANSION TANK (18 X 72 X 235) REMOVABLE   |
| 154      | 2            | SUPPORT FOR EXPANSION TANK   |
| 155      | 2            | BRACKET FOR EXPANSION TANK   |
| 156      | 1            | BREATHER FOR EXPANSION TANK  |
| 157      | 1            | COUPLING (REMOVABLE) FOR CONNECTING EXPANSION TANK TO TANK, WITH SHUT-OFF VALVE ON TANK  |
| 158      | 1            | COUPLING (REMOVABLE) FOR CONNECTING ITEM #62 TO TANK, WITH SHUT-OFF VALVE ON TANK  |
| 159      | 1            | FAULT PRESSURE RELAY TYPE "J" WITH ALARM CONTACTS (250 VOLTS MAX) AND SHUT-OFF VALVE ON TANK   |
| 167      | 1            | PRESSURE VACUUM BLEEDER DEVICE (FOR ITEM #153)   |
| 203      | 3            | FLEXIBLE CONNECTOR (SEE DETAIL)  |
| 204      | 1            | NEUTRAL BUSH GROUND CABLE (#2 AWG BARE CONDUCTOR)  |
| 205      | 1            | SEALED WELL FOR BULB OF REMOTE TYPE TOP LIQUID TEMPERATURE INDICATOR TYPE AL   |

NOTES:

- ALL DIMENSIONS IN ELEVATION VIEW ARE TO BASE LINE UNLESS OTHERWISE SPECIFIED.
- TANK DESIGNED FOR FULL VACUUM.
- PRESSURE RELIEF SHIPPING COVER HAS .375 NPT FOR PRESSURE TEST, 2" NPT FOR VACUUM FILLING AND 1" NPT FOR OIL FILLING.
- CRANE LIFT FOR CORE AND COILS (MAIN UNIT): (4) 5" DIA. CAPSTANS ON 84.500 X 19.750 CENTERLINES 32 BELOW 4" HIGH INTERNAL UNIT. CRANE HOOK TO BASE LINE 350.500 MINIMUM, DEPENDENT ON LENGTH OF SLING. LENGTH OF SLING MUST BE SUCH THAT THE HEIGHT (CRANE HOOK TO CAPSTAN) EXCEEDS 84.500.

POL150139 DL3967X325AA

DESCRIPTION OF GROUPS	REVISIONS	PRINTS TO
		350 350H
		358A 00100
		066
		057
		082A
		251

#409184

APPROVALS: [Signature] DATE: 12/13/70  
 LOCATION: PITTSFIELD

**ISSUED FOR BID**

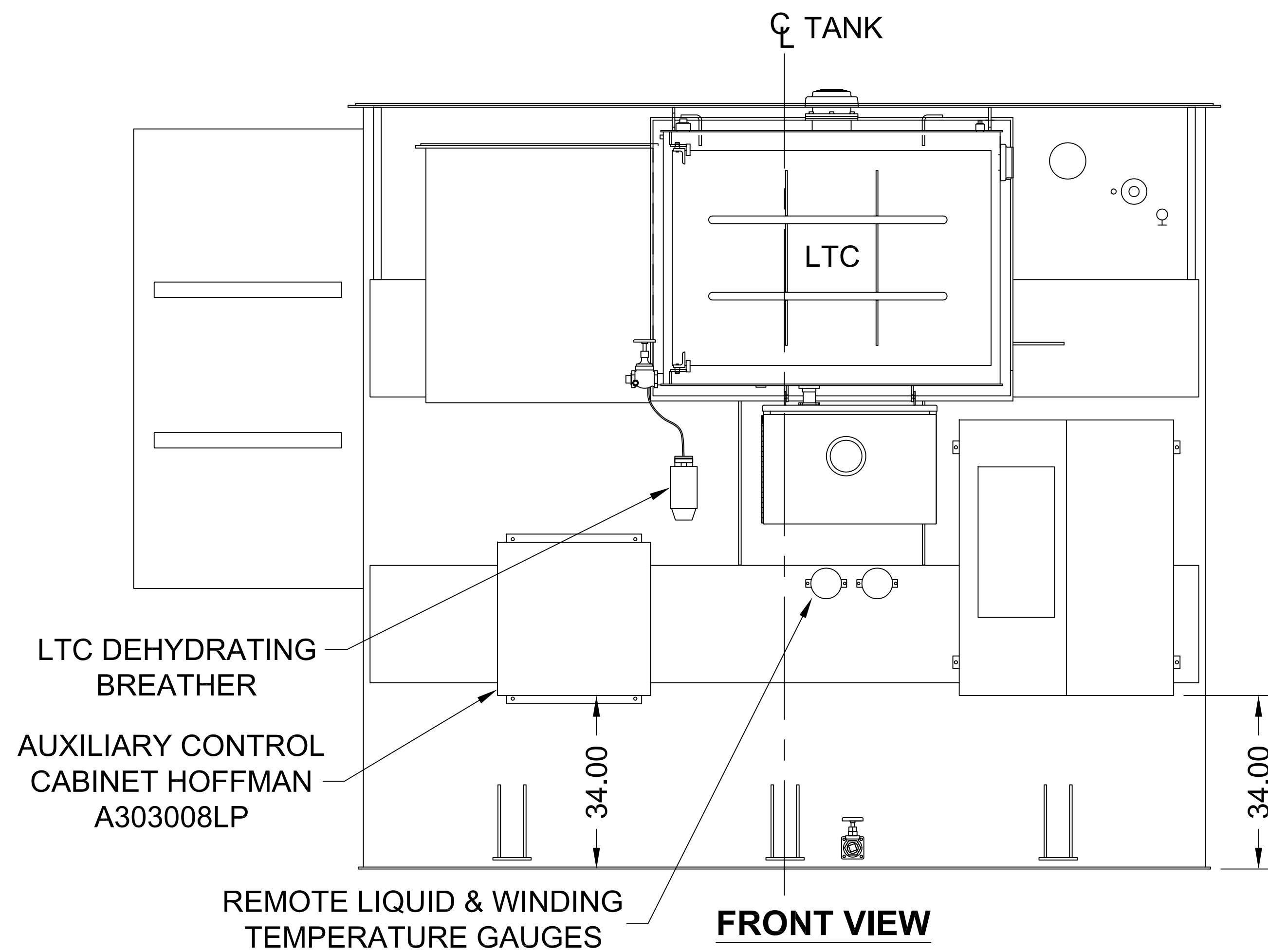
GRAND RIVER DAM AUTHORITY  
 AFTON SWITCHING STATION S294  
 AFTON, OKLAHOMA  
 161/69KV

**TRANSFORMER #1  
 OUTLINE**

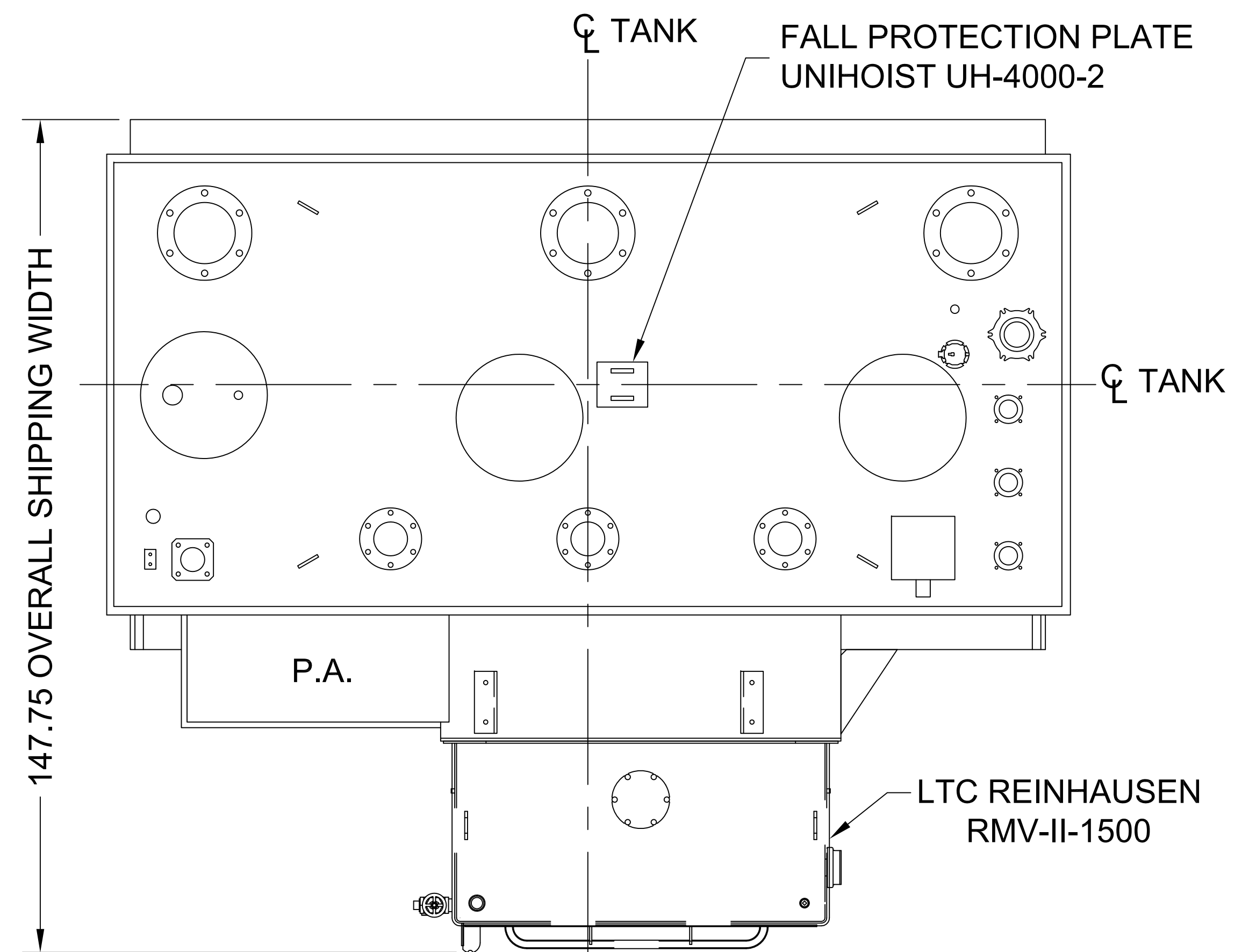
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 CH: BA DATE: 12/MAR/72

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 P. O. BOX 409  
 VINITA, OK 74301

DRAWING No. S294PX01 REV. 0



**FRONT VIEW**



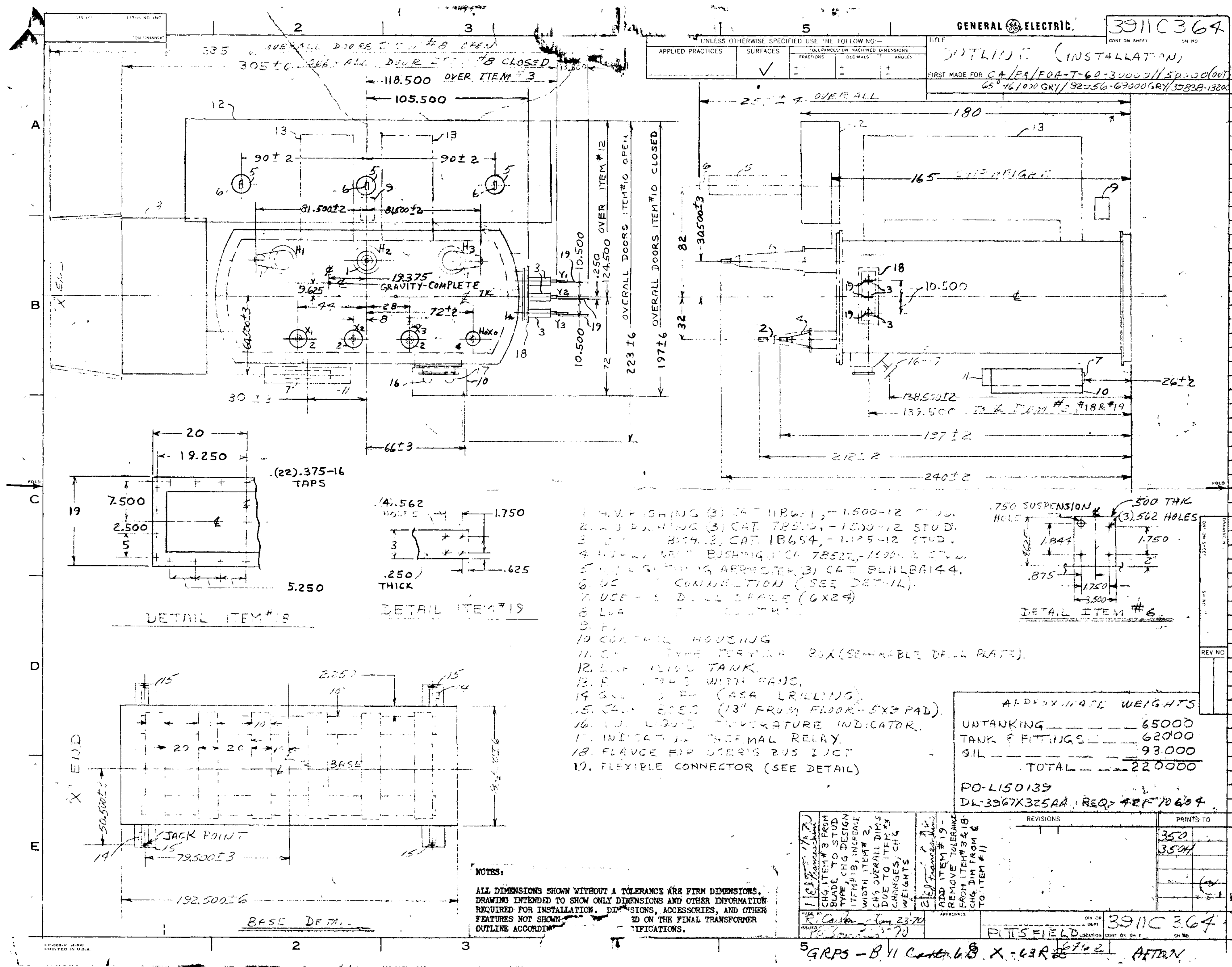
**LID VIEW**

**NOTE:**  
FOR ALL OTHER NOTES, DEVICES, OR ITEMS NOT SHOWN ON THIS DRAWING, REFER TO ORIGINAL OUTLINE DRAWING.

0	INITIAL RELEASE	PJS	06/25/10
REV	REVISION DESCRIPTION	BY	REL. DATE
REVISIONS TO THIS DRAWING MUST BE MADE ON THE CAD SYSTEM ONLY			
R.O. NO.	REWORK NO.	<b>SOUTHWEST ELECTRIC CO.</b> OKLAHOMA CITY, OK	
0912401894	-		
TOLERANCES UNLESS OTHERWISE SPECIFIED		TITLE	
FRACTIONAL	±1/16"	AUXILIARY OUTLINE	
TWO PLACE	±0.05	CUSTOMER NAME	
THREE PLACE	±0.005	GRDA	
ANGULARITY	±0.5°	CUST. REF. NO.	
TASK	BY	DATE	17909
DRAWN	P. SANTANA	06/18/10	SIZE
CHECKED	R. VRTIS	06/25/10	DRAWING NO.
ENGR	-	-	<b>B 091894M-OD-01</b>
SCALE: NTS		REF: -	REV
			<b>0</b>
			SHT. 1 OF 1

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY			
AFTON SWITCHING STATION S294			
AFTON, OKLAHOMA			
161/69KV			
TRANSFORMER #2 OUTLINE			
SCALE: N.T.S.	DRAWN BY: JT	ENGR: BA	APPD: BA
		CH: BA	DATE: 22FEB12
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No.	REV.
		S294PX02	0



GENERAL ELECTRIC 3911C364

APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS
✓	✓	✓

TITLE: OUTLINE (INSTALLATION)  
 FIRST MADE FOR: CA/EA/EOA-T-60-30002/1/50.00(OUT)  
 65°-46/1000 GR/192356-670004R/132838-1320

1. 4V. WASHING (3) CAT. 11861, -1500-12
2. 3/8" WASHING (3) CAT. 7852, -1500-12 STUD.
3. 1/2" WASHING (3) CAT. 18654, -1125-12 STUD.
4. 1/2" WASHING (3) CAT. 7852, -1500-12 STUD.
5. 1/2" WASHING (3) CAT. 7852, -1500-12 STUD.
6. USE - 5/8" D. FLANGE (6X24)
7. USE - 5/8" D. FLANGE (6X24)
8. LUBRICANT
9. F.
10. CONTAINER HOUSING
11. CONTAINER TERMINAL BOX (SEPARABLE DRILL PLATE)
12. LUBRICANT TANK
13. FAN WITH FAN
14. 3/8" DIA. (ASA DRILLING)
15. 3/8" DIA. (13" FROM FLOOR - 5X3 PAD)
16. LIQUID TEMPERATURE INDICATOR
17. INDICATOR THERMAL RELAY
18. FLANGE FOR USER'S BUS DUCT
19. FLEXIBLE CONNECTOR (SEE DETAIL)

APPROXIMATE WEIGHTS

UNTANKING	65000
TANK & FITTINGS	62000
GIL	93000
<b>TOTAL</b>	<b>220000</b>

PO-L150139  
 DL-3967X325AA REQ. REF. 70604

REVISIONS	PRINTS TO
1	350
2	350H

NOTES:  
 ALL DIMENSIONS SHOWN WITHOUT A TOLERANCE ARE FIRM DIMENSIONS.  
 DRAWING INTENDED TO SHOW ONLY DIMENSIONS AND OTHER INFORMATION  
 REQUIRED FOR INSTALLATION. DIMENSIONS, ACCESSORIES, AND OTHER  
 FEATURES NOT SHOWN TO BE SHOWN ON THE FINAL TRANSFORMER  
 SPECIFICATIONS.

GRPS - B.11 Center 68 X-GR 2/10/12 AFTON

ISSUED FOR BID

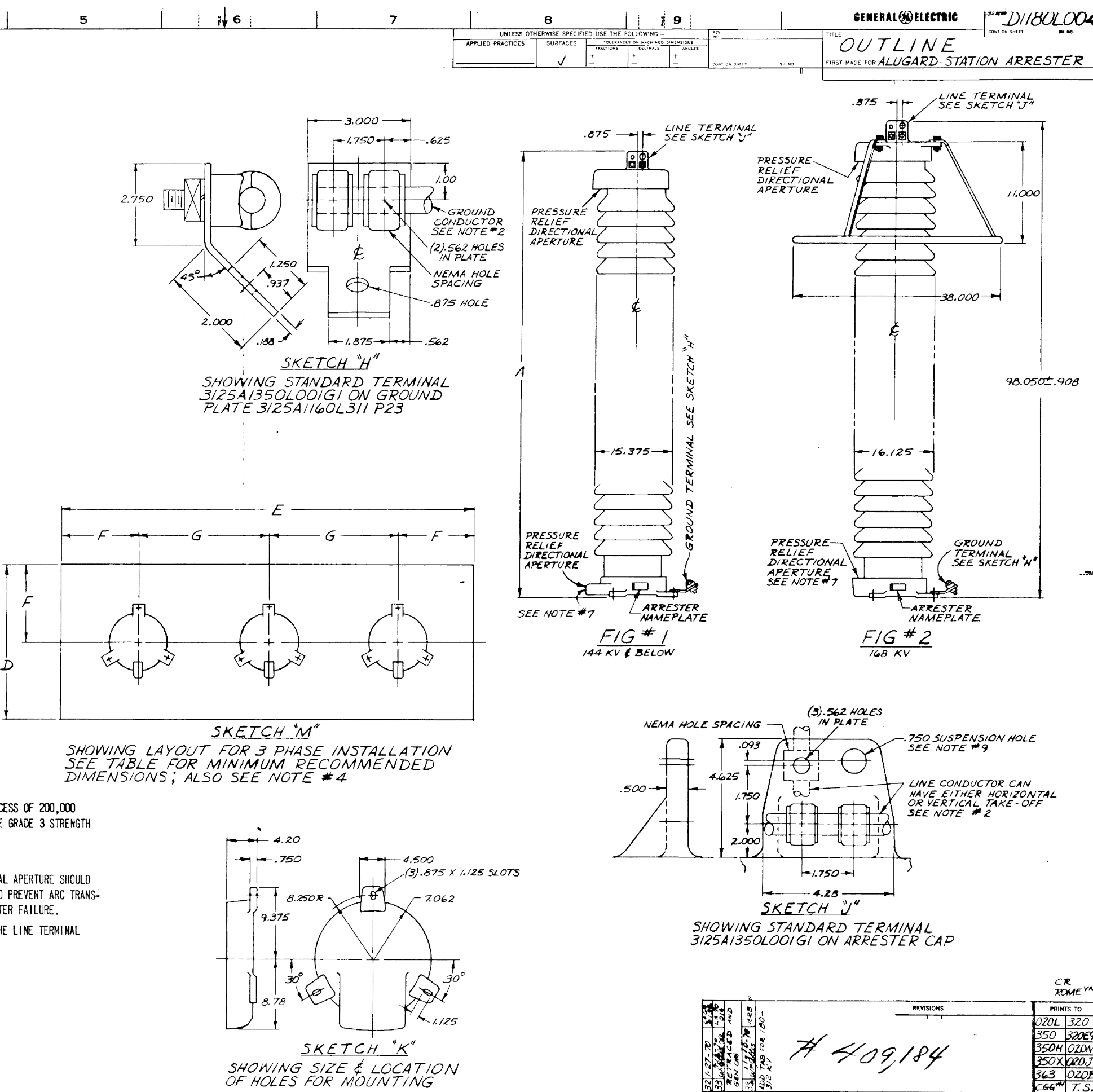
GRAND RIVER DAM AUTHORITY  
 AFTON SWITCHING STATION S294  
 AFTON, OKLAHOMA  
 161/69KV

TRANSFORMER #1  
 OUTLINE (INSTALLATION)

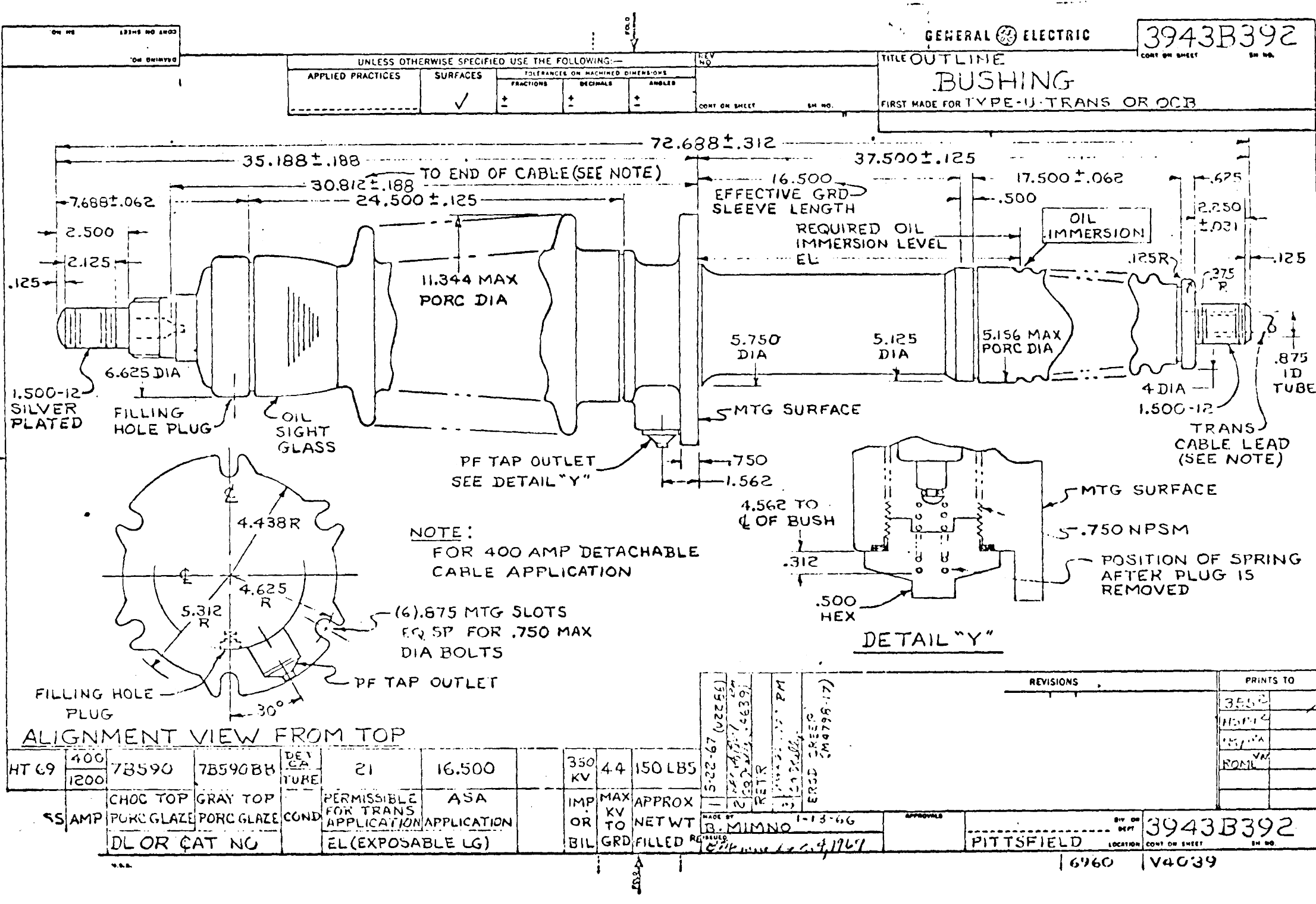
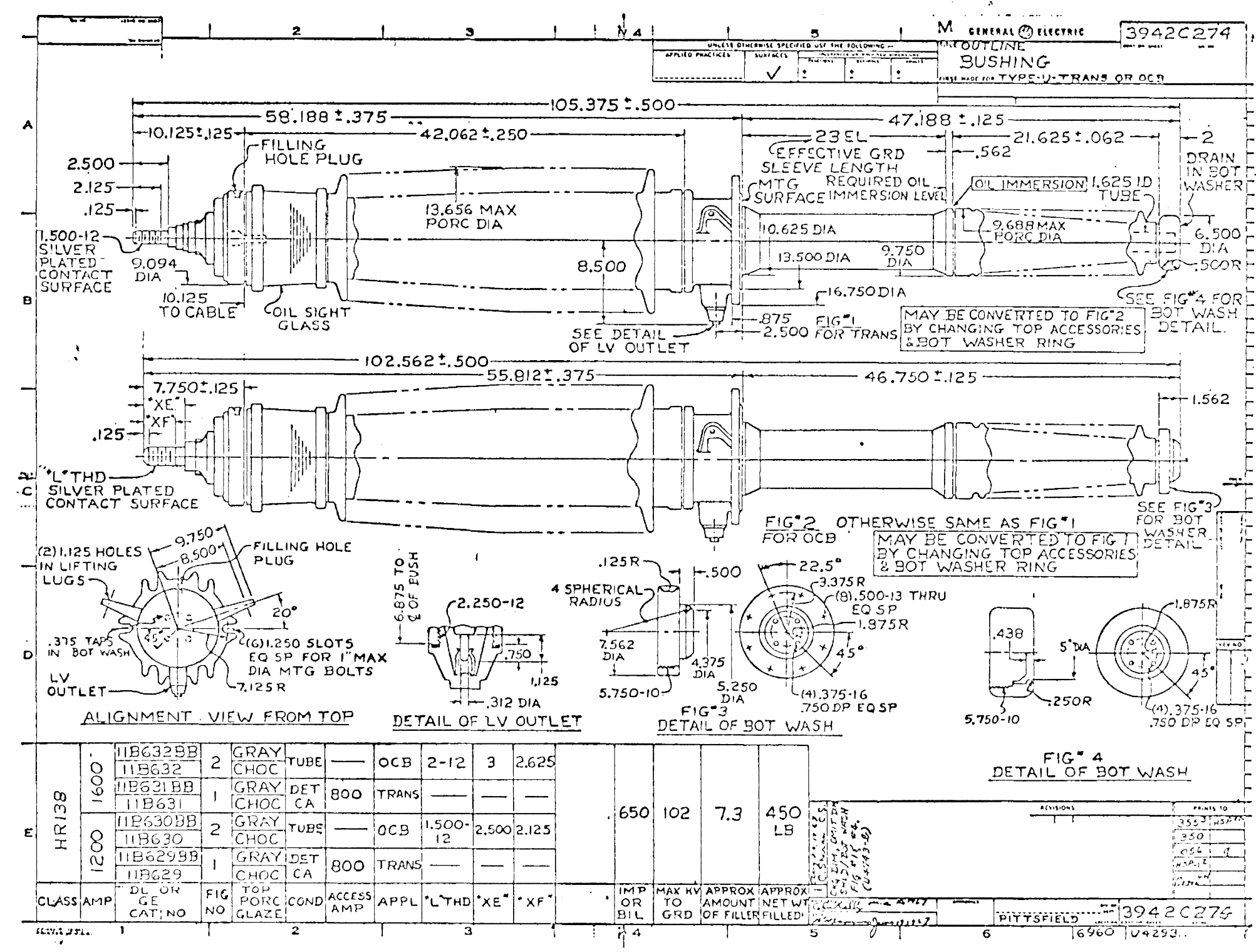
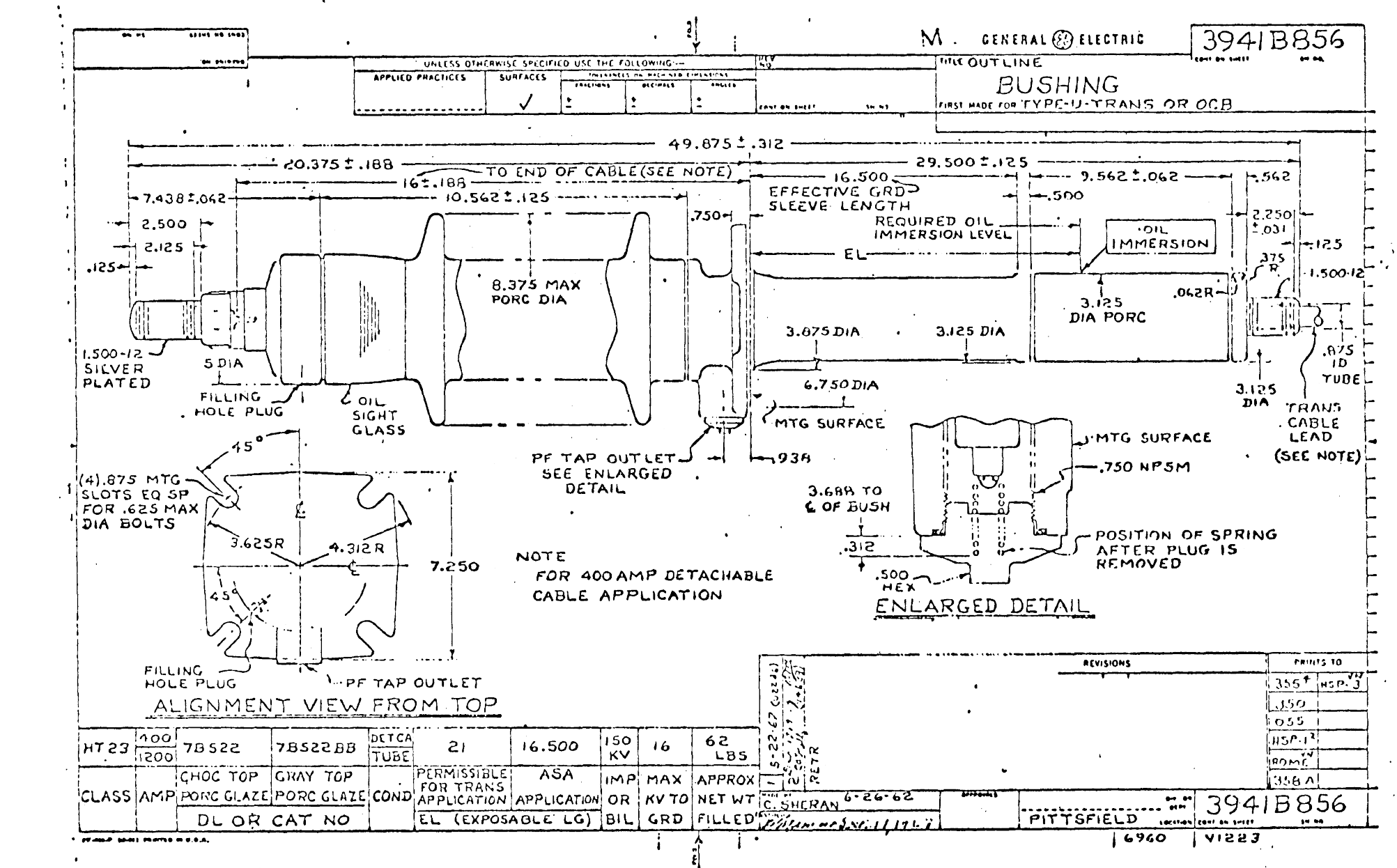
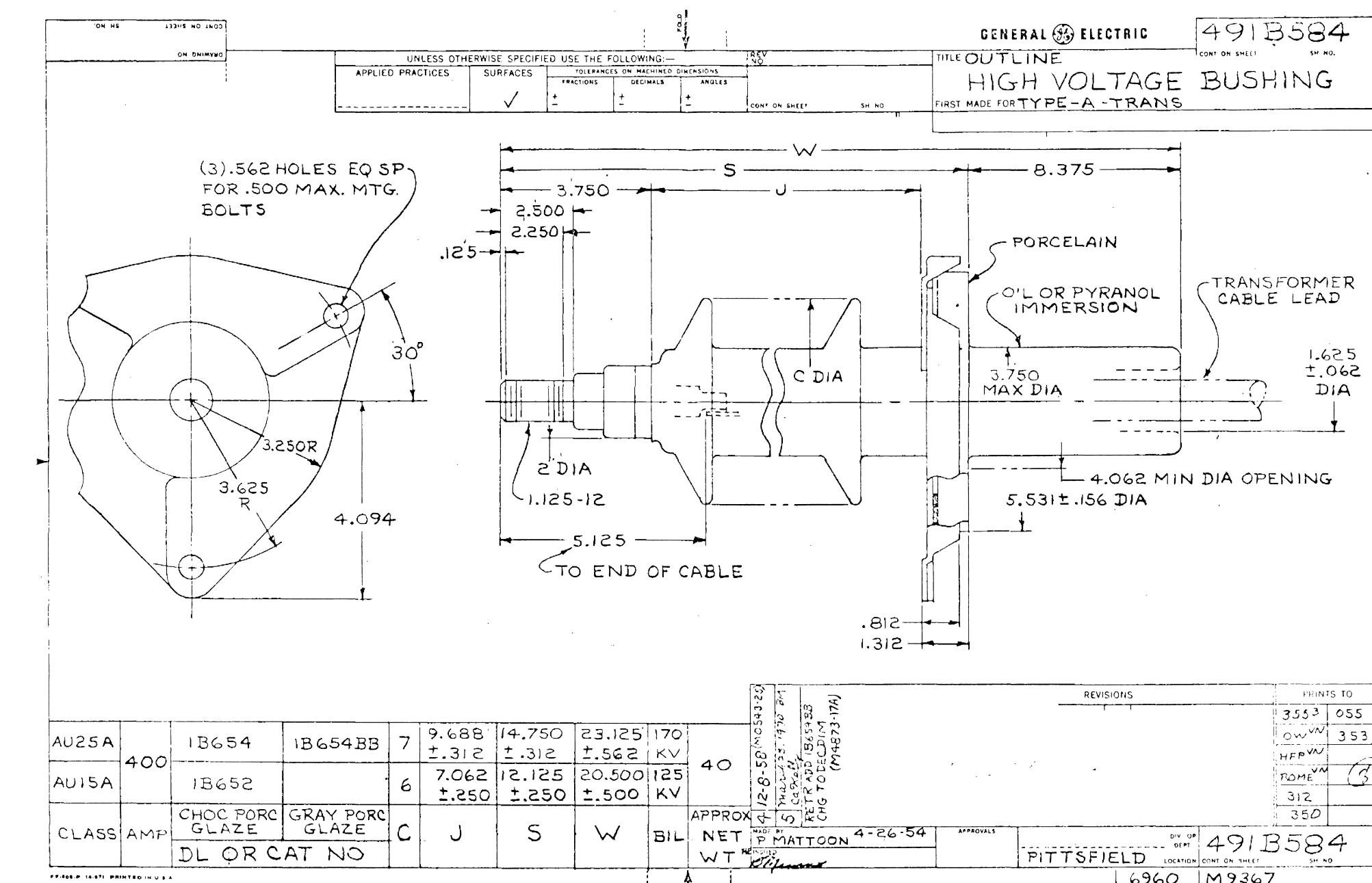
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		CH: BA	DATE: 12MAR12
		DRAWING No.	REV.
		S294PX03	0



ARRESTER MODEL NO.	KV RATING	FIG NO.	OVERALL HEIGHT	NET WT IN LBS.	MINIMUM CLEARANCE	TOTAL CLEARANCE	3 PHASE INSTALLATION PLAN
100	10	1	43.51 ± .36	400	24.00	67.51 ± .36	100
100	15	1	43.51 ± .36	425	29.00	72.51 ± .36	100
100	20	1	54.21 ± .46	475	31.00	85.21 ± .46	100
100	25	1	54.21 ± .46	480	33.00	87.21 ± .46	100
100	30	1	54.21 ± .46	485	34.00	89.21 ± .46	100
100	35	1	54.21 ± .46	490	37.00	91.21 ± .46	100
100	40	1	64.51 ± .57	560	41.00	105.51 ± .57	100
100	45	1	64.51 ± .57	575	46.00	110.51 ± .57	100
100	50	1	75.31 ± .68	640	51.00	126.31 ± .68	100
100	55	1	75.31 ± .68	650	55.00	131.31 ± .68	100
100	60	2	98.05 ± .90	850	64.00	162.05 ± .90	100
100	65	2	98.05 ± .90	870	71.00	169.05 ± .90	100
100	70	2	136.71 ± 1.29	1150	86.00	222.71 ± 1.29	100
100	75	2	136.71 ± 1.29	1200	92.00	228.71 ± 1.29	100
100	80	2	136.71 ± 1.29	1250	101.00	234.71 ± 1.29	100
100	85	2	136.71 ± 1.29	1300	104.00	237.71 ± 1.29	100
100	90	2	136.71 ± 1.29	1350	109.00	242.71 ± 1.29	100
100	95	2	154.11 ± 1.46	1500	113.00	267.11 ± 1.46	100
100	100	2	154.11 ± 1.46	1550	116.00	270.11 ± 1.46	100
100	105	2	154.11 ± 1.46	1600	121.00	275.11 ± 1.46	100
100	110	2	154.11 ± 1.46	1650	124.00	278.11 ± 1.46	100



- NOTES:
1. THESE ARRESTERS ARE FOR 0 TO 10,000 FT. ALTITUDES. FOR SPECIAL ARRESTERS INVOLVING HIGH ALTITUDES, OTHER COMBINATIONS OF HARDWARE, ETC., REFER TO THE NEAREST S. E. REPRESENTATIVE OFFICE.
  2. STROK ARRESTERS INCLUDE LINE TERMINAL, GROUND PLATE, BOLTS, ETC., SPRING RINGS (WHEN REQUIRED) AND TWO CLAMP TYPE TERMINALS. THESE STEEL TERMINALS ARE SALVAGED, HAVE .750 DIAMETER OPENINGS, AND WILL ACCOMMODATE #2 TO #50 NON COPPER OR ALUMINUM CABLE.
  3. IF STANDARD TERMINALS ARE NOT AVAILABLE, SPECIFY "LESS STD TERMINAL 3125A15000101" AND SPECIFY INSTEAD SPECIAL TERMINAL PER FIG #3 OR FIG #4 STATING CONDUCTOR SIZE AND TYPE TO BE ACCOMMODATED. FIG #3 IS SUITABLE FOR EITHER SPRING OR LINE USE AND IS RECOMMENDED. FIG #4 IS SUITABLE FOR LINE USE ONLY. THESE WILL BE FURNISHED WITH THE REQUIRED BOLTS, ETC.
  4. CLEARANCES ARE FOR 2000 FT. ALTITUDE. ADD 3% TO CLEARANCES FOR EACH ADDITIONAL 1000 FT.
  5. CANTILEVER STRENGTH OF ALL UNITS IS AN EXCESS OF 200.00 INCH POUNDS, WHICH REQUIRES THE USE OF SAE GRADE 3 STRENGTH FOUNDATION BOLTS.
  6. ALL DIMENSIONS ARE IN INCHES.
  7. WHEN INSTALLED, PRESSURE RELIEF DIRECTIONAL APERTURE SHOULD BE LOCATED AWAY FROM ADJACENT APPARATUS TO PREVENT ARC TRANSFER OR DAMAGE IN THE REMOTE CASE OF ARRESTER FAILURE.
  8. ARRESTER MAY BE LIFTED AND SUSPENDED BY THE LINE TERMINAL TAB USING THE .750 DIA. SUSPENSION HOLE.



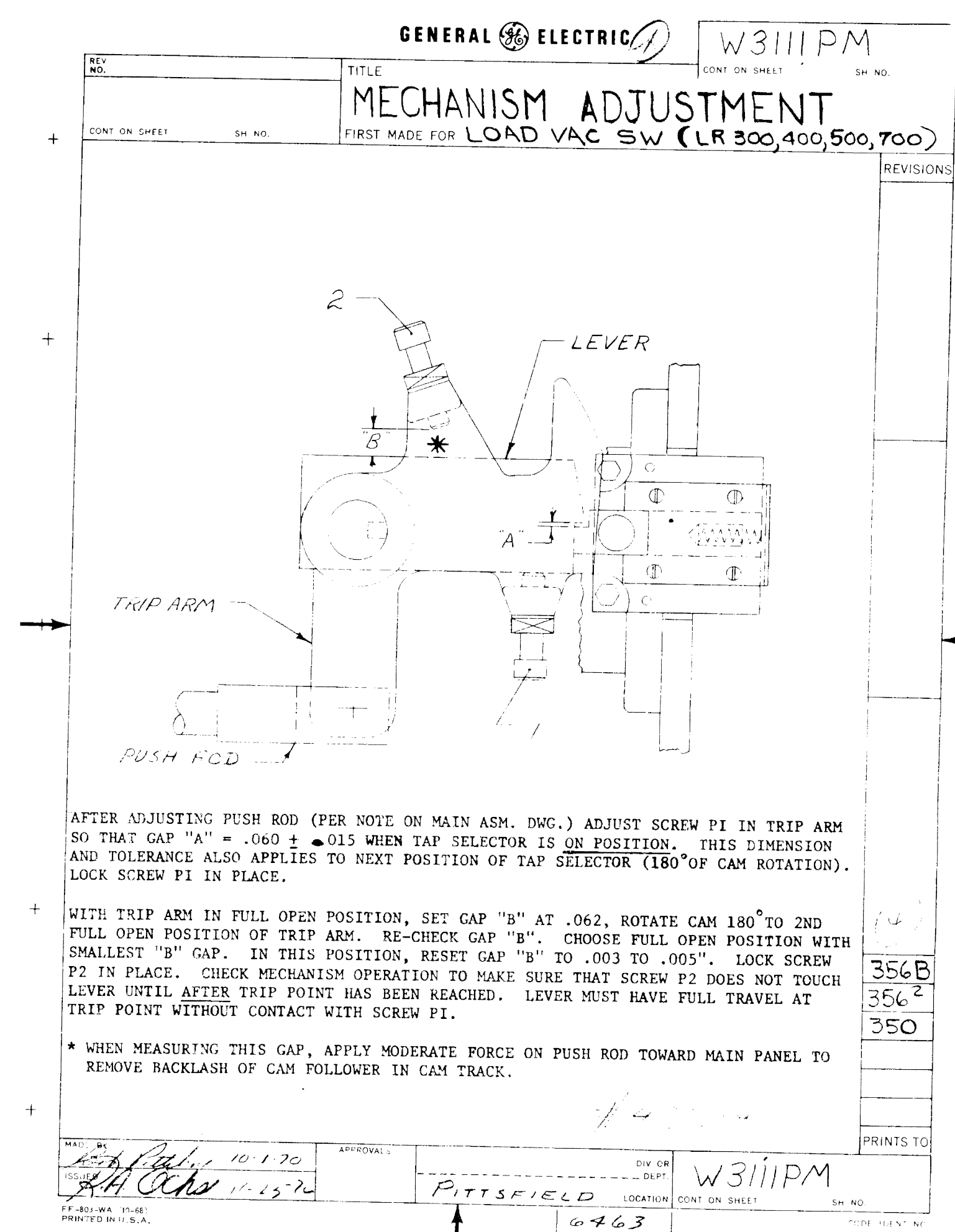
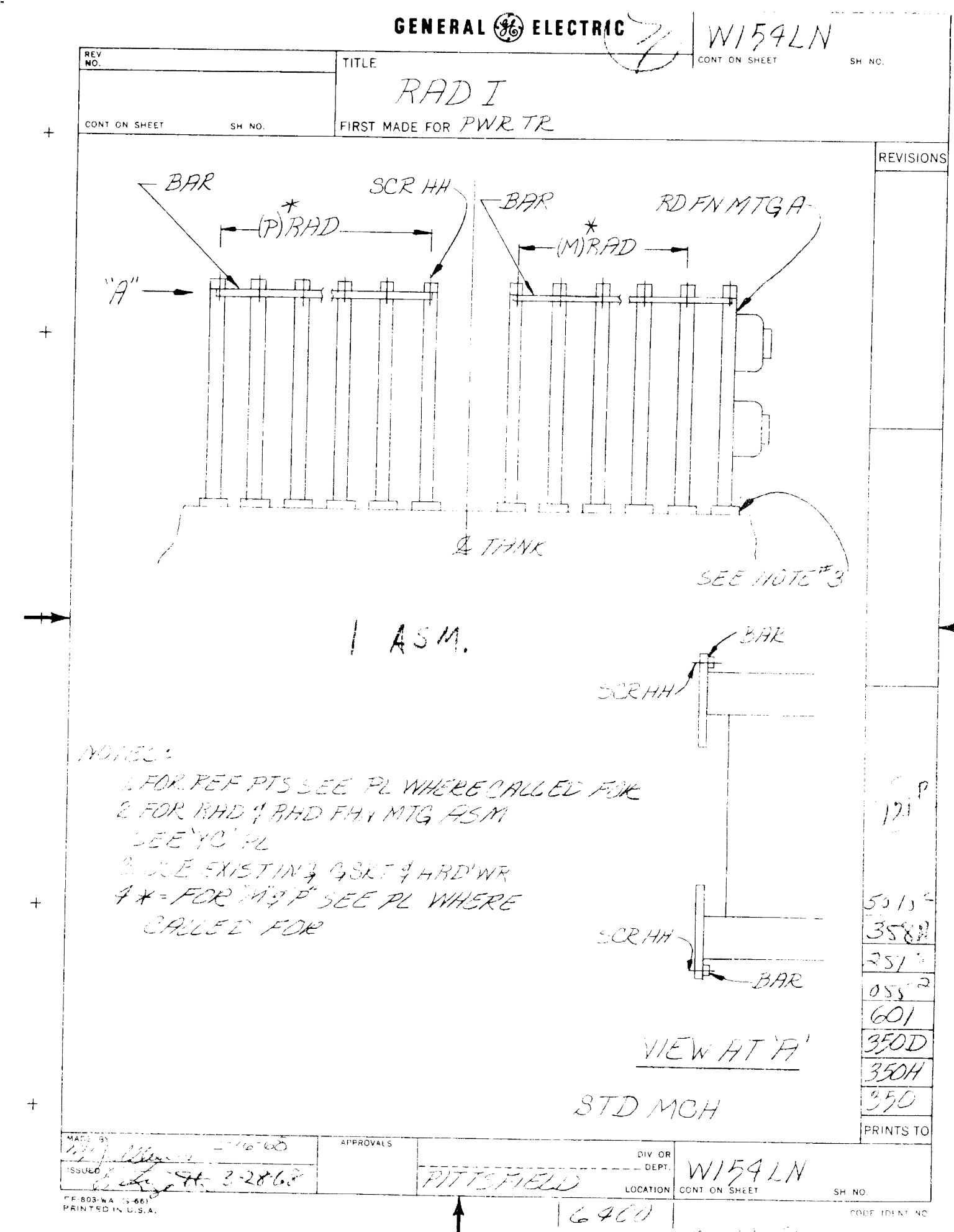
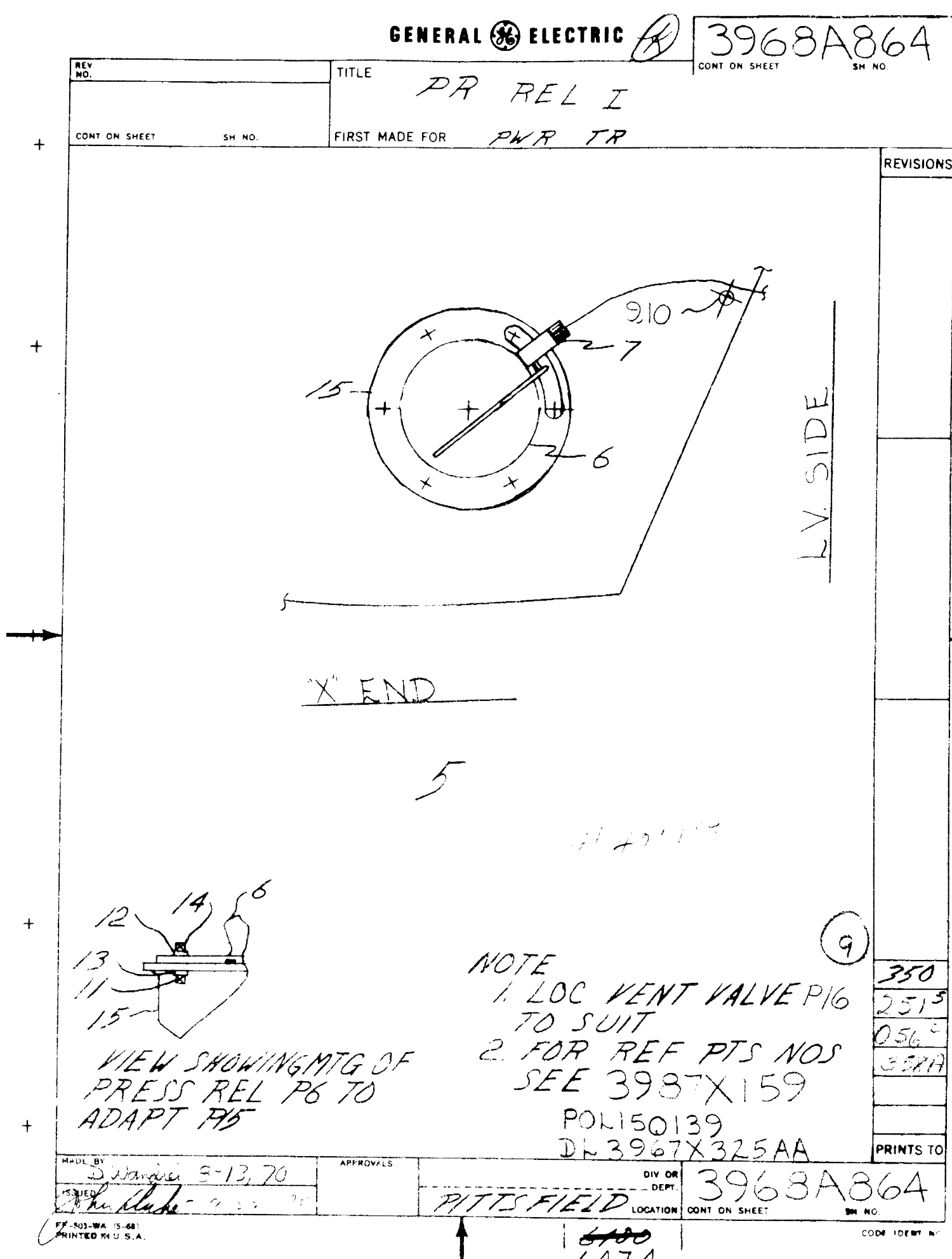
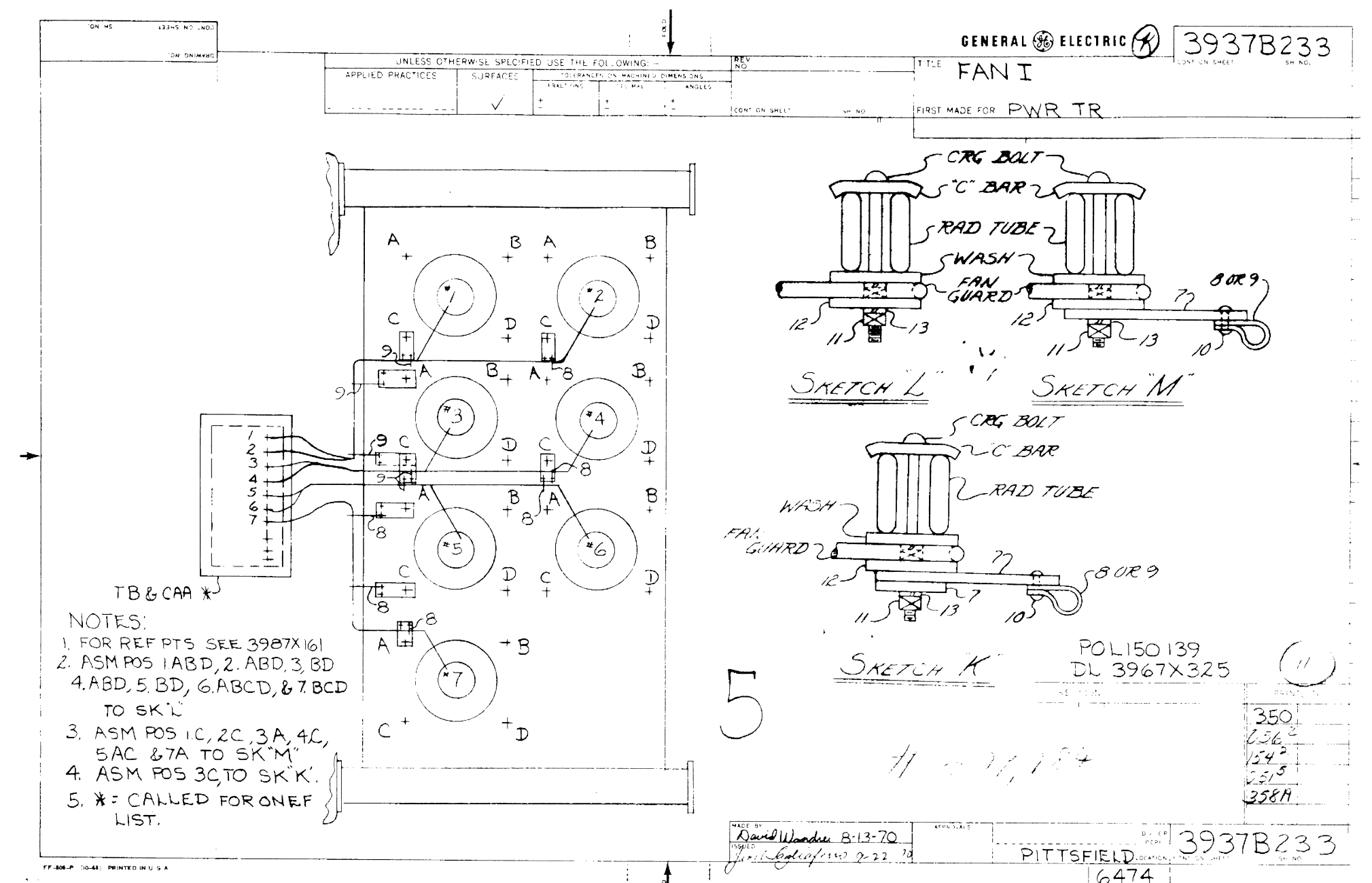
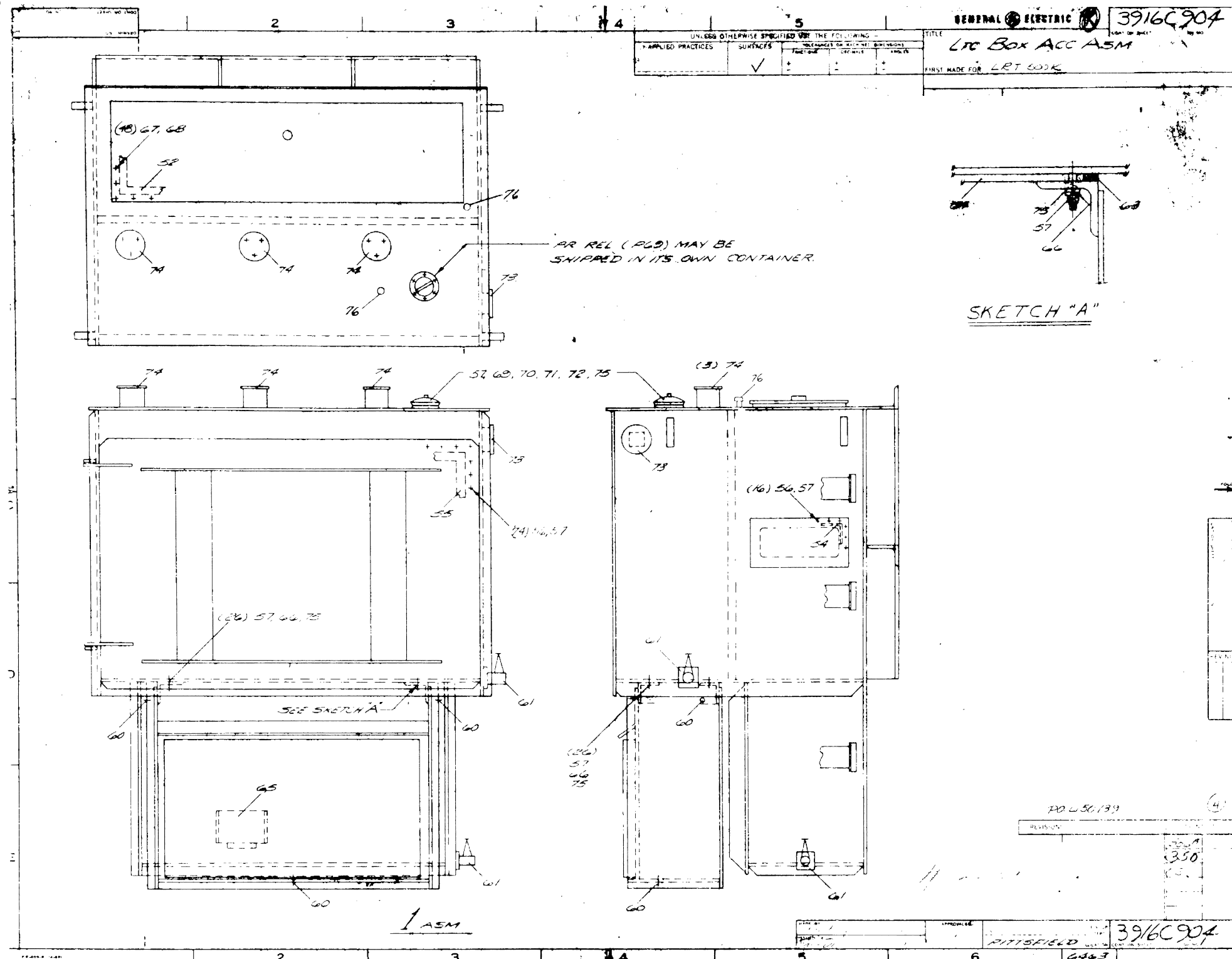
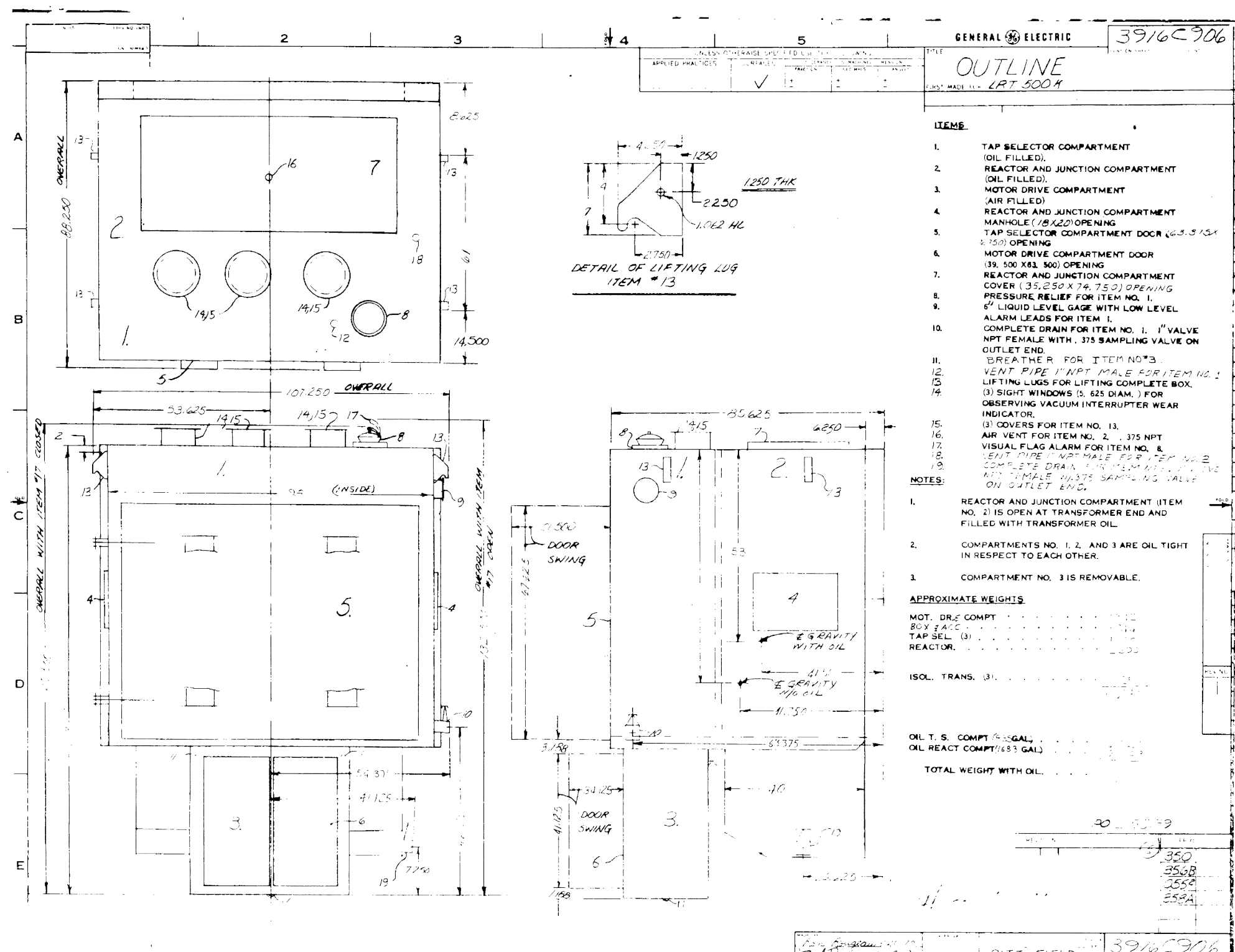
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GRAND RIVER DAM AUTHORITY  
AFTON SWITCHING STATION S294  
AFTON, OKLAHOMA  
161/69KV

TRANSFORMER #1  
BUSHING OUTLINES

SCALE: N.T.S. DRAWN BY: JT ENGR: BA APPD: BA  
CH: BA DATE: 12MAR12  
DRAWING No. S294PX04 REV. 0

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Grand River Dam Authority  
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VINITA, OK 74301

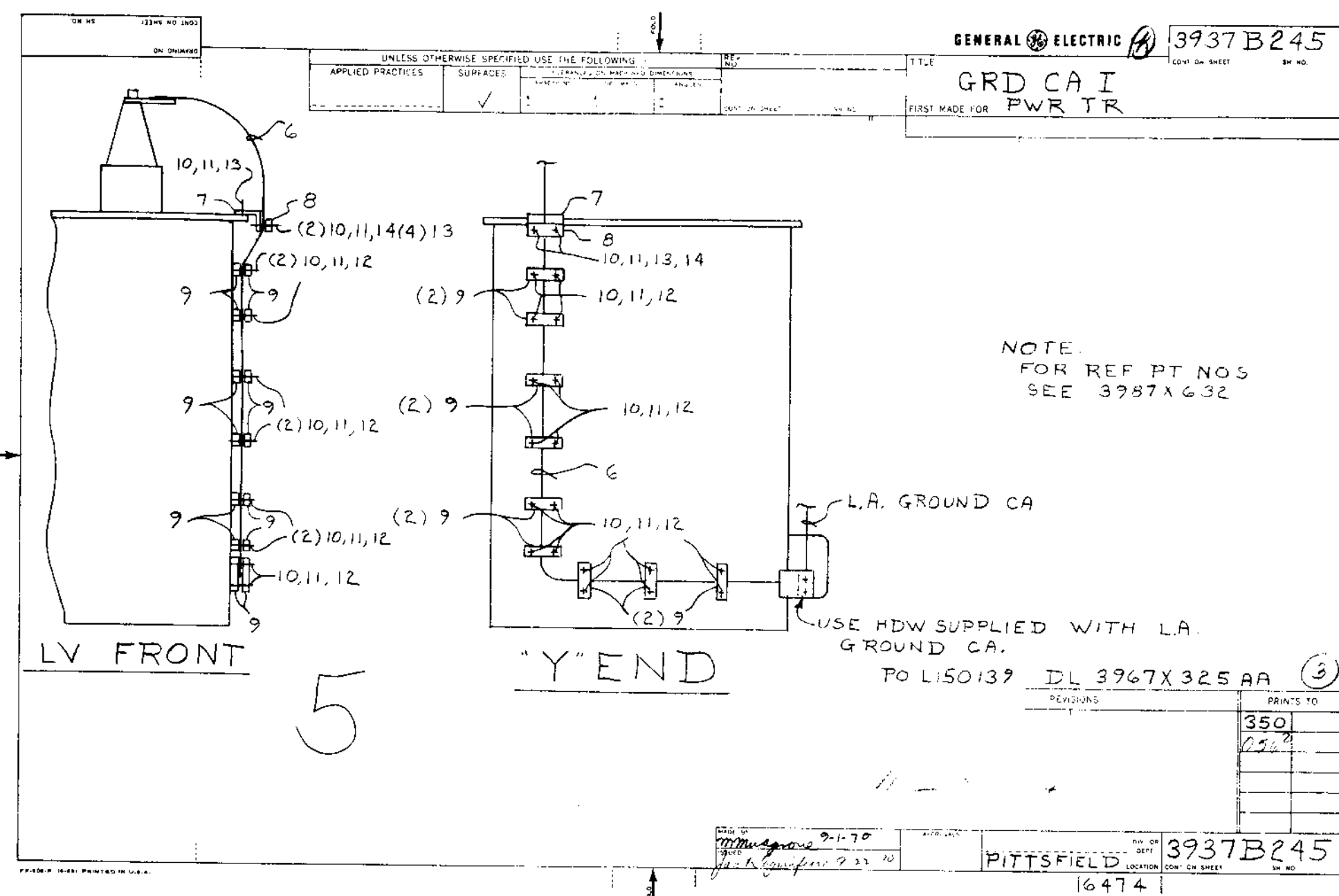
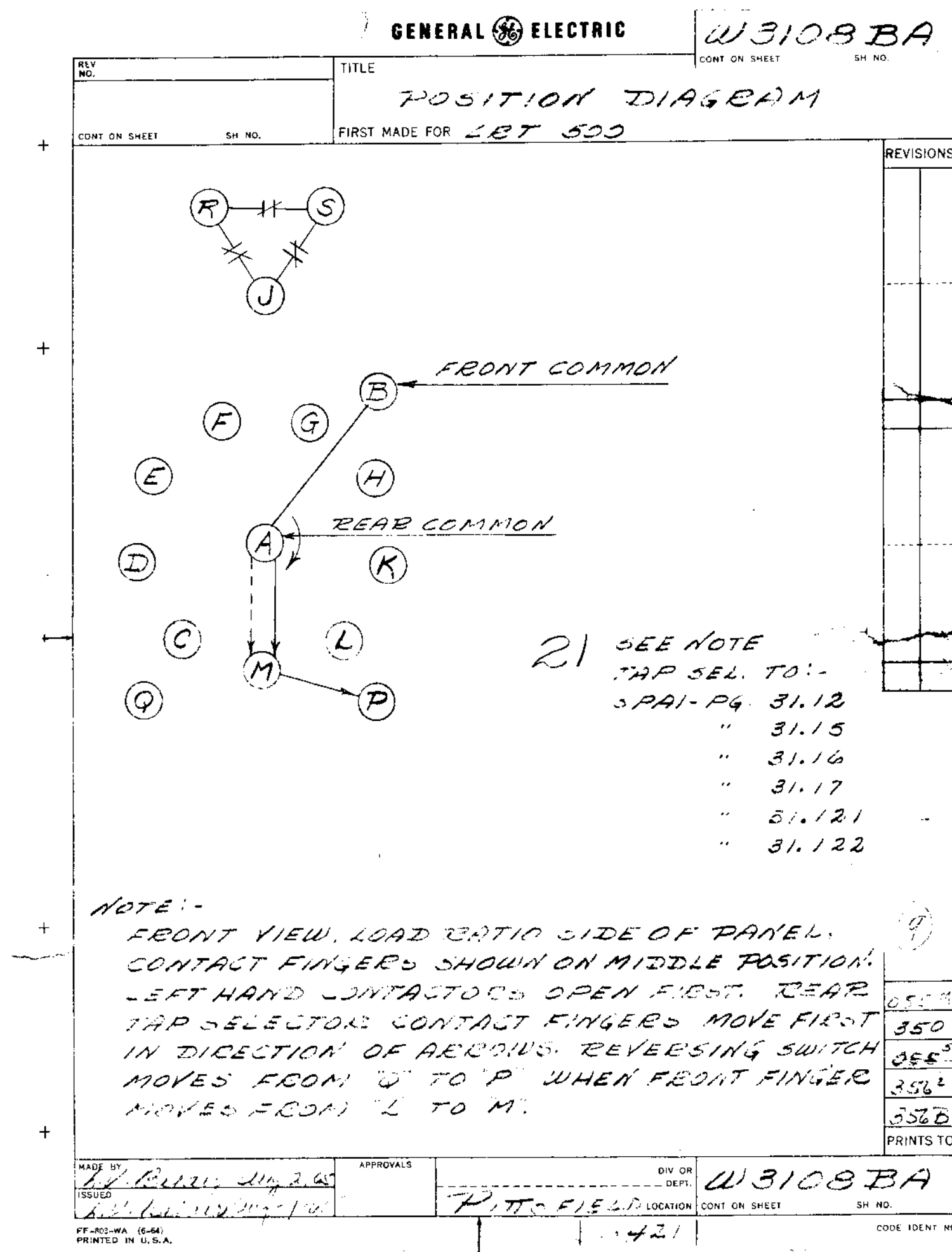
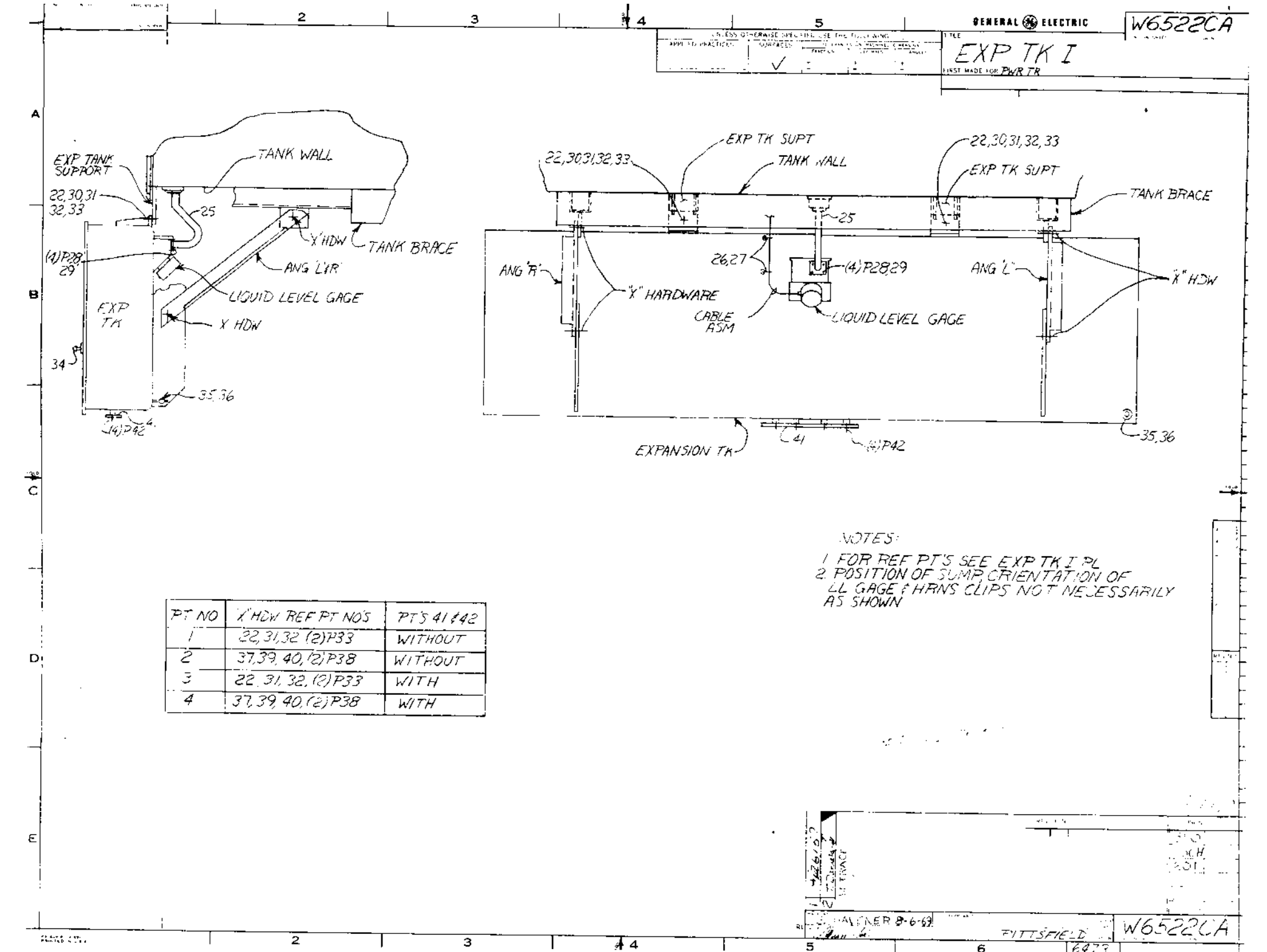
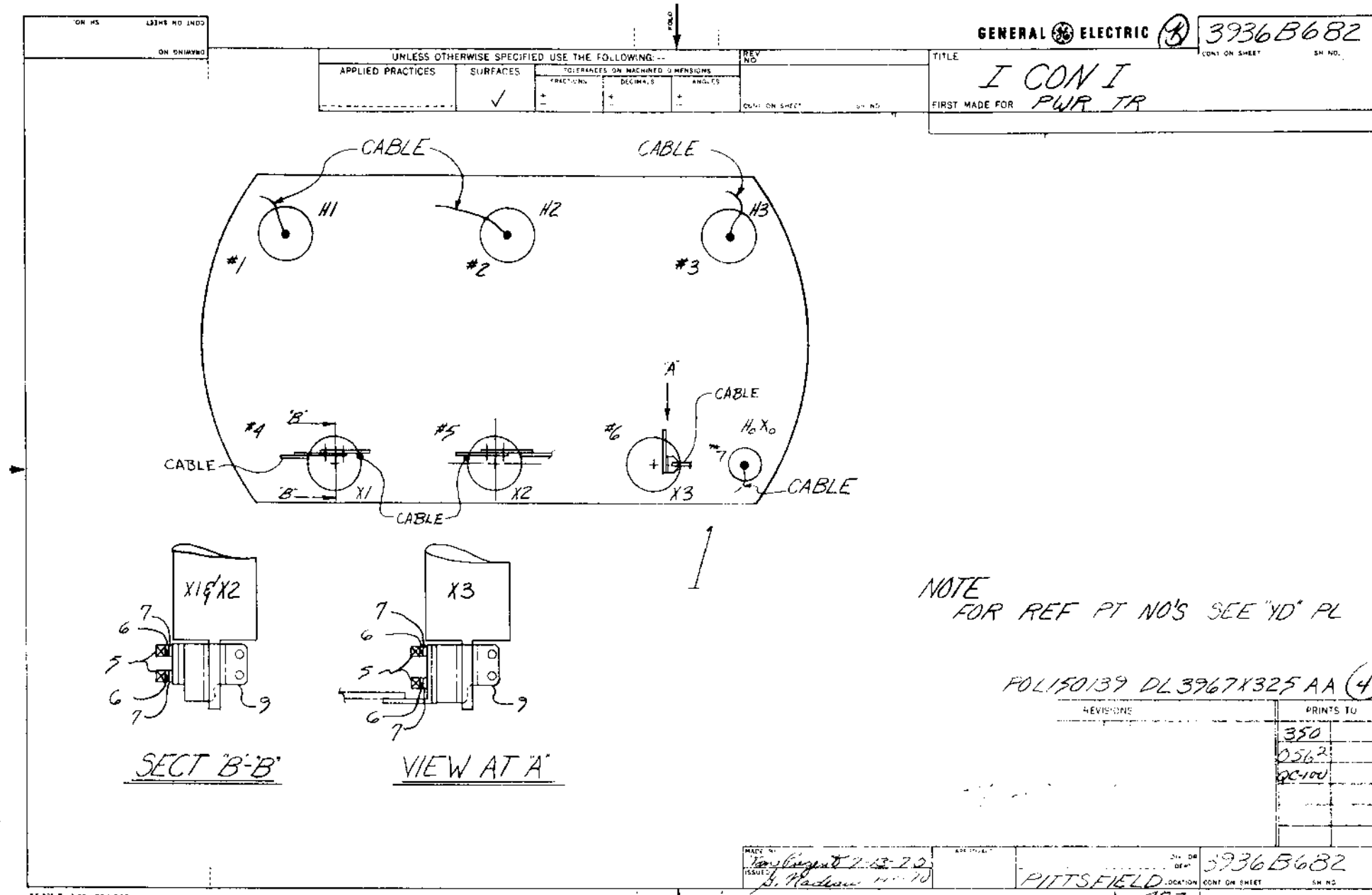
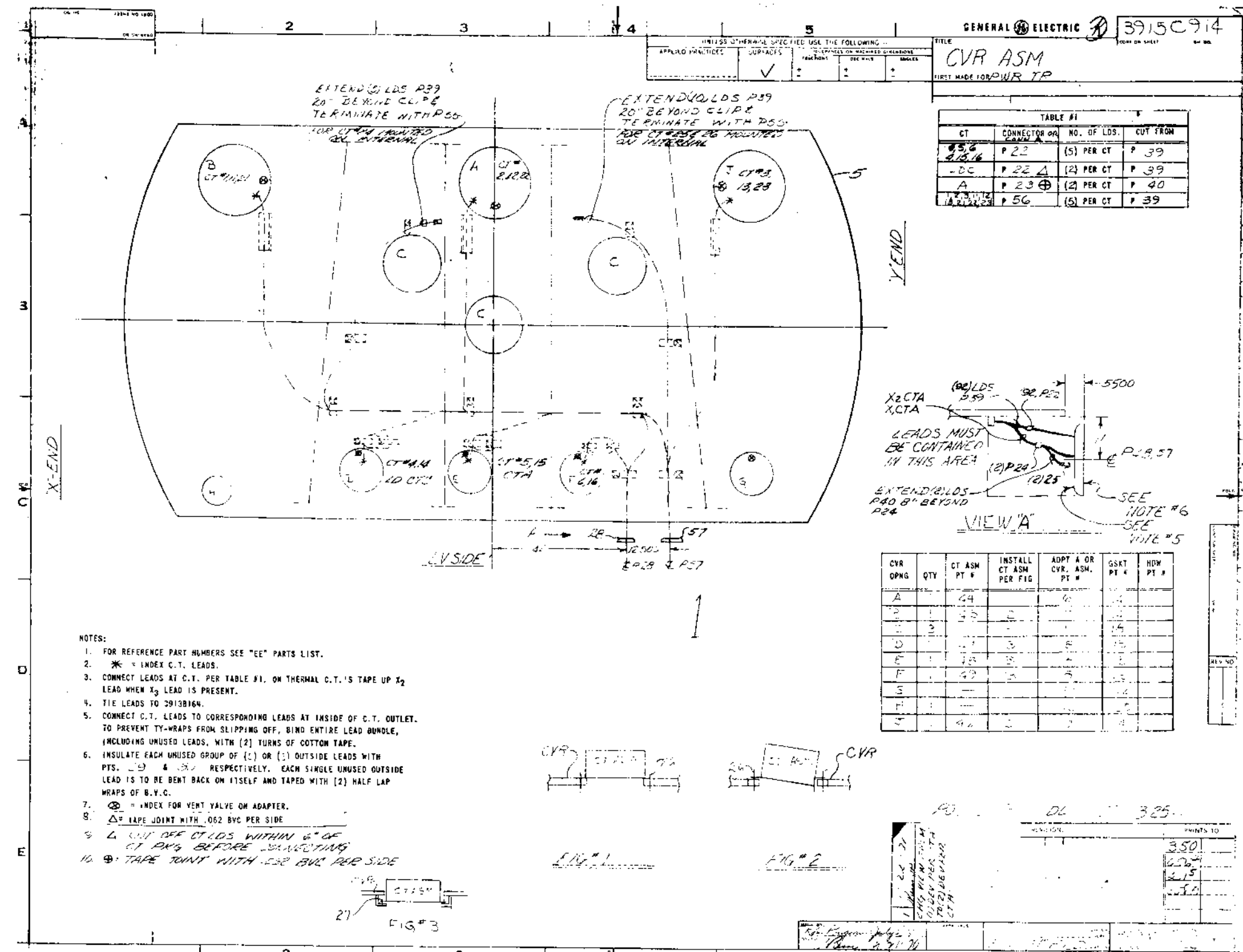


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GRAND RIVER DAM AUTHORITY  
 AFTON SWITCHING STATION S294  
 AFTON, OKLAHOMA  
 161/69KV

TRANSFORMER #1  
 MISCELLANEOUS DETAILS

SCALE: N.T.S. DRAWN BY: JT ENGR: BA APPD: BA  
 CH: BA DATE: 13MAR12  
 DRAWING No. S294PX05 REV. 0  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301



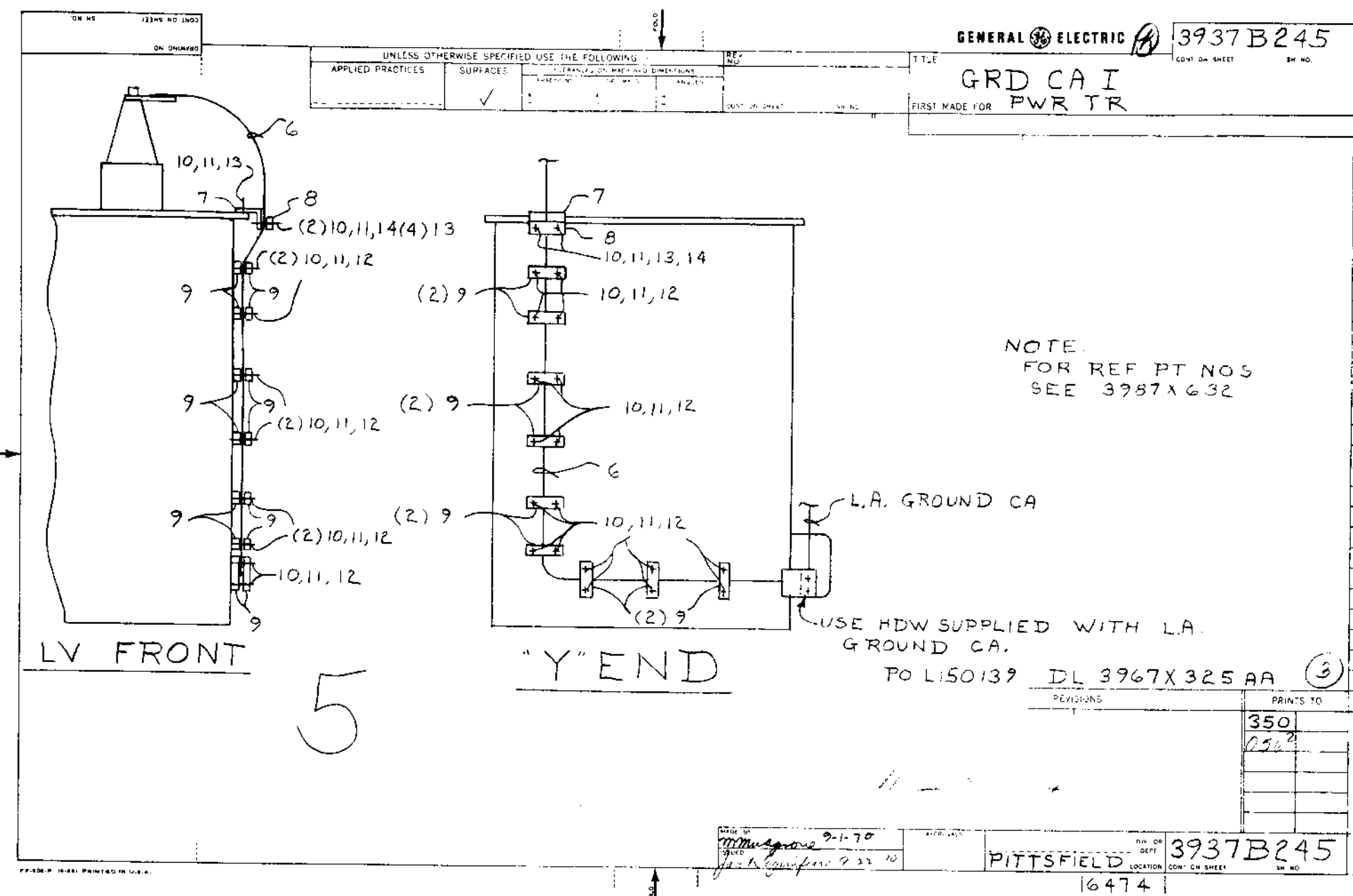
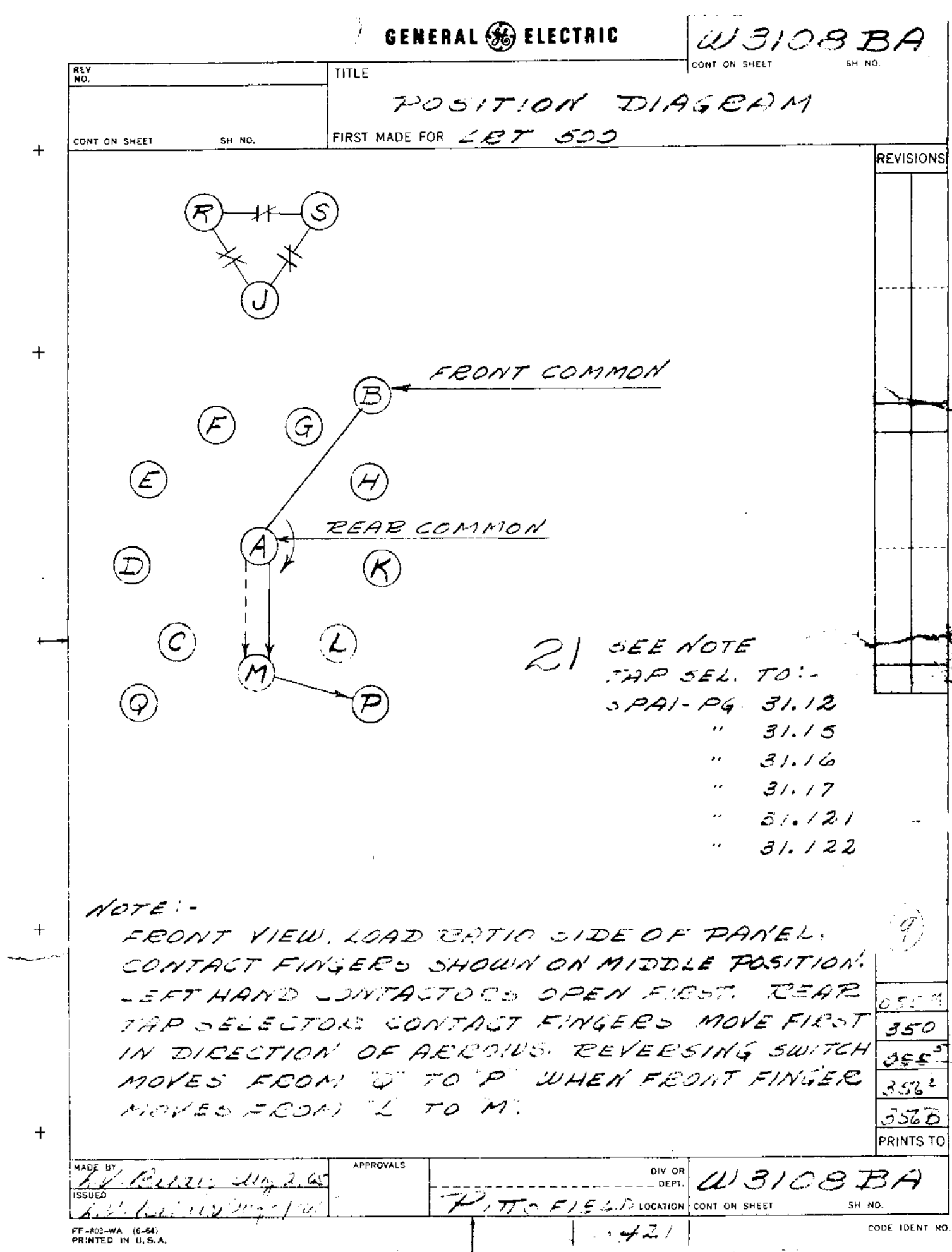
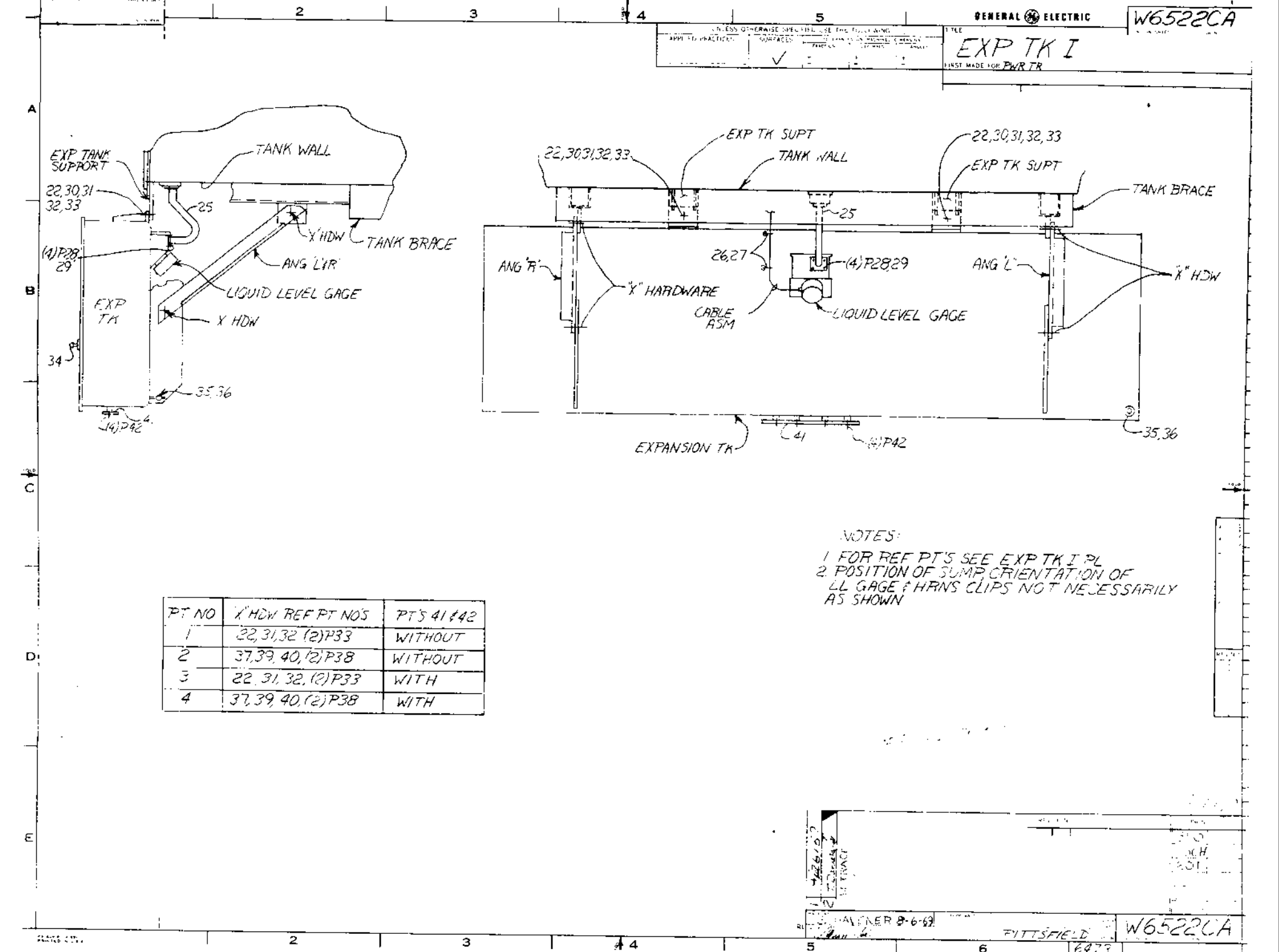
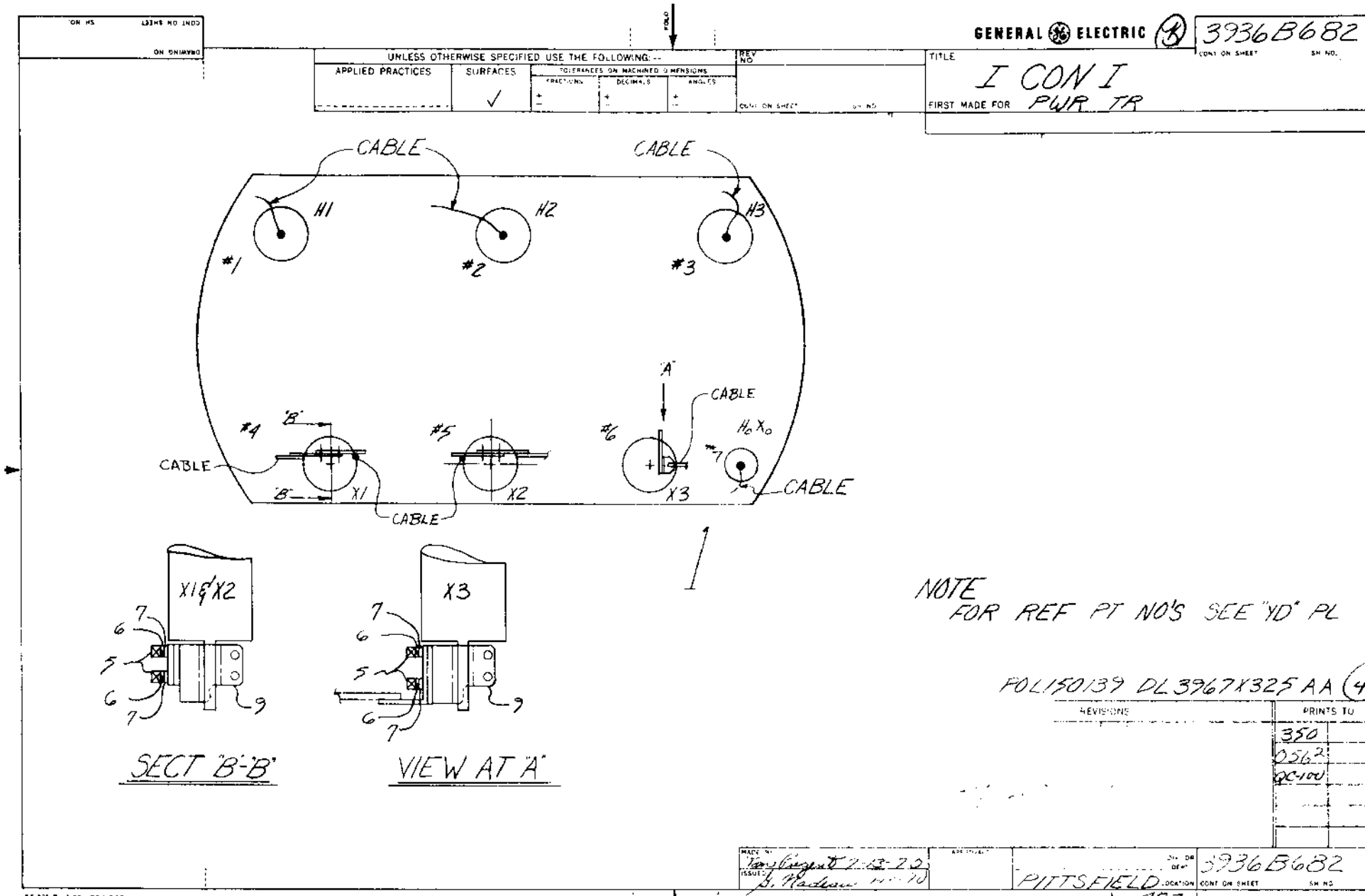
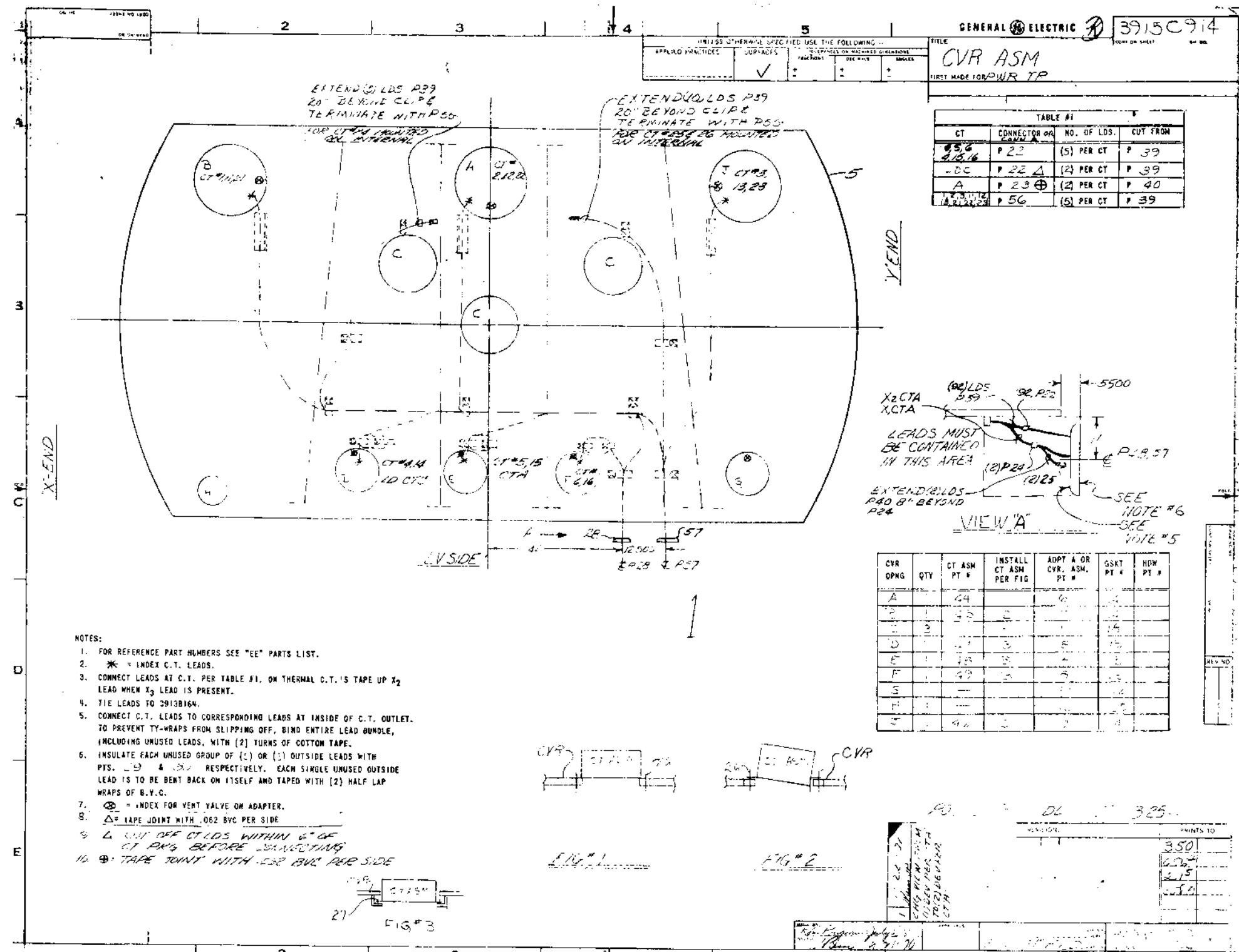
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**GRAND RIVER DAM AUTHORITY**  
**AFTON SWITCHING STATION S294**  
 AFTON, OKLAHOMA  
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**TRANSFORMER #1**

SCALE: N.T.S. DRAWN BY: JT ENGR: BA APPD: BA  
 CH: BA DATE: 13MAY12  
**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 488  
 WETA, OK 74991

DRAWING No. S294PX06 REV. 0

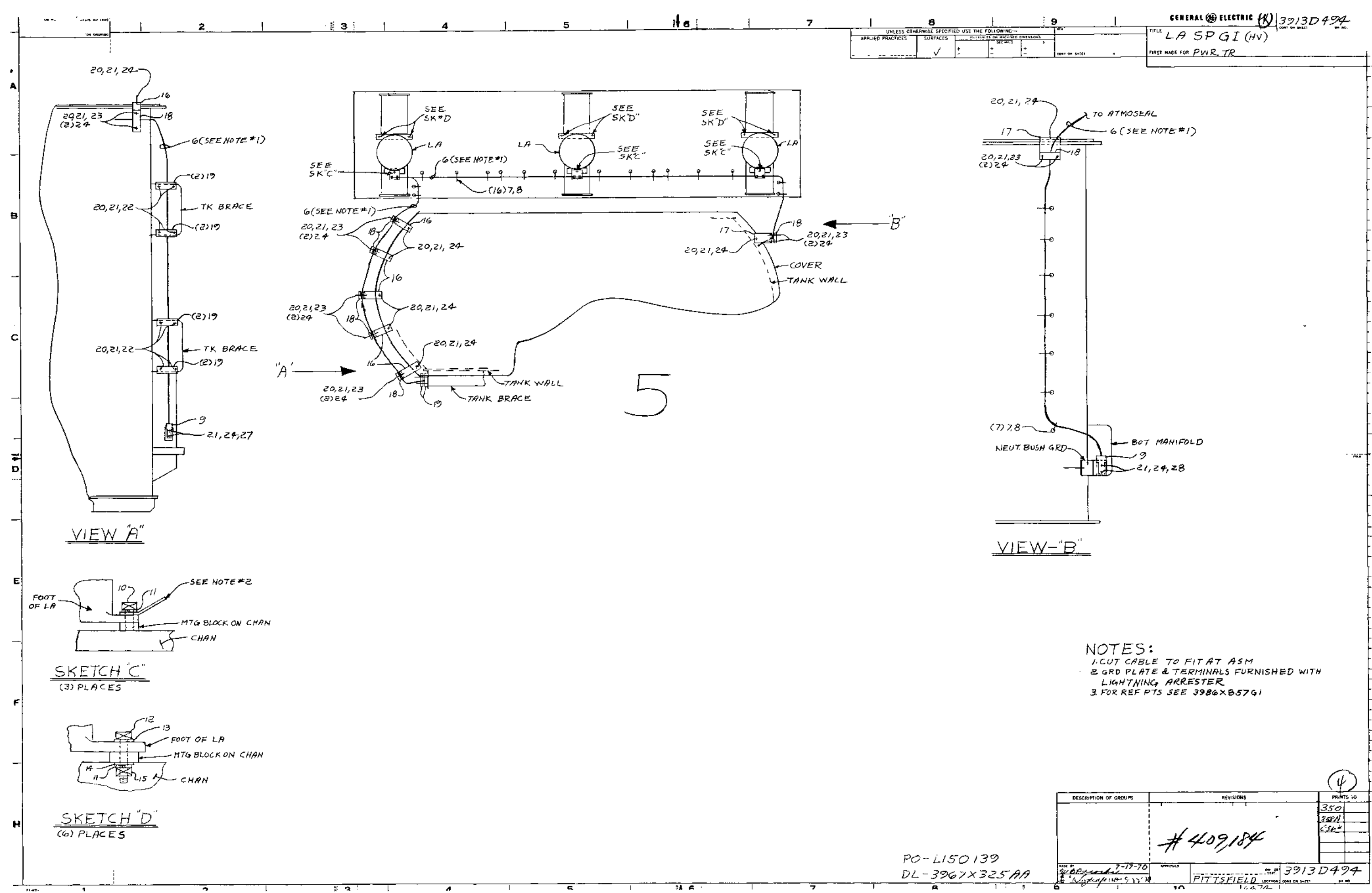
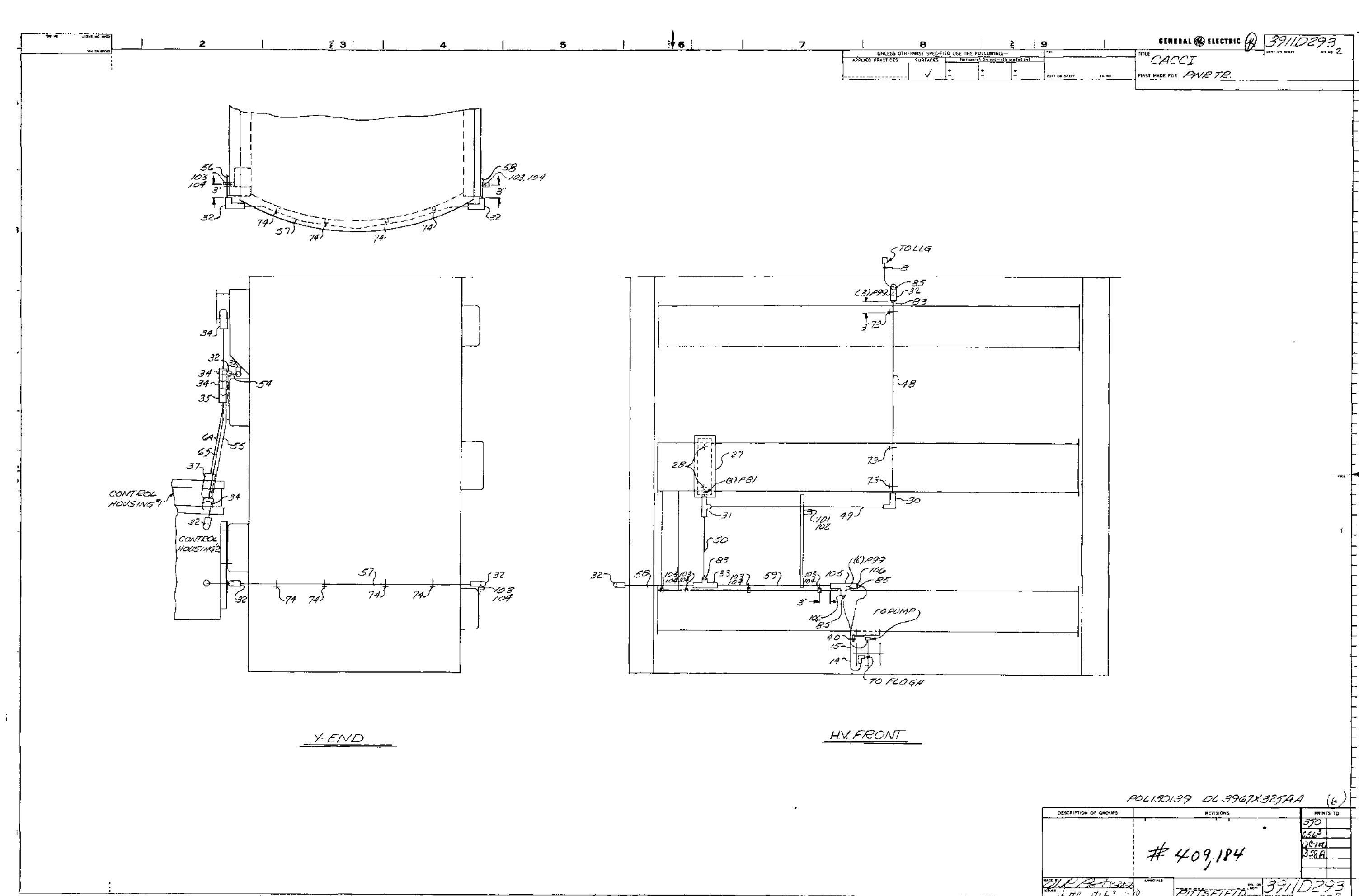
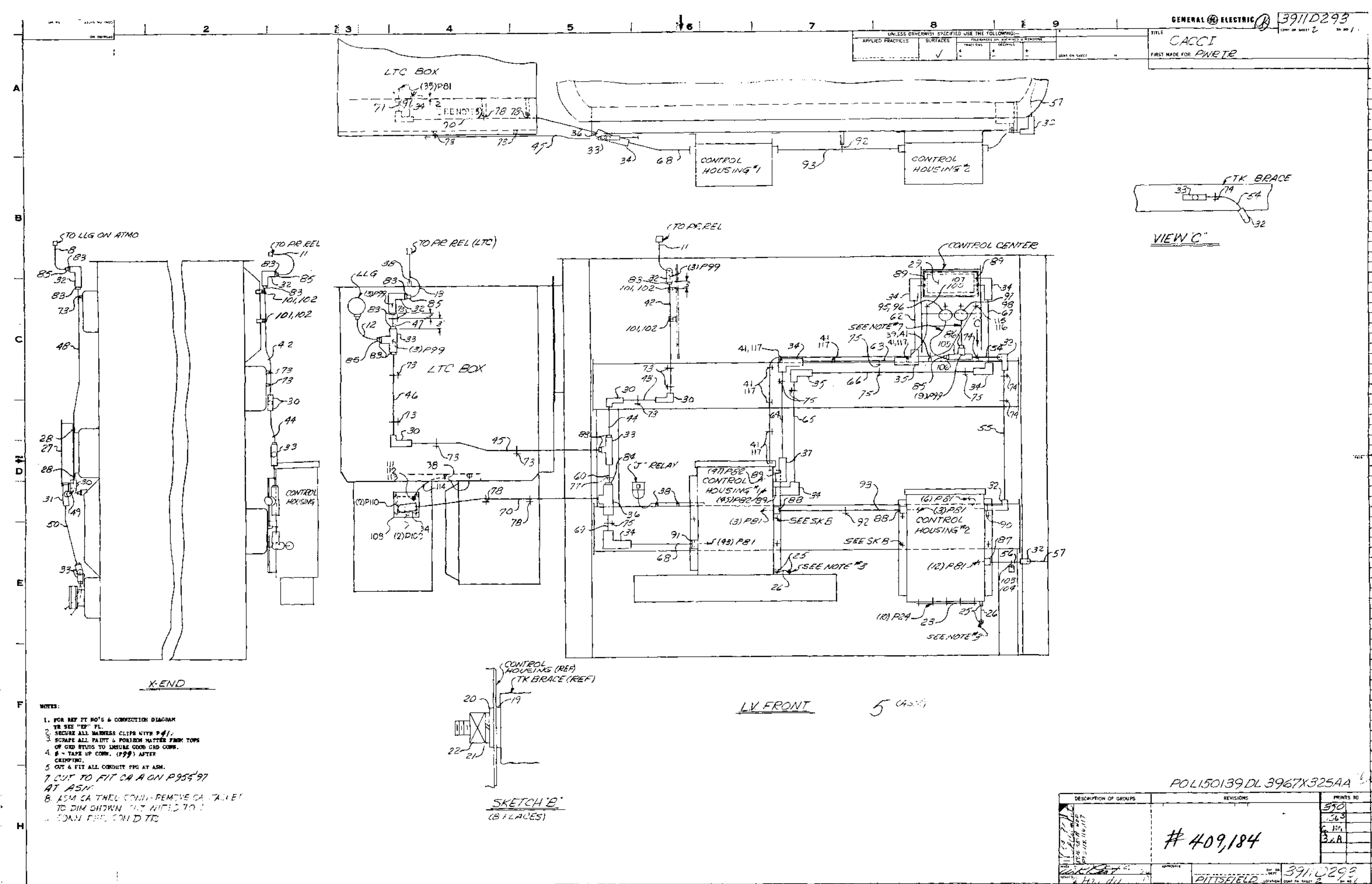


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AFTON SWITCHING STATION S294  
AFTON, OKLAHOMA  
161/69KV  
TRANSFORMER #1

SCALE: N.T.S.	DRAWN BY: JT	ENGR: BA	APPD: BA
CH: BA	DATE: 13MAR12	DRAWING No. S294PX06	REV: 0

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GRAND RIVER DAM AUTHORITY  
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VINITA, OK 74301

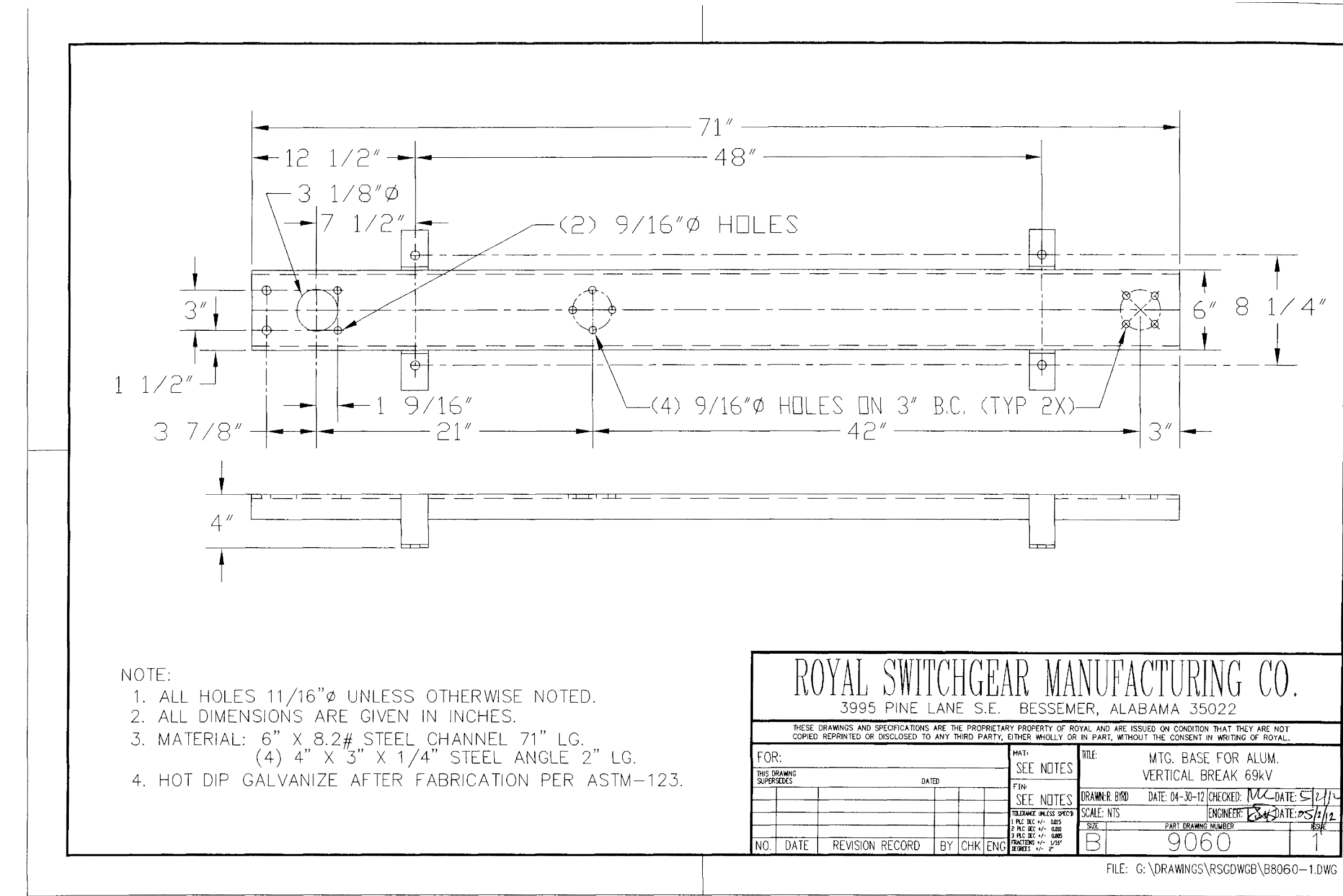
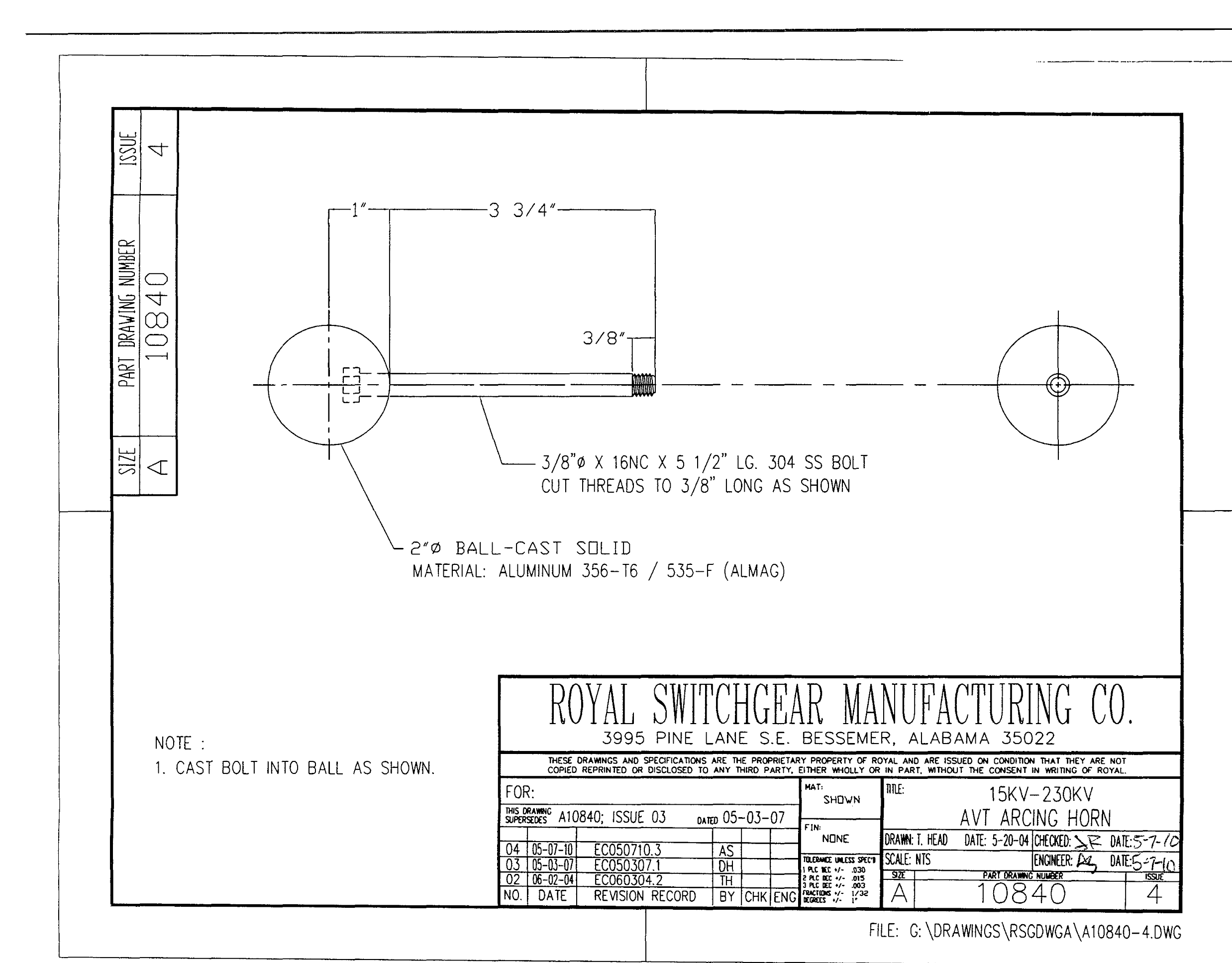
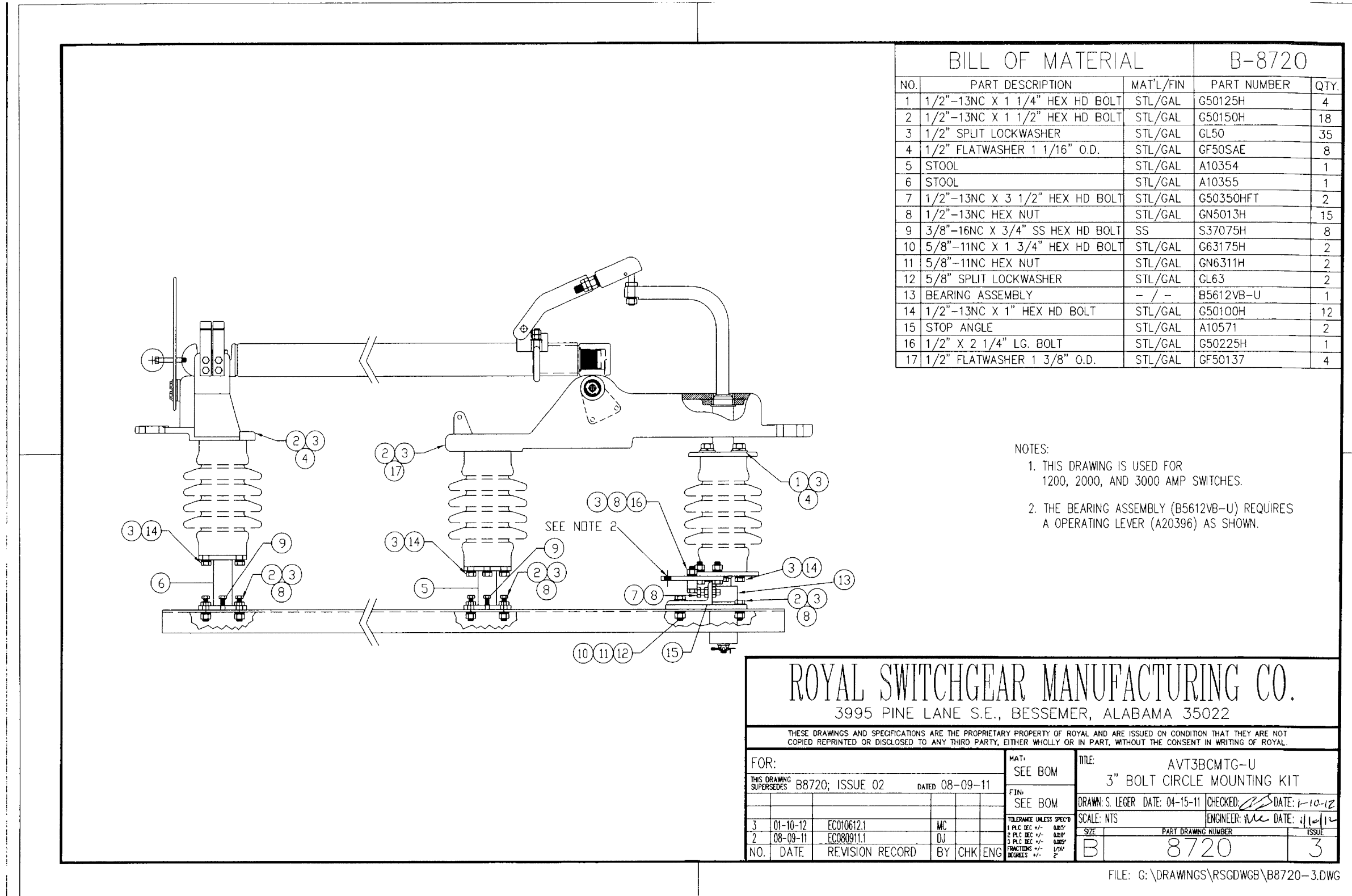
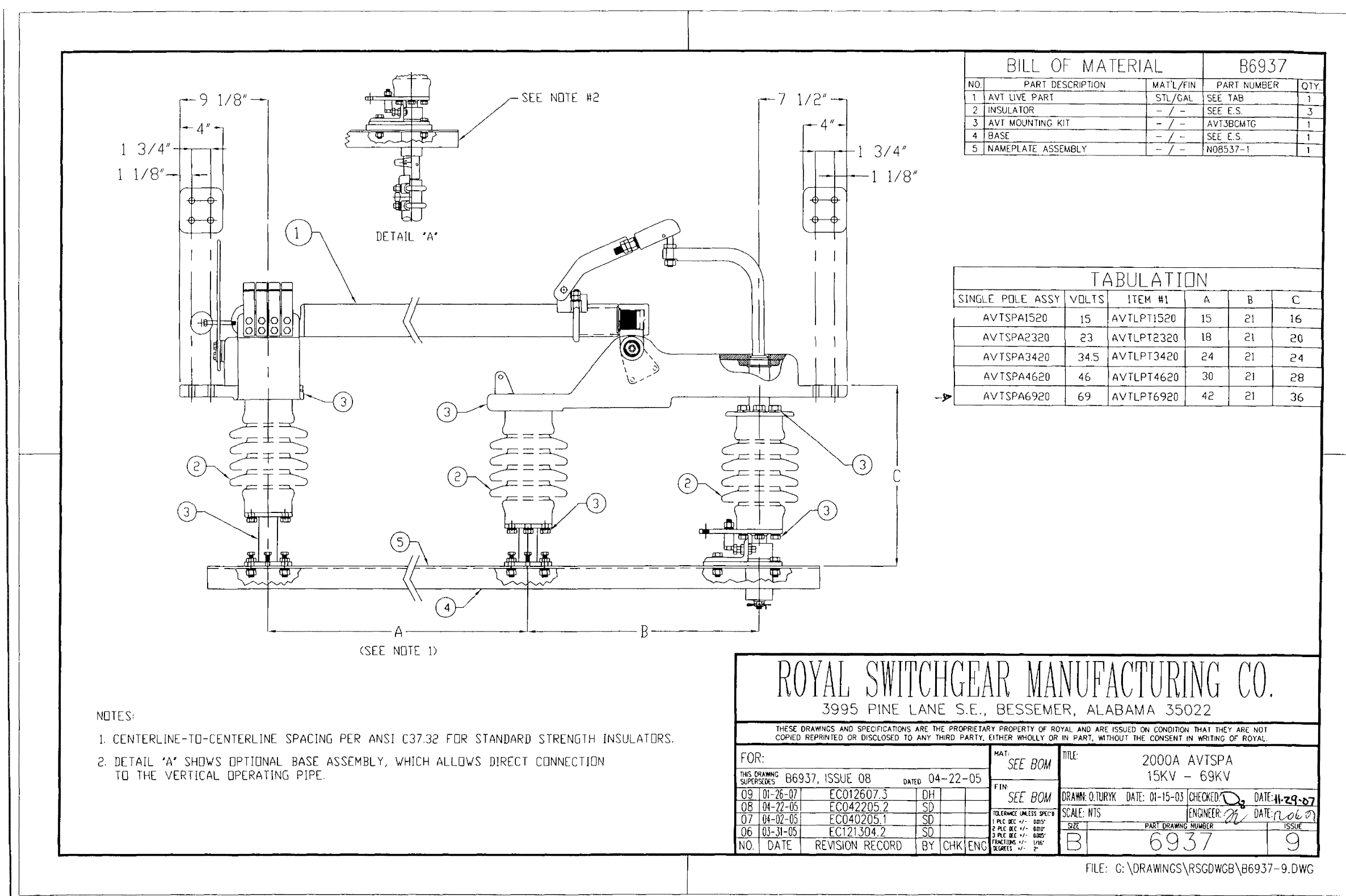


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GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV  
TRANSFORMER #1

SCALE: N.T.S.	DRAWN BY: JT	ENGR: BA	APPD: BA
		CH: BA	DATE: 13MAR12
		DRAWING No. S294PX07	REV. 0

Grand River Dam Authority  
P.O. BOX 409  
VINITA, OK 74301



**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON, OKLAHOMA S294  
 161/69KV  
 69KV SWITCH  
 MANUFACTURERS DRAWINGS

SCALE: N.T.S. DRAWN BY: AS ENGR: BA APPD: BA  
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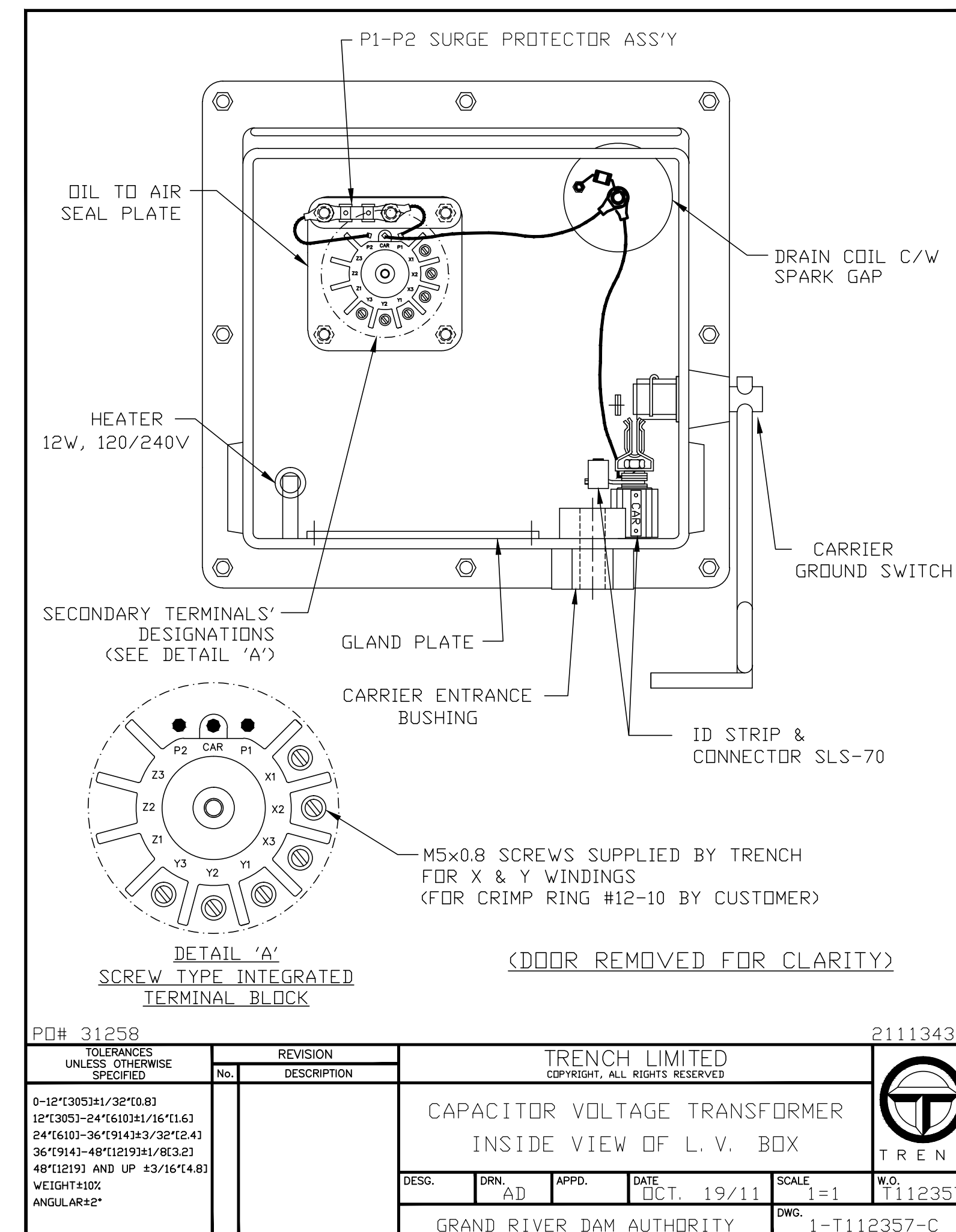
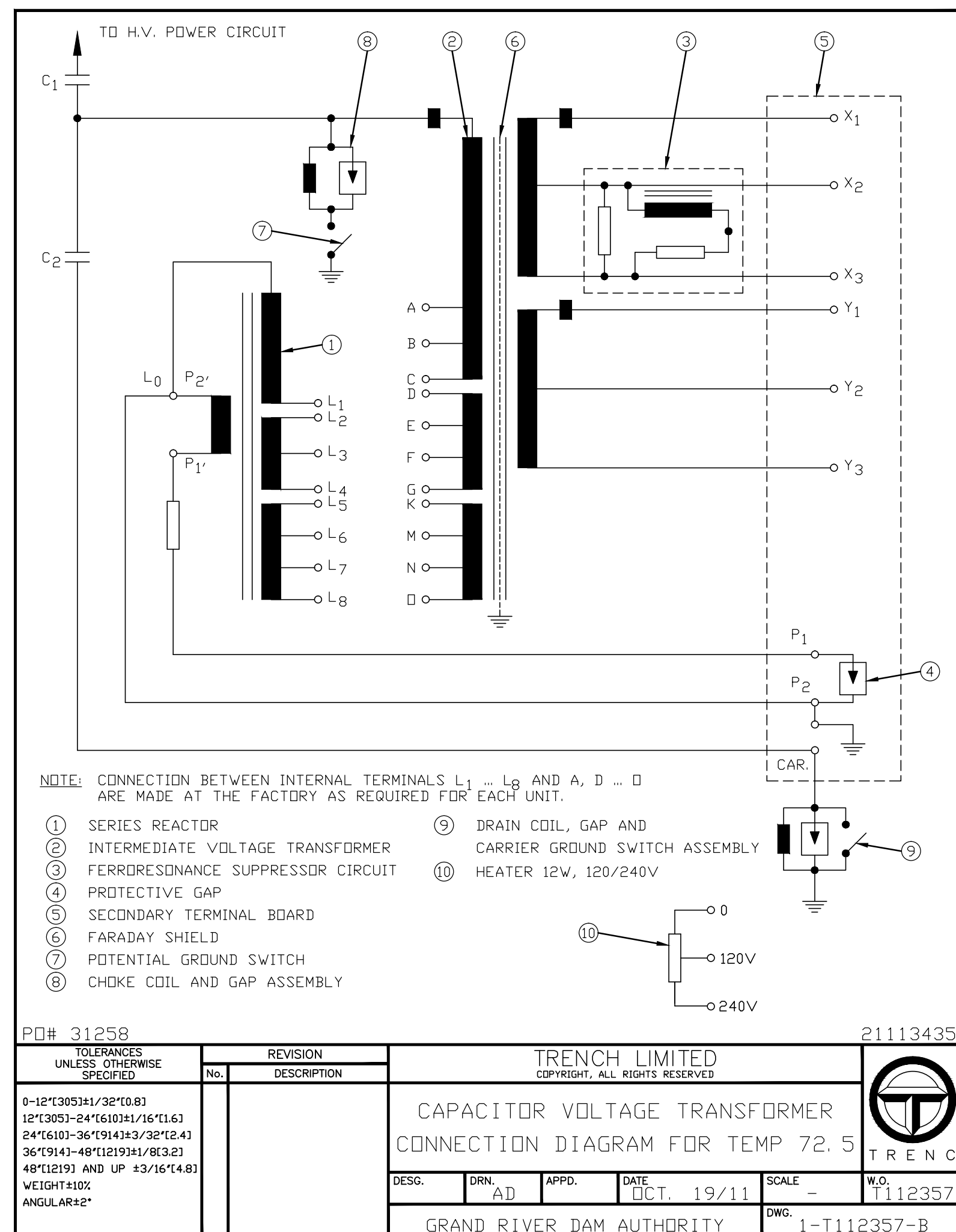
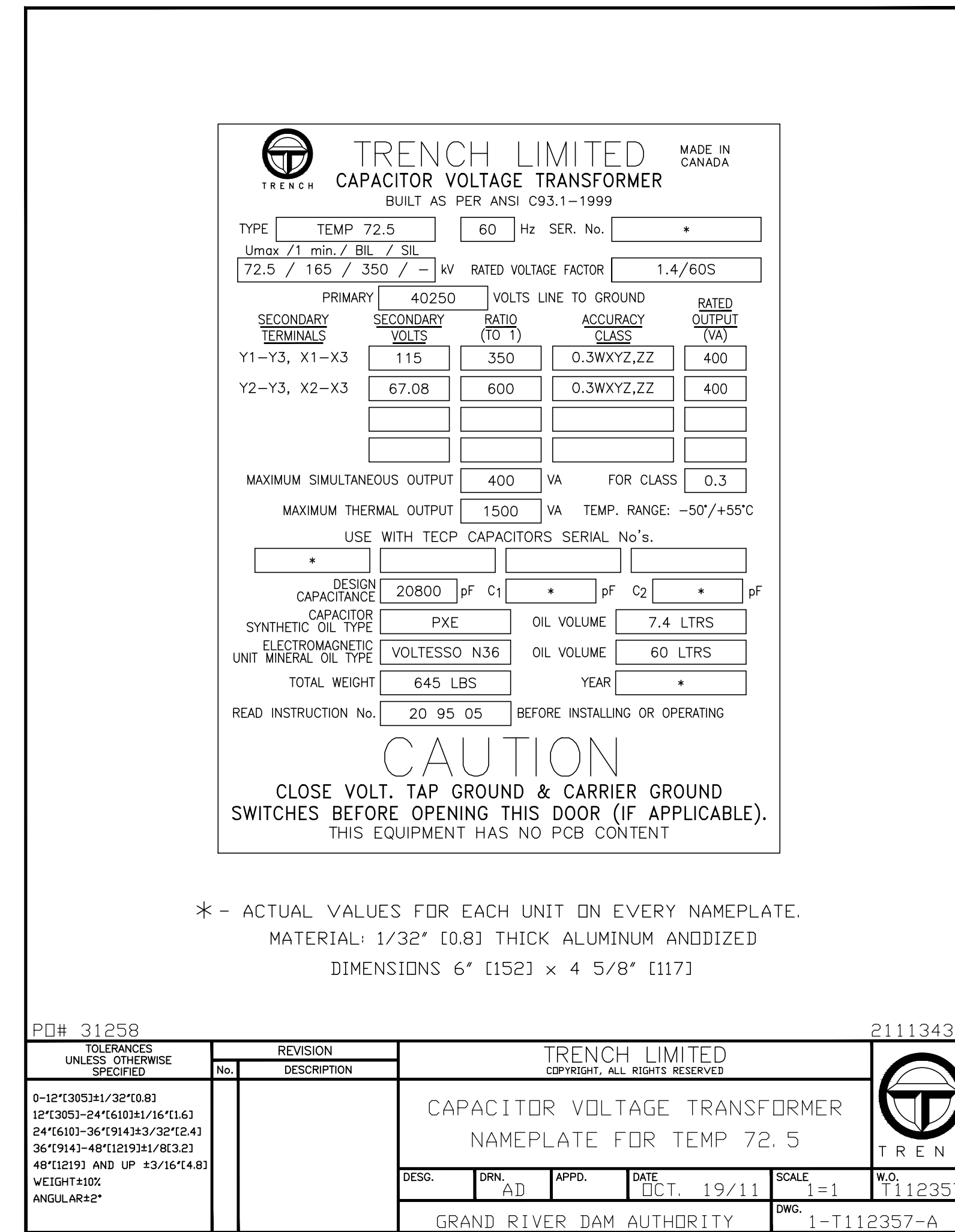
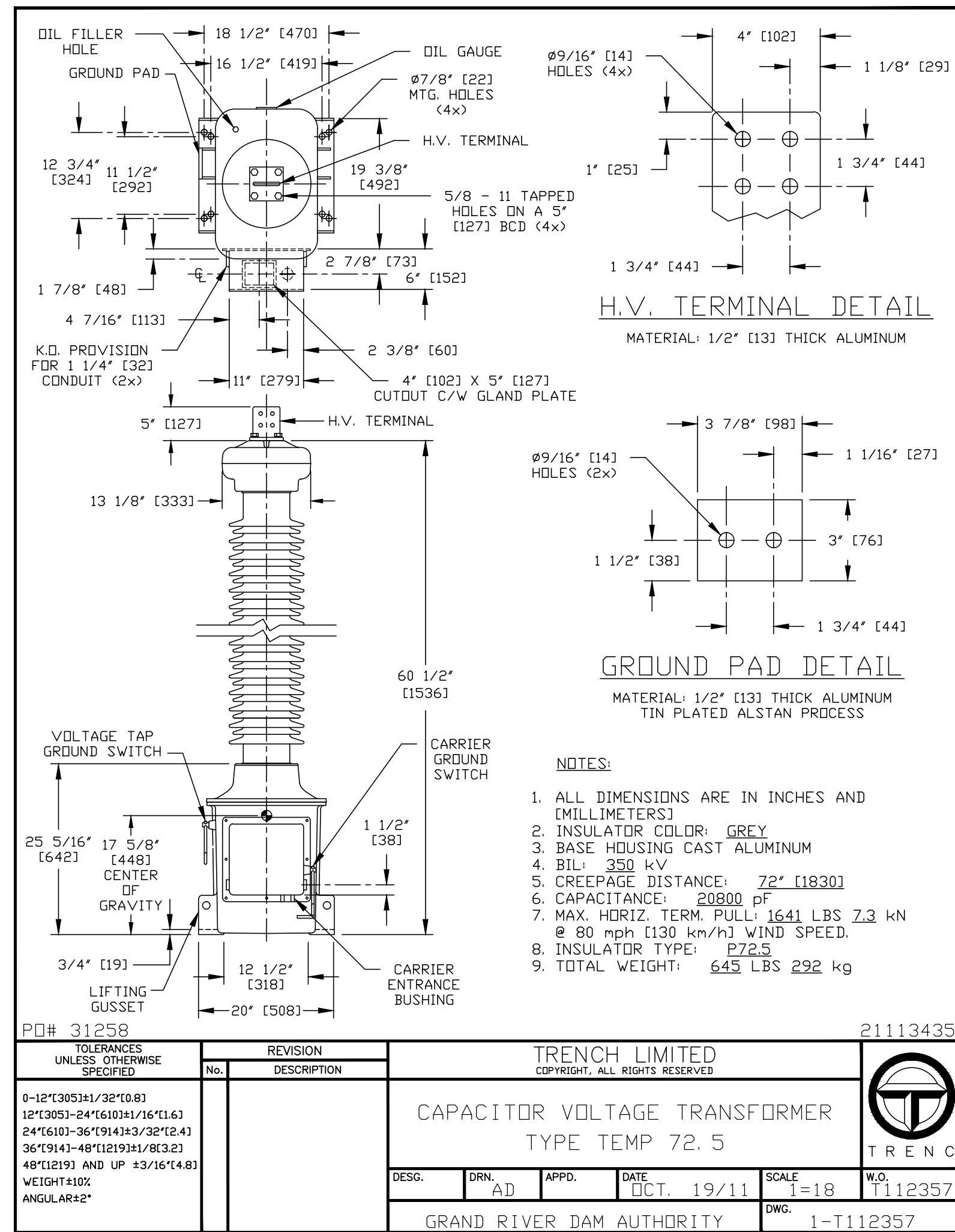
GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

DRAWING No. S294PX09 REV. 0

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			DFT	ENG

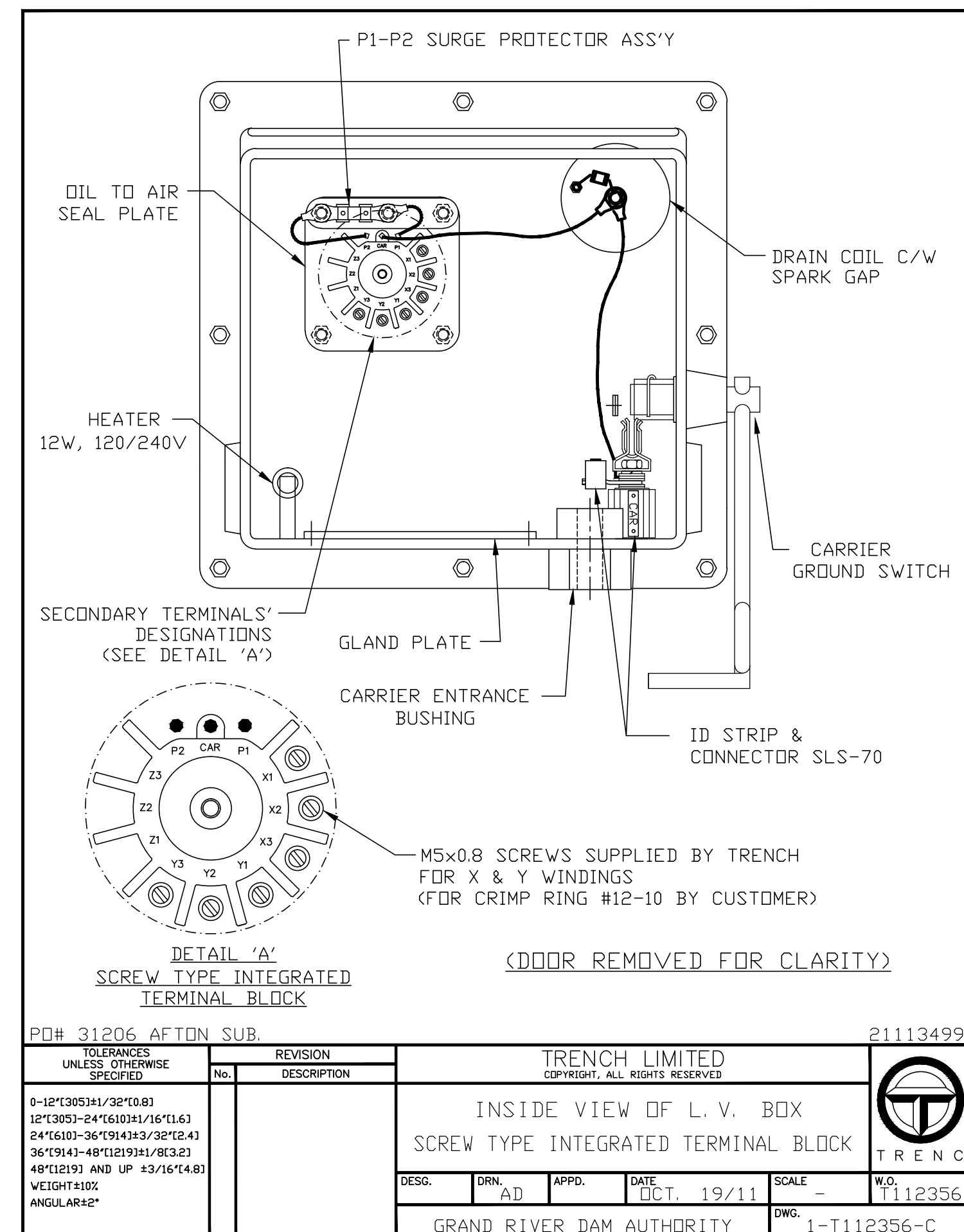
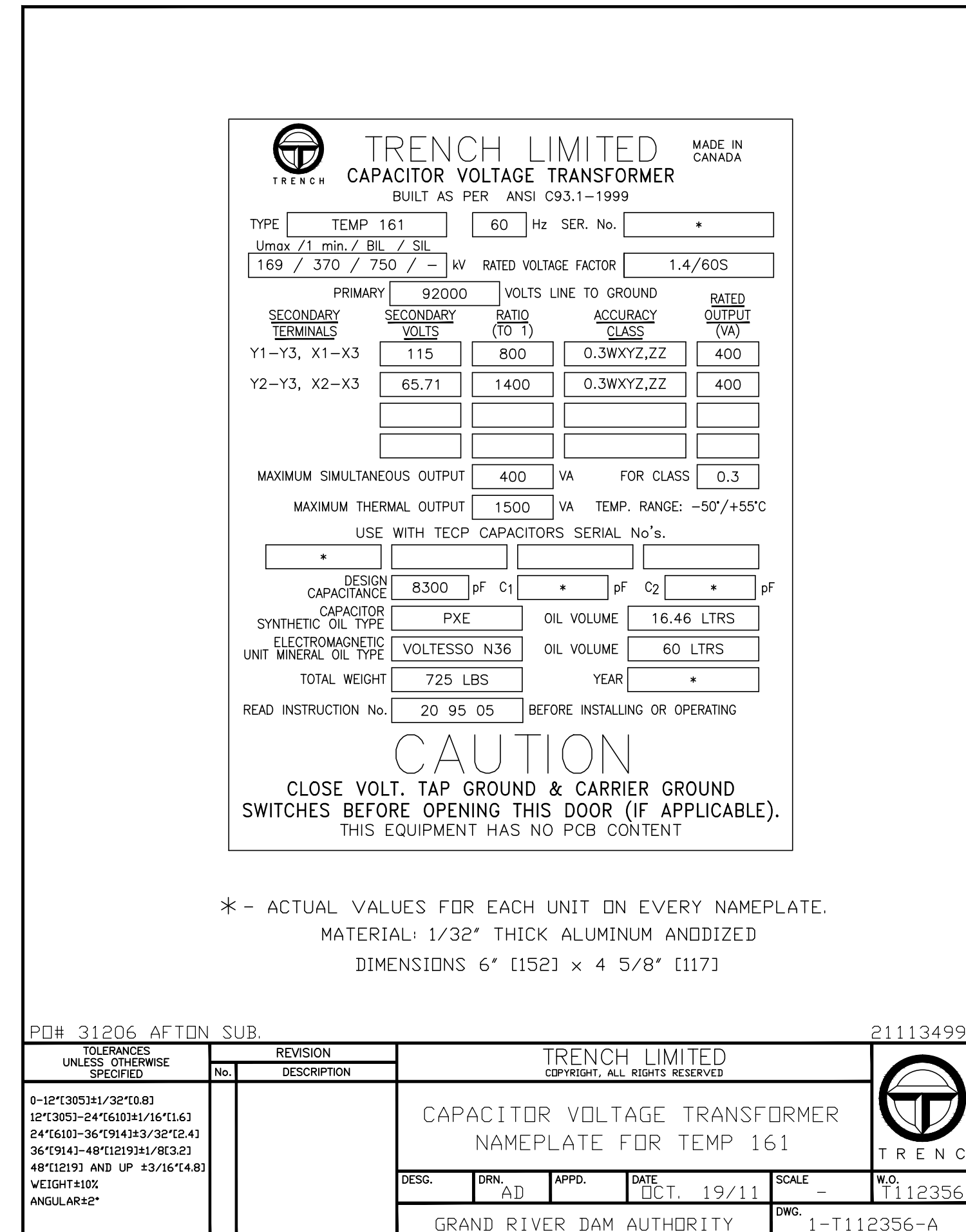
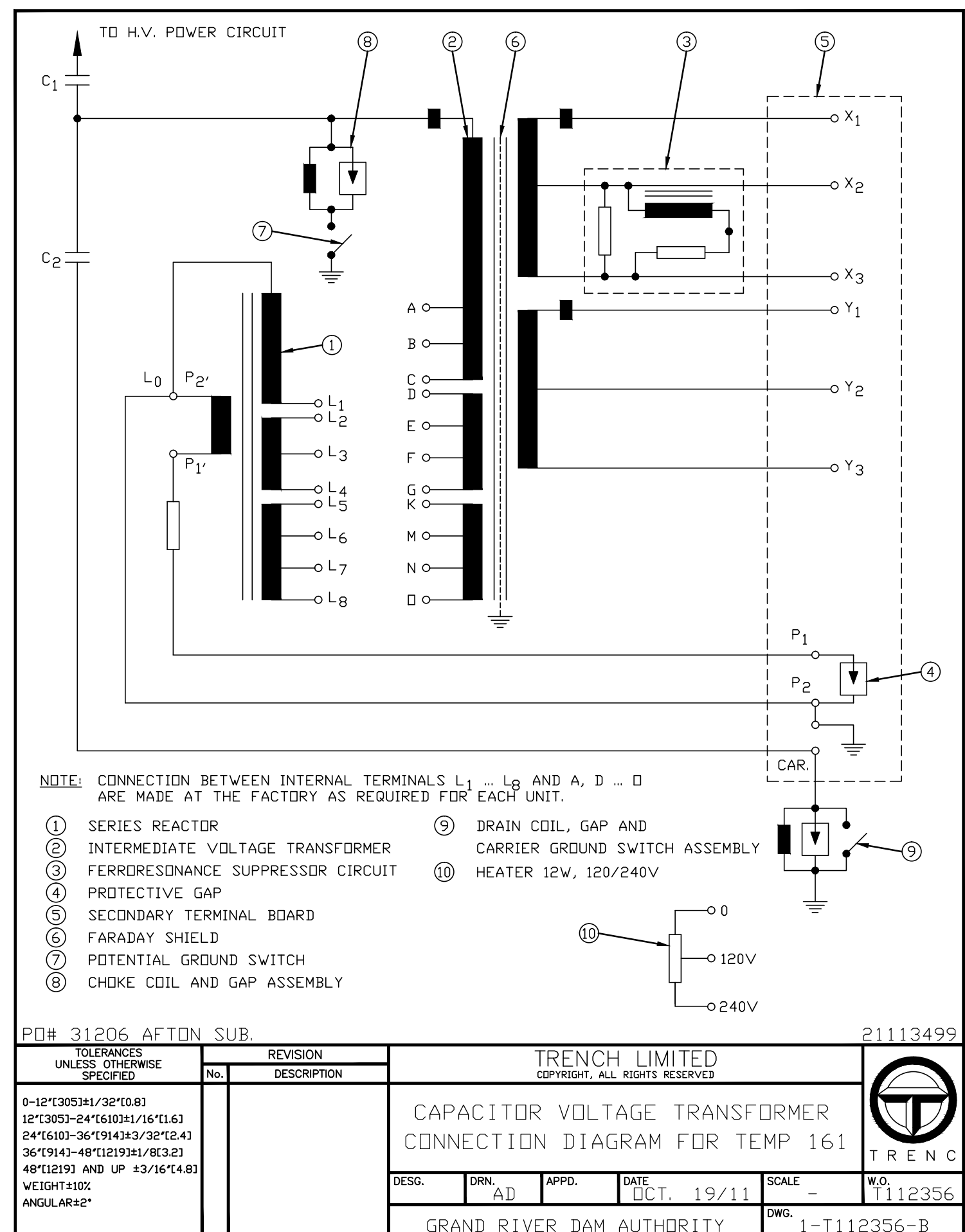
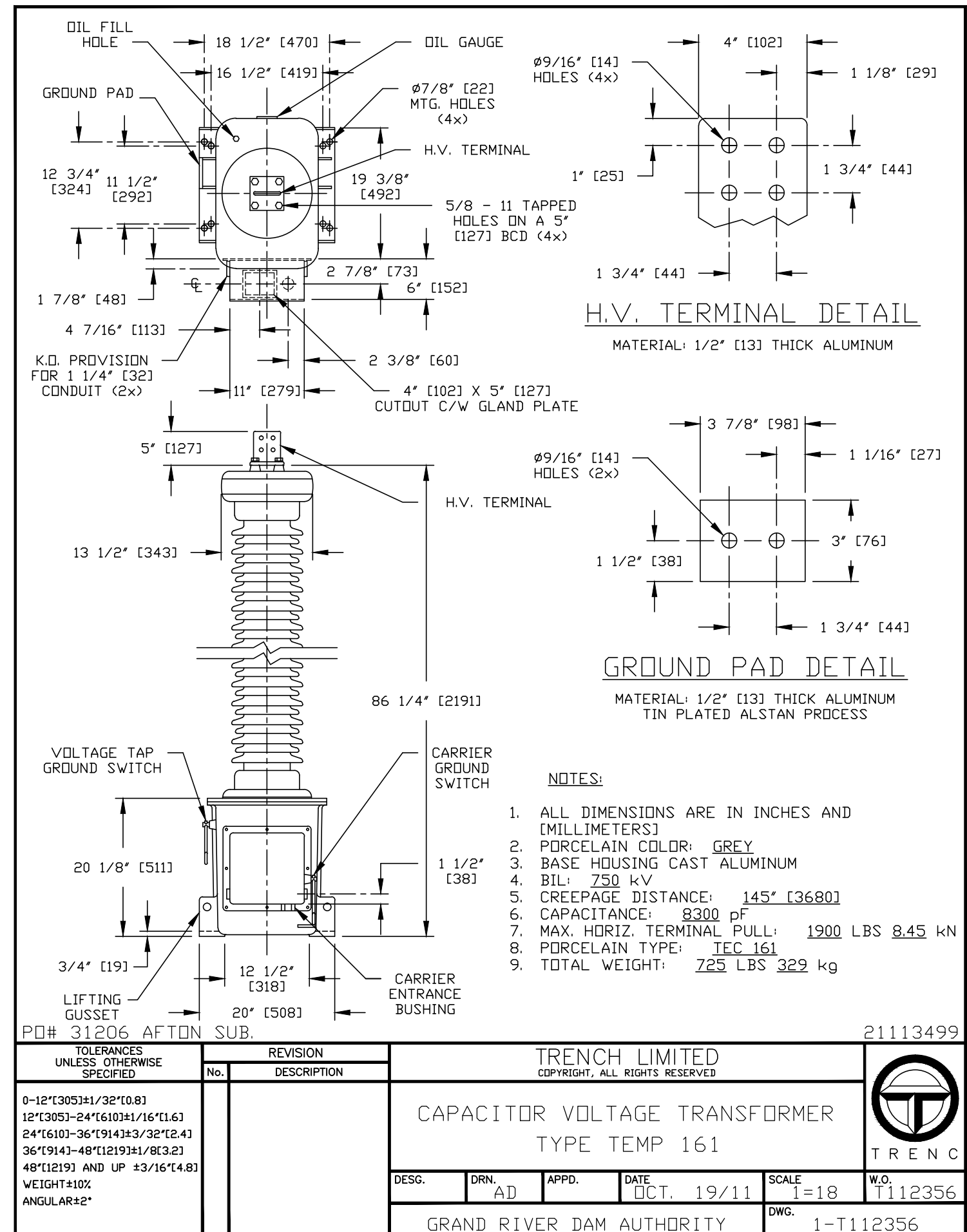
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FILE: G:\DRAWINGS\RSGDWG\B8720-1.DWG



ISSUED FOR BID

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69kV			
69kV CCVT			
MANUFACTURERS DRAWINGS			
SCALE: N.T.S.	DRAWN BY: JT	ENGR: BA	APPD: BA
		CH: BA	DATE: 27APR12
GRDA GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINETA, OK 74301		DRAWING No. S294PX10	REV. 0

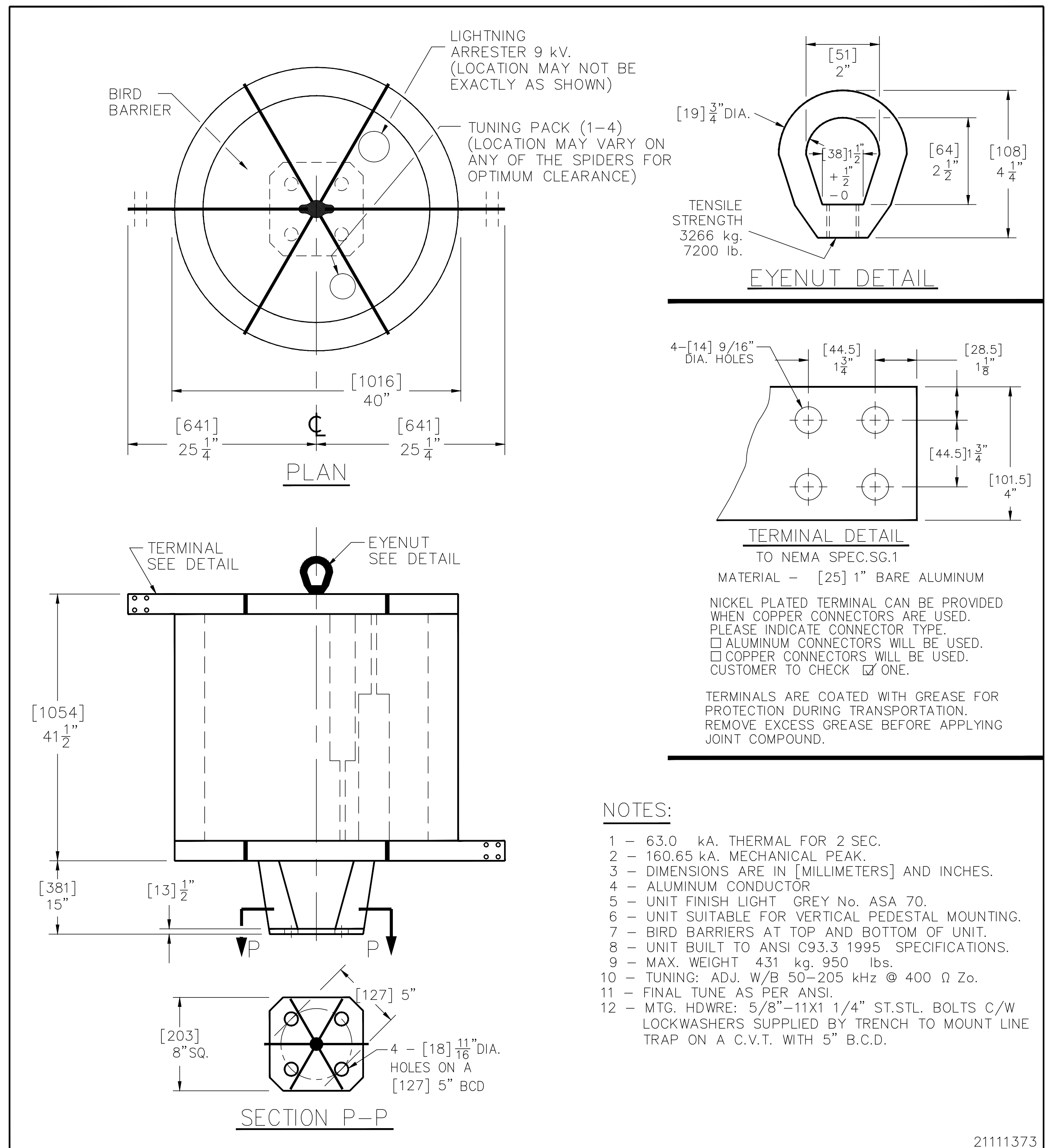


ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 161/69KV			
161kV CCVTs MANUFACTURERS DRAWINGS			
SCALE: N.T.S.	DRAWN BY: JT	ENGR: BA	APPD: BA
GRDA Grand River Dam Authority P.O. BOX 409 VINITA, OK 74301		CH: BA	DATE: 30APR12
DRAWING No. S294PX11		REV. 0	

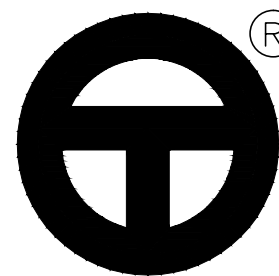


10/3/2011 11:05:40 AM



- NOTES:**
- 1 - 63.0 kA. THERMAL FOR 2 SEC.
  - 2 - 160.65 kA. MECHANICAL PEAK.
  - 3 - DIMENSIONS ARE IN [MILLIMETERS] AND INCHES.
  - 4 - ALUMINUM CONDUCTOR
  - 5 - UNIT FINISH LIGHT GREY No. ASA 70.
  - 6 - UNIT SUITABLE FOR VERTICAL PEDESTAL MOUNTING.
  - 7 - BIRD BARRIERS AT TOP AND BOTTOM OF UNIT.
  - 8 - UNIT BUILT TO ANSI C93.3 1995 SPECIFICATIONS.
  - 9 - MAX. WEIGHT 431 kg. 950 lbs.
  - 10 - TUNING: ADJ. W/B 50-205 kHz @ 400 Ω Zo.
  - 11 - FINAL TUNE AS PER ANSI.
  - 12 - MTG. HDWRE: 5/8"-11X1 1/4" ST.STL. BOLTS C/W LOCKWASHERS SUPPLIED BY TRENCH TO MOUNT LINE TRAP ON A C.V.T. WITH 5" B.C.D.

21111373


TOLERANCES UNLESS OTHERWISE SPECIFIED	REVISIONS		TRENCH LIMITED COPYRIGHT ALL RIGHTS RESERVED.				
	No.	DESCRIPTION	AIR CORE LINE TRAP				
0-6" [152] ±1/16" [1.6] 6"[152]-12"[305]±1/8"[3] 12"[305]-36"[914]±1/4"[6] 36"[914]-80"[2032]±1/2"[13] 80"[2032] AND UP ±3/4"[19] ANGULAR 2 DEGREES			2000 A, 0.265 mH, 161 kV, 60 Hz.		TRENCH		
			DRN. S.I.	APPD.	DATE OCT. 03/11	SCALE N.T.S.	W.O. C111151
			GRAND RIVER DAM AUTHORITY P.O. No. 31206		DWG. 1-34592	REV. 0	

**ISSUED FOR BID**

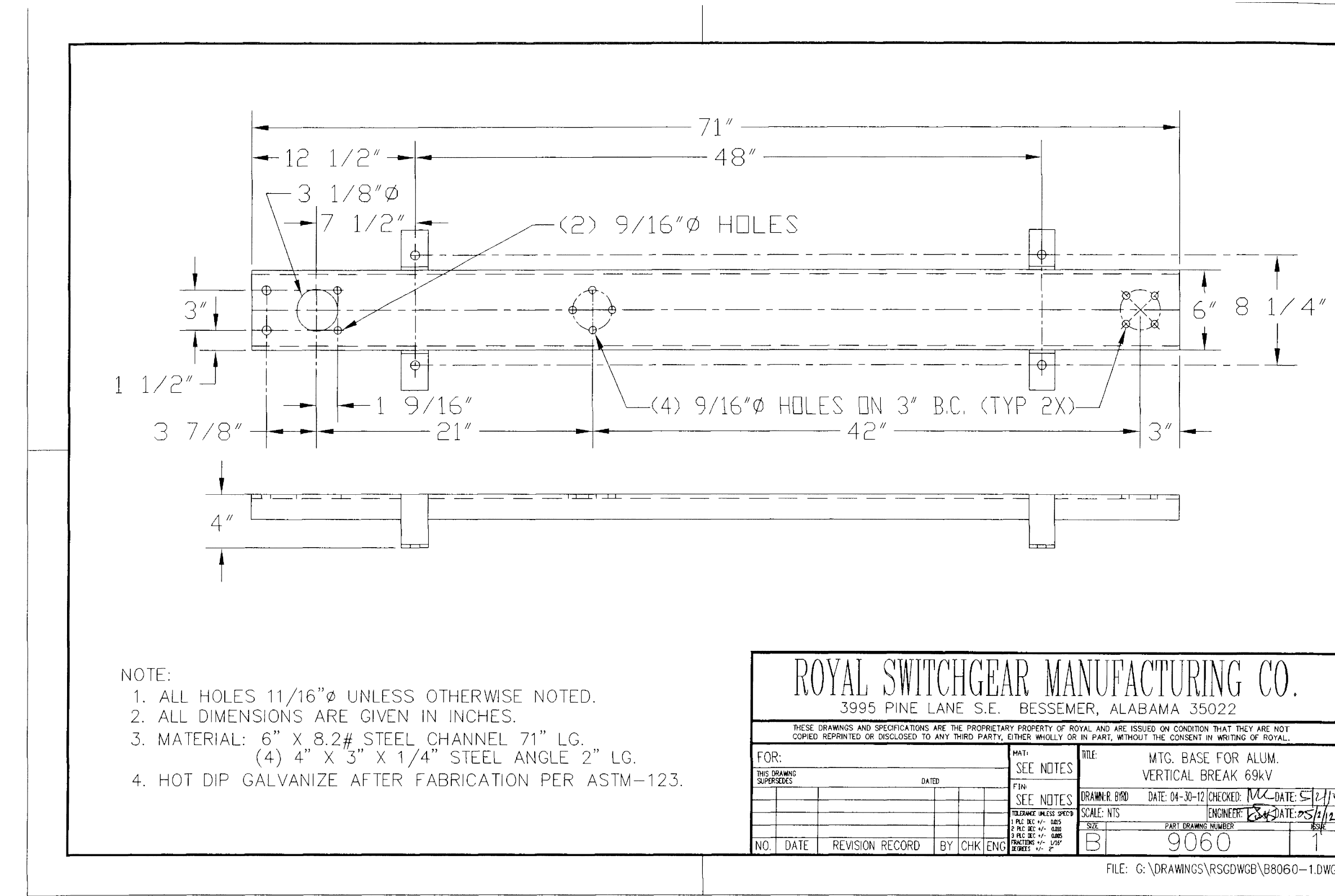
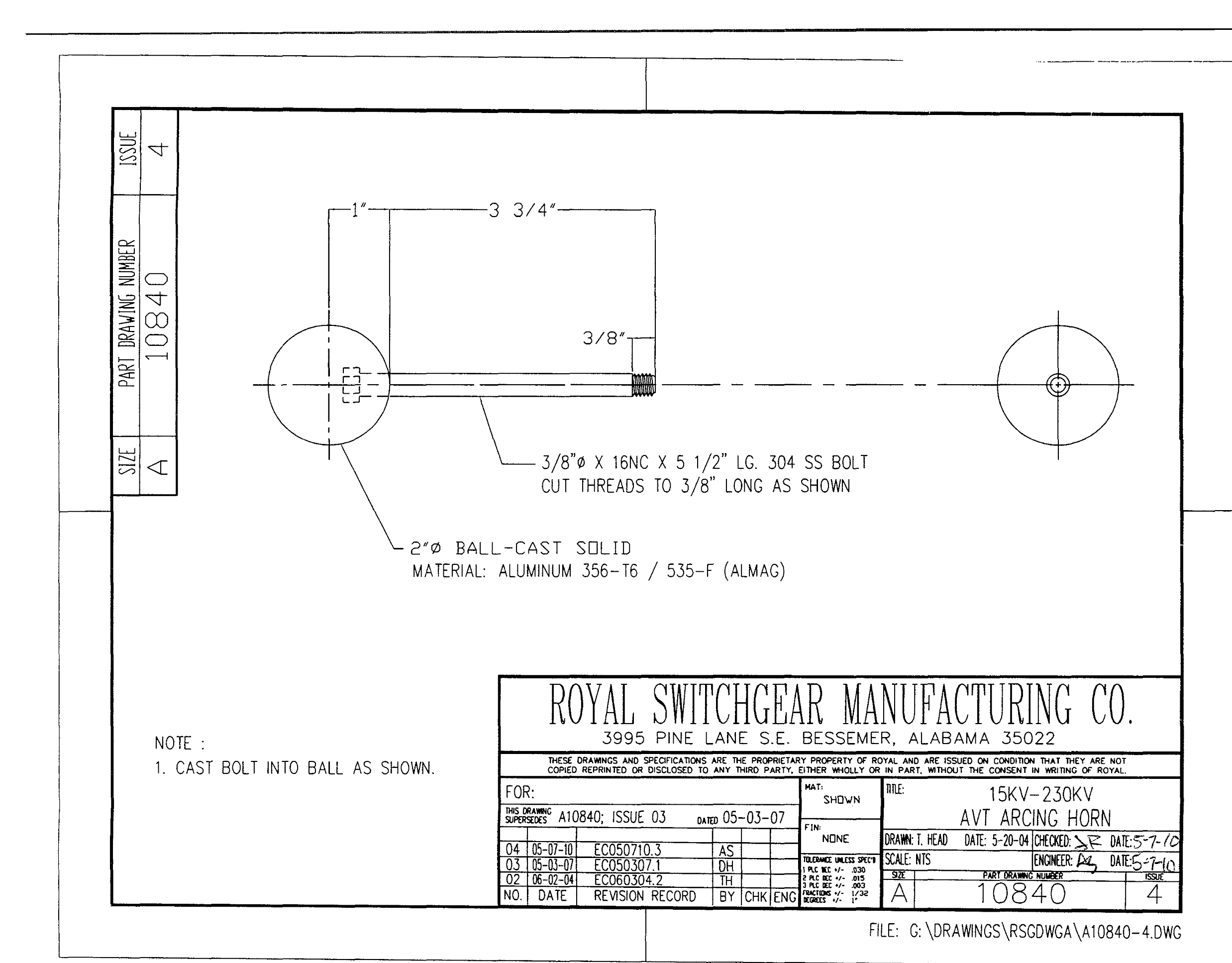
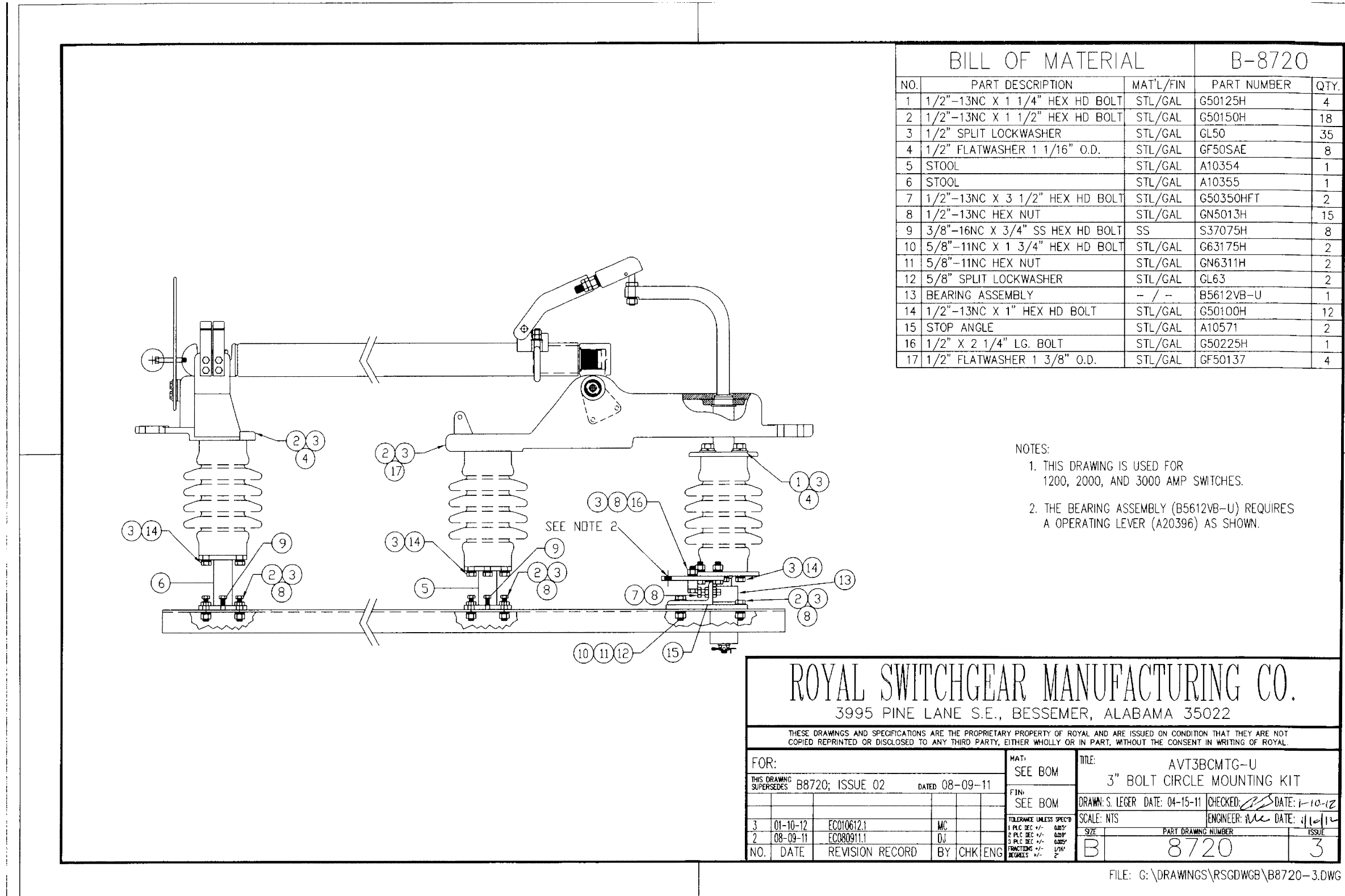
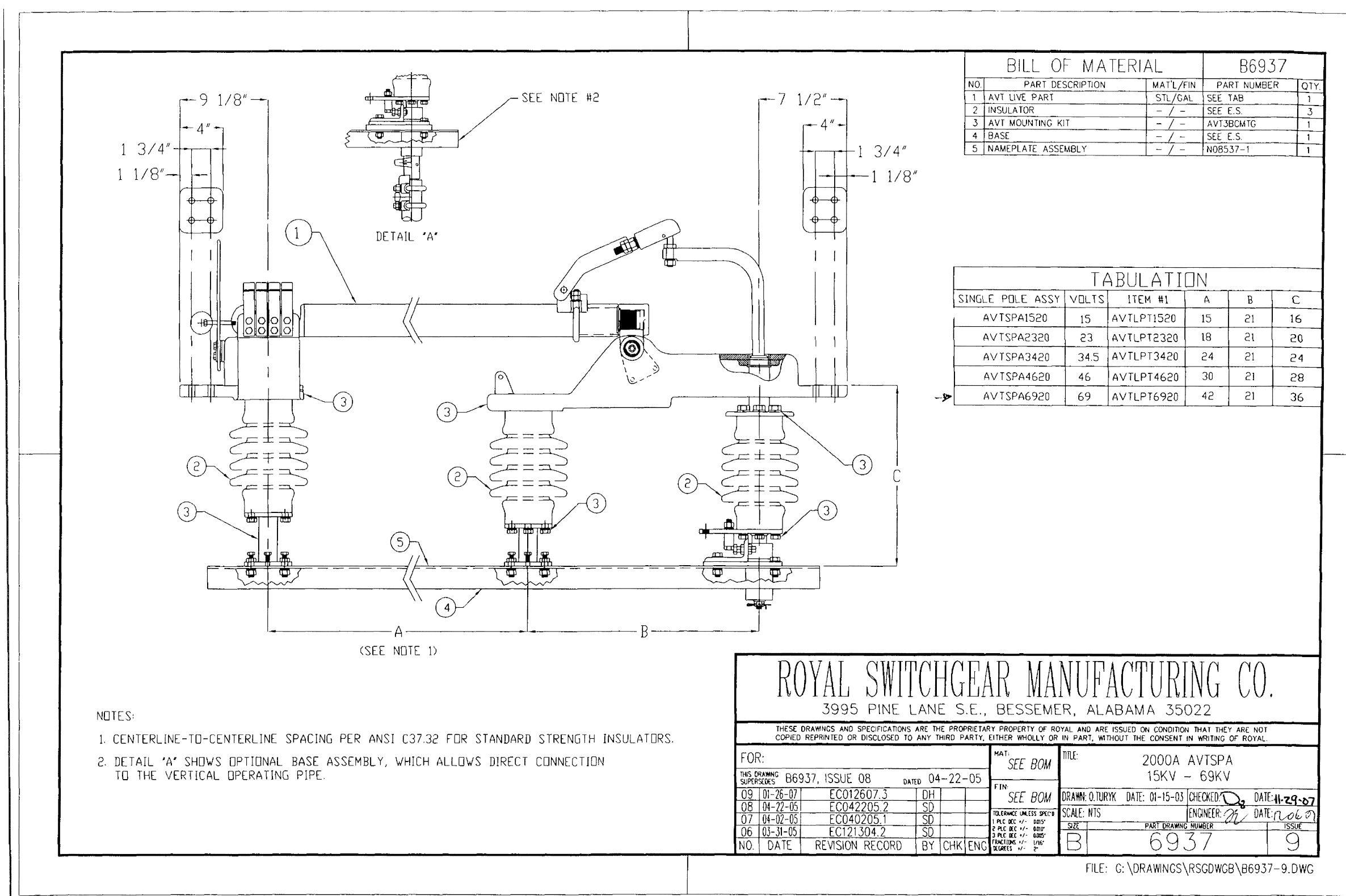
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION **S294**  
AFTON, OKLAHOMA  
161/69kV

**161kV WAVE TRAP**

SCALE: N.T.S. DRAWN BY: JT ENGR: BA APPD: BA  
CH: BA DATE: 30APR12

 GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

DRAWING No. **S294PX12** REV. **0**



**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON, OKLAHOMA S294  
161/69KV

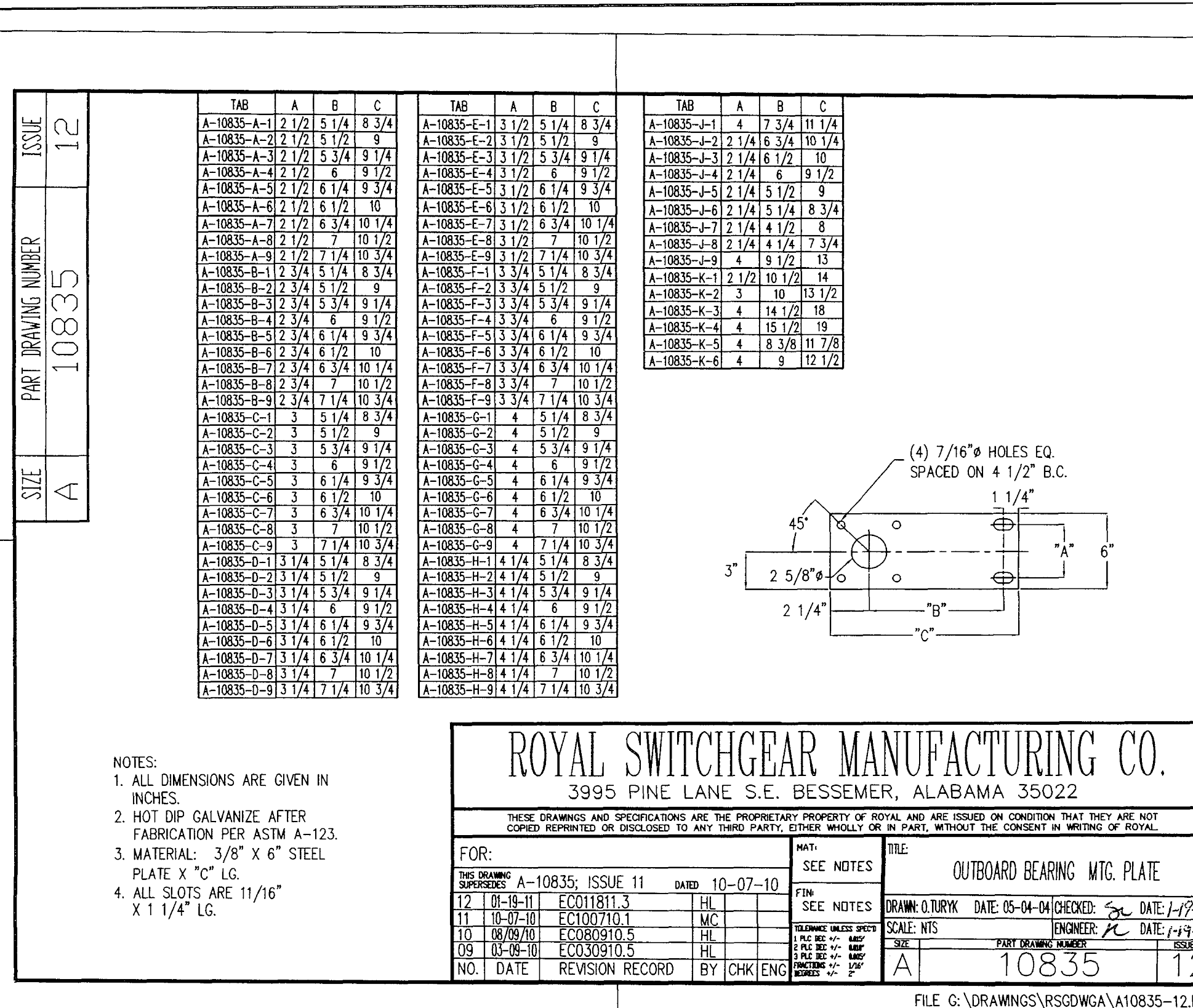
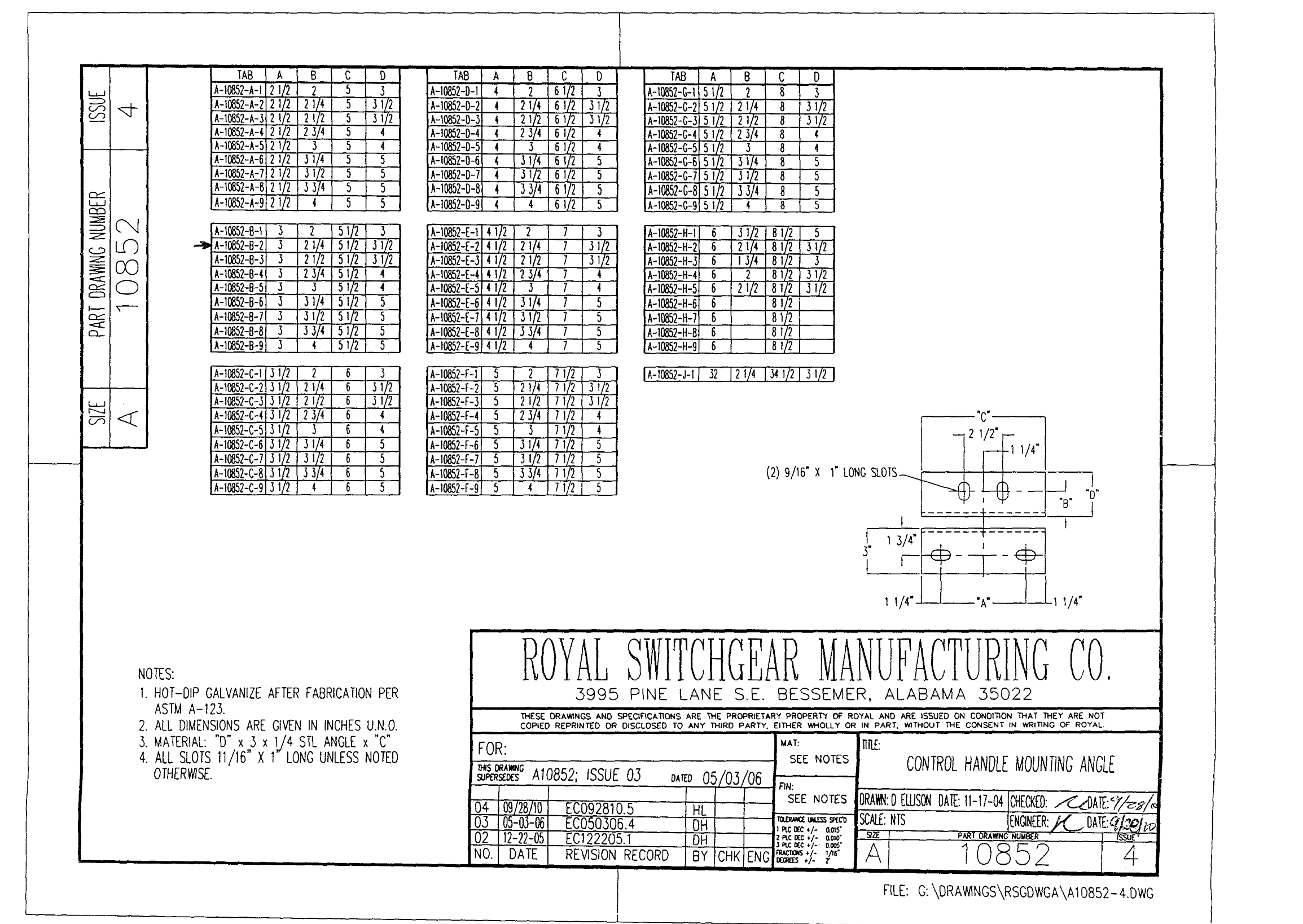
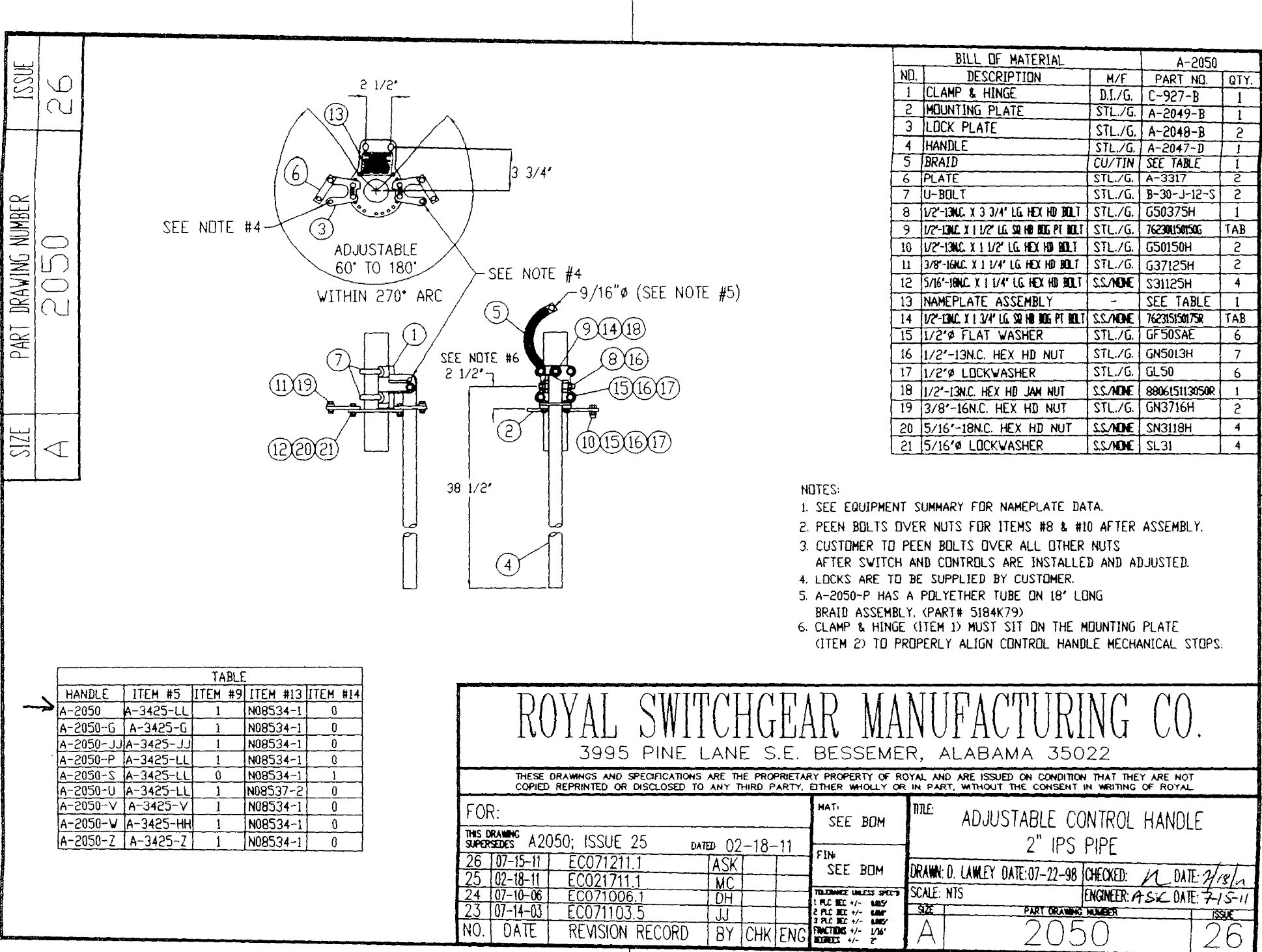
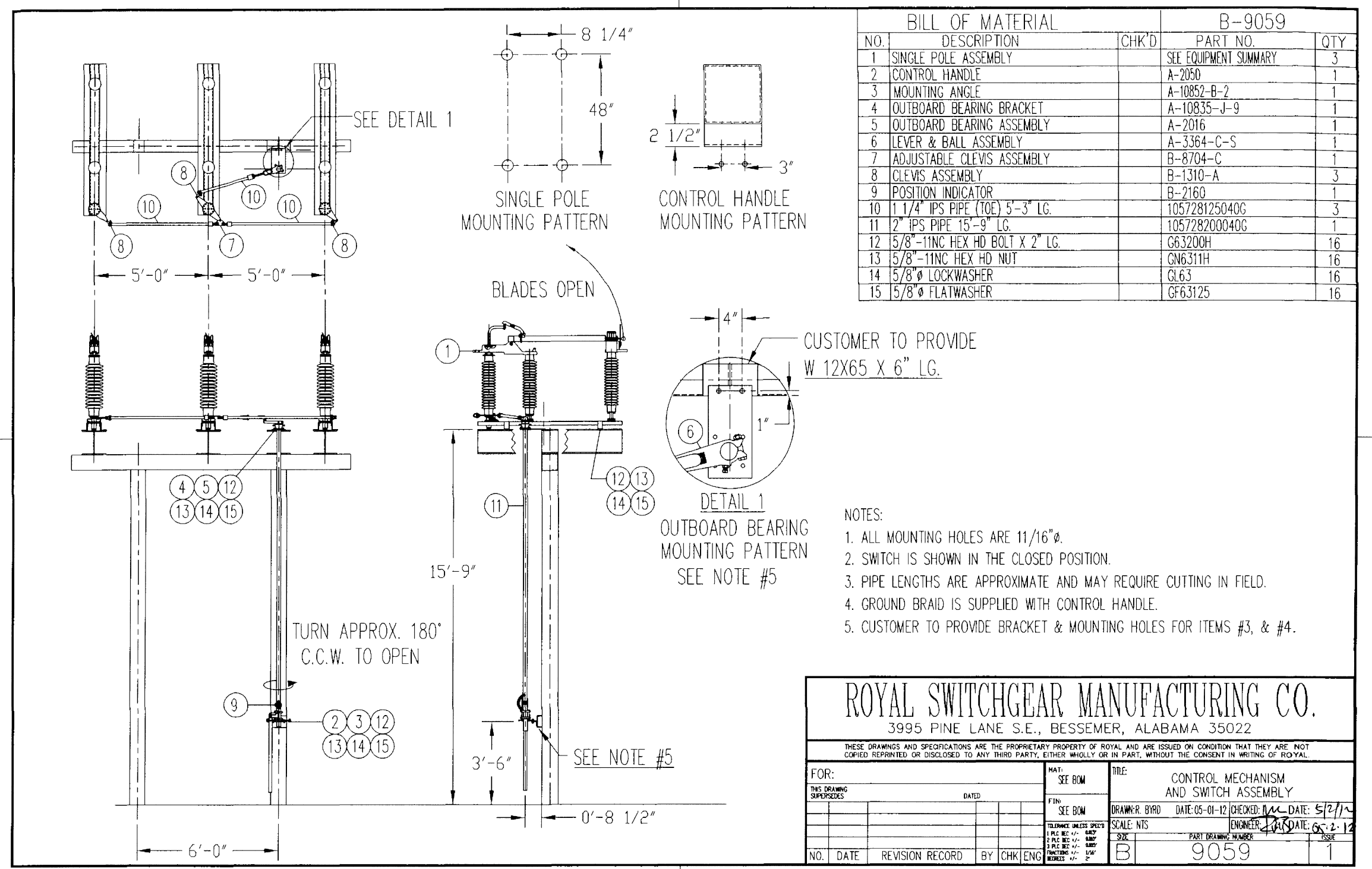
69kV SWITCH  
MANUFACTURERS DRAWINGS - 1

SCALE: N.T.S. DRAWN BY: AS ENGR: BA APPD: BA  
CH: BA DATE: 27APR12

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Grand River Dam Authority  
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VINITA, OK 74301

DRAWING No. S294PX13 REV. 0

0 5/29/12 ISSUED FOR BID AS BA  
REV DATE DESCRIPTION DFT ENG



**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
**AFTON SUBSTATION S294**  
 AFTON, OKLAHOMA  
 161/69KV  
**69kV SWITCH  
 MANUFACTURERS DRAWINGS - 2**

SCALE: N.T.S.    DRAWN BY: AS    ENGR: BA    APPD: BA  
 CH: BA    DATE: 27APR12

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

DRAWING No. **S294PX13**    REV. **0**

0	5/29/12	ISSUED FOR BID	AS	BA
REV	DATE	DESCRIPTION	DFT	ENG

ITEM	DESCRIPTION	PART NO.	QTY.
1	OUTER BEARING RACE (BRONZE)	A-2013-A	2
2	INNER RACE & SPINDLE (BRONZE)	A-2014-A	1
3	BEARING BALL	A-9080-A	26
4	ROLL PIN	S12075RP	2
5	1/2" X 1 1/2" SQUARE HD DOG POINT SET BOLT (GALV.)	76230150150G	SEE TAB
6	1/2" X 1 1/2" SQUARE HD DOG POINT SET BOLT (S.S.)	762315150175R	SEE TAB
7	3/8"-16NC HEX HD BOLT X 2" LG. (GALV.)	G37200H	4
8	3/8"-16NC HEX HD NUT	GN3716H	4
9	3/8" LOCKWASHER	GL37	4

TAB	ITEM #5	ITEM #6
A-2016	2	0
A-2016-S	0	2

**ROYAL SWITCHGEAR MANUFACTURING CO.**  
3995 PINE LANE S.E., BESSEMER, ALABAMA 35022

THIS DRAWING SUPERSEDES A2016; ISSUE 6 DATED 12-10-92

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TITLE: **OUTBOARD BEARING FOR 2" IPS PIPE**

DRAWN: DLAWLEY DATE: 10-4-00 CHECKED: *DLW* DATE: 10/5/00  
SCALE: NTS ENGINEER: *DLW* DATE: 10/5/00

NO. DATE REVISION RECORD BY CHK/ENG

7 10-04-00 EC100400.2 DWL

SIZE: A PART DRAWING NUMBER: 2016 ISSUE: 7

FILE: G:\RSGDWGA\A2016-7.DWG

NO.	DESCRIPTION	PART NO.	QTY.
1	BALL AND SOCKET ASSEMBLY	SEE TAB	1
2	LEVER	B-1291	1
3	SERRATED WASHER	A-2022	1
4	SQ HD DOG POINT SCREW 1/2"-13NC X 1-1/2" LG.	762301150150G	1
5	HEX JAM NUT 1/2"-13 SS	880615113050R	1
6	HEX HD BOLT 5/8"-11NC X 3-1/4" LG.	700201162325G	1
7	HEX NUT 5/8"-11NC	GN6311H	1
8	LOCKWASHER 5/8"	GL63	1

DWG. NO.	ITEM #1	SPS
A-3364-AS	A-3354-AS	2"
A-3364-AL	A-3354-AL	2"
A-3364-AR	A-3354-AR	2"
A-3364-BS	A-3354-BS	1-1/2"
A-3364-BL	A-3354-BL	1-1/2"
A-3364-BR	A-3354-BR	1-1/2"
A-3364-CS	A-3354-CS	1-1/4"
A-3364-CL	A-3354-CL	1-1/4"
A-3364-CR	A-3354-CR	1-1/4"
A-3364-DS	A-3354-DS	1"
A-3364-DL	A-3354-DL	1"
A-3364-DR	A-3354-DR	1"

**ROYAL SWITCHGEAR MANUFACTURING CO.**  
3995 PINE LANE S.E., BESSEMER, ALABAMA 35022

THIS DRAWING SUPERSEDES A-3364; ISSUE 3 DATED 1-24-92

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TITLE: **LEVER BALL AND SOCKET ASSEMBLY**

DRAWN: LVC DATE: 10/3/00 CHECKED: *DLW* DATE: 10/10/00  
SCALE: NTS ENGINEER: *DLW* DATE: 10/10/00

NO. DATE REVISION RECORD BY CHK/ENG

4 10/3/00 EC100200.3 LVC

SIZE: A PART DRAWING NUMBER: 3364 ISSUE: 4

FILE: G:\RSGDWGA\A3364...

NO.	DESCRIPTION	CHK'D	PART NO.	QTY.
1	ADJUSTABLE CLEVIS PLATE		B-8703	1
2	THREADED PIPE COUPLING		SEE TAB	2
3	BOLT HH 3/4" X 4" GALV.		G75400HFT	2
4	NUT HEX 3/4"-10 GALV.		GN7510H	2
5	3/4" GALV. LOCKWASHER		GL75	2

P/N	PIPE SIZE	ITEM #2
B-8704-C	1 1/4" IPS	A-18-C
B-8704-D	1 1/2" IPS	A-18-D
B-8704-E	2" IPS	A-18-E

**ROYAL SWITCHGEAR MANUFACTURING CO.**  
3995 PINE LANE S.E., BESSEMER, ALABAMA 35022

THIS DRAWING SUPERSEDES B8704; ISSUE 02 DATED 8-16-11

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TITLE: **ADJUSTABLE CLEVIS ASSEMBLY**

FOR: **ADJUSTABLE CLEVIS ASSEMBLY**

DRAWN: *DLW* DATE: 5-12-94 CHECKED: *DLW* DATE: 5/12/94  
SCALE: NTS ENGINEER: *DLW* DATE: 5/12/94

NO. DATE REVISION RECORD BY CHK/ENG

1 8-16-11 EC080201.8 DLW

SIZE: A PART DRAWING NUMBER: 8704 ISSUE: 3

FILE: G:\DRAWINGS\RSGDWGA\B8704-3.DWG

NO.	DESCRIPTION	PART NO.	QTY.
1	B-1310	SEE TAB	1
2	B-1310	SEE TAB	1
3	B-1310	SEE TAB	1
4	B-1310	SEE TAB	1
5	B-1310	SEE TAB	1
6	B-1310	SEE TAB	1
7	B-1310	SEE TAB	1
8	B-1310	SEE TAB	1
9	B-1310	SEE TAB	1
10	B-1310	SEE TAB	1
11	B-1310	SEE TAB	1
12	B-1310	SEE TAB	1
13	B-1310	SEE TAB	1
14	B-1310	SEE TAB	1
15	B-1310	SEE TAB	1
16	B-1310	SEE TAB	1
17	B-1310	SEE TAB	1
18	B-1310	SEE TAB	1
19	B-1310	SEE TAB	1
20	B-1310	SEE TAB	1
21	B-1310	SEE TAB	1
22	B-1310	SEE TAB	1
23	B-1310	SEE TAB	1
24	B-1310	SEE TAB	1
25	B-1310	SEE TAB	1
26	B-1310	SEE TAB	1
27	B-1310	SEE TAB	1
28	B-1310	SEE TAB	1
29	B-1310	SEE TAB	1
30	B-1310	SEE TAB	1

**ROYAL SWITCHGEAR MANUFACTURING CO.**  
3995 PINE LANE S.E., BESSEMER, ALABAMA 35022

THIS DRAWING SUPERSEDES B-1310; ISSUE 9 DATED 5-12-94

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TITLE: **CLEVIS ASSEMBLIES**

FOR: **CLEVIS ASSEMBLIES**

DRAWN: *DLW* DATE: 5-12-94 CHECKED: *DLW* DATE: 5/12/94  
SCALE: NTS ENGINEER: *DLW* DATE: 5/12/94

NO. DATE REVISION RECORD BY CHK/ENG

1 5-12-94 EC050201.9 DLW

SIZE: A PART DRAWING NUMBER: 1310 ISSUE: 9

FILE: G:\DRAWINGS\RSGDWGA\B1310-10.DWG

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

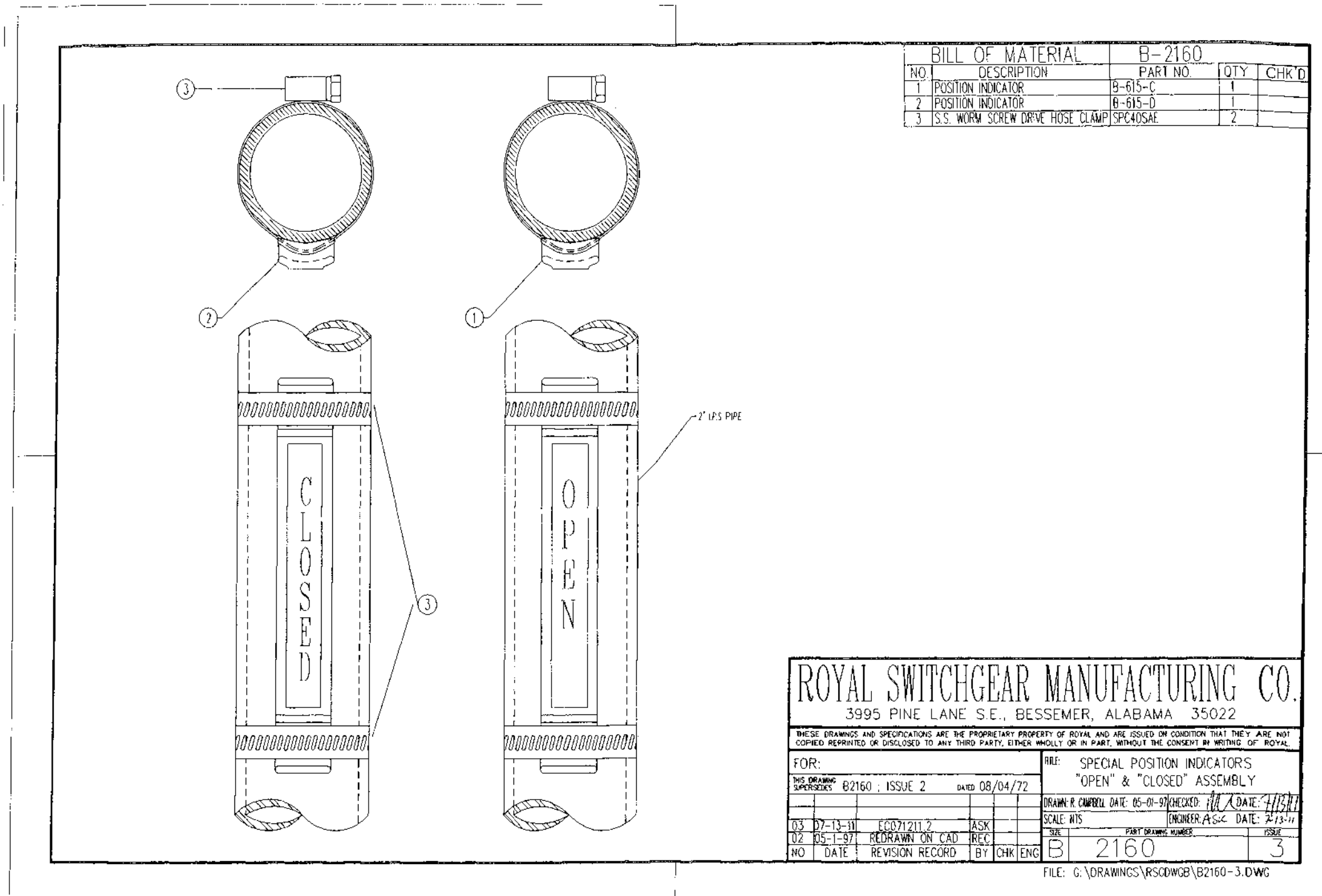
69kV SWITCH  
MANUFACTURERS DRAWINGS - 3

SCALE: N.T.S.	DRAWN BY: AS	ENGR: BA	APPD: BA
	CH: BA	DATE: 27APR12	

0 5/29/12	ISSUED FOR BID	AS BA
REV DATE DESCRIPTION		DFT ENG

**GRDA**  
Grand River Dam Authority  
P.O. BOX 409  
VINITA, OK 74301

DRAWING No. S294PX15  
REV. 0



**ROYAL SWITCHGEAR MANUFACTURING CO.**  
 3995 PINE LANE S.E., BESSEMER, ALABAMA 35022

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FOR: SPECIAL POSITION INDICATORS  
 "OPEN" & "CLOSED" ASSEMBLY

DATE: 08/04/77

DESIGNED BY: [Signature] CHECKED BY: [Signature] DATE: 4/23/12

NO. DATE REVISION RECORD BY: [Signature] 2160 3

FILE: C:\ORAM\SCS\SCGMB\B2160-3.DWG

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69kV

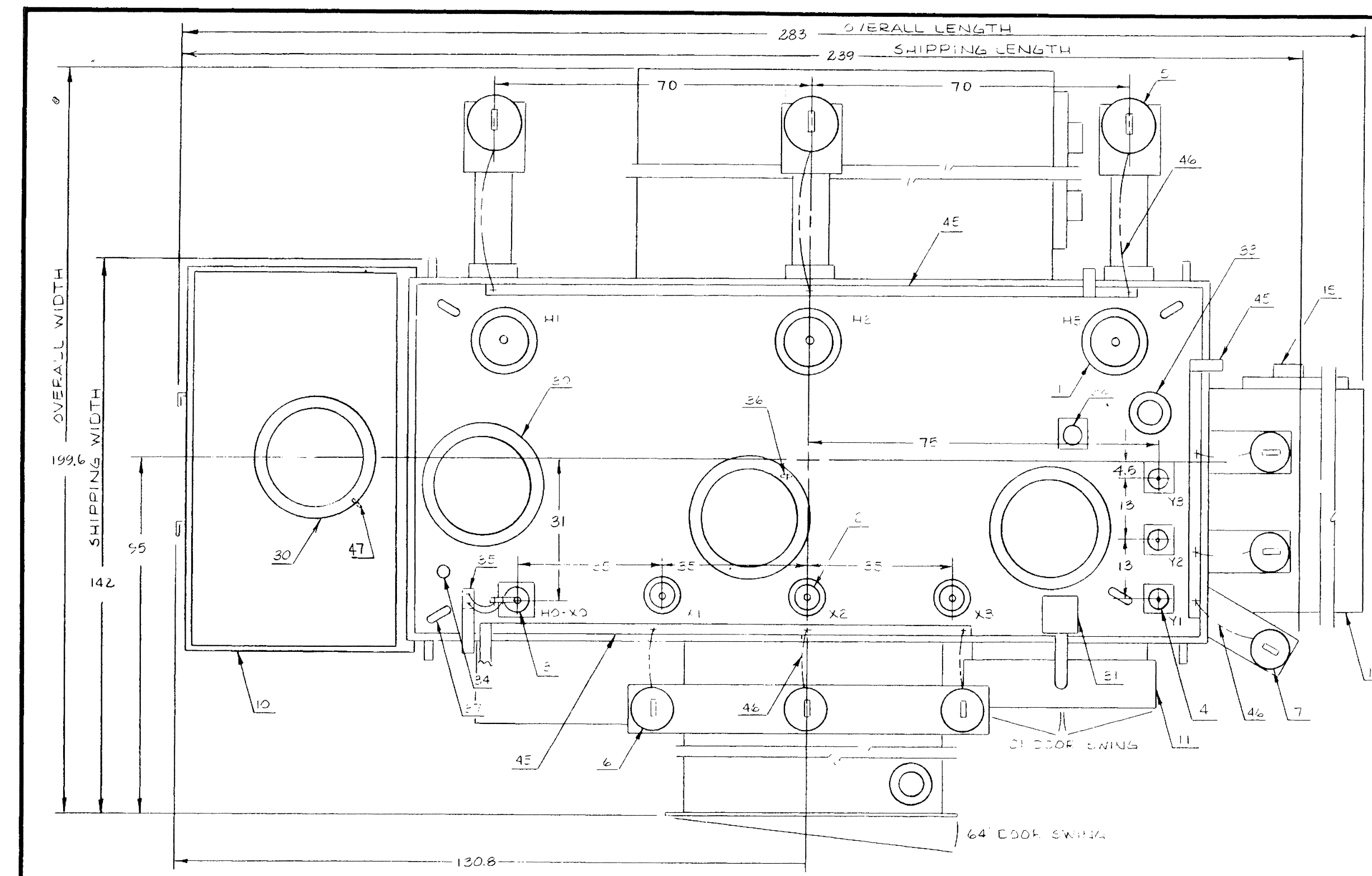
69kV SWITCH  
 MANUFACTURERS DRAWINGS - 4

SCALE: N.T.S. DRAWN BY: AS ENGR: BA APPD: BA  
 CH: BA DATE: 27APR12

**GRDA**  
 Grand River Dam Authority  
 P.O. BOX 409  
 VINITA, OK 74301

DRAWING No. S294PX16 REV. 0

REV	DATE	DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA



**ELECTRICAL DESCRIPTION**

MAX. MVA . . . . . 30/56  
 PHASE . . . . . 3  
 HERTZ . . . . . 60  
 RISE . . . . . .55/65°C  
 CLASS . . . . . OA/FA/FA  
 PRIMARY VOLTAGE . . . . . 161000 GRDY / 92955  
 SECONDARY VOLTAGE . . . . . 69000 GRDY / 39840  
 TERTIARY MVA . . . . . 0/11.2  
 TERTIARY VOLTAGE . . . . . 13200

NOTE: ITEMS REMOVED FOR SHIPMENT.  
 TANK DESIGNED FOR FULL VACUUM.  
 PAINT FINISH - ANSI #70 LIGHT GRAY.  
 MANUFACTURED IN ACCORDANCE W/ANSI & NEMA.

- ⊙ OPERATING CENTER OF GRAVITY
- ⊕ SHIPPING CENTER OF GRAVITY

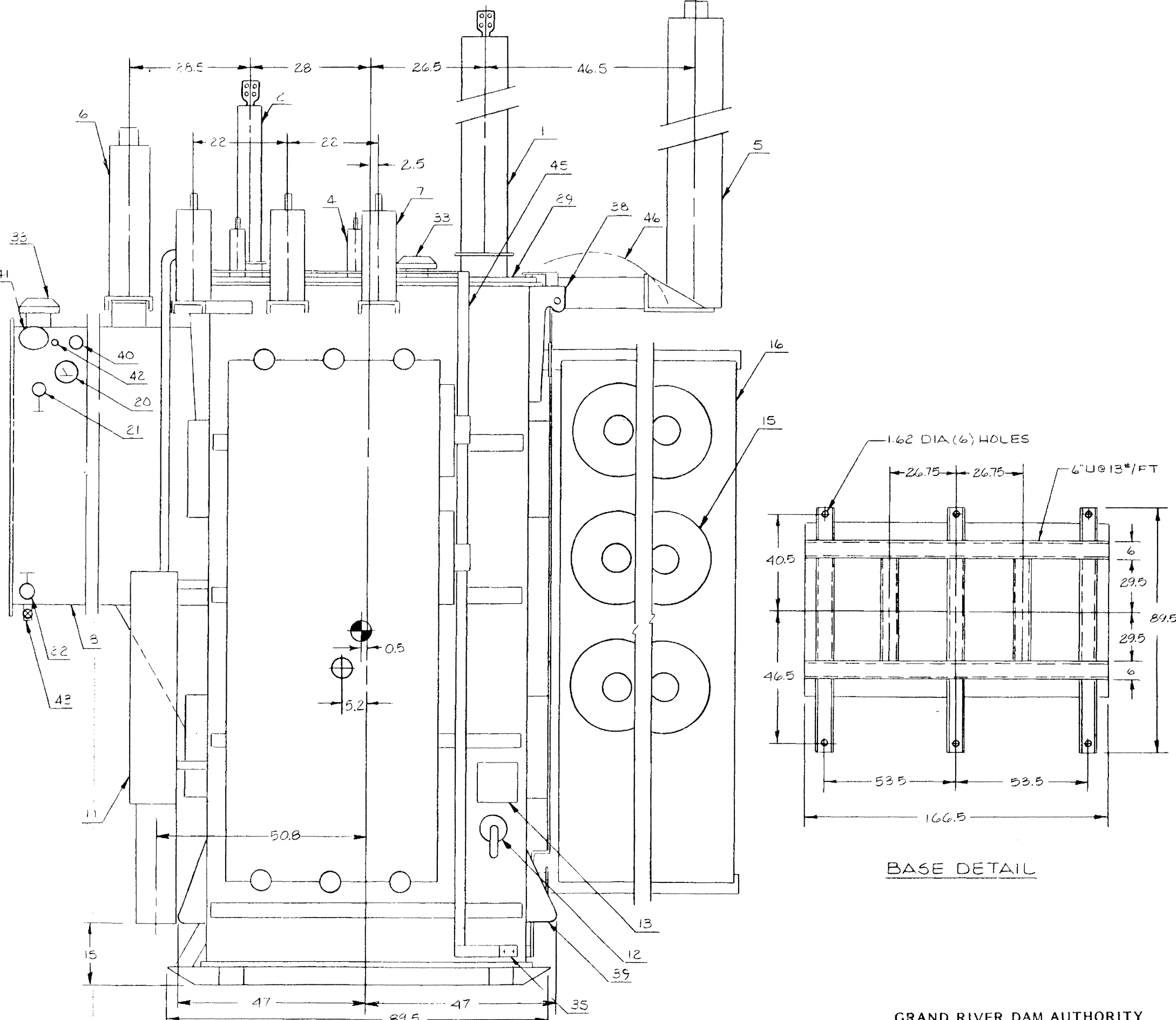
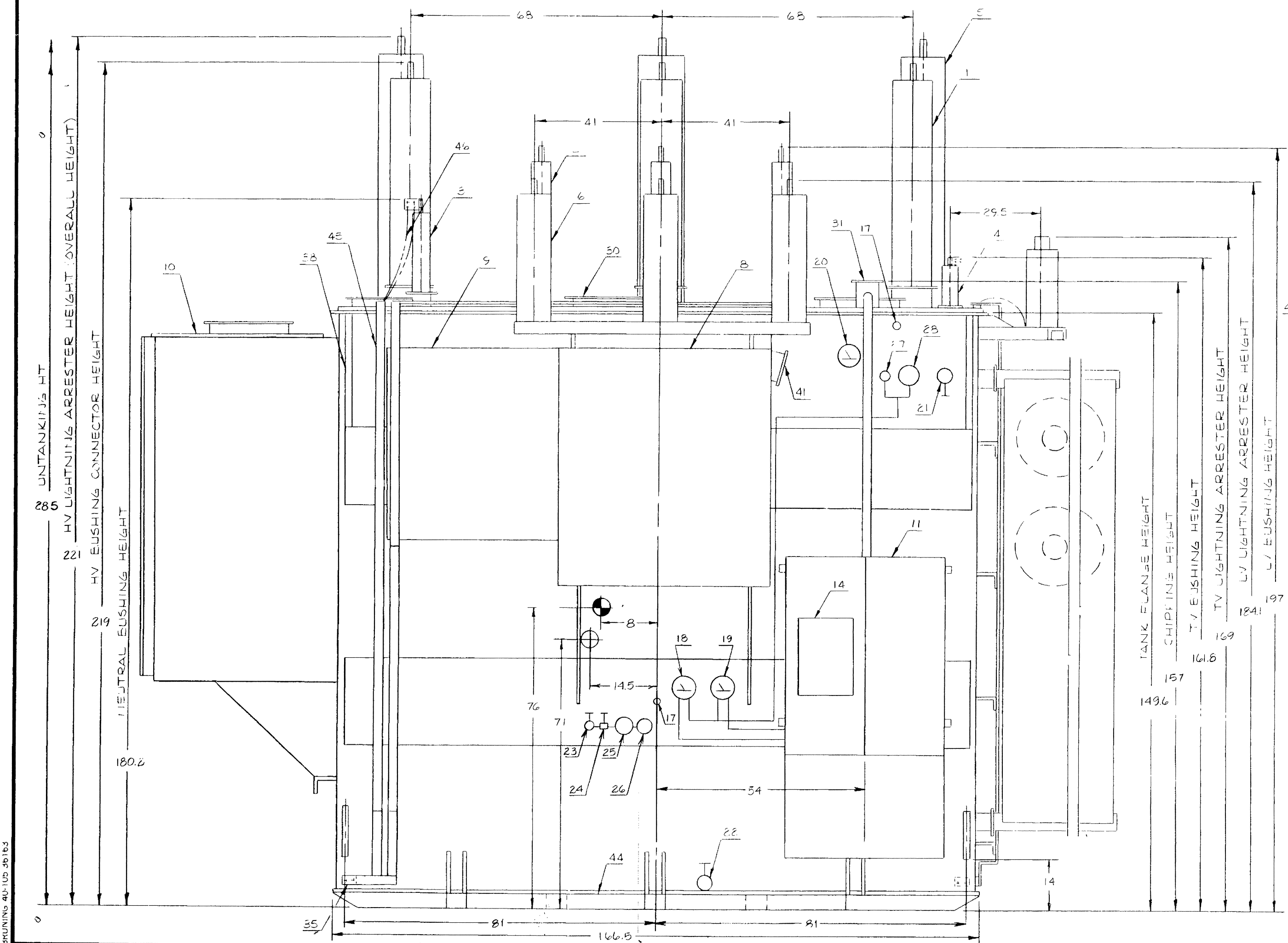
SHIPPING WITHOUT OIL . . . . . 116000

APPROXIMATE	WEIGHTS (LBS.)	VOLUME (G)
UNTANKING (CORE & COIL)	85000	
TANK & FITTINGS	48700	
OIL - RADIATORS	5200	690
OIL - MAIN TANK	52150	6950
OIL - LTC TANK	5250	700
TOTAL	196300	8340

\*\*INCLUDES 12000# SERIES TRANSFORMER AND 2000# PREVENTIVE AUTO TRANSFORMER.

- | ITEM | QTY | DESCRIPTION  |
|------|-----|--|
| 1    | 3   | *HV BUSHING, G.E. TYPE U, #11B410BB, 138 KV, 800 A, 1.5-12 NF W/NEMA 4-HOLE SPADE TERMINAL.                    |
| 2    | 3   | *LV BUSHING, G.E. TYPE U, #17B600BB, 69 KV, 400-1200 A, 1.5-12 NF W/NEMA 4-HOLE SPADE TERMINAL.                |
| 3    | 1   | *HV & LV NEUTRAL BUSHING, G.E. TYPE U, #17B300BB, 34.5 KV, 400-1200 A, 1.5-12 NF W/NEMA 4-HOLE SPADE TERMINAL. |
| 4    | 3   | *TV BUSHING, G.E. TYPE A, #1B579BB, 15 KV, 600A, 1.125-12 NF, W/NEMA 4-HOLE SPADE TERMINAL.                    |
| 5    | 3   | HV LIGHTNING ARRESTER, 98 KV, OHIO BRASS #VS216098.  |
| 6    | 3   | LV LIGHTNING ARRESTER, 48 KV, OHIO BRASS #VS216048.  |
| 7    | 3   | *TV LIGHTNING ARRESTER, 12.7 KV, OHIO BRASS # VL216013.  |
| 8    | 1   | LOAD TAP CHANGER COMPARTMENT.  |
| 9    | 1   | PREVENTIVE AUTO TRANSFORMER COMPARTMENT.   |
| 10   | 1   | SERIES TRANSFORMER COMPARTMENT.  |
| 11   | 1   | CONTROL CABINET SPLIT TYPE W/REMOVABLE BOTTOM, PROVISION FOR PADLOCKING HINGED DOOR.                           |
| 12   | 1   | TAP CHANGER MECHANISM FOR HV WINDING FOR DE-ENERGIZED OPERATION ONLY. PADLOCKING PROVISION IN ANY POSITION.    |
| 13   | 1   | HANDHOLE FOR HV TAP CHANGER SHAFT.   |
| 14   | 1   | NAMEPLATE.   |
| 15   | 10  | *COOLING FANS, 60 HZ, 230 V, 1 Ø. (POWER REQUIREMENT 2.7 KW)   |
| 16   | 6   | *REMOVABLE RADIATORS W/DRAIN PLUG MOUNTED ON SHUT-OFF VALVES.  |
| 17   | 2   | PRESSURE TEST, 0.25 NPT FEMALE W/PLUG.   |
| 18   | 1   | LIQUID TEMPERATURE INDICATOR W/ADJUSTABLE CONTACTS.  |
| 19   | 1   | WINDING TEMPERATURE INDICATOR W/ADJUSTABLE CONTACTS FOR AUTOMATIC FAN OPERATION.                               |
| 20   | 2   | MAGNETIC LIQUID LEVEL GAGE W/LOW LEVEL ALARM CONTACTS, ONE ON MAIN TANK AND ONE ON LTC.                        |
| 21   | 2   | 1" UPPER FILTER VALVE, ONE ON MAIN TANK & ONE ON LTC.  |
| 22   | 2   | 2" DRAIN VALVE W/SAMPLER, ONE ON MAIN TANK AND ONE ON LTC.   |
| 23   | 1   | GAS SAMPLING VALVE 0.25".  |
| 24   | 1   | REGULATOR VALVE 0.25".   |
| 25   | 1   | PRESSURE VACUUM GAGE.  |
| 26   | 1   | PRESSURE VACUUM BLEEDER.   |
| 27   | 1   | SEALED WELL FOR BULB OF LIQUID TEMPERATURE INDICATOR.  |
| 28   | 1   | SEALED WELL FOR BULB OF WINDING TEMPERATURE INDICATOR.   |
| 29   | 1   | COVER WELDED.  |
| 30   | 4   | MANHOLE 21 INCH ROUND OPENING, 3 ON MAIN TANK AND 1 ON SERIES TANK.  |
| 31   | 1   | CURRENT TRANSFORMER LEAD JUNCTION BOX.   |
| 32   | 1   | SUDDEN PRESSURE RELAY.   |
| 33   | 2   | PRESSURE RELIEF DEVICE, ONE ON MAIN TANK AND ONE ON LTC.   |
| 34   | 1   | 2" NPT MALE CONNECTION FOR VACUUM FILLING.   |
| 35   | 4   | GROUND PAD - (2) 0.5-13 FEMALE THREAD, 1.75 CENTER TO CENTER.  |
| 36   | 1   | CORE GROUND DISCONNECT ACCESSIBLE THROUGH MANHOLE  |
| 37   | 4   | LIFTING LUG FOR LIFTING COVER ONLY.  |
| 38   | 4   | LIFTING LUG FOR LIFTING COMPLETE UNIT.   |
| 39   | 4   | JACKING LUGS.  |
| 40   | 1   | PLUGGED OPENING FOR MANUAL CRANK OPERATION OF LTC.   |
| 41   | 1   | TAP POSITION INDICATOR.  |
| 42   | 1   | LTC BLEEDER.   |
| 43   | 1   | LTC SUMP DRAIN VALVE 0.5".   |
| 44   | 1   | CHANNEL BASE - SEE BASE DETAIL.  |
| 45   | 3   | 0.25 x 2 COPPER BUS BAR.   |
| 46   | 11  | LIGHTNING ARRESTER & NEUTRAL GROUND CONDUCTOR-4/0 BARE CU CABLE.   |
| 47   | 1   | SERIES TRANSFORMER CORE GROUND ACCESSIBLE THROUGH MANHOLE  |

LTR.	REVISIONS	BY	DATE	APPV.
1	REVISE BASE TO CONT. CAB. DIM. WAS 14"	GL	7-1-83	FM
2	GENERAL REVISIONS	KB	7/7/83	FM
3	RELOCATE NAMEPLATE	GL	7-14-83	



ITEM	QTY.	MATERIAL	WT.
H. K. PORTER COMPANY, INC. ELECTRICAL DIVISION 1777 INDUSTRIAL WAY, BELMONT, CALIFORNIA 94602			
<b>TITLE</b> AUTO TRANSFORMER OUTLINE			
<b>DRN.</b> BY: GLOFTON CHKD: J. J. ANDERSON	<b>SCALE</b> NONE	<b>D</b> -30-E-7179	<b>3</b>
<b>DATE</b> 6-30-83	<b>DATE</b> 6-30-83	<b>DRAWING NO.</b> D-30-E-7179	<b>REV.</b> 3

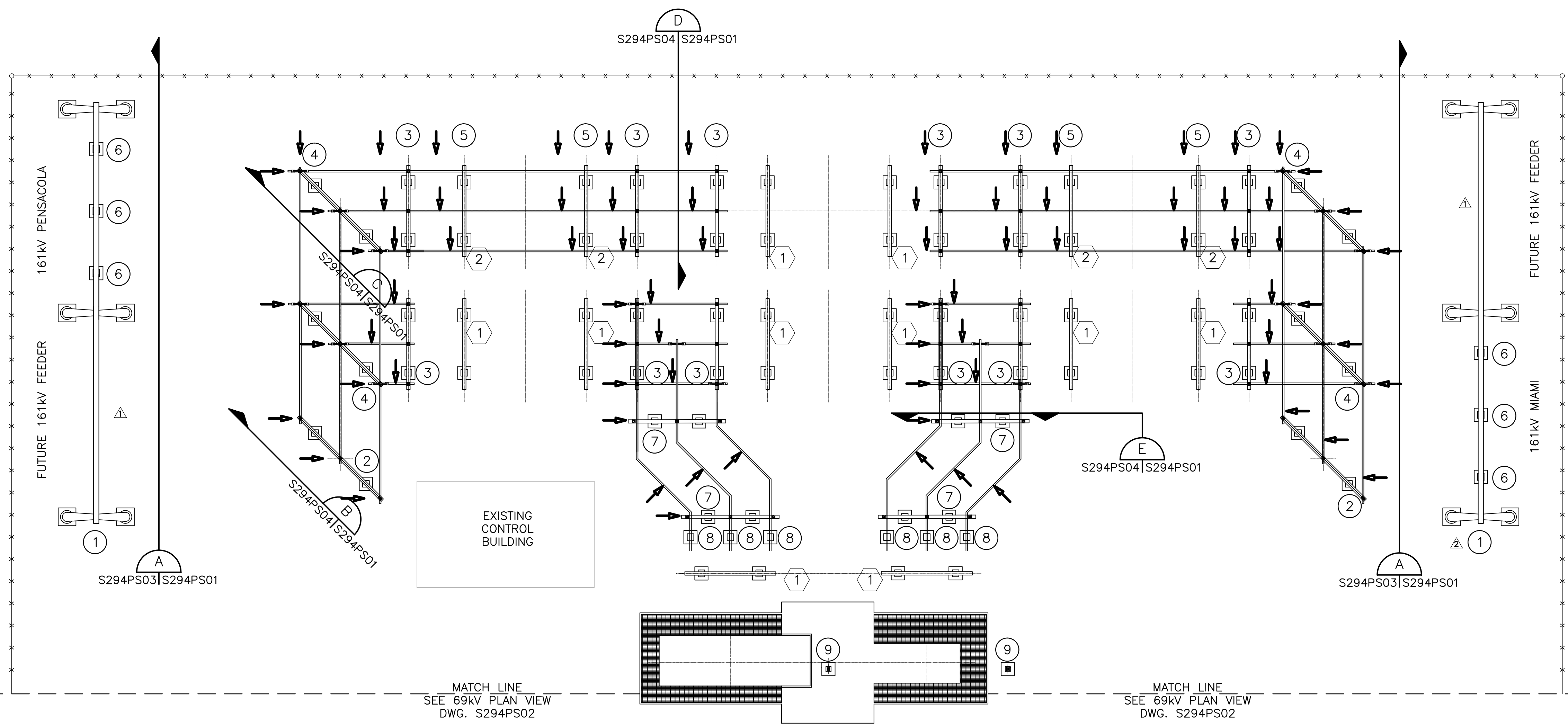
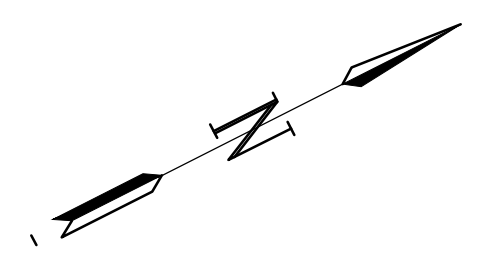
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
**TRANSFORMER #2**  
**ORIGINAL OUTLINE**

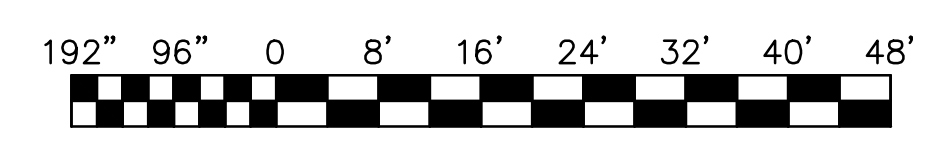
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		CH: BA	DATE: 30APR12
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		<b>DRAWING No.</b> <b>S294PX20</b>	<b>REV.</b> <b>0</b>

## Afton Substation

S294PS01	161kV STEEL PLAN VIEW
S294PS02	69kV STEEL PLAN VIEW
S294PS03	161kV DEAD-END STRUCTURE VIEW A & END VIEW
S294PS04	161kV BUS SUPPORT STRUCTURE VIEW B, C, D, & E
S294PS05	69kV DEAD-END STRUCTURE VIEW F & END VIEW
S294PS06	69kV BKR STRUCTURE VIEW G & END VIEW
S294PS07	69kV TRANSFORMER FDR BAY STRUCTURE VIEW H
S294PS08	69kV TRANSFORMER FDR BAY STRUCTURE VIEW J & K
S294PS09	69kV BKR STRUCTURE VIEW L
S294PS10	STEEL DETAILS SHEET 1 OF 5
S294PS11	STEEL DETAILS SHEET 2 OF 5
S294PS12	STEEL DETAILS SHEET 3 OF 5
S294PS13	STEEL DETAILS SHEET 4 OF 5
S294PS14	STEEL DETAILS SHEET 5 OF 5
S294PS15	161kV SWITCH STAND
S294PS16	161kV DEAD-END STRUCTURE TENSION LOADS
S294PS17	69kV DEAD-END STRUCTURE TENSION LOADS
S294PS18	161kV DEAD-END STRUCTURE VERTICAL LOADS
S294PS19	161kV BUS SUPPORT STRUCTURE VERTICAL LOADS
S294PS20	69kV DEAD-END VIEW F VERTICAL LOADS
S294PS21	69kV BKR STRUCTURE VIEW G VERTICAL LOADS
S294PS22	69kV TRANSFORMER FDR BAY STRUCTURAL VIEW H V.L.
S294PS23	69kV TRANSFORMER FDR BAY STRUCTURE VIEW J & K V.L.
S294PS24	69kV BKR STRUCTURE VIEW L VERTICAL LOADS
S294PS25	69Kv Switch Stand Vertical Break Switch



**LEGEND**  
 → WIND LOADING DIRECTION  
 SEE NOTE 1 & 2.



**STRUCTURE NUMBERS**

- ① 161kV DEADEND STRUCTURE, QTY. 2, SEE S294PS03
- ② 161kV ANGLED BUS SUPPORT-HIGH, QTY. 2, SEE S294PS04
- ③ 161kV BUS SUPPORT, QTY. 12, SEE S294PS04
- ④ 161kV ANGLED BUS SUPPORT-LOW, QTY. 4, SEE S294PS04
- ⑤ 161kV BUS SUPPORT (FUTURE SWITCH LOCATION), QTY. 4. SEE DWG. S294PS04
- ⑥ CCVT STANDS, QTY. 6, SEE S294PS03
- ⑦ 161kV BUS SUPPORT-NARROW, QTY. 4, SEE S294PS04
- ⑧ CCVT STAND, QTY. 6, SEE S294PS04
- ⑨ TERMINATION STAND, QTY. 2, SEE S294PS04

**NOTES:**

1. STEEL MANUFACTURER SHALL DESIGN STEEL FOR A WIND LOADING OF 218.8 LBS PLUS ELECTRICAL FAULT LOADING FOR 161kV OF 60 LBS. THE LOADINGS SHALL BE APPLIED AT EACH BUS SUPPORT IN ANY DIRECTION.
2. WIND LOADING IS SHOWN IN ONE DIRECTION PERPENDICULAR TO THE BUS. WIND SHALL BE CONSIDERED IN ANY ONE DIRECTION AND ELECTRICAL FAULT LOADING SHALL BE ADDITIVE TO WIND LOADING.

**KEYED NOTES:**

- ① SWITCH MOUNTING STEEL PROVIDED BY SWITCH MANUFACTURER. VERIFY FOUNDATIONAL DIMENSIONS WITH SWITCH MANUFACTURER SHOP DRAWINGS.
- ② FOUNDATION DIMENSIONS FOR THESE FOUNDATIONS TO MATCH 161kV SWITCH MANUFACTURERS SHOP DRAWINGS. FABRICATE THESE 161kV BUS SUPPORTS TO FIT FOUNDATIONS.

**REFERENCE DRAWINGS**

- S294PS02 69kV STEEL PLAN VIEW
- S294PS03 161kV DEAD-END STRUCTURE VIEW A & END VIEW
- S294PS04 161kV BUS SUPPORT STRUCTURE VIEW B, C, D, & E
- S294PS10 STEEL DETAILS
- S294PS11 STEEL DETAILS

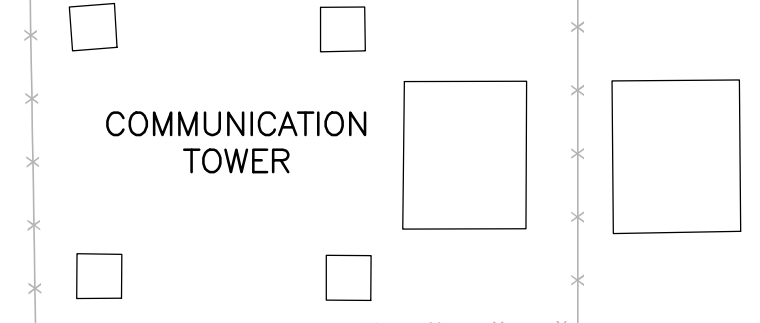
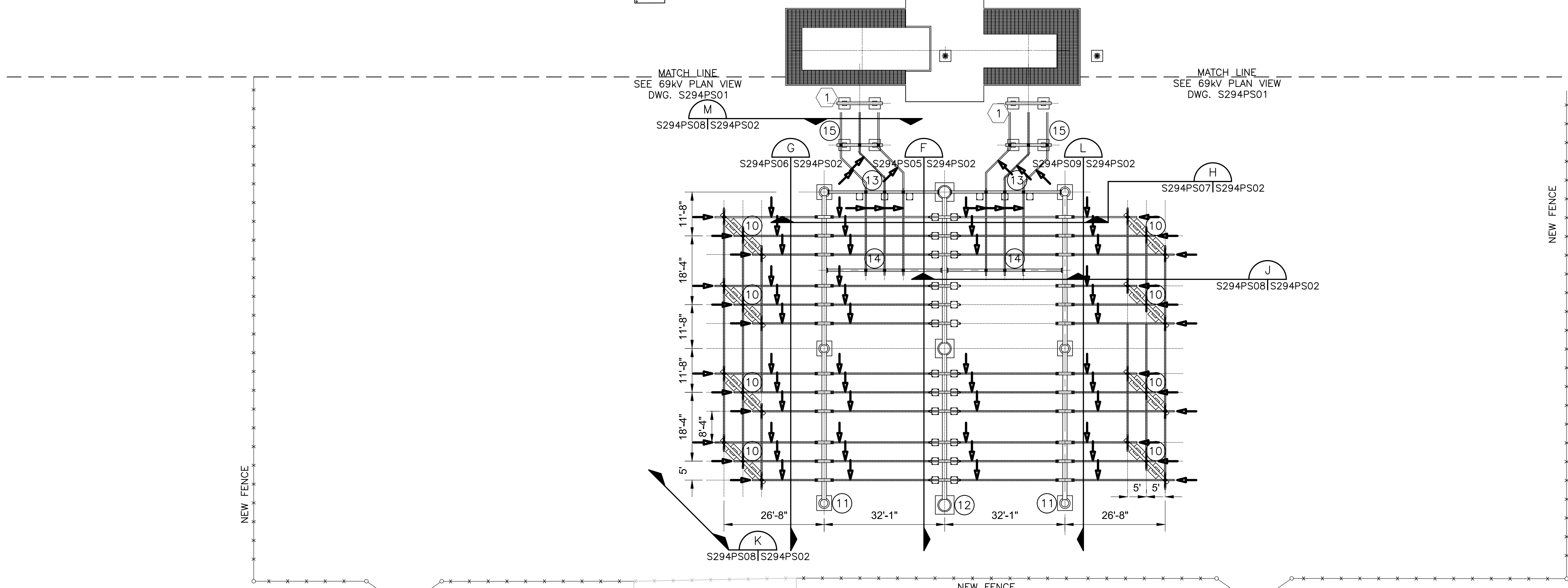
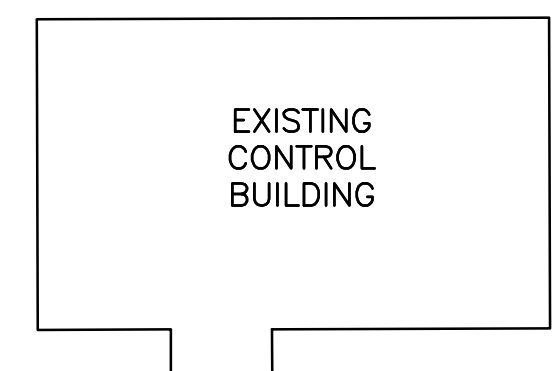
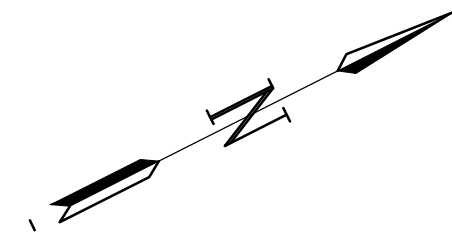
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b>			
<b>AFTON SUBSTATION</b>		S294	
AFTON, OKLAHOMA			
161/69kV			
<b>161kV</b>			
<b>STEEL PLAN VIEW</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PS01	REV. 0

0	5/11/12	ISSUED FOR BID	JT	BA
REV	DATE	REVISION DESCRIPTION	DFT	ENG

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**LEGEND**  
 → WIND LOADING DIRECTION  
 SEE NOTE 1 & 2.

**KEYED NOTES:**  
 1 SWITCH MOUNTING STEEL PROVIDED BY SWITCH MANUFACTURER.  
 VERIFY FOUNDATION DIMENSIONS WITH SWITCH MANUFACTURER SHOP DRAWINGS.

**NOTES:**  
 1. STEEL MANUFACTURER SHALL DESIGN STEEL FOR A WIND LOADING OF 218.8 LBS PLUS ELECTRICAL FAULT LOADING FOR 69kV OF 93.75LBS. THE LOADINGS SHALL BE APPLIED AT EACH BUS SUPPORT IN ANY DIRECTION.  
 2. WIND LOADING IS SHOWN AS A WORSE CASE CONDITION, PERPENDICULAR TO THE BUS. WIND SHALL BE CONSIDERED IN ANY ONE DIRECTION AND ELECTRICAL FAULT LOADING SHALL BE ADDITIVE TO WIND LOADING.

**REFERENCE DRAWINGS**

- S294PS01 161kV STEEL PLAN VIEW
- S294PS05 69kV DEAD-END STRUCTURE VIEW F & END VIEW
- S294PS06 69kV BREAKER STRUCTURE VIEW G & END VIEW
- S294PS07 69kV TRANSFORMER FDR BAY STRUCTURE VIEW H
- S294PS08 69kV TRANSFORMER FDR BAY STRUCTURE VIEW J & VIEW K
- S294PS09 69kV BREAKER STRUCTURE VIEW L
- S294PS10 STEEL DETAILS
- S294PS11 STEEL DETAILS

**STRUCTURE NUMBERS**

- 10 69kV BUS SUPPORT STRUCTURE, QTY. 8, SEE S294PS08
- 11 69kV BREAKER STRUCTURE, QTY. 2, SEE S294S06
- 12 69kV DEADEND STRUCTURE, QTY. 1, SEE S294S05
- 13 69kV CCVT MOUNT STRUCTURE, QTY. 2, SEE S294PS07
- 14 69kV XFMR FDR BAY BUS SUPPORT STRUCTURE, QTY. 2, SEE S294PS08
- 15 69kV BUS SUPPORT, QTY. 2.



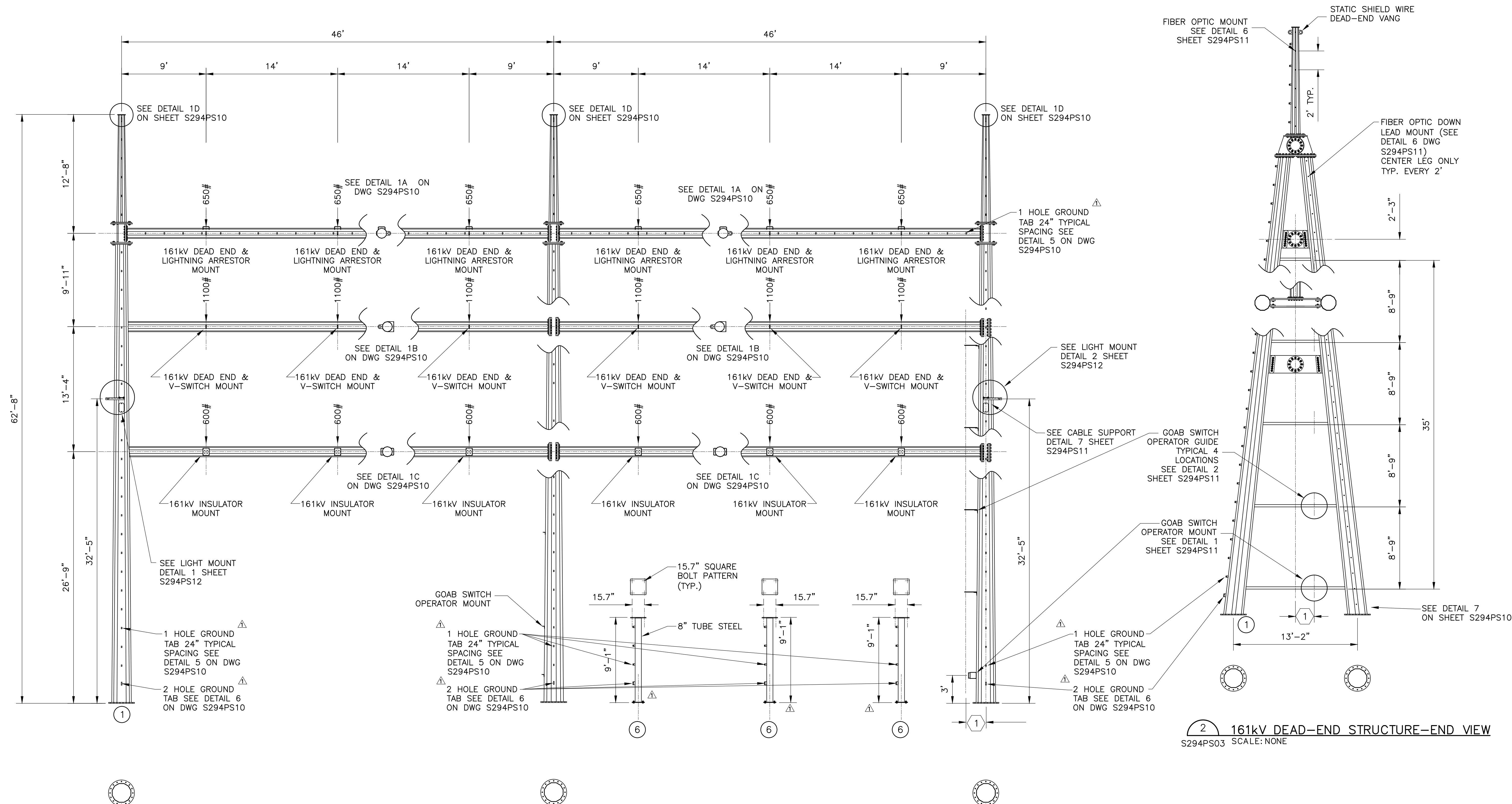
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b>			
<b>AFTON SUBSTATION</b>		S294	
AFTON, OKLAHOMA 161/69kV			
<b>69kV</b> <b>STEEL PLAN VIEW</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PS02	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA

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1 161kV DEAD-END STRUCTURE (QTY. 2)-VIEW A  
 S294PS01/S294PS03 SCALE: NONE

2 161kV DEAD-END STRUCTURE-END VIEW  
 S294PS03 SCALE: NONE

**REFERENCE DRAWINGS**

S294PS01	161kV STEEL PLAN VIEW
S294PS10	STEEL DETAILS SHEET 1 OF 5
S294PS11	STEEL DETAILS SHEET 2 OF 5
S294PS12	STEEL DETAILS SHEET 3 OF 5
S294PS16	161kV DEAD-END STRUCTURE TENSION LOADS

**STRUCTURE NUMBERS**

1	161kV DEADEND STRUCTURE, QTY 2, SEE S294PS01
6	CCVT STANDS, QTY 6, SEE S294PS01

**KEYED NOTES:**

1 VERIFY DIMENSIONS WITH SWITCH MANUFACTURER SHOP DRAWINGS.

**NOTES:**

- SECTION VIEWS ARE FROM RIGHT LOOKING LEFT AND FROM TOP LOOKING DOWN.
- LOADINGS ARE ACTUAL EQUIPMENT WEIGHTS, UNFACTORED.

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA

**ISSUED FOR BID**

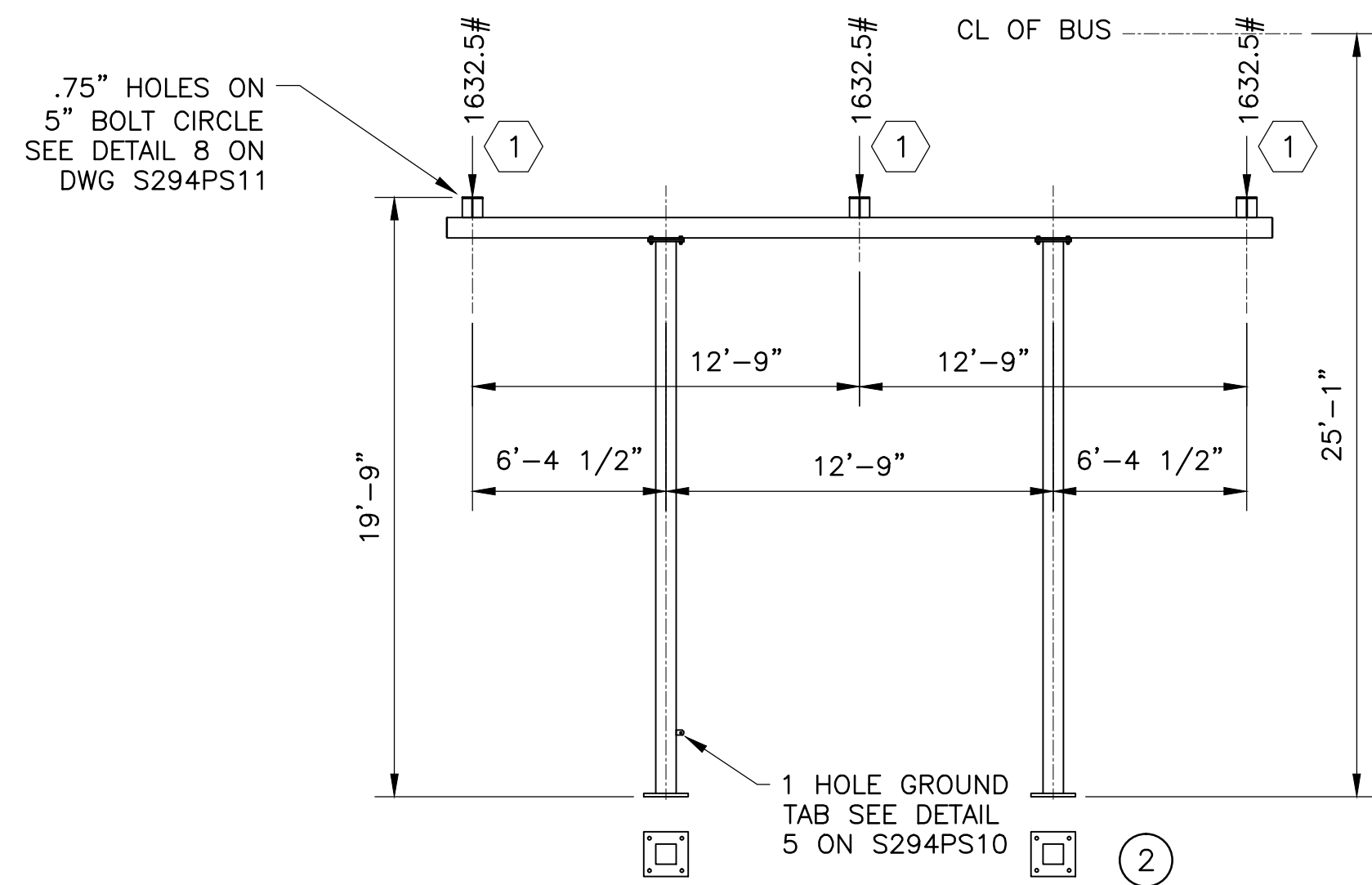
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

161kV DEAD-END STRUCTURE  
 VIEW A & END VIEW

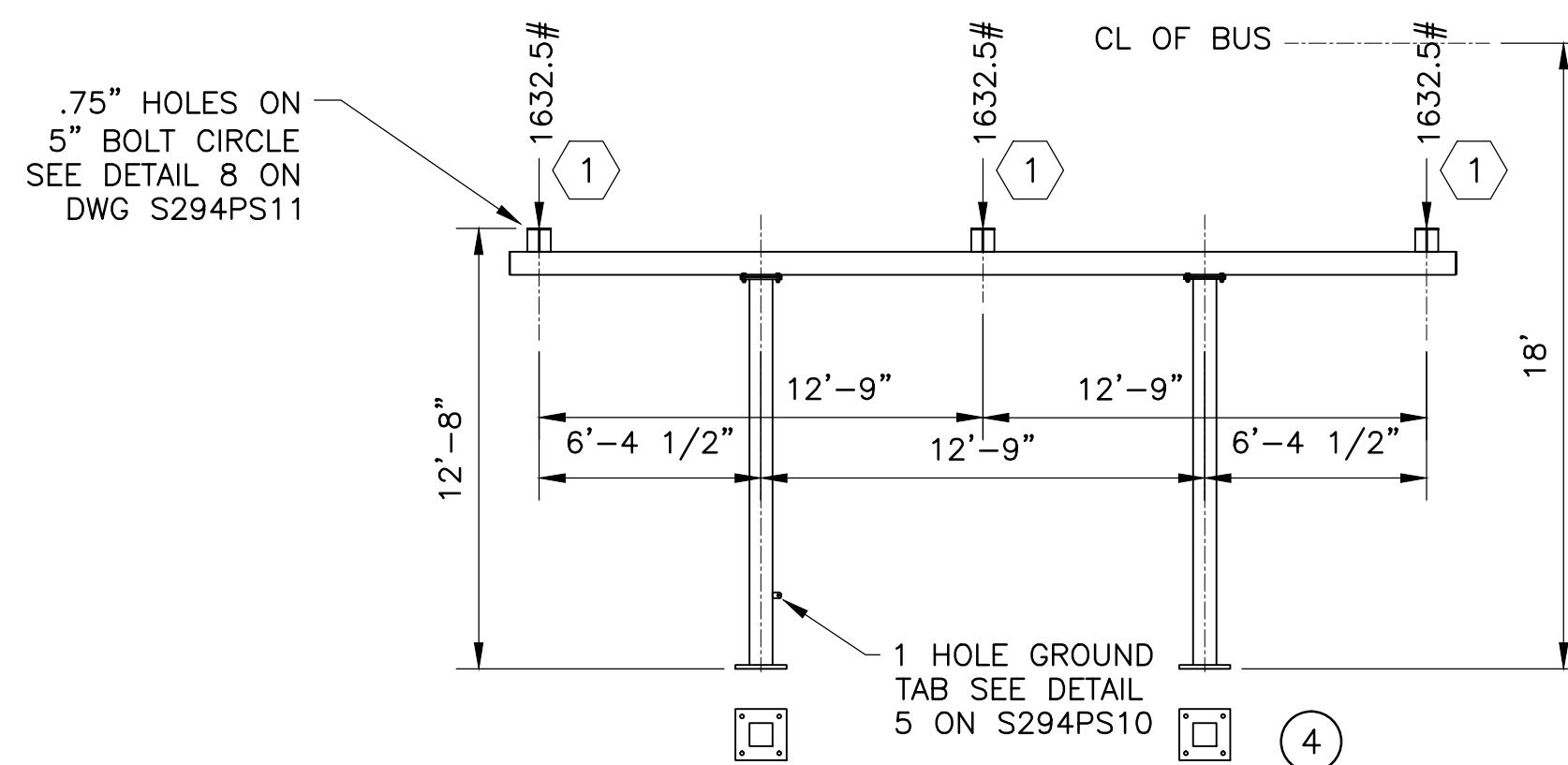
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CH: MW	DATE: 3/7/2011	DRAWING No. S294PS03	REV. 0

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

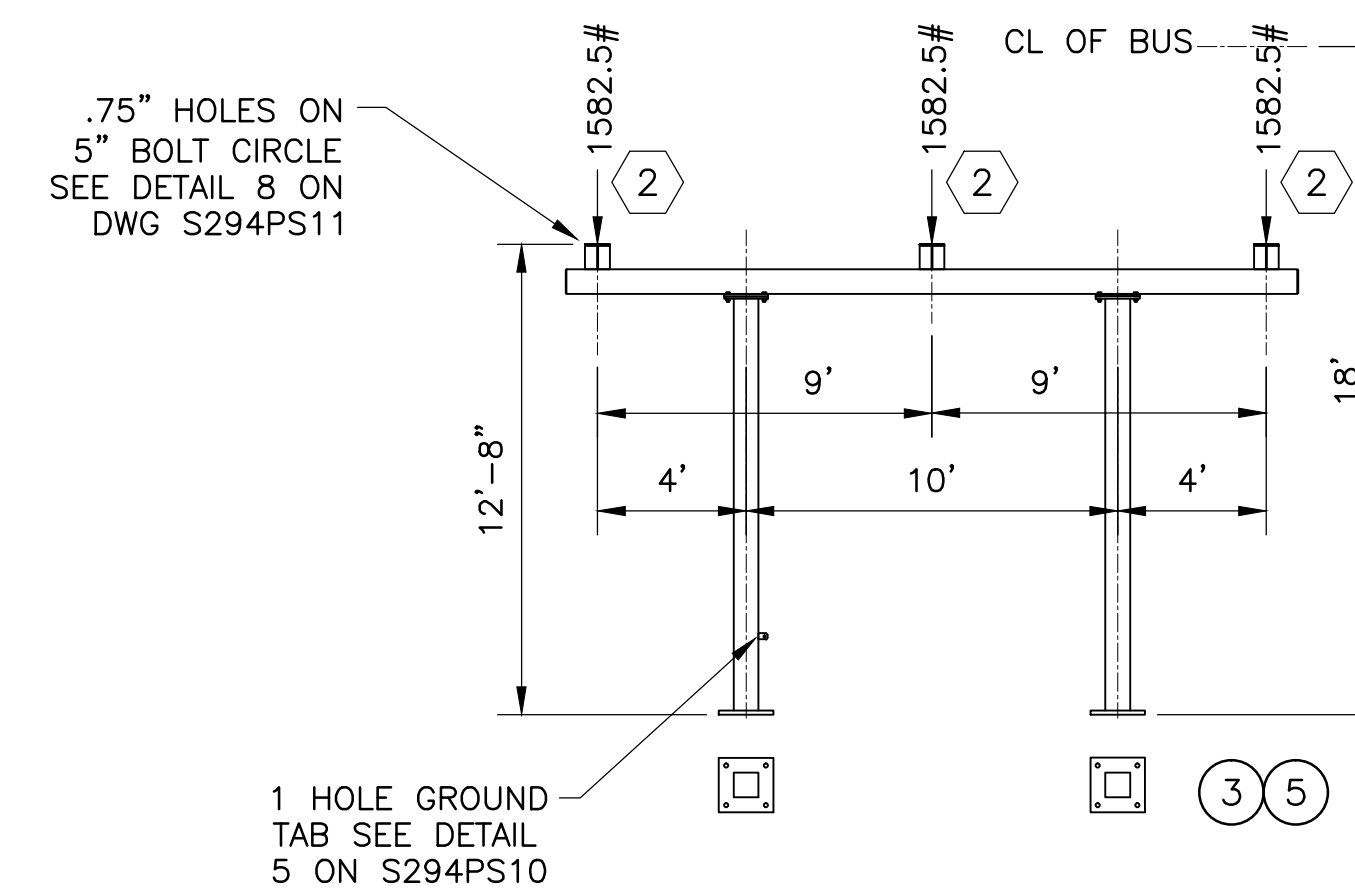
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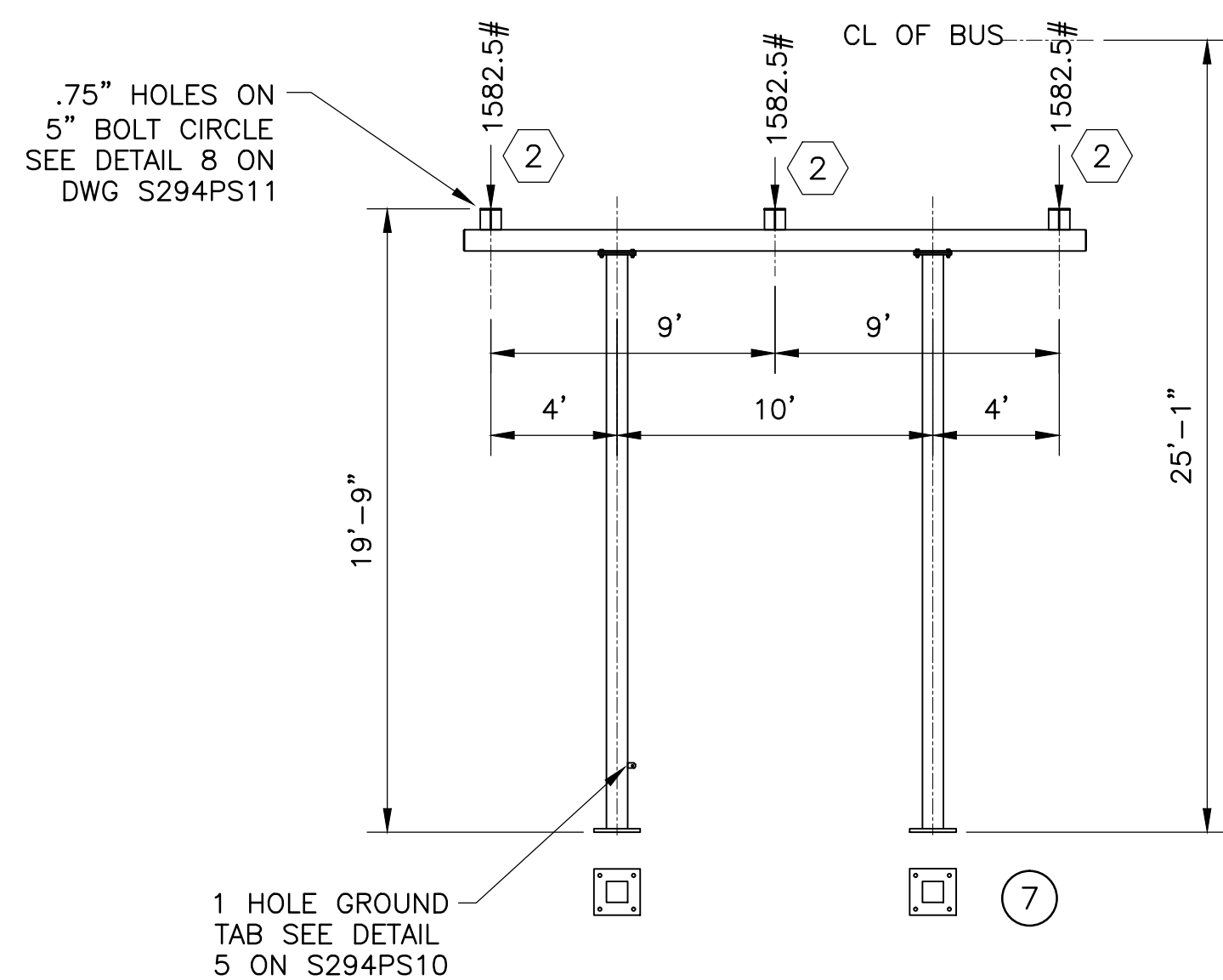
1 161kV ANGLED BUS SUPPORT-HIGH VIEW B  
S294PS01|S294PS04 SCALE: NONE



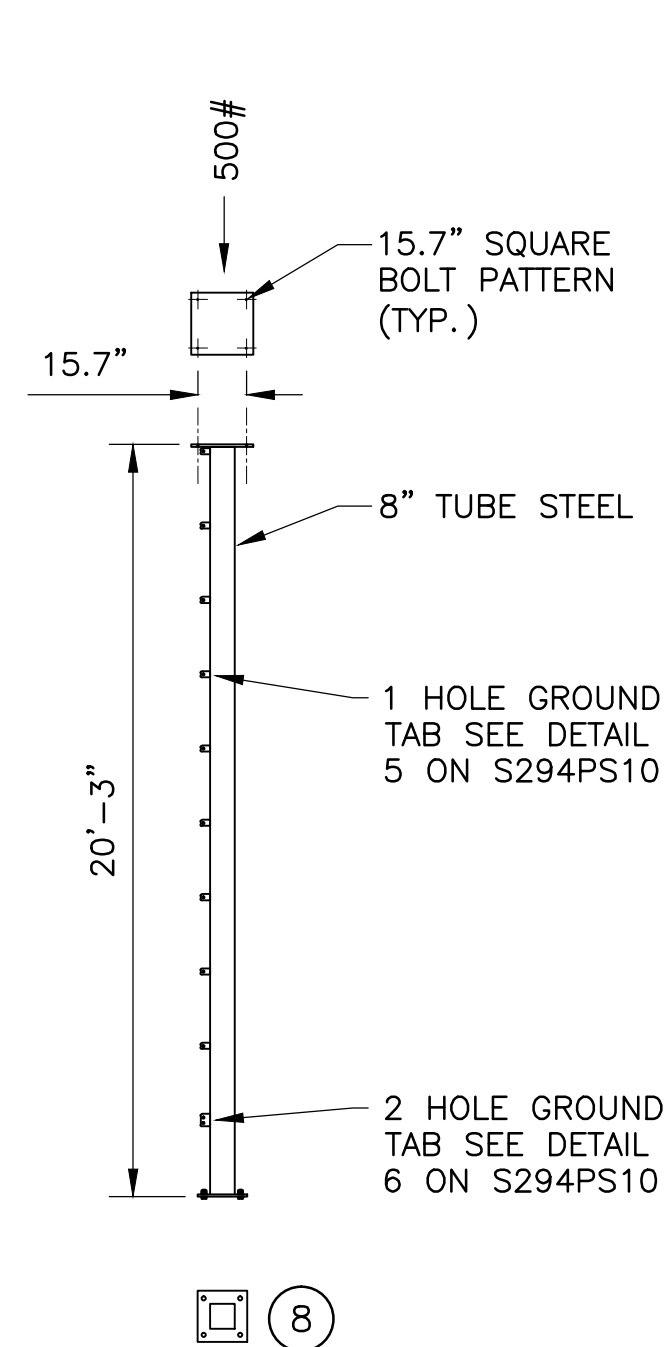
2 161kV ANGLED BUS SUPPORT-LOW VIEW C  
S294PS01|S294PS04 SCALE: NONE



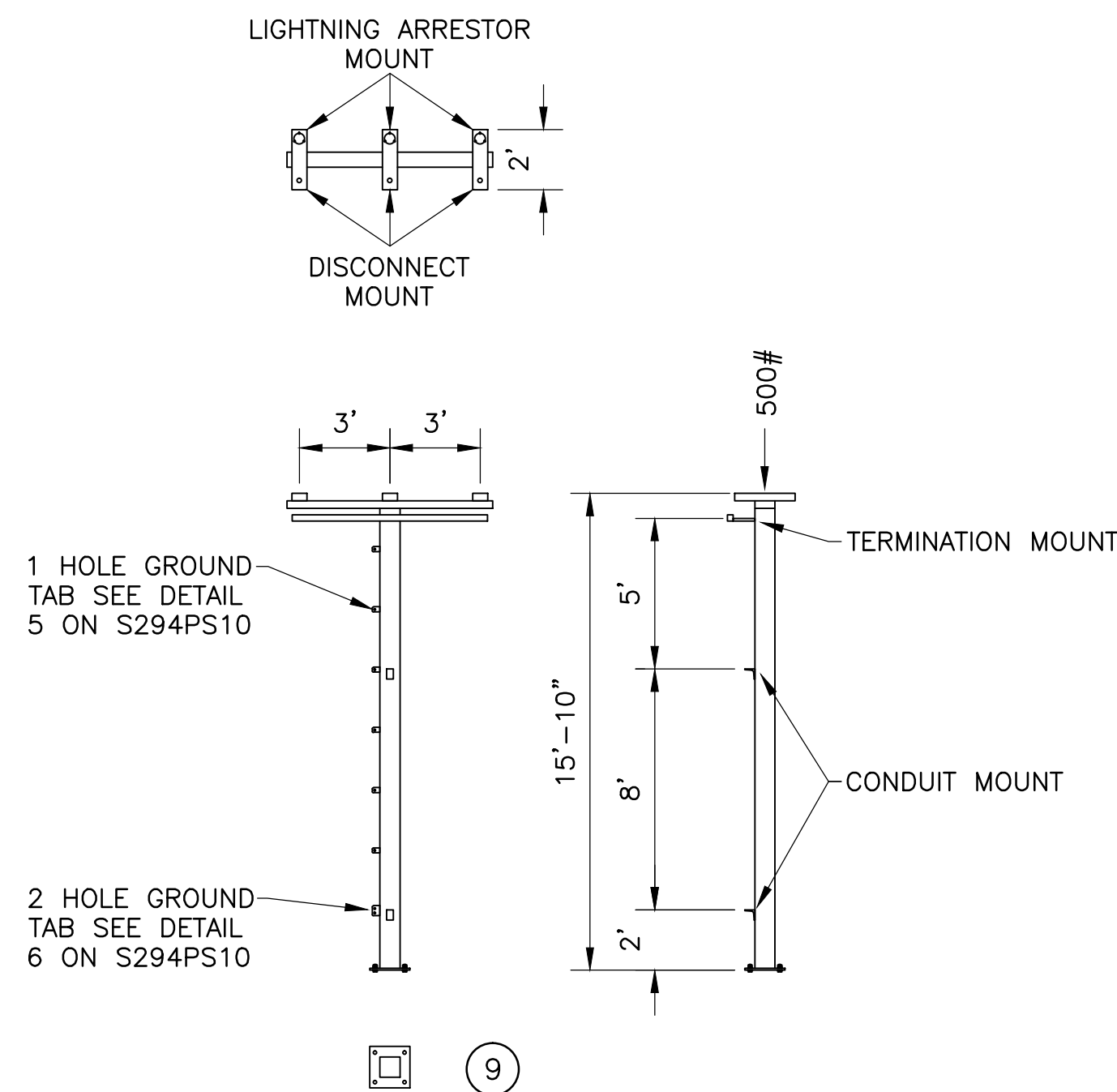
3 161kV BUS SUPPORT VIEW D  
S294PS01|S294PS04 SCALE: NONE



4 161kV BUS SUPPORT-NARROW VIEW E  
S294PS01|S294PS04 SCALE: NONE



5 CCVT STAND  
S294PS04|S294PS04 SCALE: NONE



6 TERMINATION STAND  
S294PS04|S294PS04 SCALE: NONE

**NOTES:**

- ALL LOADINGS ARE UNFACTORED.

**KEYED NOTES:**

- 1 INDICATES 500LBS. EQUIPMENT WEIGHT PLUS 1132.5LBS FOR 2" RADIAL ICE AND BUS WEIGHT.
- 2 INDICATES 450LBS. EQUIPMENT WEIGHT PLUS 1132.5LBS FOR 2" RADIAL ICE AND BUS WEIGHT.

**STRUCTURE NUMBERS**

- 2 161kV ANGLED BUS SUPPORT-HIGH, QTY. 2, SEE S294PS01
- 3 5 161kV BUS SUPPORT, QTY. 16, SEE S294PS01
- 4 161kV ANGLED BUS SUPPORT-LOW, QTY. 4, SEE S294PS01
- 7 161kV BUS SUPPORT-NARROW, QTY. 4, SEE S294PS01
- 8 CCVT STAND, QTY. 6, SEE S294PS01
- 9 TERMINATION STAND, QTY. 2, SEE S294PS01

**REFERENCE DRAWINGS**

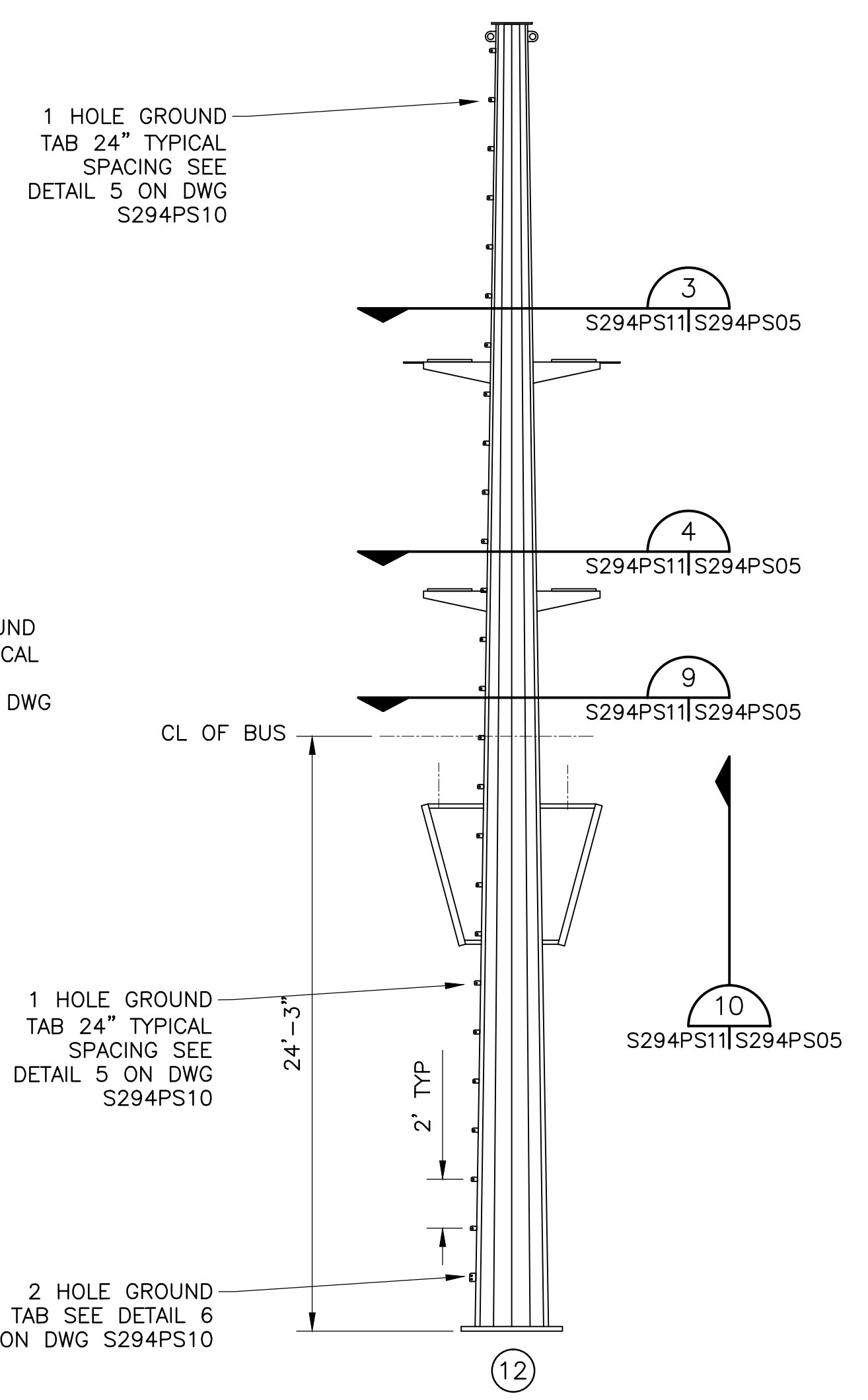
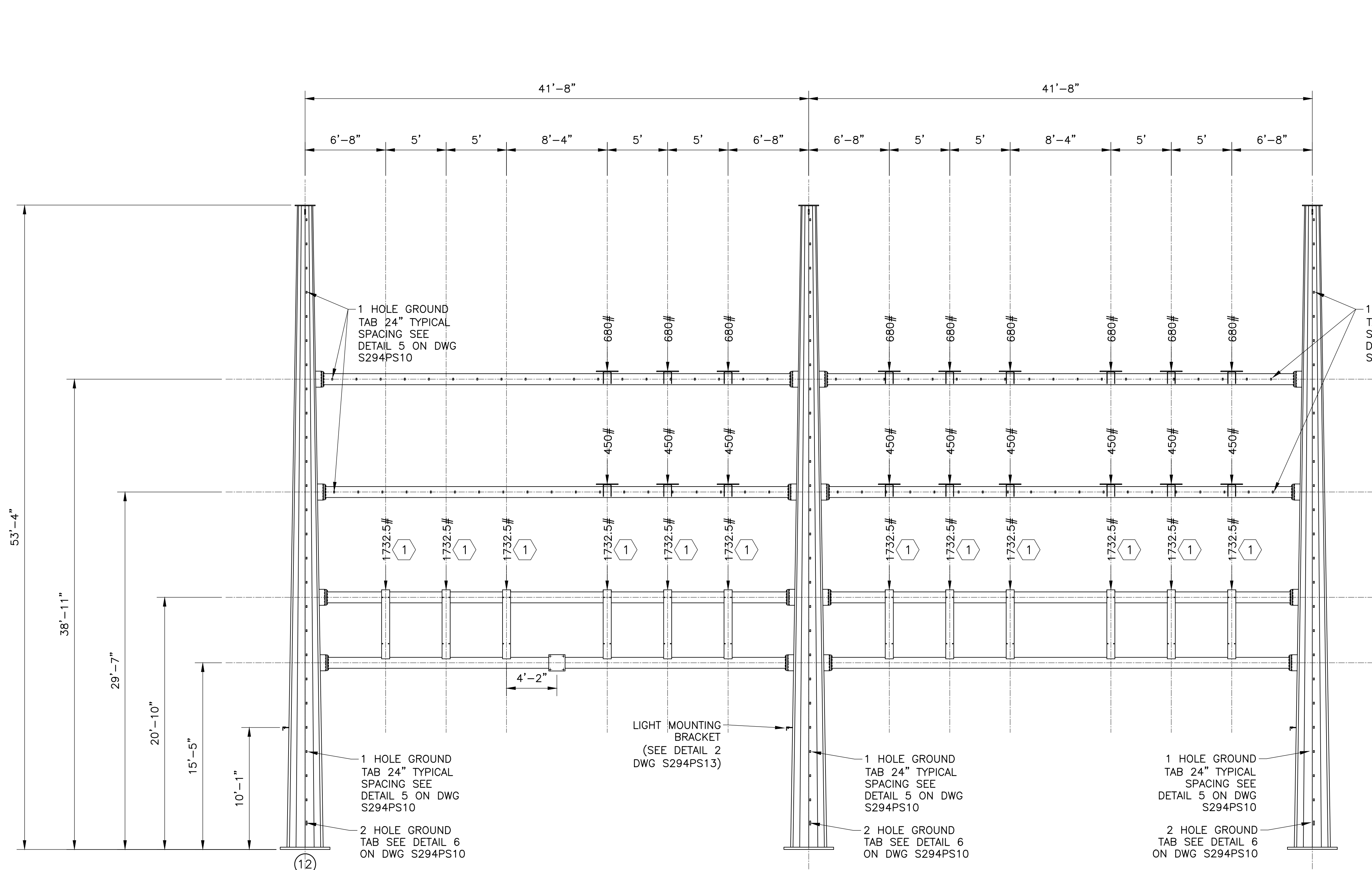
- S294PS01 161kV STEEL PLAN VIEW
- S294PS10 STEEL DETAILS SHEET 1 OF 5
- S294PS11 STEEL DETAILS SHEET 2 OF 5

REV	DATE	ISSUED FOR BID	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID		JT	BA

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>161kV BUS SUPPORT STRUCTURE</b> <b>VIEW B, C, D, E, &amp; F</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW	DATE: 3/7/2011		
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			DRAWING No. <b>S294PS04</b>
			REV. <b>0</b>

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1 69kV DEAD-END STRUCTURE VIEW F  
 S294PS02|S294PS05 SCALE: NONE

2 69kV DEAD-END STRUCTURE END VIEW  
 S294PS05 SCALE: NONE

**REFERENCE DRAWINGS**

S294PS02	69kV STEEL PLAN VIEW
S294PS10	STEEL DETAILS SHEET 1 OF 5
S294PS11	STEEL DETAILS SHEET 2 OF 5
S294PS13	STEEL DETAILS SHEET 3 OF 5

**STRUCTURE NUMBERS**

<span style="border: 1px solid black; border-radius: 50%; padding: 2px;">12</span>	69kV DEADEND STRUCTURE, QTY 1, SEE S294PS02
--	---

**NOTES:**

- LOADINGS ARE UNFACTORED.

**KEYED NOTES:**

1 INDICATES 600LBS. EQUIPMENT WEIGHT PLUS 1132.5LBS. FOR 2" RADIAL ICE AND BUS WEIGHT.

**ISSUED FOR BID**

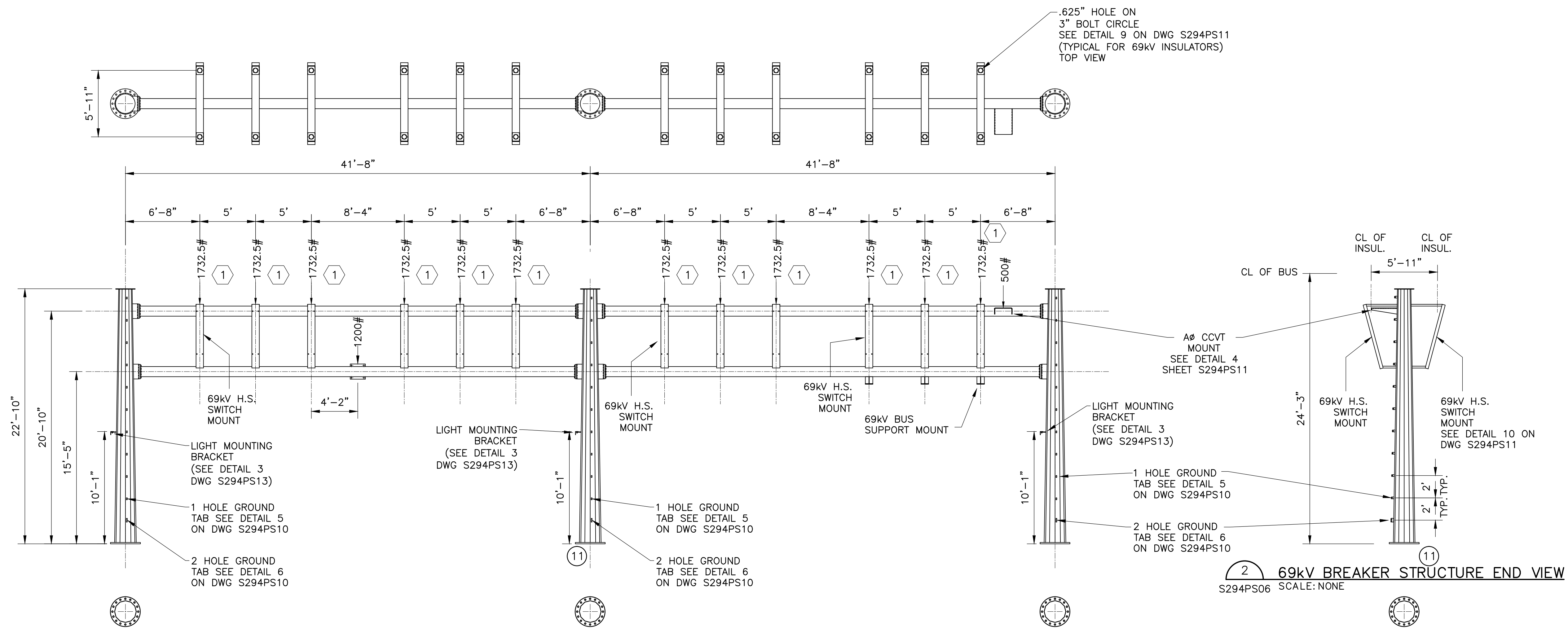
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69kV

69kV DEAD-END STRUCTURE  
 VIEW F & END VIEW

SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW	DATE: 3/7/2011		
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REV	DATE	ISSUED FOR BID	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID		JT	BA

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2 69kV BREAKER STRUCTURE END VIEW  
S294PS06 SCALE: NONE

REFERENCE DRAWINGS

- S294PS02 69kV STEEL PLAN VIEW
- S294PS10 STEEL DETAIL SHEET 1 OF 5
- S294PS11 STEEL DETAIL SHEET 2 OF 5
- S294PS13 STEEL DETAIL SHEET 4 OF 5

1 69kV BREAKER STRUCTURE VIEW G  
S294PS02|S294PS06 SCALE: NONE

STRUCTURE NUMBERS

- 11 69kV BREAKER STRUCTURE, QTY. 2, SEE S294PS02

NOTES:

- 1. LOADINGS ARE UNFACTORED.

KEYED NOTES:

- 1 INDICATES 600LBS. EQUIPMENT WEIGHT PLUS 1132.5LBS. FOR 2" RADIAL ICE AND BUS WEIGHT.

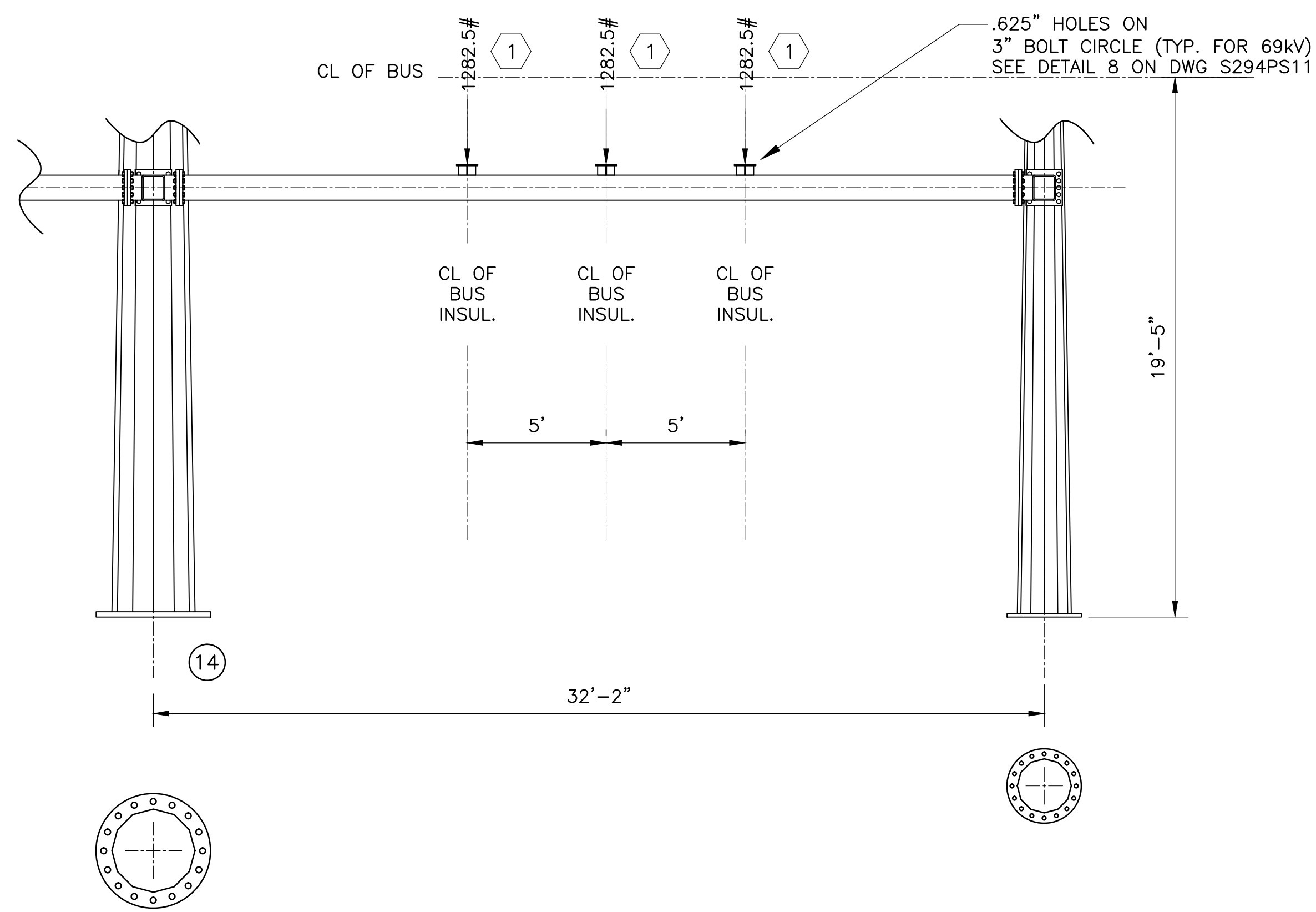
ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 1616/69kV			
69kV BREAKER STRUCTURE VIEW G & END VIEW			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BRF
CH: MWSRF		DATE: 3/7/2011	
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			DRAWING No. <b>S294PS06</b> REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA



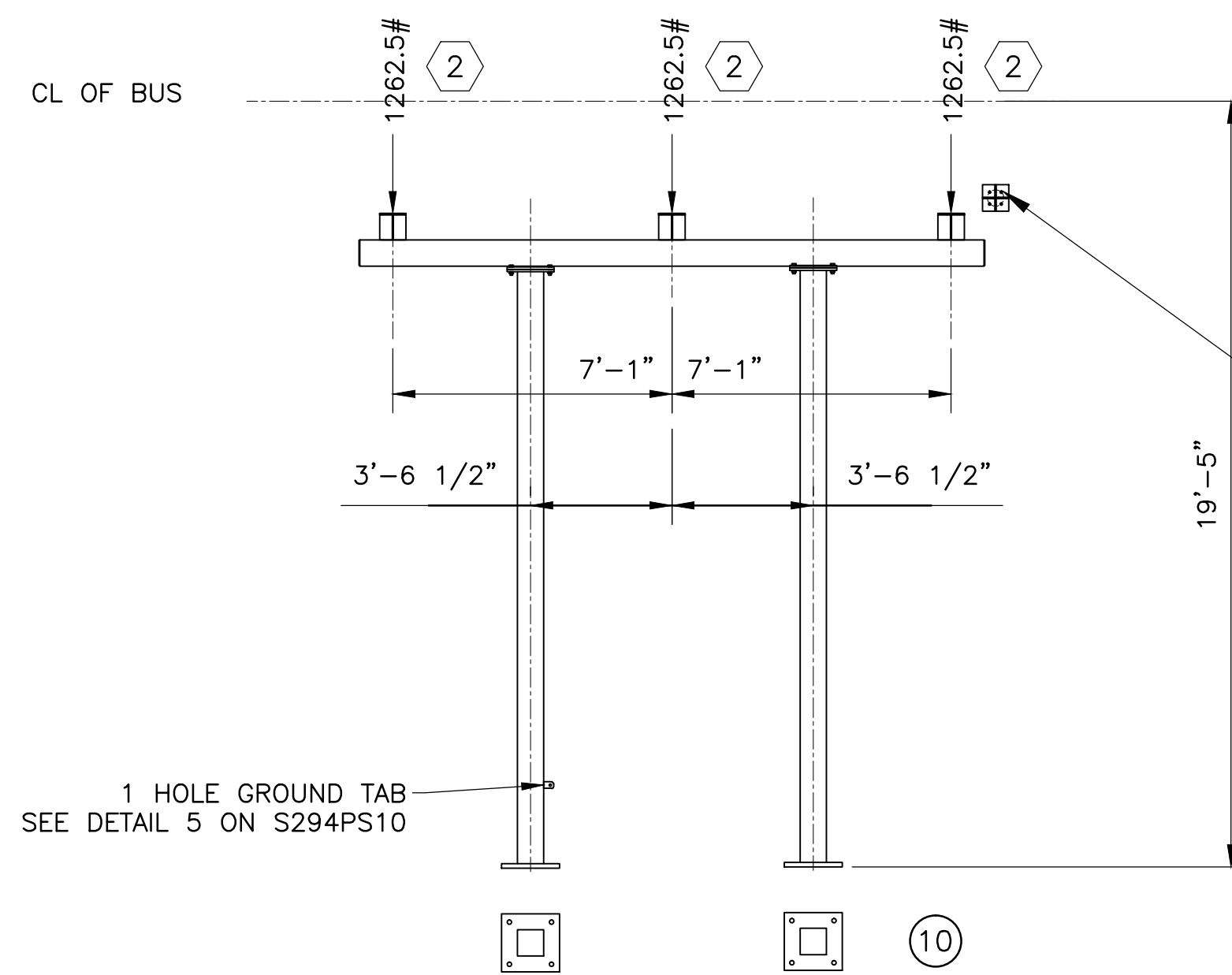
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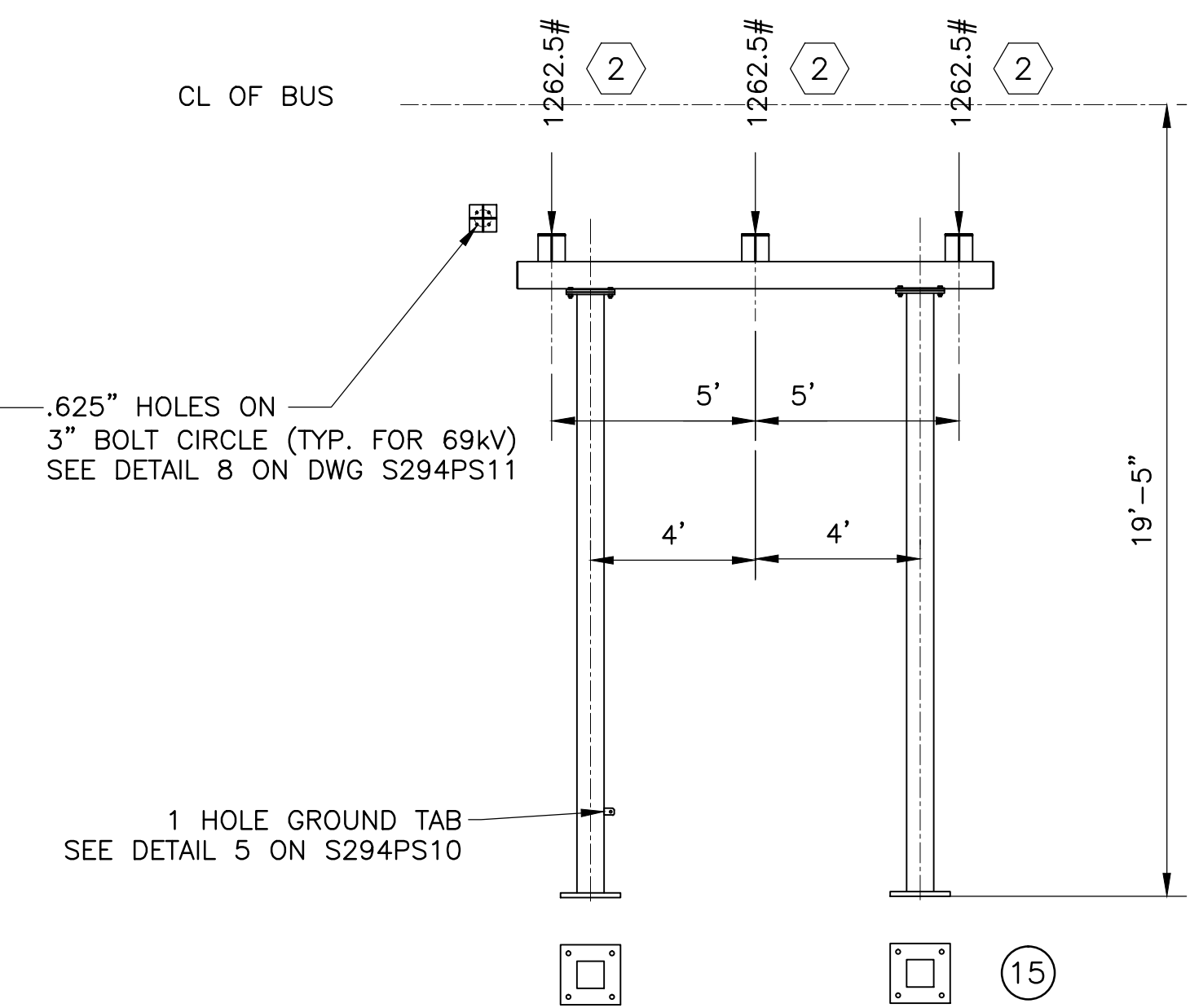
**1** 69kV TRANSFORMER FEEDER BAY STRUCTURE VIEW J  
 S294PS02|S294PS08 SCALE: NONE

REFERENCE DRAWINGS

S294PS02	69kV STEEL PLAN VIEW
S294PS10	STEEL DETAILS SHEET 1 OF 5
S294PS11	STEEL DETAILS SHEET 2 OF 5



**2** 69kV BUS SUPPORT STRUCTURE VIEW K  
 S294PS02|S294PS08 SCALE: NONE



**2** 69kV BUS SUPPORT STRUCTURE VIEW M  
 S294PS02|S294PS08 SCALE: NONE

**NOTES:**

1. LOADS ARE UNFACTORED.

**KEYED NOTES:**

- 1** INDICATES 150LBS. EQUIPMENT WEIGHT PLUS 1132.5LBS. FOR 2" RADIAL ICE AND BUS WEIGHT.
- 2** INDICATES 130LBS. EQUIPMENT WEIGHT PLUS 1132.5LBS. FOR 2" RADIAL ICE AND BUS WEIGHT.

**STRUCTURE NUMBERS**

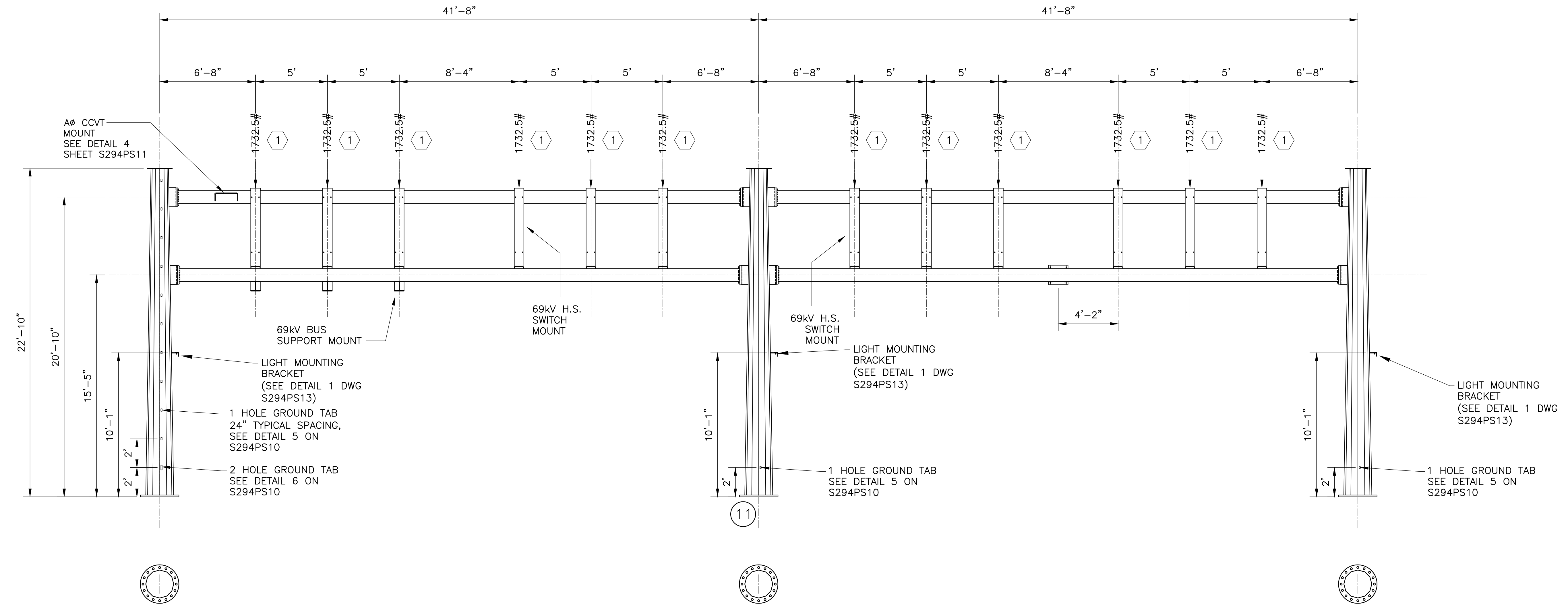
- 10** 69kV BUS SUPPORT STRUCTURE, QTY. 8, SEE S294PS02
- 14** 69kV XFMR FDR BAY BUS SUPPORT STRUCTURE, QTY. 2 SEE S294PS02
- 15** 69kV BUS SUPPORT STRUCTURE, QTY. 2 SEE S294PS02

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69KV</small>			
<b>69kV TRANSFORMER FDR BAY STRUCTURE VIEW J &amp; VIEW K</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
		DRAWING No. S294PS08	REV. 0
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA

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 Last Plotted by: Trundle, Jimmy Plot Style: Garver\_Standard Half.ctb Plot Scale: 1:2 Plot Date: 5/29/2012 12:55 PM Plotter used: \\gltps01\UT\_IR\_C5185\_PS3\_East\_Tech\_Area



1 69kV BREAKER STRUCTURE VIEW L  
 S294PS02\S294PS09 SCALE: NONE

NOTES:  
 1. LOADINGS ARE UNFACTORED.

KEYED NOTES:  
 1 INDICATES 600LBS. EQUIPMENT WEIGHT PLUS 1132.5LBS. FOR 2" RADIAL ICE AND BUS WEIGHT.

REFERENCE DRAWINGS

S294PS02	69kV STEEL PLAN VIEW
S294PS11	STEEL DETAILS SHEET 2 OF 5
S294PS13	STEEL DETAILS SHEET 4 OF 5

STRUCTURE NUMBERS

11	69kV BREAKER STRUCTURE, QTY. 2, SEE S294PS02
----	--

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69kV

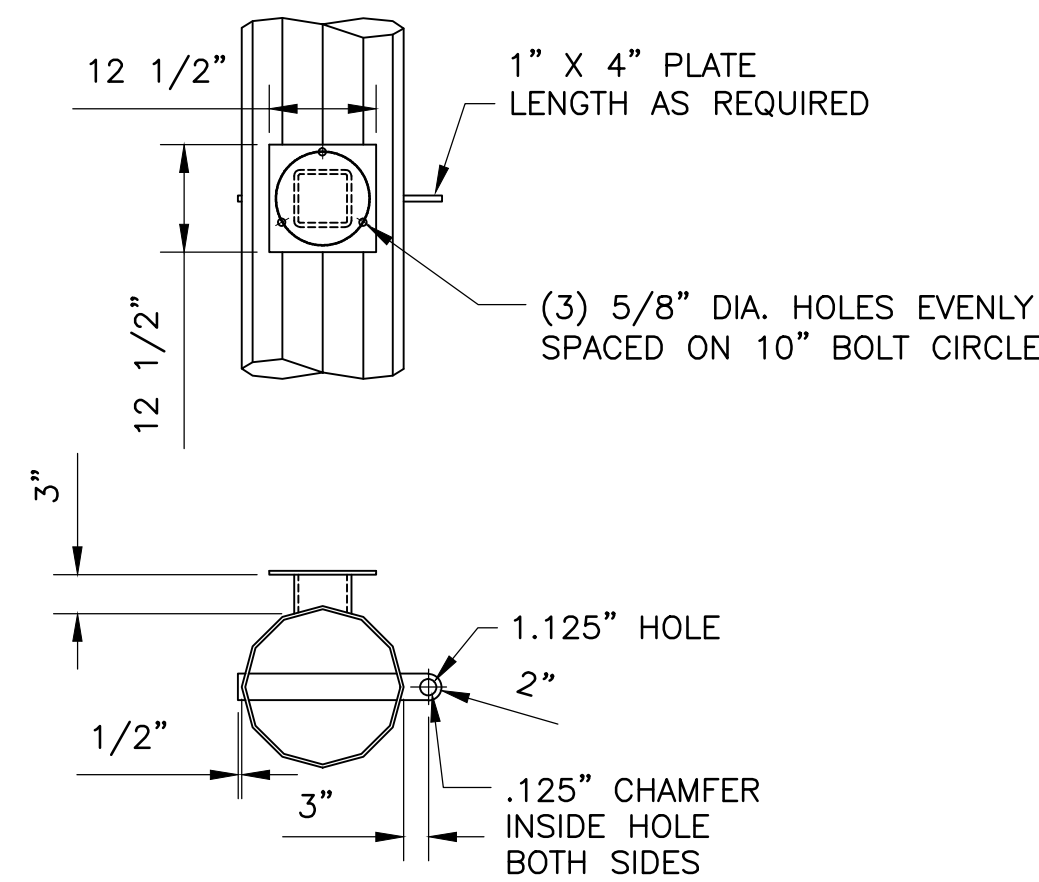
69kV BREAKER STRUCTURE  
 VIEW L

SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW	DATE: 3/7/2011	DRAWING No. S294PS09	
		REV. 0	

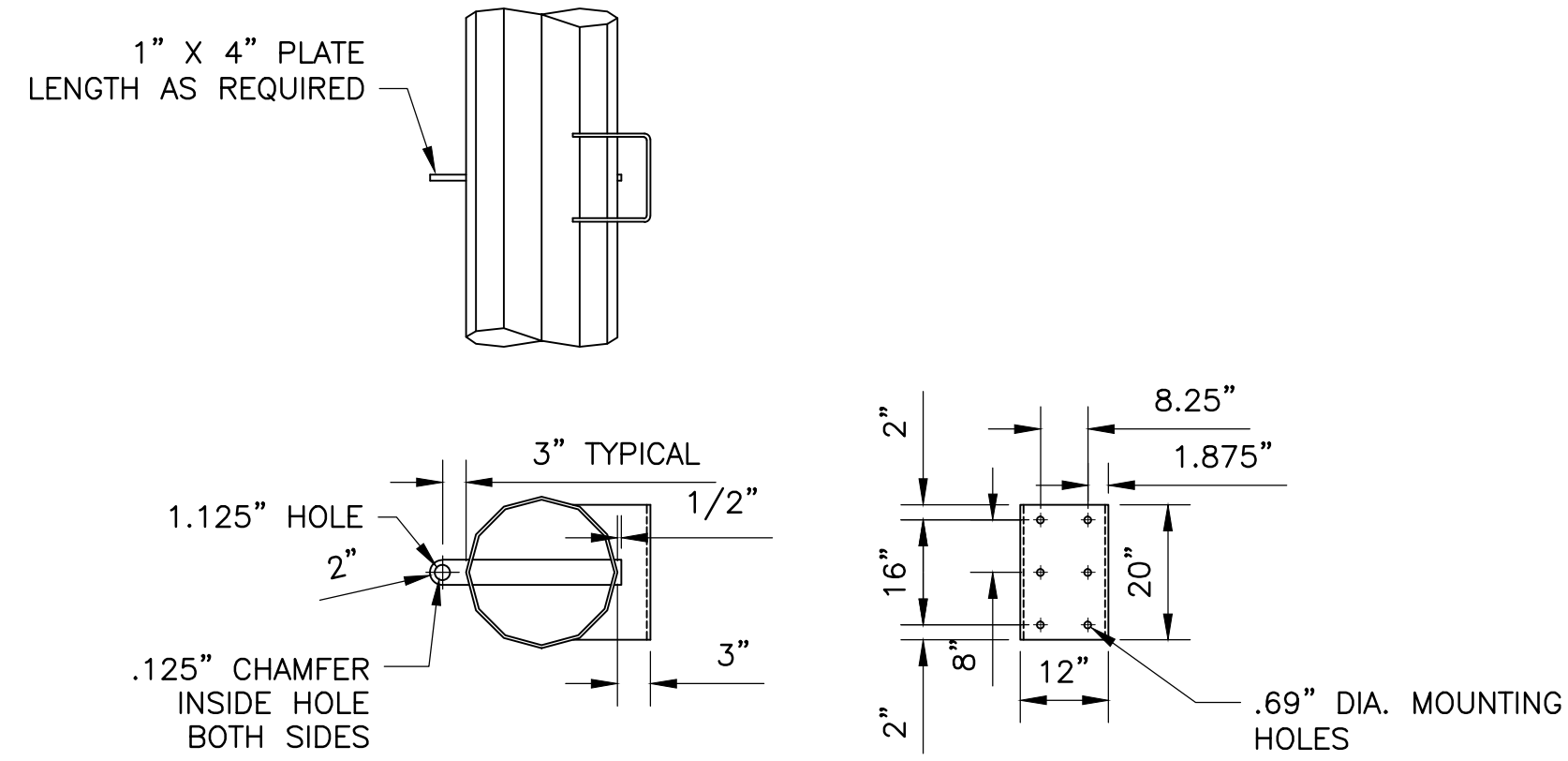
REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA



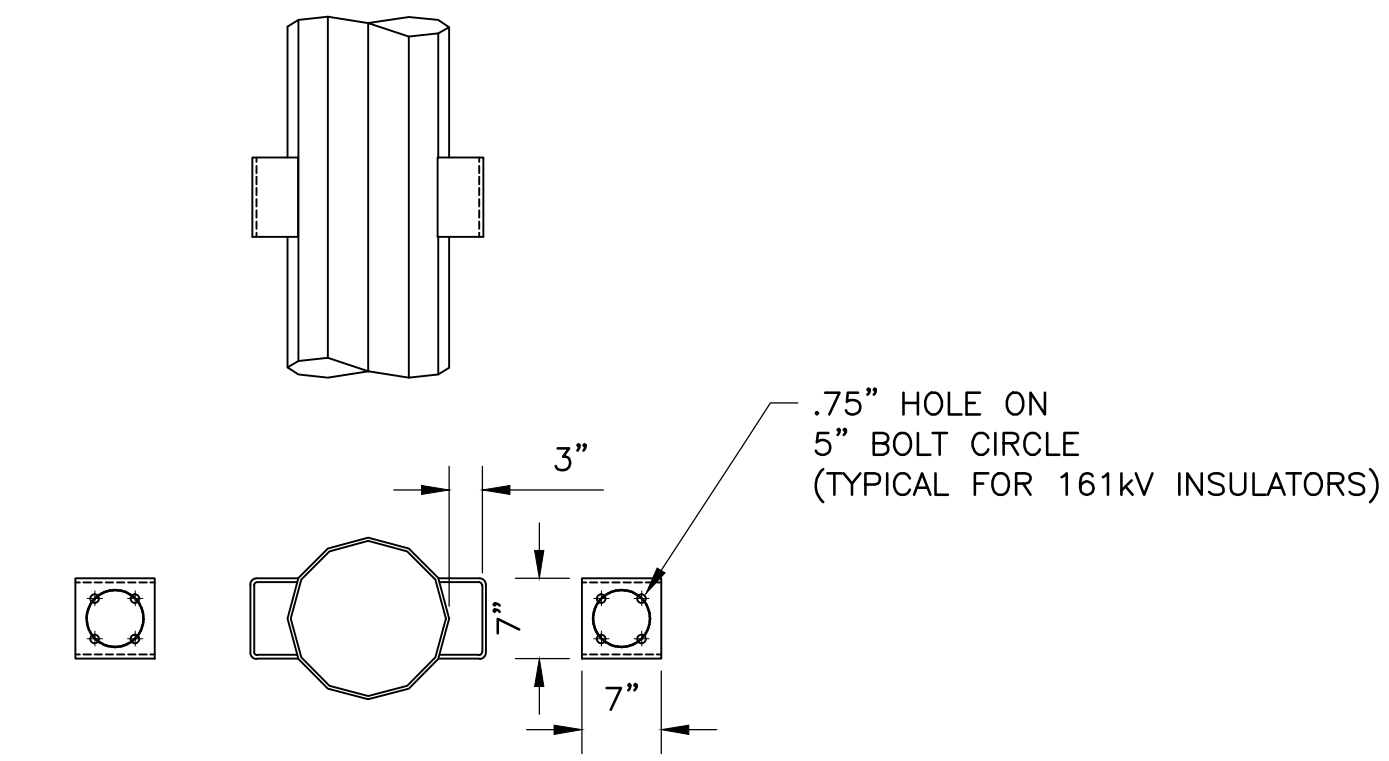
File: G:\Substation\AFTON\CAD Drawings 2-16-12\S294PS10 STEEL DETAILS SHEET 1 OF 5.dwg Last\_Saved\_by: DJRogers  
 Last\_Plotting\_by: Trundle, Jimmy\_Plot\_Style: Carver\_Standard Half.ctb Plot\_Scale: 1:2 Plot\_Date: 5/29/2012 12:58 PM Plotter\_used: \\Gltips01\LT\_IR\_C5185\_P53\_East\_Tech\_Area



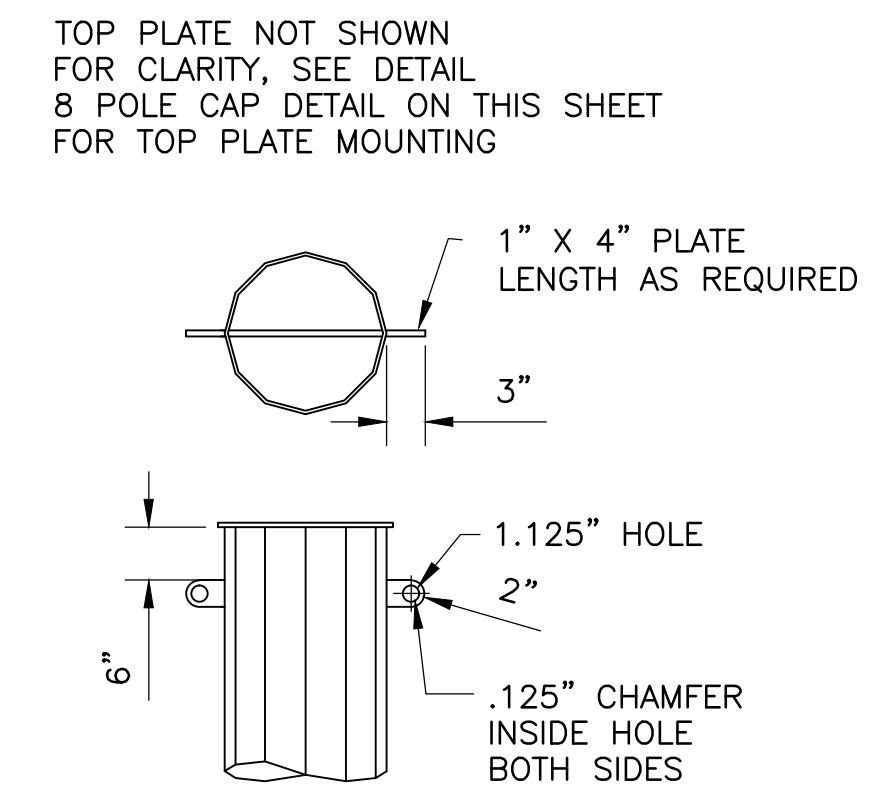
1 1A-161kV D.E./L.A. MOUNT  
S294PS03|S294PS10 SCALE: NONE



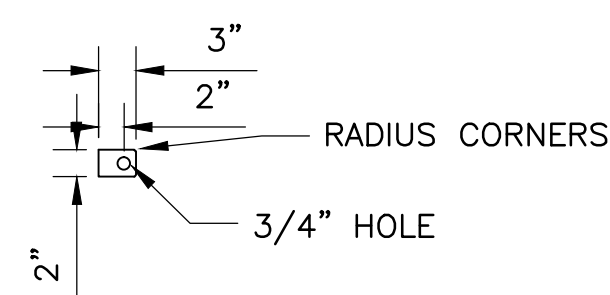
2 1B-161kV V-SWITCH MOUNT/STRAIN BUS D.E.  
S294PS03|S294PS10 SCALE: NONE



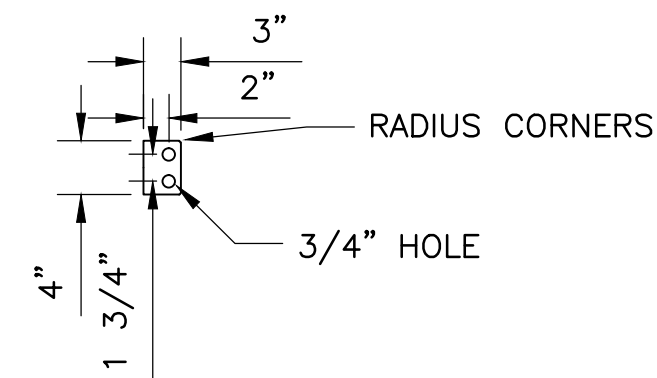
3 1C-JUMPER INSULATOR MOUNTS  
S294PS03|S294PS10 SCALE: NONE



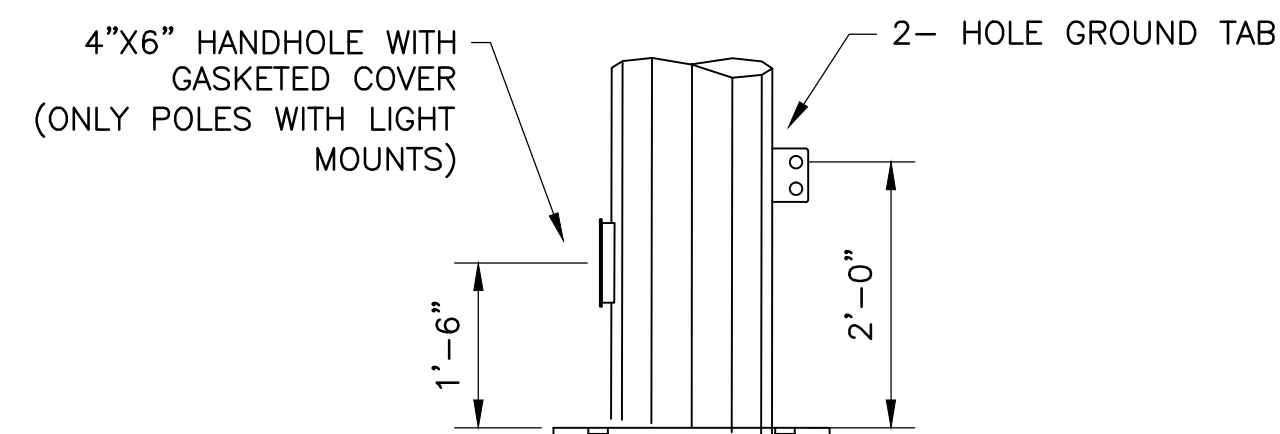
4 1D-OVERHEAD STATIC DEADEND  
S294PS03|S294PS10 SCALE: NONE



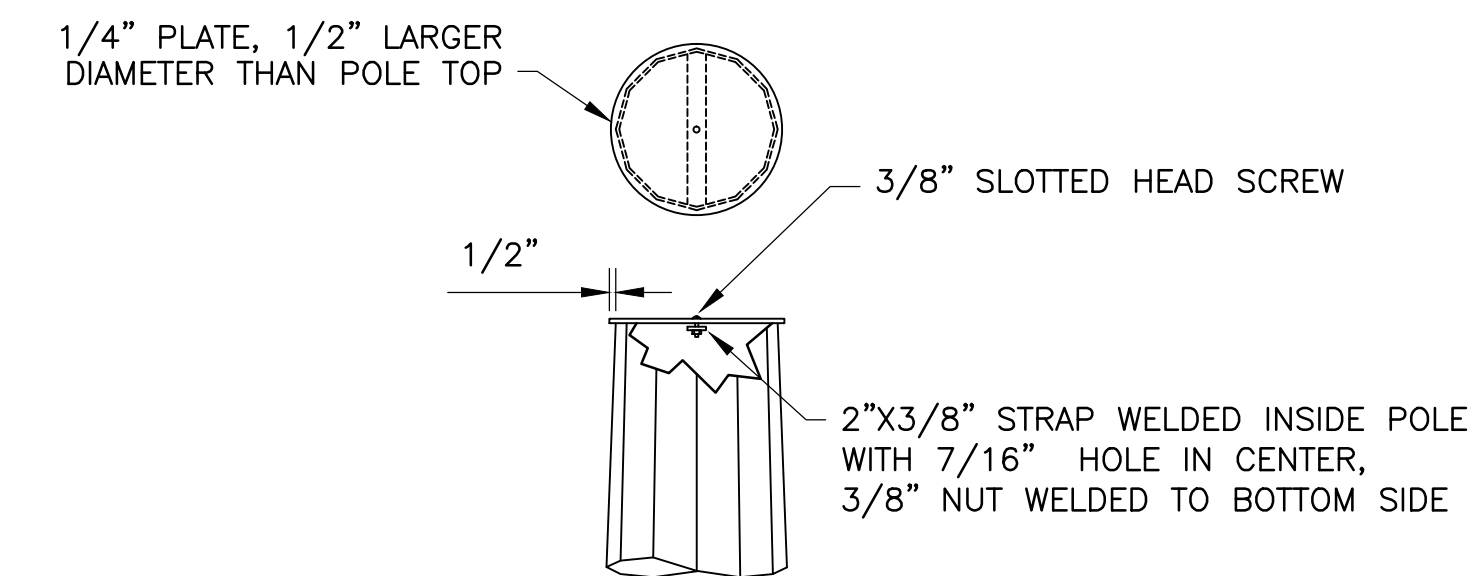
5 1-HOLE GROUND TAB DETAIL  
S294PS10 SCALE: NONE



6 2-HOLE GROUND TAB DETAIL  
S294PS10 SCALE: NONE



7 POLE BASE HANDHOLE DETAIL  
S294PS03|S294PS10 SCALE: NONE



8 POLE CAP DETAIL  
S294PS10 SCALE: NONE

REFERENCE DRAWINGS

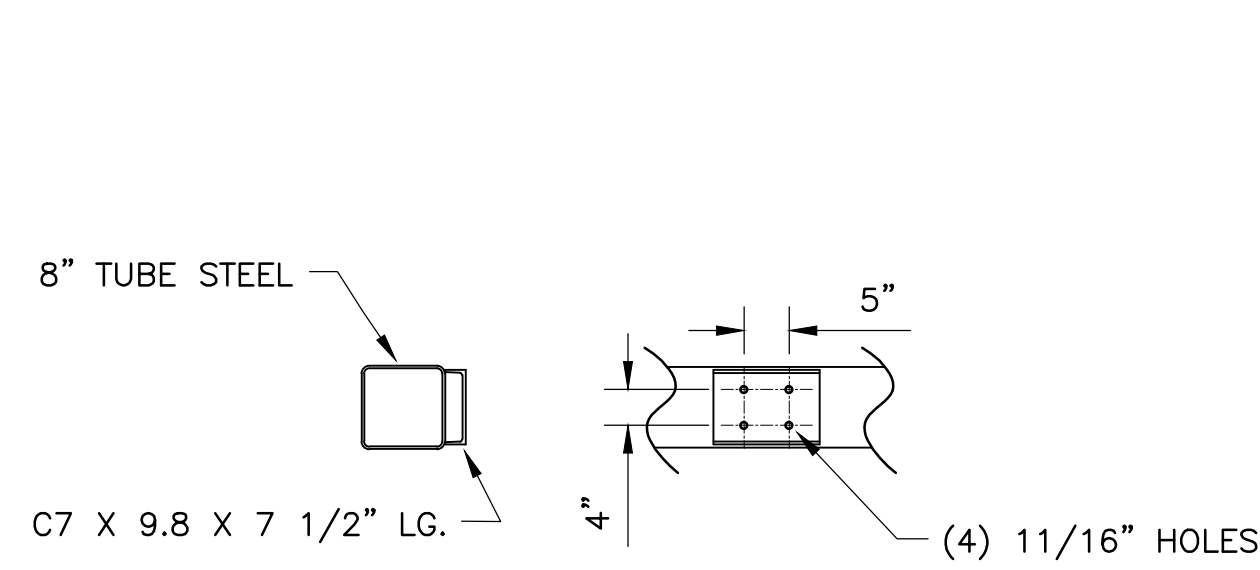
- S294PS01 161kV STEEL PLAN VIEW
- S294PS02 69kV STEEL PLAN VIEW
- S294PS03 161kV DEAD-END STRUCTURE VIEW A & END VIEW
- S294PS04 161kV BUS SUPPORT STRUCTURE VIEW B, C, D, & E
- S294PS05 69kV DEAD-END STRUCTURE VIEW F & END VIEW
- S294PS06 69kV BREAKER STRUCTURE VIEW G & END VIEW
- S294PS07 TRANSFORMER FDR BAY STRUCTURE VIEW H
- S294PS08 TRANSFORMER FDR BAY STRUCTURE VIEW J & VIEW K
- S294PS09 69kV BREAKER STRUCTURE VIEW L
- S294PS11 STEEL DETAILS SHEET 2 OF 2

ISSUED FOR BID

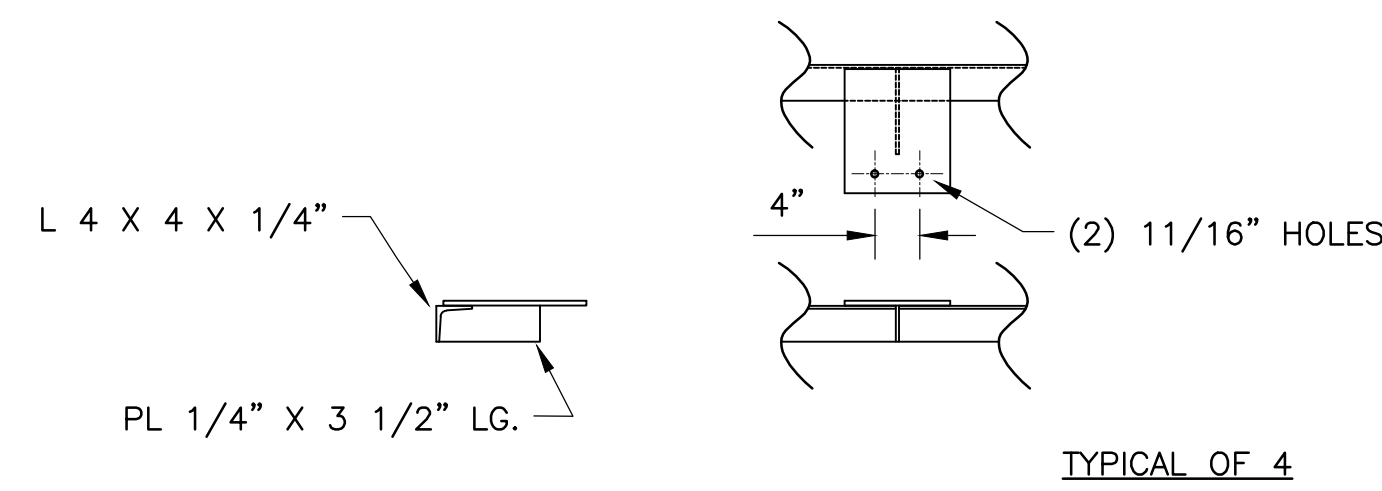
<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>STEEL DETAILS</b> <b>SHEET 1 OF 5</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW	DATE: 3/7/2011		
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294PS10</b>	REV. <b>0</b>

REV	DATE	ISSUED FOR BID	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID		JT	BA

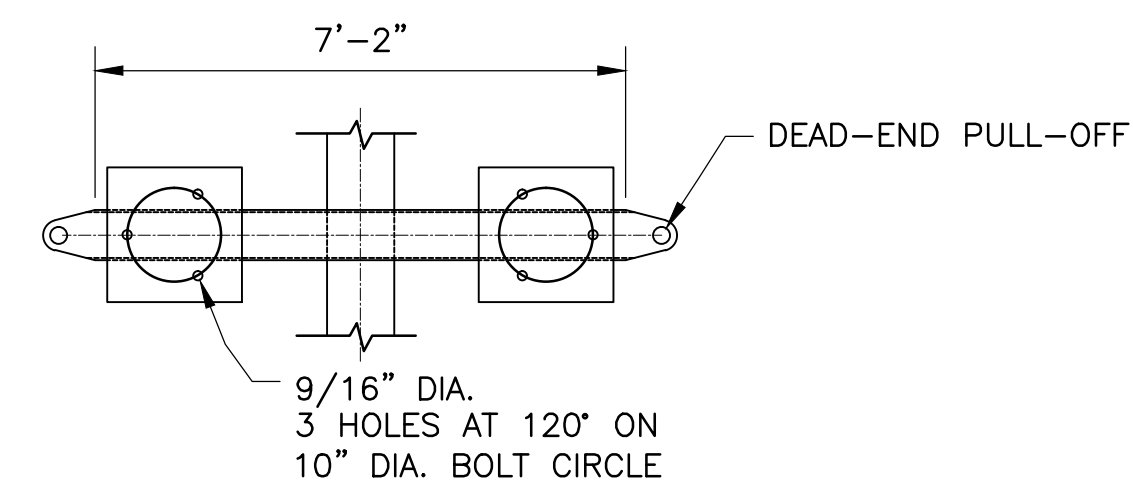
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 Last\_Plotting\_By: Trundle, Jimmy Plot\_Style: Garver Standard Half.ctb Plot\_Scale: 1:2 Plot\_Date: 5/29/2012 1:00 PM Plotter\_Used: \\c:\ps01\l1t IR C5185 PS3 East Tech Area



**1 OPERATOR MOUNT DETAIL**  
S294PS03|S294PS11 SCALE: NONE



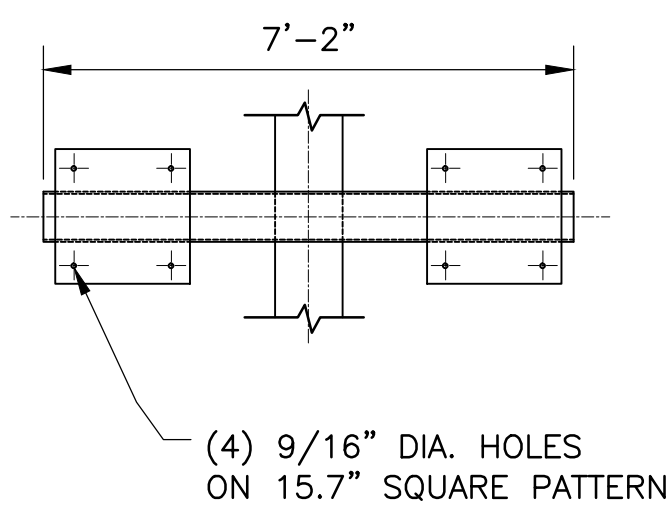
**2 GOAB SWITCH OPERATOR GUIDE MOUNT DETAIL**  
S294PS03|S294PS11 SCALE: NONE



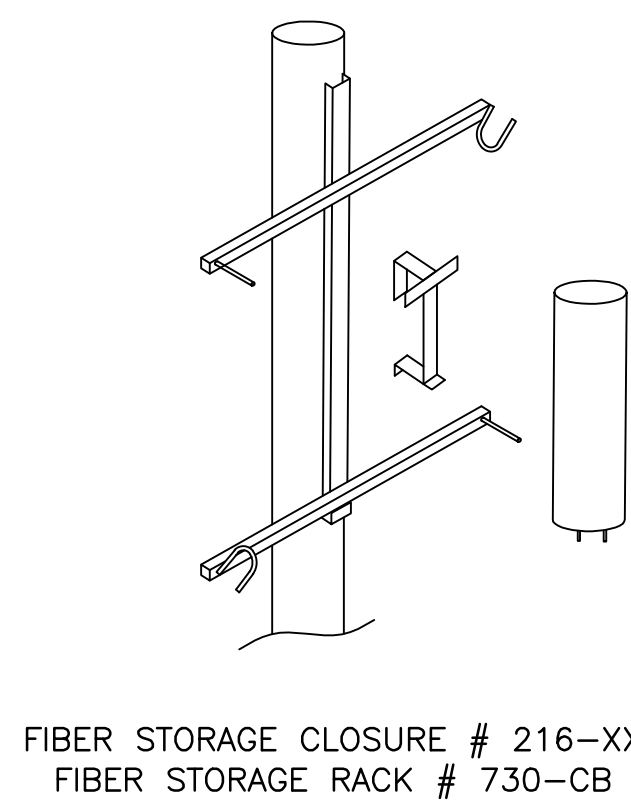
**3 LIGHTNING ARRESTOR MOUNT**  
S294PS05|S294PS11 SCALE: NONE

**GENERAL NOTES:**

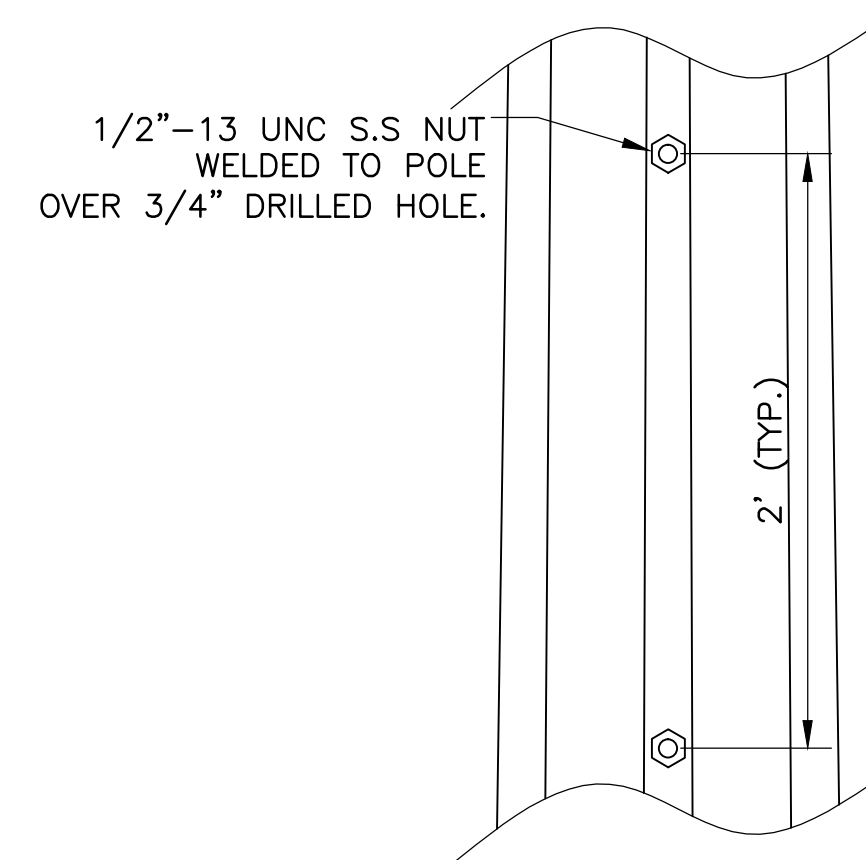
1. VERIFY DIMENSIONS WITH SWITCH MANUFACTURER SHOP DRAWINGS.



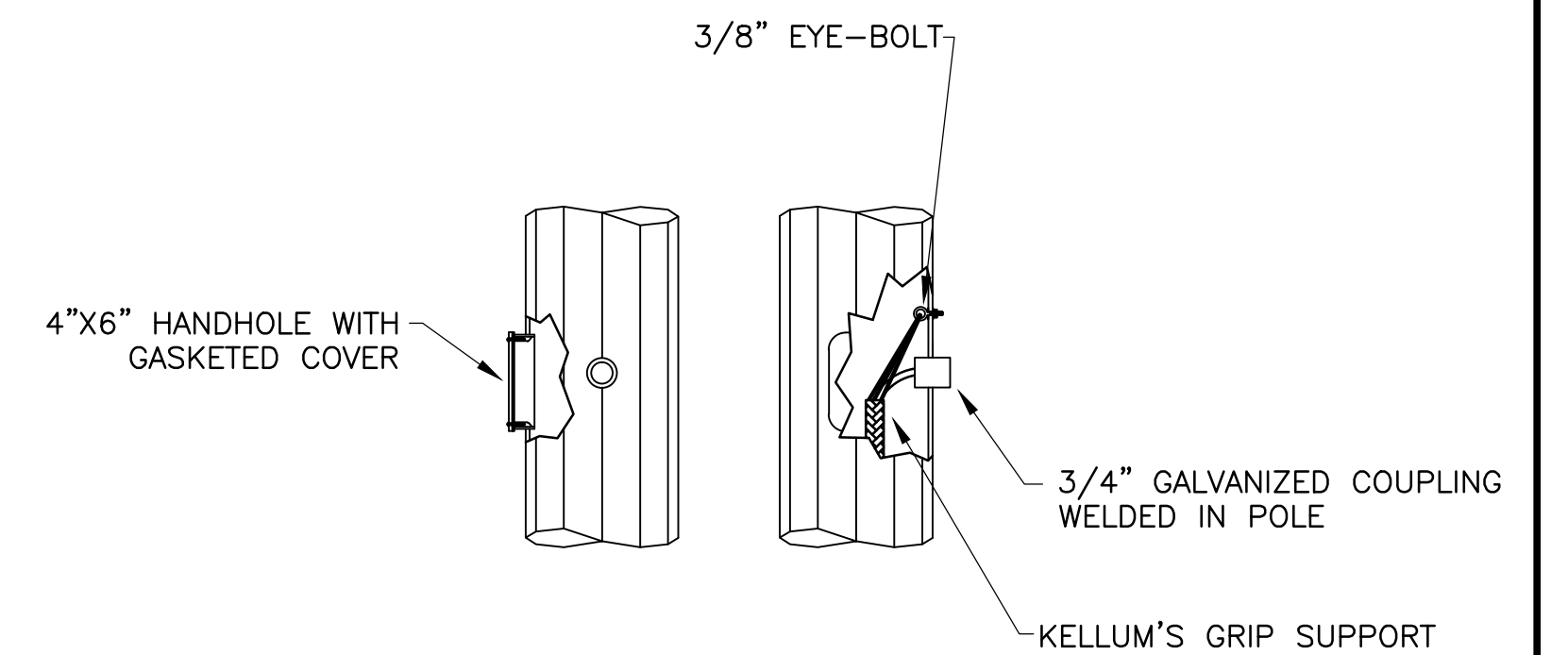
**4 CCVT MOUNT**  
S294PS05|S294PS11 SCALE: NONE



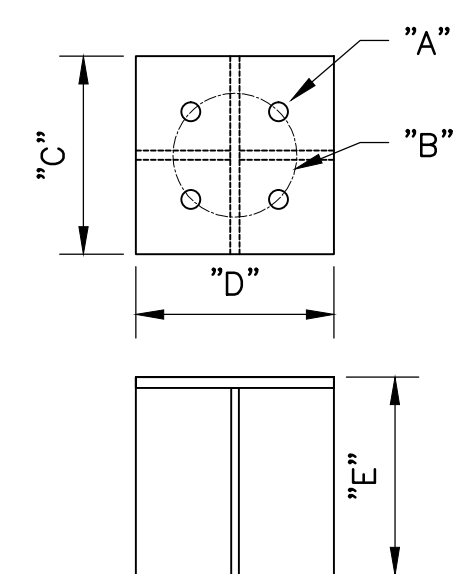
**5 FIBER OPTIC RACK MOUNT**  
S294PS05|S294PS11 SCALE: NONE



**6 FIBER OPTIC CABLE MOUNT**  
S294PS03|S294PS11 SCALE: NONE

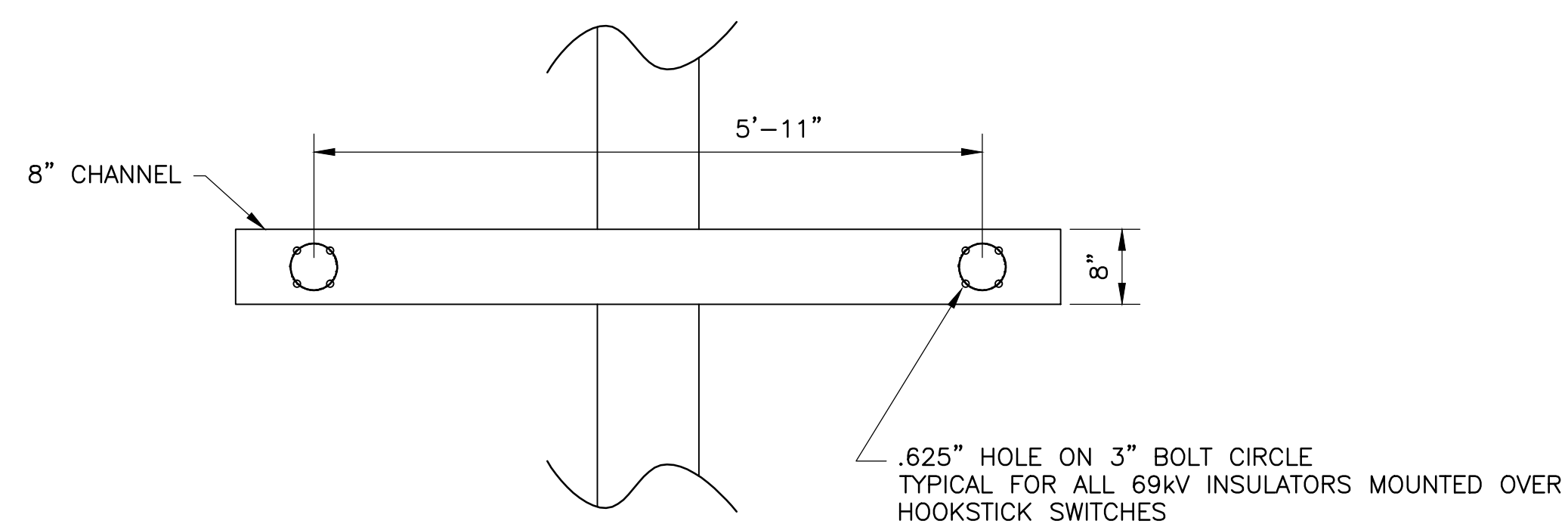


**7 CABLE SUPPORT DETAIL**  
S294PS03|S294PS11 SCALE: NONE

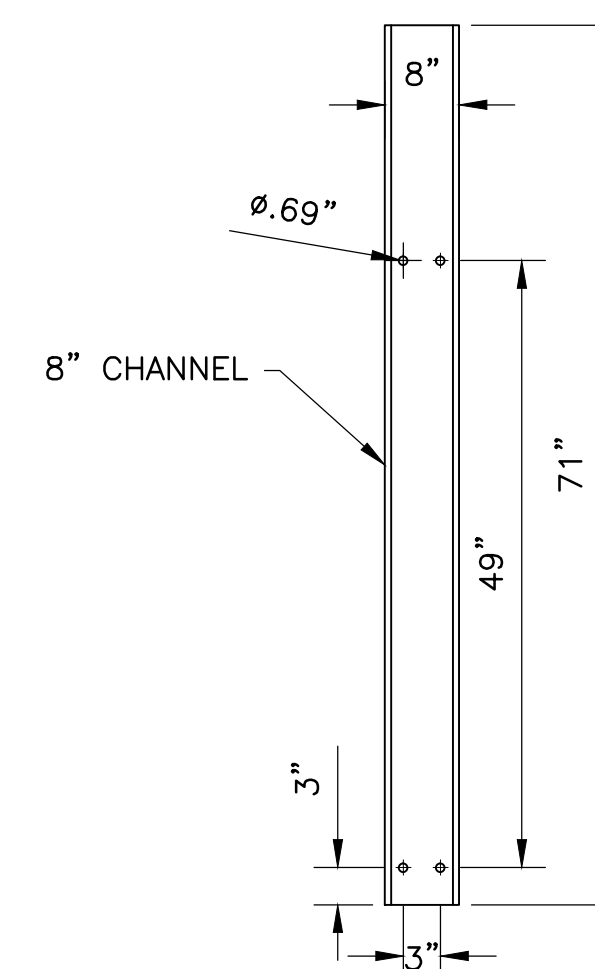


	"A"	"B"	"C"	"D"	"E"
69kV	5/8"	3"	5 1/4"	5 1/4"	3 1/2"
161kV	3/4"	5"	7 1/4"	7 1/4"	3 1/2"

**8 STATION POST INSULATOR MOUNT**  
S294PS11|S294PS11 SCALE: NONE



**9 69kV INSULATOR MOUNT DETAIL**  
S294PS11|S294PS11 SCALE: NONE



**10 69kV HOOKSTICK SWITCH MOUNT DETAIL**  
S294PS06|S294PS11 SCALE: NONE

**REFERENCE DRAWINGS**

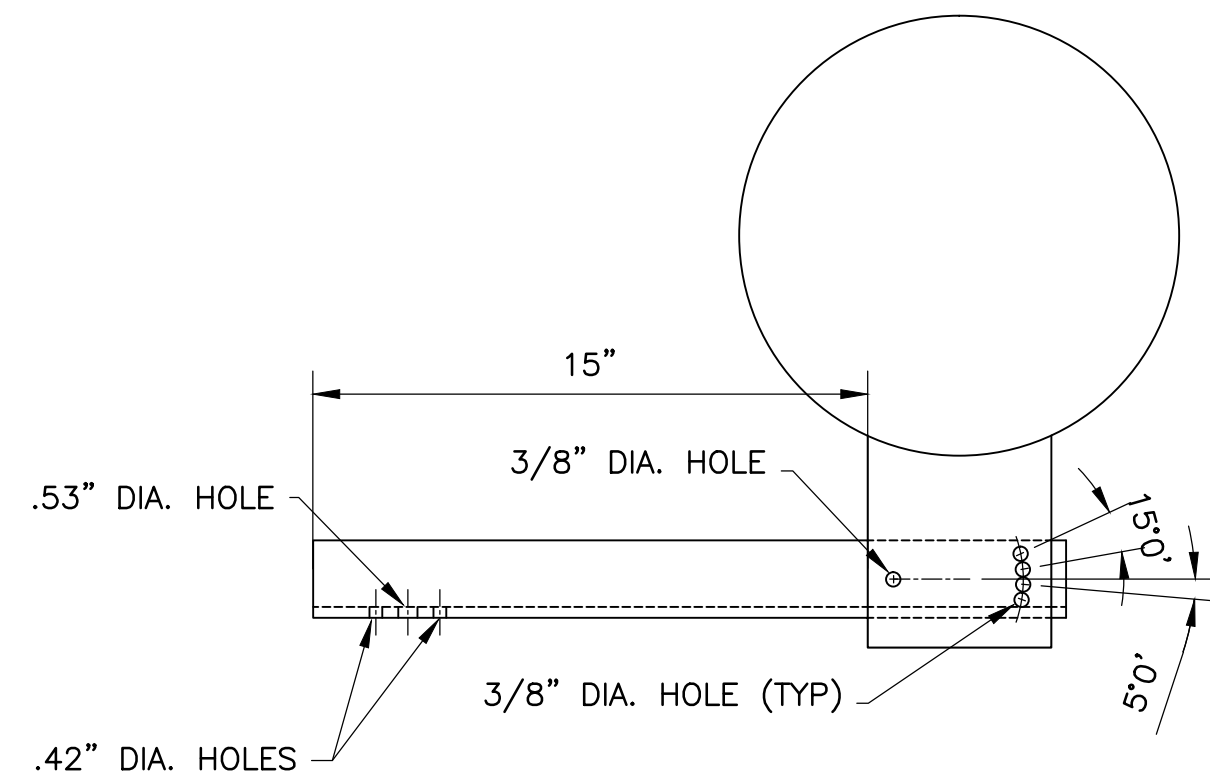
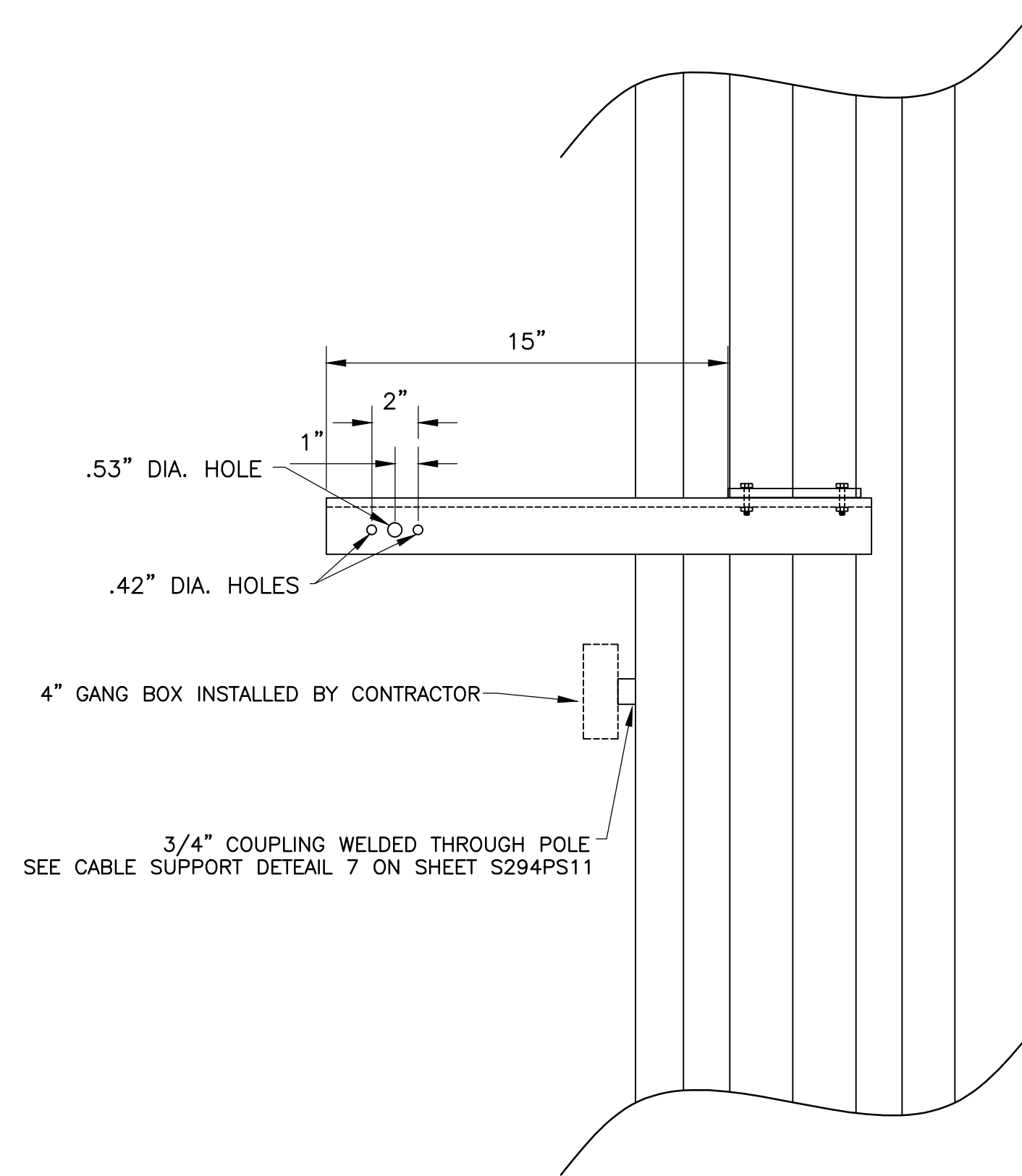
- S294PS01 161kV STEEL PLAN VIEW
- S294PS02 69kV STEEL PLAN VIEW
- S294PS03 161kV DEAD-END STRUCTURE VIEW A & END VIEW
- S294PS04 161kV BUS SUPPORT STRUCTURE VIEW B, C, D, & E
- S294PS05 69kV DEAD-END STRUCTURE VIEW F & END VIEW
- S294PS06 69kV BREAKER STRUCTURE VIEW G & END VIEW
- S294PS07 TRANSFORMER FDR BAY STRUCTURE VIEW H
- S294PS08 TRANSFORMER FDR BAY STRUCTURE VIEW J & VIEW K
- S294PS09 69kV BREAKER STRUCTURE VIEW L
- S294PS10 STEEL DETAILS SHEET 1 OF 2

**ISSUED FOR BID**

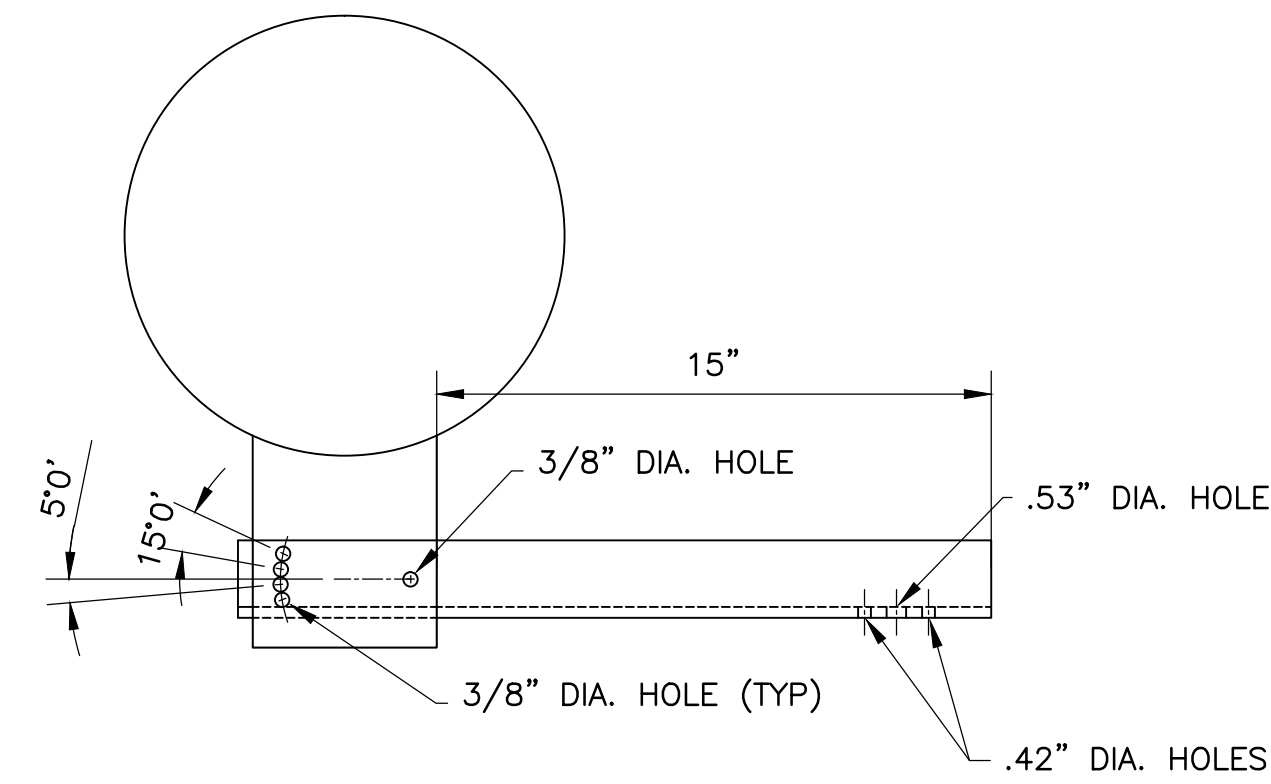
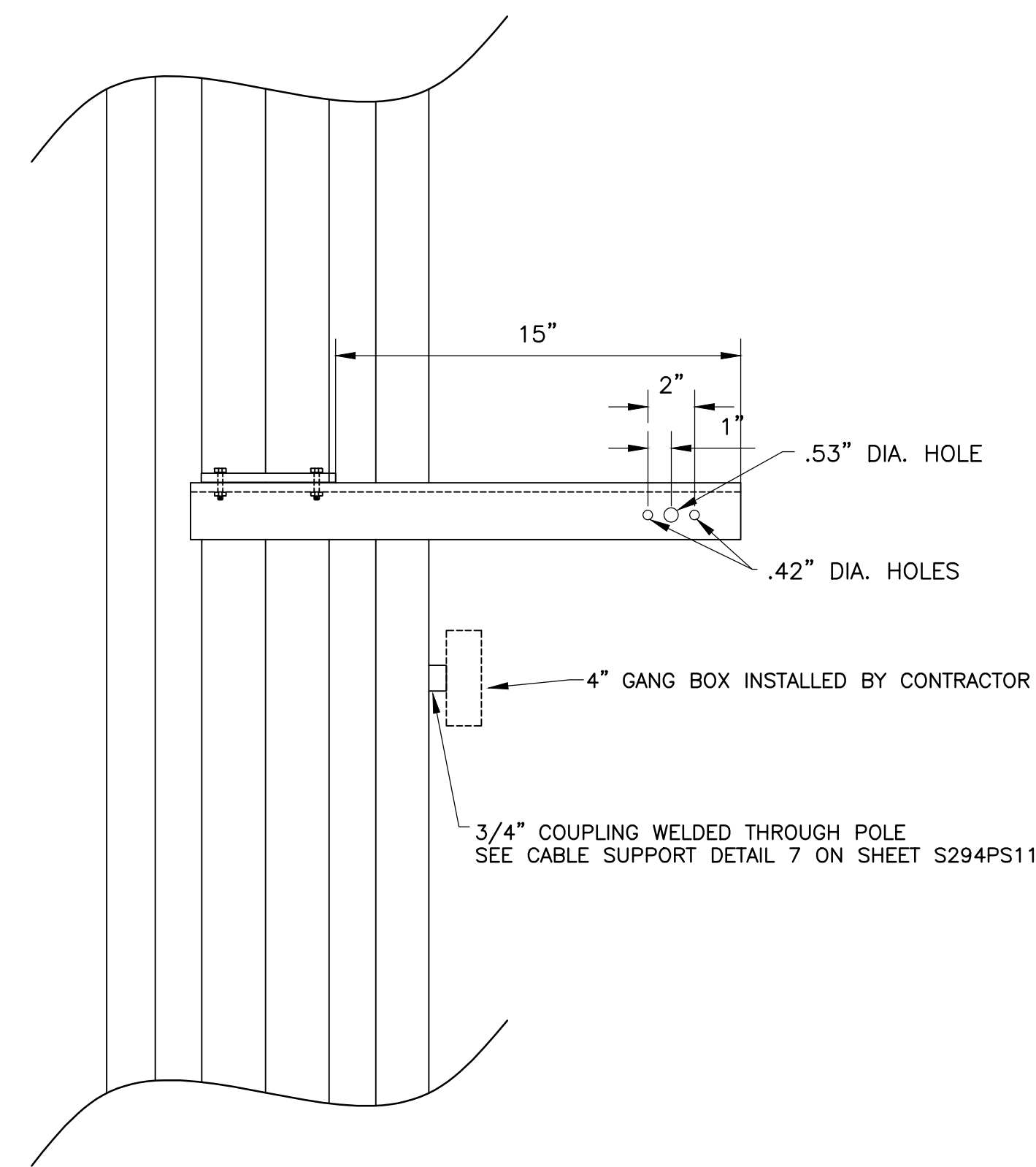
<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>STEEL DETAILS</b> <b>SHEET 2 OF 5</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW	DATE: 3/7/2011	DRAWING No. S294PS11	
		REV. 0	

REV	DATE	ISSUED FOR BID	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID		JT	BA

File: C:\Substation\AFTON\Garver CAD Drawings 2-16-12\S294PS12 STEEL DETAILS SHEET 3 OF 5.dwg Last saved by: DJRogers  
 Last plotted by: Trondie, Jimmy Plot Style: Garver Standard Hatched Plot Scale: 1:2 Plot Date: 5/29/2012 1:03 PM Plotter Used: \Gripso01\Plot IR C3185 P33 East Tech Area



**1 PRISMBEAM II "A" LIGHT MOUNT**  
 S294PS03IS294PS12 SCALE: NONE



**2 PRISMBEAM II "A" LIGHT MOUNT**  
 S294PS03IS294PS12 SCALE: NONE

**REFERENCE DRAWINGS**

- S294PE01 161KV EQUIPMENT PLAN VIEW
- S294PE03 161KV DEAD-END STRUCTURE VIEW A & END VIEW
- S294PE09 161KV ELEVATION VIEW G1 & G2
- S294PE10 STEEL DETAILS SHEET 1 OF 5
- S294PE11 STEEL DETAILS SHEET 2 OF 5

**NOTES:**

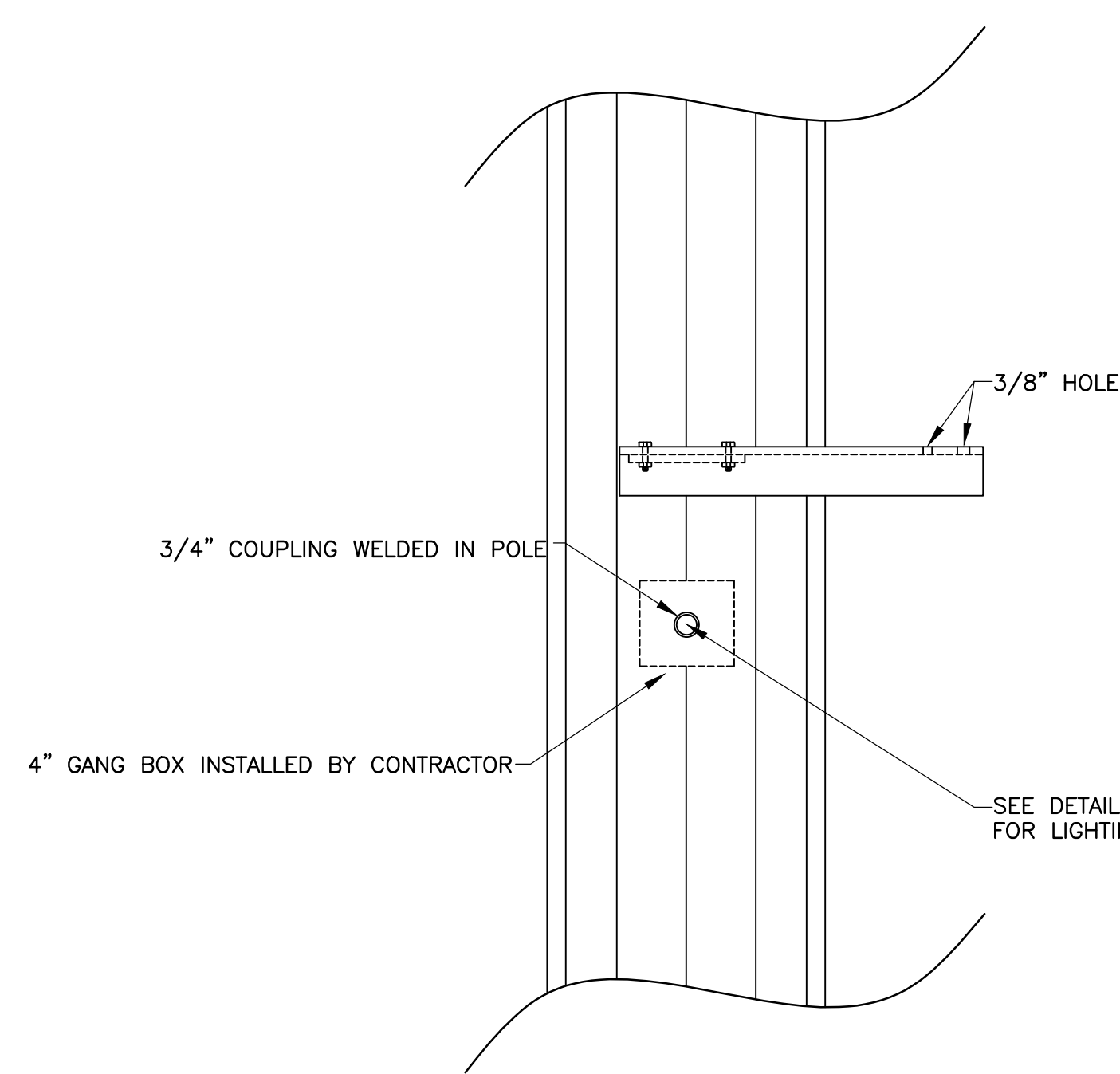
1. SEE DETAIL 7 ON DRAWING S294PS10 FOR POLE BASE HANDHOLE DETAIL.

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>STEEL DETAILS</b> <b>SHEET 3 OF 5</b>			
SCALE: AS SHOWN	DRAWN BY: DJR	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
 <small>Grand River Dam Authority</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294PS12</b>	REV. <b>0</b>

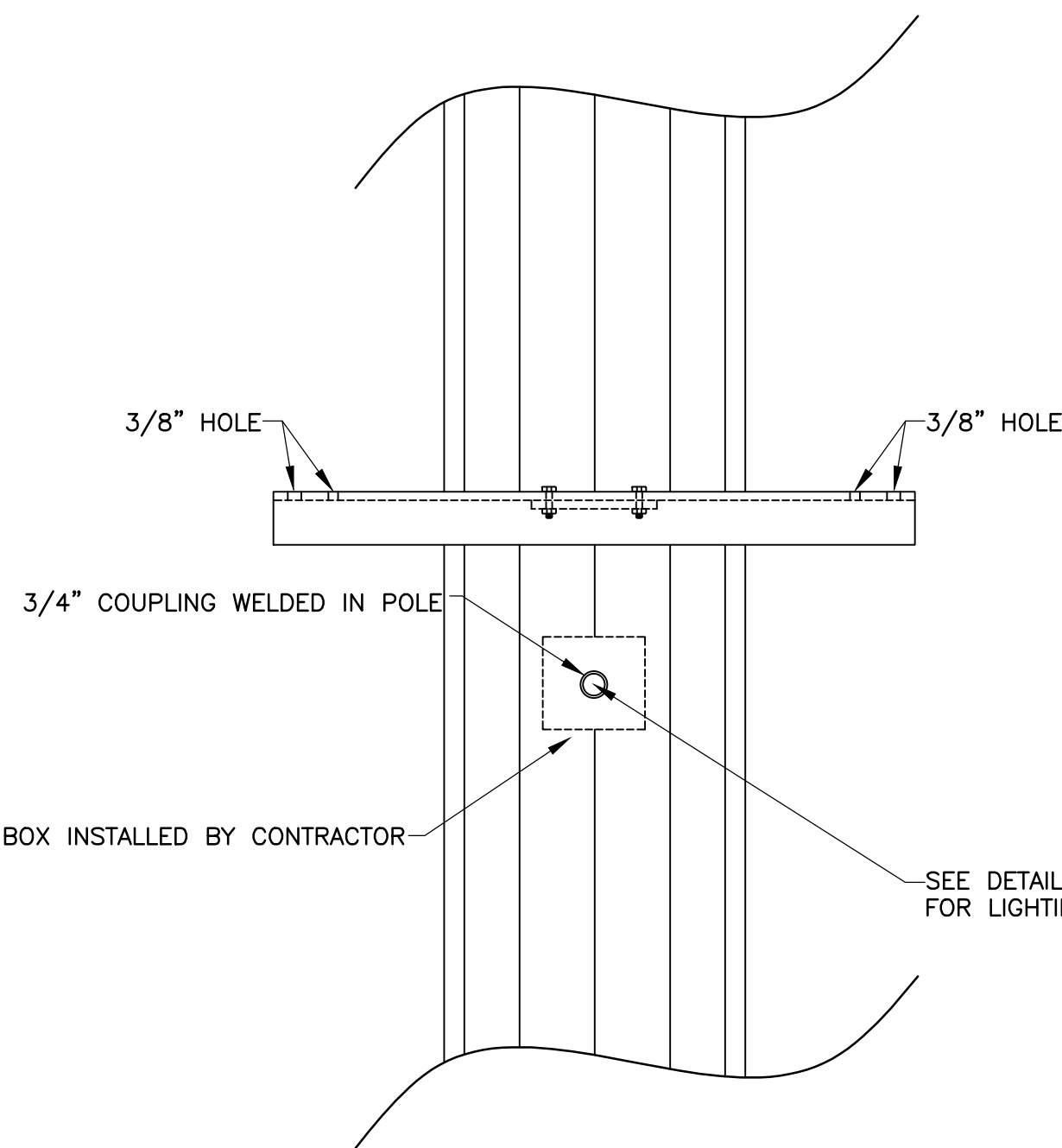
REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA

File: C:\Substation\AFTON\CAD Drawings 2-16-12\S294PS13 STEEL DETAILS SHEET 4 OF 5.dwg Last saved by: DJRogers  
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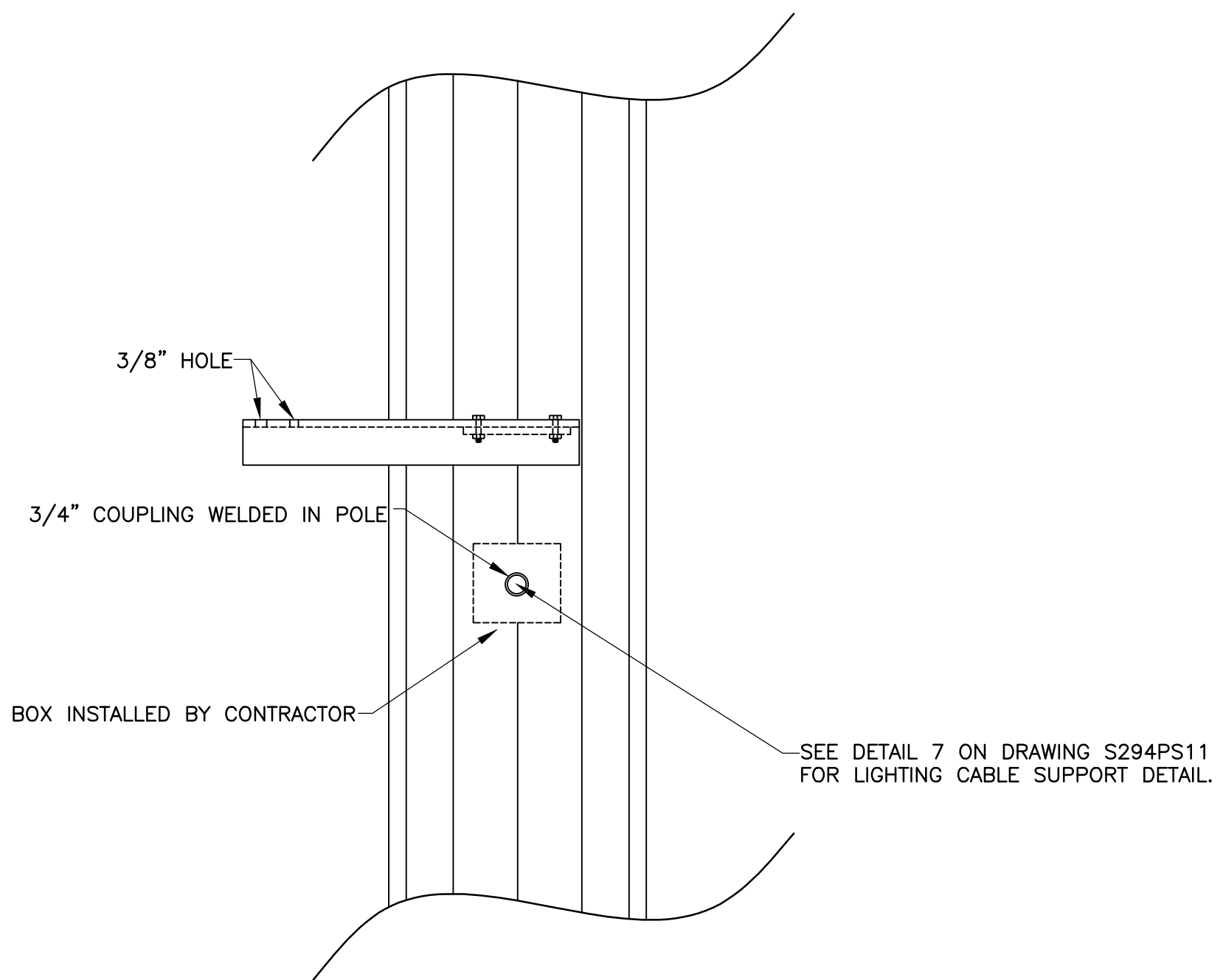
SEE DETAIL 7 ON DRAWING S294PS11 FOR LIGHTING CABLE SUPPORT DETAIL.

**1 PREDATOR "C" LIGHT MOUNT**  
S294PS13 SCALE: NONE



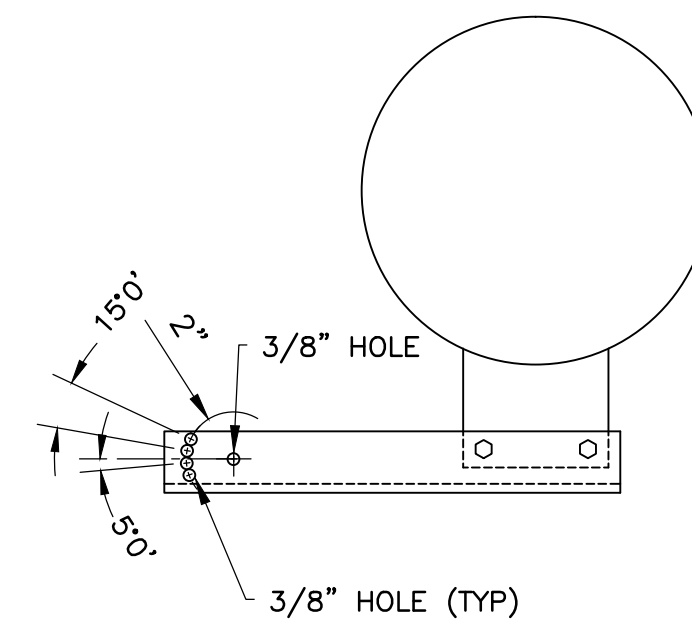
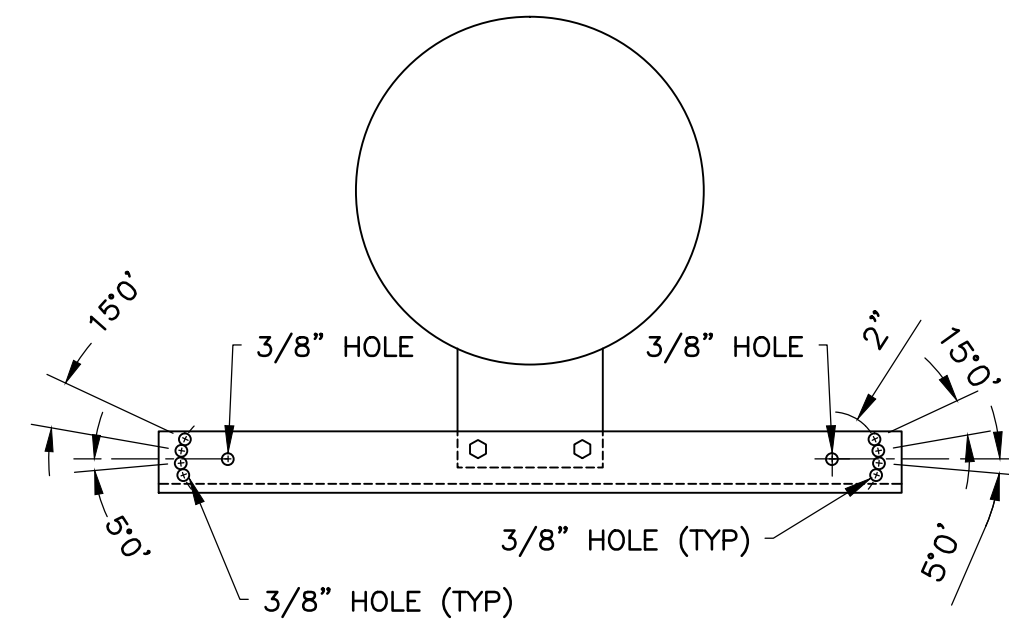
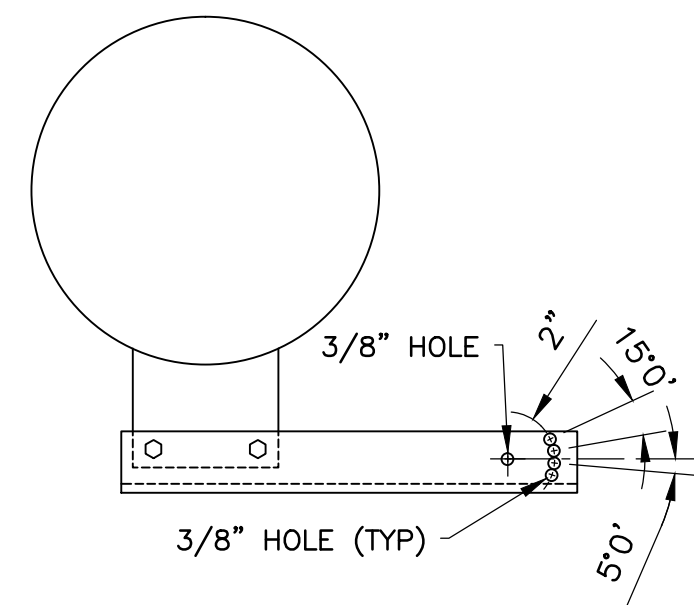
SEE DETAIL 7 ON DRAWING S294PS11 FOR LIGHTING CABLE SUPPORT DETAIL.

**2 PREDATOR "C" LIGHT MOUNT**  
S294PS13 SCALE: NONE



SEE DETAIL 7 ON DRAWING S294PS11 FOR LIGHTING CABLE SUPPORT DETAIL.

**3 PREDATOR "C" LIGHT MOUNT**  
S294PS13 SCALE: NONE



**REFERENCE DRAWINGS**

- S294PS01 161KV STEEL PLAN VIEW
- S294PS02 69KV STEEL PLAN VIEW
- S294PS05 69KV DEAD-END STRUCTURE VIEW F & END VIEW
- S294PS06 69KV BREAKER STRUCTURE VIEW G & END VIEW
- S294PS09 69KV BREAKER STRUCTURE VIEW L
- S294PS10 STEEL DETAILS SHEET 1 OF 5
- S294PS11 STEEL DETAILS SHEET 2 OF 5

**NOTES:**

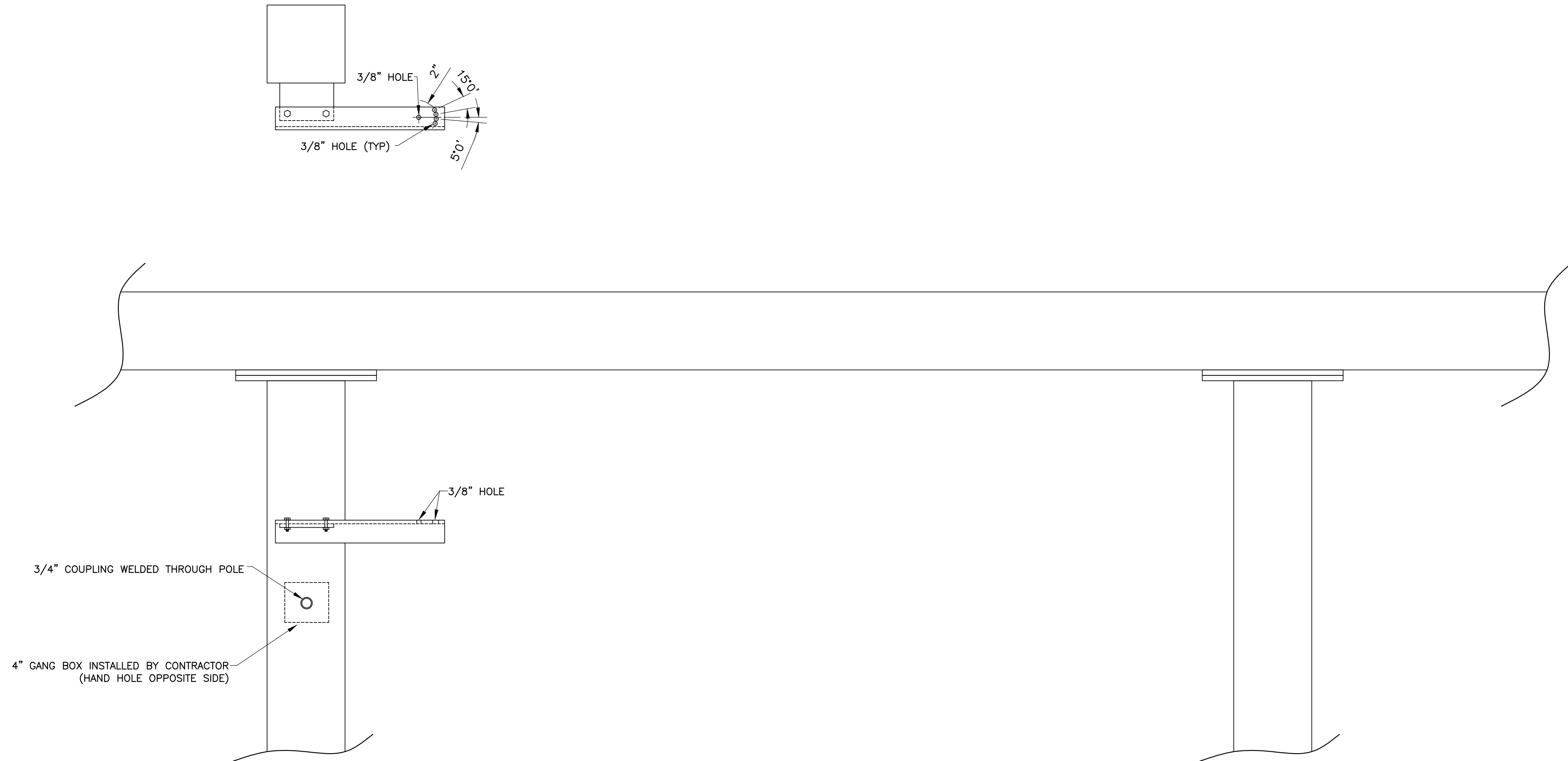
1. SEE DETAIL 7 ON DRAWING S294PS10 FOR POLE BASE HANDHOLE DETAIL.

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>STEEL DETAILS</b> <b>SHEET 4 OF 5</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
 <small>Grand River Dam Authority</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		<small>DRAWING No.</small> <b>S294PS13</b>	<small>REV.</small> <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA

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 Last Plotted by: Trondie, Jimmy Plot Style: Garver Standard Hatched Plot Scale: 1:2 Plot Date: 5/29/2012 1:07 PM Plotter Used: \cintiso1\lpr CS185 PS3 East Tech Area



1 PREDATOR "B" LIGHT MOUNT  
 S294PS14 SCALE: NONE

**REFERENCE DRAWINGS**

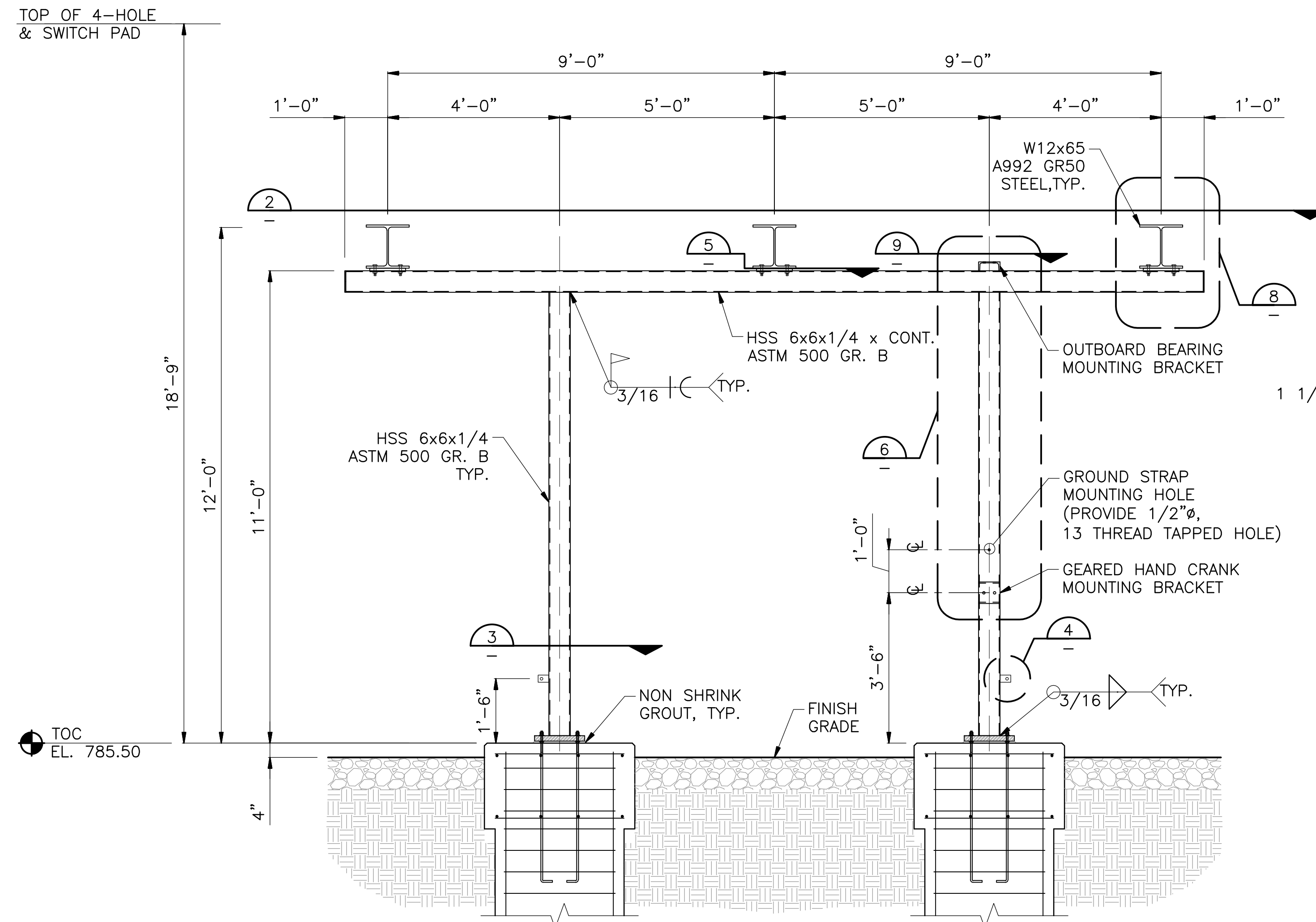
S294PE01 161KV EQUIPMENT PLAN VIEW  
 S294PE09 161KV ELEVATION VIEW G1 & G2

**ISSUED FOR BID**

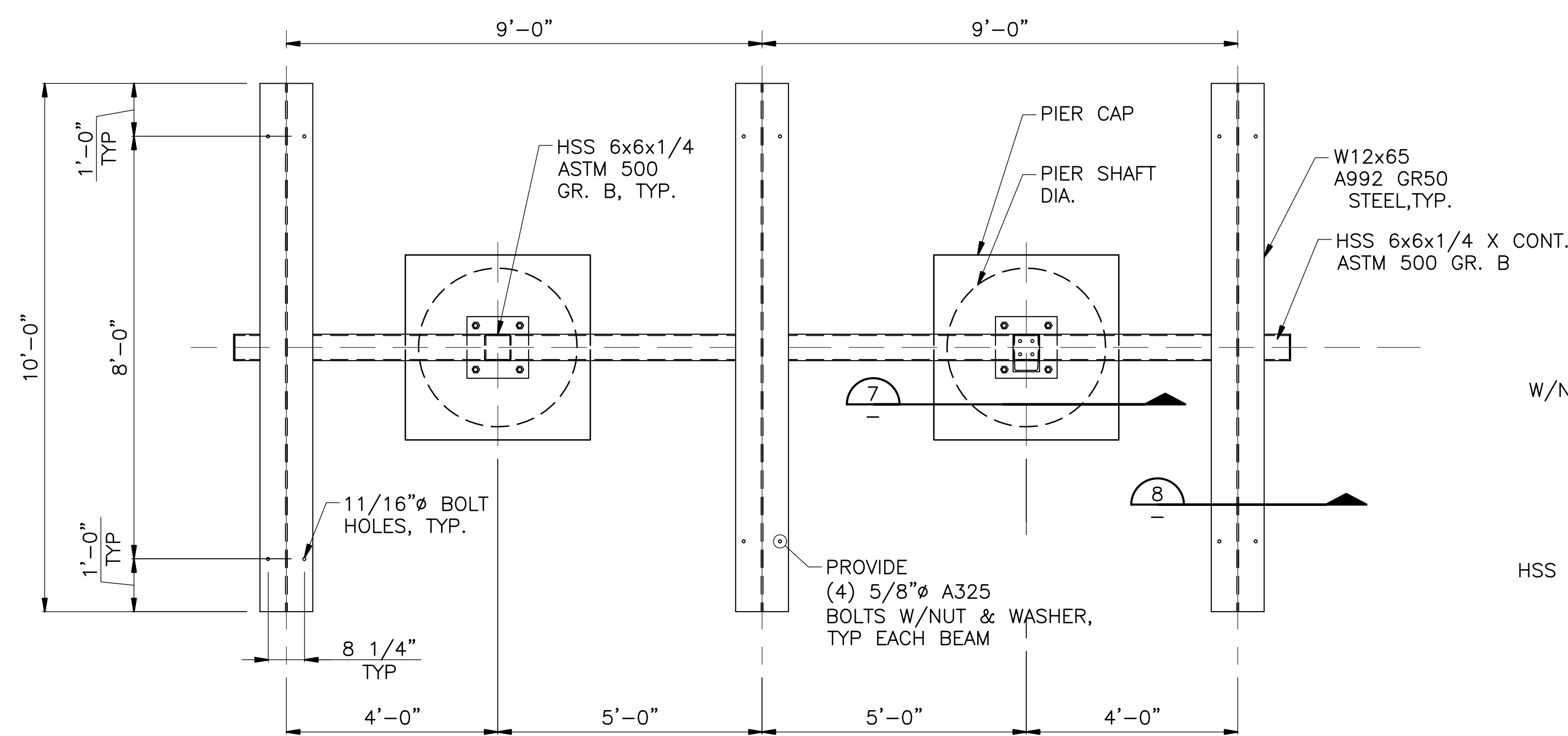
<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>STEEL DETAILS</b> <b>SHEET 5 OF 5</b>			
SCALE: AS SHOWN	DRAWN BY: DJR	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
 <small>Grand River Dam Authority</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. S294PS14	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA

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 Last Plotted: 5/29/2012 1:10 PM Plotter used: \\\dots\Plotter used: S:\dots\PS3 East Tech Area



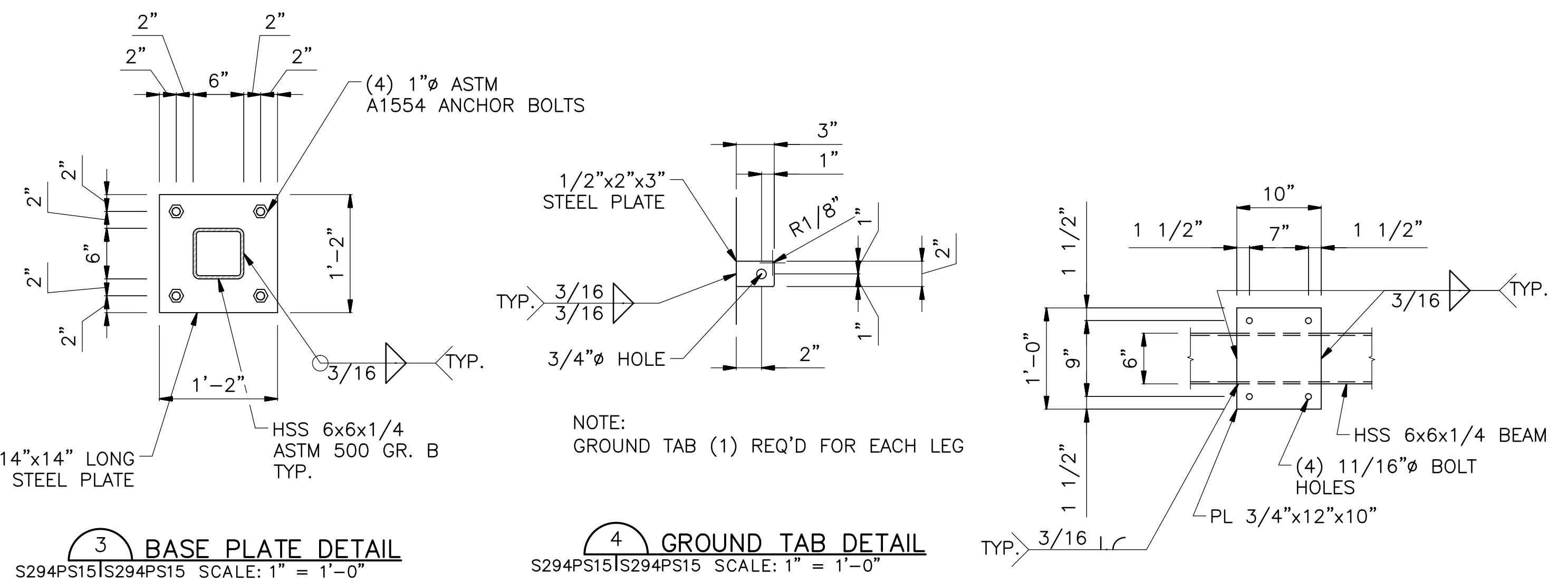
**1 SWITCH STAND ELEVATION**  
S294PS15\S294PS15 SCALE: 1/2" = 1'-0"



**2 SWITCH STAND PLAN VIEW**  
S294PS15\S294PS15 SCALE: 1/2" = 1'-0"

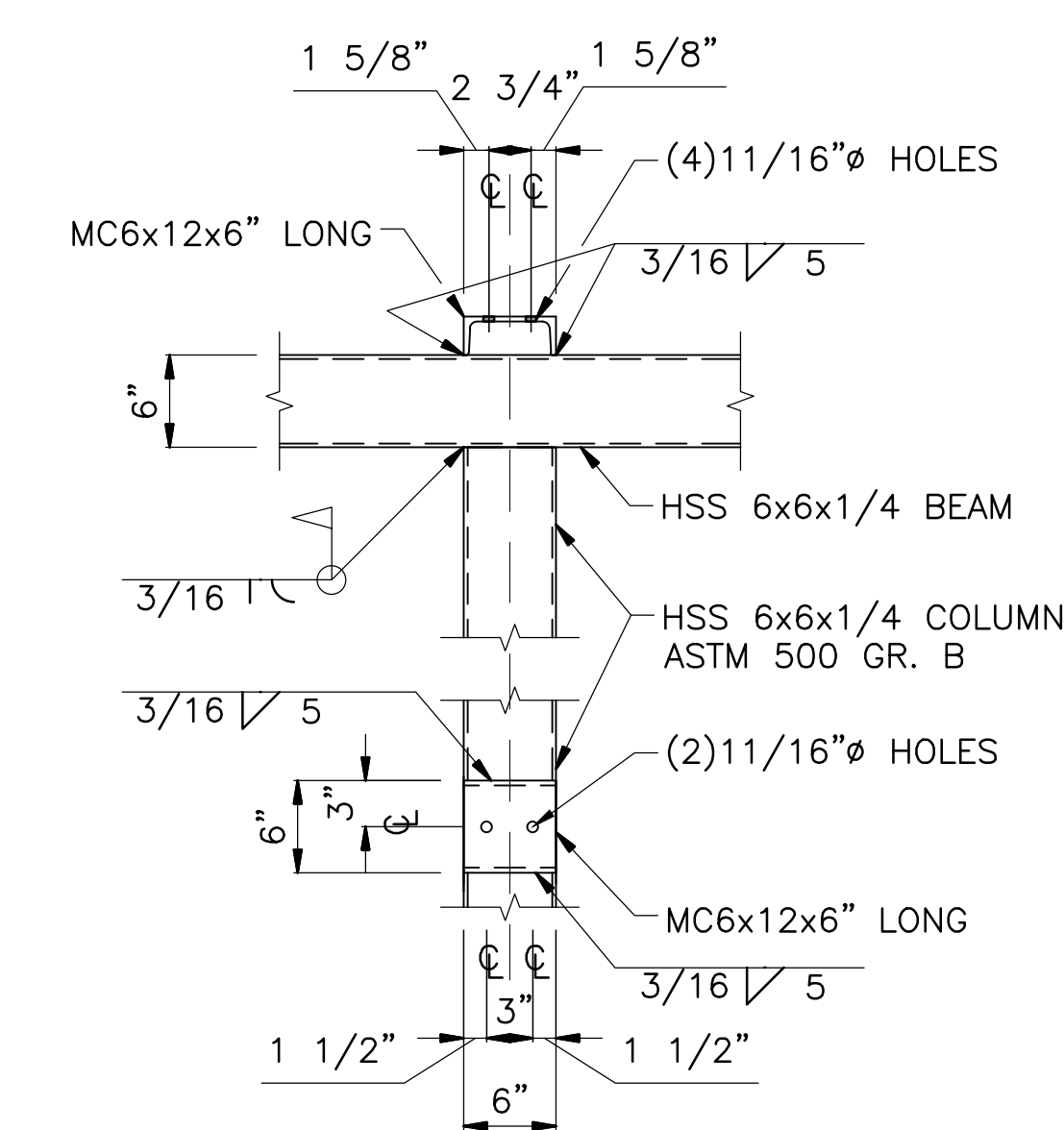
**REFERENCE DRAWINGS**

- S294PG30 161KV FOUNDATION PLAN VIEW
- S294PG33 TYPICAL FOUNDATION DETAILS
- S294PE01 161KV EQUIPMENT PLAN VIEW



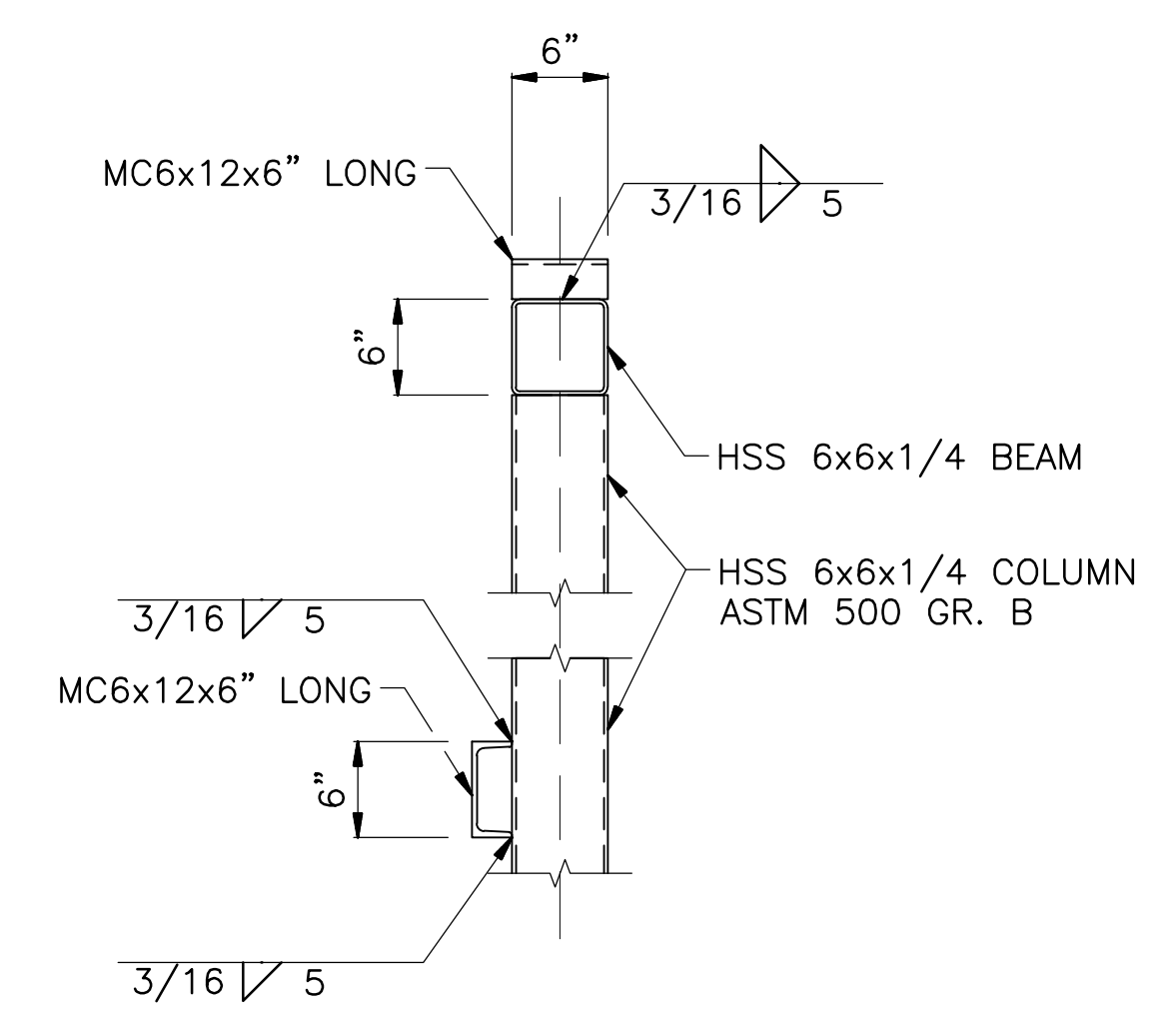
**3 BASE PLATE DETAIL**  
S294PS15\S294PS15 SCALE: 1" = 1'-0"

**4 GROUND TAB DETAIL**  
S294PS15\S294PS15 SCALE: 1" = 1'-0"

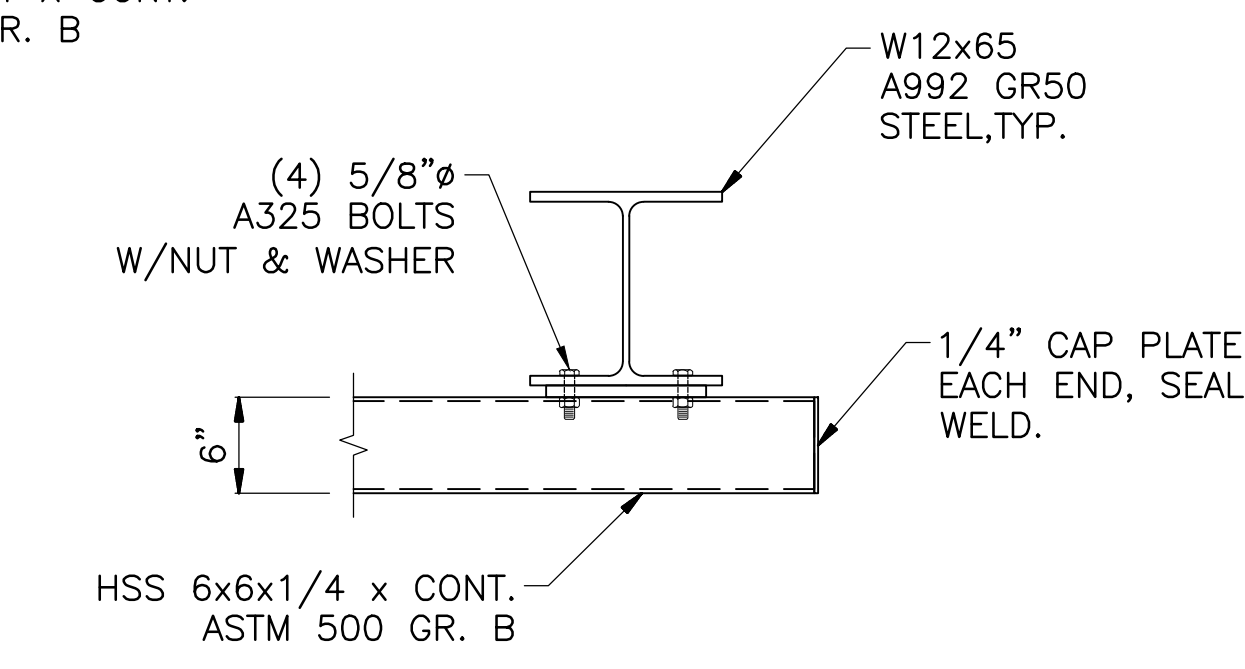


**6 CONNECTION DETAIL**  
S294PS15\S294PS15 SCALE: 1" = 1'-0"

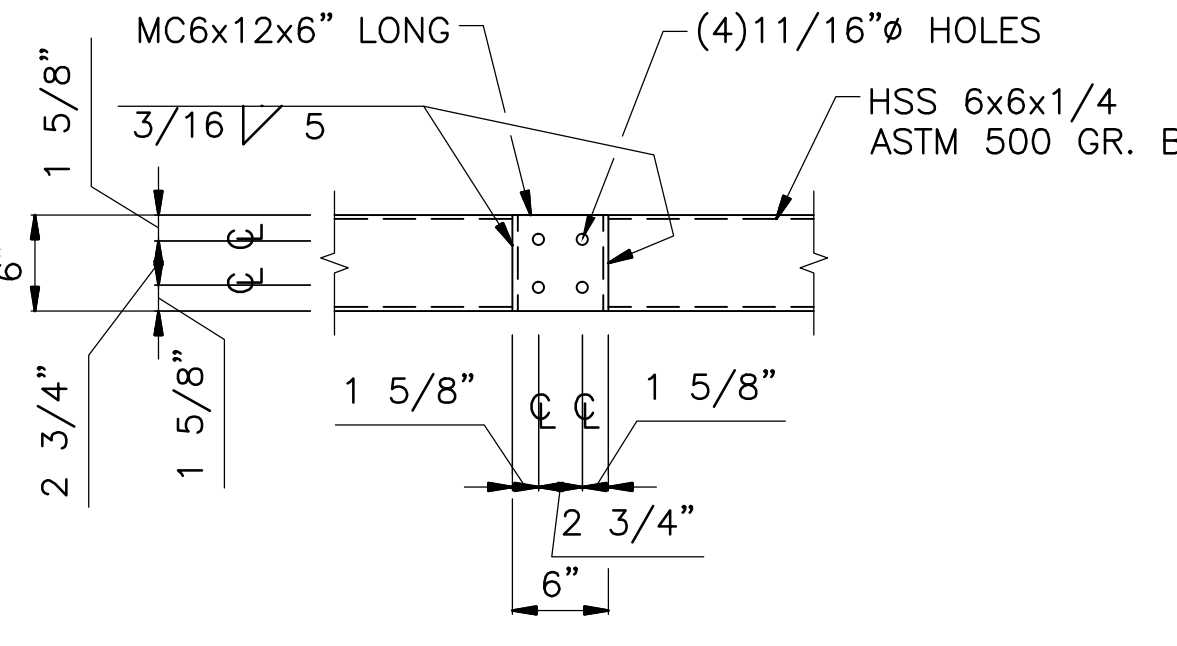
**5 CONNECTION DETAIL-PLAN VIEW**  
S294PS15\S294PS15 SCALE: 1" = 1'-0"



**7 CONNECTION DETAIL**  
S294PS15\S294PS15 SCALE: 1" = 1'-0"



**8 CONNECTION DETAIL**  
S294PS15\S294PS15 SCALE: 1" = 1'-0"



**9 CONNECTION DETAIL**  
S294PS15\S294PS15 SCALE: 1" = 1'-0"

SHEET NOTE:  
USE 3.9MIL GALVANIZED STEEL COATING ON ALL MEMBERS.

**ISSUED FOR BID**

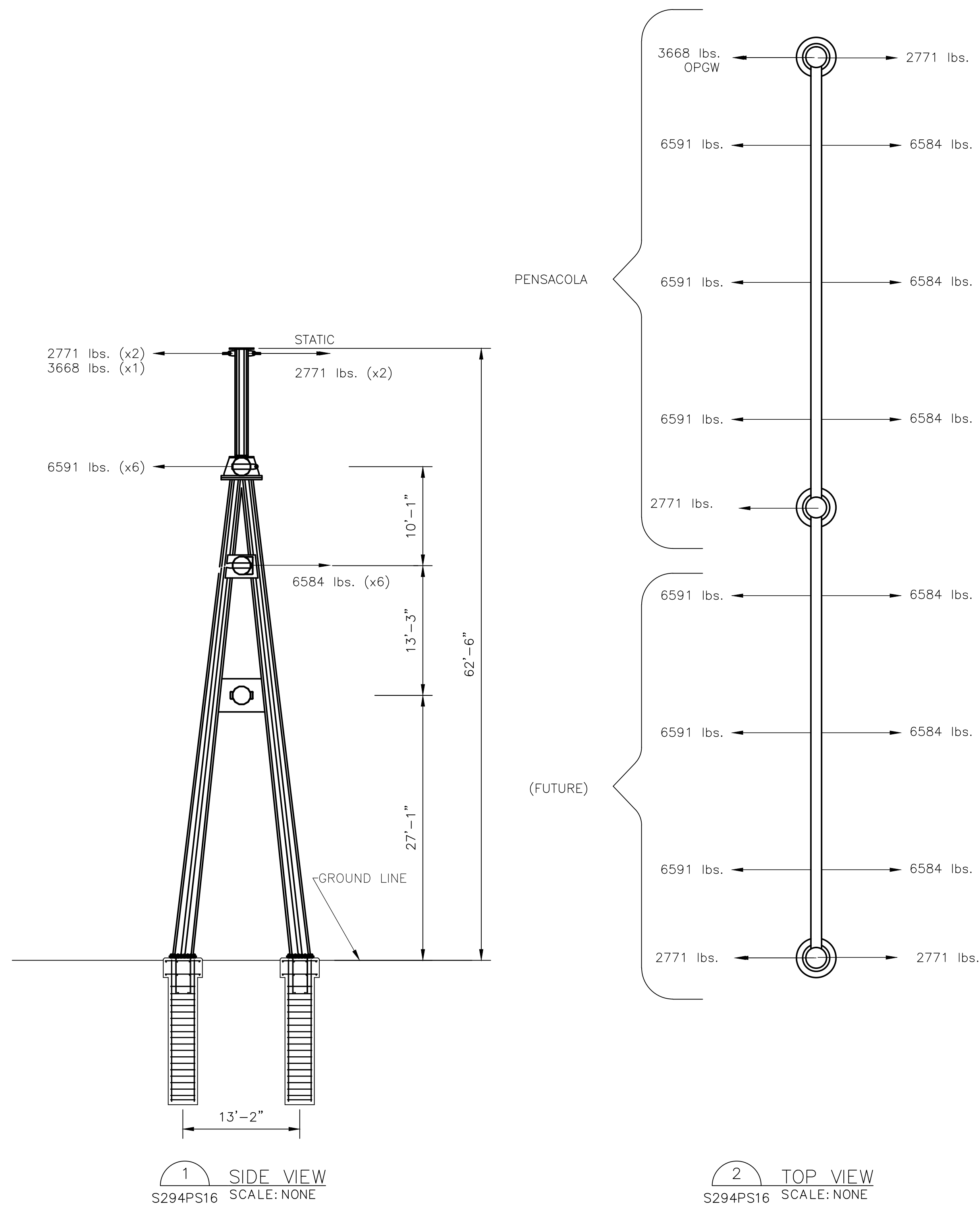
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV  
161KV SWITCH STAND

SCALE: AS SHOWN	DRAWN BY: EGB	ENGR: AEM	APPD: BA
CH: MW	DATE: 3/7/2011	DRAWING No. S294PS15	REV. 0

GRDA  
Grand River Dam Authority  
P.O. BOX 409  
VINITA, OK 74301

0	5/11/12	ISSUED FOR BID	JT	BA
REV	DATE	REVISION DESCRIPTION	DFT	ENG

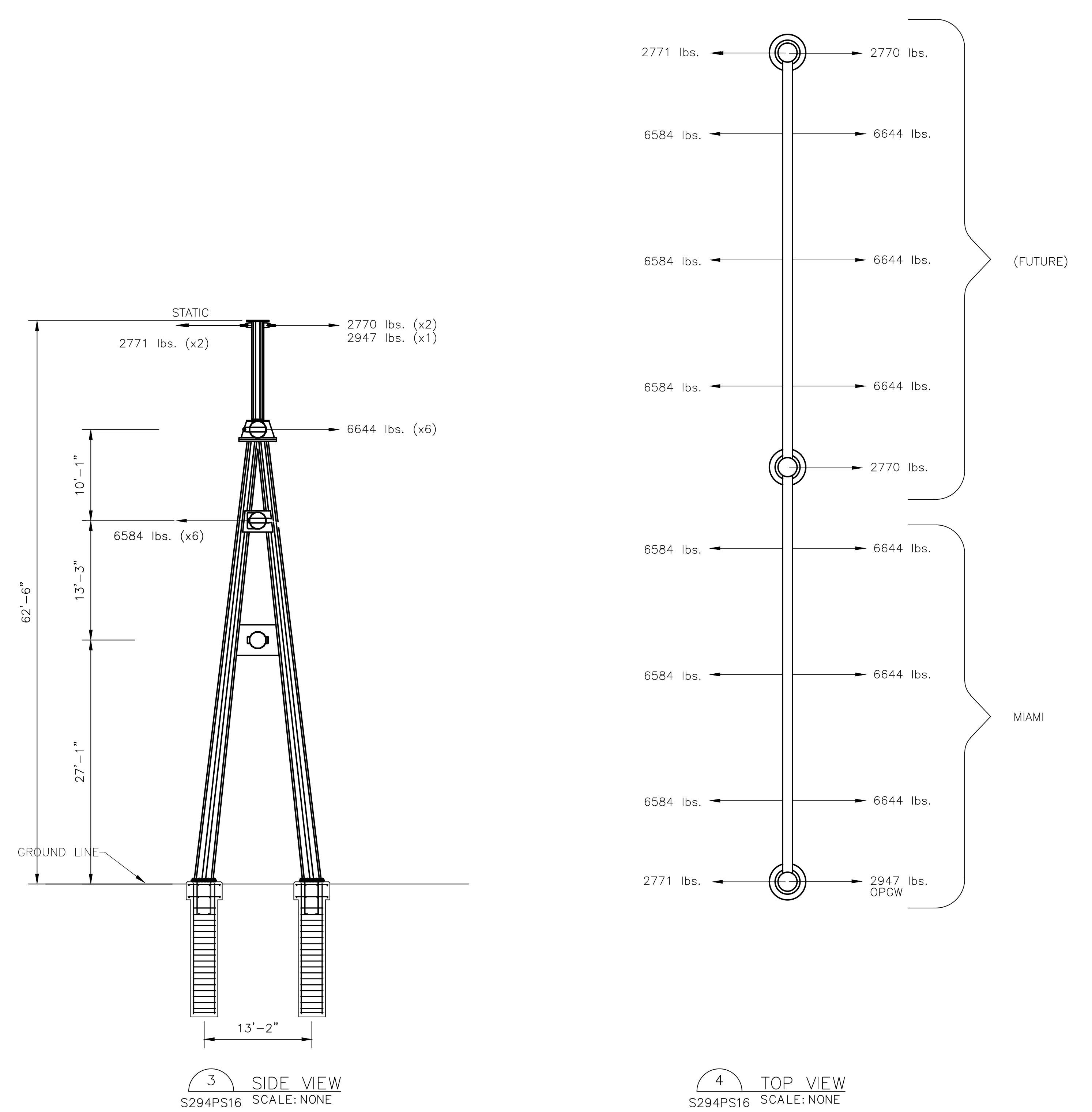
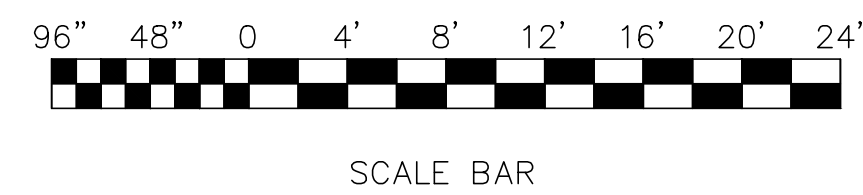
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 Last\_Plot: 5/30/2012 1:51 PM Plotter\_used: DWG To PDF.pc3  
 Last\_Plot: 5/30/2012 1:51 PM Plotter\_used: DWG To PDF.pc3



161kV DEAD-END  
PENSACOLA STRUCTURE

REFERENCE DRAWINGS

- S294PS01 161kV STEEL PLAN VIEW
- S294PS03 161kV DEAD-END STRUCTURE VIEW A & END VIEW

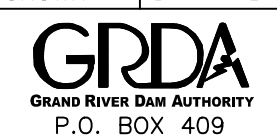


161kV DEAD-END  
MIAMI STRUCTURE

NOTES:

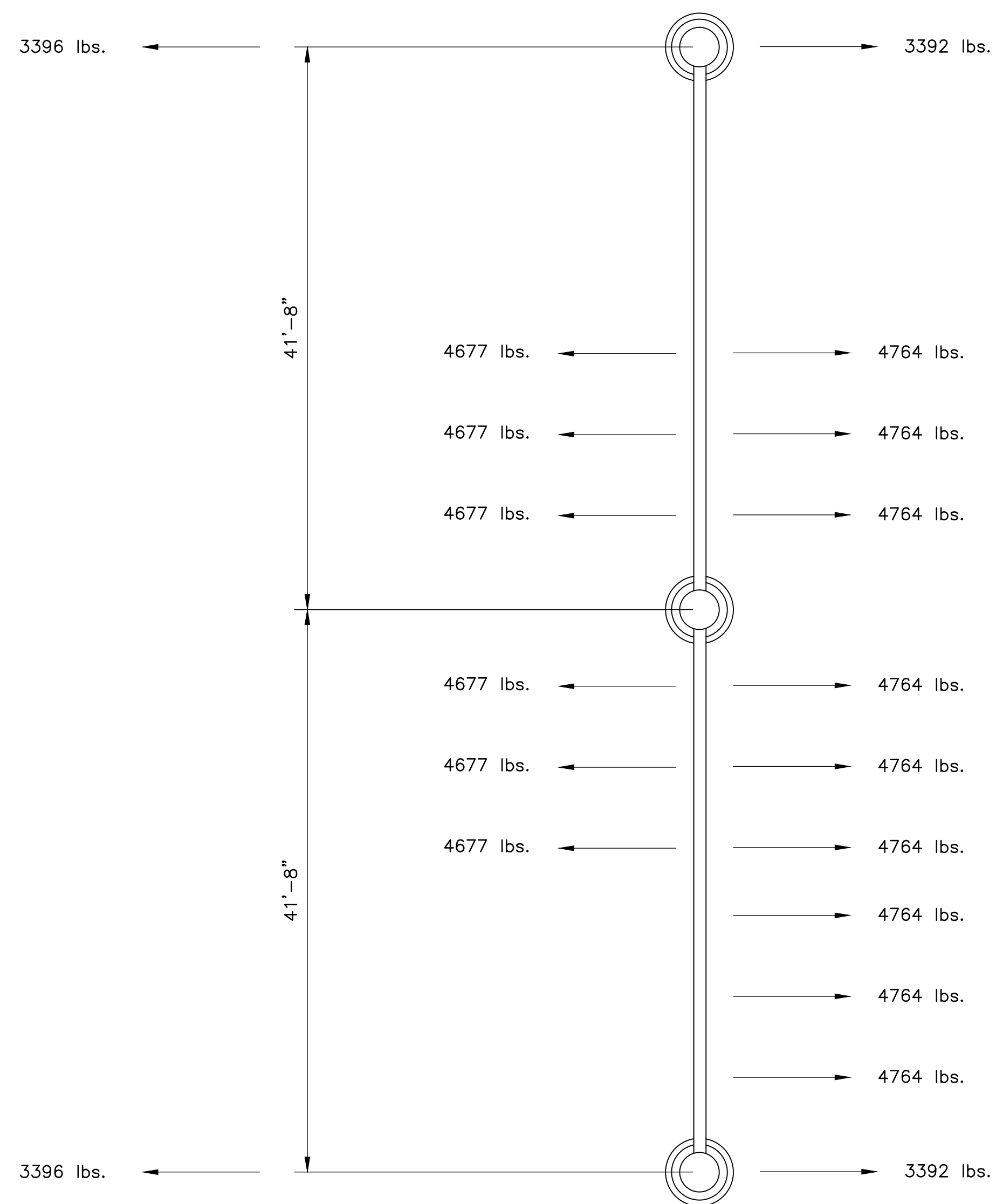
1. ALL TENSIONS ARE NESC HEAVY, UNFACTORED

ISSUED FOR BID

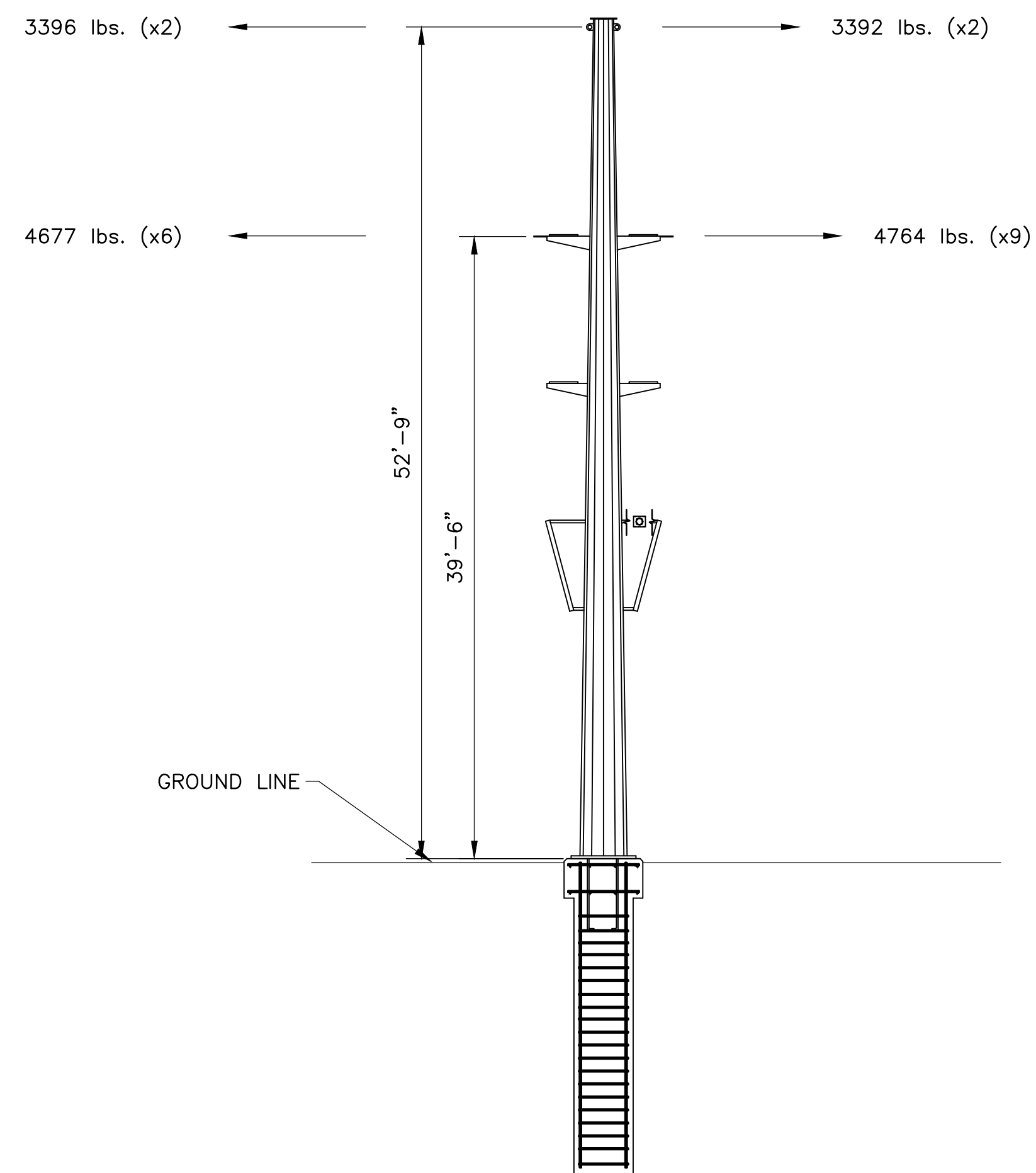
GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
161kV DEAD-END STRUCTURE TENSION LOADS			
SCALE: AS SHOWN	DRAWN BY: DJR	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
		DRAWING No. S294PS16	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	JT	BA

File: G:\Substation\AFTON\Carver CAD Drawings 2-16-12\S294PS17 69kV DEAD-END STRUCTURE TENSION LOADS.dwg Last Save: 2/16/2012 11:25 AM Last saved by: DJRogers  
 Last plotted by: Trundle, Jimmy Plot Style: Carver Standard Half.ctb Plot Scale: 1:2 Plot Date: 5/29/2012 1:12 PM Plotter Used: \Gltips01\LT IR C5185 PS3 East Tech Area



1 TOP VIEW  
S294PS17 SCALE: NONE



2 SIDE VIEW  
S294PS17 SCALE: NONE

### 69kV DEAD-END STRUCTURE

**REFERENCE DRAWINGS**

- S294PS01 161kV STEEL PLAN VIEW
- S294PS05 69kV DEAD-END STRUCTURE VIEW F & END VIEW

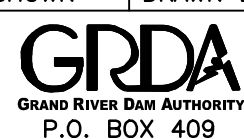


SCALE BAR

**NOTES:**

1. ALL TENSIONS ARE NESC HEAVY, UNFACTORED

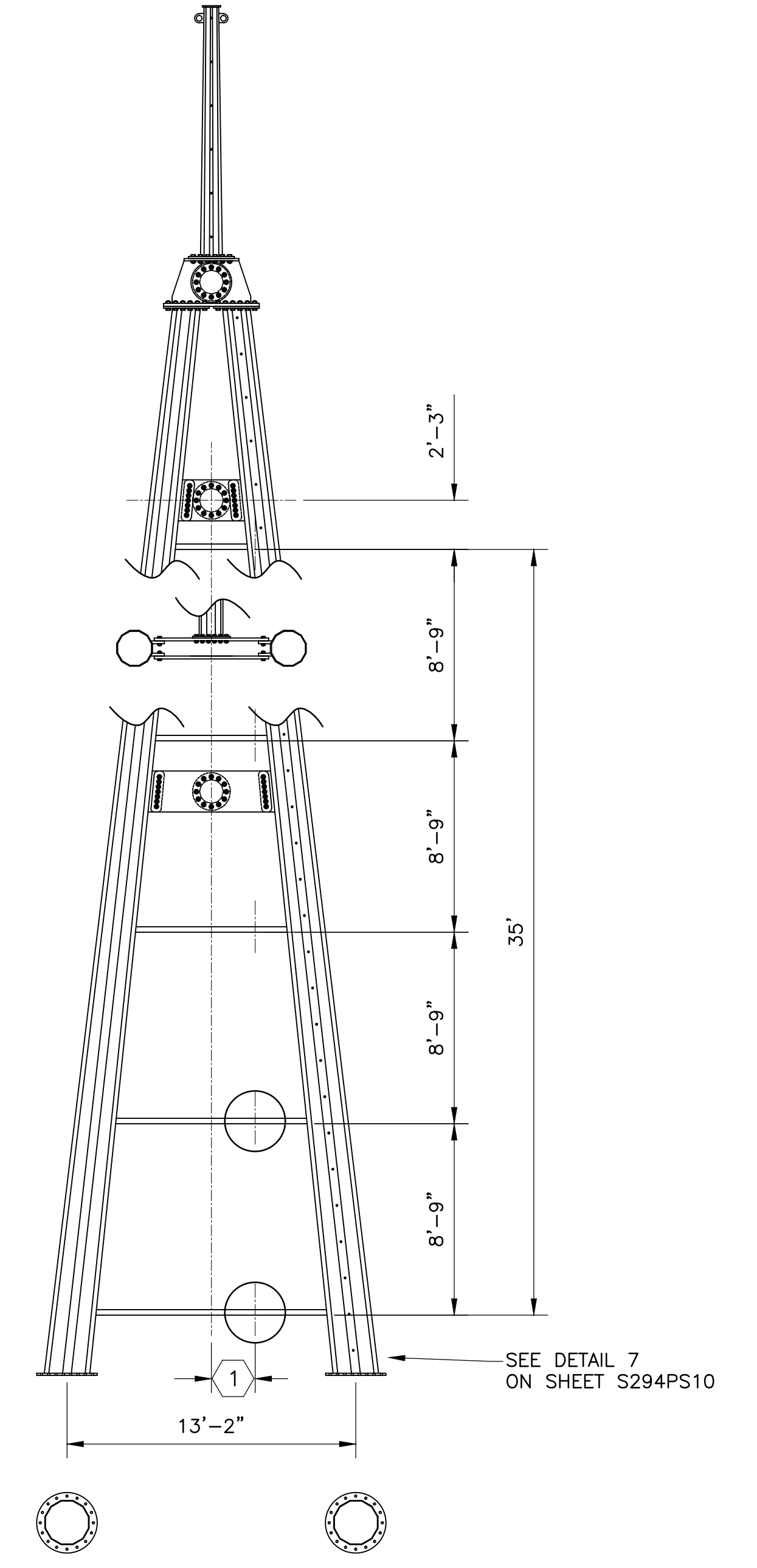
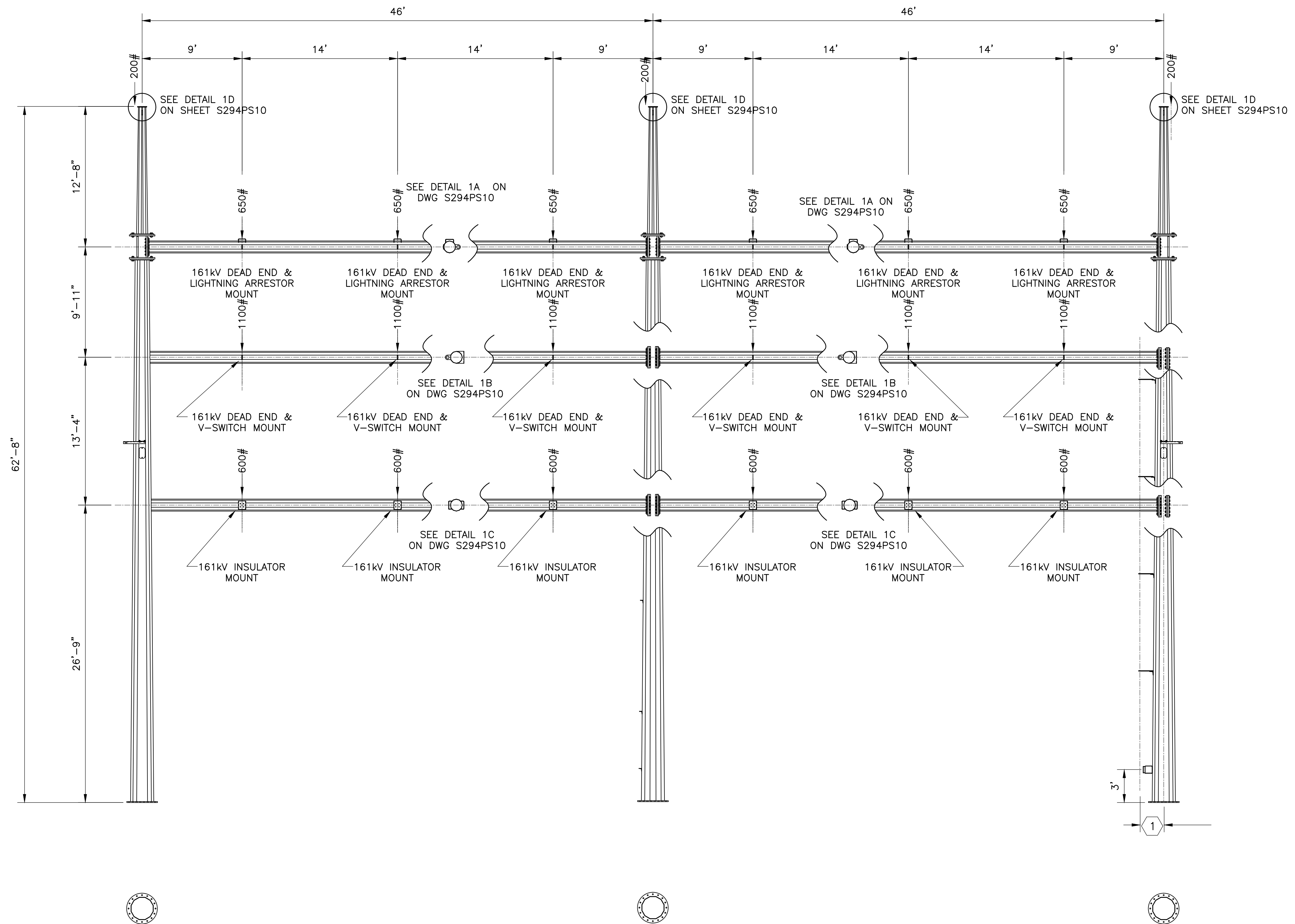
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>69kV DEAD-END STRUCTURE</b> <b>TENSION LOADS</b>			
SCALE: AS SHOWN	DRAWN BY: DJR	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
 <small>Grand River Dam Authority</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294PS17</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA



File: W:\Drafting\Drawings\Substation\AFTON\Garver CAD Drawings 2-16-12\S294PS18 161kV DEAD-END STRUCTURE VERTICAL LOADS.dwg Last Save: 5/30/2012 2:00 PM Last saved by: Ashults  
 Last Plotted by: Shults, Arlene Plot Style: Garver Standard Half.ctb Plot Scale: 1:2 Plot Date: 5/30/2012 2:00 PM Plotter used: \\Gtpps01\LT\_IR\_C5185\_P53\_East\_Tech\_Area



**2** 161kV DEAD-END STRUCTURE-END VIEW  
 S294PS03 SCALE: NONE

**REFERENCE DRAWINGS**

- S294PS01 161kV STEEL PLAN VIEW
- S294PS10 STEEL DETAILS SHEET 1 OF 5
- S294PS11 STEEL DETAILS SHEET 2 OF 5
- S294PS12 STEEL DETAILS SHEET 3 OF 5

**1** 161kV DEAD-END STRUCTURE (QTY. 2)-VIEW A  
 S294PS01/S294PS03 SCALE: NONE

**KEYED NOTES:**

- 1 VERIFY DIMENSIONS WITH SWITCH MANUFACTURER SHOP DRAWINGS.

**NOTES:**

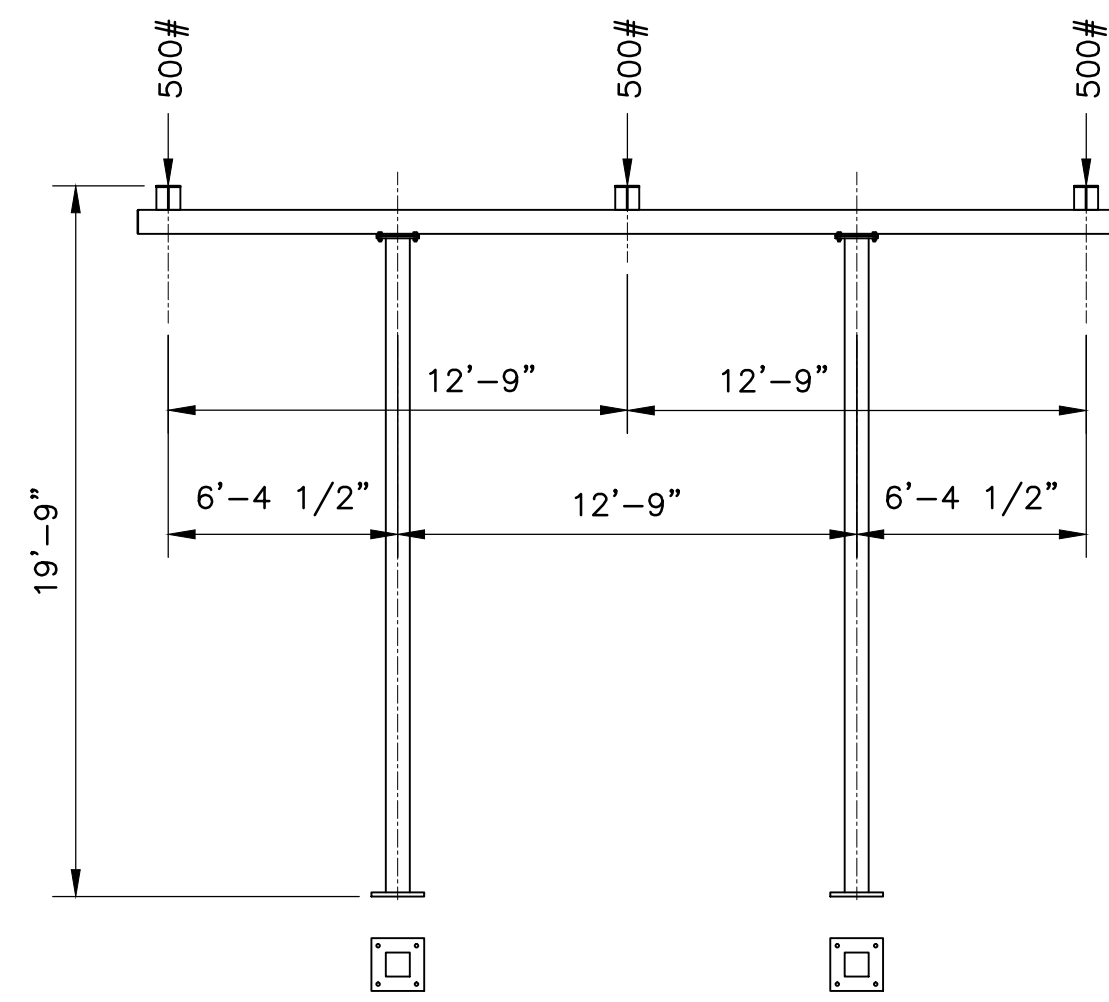
- 1. SECTION VIEWS ARE FROM RIGHT LOOKING LEFT AND FROM TOP LOOKING DOWN.
- 2. LOADINGS ARE ACTUAL EQUIPMENT WEIGHTS, UNFACTORED.

**ISSUED FOR BID**

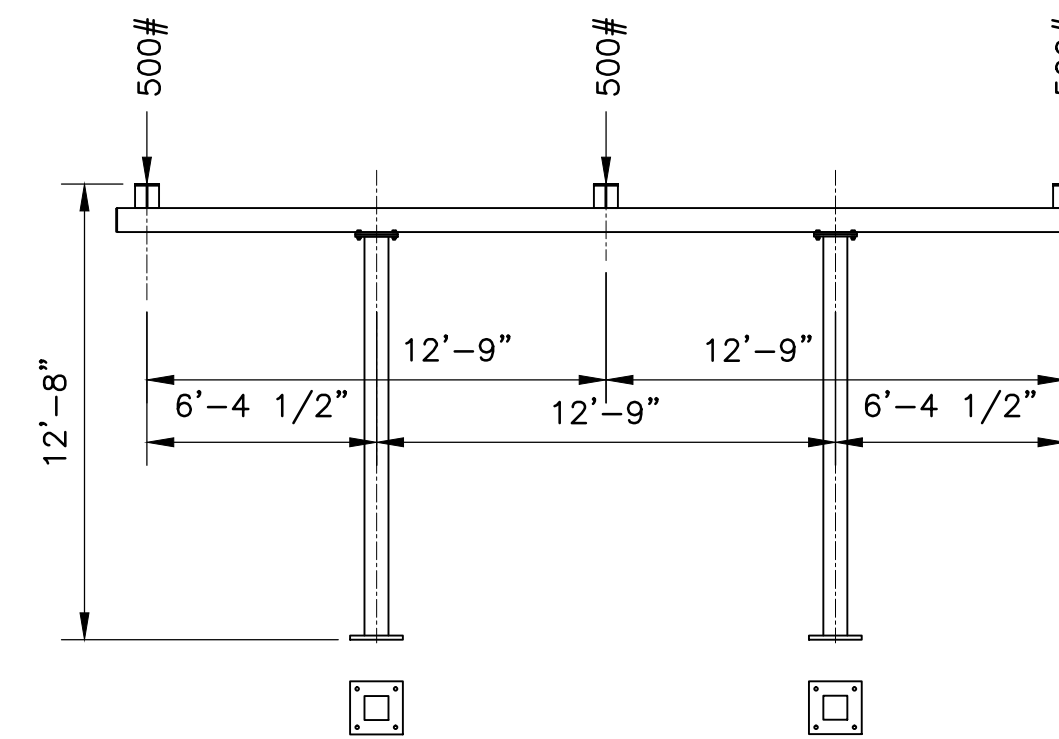
GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69kV</small>			
<b>161kV DEAD-END STRUCTURE VERTICAL LOADS</b>			
SCALE: AS SHOWN	DRAWN BY: DJR	ENGR: AEM	APPD: BA
CH: MW	DATE: 3/7/2011		
<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. <b>S294PS18</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG

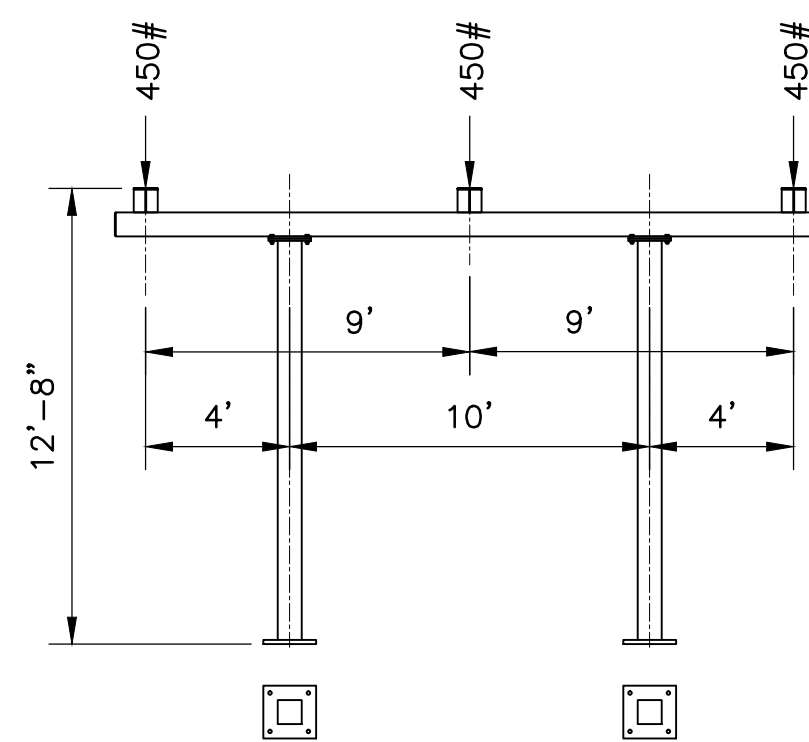
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 Last plotted by: Shults, Arlene Plot Style: Garver Standard Half.ctb Plot Scale: 1:2 Plot Date: 5/30/2012 1:58 PM Plotter Used: \\Gltips01\LT\_IR\_C5185\_PS3\_East\_Tech\_Area



1 161kV ANGLED BUS SUPPORT-HIGH VIEW B  
 S294PS19\S294PS19 SCALE: NONE



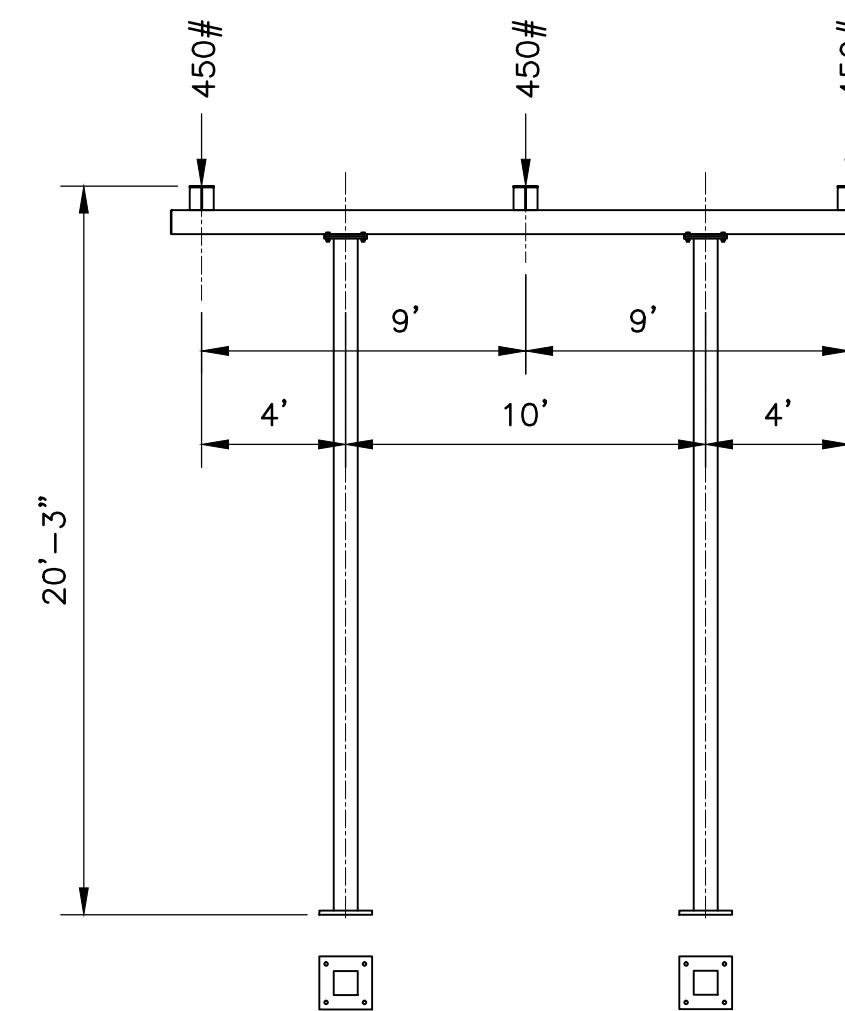
2 161kV ANGLED BUS SUPPORT-LOW VIEW C  
 S294PS19\S294PS19 SCALE: NONE



REFERENCE DRAWINGS

S294PS01 161kV STEEL PLAN VIEW

3 161kV BUS SUPPORT VIEW D  
 S294PS19\S294PS19 SCALE: NONE



4 161kV BUS SUPPORT-NARROW VIEW E  
 S294PS19\S294PS19 SCALE: NONE

NOTES:

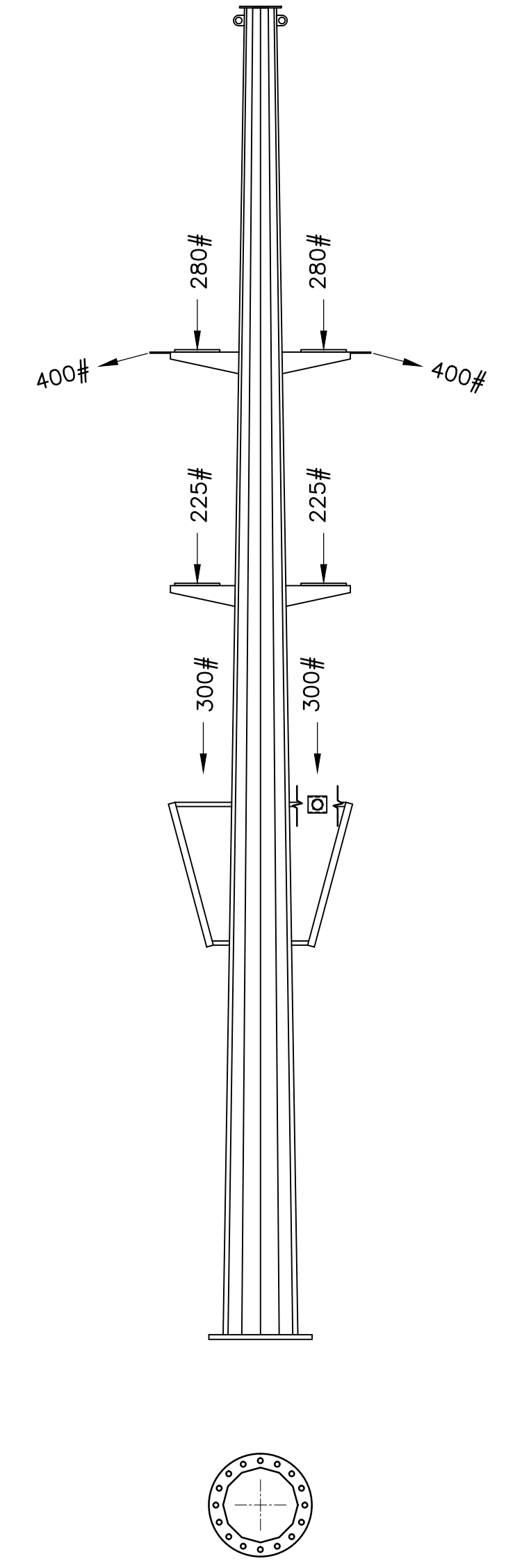
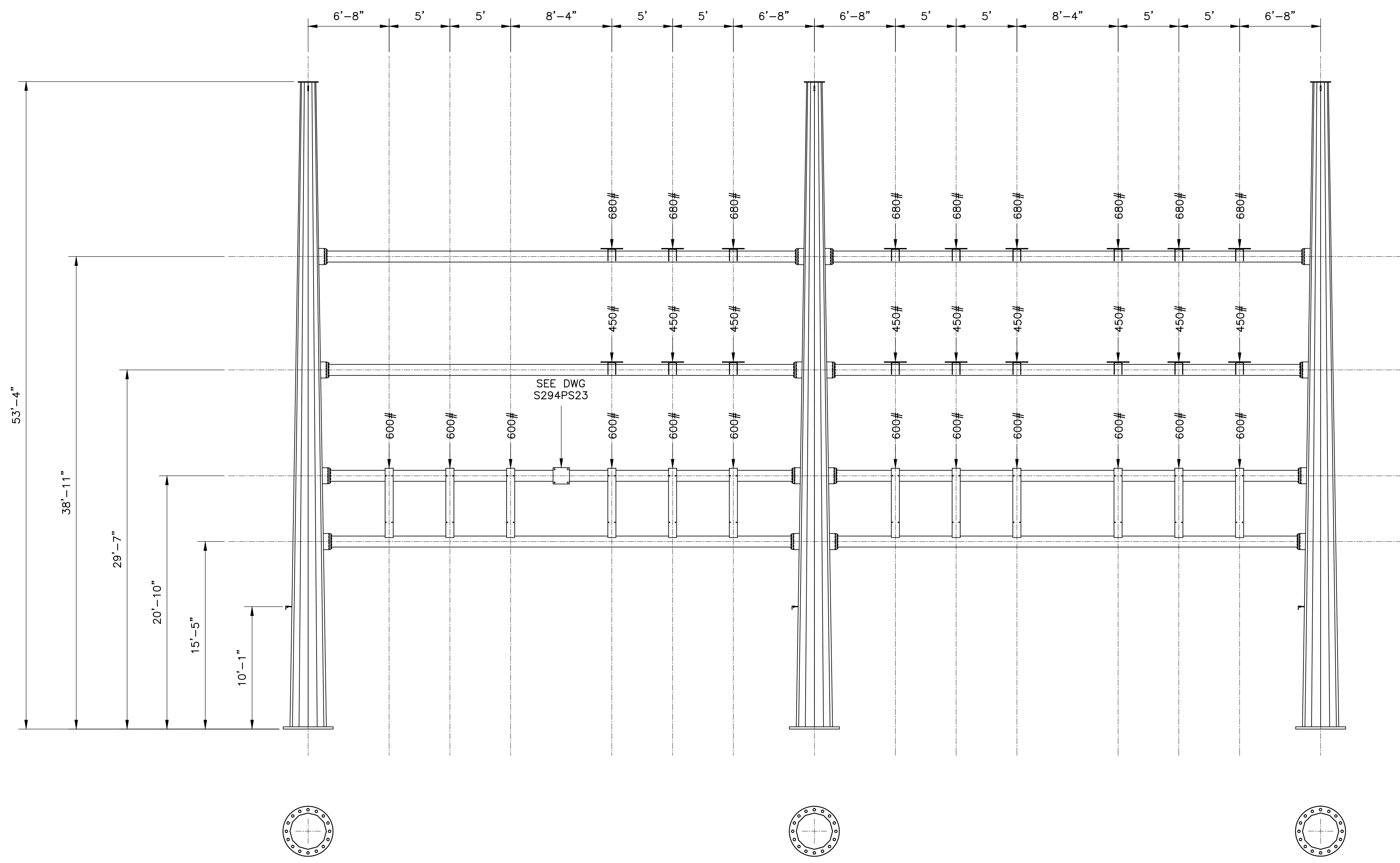
- LOADINGS ARE ACTUAL EQUIPMENT WEIGHTS, UNFACTORED.

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
161kV BUS SUPPORT STRUCTURE VERTICAL LOADS			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
DRAWING No. S294PS19			REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG

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 Last plotted by: Shults, Arlene Plot Style: Garver Standard Half.ctb Plot Scale: 1:2 Plot Date: 5/30/2012 1:57 PM Plotter used: \\Gltips01\LT\_IR C5185 PS3 East Tech Area



2 69kV DEAD-END STRUCTURE END VIEW  
 S294PS20 SCALE: NONE

**REFERENCE DRAWINGS**  
 S294PS02 69KV STEEL PLAN VIEW  
 S294PS23 69KV TRANSFORMER FDR BAY STRUCTURE VERTICAL LOADS

1 69kV DEAD-END STRUCTURE VIEW F  
 S294PS20\S294PS20 SCALE: NONE

**NOTES:**  
 1. LOADINGS ARE ACTUAL EQUIPMENT WEIGHTS, UNFACTORED.

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

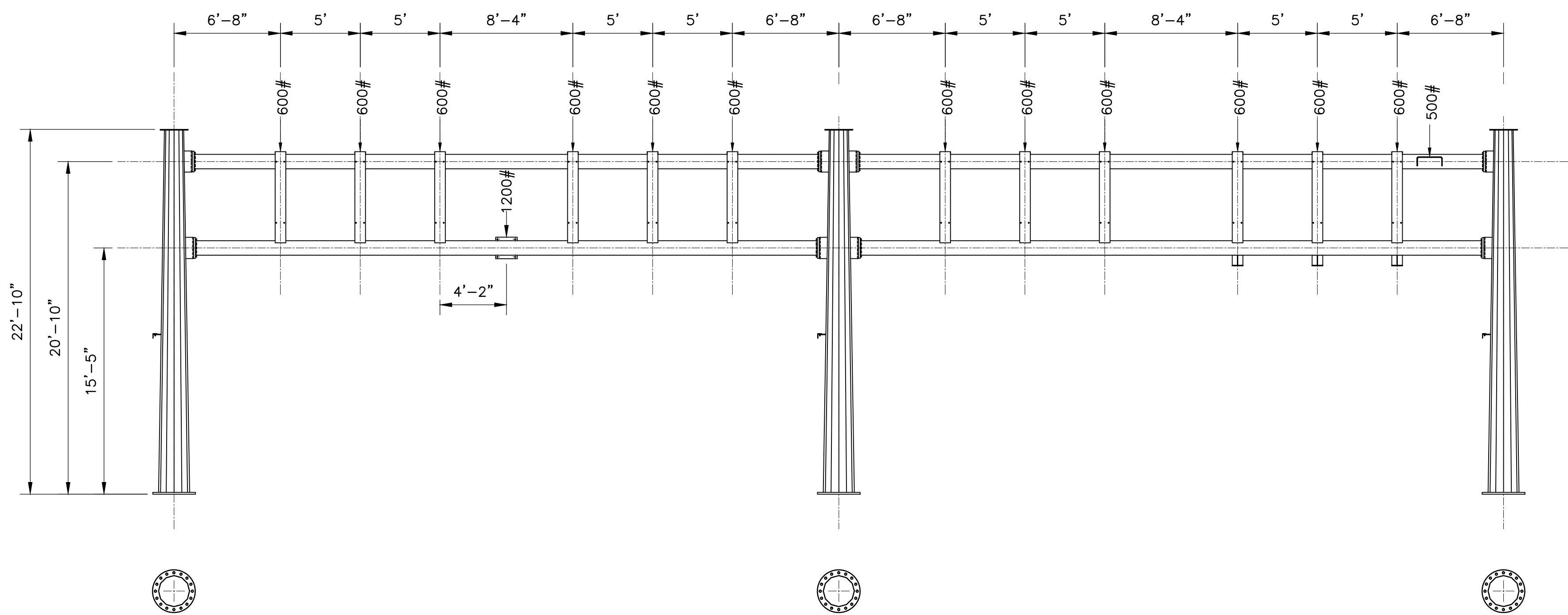
69kV DEAD-END STRUCTURE  
 VIEW F VERTICAL LOADS

SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
DRAWING No. S294PS20		REV. 0	

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	DFT	ENG

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 Last plotted by: Shults, Arlene Plot Style: Garver Standard Full.ctb Plot Scale: 1:64 Plot Date: 5/30/2012 1:57 PM Plotter Used: DWG To PDF.pc3



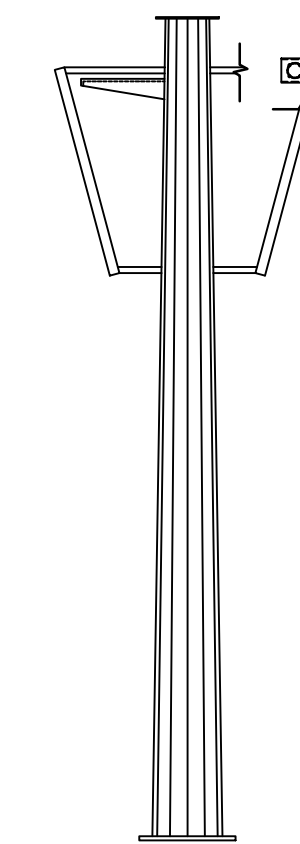
**REFERENCE DRAWINGS**

- S294PS02 69kV STEEL PLAN VIEW
- S294PS06 69kV BREAKER STRUCTURE VIEW G & END VIEW

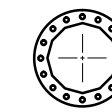
1 **69kV BREAKER STRUCTURE VIEW G**  
 S294PS21\S294PS21 SCALE: NONE

**NOTES:**

1. LOADINGS ARE ACTUAL EQUIPMENT WEIGHTS, UNFACTORED.



2 **69kV BREAKER STRUCTURE END VIEW**  
 S294PS21 SCALE: NONE

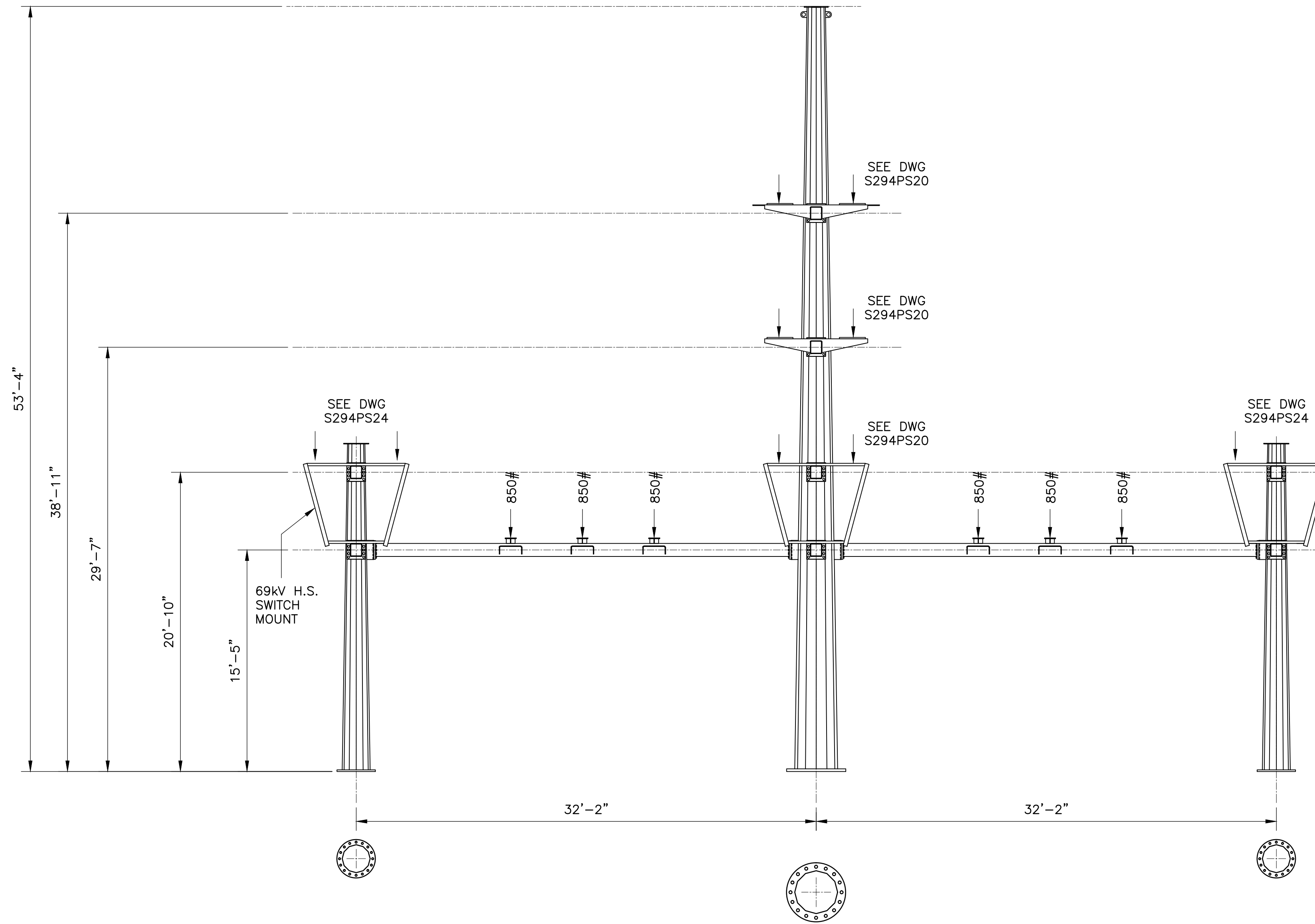


REV	DATE	REVISION DESCRIPTION	DFT	ENG

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV			
69kV BREAKER STRUCTURE VIEW G VERTICAL LOADS			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			DRAWING No. S294PS21
			REV. 0

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 Last Plotted: 5/30/2012 1:56 PM  
 Plotter Used: DWG To PDF.pc3  
 Last Plotted by: Shults, Arlene  
 Plot Style: Garver Standard Full.ctb  
 Plot Scale: 1:64



**REFERENCE DRAWINGS**

- S294PS02 69kV STEEL PLAN VIEW
- S294PS20 69kV DEAD-END STRUCTURE VIEW F VERTICAL LOADS
- S294PS24 69kV BREAKER STRUCTURE VIEW L VERTICAL LOADS

**1 69kV TRANSFORMER FEEDER BAY STRUCTURE VIEW H**  
 S294PS22|S294PS22 SCALE: NONE

**NOTES:**

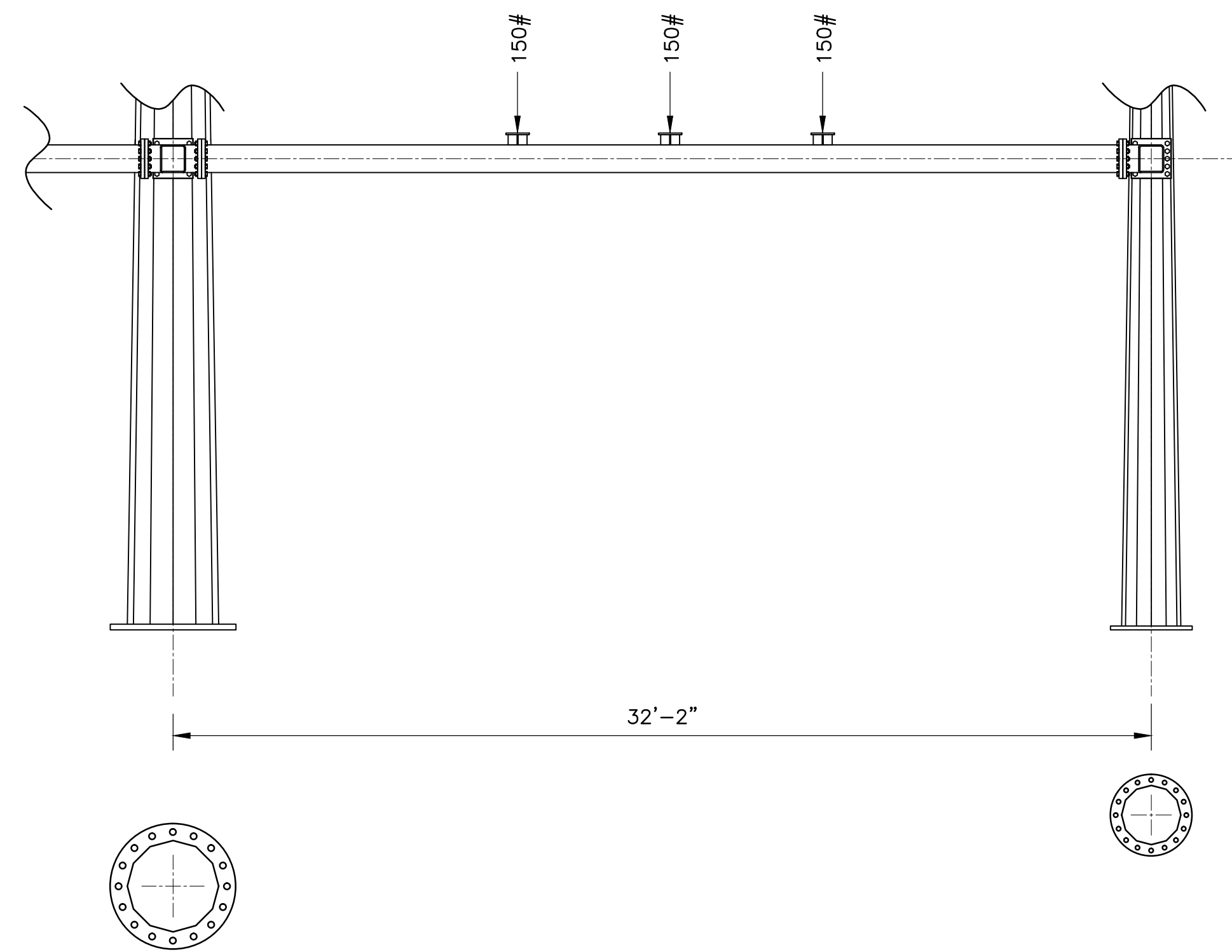
- 1. LOADINGS ARE ACTUAL EQUIPMENT WEIGHTS, UNFACTORED.

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69kV</small>			
<b>69kV TRANSFORMER FDR BAY STRUCTURE</b> <b>VIEW H VERTICAL LOADS</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294PS22</b>	REV. <b>0</b>

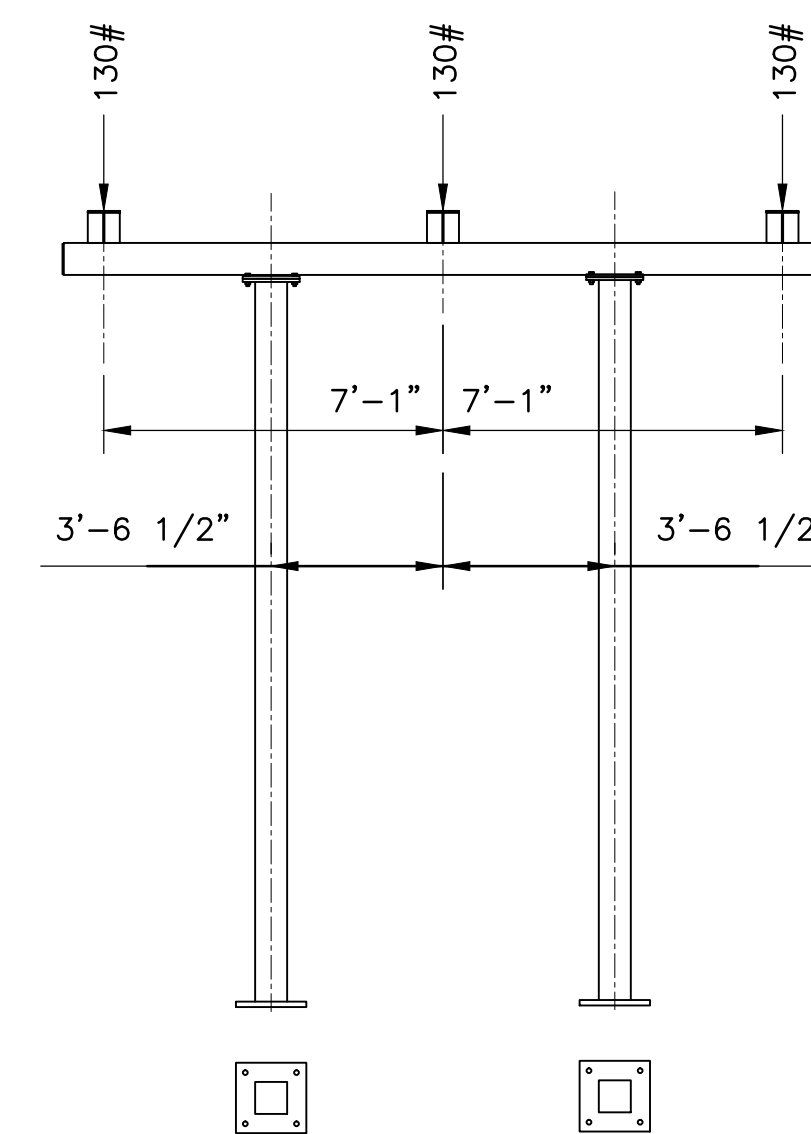
REV	DATE	REVISION DESCRIPTION	DFT	ENG

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1 **69kV TRANSFORMER FEEDER BAY STRUCTURE VIEW J**  
 S294PS23\S294PS23 SCALE: NONE

**REFERENCE DRAWINGS**  
 S294PS02 69KV STEEL PLAN VIEW



2 **69kV BUS SUPPORT STRUCTURE VIEW K**  
 S294PS23\S294PS23 SCALE: NONE

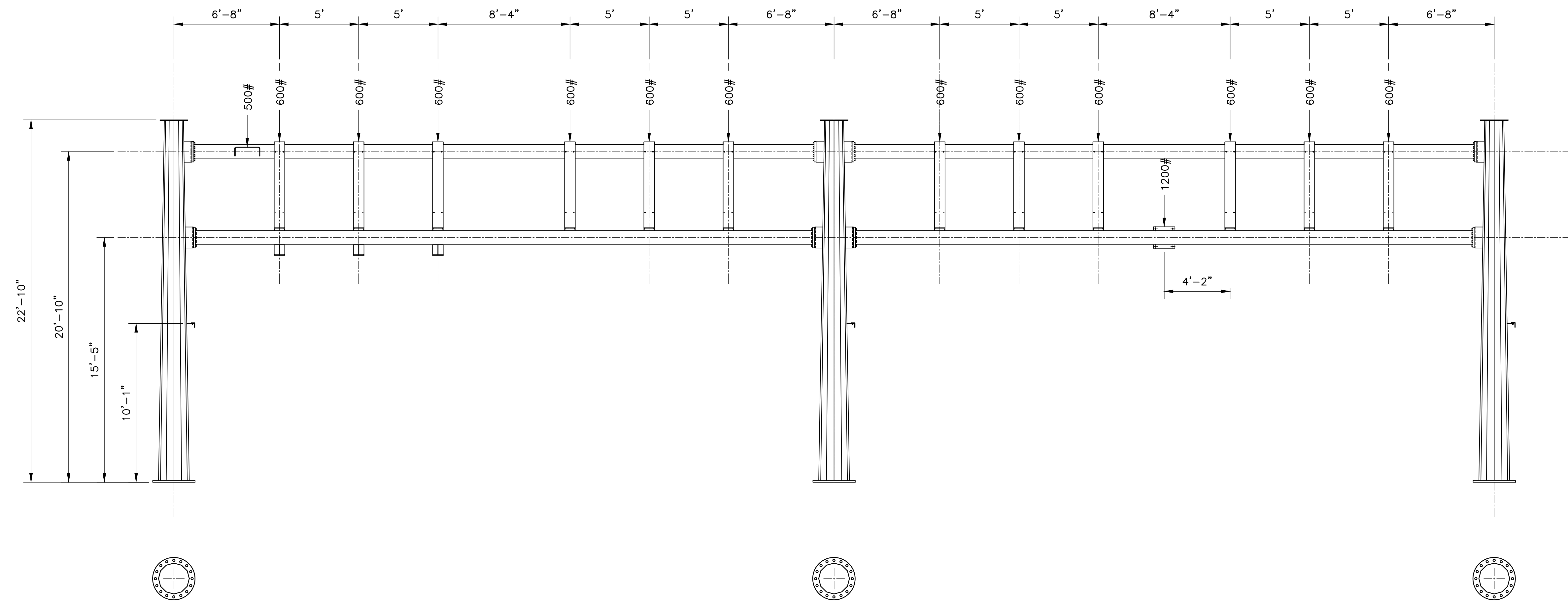
**NOTES:**  
 1. LOADINGS ARE ACTUAL EQUIPMENT WEIGHTS,  
 UNFACTORED.

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>69kV TRANSFORMER FDR BAY STRUCTURE</b> <b>VIEW J &amp; K VERTICAL LOADS</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. S294PS23	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG

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**REFERENCE DRAWINGS**  
 S294PS02 69kV STEEL PLAN VIEW  
 S294PS13 STEEL DETAILS SHEET 4 OF 5

1  
**69kV BREAKER STRUCTURE VIEW L**  
 S294PS24|S294PS24 SCALE: NONE

**NOTES:**  
 1. LOADINGS ARE ACTUAL EQUIPMENT WEIGHTS,  
 UNFACTORED.

**ISSUED FOR BID**

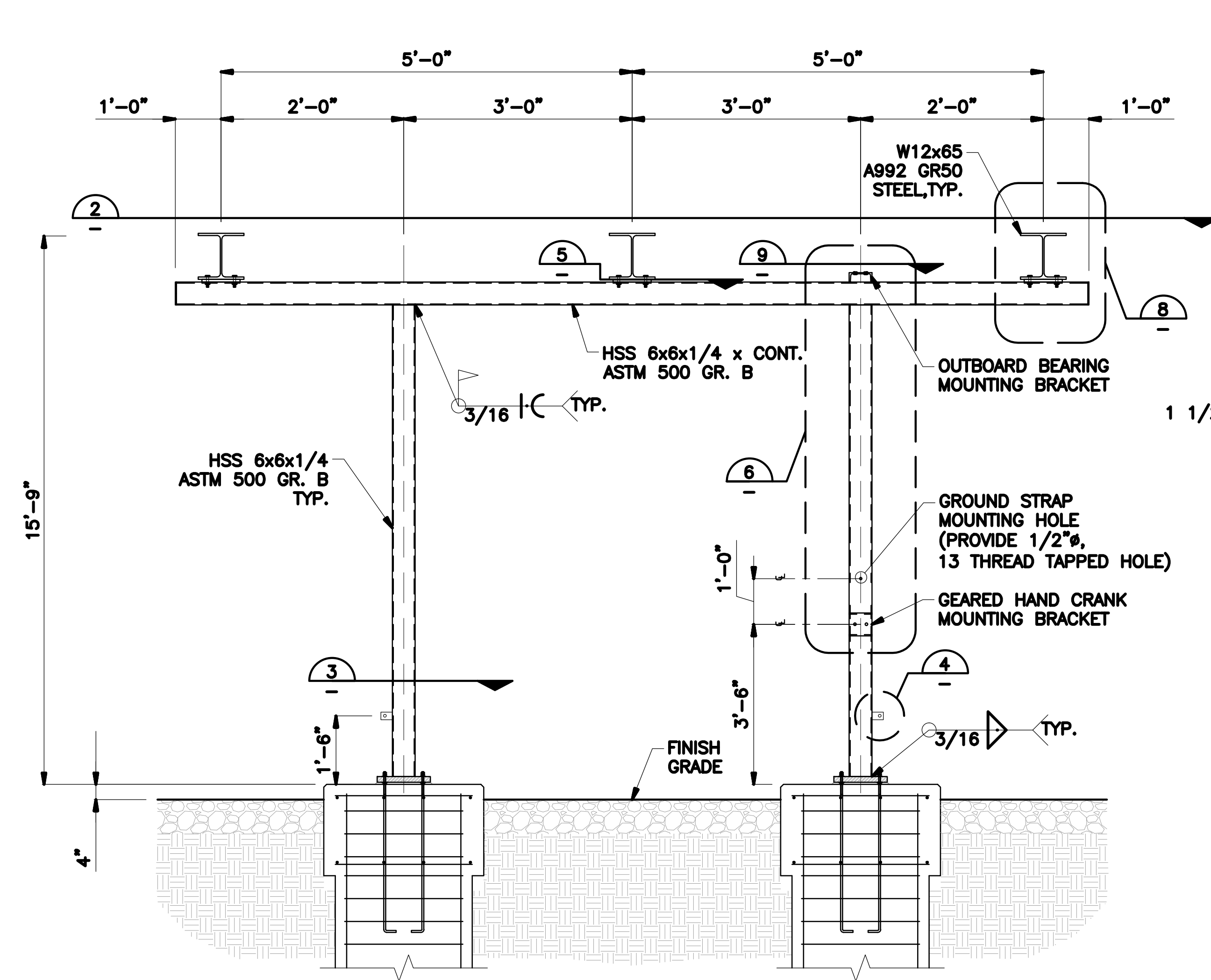
GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 1616/69kV

**69kV BREAKER STRUCTURE**  
**VIEW L VERTICAL LOADS**

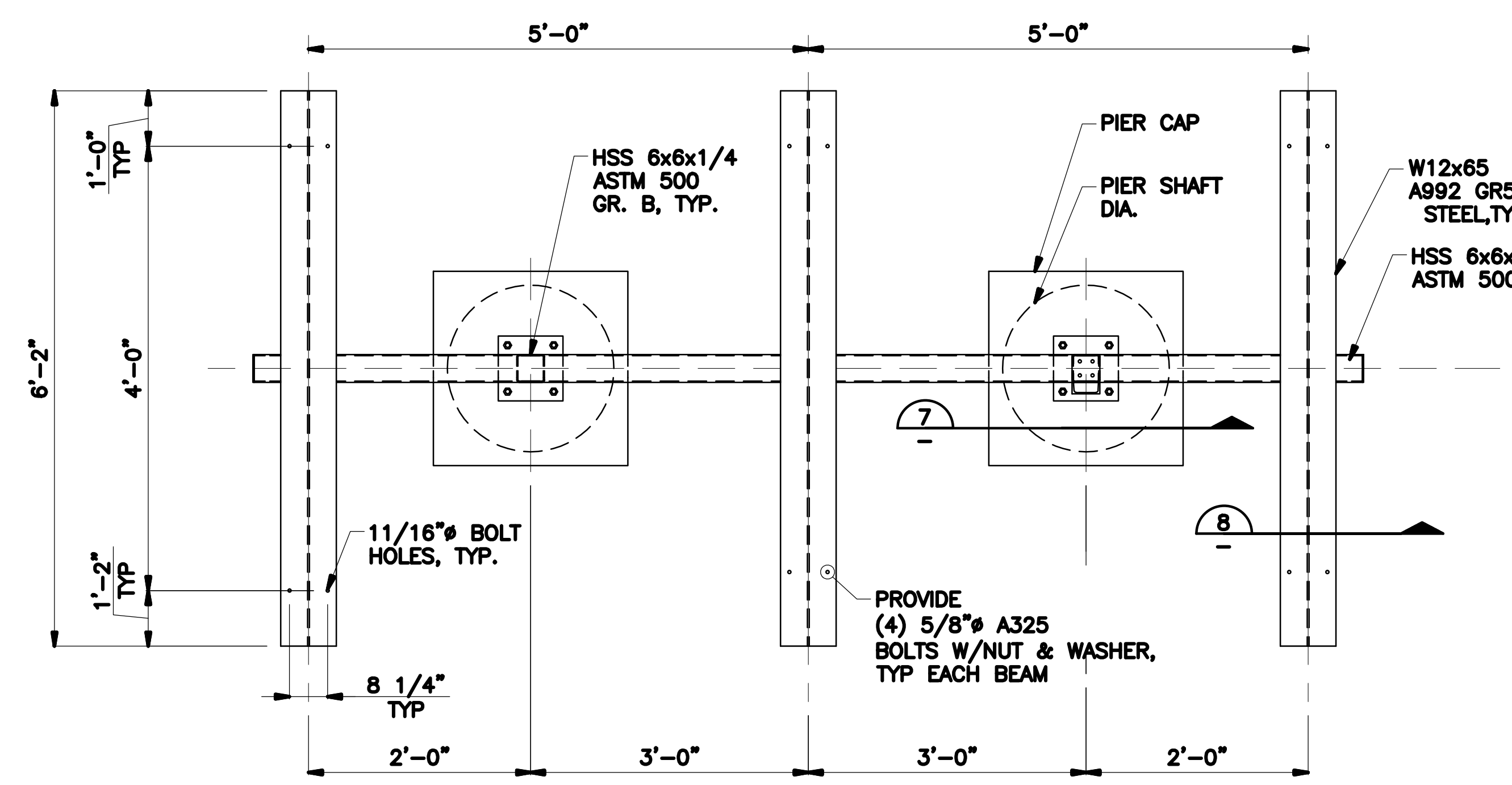
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: <del>SAF</del>
		CH: MWSRF	DATE: 3/7/2011
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		S294PS24	0

GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

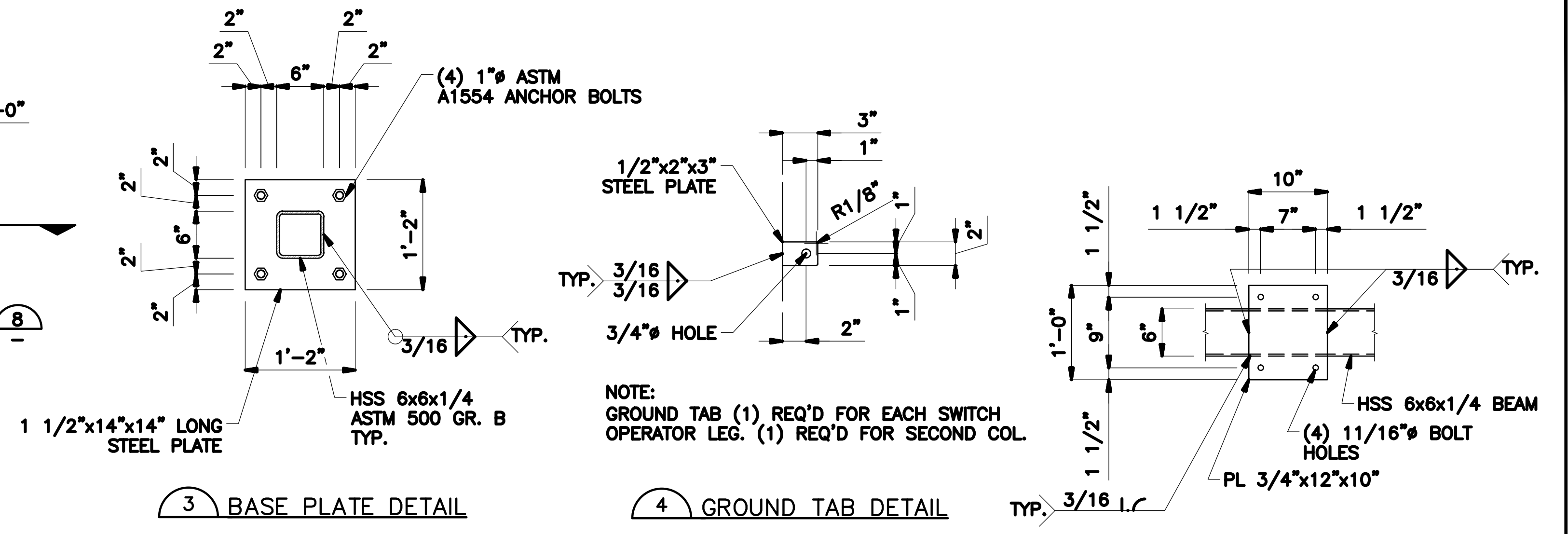
REV	DATE	REVISION DESCRIPTION	DFT	ENG



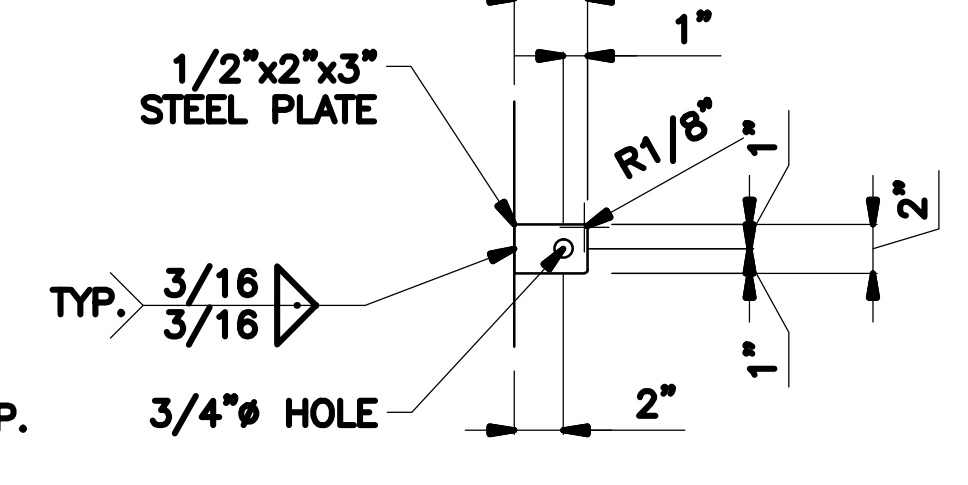
1 SWITCH STAND ELEVATION



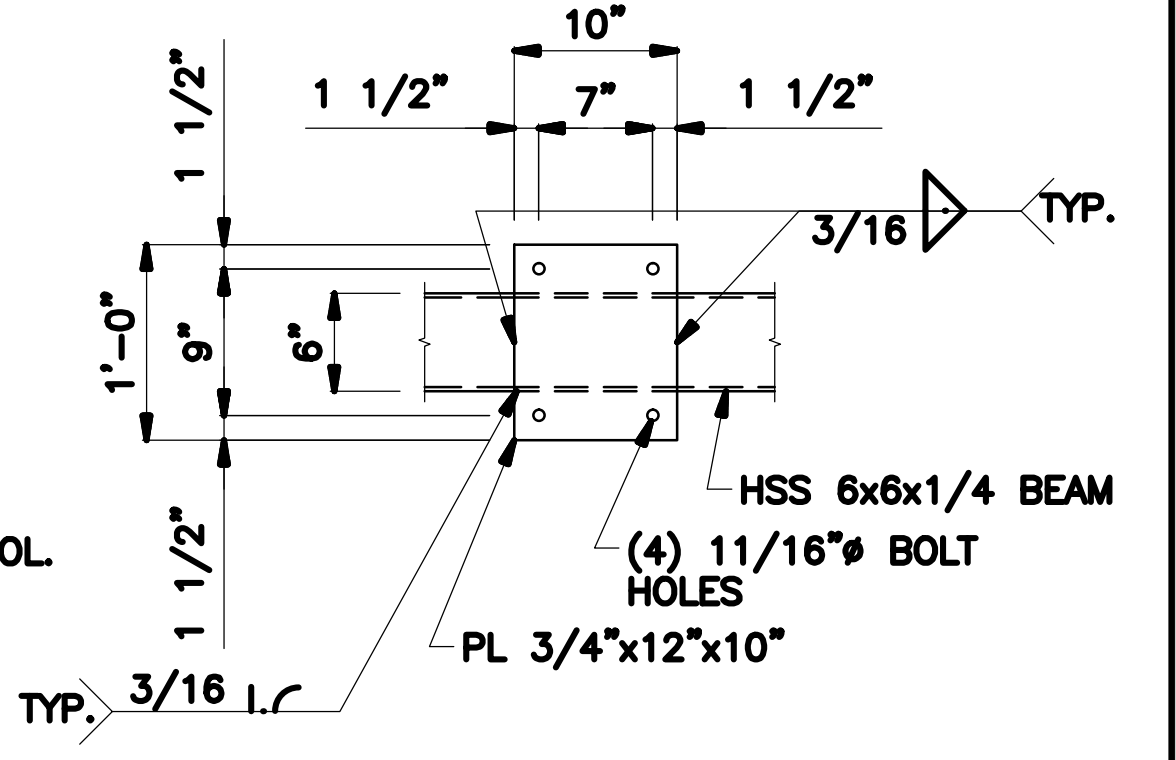
2 SWITCH STAND PLAN VIEW



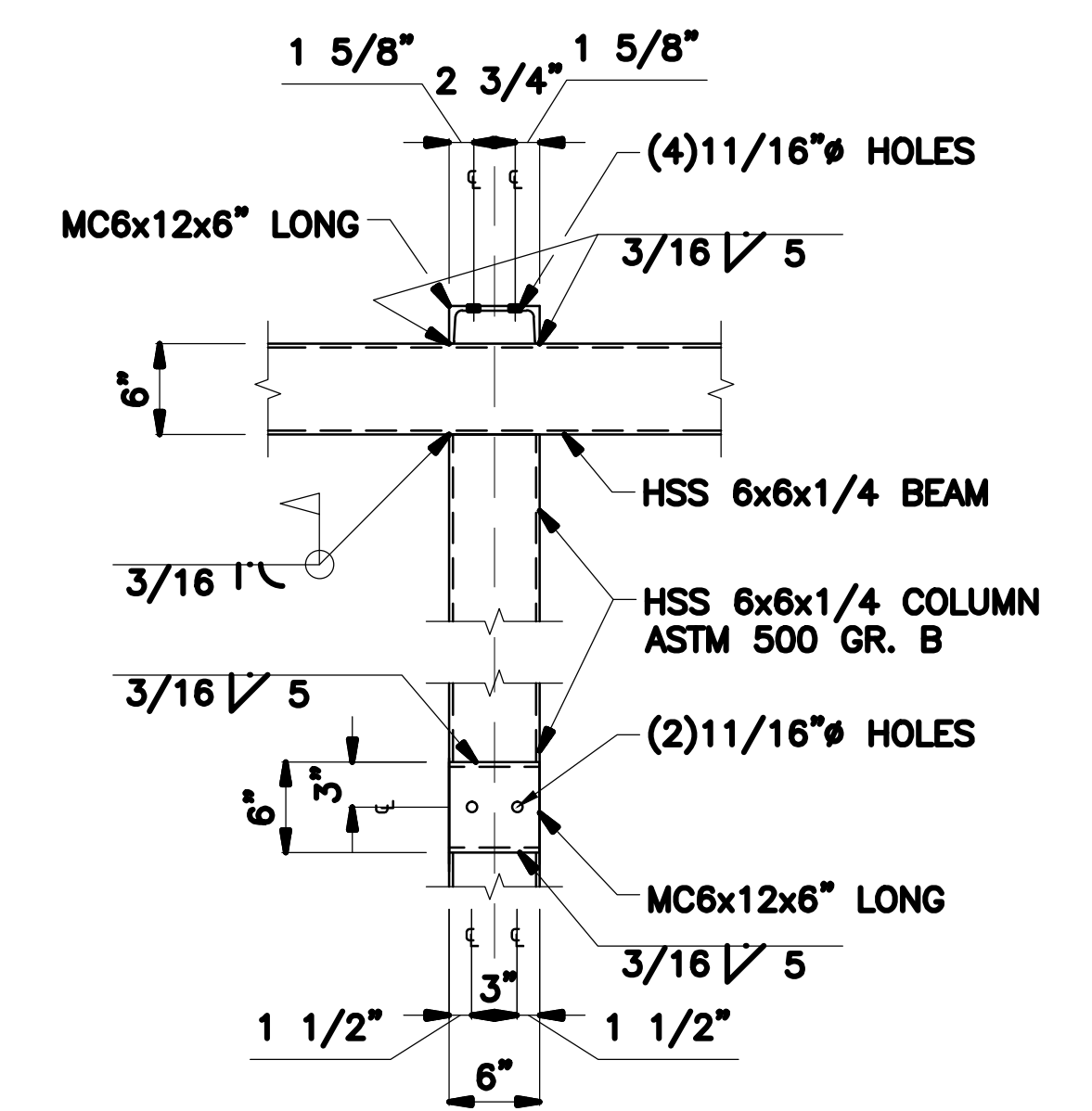
3 BASE PLATE DETAIL



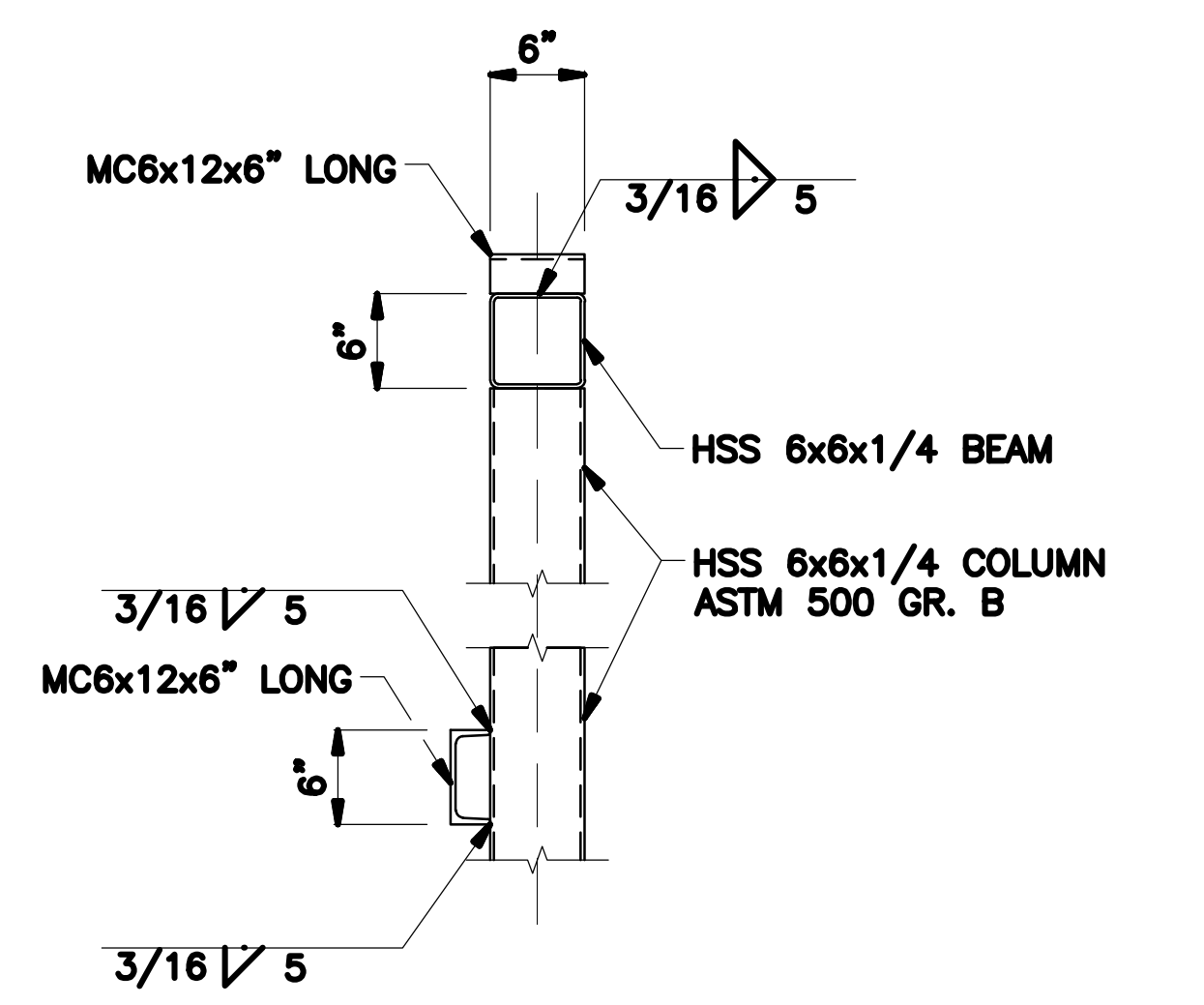
4 GROUND TAB DETAIL



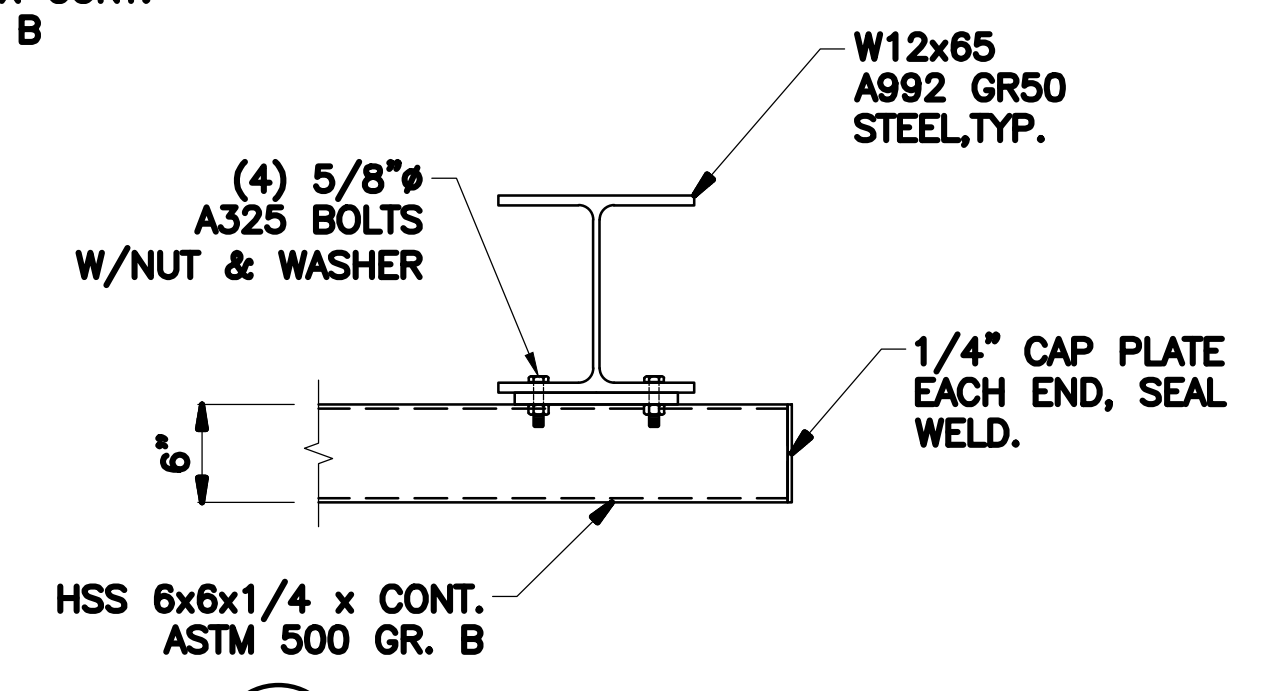
5 CONNECTION DETAIL-PLAN VIEW



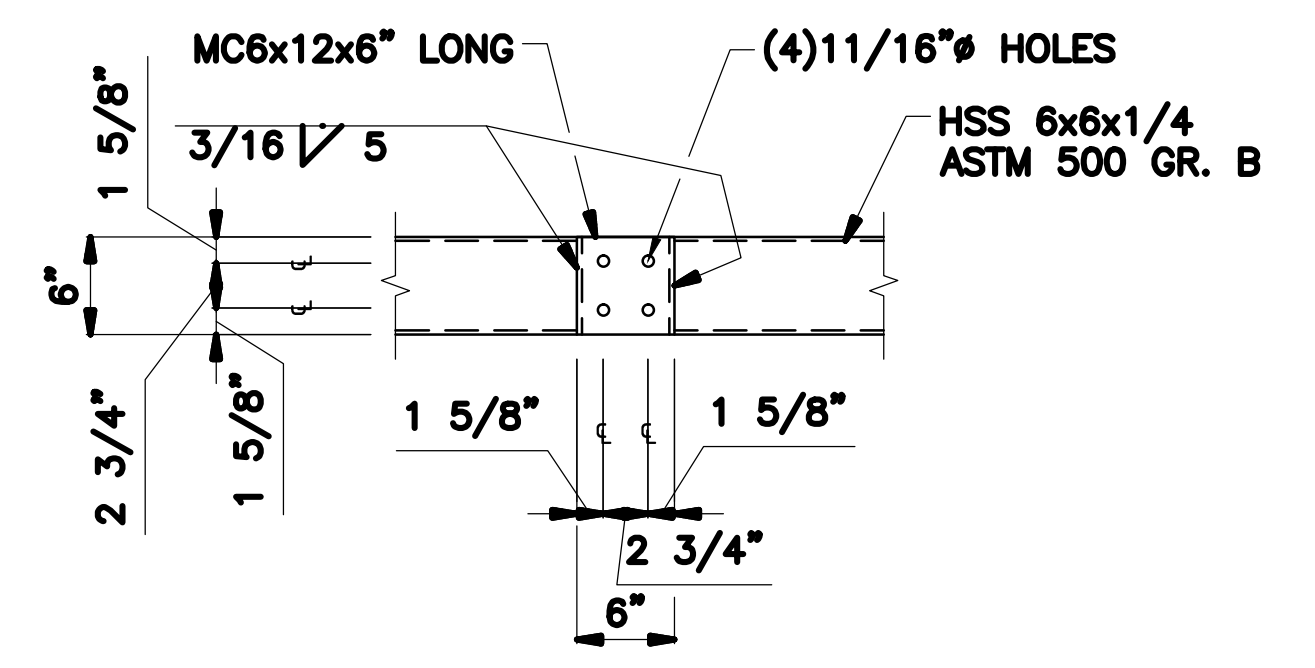
6 CONNECTION DETAIL



7 CONNECTION DETAIL

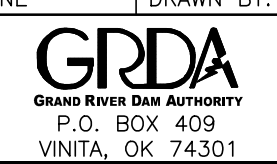


8 CONNECTION DETAIL



9 CONNECTION DETAIL

SHEET NOTE:  
USE 3.9MIL GALVANIZED STEEL COATING ON ALL MEMBERS.

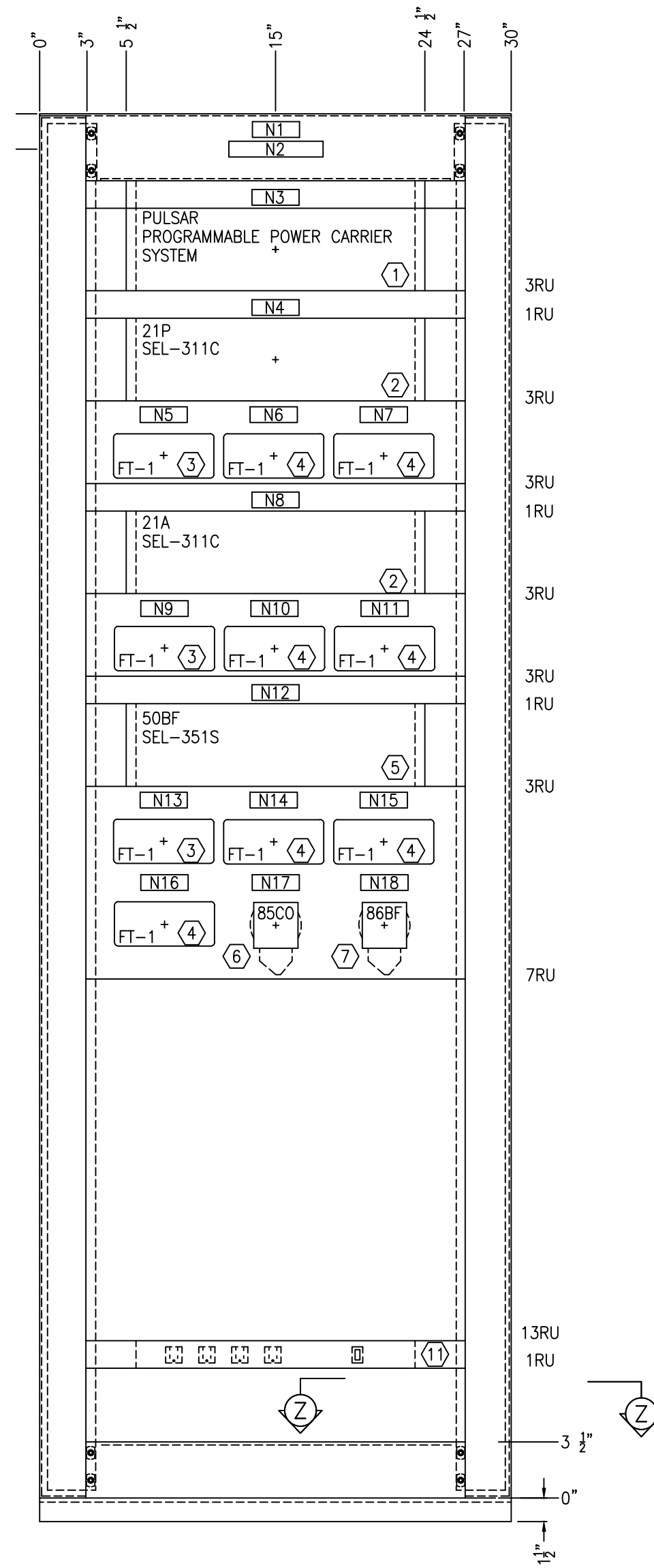
<b>ISSUED FOR BID</b>			
GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161KV			
<b>69kV SWITCH STAND VERTICAL BREAK SWITCH</b>			
SCALE: NONE	DRAWN BY: JT	ENGR: BA	APPD: BA
CH: BA	DATE: 18APR12	DRAWING No. S294PS25	
			REV. 0



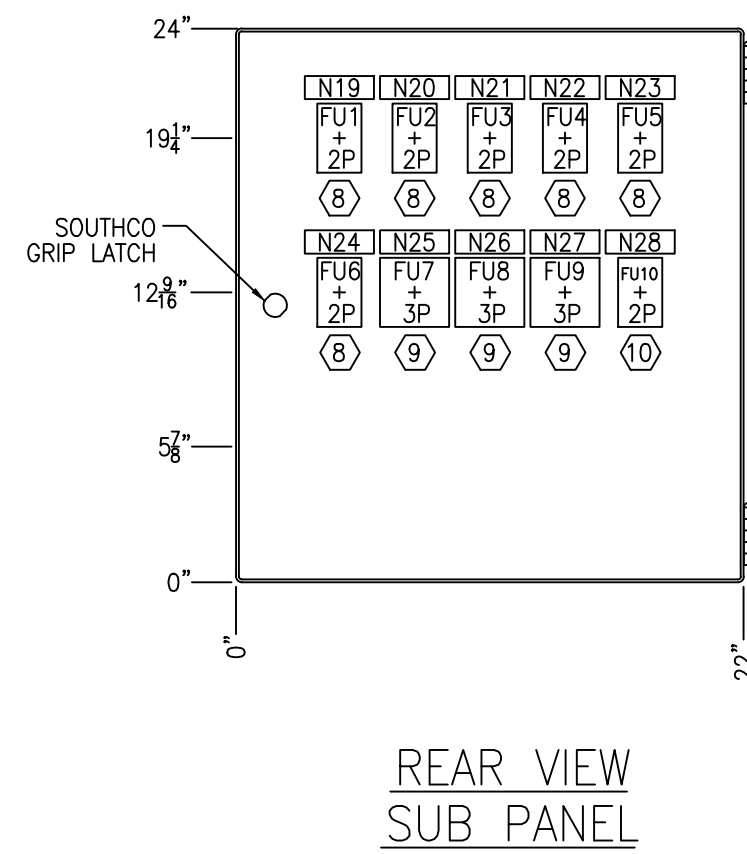
## Afton Substation

S294PP101	BKR 100 FDR 22 - 161 kV MIAMI PANEL 101
S294PP102	BKR 2270 FDR 22 - 161 kV MIAMI
S294PP103	FDR 126 - 161kV PENSACOLA
S294PP104	TRANSFORMER NO 1 & BKR 300
S294PP105	BKR 400 & 69 kV DIFF ZONE S1 & N1
S294PP106	TRANSFORMER NO 2 & BKR 500
S294PP107	FDR 5 69kV PENSACOLA PNL 107 - BKR 540
S294PP108	FDR 61 - 69 kV MIAMI PNL 108 BKR 6140
S294PP109	PNL 109 - BKR 6040 - FDR 60 - 69kV VINITA
S294PP110	PNL 110 - BUS TIE BKRS 600, 700, 800
S294PP111	FDR 63 - 69kV MONKEY ISLAND PANEL 111
S294PP112	FDR 62 - 69kV SAILBOAT BRIDGE PANEL 112

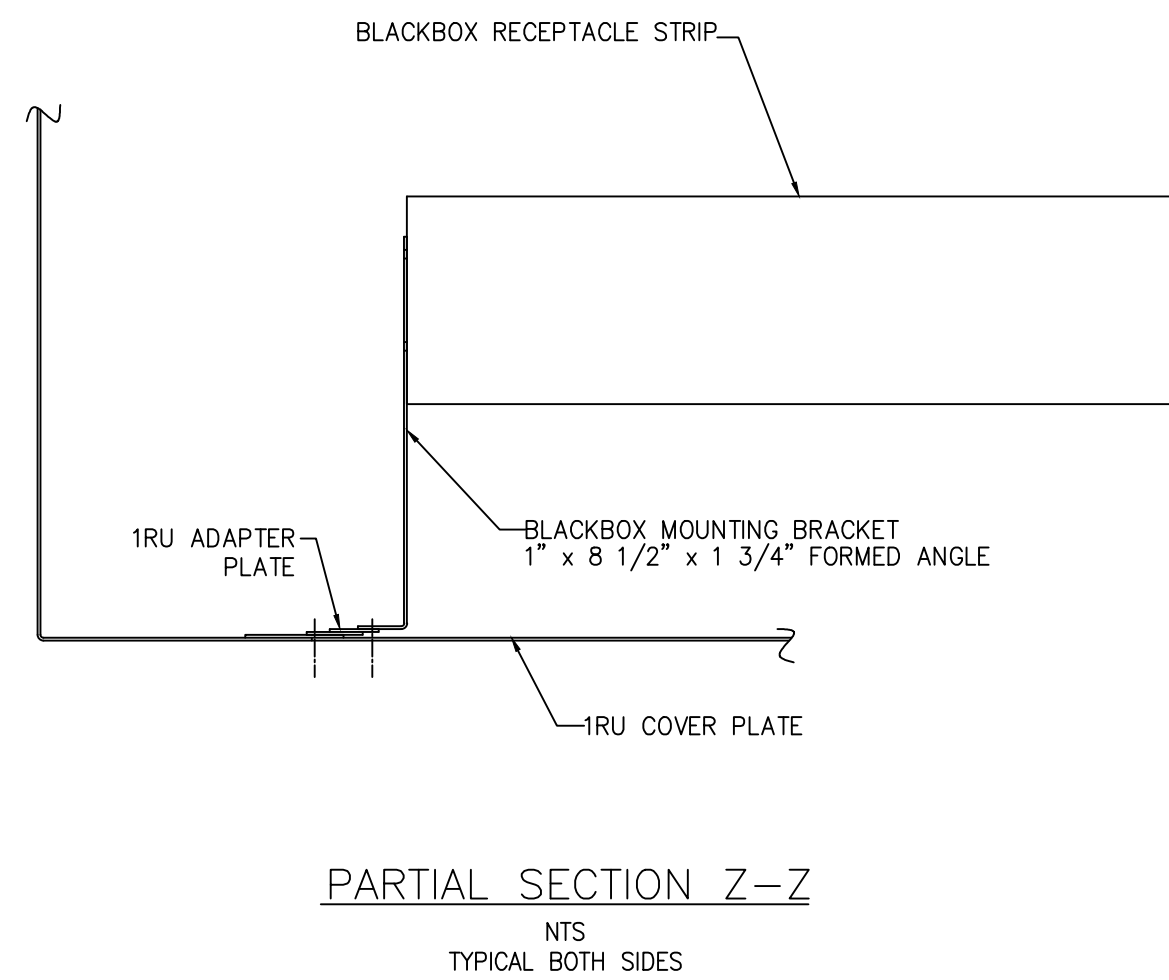
File: W:\Drafting\Drawings\Substation\AFTON\Convex CAD Drawings 2-16-12\S294PP101 FDR 22-161KV MIAMI PANEL 101-BREAKER 100.dwg Last\_Saved: 4/23/2012 8:00 AM Last\_saved\_by: Ashulis  
 Last\_plotted\_by: Shulls, Ariene Plot\_Style: Monochrome.ctb Plot\_Scale: 1:7.6084 Plot\_Date: 5/31/2012 10:41 AM Plotter Used: Adobe PDF-11x17.pc3



FRONT VIEW PNL 101  
FEEDER NO. 22  
161KV MIAMI TRANSMISSION LINE  
BREAKER 100 PANEL



REAR VIEW  
SUB PANEL



PARTIAL SECTION Z-Z  
NTS  
TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION
1	1	PULSAR PROGRAMMABLE POWER CARRIER SYSTEM
		S# US1NSCIANS
2	2	SEL 311C LINE PROTECTION RELAY 21P/21A
		S# SEL-0311C11HA3A5421 (125VDC)
3	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) FT1/TS
		S# 129A514G01
4	7	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT) FT1/TS
		S# 129A501G01
5	1	SEL 351S CIRCUIT BREAKER CONTROL RELAY 50BF
		S# SEL351S61H63554X1 (125VDC)
6	1	ELECTROSWITCH, SERIES 31LSR CARRIER CUTOFF SWITCH, 85CO
		125VDC, S# 9303DB, ENGRAVED "CARRIER ON OFF"
7	1	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 86BF
		125VDC, S# 78PB08D, 8 DECK, MANUAL RESET LOR, WITH LIGHTS
		RED LED=COIL MONITOR & GREEN LED=TRIPPED
8	6	MARATHON #F30A2S FUSE BLOCK/2 POLE FU
		WITH TYPE NON-10 AMP FUSES
9	3	MARATHON #F30A3S FUSE BLOCK/3 POLE FU
		WITH TYPE NON-6 AMP FUSES
10	1	MARATHON #F30A2S FUSE BLOCK/2 POLE FU
		WITH TYPE NON-6 AMP FUSES
11	1	BLACK BOX RECEPTACLE STRIP, 120V AC, 8 PLUGS WITH SURGE PROTECTION #SP196A-R2
12	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, TB
		4 CIRCUIT, S# EB25B04
13	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, TB
		12 CIRCUIT, S# EB25B12
14	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, TB
		4 CIRCUIT, S# EB27B04S
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.		

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 101			1.0x3.0	.187
2	1	161KV	MIAMI FDR 22	TRANSMISSION LINE	1.0x6.0	.375
3	1	PWR. LINE CARRIER	MIAMI FDR 22	DCB		
4	1	PRIMARY RELAY	(21P)		1.0x3.0	.187
5	1	PRIMARY RELAY	POT.&CUR. TEST SW.	(21P/TS1)		
6	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS2)		
7	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS3)		
8	1	ALTERNATE RELAY	(21A)			
9	1	ALTERNATE RELAY	POT.&CUR. TEST SW.	(21A/TS1)		
10	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS2)		
11	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS3)		
12	1	BF & RECLOSE RELAY	(50BF/BKR 100)			
13	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
14	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
15	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
16	1	BKR 100-LOCKOUT RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
17	1	CARRIER - FDR. 22	ON/OFF SWITCH	85CO		
18	1	CB 100 BF	BF LOCKOUT RELAY	86BF/100		
19	1	UPLC CARRIER SET	DC CONTROL	FU1 (10A)		
20	1	PRIMARY RELAY	DC CONTROL	FU2 (10A)		
21	1	ALTERNATE RELAY	DC CONTROL	FU3 (10A)		
22	1	CB 100 BF	DC CONTROL	FU4 (10A)		
23	1	SPARE DC		FU5 (10A)		
24	1	AC POWER STRIP	POTENTIAL	FU6 (10A)		
25	1	PRIMARY RELAY	POTENTIAL	FU7 (6A)		
26	1	ALTERNATE RELAY	POTENTIAL	FU8 (6A)		
27	1	CB 100	POTENTIAL	FU9 (6A)		
28	1	CB 100 SYNC	POTENTIAL	FU10 (6A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

NOTES:

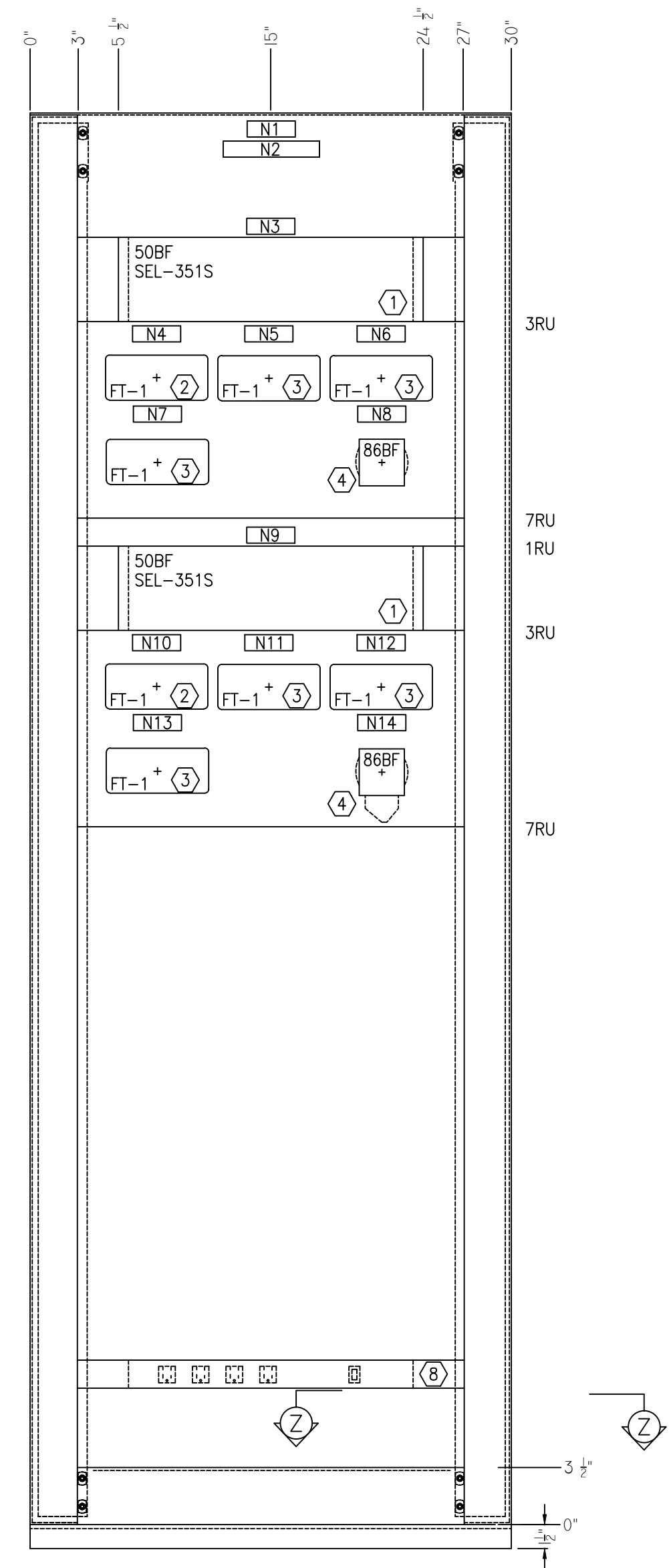
1. INDICATES TYPICAL BILL OF MATERIAL ITEM NO.
2. INDICATES TYPICAL NAMEPLATE ITEM NO.
3. 11GA. CONSTRUCTION UNLESS OTHERWISE INDICATED.
4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY. INTERIOR - HENTZEN WHITE.
5. INDICATES CUTOUT AND COVER.

ISSUED FOR BID

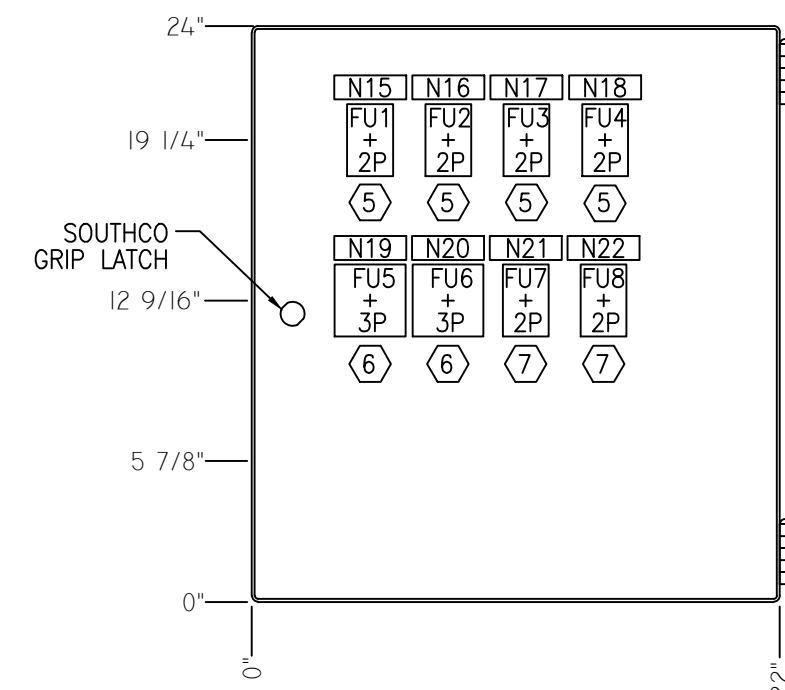
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FDR 22-161KV MIAMI PANEL 101-BREAKER 100			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
	CH: NN	DATE: 3/7/2011	
		DRAWING No. S294PP101	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	4/23/12	ISSUED FOR BID	AS	NN

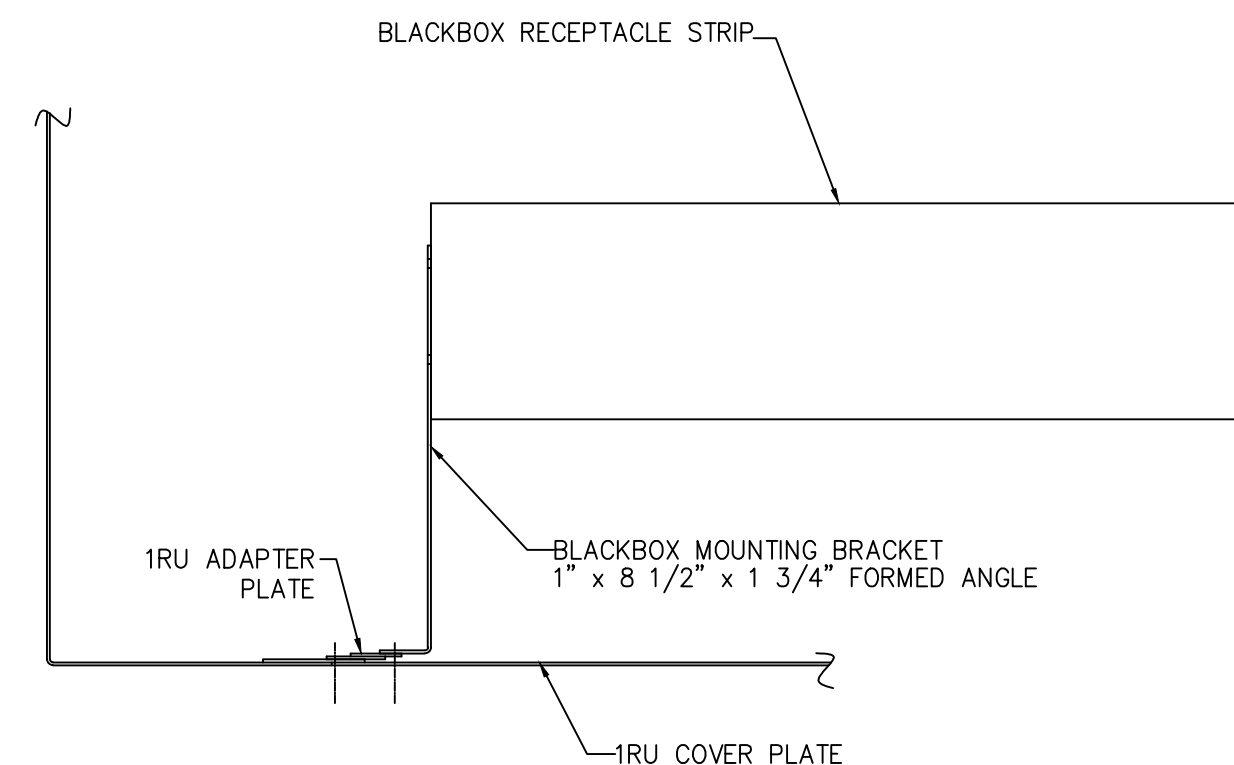
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FRONT VIEW PNL 102  
BREAKER 2270 & 200



REAR VIEW  
SUB PANEL



PARTIAL SECTION Z-Z  
NTS  
TYPICAL BOTH SIDES

**BILL OF MATERIAL**

IT#	QUAN	DESCRIPTION	
1	2	SEL 351S CIRCUIT BREAKER CONTROL RELAY	50BF
		S# SEL-0351S61H63554X1 (125VDC)	
2	2	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) FT1/TS	
		S# 129A514G01	
3	6	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT) FT1/TS	
		S# 129A501G01	
4	2	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 125VDC, S# 78PB08D, 8 DECK, MANUAL RESET LOR, WITH LIGHTS	86BF
		RED LED=COIL MONITOR & GREEN LED=TRIPPED	
5	4	MARATHON #F30A2S FUSE BLOCK/ 2 POLE	FU
		WITH TYPE NON-6 AMP FUSES	
6	2	MARATHON #F30A3S FUSE BLOCK/ 3 POLE	FU
		WITH TYPE NON-6 AMP FUSES	
7	2	MARATHON #F30A2S FUSE BLOCK/ 2 POLE	FU
		WITH TYPE NON-6 AMP FUSES	
8	1	BLACK BOX RECEPTACLE STRIP, 120V AC, 8 PLUGS WITH SURGE PROTECTION #SP196A-R2	
9	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 4 CIRCUIT, S# EB25B04	TB
10	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 12 CIRCUIT, S# EB25B12	TB
11	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, 4 CIRCUIT, S# EB27B04S	TB
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.			

**NAMEPLATE ENGRAVING LIST**

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 102			1.0x3.0	.187
2	1	161KV	FDR. 22/T2		1.0x6.0	.375
3	1	BF & RECLOSE RELAY	50BF/2270		1.0x3.0	.187
4	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
5	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
6	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
7	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
8	1	CB 2270	BF LOCKOUT RELAY	86BF/2270		
9	1	BF & RECLOSE RELAY	50BF/200			
10	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
11	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
12	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
13	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
14	1	CB 200	BF LOCKOUT RELAY	86BF/200		
15	1	CB 2270	DC CONTROL	FU1 (10A)		
16	1	CB 200	DC CONTROL	FU2 (10A)		
17	1	SPARE	DC CONTROL	FU3 (10A)		
18	1	CB 2270 - SYNC.	POTENTIAL	FU4 (6A)		
19	1	CB 200	POTENTIAL	FU5 (6A)		
20	1	CB 2270	POTENTIAL	FU6 (6A)		
21	1	CB 200 - SYNC.	POTENTIAL	FU7 (6A)		
22	1	A.C. POWER STRIP	POTENTIAL	FU8 (10A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

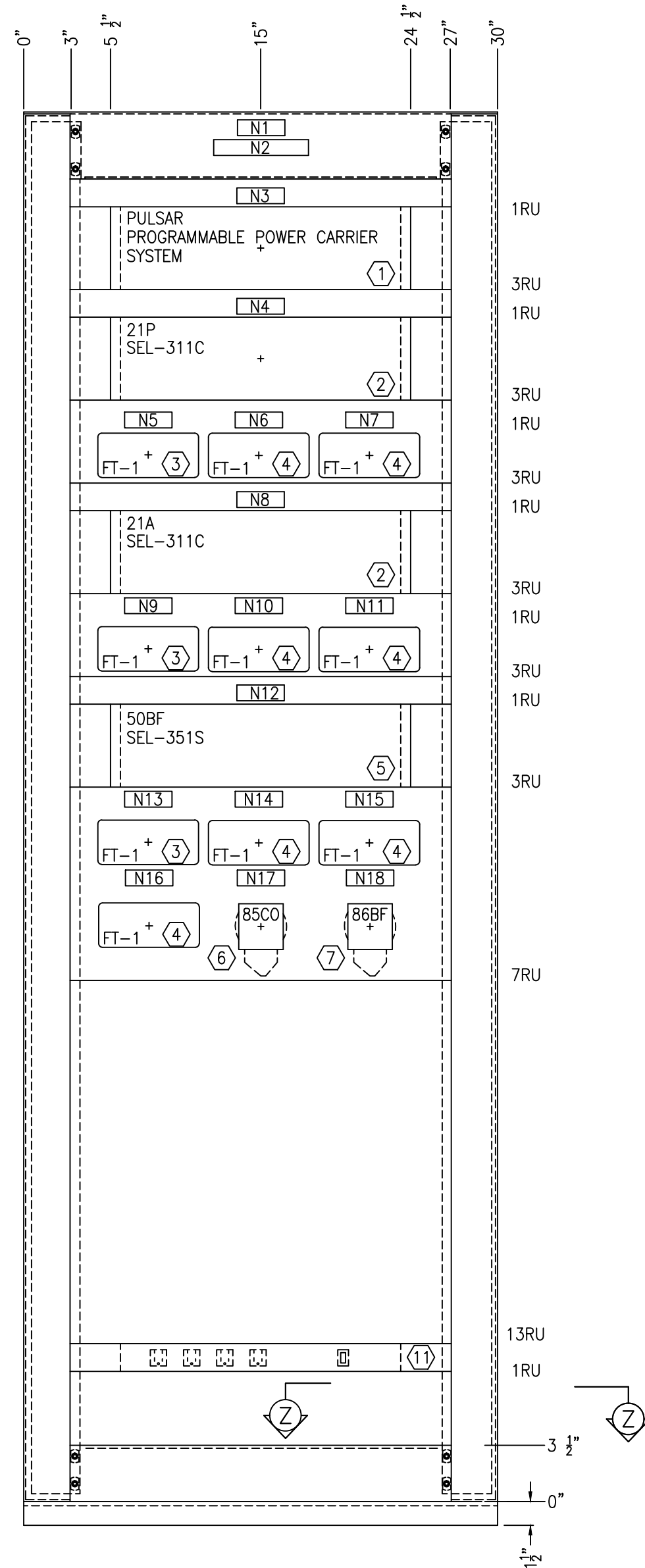
**NOTES:**

1. INDICATES TYPICAL BILL OF MATERIAL ITEM NO.
2. INDICATES TYPICAL NAMEPLATE ITEM NO.
3. IIGA. CONSTRUCTION UNLESS OTHERWISE INDICATED.
4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY.  
INTERIOR - HENTZEN WHITE.
5. INDICATES CUTOUT AND COVER.

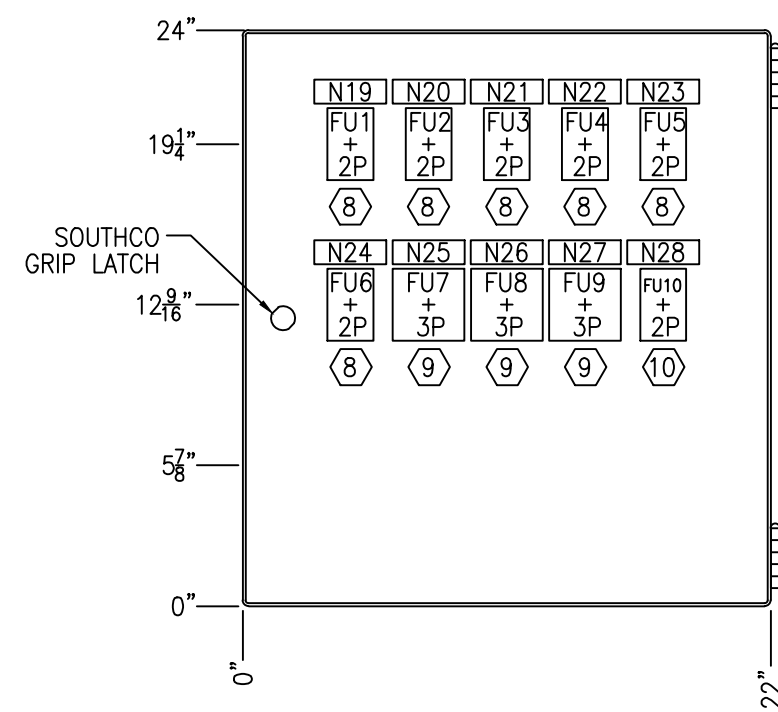
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV FDR 22-161KV MIAMI & BKR 2270 PANEL 102-BREAKER 200			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
		CH: NN	DATE: 3/7/2011
0 4/23/12 ISSUED FOR BID AS NN REV DATE REVISION DESCRIPTION DFT ENG		DRAWING No. S294PP102 REV. 0	

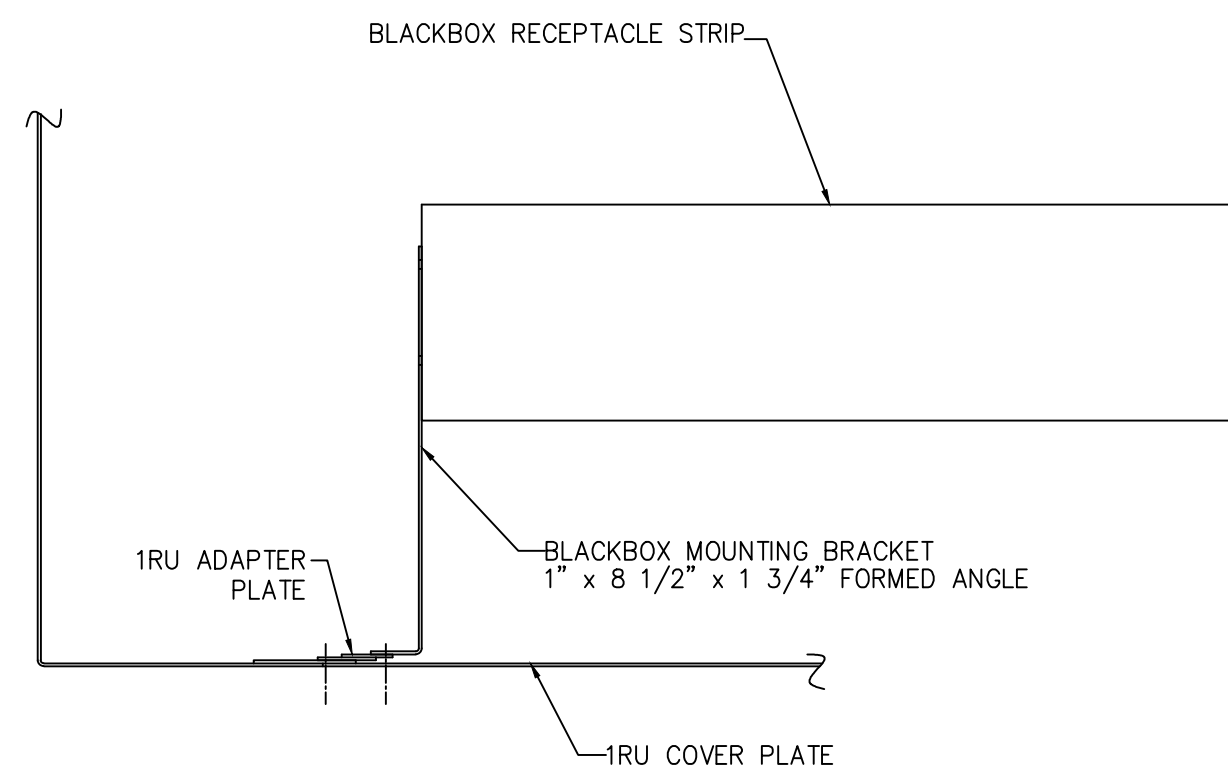
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FRONT VIEW PNL 103  
 FEEDER NO. 126  
 161KV PENSACOLA TRANSMISSION LINE  
 BREAKER 12670 PANEL



REAR VIEW SUB PANEL



PARTIAL SECTION Z-Z  
 NTS  
 TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION
1	1	PULSAR PROGRAMMABLE POWER CARRIER SYSTEM S# USINSCIANS
2	2	SEL 311C LINE PROTECTION RELAY S# SEL-0311C11HA3A5421 (125VDC) 21P/21A
* 3	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) S# 129A514G01 FT1/TS
* 4	7	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT) S# 129A501G01 FT1/TS
5	1	SEL 351S CIRCUIT BREAKER CONTROL RELAY S# SEL-0351S61H63554X1 (125VDC) 50BF
6	1	ELECTROSWITCH, SERIES 31LSR CARRIER CUTOFF SWITCH, 125VDC, S# 9303DB, ENGRAVED "CARRIER ON OFF" 85CO
7	1	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 125VDC, S# 78PB08D, 8 DECK, MANUAL RESET LOR, WITH LIGHTS RED LED=COIL MONITOR & GREEN LED=TRIPPED 86BF
8	6	MARATHON #F30A2S FUSE BLOCK/ 2 POLE WITH TYPE NON-10 AMP FUSES FU
9	3	MARATHON #F30A3S FUSE BLOCK/ 3 POLE WITH TYPE NON-6 AMP FUSES FU
10	1	MARATHON #F30A2S FUSE BLOCK/ 2 POLE WITH TYPE NON-6 AMP FUSES FU
11	1	BLACK BOX RECEPTACLE STRIP, 120V AC, 8 PLUGS WITH SURGE PROTECTION #SP196A-R2
12	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 4 CIRCUIT, S# EB25B04 TB
13	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 12 CIRCUIT, S# EB25B12 TB
14	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, 4 CIRCUIT, S# EB27B04S TB
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.		

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 103			1.0x3.0	.187
2	1	161KV	PENSACOLA FDR 126	TRANSMISSION LINE	1.0x6.0	.375
3	1	PWR. LINE CARRIER	PENSACOLA FDR 126	DCB		
4	1	PRIMARY RELAY	(21P)		1.0x3.0	.187
5	1	PRIMARY RELAY	POT. & CUR. TEST SW.	(21P/TS1)		
6	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS2)		
7	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS3)		
8	1	ALTERNATE RELAY	(21A)			
9	1	ALTERNATE RELAY	POT. & CUR. TEST SW.	(21A/TS1)		
10	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS2)		
11	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS3)		
12	1	BF & RECLOSE RELAY	(50BF/BKR 2670)			
13	1	BF & RECLOSE RELAY	POT. & CUR. TEST SW.	(50BF/TS1)		
14	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
15	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
16	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
17	1	CARRIER ON/OFF SW.		85CO		
18	1	CB 12670	BF LOCKOUT RELAY	86BF/12670		
19	1	UPLC CARRIER SET	DC CONTROL	FU1 (10A)		
20	1	PRIMARY RELAY	DC CONTROL	FU2 (10A)		
21	1	ALTERNATE RELAY	DC CONTROL	FU3 (10A)		
22	1	CB 12670 BF	DC CONTROL	FU4 (10A)		
23	1	SPARE DC		FU5 (10A)		
24	1	AC POWER STRIP	POTENTIAL	FU6 (10A)		
25	1	PRIMARY RELAY	POTENTIAL	FU7 (6A)		
26	1	ALTERNATE RELAY	POTENTIAL	FU8 (6A)		
27	1	CB 12670 BF	POTENTIAL	FU9 (6A)		
28	1	CB 12670 SYNC	POTENTIAL	FU10 (6A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

NOTES:

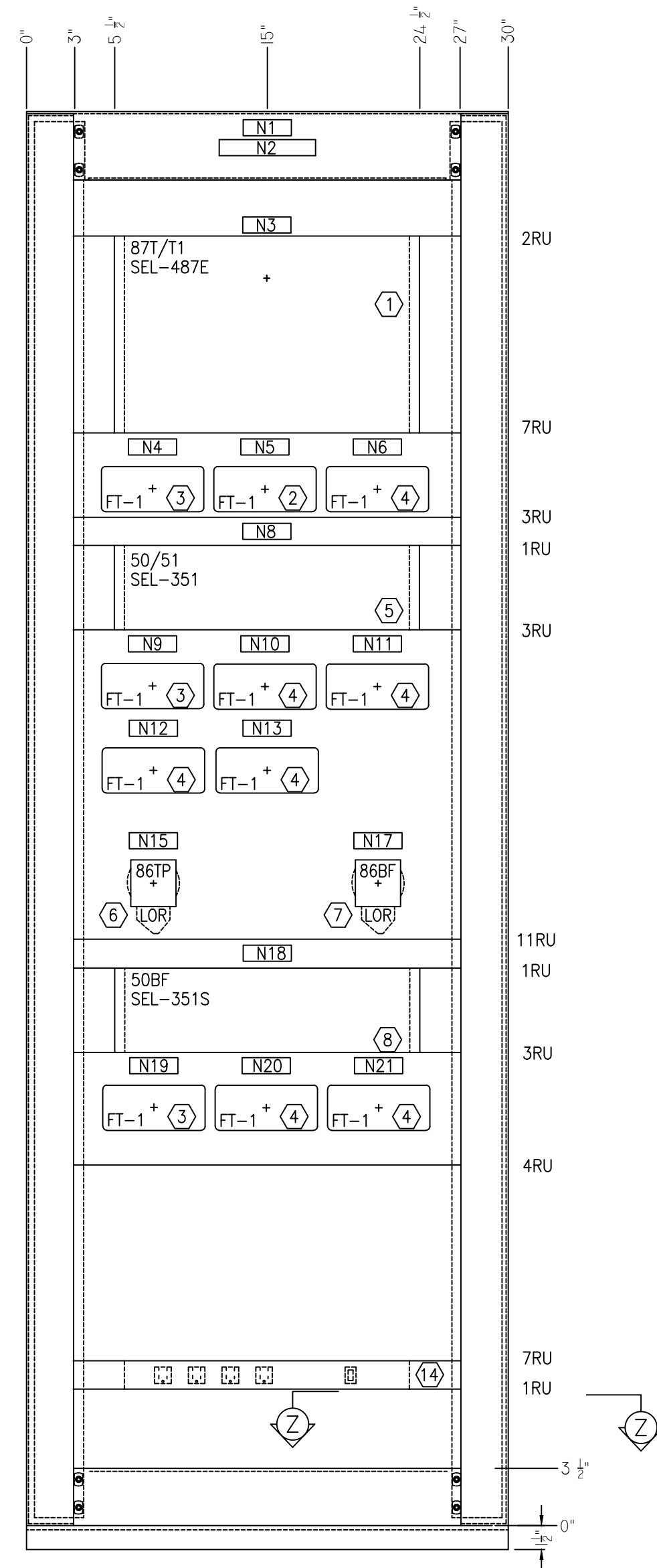
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2. INDICATES TYPICAL NAMEPLATE ITEM NO.
3. 11GA. CONSTRUCTION UNLESS OTHERWISE INDICATED.
4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY.  
INTERIOR - HENTZEN WHITE.
5. INDICATES CUTOUT AND COVER.

ISSUED FOR BID

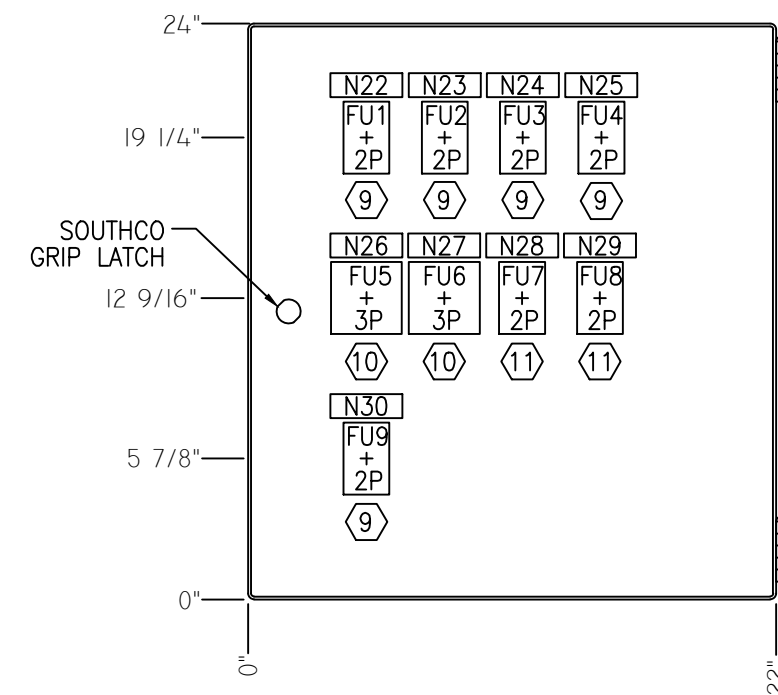
<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
FDR 126-161KV PENSACOLA PANEL 103-BREAKER 12670			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
		CH: NN	DATE: 3/7/2011
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PP103 REV. 0	

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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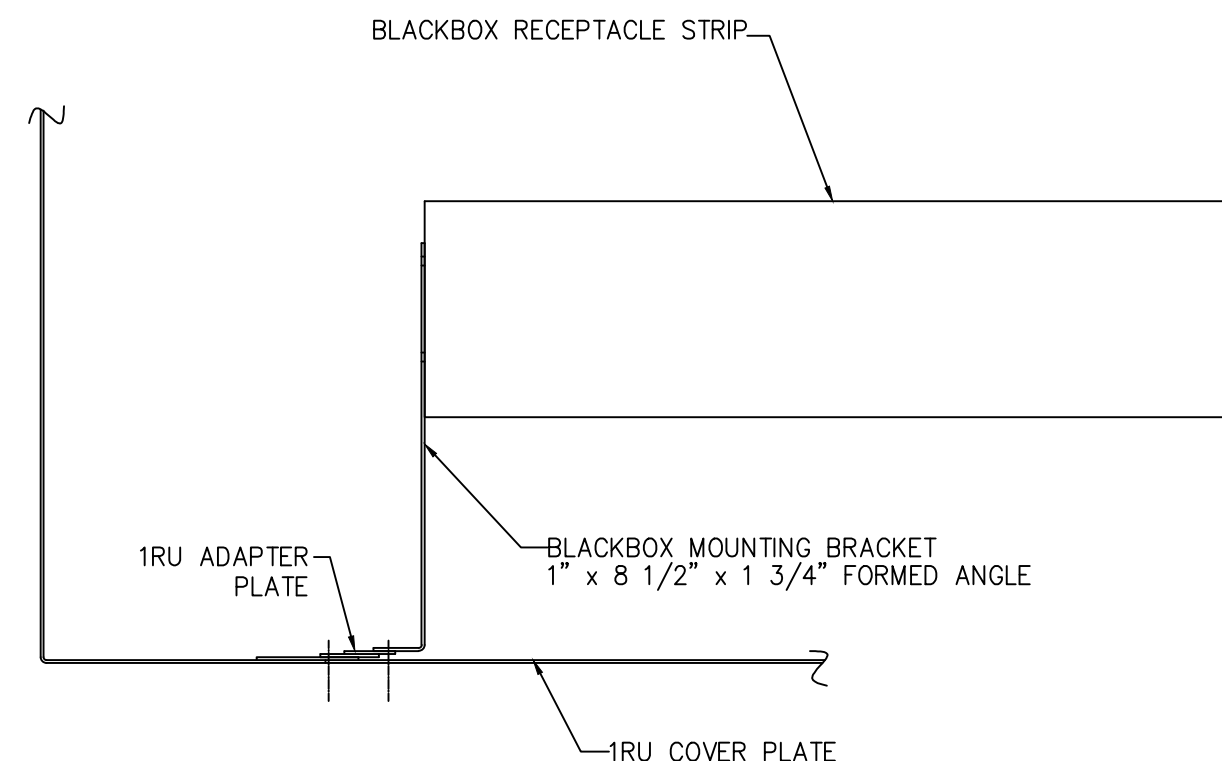
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FRONT VIEW PNL 104  
 TRANSFORMER #1 & BREAKER 300 PANEL



REAR VIEW  
 SUB PANEL



PARTIAL SECTION Z-Z  
 NTS  
 TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION	
1	1	SEL 487E TRANSFORMER PROTECTION RELAY S# SEL-0487E3X411XXB4X4H72424X (125VDC)	87T
2	1	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 CURR) S# 498A020G01	FT1/TS
3	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) S# 129A514G01	FT1/TS
4	7	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT) S# 129A501G01	FT1/TS
5	1	SEL 351 OVERCURRENT/RECLOSE RELAY S# SEL-035153A3A542X1 (125VDC)	50/51
6	1	ELECTROSWITCH, SERIES 24 AUX. TRIPPING RELAY, 10 DECK, MANUAL RESET LOR, WITH LIGHTS S# 78PB10D (125VDC), RED LED=COIL MONITOR & GREEN LED=TRIPPED	86TP
7	1	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 8 DECK, MANUAL RESET LOR, WITH LIGHTS S# 78PB08D (125VDC) RED LED=COIL MONITOR & GREEN LED=TRIPPED	86BF
8	1	SEL 351S BREAKER CONTROL RELAY S# SEL-0351561H63554X1 (125VDC)	50BF
9	5	MARATHON #F30A2S FUSE BLOCK/ 2 POLE WITH TYPE NON-10 AMP FUSES	FU
10	2	MARATHON #F30A3S FUSE BLOCK/ 3 POLE WITH TYPE NON-6 AMP FUSES	FU
11	2	MARATHON #F30A2S FUSE BLOCK/ 2 POLE WITH TYPE NON-6 AMP FUSES	FU
12	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 4 CIRCUIT, S# EB25B04	TB
13	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 12 CIRCUIT, S# EB25B12	TB
14	1	BLACK BOX RECEPTACLE STRIP, 120VAC, 8 PLUGS W/SURGE PROTECTION, #SP196A-R2	
15	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, 4 CIRCUIT, S# EB27B04S	TB
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.			

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 104			1.0x3.0	.187
2	1	TRANS. 1/BKR. 300	DIFFERENTIAL	PANEL	1.0x6.0	.375
3	1	TRANS. PROTECTION RELAY	(87T)		1.0x3.0	.187
4	1	PRI. DIFF. RELAY	POT. & CURRENT TEST SW.	87T/T1/TS1		
5	1	PRI. DIFF. RELAY	CURRENT TEST SWITCH	87T/T1/TS2		
6	1	PRI. DIFF. RELAY	POTENTIAL TEST SWITCH	87T/T1/TS3		
7	1					
8	1	TRANS. BACKUP OVERCURRE.	(50/51/T1)			
9	1	TRANS. BACKUP OVERCURRE.	POT. & CURRENT TEST SW.	50/51/T1/TS1		
10	1	TRANS. BACKUP OVERCURRE.	POTENTIAL TEST SW.	50/51/T1/TS2		
11	1	PRI. DIFF. LO RELAY	POTENTIAL TEST SW.	86TP/T1/TS1		
12	1	PRI. DIFF. LO RELAY	POTENTIAL TEST SW.	86TP/T1/TS2		
13	1	TRANS. BACKUP OVERCURRE.	POTENTIAL TEST SW.	50/51/T1/TS3		
15	1	T1	LOCKOUT	86TP		
17	1	CB 300/BF	BREAKER LOCKOUT RELAY	86BF/300		
18	1	BF & RECLOSE RELAY	(50BF/300)			
19	1	BF & RECLOSE RELAY	POT. & CURRENT TEST SW.	50BF/TS1		
20	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	50BF/TS1		
21	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	86BF/TS1		
22	1	PRIMARY RELAY	DC CONTROL	FU1 (10A)		
23	1	ALTERNATE RELAY	DC CONTROL	FU2 (10A)		
24	1	CB 300 BF	DC CONTROL	FU3 (10A)		
25	1	SPARE DC	DC CONTROL	FU4 (10A)		
26	1	T1 DIFF. RELAY	POTENTIAL	FU5 (6A)		
27	1	CB 300 BF	POTENTIAL	FU6 (6A)		
28	1	CB 300 SYNC	POTENTIAL	FU7 (6A)		
29	1	SPARE	POTENTIAL	FU8 (6A)		
30	1	AC POWER STRIP	POTENTIAL	FU9 (10A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

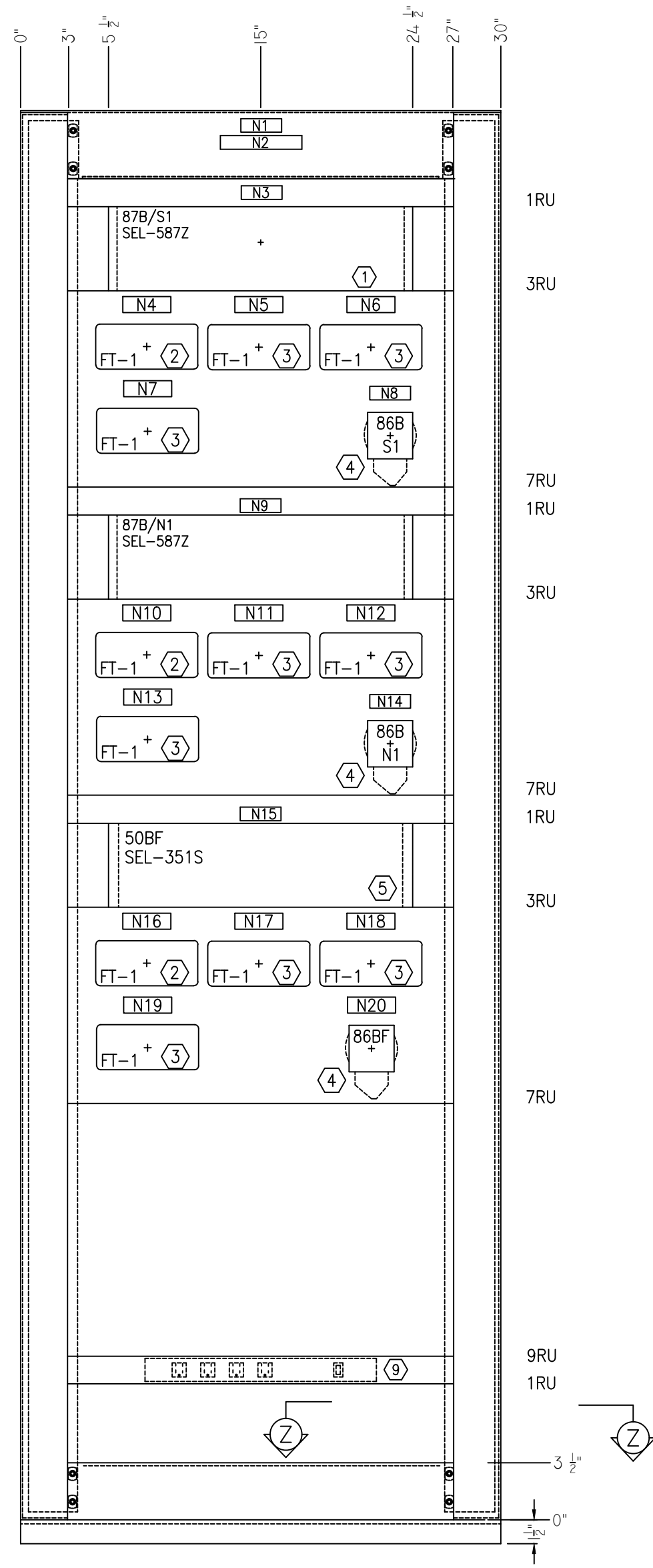
NOTES:

1. INDICATES TYPICAL BILL OF MATERIAL ITEM NO.
2. INDICATES TYPICAL NAMEPLATE ITEM NO.
3. I.I.G.A. CONSTRUCTION UNLESS OTHERWISE INDICATED.
4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY.  
INTERIOR - HENTZEN WHITE.
5. INDICATES CUTOUT AND COVER.

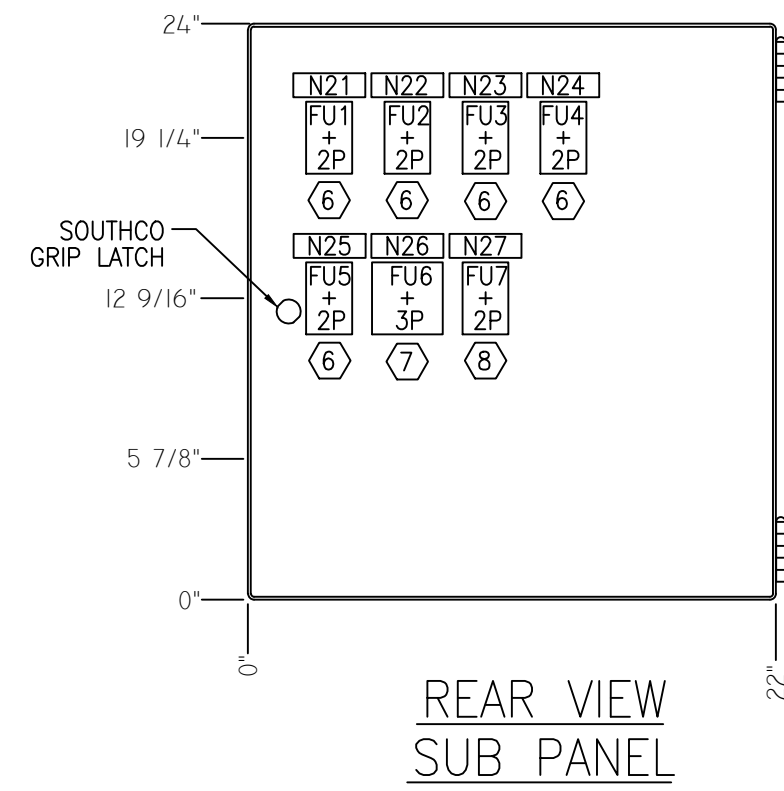
ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
TRANSFORMER NO 1 & BKR 300 PANEL 104--ELEVATION			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011		
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PP104	
REV	DATE	REVISION DESCRIPTION	DFT ENG
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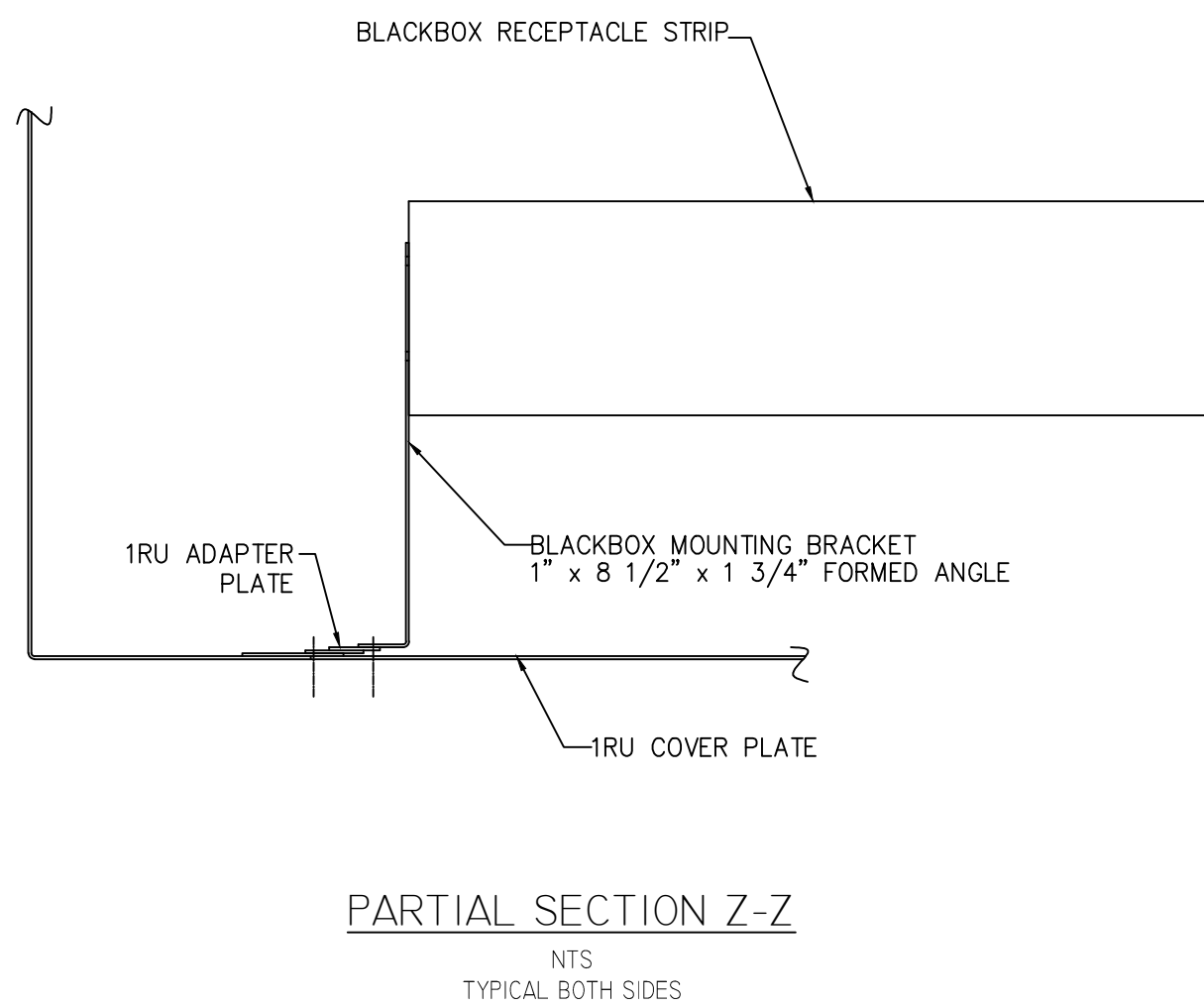
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FRONT VIEW PNL 105  
BREAKER 400 & BUS DIFFERENTIAL S1 & N1



REAR VIEW  
SUB PANEL



PARTIAL SECTION Z-Z  
NTS  
TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION	
1	2	SEL 587Z BUS DIFFERENTIAL S# SEL-0587Z0X325H12XX	87B/S1/N1
2	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) S# 129A514G01	FT1/TS
3	9	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT) S# 129A501G01	FT1/TS
4	3	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 125VDC, S# 78PB10D, 10 DECK, MANUAL RESET LOR, WITH LIGHTS RED LED=MONITOR & GREEN LED= TRIPPED.	86BF,S1,N1
5	1	SEL 351S BREAKER CONTROL RELAY S# SEL-351S61H63554X1 (125VDC)	50BF
6	5	MARATHON #F30A2S FUSE BLOCK WITH TYPE NON-10 AMP FUSES	FU
7	1	MARATHON #F30A3S FUSE BLOCK WITH TYPE NON-6 AMP FUSES	FU
8	1	MARATHON #F30A2S FUSE BLOCK WITH TYPE NON-6 AMP FUSES	FU
9	1	BLACK BOX RECEPTACLE STRIP, 120VAC, 8 PLUGS W/SURGE PROTECTION, #SP196A-R2	
10	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 4 CIRCUIT, S# EB25B04	TB
11	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 12 CIRCUIT, S# EB25B12	TB
12	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, 4 CIRCUIT, S# EB27B04S	TB
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.			

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 105			1.0x3.0	.187
2	1	BKR 400	NORTH/SOUTH BUS	DIFFERENTIAL PANEL	1.0x6.0	.375
3	1	SOUTH BUS	DIFFERENTIAL RELAY	87B/S1	1.0x3.0	.187
4	1	DIFFERENTIAL RELAY	POT. & CUR. TEST SW.	87B/S1/TS1		
5	1	DIFFERENTIAL RELAY	POTENTIAL TEST SW.	87B/S1/TS2		
6	1	DIFFERENTIAL L.O. RELAY	POTENTIAL TEST SW.	86B/S1/TS1		
7	1	DIFFERENTIAL L.O. RELAY	POTENTIAL TEST SW.	86B/S1/TS2		
8	1	SOUTH BUS DIFF.	LOCKOUT RELAY	86B/S1		
9	1	NORTH BUS	DIFFERENTIAL RELAY	87B/N1		
10	1	DIFFERENTIAL RELAY	POT. & CUR. TEST SW.	87B/N1/TS1		
11	1	DIFFERENTIAL RELAY	POTENTIAL TEST SW.	87B/N1/TS2		
12	1	DIFFERENTIAL L.O. RELAY	POTENTIAL TEST SW.	86B/N1/TS1		
13	1	DIFFERENTIAL L.O. RELAY	POTENTIAL TEST SW.	86B/N1/TS2		
14	1	NORTH BUS DIFF.	LOCKOUT RELAY	86B/N1		
15	1	BF & RECLOSE RELAY	50BF/400			
16	1	BF & RECLOSE RELAY	POT. & CUR. TEST SW.	(50BF/TS1)		
17	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
18	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
19	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	86BF/TS1		
20	1	BREAKER 400	LOCKOUT RELAY	86BF/400		
21	1	SOUTH BUS DIFF. RELAY	DC CONTROL	FU1 (10A)		
22	1	NORTH BUS DIFF. RELAY	DC CONTROL	FU2 (10A)		
23	1	BKR. 400 BF RELAY	DC CONTROL	FU3 (10A)		
24	1	AC POWER STRIP	POTENTIAL	FU4 (10A)		
25	1	SPARE	POTENTIAL	FU5 (10A)		
26	1	CB 400	POTENTIAL	FU6 (6A)		
27	1	CB 400 SYNC.	POTENTIAL	FU7 (6A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

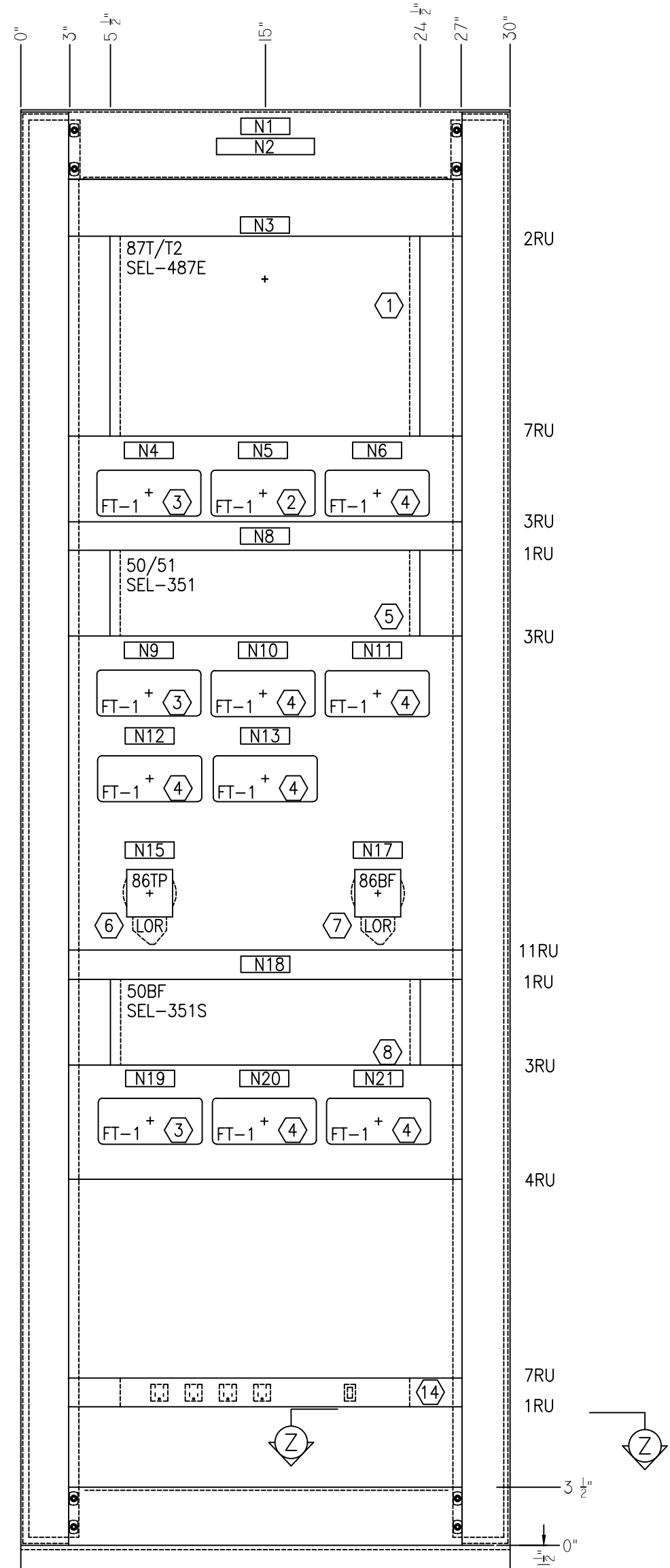
- NOTES:
1. INDICATES TYPICAL BILL OF MATERIAL ITEM NO.
  2. INDICATES TYPICAL NAMEPLATE ITEM NO.
  3. IGA. CONSTRUCTION UNLESS OTHERWISE INDICATED.
  4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY. INTERIOR - HENTZEN WHITE.
  5. INDICATES CUTOUT AND COVER.
  6. FRONT SHALL HAVE COVER PLATES ON ALL EMPTY SPACES.

ISSUED FOR BID

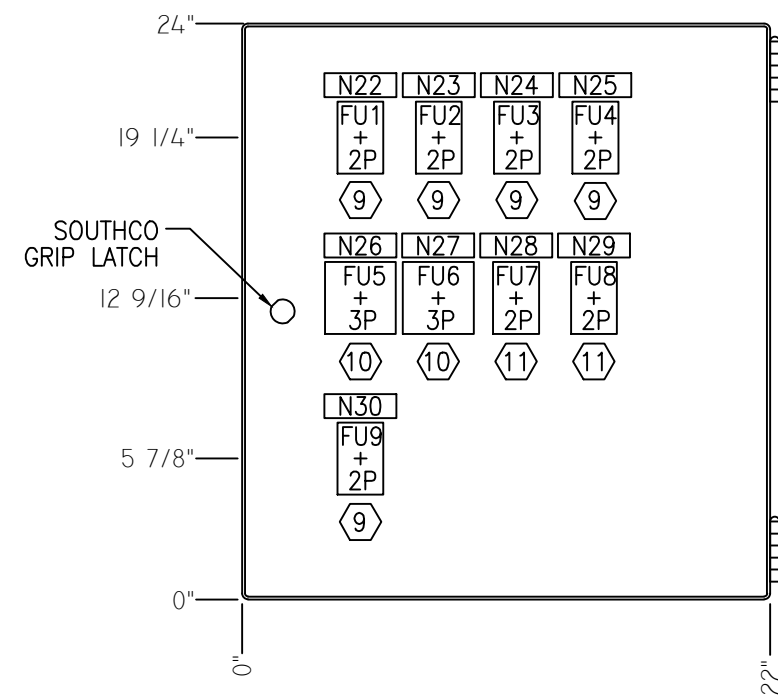
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REV	DATE	REVISION DESCRIPTION	DFT ENG
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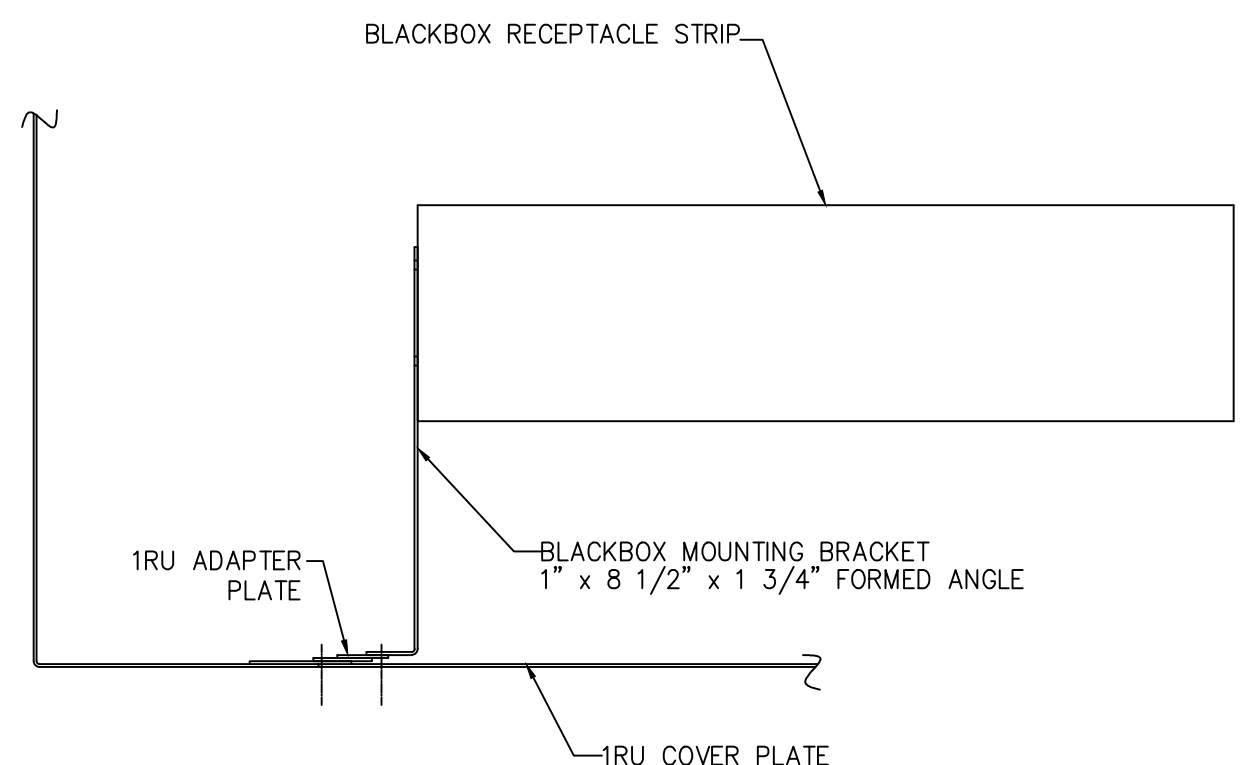
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FRONT VIEW PNL 106  
TRANSFORMER #2 & BREAKER 500 PANEL



REAR VIEW  
SUB PANEL



PARTIAL SECTION Z-Z  
NTS  
TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION	
1	1	SEL 487E TRANSFORMER PROTECTION RELAY S# SEL-0487E3X411XXB4X4H72424X (125VDC)	87T
2	1	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 CURR) S# 498A020G01	FT1/TS
3	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) S# 129A514G01	FT1/TS
4	7	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT) S# 129A501G01	FT1/TS
5	1	SEL 351 OVERCURRENT/RECLOSE RELAY S# SEL-035153A3A542X1 (125VDC)	50/51
6	1	ELECTROSWITCH, SERIES 24 AUX. TRIPPING RELAY, 10 DECK, MANUAL RESET LOR, WITH LIGHTS S# 78PB10D (125VDC), RED LED=COIL MONITOR & GREEN LED=TRIPPED	86TP,86TA
7	1	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 8 DECK, MANUAL RESET LOR, WITH LIGHTS S# 78PB08D (125VDC) RED LED=COIL MONITOR & GREEN LED=TRIPPED	86BF
8	1	SEL 351S BREAKER CONTROL RELAY S# SEL-0351S61H63554X1 (125VDC)	50BF
9	5	MARATHON #F30A2S FUSE BLOCK/ 2 POLE WITH TYPE NON-10 AMP FUSES	FU
10	2	MARATHON #F30A3S FUSE BLOCK/ 3 POLE WITH TYPE NON-6 AMP FUSES	FU
11	2	MARATHON #F30A2S FUSE BLOCK/ 2 POLE WITH TYPE NON-6 AMP FUSES	FU
12	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 4 CIRCUIT, S# EB25B04	TB
13	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 12 CIRCUIT, S# EB25B12	TB
14	1	BLACK BOX RECEPTACLE STRIP, 120VAC, 8 PLUGS W/SURGE PROTECTION, #SP196A-R2	
15	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, 4 CIRCUIT, S# EB27B04S	TB
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.			

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 106			1.0x3.0	.187
2	1	TRANS. 2/BKR. 500	DIFFERENTIAL	PANEL	1.0x6.0	.375
3	1	TRANS. PROTECTION RELAY	(87T)		1.0x3.0	.187
4	1	PRI. DIFF. RELAY	POT. & CURRENT TEST SW.	87T/T2/TS1		
5	1	PRI. DIFF. RELAY	CURRENT TEST SWITCH	87T/T2/TS2		
6	1	PRI. DIFF. RELAY	POTENTIAL TEST SWITCH	87T/T2/TS3		
7	1					
8	1	TRANS. BACKUP OVERCURR.	(50/51/T1)			
9	1	TRANS. BACKUP OVERCURR.	POT. & CURRENT TEST SW.	50/51/T2/TS1		
10	1	TRANS. BACKUP OVERCURR.	POTENTIAL TEST SW.	50/51/T2/TS2		
11	1	PRI. DIFF. RELAY	POTENTIAL TEST SW.	86TP/T2/TS1		
12	1	PRI. DIFF. RELAY	POTENTIAL TEST SW.	86TP/T2/TS2		
13	1	TRANS. BACKUP OVERCURR.	POTENTIAL TEST SW.	50/51/T2/TS3		
15	1	T2	LOCKOUT	86TP		
17	1	CB 500/BF	BREAKER LOCKOUT RELAY	86BF/500		
18	1	BF & RECLOSE RELAY	(50BF/500)			
19	1	BF & RECLOSE RELAY	POT. & CURRENT TEST SW.	50BF/TS1		
20	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	50BF/TS2		
21	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	86BF/TS1		
22	1	PRIMARY RELAY	DC CONTROL	FU1 (10A)		
23	1	ALTERNATE RELAY	DC CONTROL	FU2 (10A)		
24	1	CB 500 BF	DC CONTROL	FU3 (10A)		
25	1	SPARE DC	DC CONTROL	FU4 (10A)		
26	1	T2 DIFF. RELAY	POTENTIAL	FU5 (6A)		
27	1	CB 500 BF	POTENTIAL	FU6 (6A)		
28	1	CB 500 SYNC	POTENTIAL	FU7 (6A)		
29	1	SPARE	POTENTIAL	FU8 (6A)		
30	1	AC POWER STRIP	POTENTIAL	FU9 (10A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

NOTES:

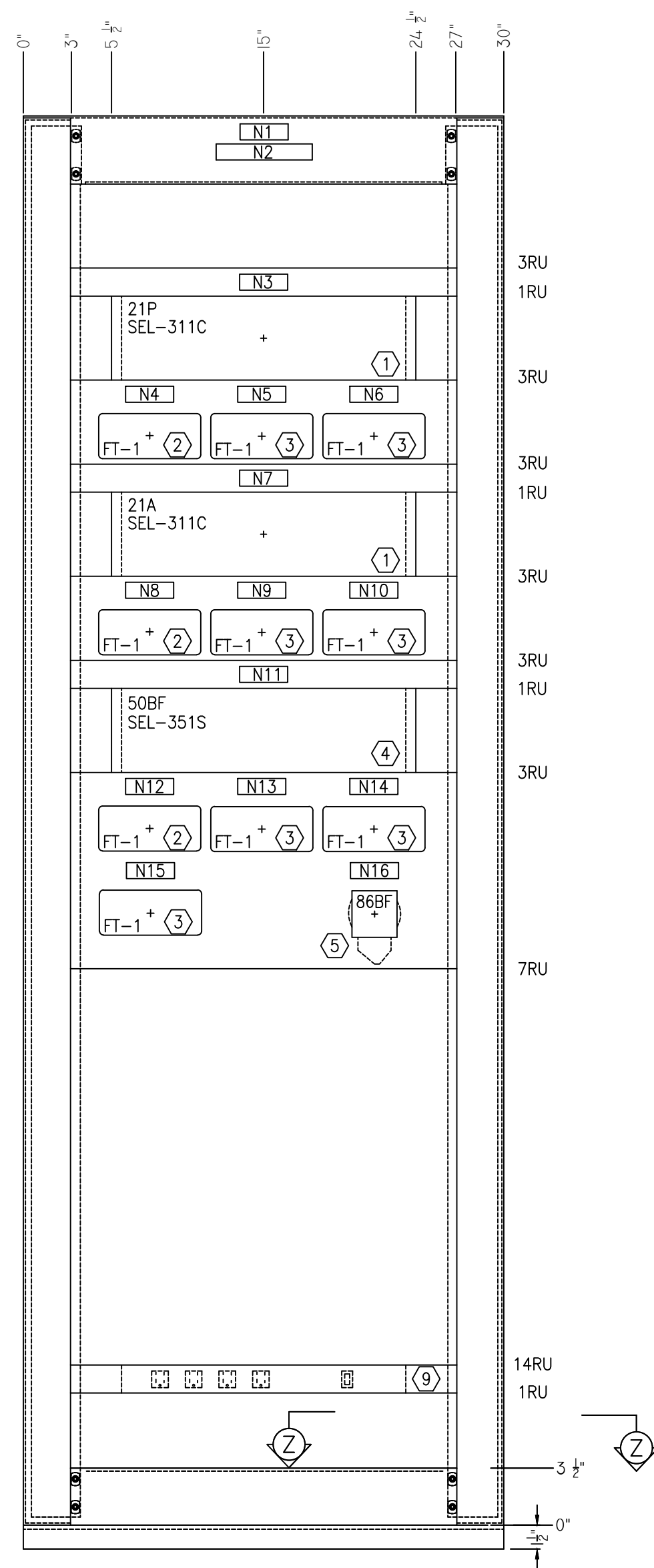
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2. INDICATES TYPICAL NAMEPLATE ITEM NO.
3. I.I.G.A. CONSTRUCTION UNLESS OTHERWISE INDICATED.
4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY.  
INTERIOR - HENTZEN WHITE.
5. INDICATES CUTOUT AND COVER.

ISSUED FOR BID

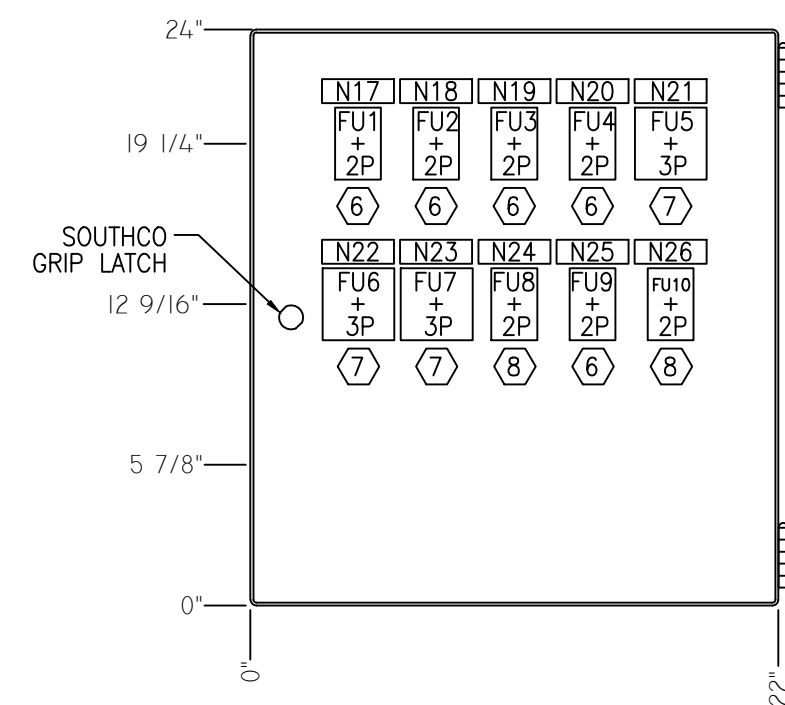
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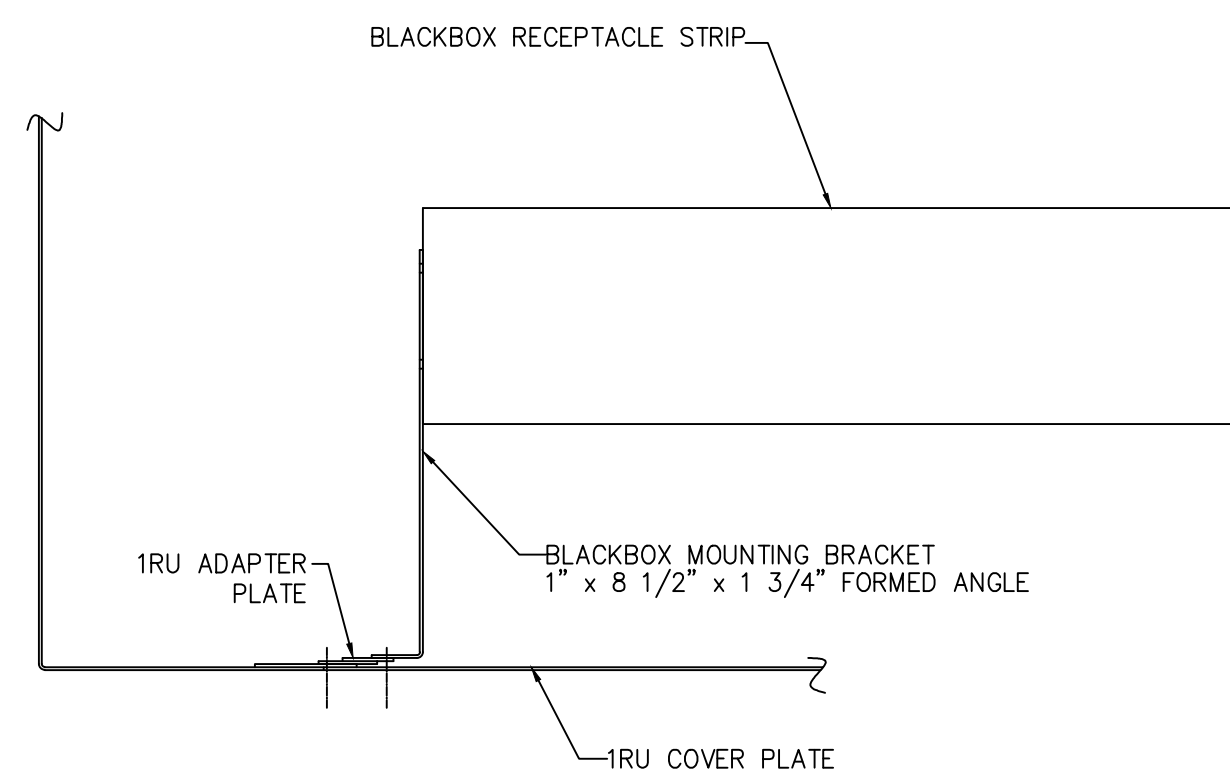
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FRONT VIEW PNL 107  
 FEEDER NO. 5  
 FDR 126-69kV PENSACOLA  
 BREAKER 540 PANEL



REAR VIEW  
 SUB PANEL



PARTIAL SECTION Z-Z  
 NTS  
 TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION	
1	2	SEL 311C LINE PROTECTION RELAY S# SEL-0311C11HA3A5421 (125VDC)	21P/21A
2	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) S# 129A514G01	FT1/TS
3	7	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT)	FT1/TS
4	1	SEL 351S CIRCUIT BREAKER CONTROL RELAY S# SEL351S61H63554X1 (125VDC)	50BF
5	1	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 125VDC, S# 78PB08D, 8 DECK, MANUAL RESET LOR, WITH LIGHTS RED LED=MONITOR & GREEN LED=TRIPPED.	86BF
6	5	MARATHON #F30A2S FUSE BLOCK WITH TYPE NON-10 AMP FUSES	FU
7	3	MARATHON #F30A3S FUSE BLOCK WITH TYPE NON-6 AMP FUSES	FU
8	2	MARATHON #F30A2S FUSE BLOCK WITH TYPE NON-6 AMP FUSES	FU
9	1	BLACK BOX RECEPTACLE STRIP, 120V AC, 8 PLUGS WITH SURGE PROTECTION #SP196A-R2	
10	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 4 CIRCUIT, S# EB25B04	TB
11	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 12 CIRCUIT, S# EB25B12	TB
12	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, 4 CIRCUIT, S# EB27B04S	TB
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.			

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 107			1.0x3.0	.187
2	1	69kV	FDR. 5 PENSACOLA	TRANSMISSION LINE	1.0x6.0	.375
3	1	PRIMARY RELAY	(21P)		1.0x3.0	.187
4	1	PRIMARY RELAY	POT. & CUR. TEST SW.	(21P/TS1)		
5	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS2)		
6	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS3)		
7	1	ALTERNATE RELAY	(21A)			
8	1	ALTERNATE RELAY	POT. & CUR. TEST SW.	(21A/TS1)		
9	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS2)		
10	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS3)		
11	1	BF & RECLOSE RELAY	50BF/540			
12	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
13	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
14	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
15	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
16	1	CB 540	BF LOCKOUT RELAY	86BF/540		
17	1	PRIMARY RELAY	DC CONTROL	FU1 (10A)		
18	1	ALTERNATE RELAY	DC CONTROL	FU2 (10A)		
19	1	CB 540 BF	DC CONTROL	FU3 (10A)		
20	1	SPARE	POTENTIAL	FU4 (10A)		
21	1	PRIMARY RELAY	POTENTIAL	FU5 (6A)		
22	1	ALTERNATE RELAY	POTENTIAL	FU6 (6A)		
23	1	CB 540	POTENTIAL	FU7 (6A)		
24	1	CB 540 SYNC	POTENTIAL	FU8 (6A)		
25	1	AC POWER STRIP	POTENTIAL	FU9 (10A)		
26	1	SPARE	POTENTIAL	FU10 (6A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

NOTES:

1. INDICATES TYPICAL BILL OF MATERIAL ITEM NO.
2. INDICATES TYPICAL NAMEPLATE ITEM NO.
3. IIGA. CONSTRUCTION UNLESS OTHERWISE INDICATED.
4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY.  
INTERIOR - HENTZEN WHITE.
5. INDICATES CUTOUT AND COVER.

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REV	DATE	REVISION DESCRIPTION	DFT	ENG

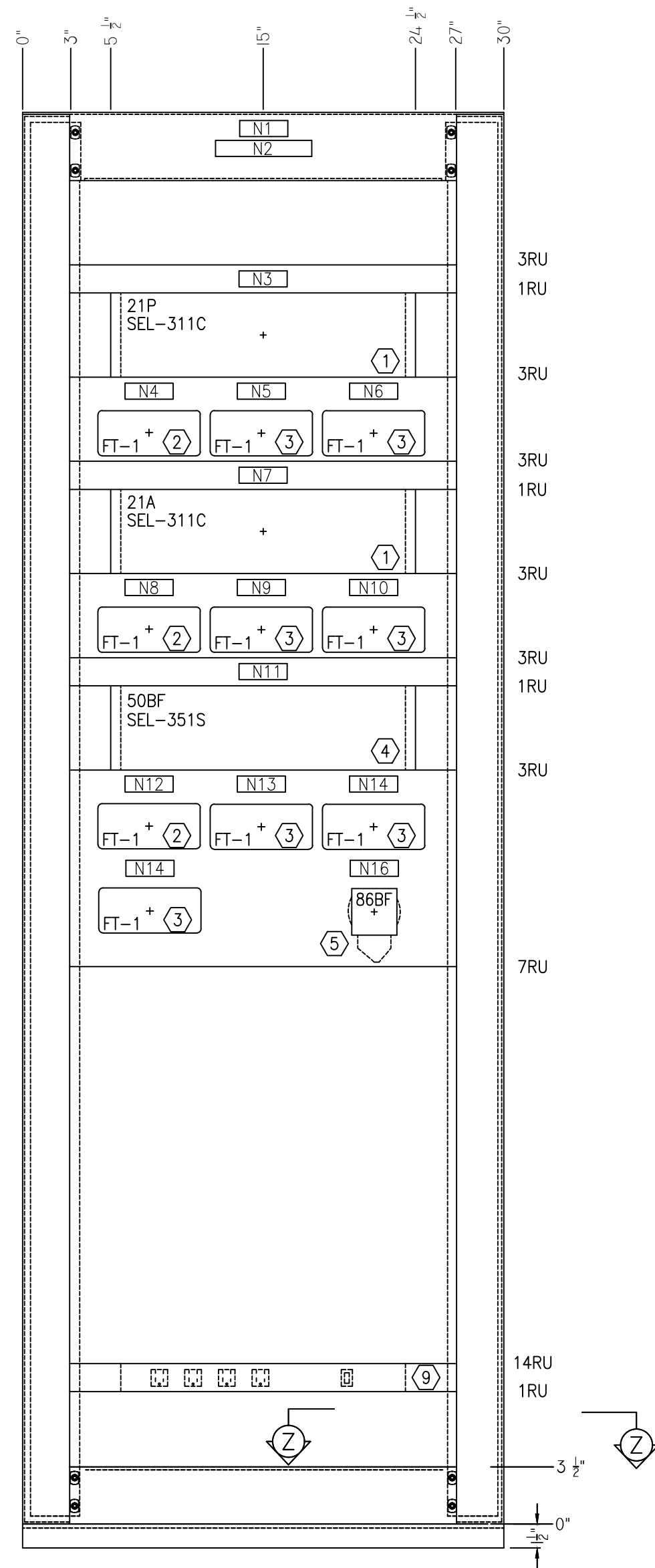
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69kV  
 FDR 5-69kV PENSACOLA  
 PANEL 107-BREAKER 540

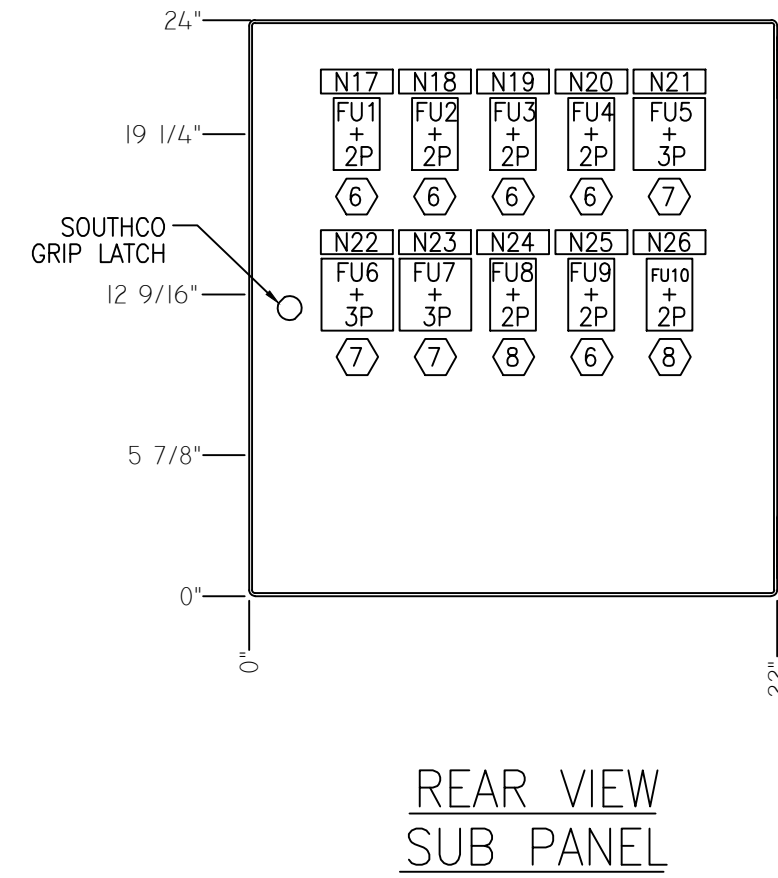
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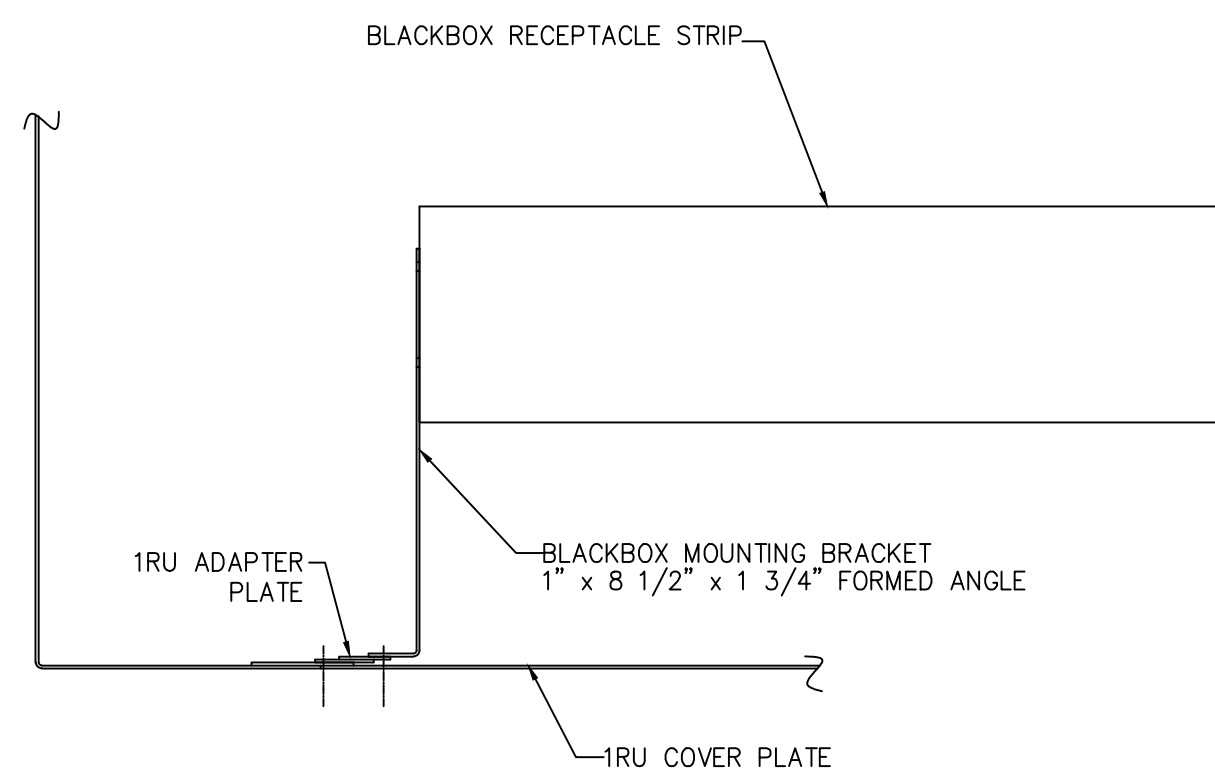
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FRONT VIEW PNL 108  
 FEEDER NO. 61  
 69kV MIAMI TRANSMISSION LINE  
 BREAKER 6140 PANEL



REAR VIEW  
 SUB PANEL



PARTIAL SECTION Z-Z  
 NTS  
 TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION	
1	2	SEL 311C LINE PROTECTION RELAY	21P/21A
		S# SEL-0311C11HA3A5421 (125VDC)	
2	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR)	FT1/TS
		S# 129A514G01	
3	7	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT)	FT1/TS
4	1	SEL 351S CIRCUIT BREAKER CONTROL RELAY	50BF
		S# SEL351S61H63554X1 (125VDC)	
5	1	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY,	86BF
		125VDC, S# 78PB08D, 8 DECK, MANUAL RESET LOR, WITH LIGHTS	
		RED LED=MONITOR & GREEN LED=TRIPPED.	
6	5	MARATHON #F30A2S FUSE BLOCK	FU
		WITH TYPE NON-10 AMP FUSES	
7	3	MARATHON #F30A3S FUSE BLOCK	FU
		WITH TYPE NON-6 AMP FUSES	
8	2	MARATHON #F30A2S FUSE BLOCK	FU
		WITH TYPE NON-6 AMP FUSES	
9	1	BLACK BOX RECEPTACLE STRIP, 120V AC, 8 PLUGS WITH SURGE	
		PROTECTION #SP196A-R2	
10	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK,	TB
		4 CIRCUIT, S# EB25B04	
11	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK,	TB
		12 CIRCUIT, S# EB25B12	
12	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK,	TB
		4 CIRCUIT, S# EB27B04S	
		**FINAL QUANTITIES TO BE DETERMINED BY VENDOR.	

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 108			1.0x3.0	.187
2	1	69kV	FDR. 61 MIAMI	TRANSMISSION LINE	1.0x6.0	.375
3	1	PRIMARY RELAY	(21P)		1.0x3.0	.187
4	1	PRIMARY RELAY	POT. & CUR. TEST SW.	(21P/TS1)		
5	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS2)		
6	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS3)		
7	1	ALTERNATE RELAY	(21A)			
8	1	ALTERNATE RELAY	POT. & CUR. TEST SW.	(21A/TS1)		
9	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS2)		
10	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS3)		
11	1	BF & RECLOSE RELAY	50BF/6140			
12	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
13	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
14	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
15	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
16	1	CB 6140	BF LOCKOUT RELAY	86BF/6140		
17	1	PRIMARY RELAY	DC CONTROL	FU1 (10A)		
18	1	ALTERNATE RELAY	DC CONTROL	FU2 (10A)		
19	1	CB 6140	DC CONTROL	FU3 (10A)		
20	1	SPARE	DC CONTROL	FU4 (10A)		
21	1	PRIMARY RELAY	POTENTIAL	FU5 (6A)		
22	1	ALTERNATE RELAY	POTENTIAL	FU6 (6A)		
23	1	CB 6140	POTENTIAL	FU7 (6A)		
24	1	CB 6140 SYNC	POTENTIAL	FU8 (6A)		
25	1	AC POWER STRIP	POTENTIAL	FU9 (10A)		
26	1	SPARE	POTENTIAL	FU10		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

NOTES:

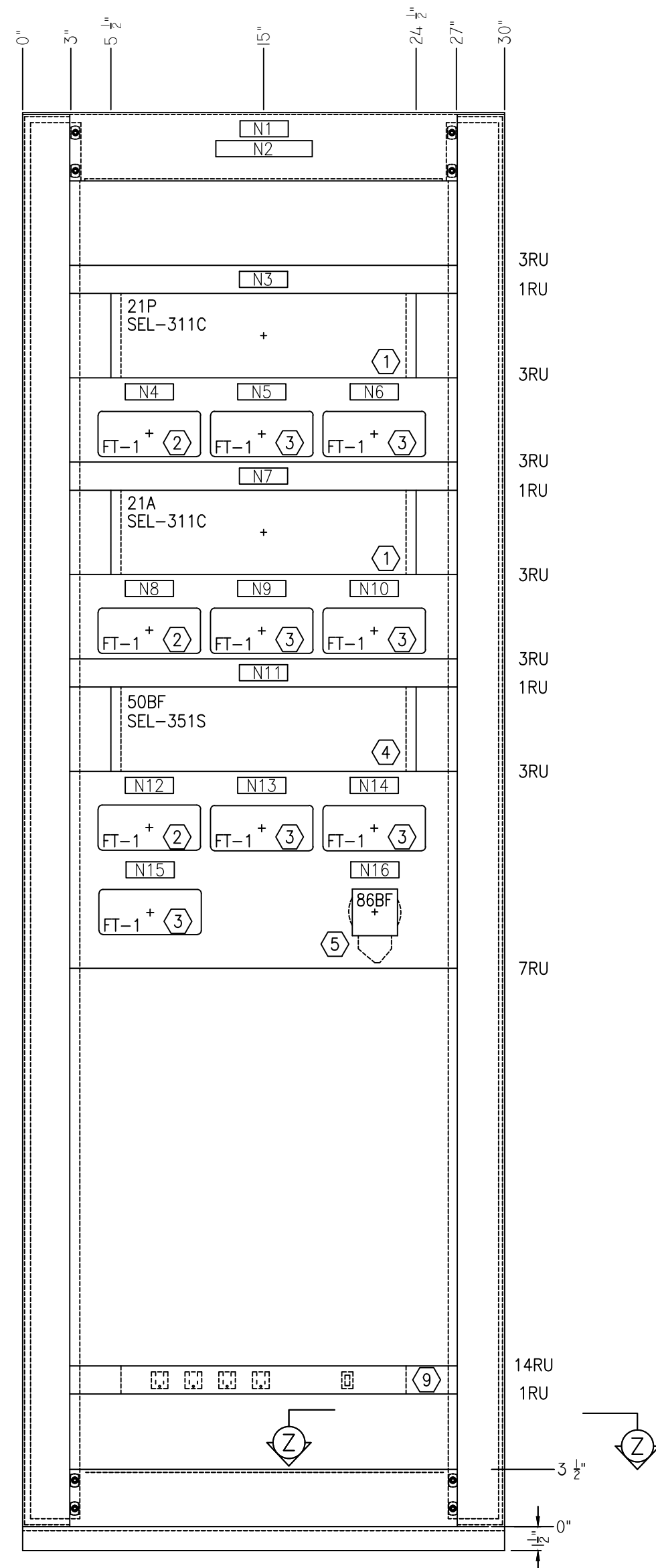
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2. INDICATES TYPICAL NAMEPLATE ITEM NO.
3. I.I.G.A. CONSTRUCTION UNLESS OTHERWISE INDICATED.
4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY.  
INTERIOR - HENTZEN WHITE.
5. INDICATES CUTOUT AND COVER.

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

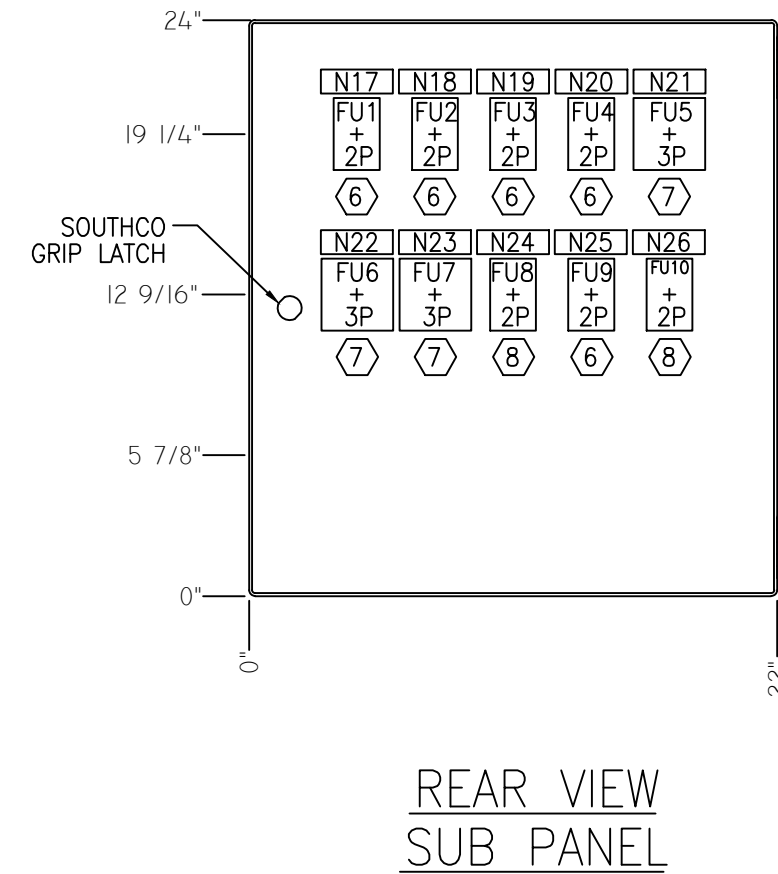
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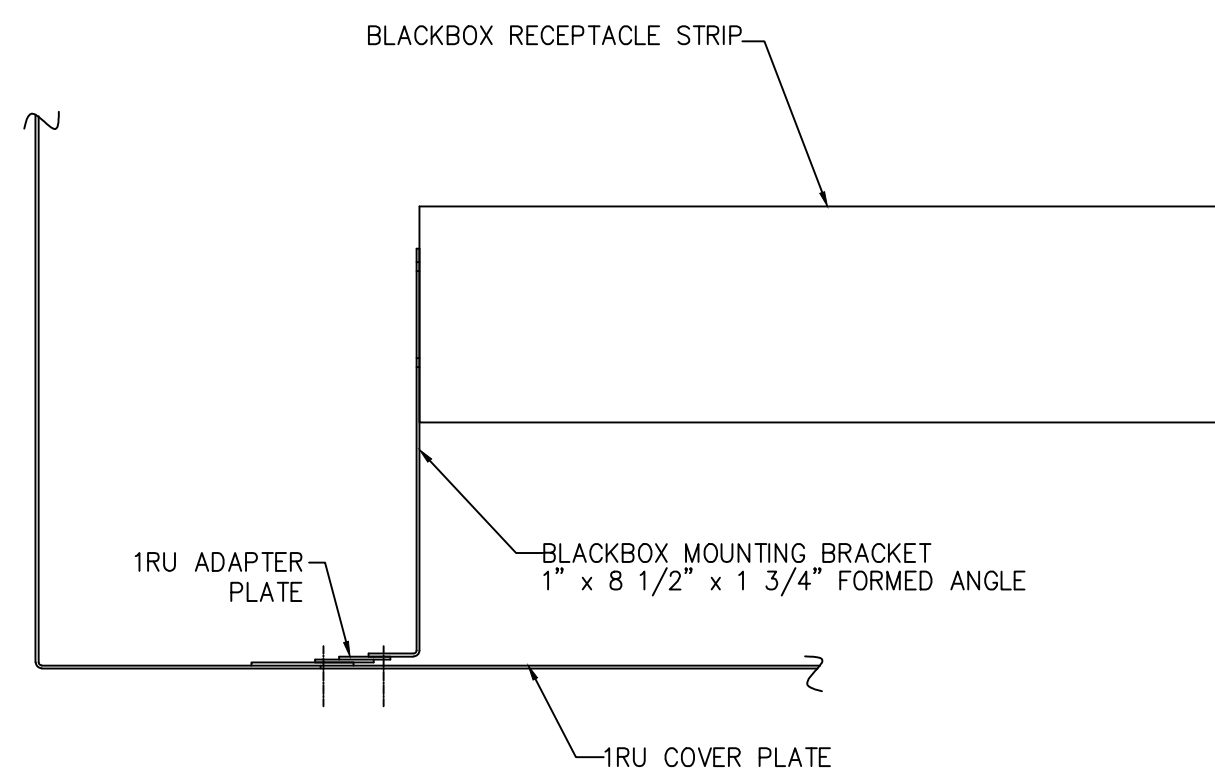
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FRONT VIEW PNL 109  
 FEEDER NO. 60  
 69KV VINITA TRANSMISSION LINE  
 BREAKER 6040 PANEL



REAR VIEW SUB PANEL



PARTIAL SECTION Z-Z  
 NTS  
 TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION	
1	2	SEL 311C LINE PROTECTION RELAY	21P/21A
		S# SEL-0311C11HA3A5421 (125VDC)	
2	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR)	FT1/TS
		S# 129A514G01	
3	7	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT)	FT1/TS
4	1	SEL 351S CIRCUIT BREAKER CONTROL RELAY	50BF
		S# SEL351S61H63554X1 (125VDC)	
5	1	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 125VDC, S# 78PB08D, 8 DECK, MANUAL RESET LOR, WITH LIGHTS	86BF
		RED LED=MONITOR & GREEN LED=TRIPPED.	
6	5	MARATHON #F30A2S FUSE BLOCK WITH TYPE NON-10 AMP FUSES	FU
7	3	MARATHON #F30A3S FUSE BLOCK WITH TYPE NON-6 AMP FUSES	FU
8	2	MARATHON #F30A2S FUSE BLOCK WITH TYPE NON-6 AMP FUSES	FU
9	1	BLACK BOX RECEPTACLE STRIP, 120V AC, 8 PLUGS WITH SURGE PROTECTION #SP196A-R2	
12	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 4 CIRCUIT, S# EB25B04	TB
13	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 12 CIRCUIT, S# EB25B12	TB
14	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, 4 CIRCUIT, S# EB27B04S	TB
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.			

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 109			1.0x3.0	.187
2	1	69kV	FDR. 60 VINITA	TRANSMISSION LINE	1.0x6.0	.375
3	1	PRIMARY RELAY	(21P)		1.0x3.0	.187
4	1	PRIMARY RELAY	POT. & CUR. TEST SW.	(21P/TS1)		
5	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS2)		
6	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS3)		
7	1	ALTERNATE RELAY	(21A)			
8	1	ALTERNATE RELAY	POT. & CUR. TEST SW.	(21A/TS1)		
9	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS2)		
10	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS3)		
11	1	BF & RECLOSE RELAY	50BF/6040			
12	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
13	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
14	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
15	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
16	1	CB 6040	BF LOCKOUT RELAY	86BF/6040		
17	1	PRIMARY RELAY	DC CONTROL	FU1 (10A)		
18	1	ALTERNATE RELAY	DC CONTROL	FU2 (10A)		
19	1	CB 6040	DC CONTROL	FU3 (10A)		
20	1	SPARE	DC CONTROL	FU4 (10A)		
21	1	PRIMARY RELAY	POTENTIAL	FU5 (6A)		
22	1	ALTERNATE RELAY	POTENTIAL	FU6 (6A)		
23	1	CB 6040 BF	POTENTIAL	FU7 (6A)		
24	1	CB 6040 SYNC	POTENTIAL	FU8 (6A)		
25	1	AC POWER STRIP	POTENTIAL	FU9 (10A)		
26	1	SPARE	POTENTIAL	FU10 (6A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

NOTES:

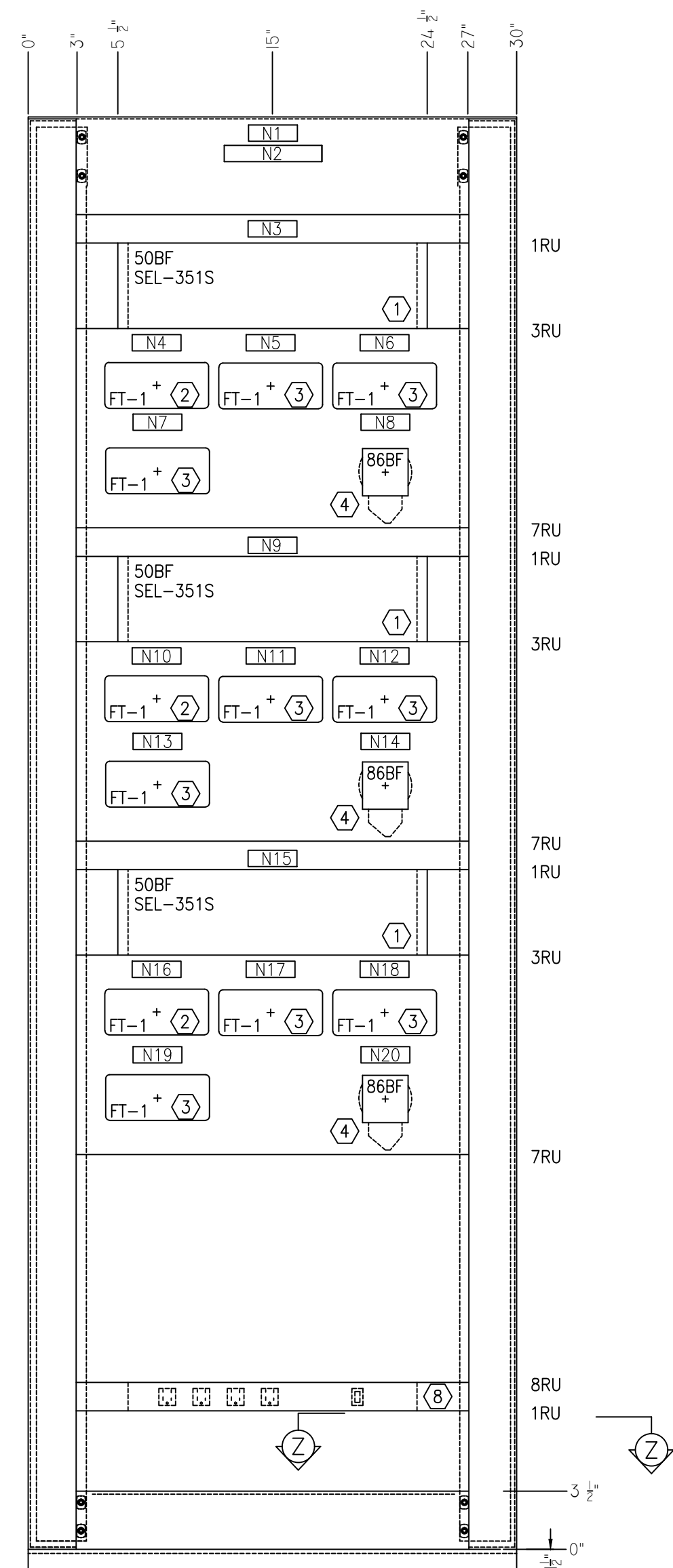
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2. INDICATES TYPICAL NAMEPLATE ITEM NO.
3. IIG. CONSTRUCTION UNLESS OTHERWISE INDICATED.
4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY. INTERIOR - HENTZEN WHITE.
5. INDICATES CUTOUT AND COVER.

0	4/23/12	ISSUED FOR BID	AS	NN
REV	DATE	REVISION DESCRIPTION	DFT	ENG

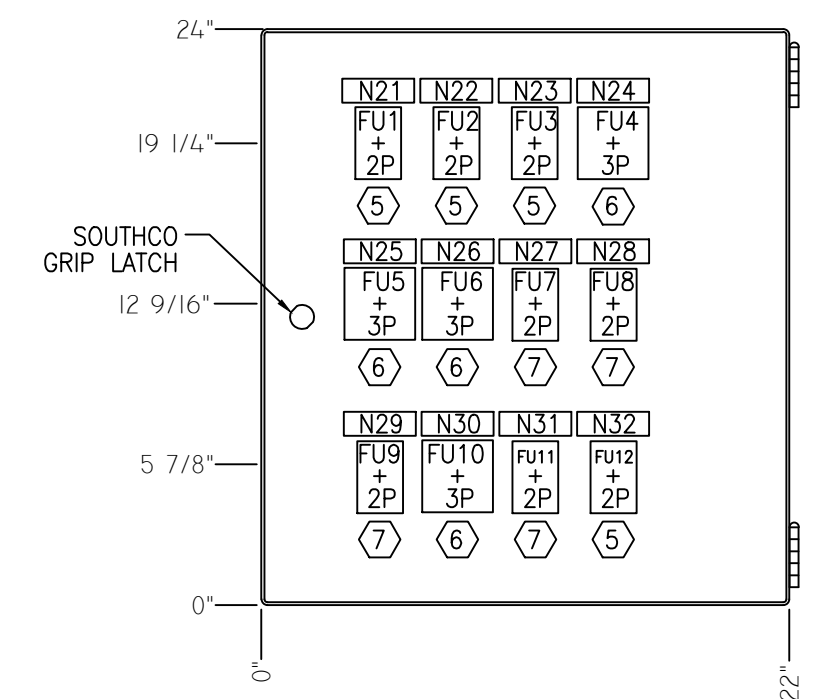
ISSUED FOR BID

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FDR 60-69KV VINITA PANEL 109-BREAKER 6040			
SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
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 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PP109	REV. 0

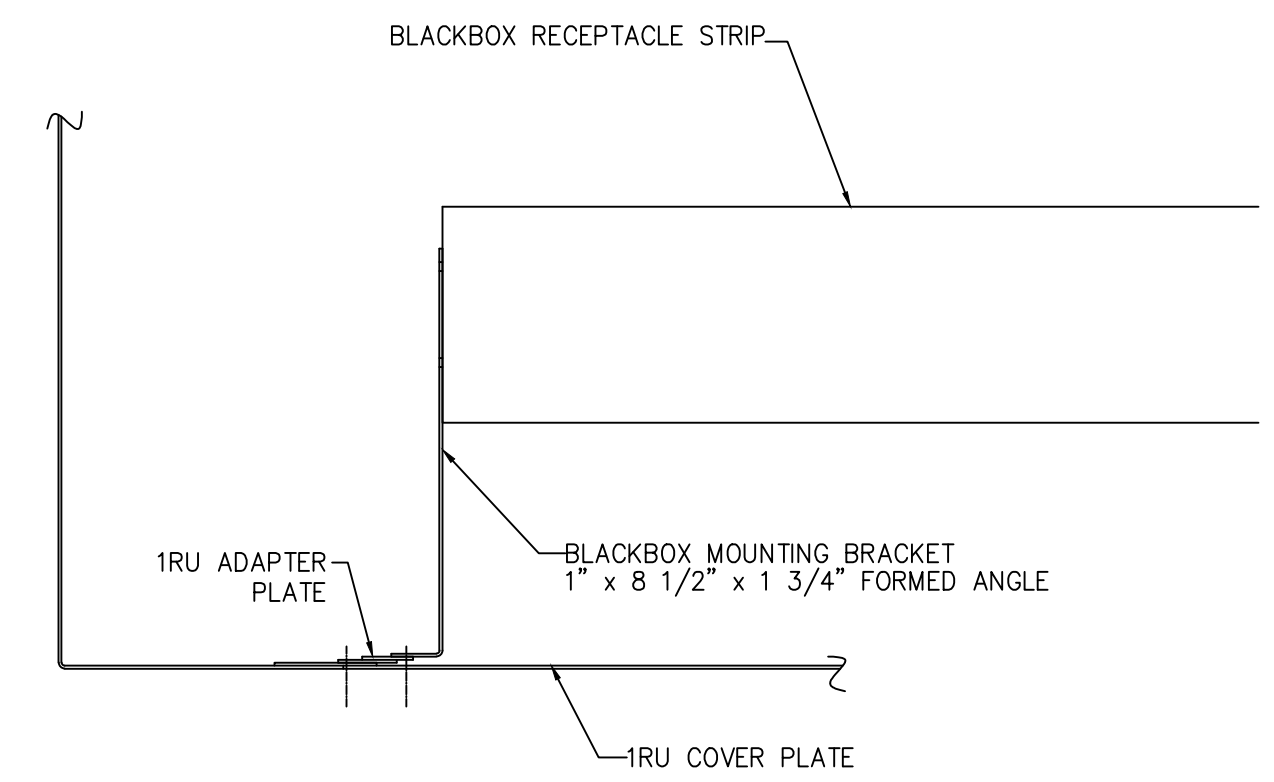
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FRONT VIEW PNL 110  
 BUS TIE BREAKERS  
 BREAKER 600, 700, 800.



REAR VIEW  
 SUB PANEL



PARTIAL SECTION Z-Z  
 NTS  
 TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION
1	3	SEL 351S LINE CONTROL RELAY 50BF S# SEL351S61H63554X1 (125VDC)
2	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) FT1/TS S# 129A514G01
3	9	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT) FT1/TS S# 129A501G01
4	3	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 86BF 125VDC, S# 78PB08D, 8 DECK, MANUAL RESET LOR, WITH LIGHTS RED LED=COIL MONITOR & GREEN LED=TRIPPED
5	4	MARATHON #F30A2S FUSE BLOCK FU WITH TYPE NON-10 AMP FUSES
6	4	MARATHON #F30A3S FUSE BLOCK FU WITH TYPE NON-6 AMP FUSES
7	4	MARATHON #F30A2S FUSE BLOCK FU WITH TYPE NON-6 AMP FUSES
8	1	BLACK BOX RECEPTACLE STRIP, 120V AC, 8 PLUGS WITH SURGE PROTECTION #SP196A-R2
9	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, TB 4 CIRCUIT, S# EB25B04
10	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, TB 12 CIRCUIT, S# EB25B12
11	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, TB 4 CIRCUIT, S# EB27B04S
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.		

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 110			1.0x3.0	.187
2	1	69KV	BKR 600, BKR 700	BKR 800 PNL	1.0x6.0	.375
3	1	BF & RECLOSE RELAY	50BF/600			
4	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)	1.0x3.0	.187
5	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
6	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
7	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
8	1	CB 600	BK LOCKOUT RELAY	86BF/600		
9	1	BF & RECLOSE RELAY	50BF/700			
10	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
11	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
12	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
13	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
14	1	CB 700	BK LOCKOUT RELAY	86BF/700		
15	1	BF & RECLOSE RELAY	50BF/800			
16	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
17	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
18	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
19	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
20	1	CB 800	BK LOCKOUT RELAY	86BF/800		
21	1	CB 600	CONTROL	FU1 (10A)		
22	1	CB 700	CONTROL	FU2 (10A)		
23	1	CB 800	CONTROL	FU3 (10A)		
24	1	CB 600	POTENTIAL	FU4 (6A)		
25	1	CB 700	POTENTIAL	FU5 (6A)		
26	1	CB 800	POTENTIAL	FU6 (6A)		
27	1	CB 600 - SYNC.	POTENTIAL	FU7 (6A)		
28	1	CB 700 - SYNC.	POTENTIAL	FU8 (6A)		
29	1	CB 800 - SYNC.	POTENTIAL	FU9 (6A)		
30	1	SPARE	POTENTIAL	FU10 (6A)		
31	1	SPARE	POTENTIAL	FU11 (6A)		
32	1	AC POWER STRIP	POTENTIAL	FU12 (10A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

NOTES:

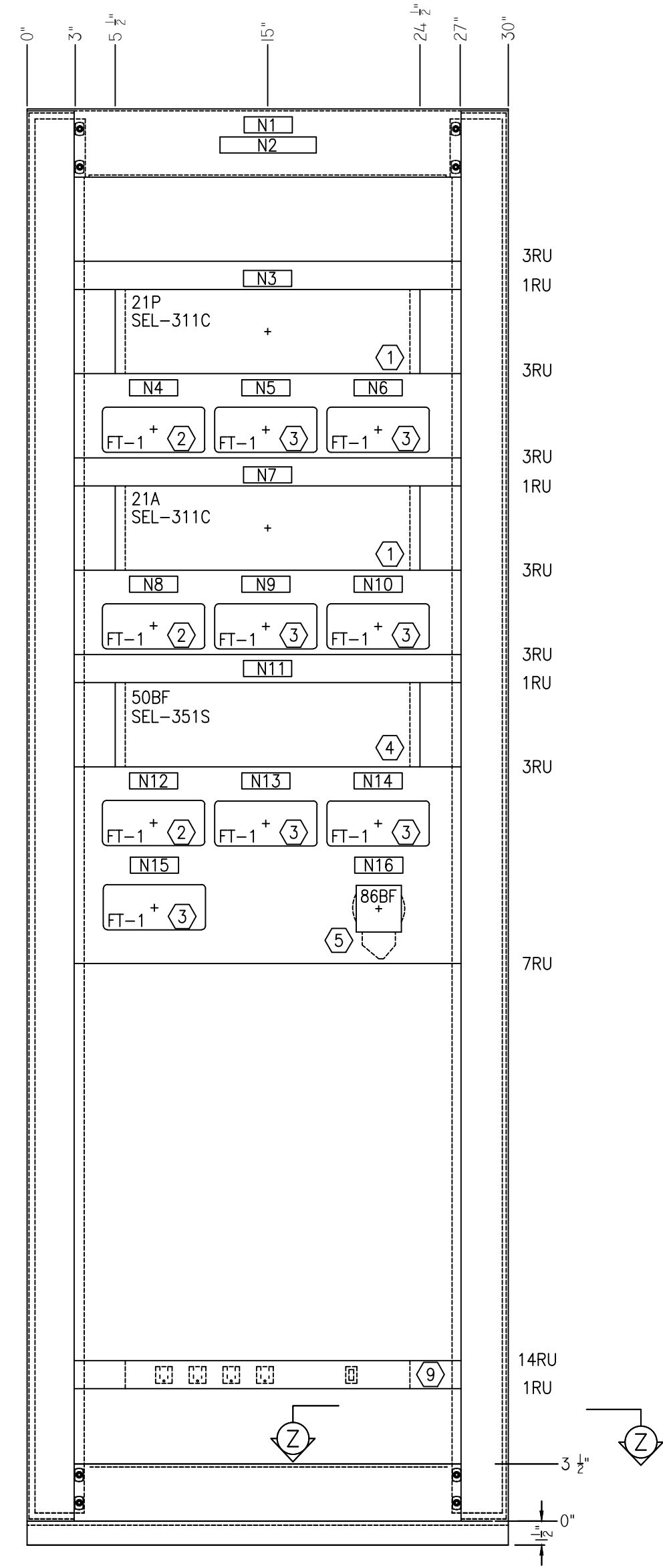
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- INDICATES TYPICAL NAMEPLATE ITEM NO.
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INTERIOR - HENTZEN WHITE.
- ▲ INDICATES CUTOUT AND COVER.

ISSUED FOR BID

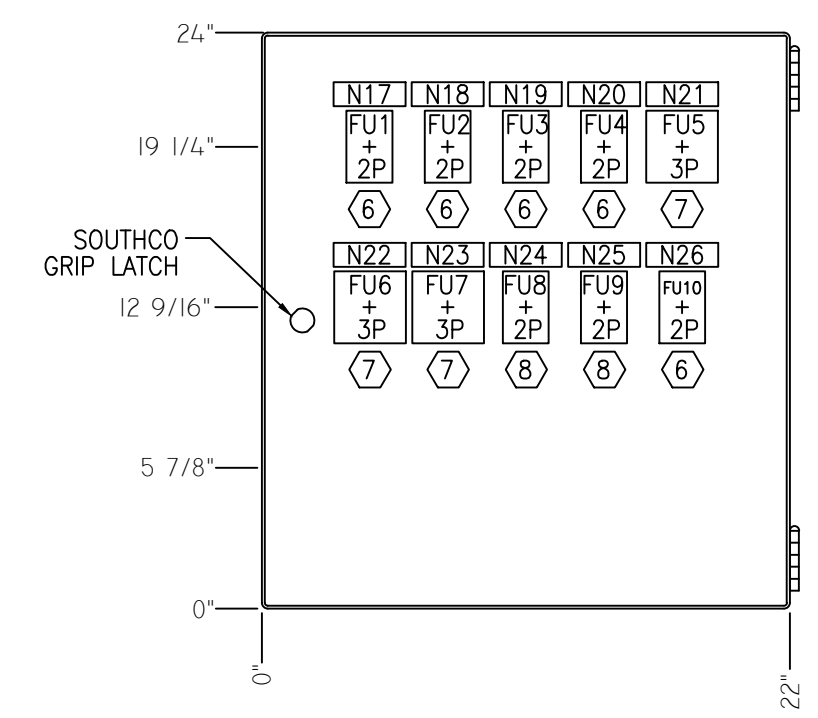
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CH: NN	DATE: 3/7/2011	DRAWING No. S294PP110	
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		REV. 0	

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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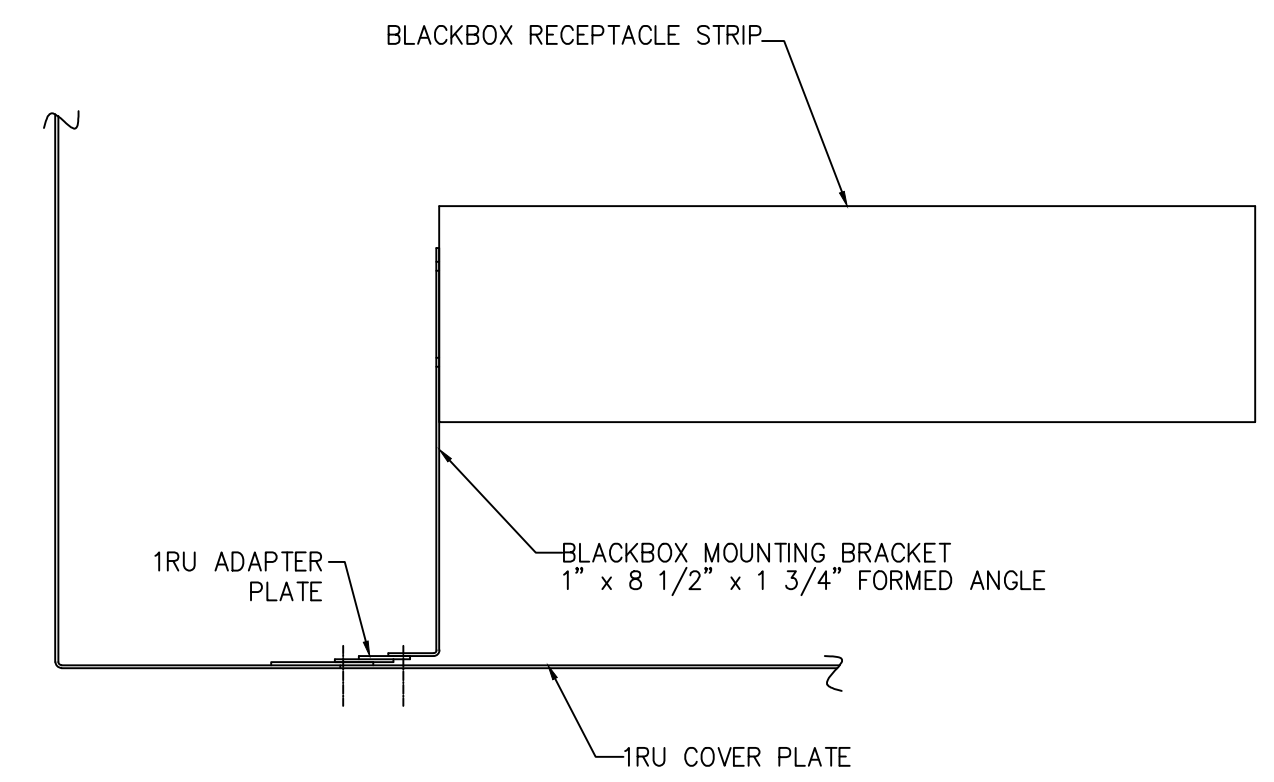
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FRONT VIEW PNL 111  
 FEEDER NO. 63  
 69kV MONKEY ISLAND TRANSMISSION LINE  
 BREAKER 6340 PANEL



REAR VIEW SUB PANEL



PARTIAL SECTION Z-Z  
 NTS  
 TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION
1	2	SEL 311C LINE PROTECTION RELAY 21P/21A S# SEL-0311C11HA3A5421 (125VDC)
2	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) FT1/TS S# 129A514G01
3	7	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT) FT1/TS
4	1	SEL 351S CIRCUIT BREAKER CONTROL RELAY 50BF S# SEL351S61H63554X1 (125VDC)
5	1	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 86BF 125VDC, S# 78PB08D, 8 DECK, MANUAL RESET LOR, WITH LIGHTS RED LED=MONITOR & GREEN LED=TRIPPED.
6	5	MARATHON #F30A2S FUSE BLOCK FU WITH TYPE NON-10 AMP FUSES
7	3	MARATHON #F30A3S FUSE BLOCK FU WITH TYPE NON-6 AMP FUSES
8	2	MARATHON #F30A2S FUSE BLOCK FU WITH TYPE NON-6 AMP FUSES
9	1	BLACK BOX RECEPTACLE STRIP, 120V AC, 8 PLUGS WITH SURGE PROTECTION #SP196A-R2
10	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 4 CIRCUIT, S# EB25B04 TB
11	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 12 CIRCUIT, S# EB25B12 TB
12	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, 4 CIRCUIT, S# EB27B04S TB
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.		

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 111			1.0x3.0	.187
2	1	69kV	FDR 63	MONKEY ISLAND LINE	1.0x6.0	.375
3	1	PRIMARY RELAY	(21P)		1.0x3.0	.187
4	1	PRIMARY RELAY	POT. & CUR. TEST SW.	(21P/TS1)		
5	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS2)		
6	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS3)		
7	1	ALTERNATE RELAY	(21A)			
8	1	ALTERNATE RELAY	POT. & CUR. TEST SW.	(21A/TS1)		
9	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS2)		
10	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS3)		
11	1	BF & RECLOSE RELAY	50BF/6340			
12	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
13	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
14	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
15	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
16	1	BF & RECLOSE RELAY	BF LOCKOUT RELAY	86BF/6340		
17	1	PRIMARY RELAY	DC CONTROL	FU1 (10A)		
18	1	ALTERNATE RELAY	DC CONTROL	FU2 (10A)		
19	1	CB 6340	DC CONTROL	FU3 (10A)		
20	1	SPARE	DC CONTROL	FU4 (10A)		
21	1	PRIMARY RELAY	POTENTIAL	FU5 (6A)		
22	1	ALTERNATE RELAY	POTENTIAL	FU6 (6A)		
23	1	CB 6340	POTENTIAL	FU7 (6A)		
24	1	CB 6340 SYNC	POTENTIAL	FU8 (6A)		
25	1	SPARE	POTENTIAL	FU9 (6A)		
26	1	AC POWER STRIP	POTENTIAL	FU10 (10A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

- NOTES:
1. INDICATES TYPICAL BILL OF MATERIAL ITEM NO.
  2. INDICATES TYPICAL NAMEPLATE ITEM NO.
  3. IIGA. CONSTRUCTION UNLESS OTHERWISE INDICATED.
  4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY. INTERIOR - HENTZEN WHITE.
  5. INDICATES CUTOUT AND COVER.

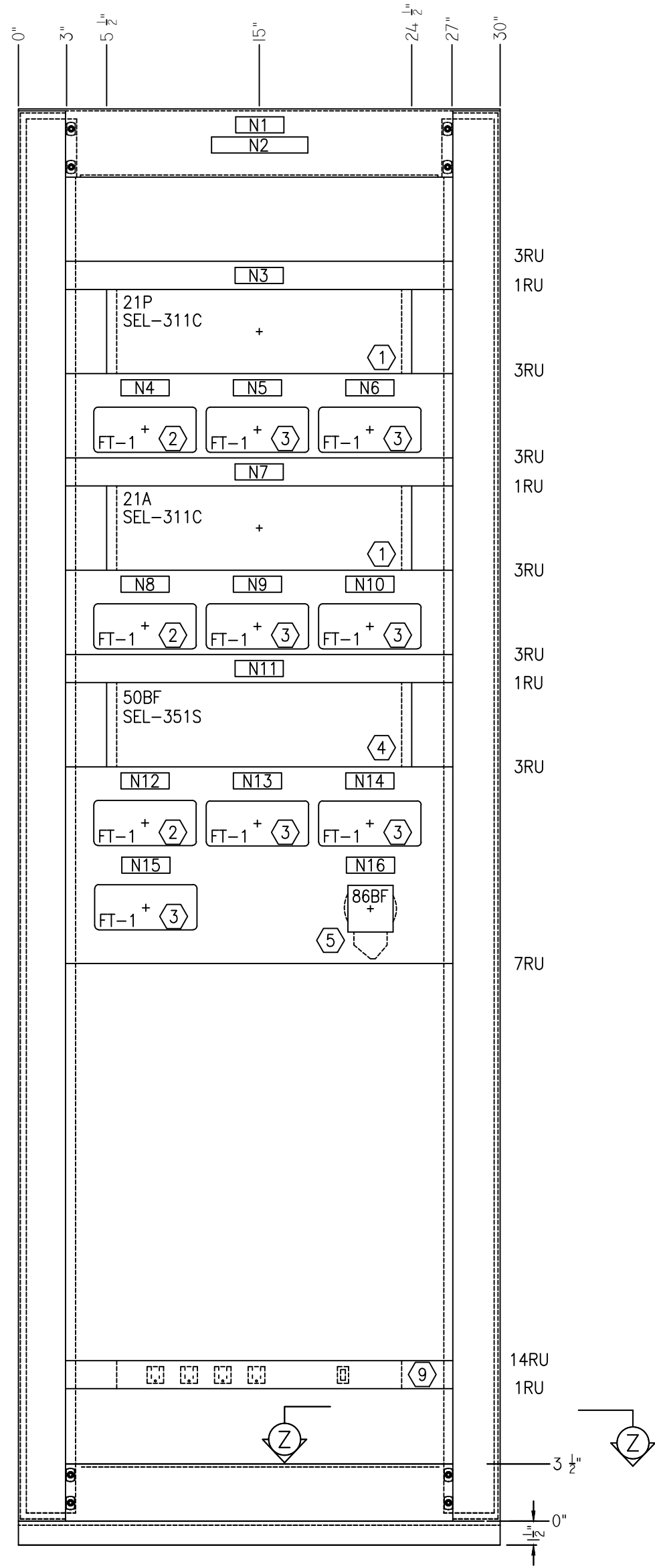
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REV	DATE	REVISION DESCRIPTION	DFT	ENG

**ISSUED FOR BID**

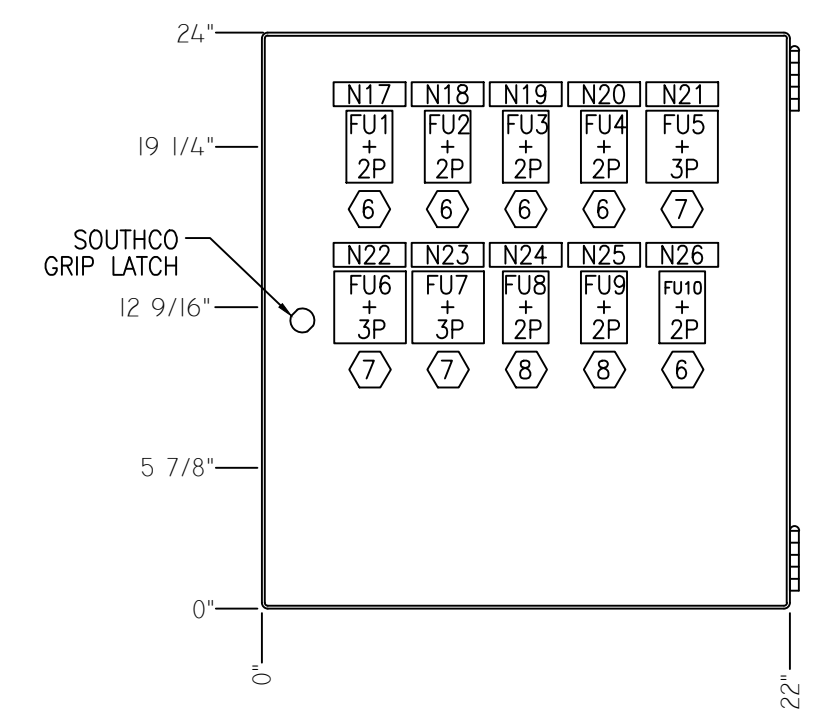
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 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69kV  
 FDR 63-69kV MONKEY ISLAND  
 PANEL 111-BREAKER 6340

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011		
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PP111	REV. 0

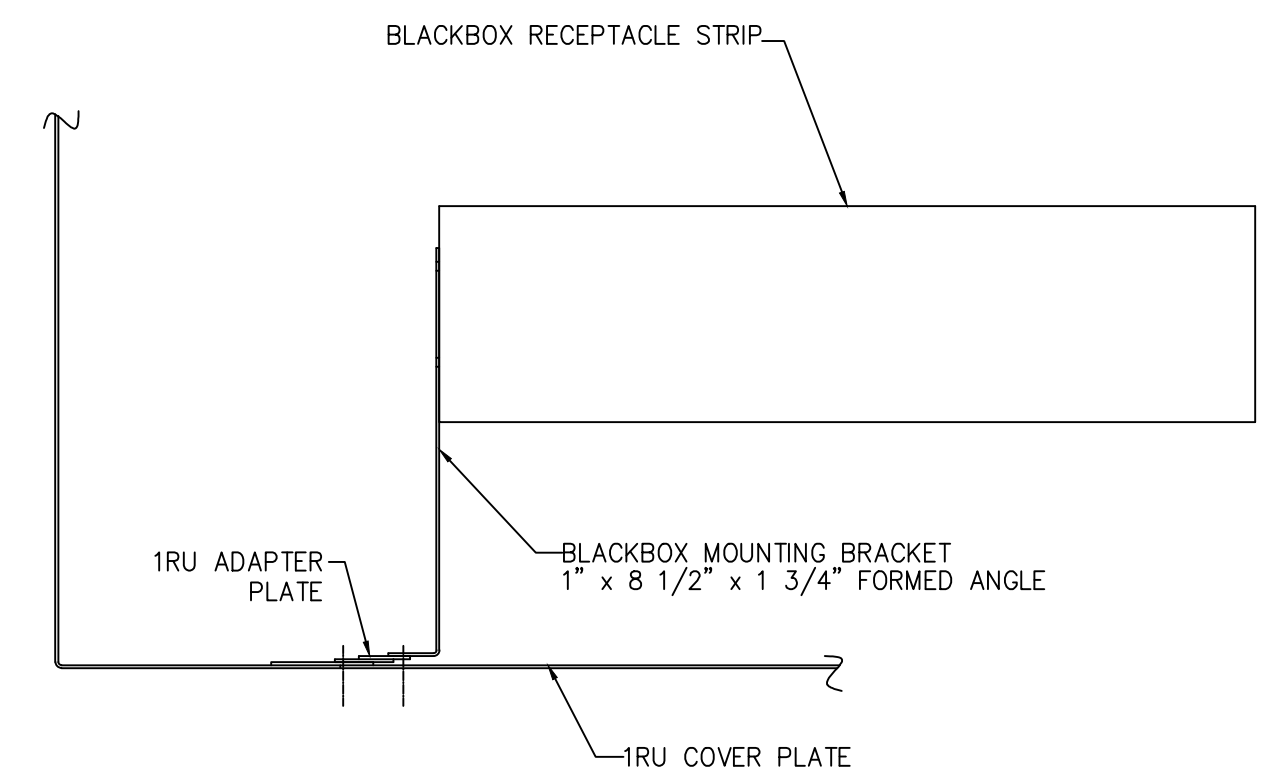
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FRONT VIEW PNL 112  
 FEEDER NO. 62  
 69KV SAILBOAT BRIDGE TRANSMISSION LINE  
 BREAKER 6240 PANEL



REAR VIEW SUB PANEL



PARTIAL SECTION Z-Z  
 NTS  
 TYPICAL BOTH SIDES

BILL OF MATERIAL

IT#	QUAN	DESCRIPTION	
1	2	SEL 311C LINE PROTECTION RELAY S# SEL-0311C11HA3A5421 (125VDC)	21P/21A
2	3	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (4 POT, 6 CURR) S# 129A514G01	FT1/TS
3	7	ABB TYPE FT-1 TEST SWITCH, 10 POLE, (10 POT)	FT1/TS
4	1	SEL 351S CIRCUIT BREAKER CONTROL RELAY S# SEL351S61H63554X1 (125VDC)	50BF
5	1	ELECTROSWITCH, SERIES 24 AUXILIARY TRIPPING RELAY, 125VDC, S# 78PB08D, 8 DECK, MANUAL RESET LOR, WITH LIGHTS RED LED=MONITOR & GREEN LED=TRIPPED.	86BF
6	5	MARATHON #F30A2S FUSE BLOCK WITH TYPE NON-10 AMP FUSES	FU
7	3	MARATHON #F30A3S FUSE BLOCK WITH TYPE NON-6 AMP FUSES	FU
8	2	MARATHON #F30A2S FUSE BLOCK WITH TYPE NON-6 AMP FUSES	FU
9	1	BLACK BOX RECEPTACLE STRIP, 120V AC, 8 PLUGS WITH SURGE PROTECTION #SP196A-R2	
10	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 4 CIRCUIT, S# EB25B04	TB
11	**	GENERAL ELECTRIC TYPE EB-25/ TERMINAL BLOCK, 12 CIRCUIT, S# EB25B12	TB
12	**	GENERAL ELECTRIC TYPE EB-27/SHORTING TERMINAL BLOCK, 4 CIRCUIT, S# EB27B04S	TB
**--FINAL QUANTITIES TO BE DETERMINED BY VENDOR.			

NAMEPLATE ENGRAVING LIST

NP#	QUAN	FIRST LINE	SECOND LINE	THIRD LINE	PLT. SIZE	LTR. SIZE
1	1	PANEL NO. 112			1.0x3.0	.187
2	1	69kV	FDR 62	SAILBOAT BRIDGE LINE	1.0x6.0	.375
3	1	PRIMARY RELAY	(21P)		1.0x3.0	.187
4	1	PRIMARY RELAY	POT. & CUR. TEST SW.	(21P/TS1)		
5	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS2)		
6	1	PRIMARY RELAY	POTENTIAL TEST SW.	(21P/TS3)		
7	1	ALTERNATE RELAY	(21A)			
8	1	ALTERNATE RELAY	POT. & CUR. TEST SW.	(21A/TS1)		
9	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS2)		
10	1	ALTERNATE RELAY	POTENTIAL TEST SW.	(21A/TS3)		
11	1	BF & RECLOSE RELAY	50BF/6240			
12	1	BF & RECLOSE RELAY	POT.&CUR. TEST SW.	(50BF/TS1)		
13	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS2)		
14	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(50BF/TS3)		
15	1	BF & RECLOSE RELAY	POTENTIAL TEST SW.	(86BF/TS1)		
16	1	BF & RECLOSE RELAY	BF LOCKOUT RELAY	86BF/6240		
17	1	PRIMARY RELAY	DC CONTROL	FU1 (10A)		
18	1	ALTERNATE RELAY	DC CONTROL	FU2 (10A)		
19	1	CB 6240	DC CONTROL	FU3 (10A)		
20	1	SPARE	DC CONTROL	FU4 (10A)		
21	1	PRIMARY RELAY	POTENTIAL	FU5 (6A)		
22	1	ALTERNATE RELAY	POTENTIAL	FU6 (6A)		
23	1	CB 6240	POTENTIAL	FU7 (6A)		
24	1	CB 6240 SYNC	POTENTIAL	FU8 (6A)		
25	1	SPARE	POTENTIAL	FU9 (6A)		
26	1	AC POWER STRIP	POTENTIAL	FU10 (10A)		
					1.0x3.0	.187

ALL NAMEPLATES ARE .062 BLACK MATERIAL & INSTALLED WITH ADHESIVE TAPE

- NOTES:
1. INDICATES TYPICAL BILL OF MATERIAL ITEM NO.
  2. INDICATES TYPICAL NAMEPLATE ITEM NO.
  3. IIGA. CONSTRUCTION UNLESS OTHERWISE INDICATED.
  4. PAINT: EXTERIOR - POWDER COAT ANSI 70 GRAY.  
INTERIOR - HENTZEN WHITE.
  5. INDICATES CUTOUT AND COVER.

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV  
 FDR 62-69KV SAILBOAT BRIDGE  
 PANEL 112-BREAKER 6240

SCALE: NONE	DRAWN BY: DJR	ENGR: BM	APPD: BA
CH: NN	DATE: 3/7/2011		

GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

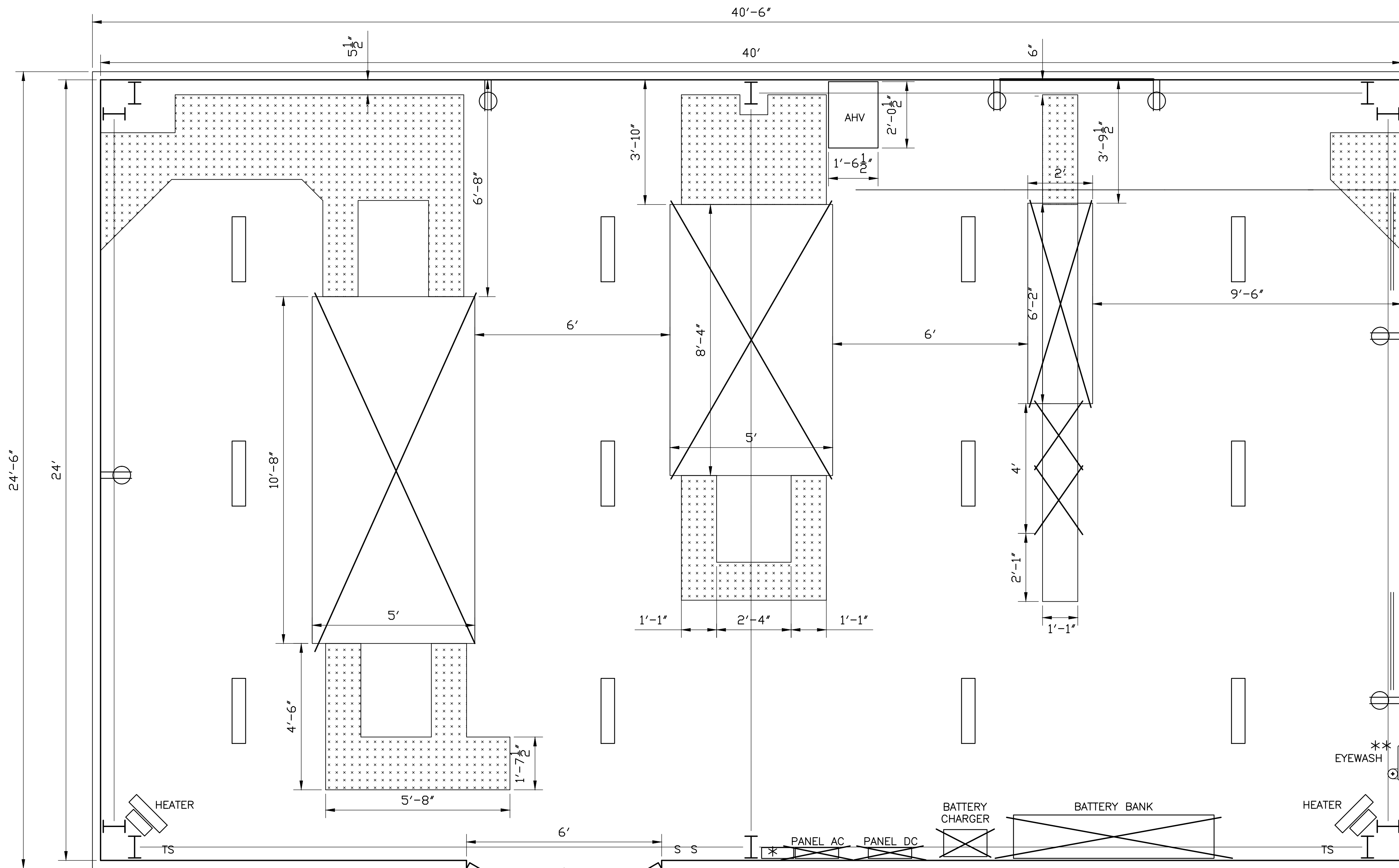
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DRAWING No. S294PP112		REV. 0
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## Afton Substation

S294PH01	CONTROL HOUSE LAYOUT REMOVAL PLAN
S294PH02	CONTROL HOUSE LAYOUT REMOVAL PLAN
S294PH03	CONTROL HOUSE GROUNDING
S294PH04	PANEL VIEW A
S294PH05	PANEL VIEW B & C
S294PH06	PANEL VIEW D & E
S294PH07	PANEL VIEW F
S294PH08	PANEL VIEW G & H
S294PH09	CABLE RACEWAY DETAIL
S294PH10	CONTROL HOUSE BATTERY AREA EXHAUST FAN
S294PH11	GENERAL NOTES AND MISC DETAILS

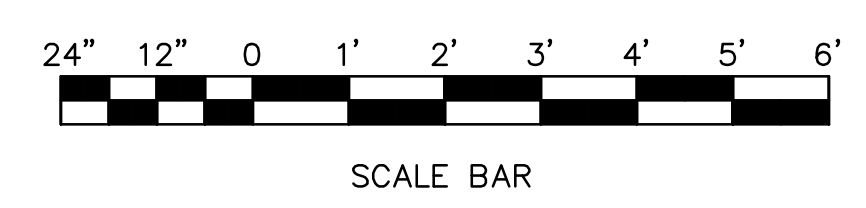
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\*\* RELOCATE EXISTING EYEWASH

\* EXISTING LIGHTING CONTROL PANEL TO REMAIN

- NOTES:**
1. X DENOTES ITEM TO BE REMOVED. REMOVE ITEMS ONLY AFTER NEW REPLACEMENT EQUIPMENT IS INSTALLED AND OPERATIONAL.
  2. SEE DWG S294PH11 GENERAL NOTES, FOR REMOVAL INSTRUCTIONS.



**REFERENCE DRAWINGS:**  
 S294PH02 NEW INSTALLATION PLAN  
 S294PH11 GENERAL NOTES

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
AFTON, OKLAHOMA  
 161/69kV

**EXISTING CONTROL HOUSE LAYOUT  
 REMOVAL PLAN**

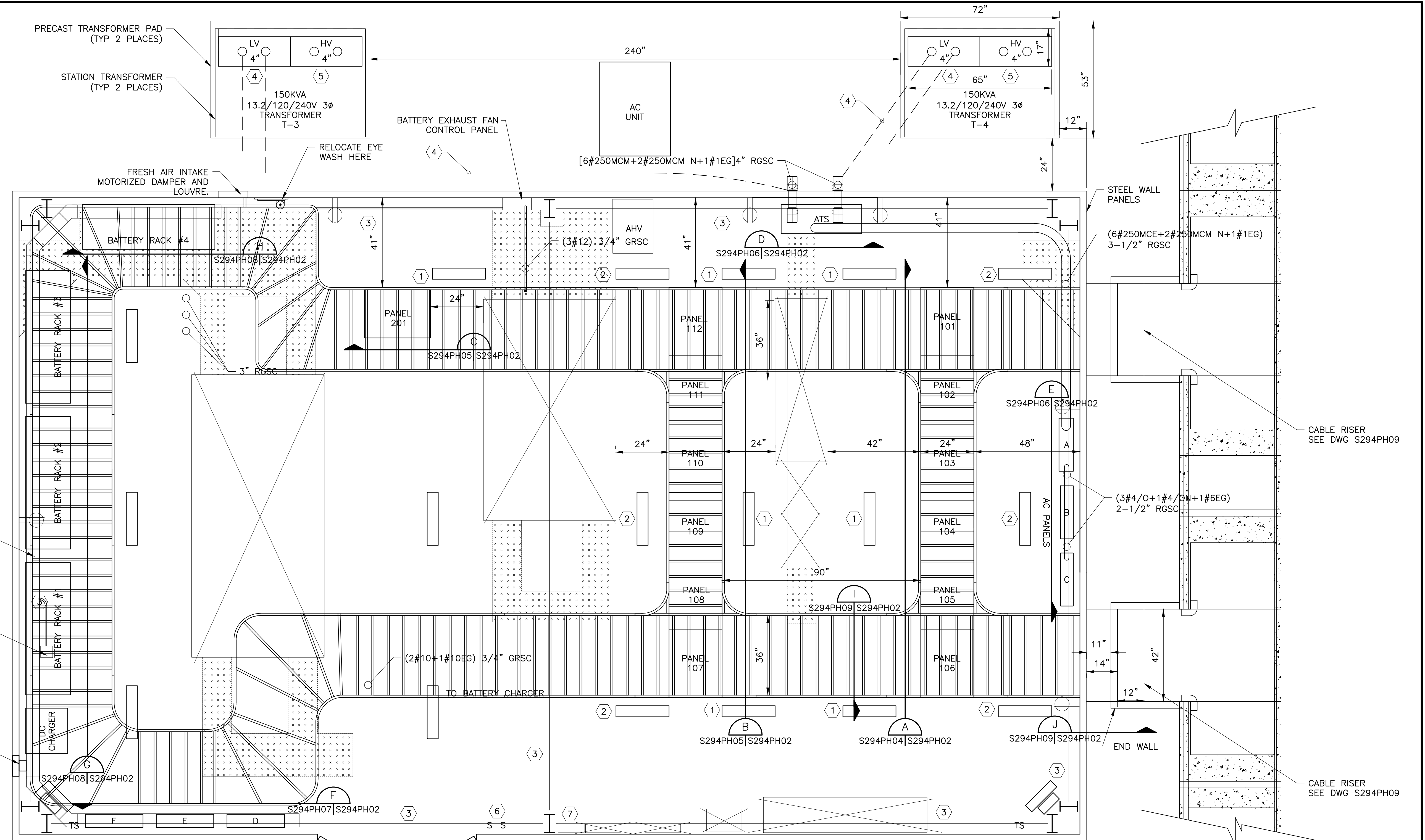
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REV	DATE	REVISION DESCRIPTION	DFT	ENG

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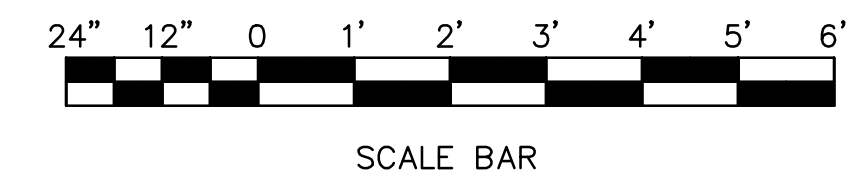
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  - 103-FDR 126, BREAKER 12670
  - 104-TRANSFORMER 1, BREAKER 300
  - 105-BUS DIFF S1 AND N1, BREAKER 400
  - 106-TRANSFORMER 2, BREAKER 500
  - 107-FDR 5, BREAKER 540
  - 108-FDR 61, BREAKER 6140
  - 109-FDR 60, BREAKER 6040
  - 110-BREAKER 600, 700, 800
  - 111-FDR 60, BREAKER 6040
  - 112-FDR 62, BREAKER 6340
  - 201-COMM. AND ANNUNCIATOR



6"x6" NEMA 1 WIREWAY ABOVE DC PANELS AND BATTERY RACKS.

BATTERY CHARGING HYDROGEN SENSOR CEILING MOUNT

BATTERY EXHAUST FAN WALL SHUTTER MOUNT



- REFERENCE DRAWINGS**
- S294PG50 TRENCH LAYOUT PLAN
  - S294PG51 TRENCH DETAILS
  - S294PH09 CABLE RACEWAY DETAIL
  - S294PH10 CONTROL HOUSE AREA EXHAUST FAN
  - S294PH11 GENERAL NOTES

- KEYED NOTES:**
- ① RELOCATE LIGHTS FROM ORIGINAL POSITION TO ACCOMMODATE FOR CABLE TRAY.
  - ② INSTALL NEW LIGHTS, MATCH EXISTING. TIE 3 NEW LIGHTS TO EACH EXISTING LIGHT CIRCUIT.
  - ③ CONFIGURATION AND SIZE OF EXISTING I-BEAMS ABOVE CEILING UNKNOWN.
  - ④ 1[6#250MCM+2#250MCM N+1#1EG]-4"GRSC AND 1 SPARE 4" C LOW VOLTAGE CONDUITS 24" U.G. TO ATS IN CONTROL HOUSE.
  - ⑤ INSTALL 2 EACH 6" GRS CONDUITS (1 IS A SPARE). ROUTE CONDUITS 48" U.G. TO T1 AND T2 TERTIARIES. CONDUCTORS SHALL BE #1AWG COPPER, 15KV, 90°C RATED, SHIELDED, 1/3 NEUTRAL, CONCENTRIC, 133% INSULATION, WITH 50 MIL LLDPE JACKET, KERITE CAT. NO. 101C15-33200 OR EQUAL.
  - ⑥ REFEED LIGHT SWITCHES FROM NEW AC PANELS. PROVIDE 1 BREAKER FOR EACH SWITCH. PLACE NINE (9) FIXTURES ON EACH CIRCUIT.
  - ⑦ USE EXISTING CONTACTOR PANEL. REFEED FROM PANEL B. ADD CIRCUIT BREAKERS AS NEEDED AND CONNECT NEW SUBSTATION AREA LIGHTING PER SCHEDULE THIS SHEET.

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 1616/134KV

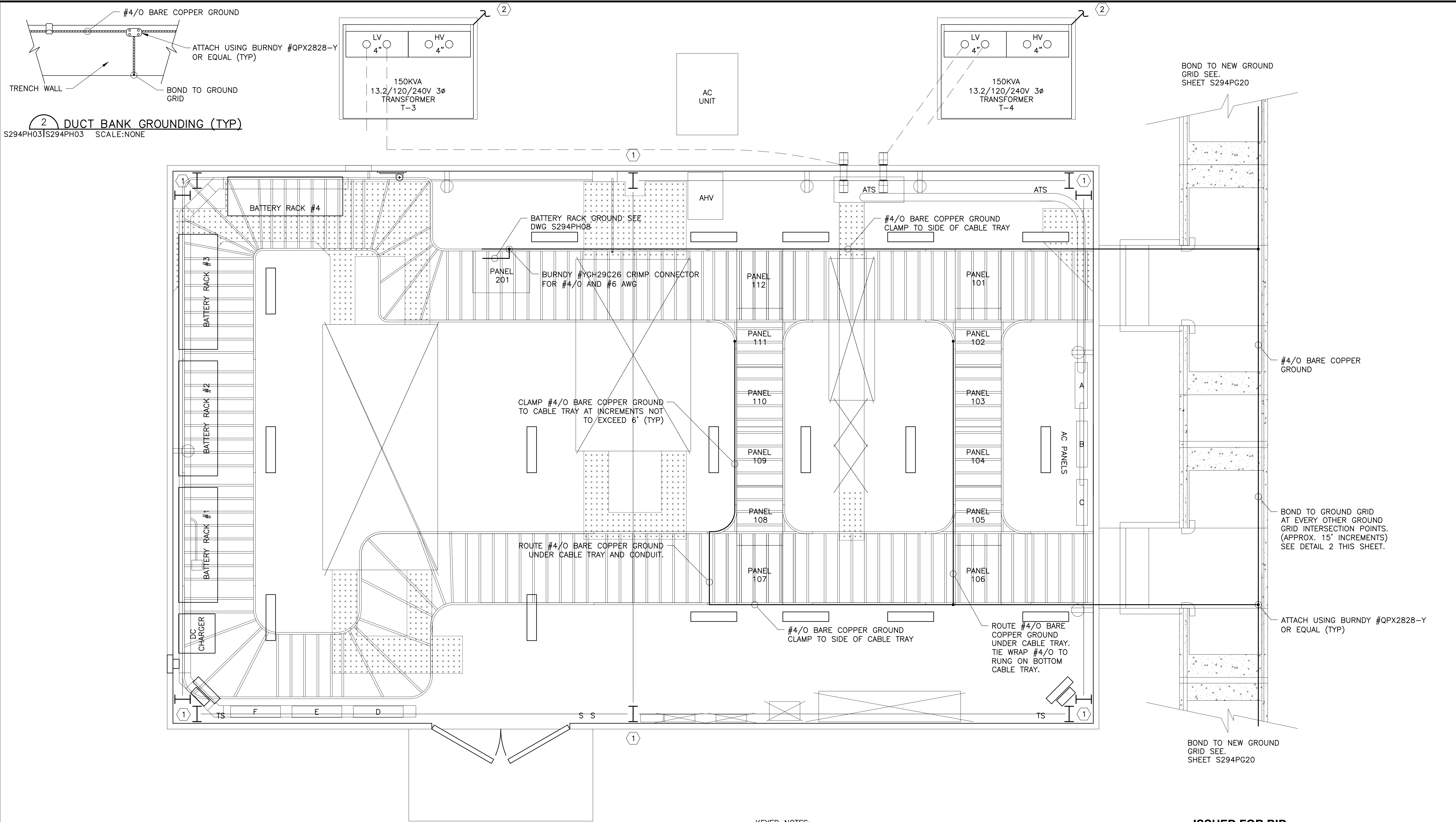
**EXISTING CONTROL HOUSE LAYOUT**  
**NEW INSTALLATION PLAN**

SCALE: AS SHOWN	DRAWN BY: SRF	ENGR: SRF	APPD: BA
CH: MW	DATE: 3/7/2011		
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294PH02</b>	REV. <b>0</b>

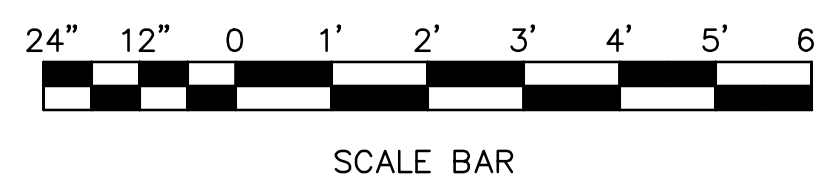
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2 DUCT BANK GROUNDING (TYP)  
 S294PH03/S294PH03 SCALE: NONE



**REFERENCE DRAWINGS:**  
 S294PG20 GROUNDING PLAN  
 S294PH08 PANEL VIEW G & H  
 S294PH11 GENERAL NOTES & MISC. DETAILS

**KEYED NOTES:**

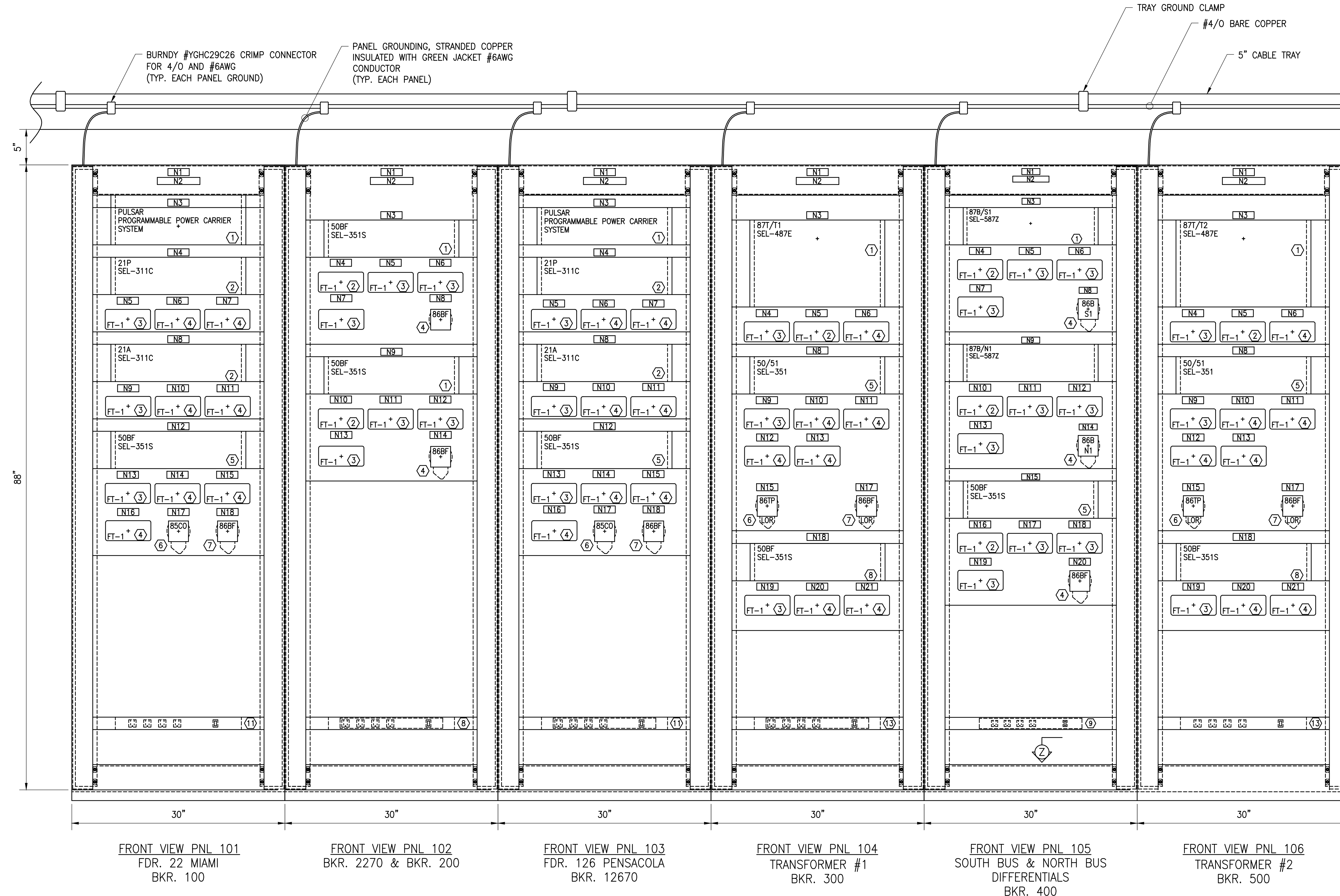
- ① CONTRACTOR SHALL VERIFY EXISTING GROUNDING OF CONTROL HOUSE. CONTRACTOR SHALL ATTACH EXISTING CONTROL HOUSE GROUNDING TO NEW GROUND GRID. SEE SHEET S294PG20 FOR NEW GROUND GRID.
- ② BOND STATION TRANSFORMER GROUND TO NEW GROUND GRID AT CLOSEST POINT

1 CONTROL HOUSE GROUNDING  
 S294PH03/S294PH03 SCALE: NONE

REV	DATE	ISSUED FOR BID	JT	BA
0	5/11/12	ISSUED FOR BID	JT	BA
		REVISION DESCRIPTION	DFT	ENG

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69KV</small>			
<b>EXISTING CONTROL HOUSE LAYOUT</b> <b>NEW GROUNDING PLAN</b>			
SCALE: AS SHOWN	DRAWN BY: SRF	ENGR: SRF	APPD: BA
		CH: MW	DATE: 3/7/2011
<b>GRDA</b> <small>Grand River Dam Authority P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. <b>S294PH03</b>	REV. <b>0</b>



REFERENCE DRAWINGS  
S294PH02 NEW INSTALLATION PLAN

1 VIEW A  
S294PH02/S294PH04 SCALE: NONE

- NOTES:
- ANCHOR EACH PANEL TO EXISTING FLOOR USING FOUR(4) PROPERLY SIZED EXPANSION ANCHORS, EACH PANEL.
  - ALIGN PANELS SQUARELY WITH THE ROOM WALLS, AND IN ALIGNMENT TO EACH OTHER. ALIGNMENT TOLERANCE: ±1/16 INCH.

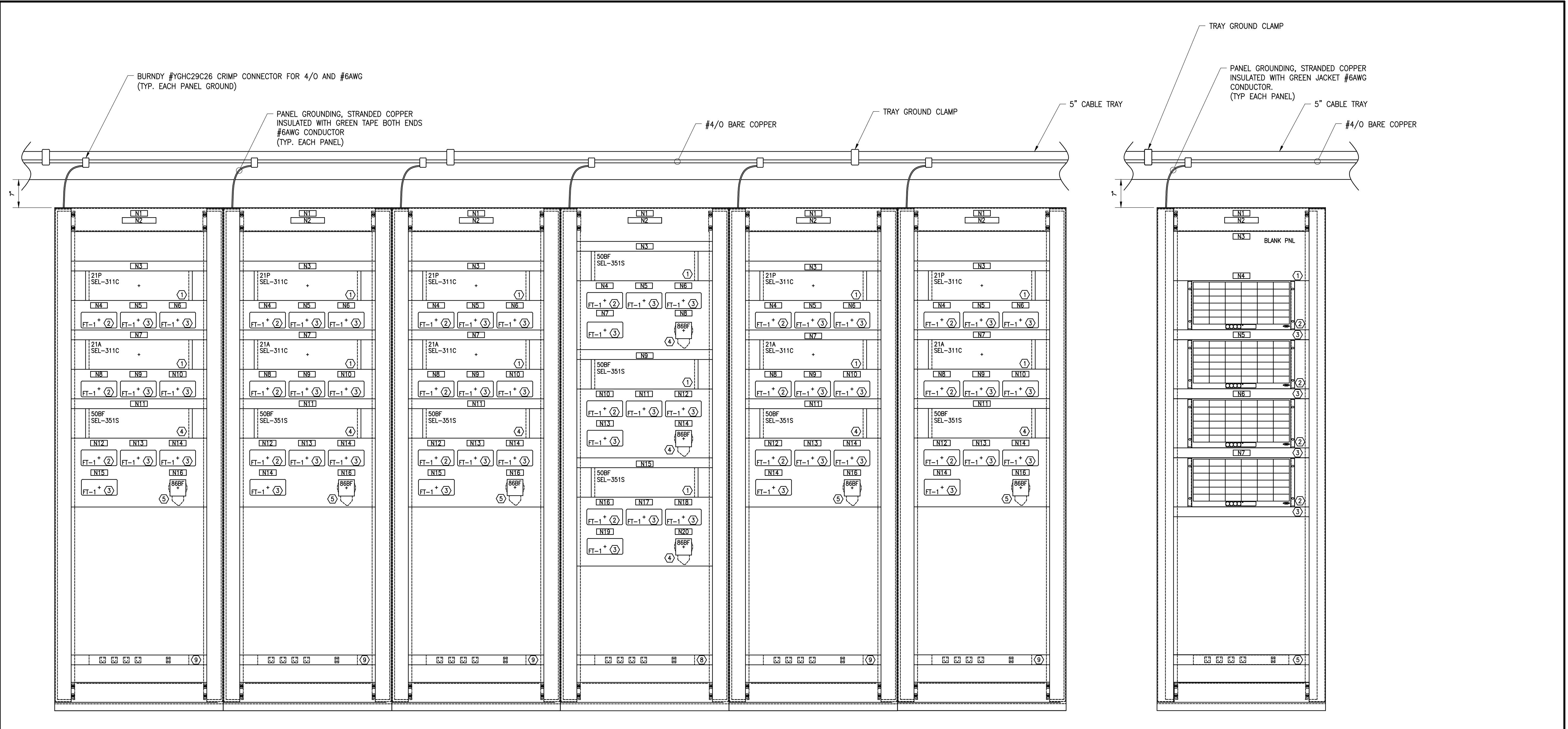
ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
NEW CONTROL PANELS VIEW A			
SCALE: NONE	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
DRAWING No. S294PH04		REV. 0	
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK. 74301			

REV	DATE	REVISION DESCRIPTION	AS	NN	DFT	ENG
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FRONT VIEW PNL 107  
FDR. 5 PENSACOLA  
BKR. 540

FRONT VIEW PNL 108  
FDR. 61 MIAMI  
BKR. 6140

FRONT VIEW PNL 109  
FDR. 60 VINITA  
BKR. 6040

FRONT VIEW PNL 110  
TIE BKRS. 600 700 800

FRONT VIEW PNL 111  
FDR. 63 MONKEY ISLAND  
BKR. 6340

FRONT VIEW PNL 112  
FDR. 62 SAILBOAT BRIDGE  
BKR. 6240

FRONT VIEW PNL 201  
ANNUNCIATORS

1 VIEW B  
S294PH02\S294PH05 SCALE:NONE

2 VIEW C  
S294PH02\S294PH05 SCALE:NONE

REFERENCE DRAWINGS  
S294PH02 NEW INSTALLATION PLAN

- NOTES:
- ANCHOR EACH PANEL TO EXISTING FLOOR USING FOUR(4) PROPERLY SIZED EXPANSION ANCHORS, EACH PANEL.
  - ALIGN PANELS SQUARELY WITH THE ROOM WALLS, AND IN ALIGNMENT TO EACH OTHER. ALIGNMENT TOLERANCE: ±1/16 INCH.

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**ISSUED FOR BID**

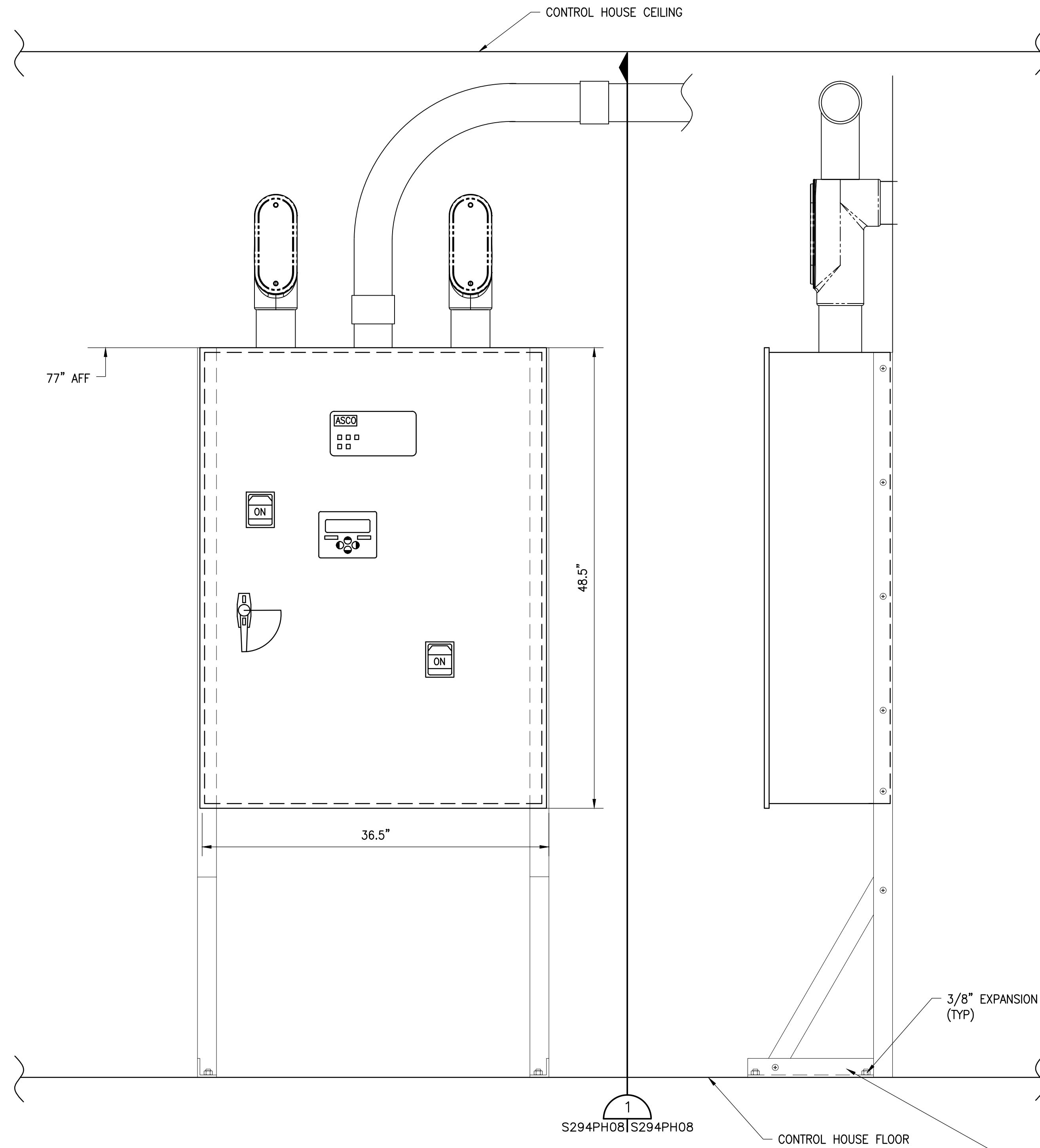
GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

NEW CONTROL PANELS  
VIEW B AND VIEW C

SCALE: NONE	DRAWN BY: DKG	ENGR: AEM	APPD:
CH: MWNN		DATE: 3/7/2011	
DRAWING No. S294PH05			REV. 0

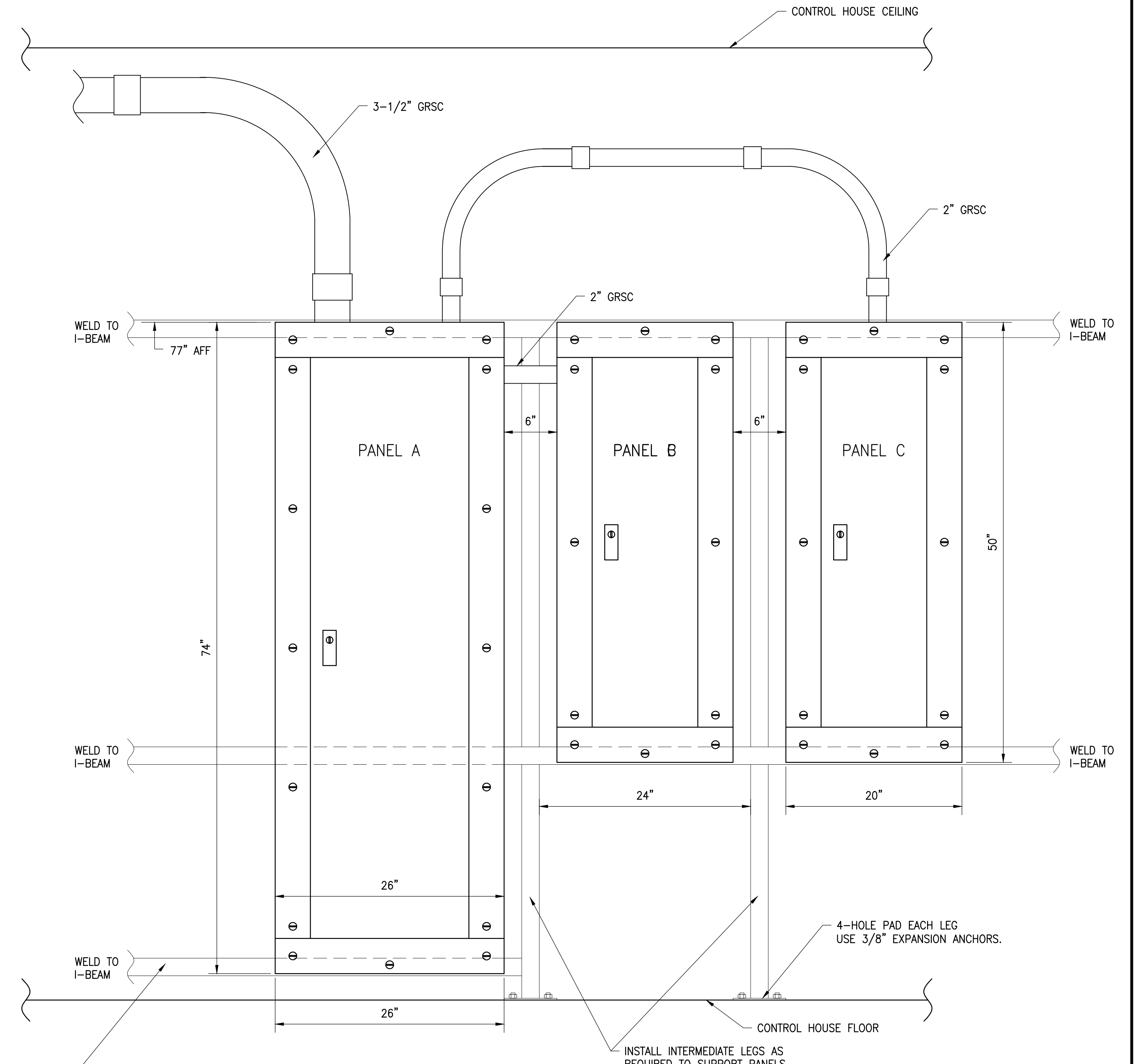
**GRDA**  
GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

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**AUTOMATIC TRANSFER SWITCH**

**1 VIEW D**  
S294PH02|S294PH06 SCALE:NONE



**240/120VAC PANELS**

**3 VIEW E**  
S294PH02|S294PH06 SCALE:NONE

INSTALL 2-1/2" ANGLE IRON AS SUPPORT FOR PANELS. THIS LAYOUT IS REPRESENTATIVE ONLY. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SHOWING PROPOSED FRAMES TO OWNER FOR APPROVAL.

**NOTES:**

1. ATS SHALL BE ASCO MODEL NO. E3APS3400F1C OR EQUAL, 400AMP, 240V, 3Ø, SOLID NEUTRAL, WITH CIRCUIT BREAKERS FOR BOTH SOURCE INPUTS, 35KAIC, RATED FOR SERVICE ENTRANCE, NEMA1.
2. PANEL A SHALL BE SQUARE D, I-LINE OR EQUAL, 240/120V, 3Ø, 4-WIRE, 400AMP, WITH 350A MCB, 22K AIC, RATED FOR SERVICE ENTRANCE, NEMA1, 45" MOUNTING SPACE FOR BREAKERS. SUPPLY BREAKERS, SPARES, AND SPACES AS INDICATED ON ONE-LINE DRAWING.
3. PANELS B AND C SHALL BE SQUARE D, I-LINE OR EQUAL, 240/120V, 3Ø, 4-WIRE, 200AMP MCB, 10KIAC RATED, NEMA1, WITH 42 POLES. SUPPLY BREAKERS, SPARES, AND SPACES AS INDICATED ON ONE-LINE DRAWING.

**REFERENCE DRAWINGS**

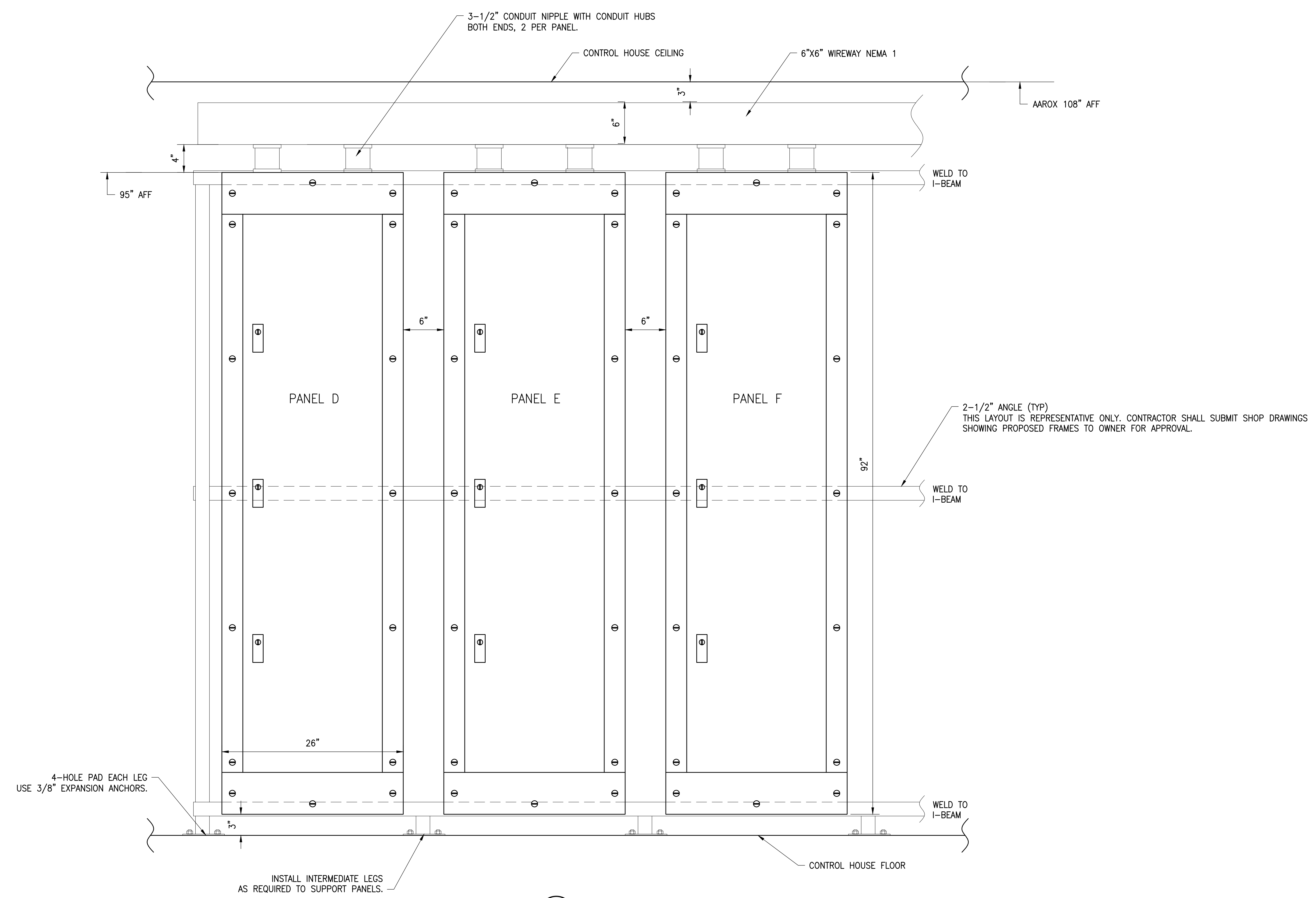
- S294PH02 NEW INSTALLATION PLAN
- S294SH002 CONTROL HOUSE AC ONE-LINE DIAGRAM

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69KV</small>			
<b>NEW CONTROL HOUSE ATS AND AC PANELS VIEW D AND E</b>			
SCALE: NONE	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. <b>S294PH06</b>	REV. <b>0</b>

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1 VIEW F  
 S294PH02|S294PH07 SCALE:NONE

REFERENCE DRAWINGS

S294PH02	NEW INSTALLATION PLAN
S294WZ10	PANEL D 125VDC WIRING DIAGRAM
S294WZ11	PANEL E 125VDC WIRING DIAGRAM
S294WZ12	PANEL F 125VDC WIRING DIAGRAM

- NOTES:
- PANELS SHALL BE SQUARED D I-LINE 200A MCB, 125VDC, 2-WIRE, TOP FEED, 20KA AIR, WITH 21 EACH 2-POLE CIRCUIT BREAKERS AS INDICATED ON WIRING DIAGRAMS.
  - CONNECT PANELS TO GROUNDING SYSTEM.

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69KV

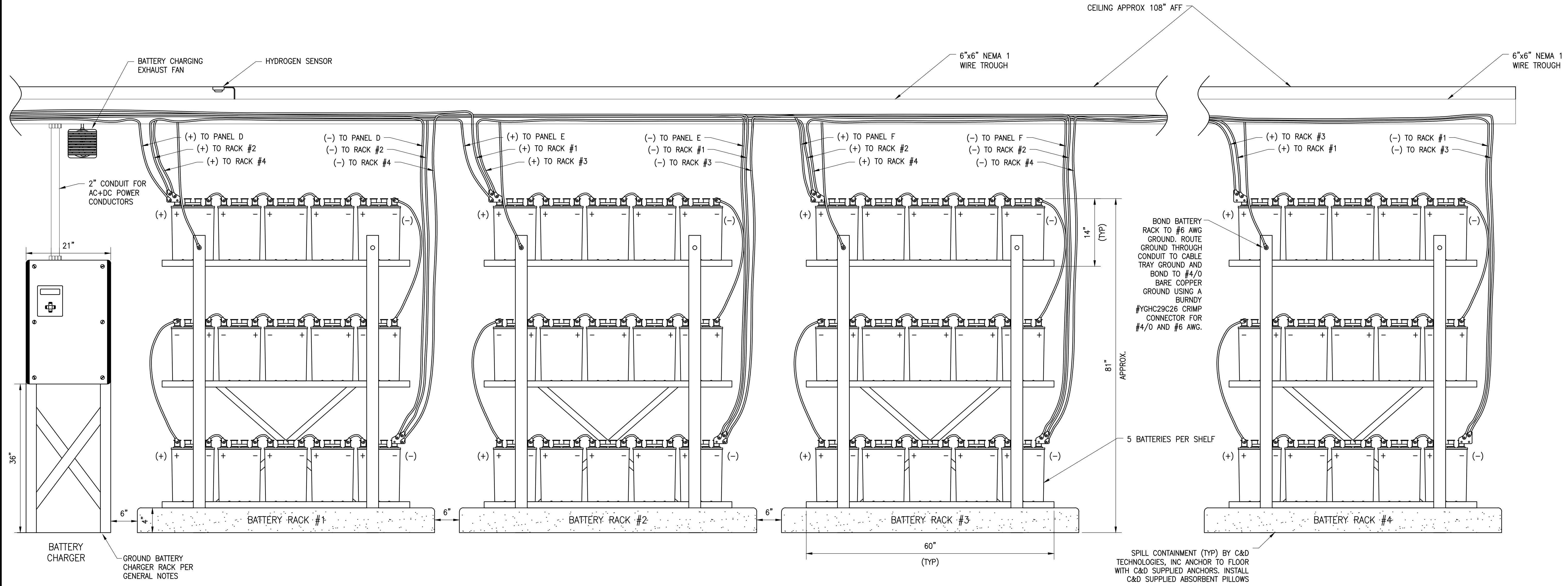
NEW CONTROL HOUSE  
 DC PANELS VIEW F

SCALE: NONE	DRAWN BY: DKG	ENGR: AEM	APPD: BA
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DRAWING No. S294PH07			REV. 0

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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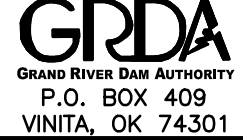
1 VIEW G  
S294PH02|S294PH08 SCALE:NONE

2 VIEW H  
S294PH02|S294PH08 SCALE:NONE

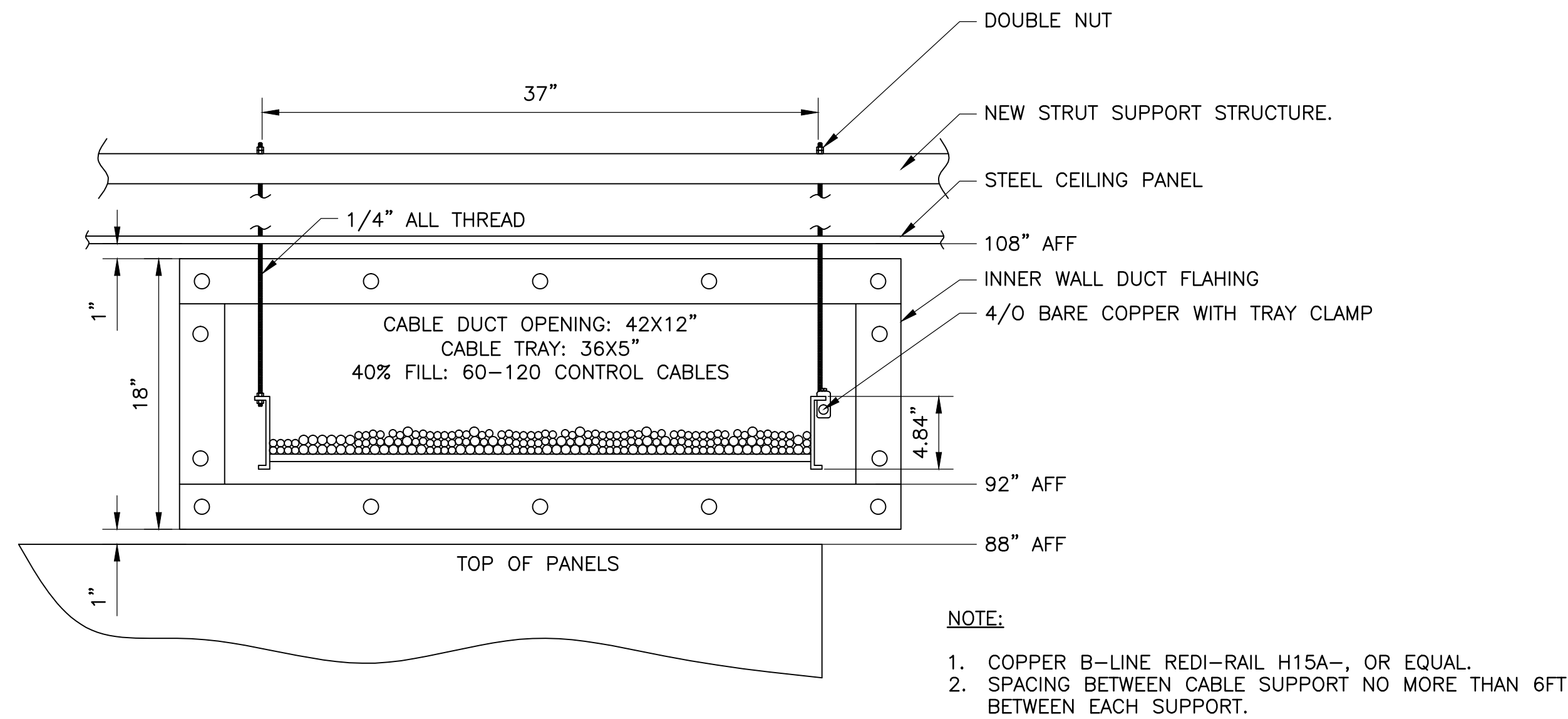
REFERENCE DRAWINGS:  
 S294PH02 NEW INSTALLATION PLAN  
 S294PH11 GENERAL NOTES

- NOTES:
1. USE C&D TECHNOLOGIES, INC EQUIPMENT, OR EQUAL.
  2. BATTERIES ARE C&D M/N 4JC-100. (60 REQUIRED)
  3. RACKS ARE C&D STANDARD, 3-TIER, 5' WIDE. (4 REQUIRED)
  4. USE C&D FACTORY MADE JUMPERS BETWEEN BATTERIES ON EACH RACK.
  5. USE C&D STANDARD SPILL CONTAINMENT/ABSORPTION UNDER EACH RACK.
  6. FOR JUMPERS BETWEEN RACKS USE #2AWG WELDING CABLE WITH CRIMP-ON LUGS.
  7. FOR CONDUCTORS TO PANELS D, E, & F, USE #3/0 WELDING CABLE WITH CRIMP-ON LUGS FOR BATTERY RACK END.
  8. FOR CABLE CONNECTIONS TO BATTERY BANKS, USE C&D TERMINAL PLATE #PT00496.
  9. USE BATTERY CHARGER M/N ARE-M13035. PROVIDE LIGHTNING PROTECTION, INDIVIDUAL ALARM LEADS, AND 36" HIGH FLOOR STAND AS OPTIONS.

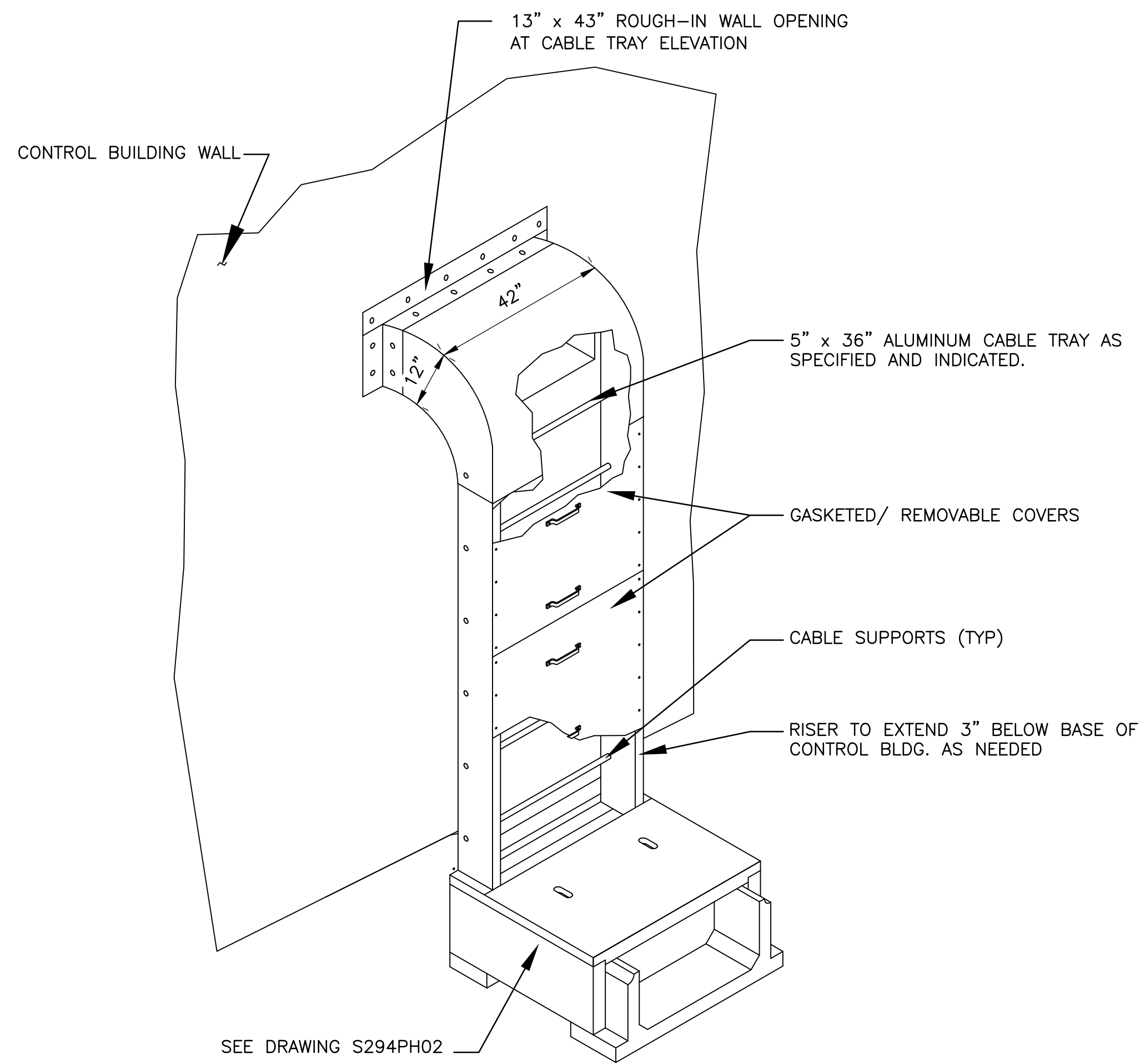
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69KV</small>			
<b>CONTROL HOUSE LAYOUT</b> <b>BATTERY RACKS VIEW G AND VIEW H</b>			
SCALE: NONE	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
 <small>Grand River Dam Authority P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. S294PH08	REV. 0

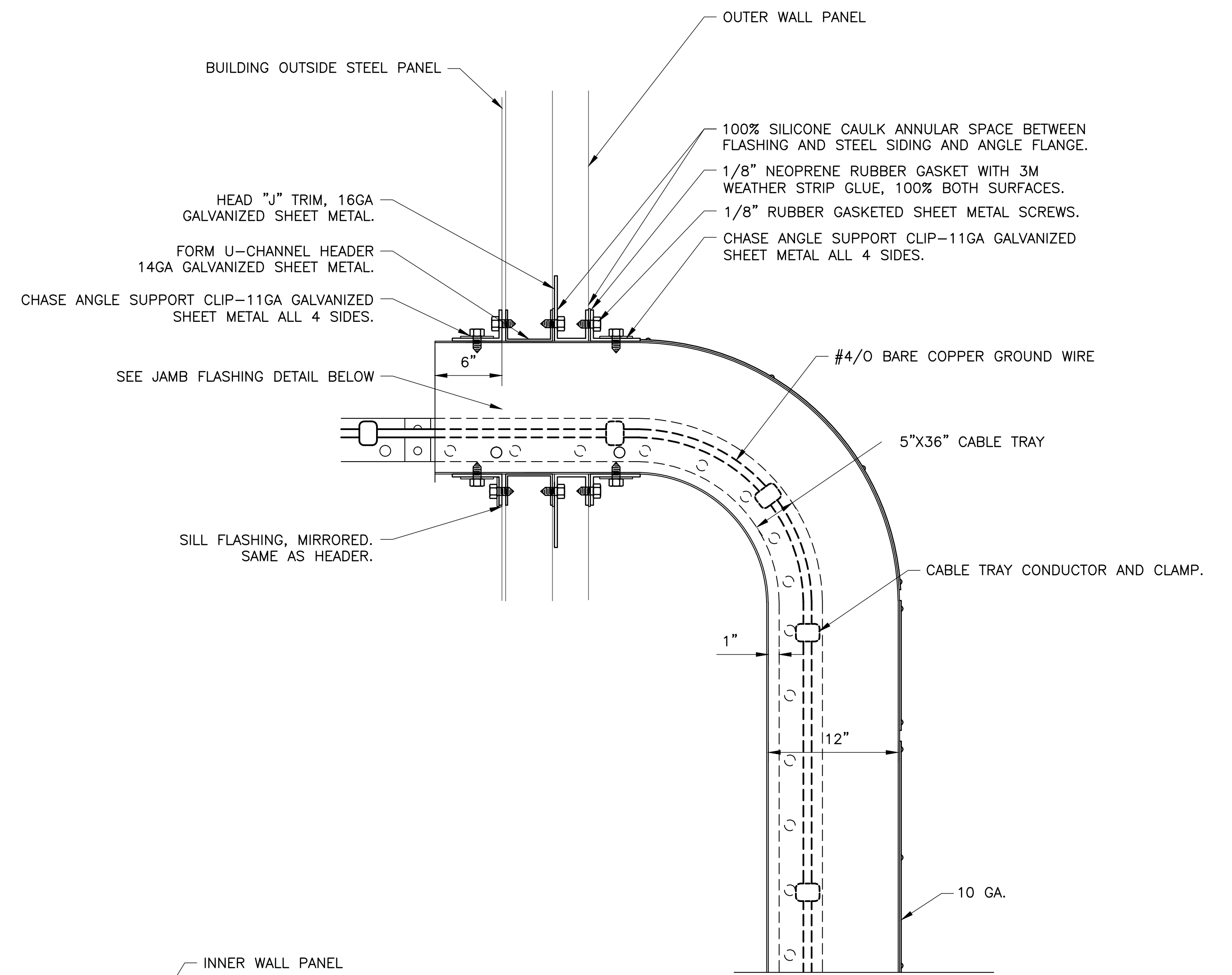
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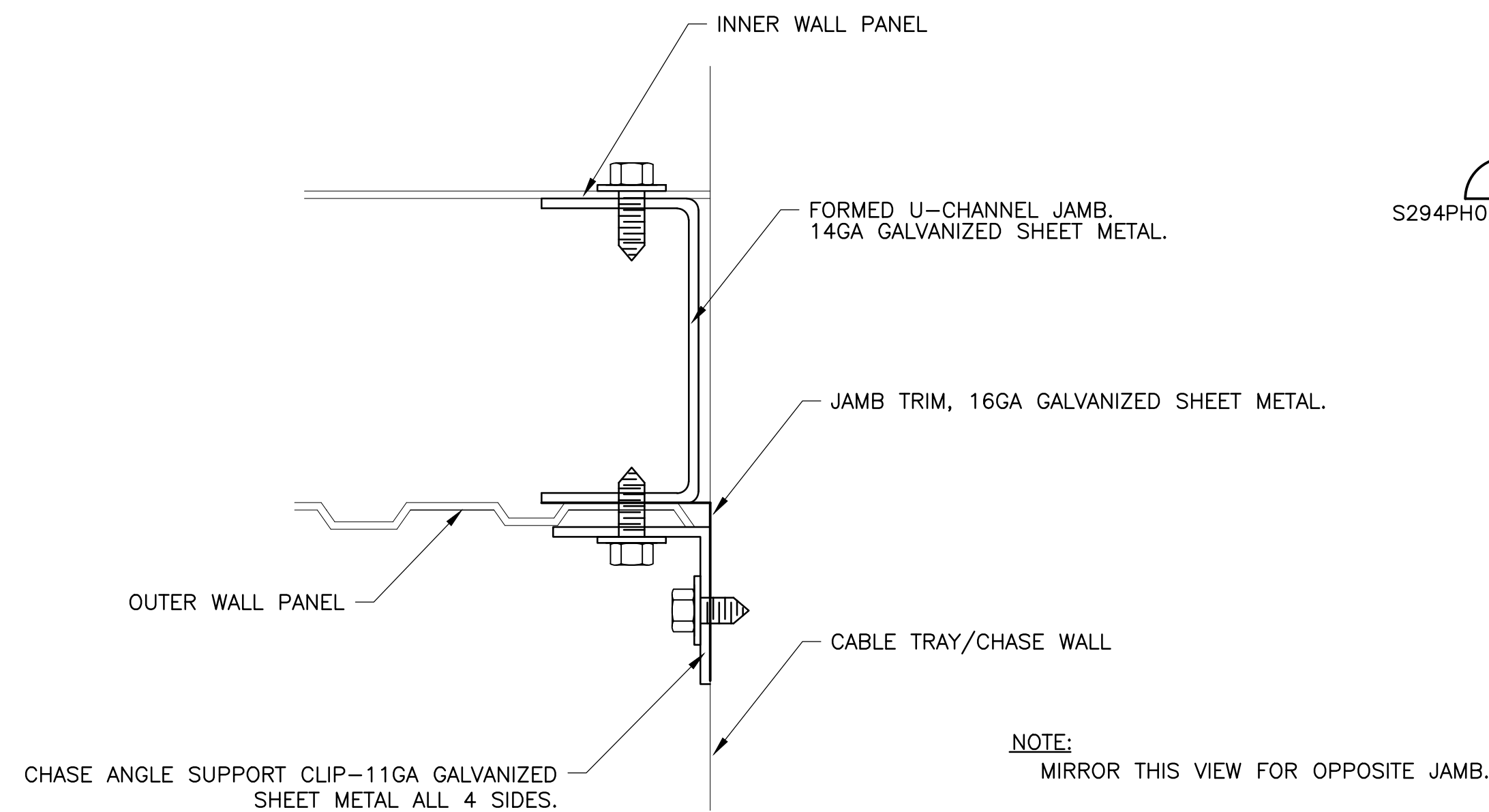
1 CABLE TRAY AND CHASE - VIEW I  
S294PH02IS294PH09 SCALE:NONE



3 CABLE RISER  
S294PHXXIS294PH05 SCALE:NONE



2 CABLE CHASE - VIEW J  
S294PH02IS294PH09 SCALE:NONE



4 CABLE CHASE - JAMB FLASHING DETAIL  
S294PH09IS294PH09 SCALE:NONE

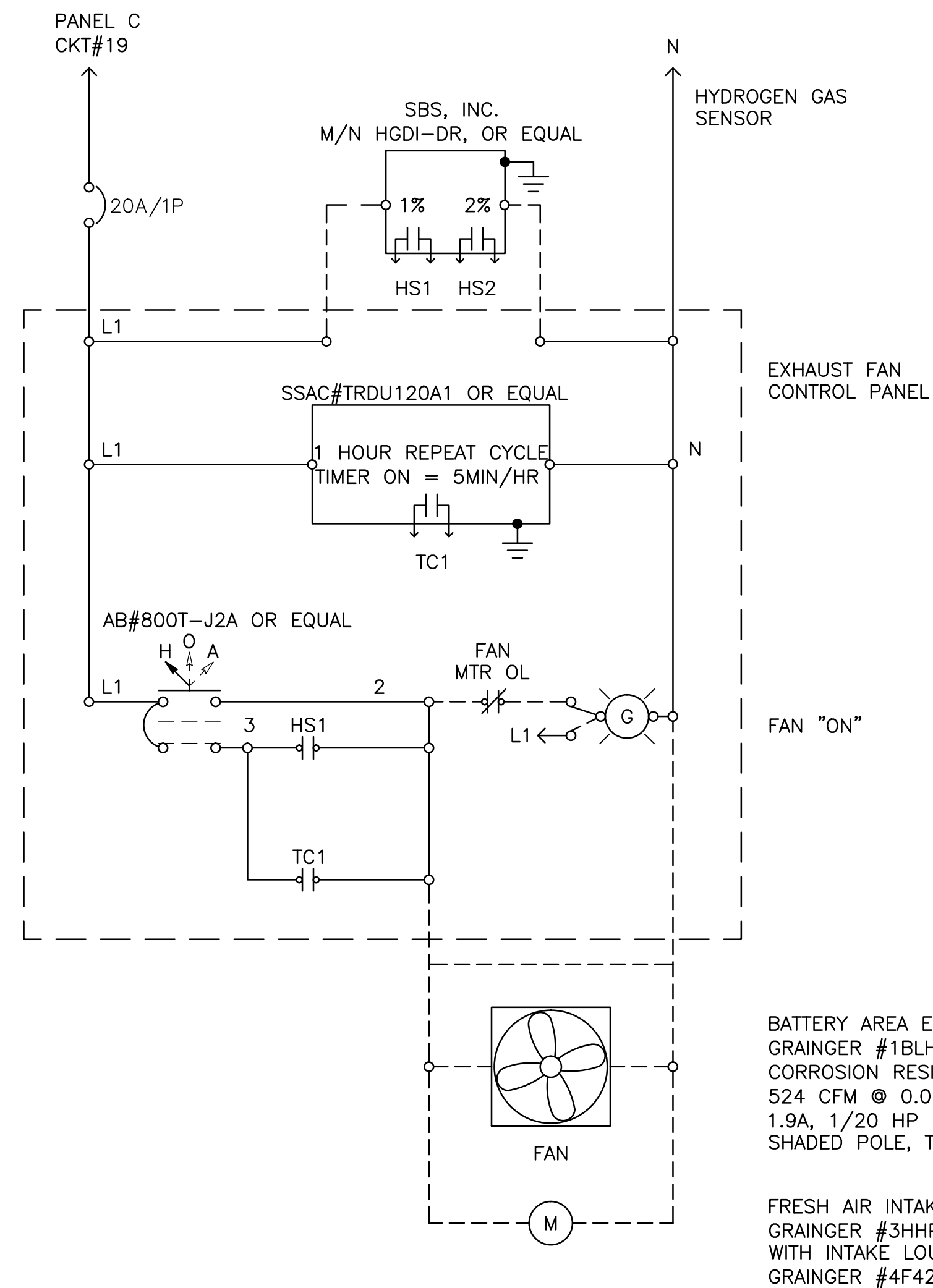
ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
CONTROL HOUSE CABLE RACEWAY DETAIL			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
DRAWING No. S294PH09		REV. 0	

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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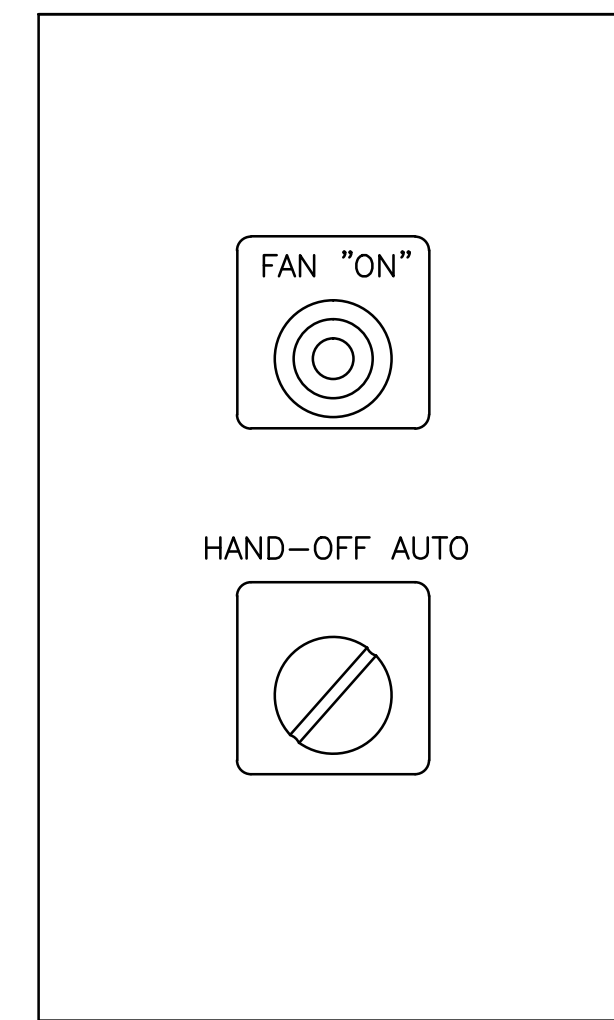
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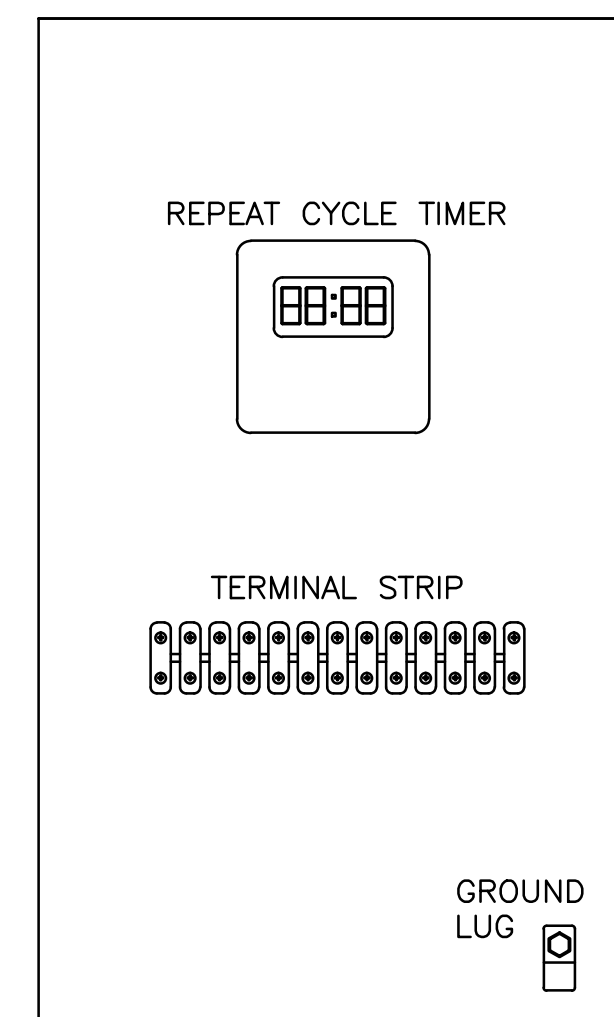
**1 CONTROL DIAGRAM**  
 S294PH10IS294PH10 SCALE:NONE

BATTERY AREA EXHAUST FAN  
 GRAINGER #1BLH6 OR EQUAL,  
 CORROSION RESISTANT 10",  
 524 CFM @ 0.0" SP 115V,  
 1.9A, 1/20 HP DIRECT DRIVE,  
 SHADED POLE, TE AIR OVER.

FRESH AIR INTAKE MOTORIZED DAMPER  
 GRAINGER #3HHP3, OR EQUAL,  
 WITH INTAKE LOUVER,  
 GRAINGER #4F421, OR EQUAL.



PANEL DOOR



PANEL INTERIOR

**NOTES:**

- THE CONTRACTOR SHALL SUPPLY THE NECESSARY BATTERY EXHAUST FAN SYSTEM, COMPLETE WITH REPEAT TIMER. THE EXHAUST FAN SHALL BE RATED 120 VOLTS AC, HAVE A MINIMUM DIAMETER OF TEN INCHES, A MINIMUM CAPACITY OF 524 CUBIC FEET PER MINUTE AT 0.0 SP, AND BE CAPABLE OF CYCLIC OPERATION. THE FAN SHALL BE EXPLOSION-PROOF, OR HAVE A SHADED POLE (NON-SPARKING) MOTOR. THE THERMAL OVERLOAD SHALL BE WIRED SUCH THAT IT IS OPERATIONAL. THE EXHAUST FAN SHALL BE SUPPLIED WITH A REPLACEABLE DUST FILTER AND SHALL BE WALL MOUNTED WITH GRAVITY SHUTTERS, PERIMETER WEATHER-STRIPPING, AND BIRD SCREEN. THE TIMER SHALL BE RATED AT 120 VOLTS AC, WITH CONTACTS CAPABLE OF SWITCHING A MINIMUM OF 10 AMPS AND MOTOR LOADS OF AT LEAST 1/3 HP. THE REPEAT TIMER SHALL BE A MULTI-FUNCTION PROGRAMMABLE DEVICE SET TO OPERATE THE FAN FOR 5 MINUTES ONCE EVERY HOUR. THE CONTROL PANEL AND TIMER SHALL BE LOCATED AWAY FROM THE BATTERY AREA. THE CONTROLS SHALL INCLUDE A HYDROGEN GAS SENSOR WITH CONTACTS THAT OPERATE THE FAN IF THE HYDROGEN GAS TO AIR RATIO IS GREATER THAN OR EQUAL TO 1%, AND ALARM CONTACTS THAT OPERATE WHEN THE RATIO EXCEEDS 2%. A MOTOR OPERATED INTAKE LOUVER SHALL BE PROVIDED THAT OPENS WHEN THE FAN IS RUNNING AND CLOSES WHEN THE FAN IS OFF. THE LOUVER SHALL PROVIDE A MINIMUM OF ONE SQUARE FOOT OF OPENING AND SHALL BE EQUIPPED WITH A BIRD SCREEN. THE FAN SHALL MOUNT IN THE WALL AS HIGH AS POSSIBLE ABOVE THE BATTERY CHARGER AS SHOWN ON DRAWING S294PH02, WITH CONDUIT RUNNING BACK TO THE CONTROL PANEL. THE HYDROGEN SENSOR SHALL MOUNT ABOVE BATTERY RACK #1 AND BE INSTALLED ON A JUNCTION BOX WITH CONDUIT RUNNING BACK TO THE CONTROL PANEL. THE CONTROL PANEL SHALL MOUNT ON THE WALL TO THE RIGHT OF BATTERY RACK #4 NEXT TO THE CENTER COLUMN. THE FRESH AIR INTAKE LOUVER SHALL BE MOUNTED IN THE WALL JUST TO THE RIGHT OF BATTERY RACK #4, WITH THE BOTTOM OF THE OPENING AT 6" AFF. THE CONTROLS SCHEME SHALL BE HAND-OFF-AUTO. MOUNT CONTROLS IN A NEMA 4X ENCLOSURE WITH INTERIOR PANEL, TERMINAL STRIP, AND GROUND LUG. ALL WIRES SHALL BE LABELED WITH PERMANENT LABELS.

**2 CONTROL HOUSE BATTERY CHARGING EXHAUST FAN**  
 S294PH10IS294PH10 SCALE:NONE

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69KV</small>			
<b>CONTROL HOUSE</b> <b>BATTERY AREA EXHAUST FAN</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
0	5/11/12	ISSUED FOR BID	JT BA
REV	DATE	REVISION DESCRIPTION	DFT ENG
<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. <b>S294PH10</b>	REV. <b>0</b>



**CONTROL HOUSE GENERAL NOTES:**

**CONTROL HOUSE DEMOLITION**

1. REMOVE THE ITEMS MARKED WITH AN "X", ONLY AFTER THE COMPARABLE COUNTERPART OF THE NEW SYSTEM INSTALLATION HAS BEEN COMMISSIONED AND IS OPERATIONAL.
2. RELOCATE THE EXISTING EYEWASH AS SHOWN, OR REMOVE IT AND REPLACE IT IN THE NEW LOCATION WITH A NEW EYEWASH SUPPLIED BY GRDA.
3. SOME OF THE EXISTING OVERHEAD FLUORESCENT LIGHT FIXTURES ARE TO BE RELOCATED. RELOCATE AS SHOWN AND RECONNECT TO THE SAME CIRCUIT AS THEY WERE ON BEFORE. PATCH THE HOLE(S) IN THE SHEET METAL CEILING WITH PAINTED SHEET METAL TRIM. USE POP-RIVETS TO MOUNT PATCHES AND MATCH PAINT AS CLOSELY AS POSSIBLE TO EXISTING CEILING COLOR.
4. IF CEILING PANELS MUST BE REMOVED, FOR ANY REASON, CARE SHALL BE TAKEN TO PREVENT DAMAGE TO THE EXISTING PANELS. ANY DAMAGED PANELS SHALL BE REPLACED WITH LIKE PANELS PAINTED TO MATCH EXISTING CEILING. REPLACEMENT COSTS SHALL BE BORNE BY THE CONTRACTOR. ALTERNATELY, REMOVE AND REPLACE ALL CEILING PANELS WITH NEW PANELS OF SIMILAR COLOR AT THE CONCLUSION OF THE CONTROL HOUSE REVISIONS.

**CONTROL HOUSE INSTALLATION**

1. ALL NEW CONDUCTORS SHALL ENTER THE CONTROL HOUSE THROUGH THE TRENCH RACEWAY AND CABLE TRAY/CHASE SYSTEM.
2. THE CABLE TRAY SYSTEM SHALL BE LOCATED AND INSTALLED AS SHOWN ON THE DRAWINGS. THE EXISTING BUILDING DRAWINGS DO NOT SHOW THE ARRANGEMENT OR SIZE OF THE STRUCTURAL STEEL ABOVE THE CEILING AND THIS IS AN UNKNOWN FACTOR. THE CONTRACTOR SHALL REMOVE EXISTING CEILING PANELS AS NEEDED TO ESTABLISH THE EXISTING STEEL DESIGN ABOVE CEILING. THE CONTRACTOR SHALL DETERMINE THE BEST WAY TO SUPPORT THE NEW CABLE TRAY SYSTEM FROM THE EXISTING STEEL OR FROM ADDED STRUCTURAL MEMBERS. THE CONTRACTOR SHALL PROVIDE A DESIGN FOR THE CABLE TRAY SUPPORTS THAT WILL CARRY THE WEIGHT OF THE CABLE TRAY AND THE INSTALLED CABLES IN THE TRAY. AN ALTERNATE METHOD OF SUPPORTING THE TRAY SYSTEM WITH FLOOR SUPPORTS, INSTEAD OF CEILING SUPPORTS, THAT DO NOT INTERFERE WITH EQUIPMENT OR WALKWAYS, MAY BE CONSIDERED BY THE OWNER. THE FINAL DESIGN SHALL BE PROVIDED BY AND SEALED BY A QUALIFIED STRUCTURAL ENGINEER, LICENSED IN OKLAHOMA. SUBMIT DESIGN TO OWNER FOR APPROVAL.
3. NEW LIGHTING FIXTURES SHALL BE INSTALLED AS INDICATED ON DRAWINGS. CONTRACTOR SHALL MATCH EXISTING FIXTURES AS MUCH AS POSSIBLE IN SIZE AND STYLE, USING NEW T8 FIXTURES. THE TOTAL NUMBER OF FIXTURES SHALL BE EVENLY DIVIDED INTO TWO SEPARATELY FED AND SEPARATELY SWITCHED CIRCUITS USING THE TWO EXISTING SWITCHES LOCATED BY THE ENTRANCE DOORS.

**CABLE CHASES**

1. THE CABLE CHASES SHALL BE CUSTOM DESIGNED BY THE TRENCH PROVIDER TO MATCH THE TRENCH AND CABLE TRAY SYSTEM. THE FINAL ELEVATION OF THE TRAY INSIDE THE CHASE SHALL MATCH THE INSIDE TRAY ELEVATION. THE SAME TRAY MANUFACTURER SHALL BE USED FOR BOTH RACEWAYS TO ALLOW FACTORY MADE SPLICES TO BE USED TO CONNECT THE TRAYS.
2. THE CHASE ENTRY INTO THE SIDE OF THE CONTROL HOUSE SHALL BE MADE BY CRAFTSMEN SKILLED IN METAL BUILDING CONSTRUCTION AND IN MAKING WEATHER TIGHT FLASHINGS AND SEALS. THE FLASHING DESIGN SHOWN ON THE DRAWINGS IS A GUIDE FOR REFERENCE ON HOW THE FLASHINGS AND SEALS ARE TO BE APPLIED. THE FINAL INSTALLATION SHALL BE MADE IN SUCH A WAY AS TO PREVENT WATER AND AIR INTRUSION AROUND THE PENETRATION. THE DESIGN SHALL ALLOW FOR EXPANSION AND CONTRACTION OF THE DUCT DUE TO TEMPERATURE CHANGES. ALL SEALANTS SHALL BE DESIGNED FOR OUTDOOR USE ON METAL BUILDINGS FOR DOOR AND WINDOW SEALS AND SHALL HAVE A 10-YEAR FUNCTIONAL EXPECTANCY.
3. AFTER ALL CABLES HAVE BEEN INSTALLED IN THE TRAY SYSTEM AND THE ENTIRE NEW SUBSTATION SYSTEM IS FULLY OPERATIONAL, THE CONTRACTOR SHALL FULLY SEAL THE TRAY AND CHASE OPENING WITH FLAME RETARDANT FOAM. THE FOAM SHALL BE APPLIED WITH A BACKING FORM, TO ALLOW A NEAT 3" THICK FOAM BARRIER TO BE MADE WITHOUT ALLOWING THE FOAM TO GO PAST THE BACKING FORM AND DOWN THE CHASE. A REMOVABLE GALVANIZED SHEET METAL COVER SHALL BE PLACED AROUND THE CABLE TRAY TO COVER THE FOAM MATERIAL FROM VIEW INSIDE THE CONTROL HOUSE - THIS IS FOR ESTHETIC PURPOSES.

**ATS, AC PANELBOARDS, AND DC PANELBOARDS**

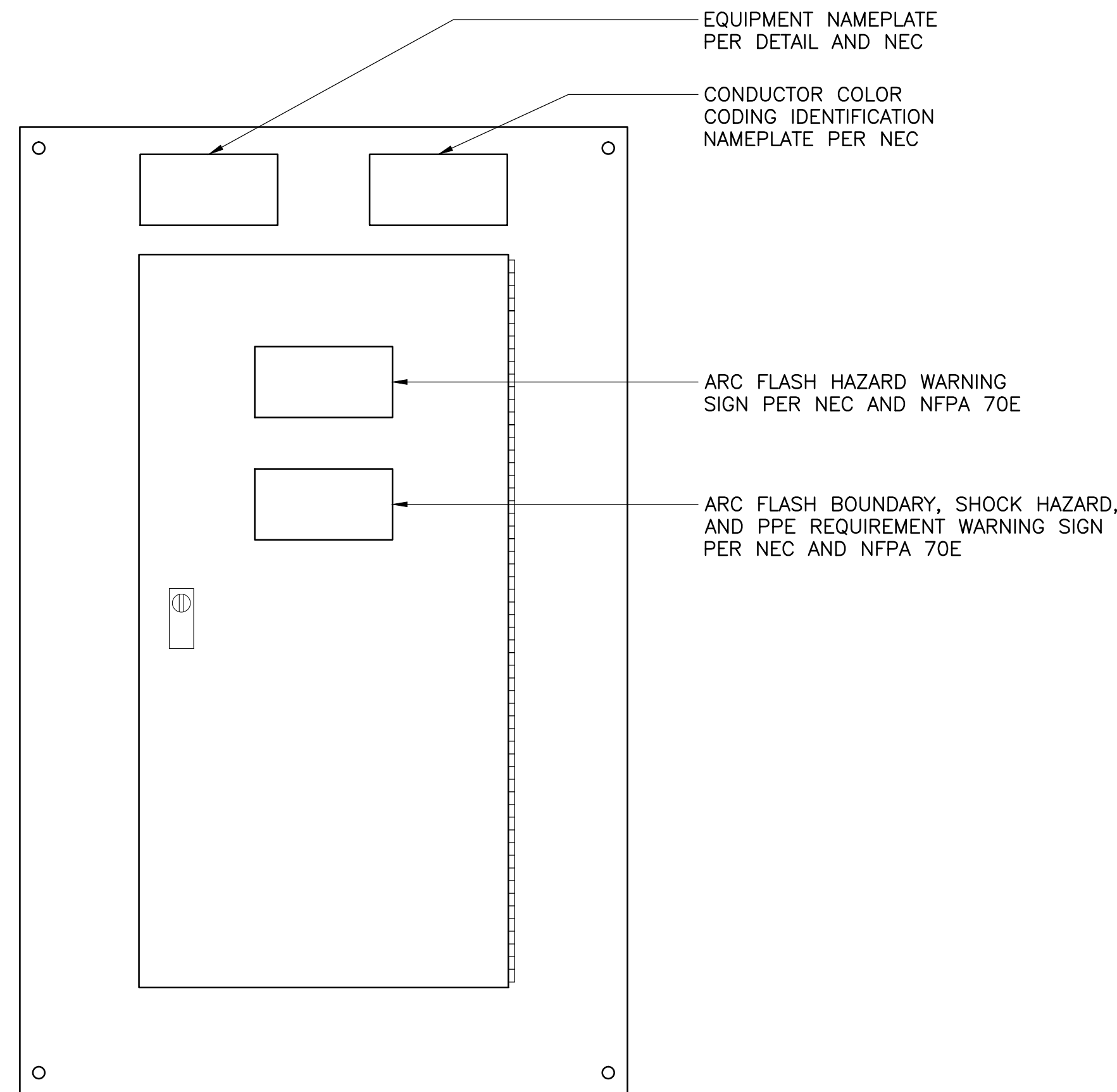
1. THE CONTRACTOR SHALL PROVIDE MOUNTING FRAMES FOR ALL PANELS. MOUNTING FRAMES SHALL BE MADE OF WELDED ANGLE IRON OF SUFFICIENT SIZE TO PROVIDE A STURDY MOUNTING STRUCTURE. THE FRAME SIZES AND ARRANGEMENTS IN THE DRAWINGS ARE PROVIDED AS A REFERENCE GUIDE; CONTRACTOR MAY PROVIDE A DIFFERENT DESIGN THAT MEETS THE REQUIREMENTS. ALL STEELS SHALL BE PRIMED AND PAINTED WITH FINAL COLOR ANSI 70 TO MATCH PANELBOARD COLOR. CONTRACTOR SHALL SUBMIT PLANS OF MOUNTING FRAME DESIGN FOR APPROVAL BY THE OWNER.
2. CONDUIT AND WIRE TROUGH ARRANGEMENTS SHALL BE APPROXIMATELY AS SHOWN ON THE DRAWINGS. CONTRACTOR MAY MAKE ADJUSTMENTS AS NEEDED TO ACCOMMODATE BUILDING STEEL, ETC.

**BATTERY AND CHARGER SYSTEM**

1. THE BATTERIES, CHARGER, CHARGER STAND, RACKS, TERMINAL PLATES, AND SPILL CONTAINMENT/ABSORBERS SHALL BE PROVIDED BY THE SAME MANUFACTURER. CONNECTORS BETWEEN BATTERIES ON THE SAME RACK TIER SHALL BE CONNECTED WITH FACTORY SUPPLIED JUMPERS. CONNECTIONS BETWEEN TIERS, RACKS AND PANELBOARDS SHALL BE MADE USING WELDING CABLE AND CRIMP-LUGS RATED FOR 200 AMPS. ALL WELDING CABLE SHALL BE FLEXIBLE FINE STRANDED COPPER PER ASTM B-172 CLASS K, WITH TAPE SEPARATOR BETWEEN CONDUCTOR AND JACKET, EPR CLASS 45 JACKET, RATED FOR 600 VOLTS. USE RED JACKET FOR POSITIVE CONNECTIONS AND BLACK JACKET FOR NEGATIVE CONNECTIONS.

**GROUNDING**

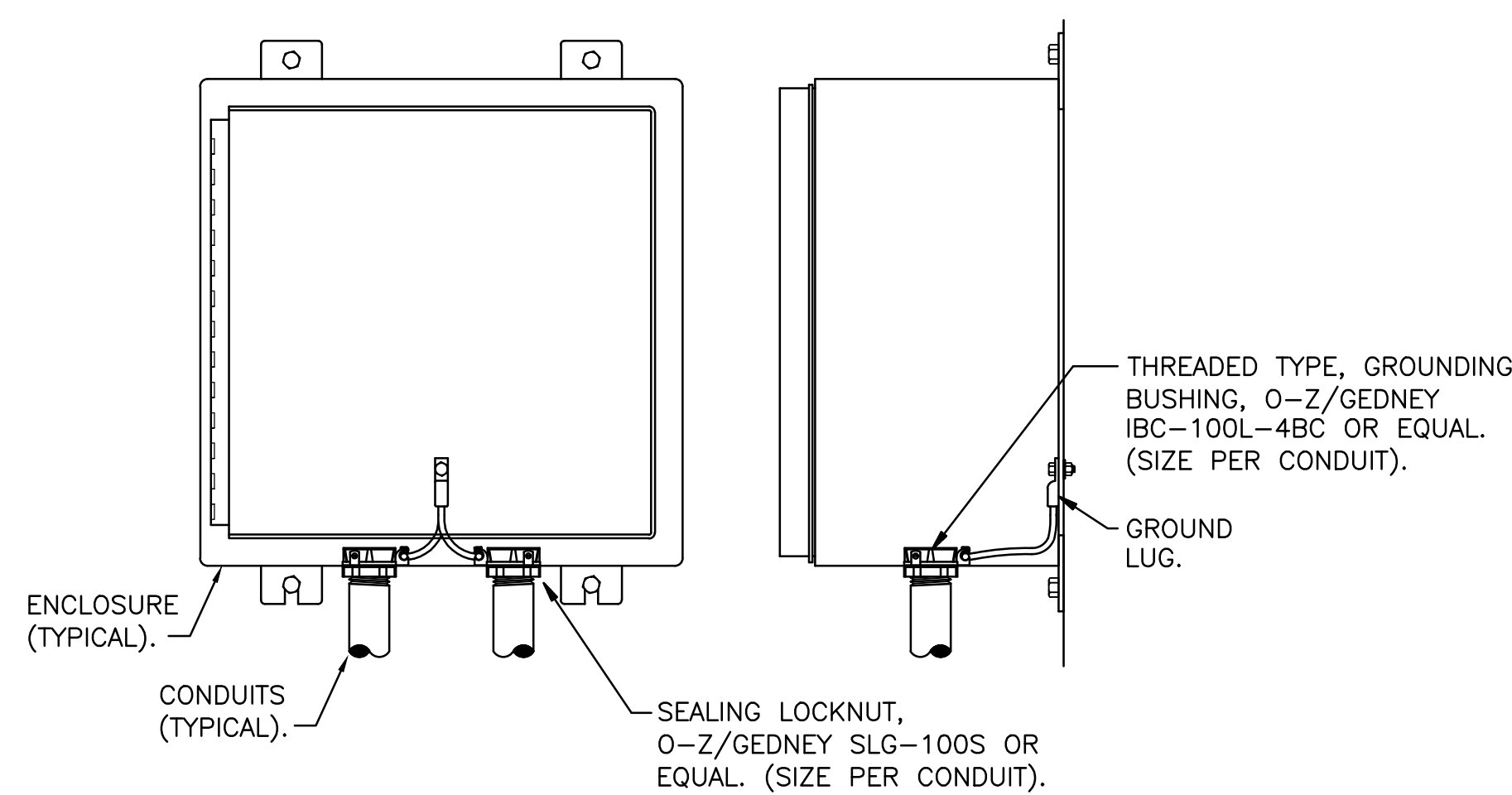
1. GROUND ALL EQUIPMENT, PANELS RACKS, AND RACEWAYS PER NFPA 70: NATIONAL ELECTRIC CODE, LATEST EDITION.



**PANEL FRONT VIEW**

**GENERAL NOTE:**

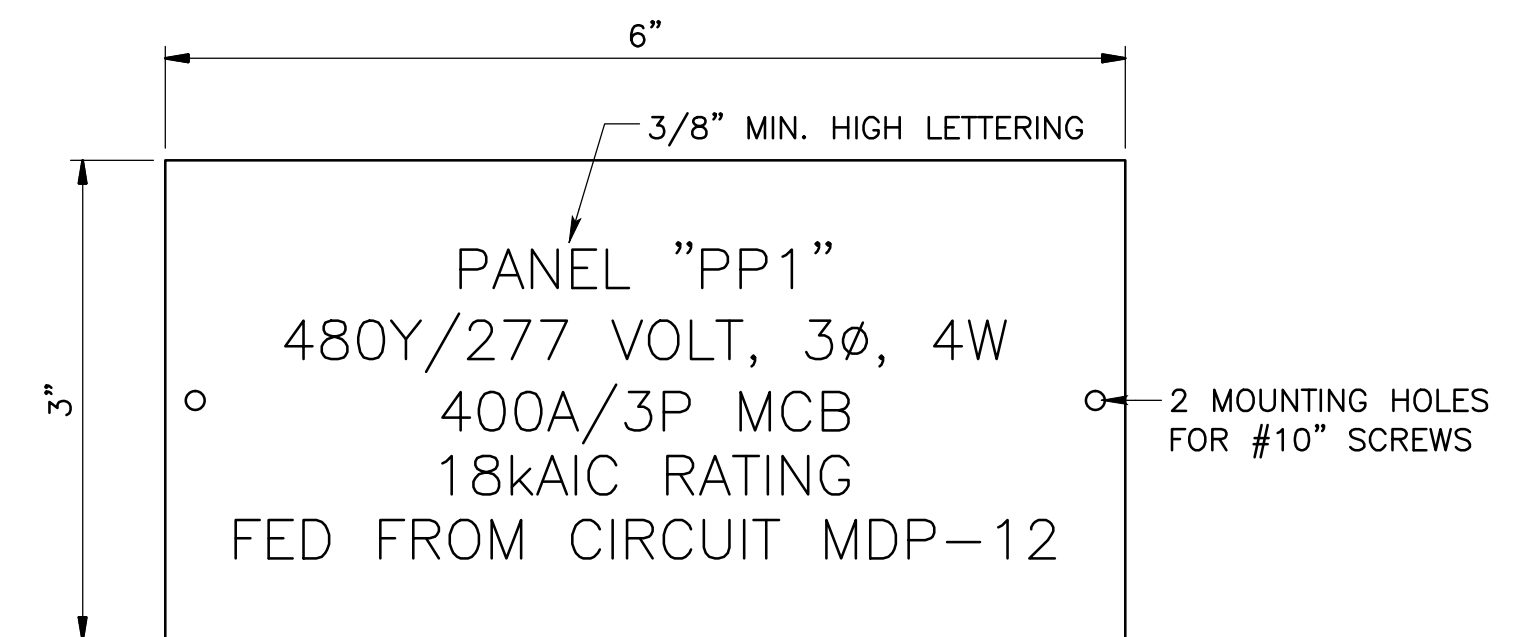
1. INSTALL ALL NAMEPLATES AND WARNING SIGNS IN ACCORDANCE WITH NEC AND NFPA 70E REQUIREMENTS.
2. INSTALL NAMEPLATES AND WARNING SIGNS ON ALL ELECTRICAL EQUIPMENT, INCLUDING BUT NOT LIMITED TO, SWITCHBOARDS, PANELBOARDS, TRANSFORMERS, SWITCHES, CONTROL PANELS AND MOTOR CONTROL CENTERS.
3. EXTERIOR EQUIPMENT SHALL HAVE WEATHER-RESISTANT, NON-FADING NAMEPLATES AND SIGNAGE.



**NOTES:**

1. ALL SERVICE AND FEEDER CONDUITS SHALL BE GROUNDED ON BOTH ENDS.

**2 CONDUIT GROUNDING DETAIL**  
S294PG22 SCALE: NONE



**EQUIPMENT NAMEPLATE NOTES:**

1. INSTALL 2-PLY ACRYLIC, WHITE ON BLACK CORE, 6"x3" TILE, 4 LINES TEXT, CUSTOM ENGRAVED NAME PLATES.
2. MOUNT WITH STAINLESS STEEL SCREWS.
3. SEAL SCREW HOLES WITH SILICONE RUBBER.
4. NAMEPLATE INFORMATION SHALL INCLUDE:
  - A. IDENTIFICATION NAME.
  - B. VOLTAGE SYSTEM.
  - C. AMPACITY RATING AND TYPE.
  - D. AIC RATING.
  - E. FEEDER DESCRIPTION.
5. WORDING USED ABOVE REPRESENTATIVE ONLY. WORDING SHALL BE SPECIFIC TO PANEL NAMEPLATE IS INSTALLED ON.

**1 TYPICAL ENGRAVED NAMEPLATE AND SIGNAGE DETAIL**  
S294PG22 SCALE: NONE

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>CONTROL HOUSE</b> <b>GENERAL NOTES &amp; MISC. DETAILS</b>			
SCALE: AS SHOWN	DRAWN BY: DJR	ENGR: AEM	APPD: BA
0 5/11/12	ISSUED FOR BID	JT BA	DATE: 3/7/2011
REV	DATE	REVISION DESCRIPTION	DFT ENG
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PH11	REV. 0

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## Afton Substation

S294PG01	PLAT OF SURVEY
S294PG02	EXISTING TOPOGRAPHIC SURVEY
S294PG03	COMMUNICATIONS EASEMENT
S294PG04	NOT USED
S294PG05	NOT USED
S294PG06	NOT USED
S294PG07	NOT USED
S294PG08	NOT USED
S294PG09	NOT USED
S294PG10	NOT USED
S294PG11	SITE GRADING PLAN
S294PG12	EROSION CONTROL AND SITE DETAILS
S294PG13	NOT USED
S294PG14	NOT USED
S294PG15	NOT USED
S294PG16	NOT USED
S294PG17	NOT USED
S294PG18	NOT USED
S294PG19	NOT USED
S294PG20	GROUNDING PLAN & CONCRETE DUCT DETAILS
S294PG21	GROUNDING DETAILS
S294PG22	GROUNDING DETAILS - TRANSFORMER & LIGHTNING ARRESTOR
S294PG23	GROUNDING DETAILS 3
S294PG24	GROUNDING DETAILS 4
S294PG25	FENCE DETAILS
S294PG26	GROUNDING DETAILS 5
S294PG27	NOT USED
S294PG28	NOT USED
S294PG29	NOT USED
S294PG30	161KV FOUNDATION PLAN
S294PG31	69KV FOUNDATION PLAN
S294PG32	STATION CENTERLINE CONTROL POINTS
S294PG33	TYPICAL FOUNDATION DETAILS (P1 - P8)
S294PG34	TYPICAL FOUNDATION DETAILS
S294PG35	NOT USED
S294PG36	NOT USED
S294PG37	NOT USED
S294PG38	NOT USED
S294PG39	NOT USED
S294PG40	161KV CABLE & CONDUITS
S294PG41	69KV CABLE AND CONDUITS
S294PG42	NOT USED
S294PG43	NOT USED
S294PG44	NOT USED
S294PG50	TRENCH LAYOUT PLAN
S294PG51	TRENCH DETAILS

Tract 1 Description

A part of the Southeast Quarter Section Thirty-four (34), Township Twenty-six (26) North, Range Twenty-two (22) East, Ottawa County, Oklahoma, being more particularly described as follows:

Commencing at the Southeast corner of the Southeast Quarter of said Section Thirty-four (34); thence N 01°45'45" W along the East line of said Southeast Quarter 1502.05 feet to the Southeastern corner of the property described in Book 322, Page 308; thence N 63°05'23" W along the South line of said property 257.62 feet to the POINT OF BEGINNING; thence continue N 63°05'23" W along said South line 284.42 feet to a found iron pin for the Southwestern corner of said property; thence S 26°59'37" W - 20.00 feet; thence S 63°05'23" E - 284.45 feet; thence N 26°54'37" E - 20.00 feet to the POINT OF BEGINNING containing 5,689 sq ft, 0.13 acres more or less.

Tract 2 Description

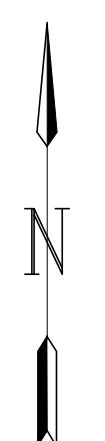
A part of the Southeast Quarter Section Thirty-four (34), Township Twenty-six (26) North, Range Twenty-two (22) East, Ottawa County, Oklahoma, being more particularly described as follows:

Commencing at the Southeast corner of the Southeast Quarter of said Section Thirty-four (34); thence N 01°45'45" W along of the East line of said Southeast Quarter 1753.05 feet to a found iron pin at the Northeastern corner of the property described in Book 322, Page 308 for the POINT OF BEGINNING; thence leaving said East line N 63°03'32" W along the Northern line of said property 421.29 feet to a found iron pin for the Northwestern corner of said property; thence N 26°59'37" E - 120.00 feet; thence S 63°03'32" E - 355.47 feet; thence S 01°45'45" E - 136.81 feet to the POINT OF BEGINNING containing 46,605 sq ft, 1.07 acres more or less. Subject to Roadway Right of way along the East side thereof.

Certification

I hereby certify that to the best of my professional knowledge and ability I have this day completed this Survey as shown hereon.

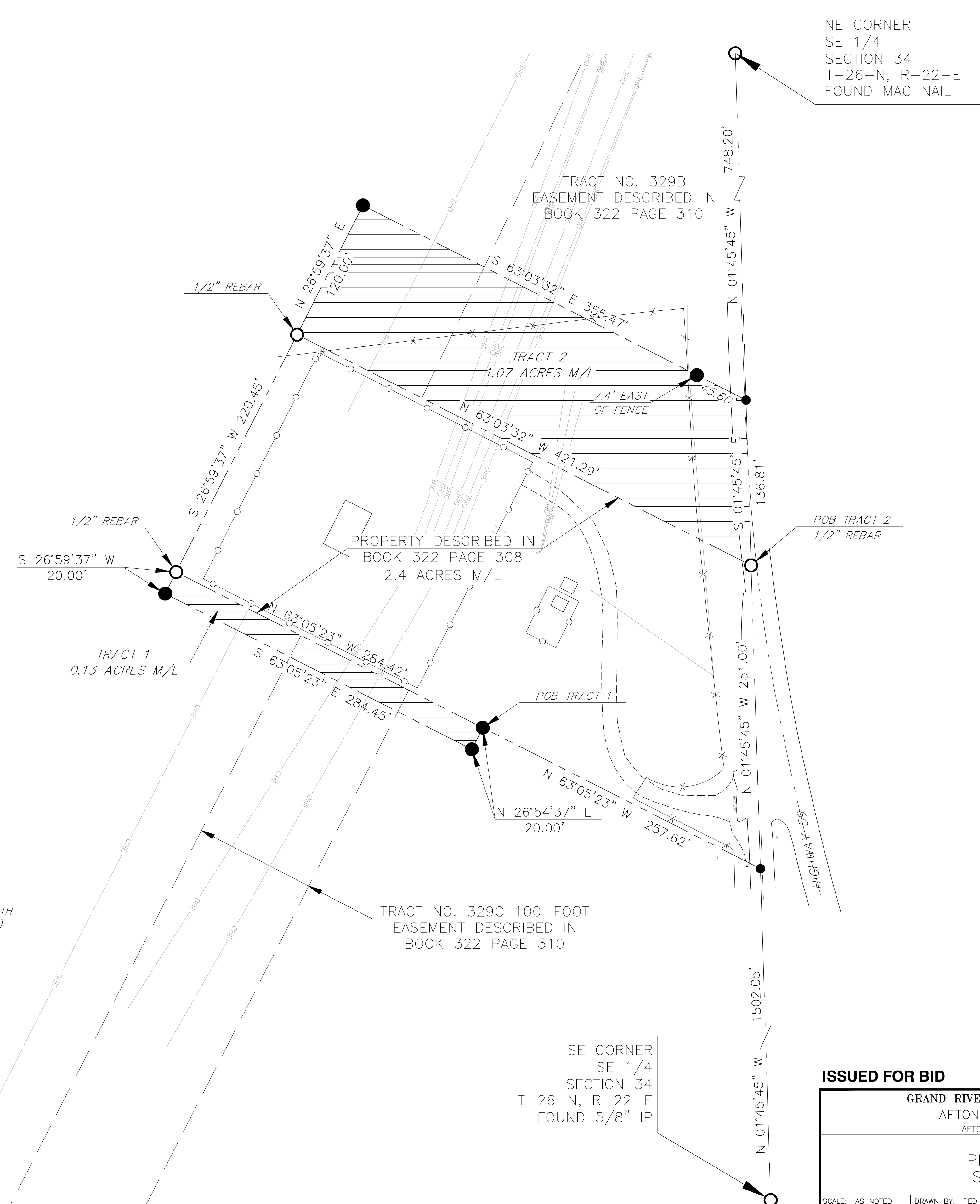
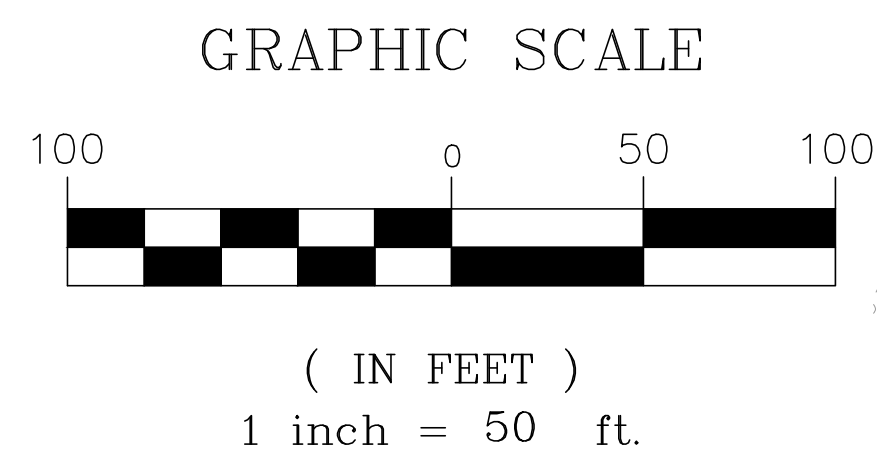
Date: \_\_\_\_\_ Paul E. Davis, PLS 1565



BEARINGS ARE OKLAHOMA STATE PLANE NORTH  
BASED ON NGS MONUMENT AFTON (GG0714)  
JULY 29, 2010.

LEGEND

- COMPUTED POINT
- SET 1/2" REBAR WITH CAP (PLS 1565)
- FOUND MONUMENT (AS NOTED)
- PROPERTY LINE
- SECTION LINE
- EXISTING EASEMENT LINE



NE CORNER  
SE 1/4  
SECTION 34  
T-26-N, R-22-E  
FOUND MAG NAIL

SE CORNER  
SE 1/4  
SECTION 34  
T-26-N, R-22-E  
FOUND 5/8" IP



OK COA #4193  
EXPIRES 6/30/2012

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

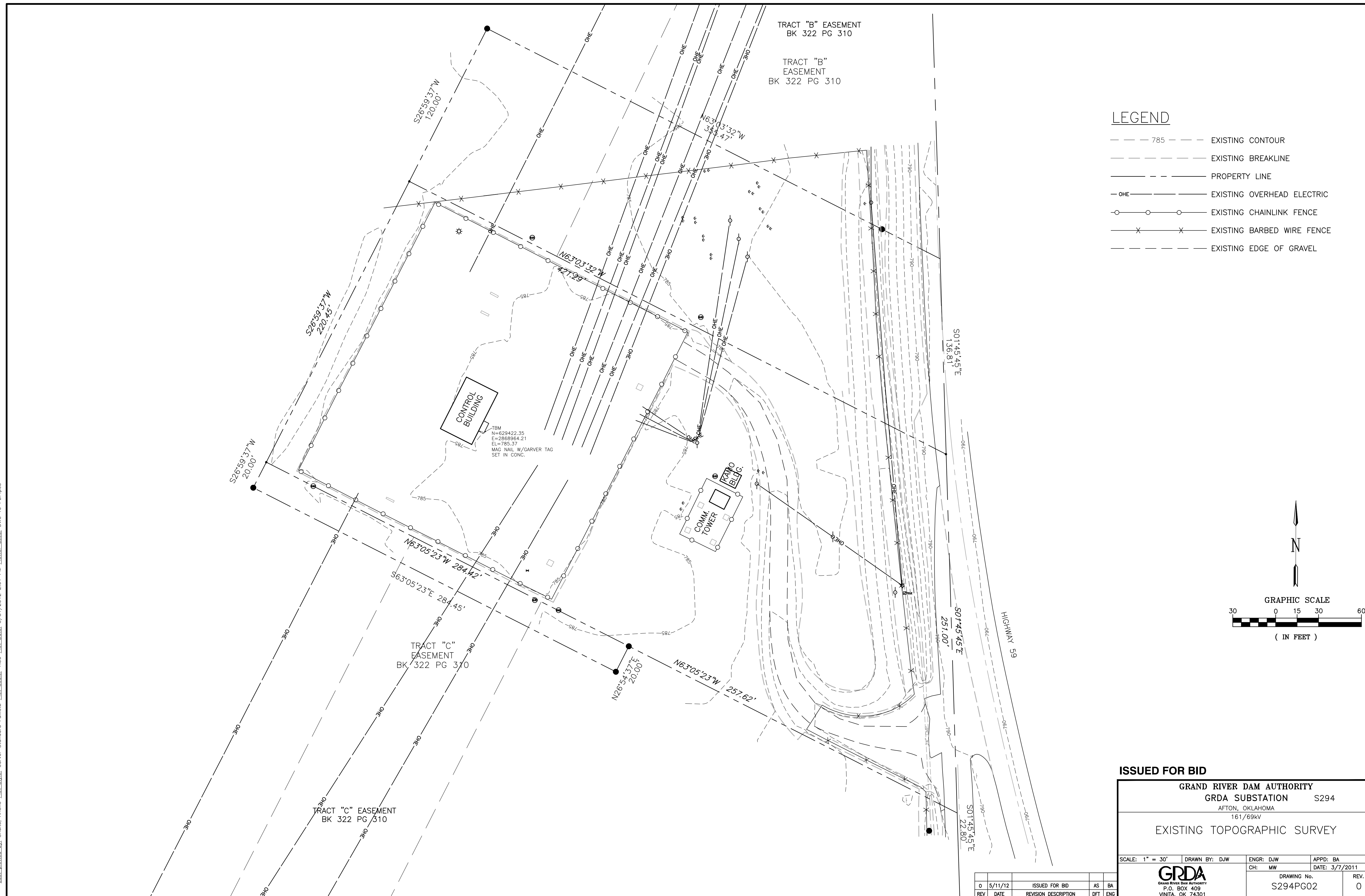
**PLAT OF SURVEY**

SCALE: AS NOTED	DRAWN BY: PED	ENGR: JAJ	APPD: PED
CH: JAJ	DATE: 3/7/2011	DRAWING No. S294PG01	REV. 0

GRDA  
Grand River Dam Authority  
P.O. BOX 409  
VINITA, OK 74301

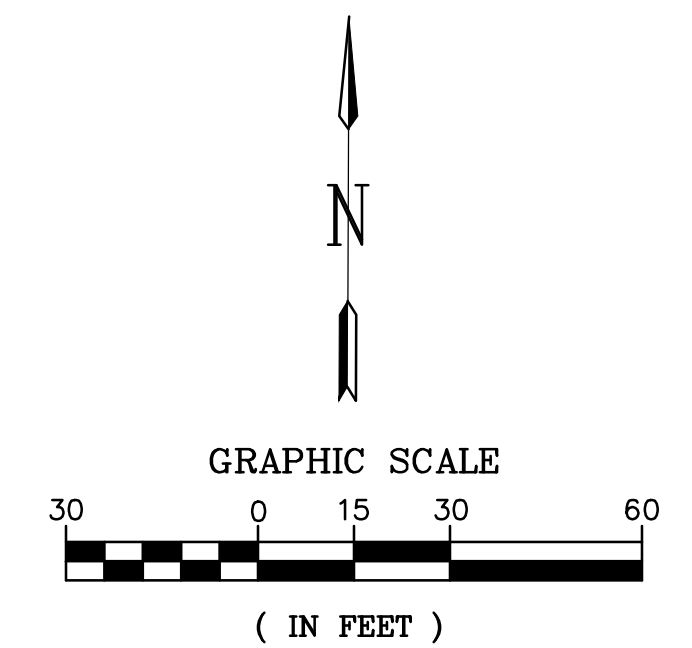
REV	DATE	REVISION DESCRIPTION	DPT	ENG
0	5/11/12	ISSUED FOR BID	JT	BA

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 Last Plotted by: Shultz, Arlene Plot Scale: 1:30 Plot Date: 5/31/2012 2:01 PM Plotter Used: DWG To PDF.pc3  
 Last Saved by: Jtrundle



**LEGEND**

- 785 --- EXISTING CONTOUR
- - - - - EXISTING BREAKLINE
- \_\_\_\_\_ PROPERTY LINE
- OHE- EXISTING OVERHEAD ELECTRIC
- ○ ○ EXISTING CHAINLINK FENCE
- × × × EXISTING BARBED WIRE FENCE
- - - - - EXISTING EDGE OF GRAVEL



**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**GRDA SUBSTATION S294**  
 AFTON, OKLAHOMA  
 161/69KV  
**EXISTING TOPOGRAPHIC SURVEY**

SCALE: 1" = 30'	DRAWN BY: DJW	ENGR: DJW	APPD: BA
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		CH: MW DATE: 3/7/2011 DRAWING No. S294PG02 REV. 0	

REV	DATE	REVISION DESCRIPTION	DWT	ENG
0	5/11/12	ISSUED FOR BID	AS	BA

**Easement No.1 Description**

A part of the Southeast Quarter of Section Thirty-four (34), Township Twenty-six (26) North, Range Twenty-two (22) East, Ottawa County, Oklahoma, being more particularly described as follows:  
 Commencing at the Southeast corner of the Southeast Quarter of said Section Thirty-four (34): thence N 01°45'45" W along the East line of said Southeast Quarter 1479.25 feet to the POINT OF BEGINNING; thence N 63°05'23" W -248.55 feet; thence S 26°54'37" W - 20.00 feet; thence N 63°05'23" W - 94.24 feet; thence S 29°52'43" W a distance of 325.00 feet; thence N 60°07'17" W a distance of 20.00 feet; thence N 29°52'43" E a distance of 323.96 feet; thence N 63°05'23" W - 190.22 feet; thence N 26°59'37" E - 20.00 feet; thence S 63°05'23" E - 284.45 feet; thence N 26°54'37" E - 20.00 feet to a point on the Southern line of the property described in Book 322, Page 308; thence S 63°05'23" E along the South line of said property 257.61 feet to the Southeast corner of said property; thence S 01°45'45" E - 22.80 feet to the POINT OF BEGINNING containing 17,841 sq ft, 0.41 acres more or less.

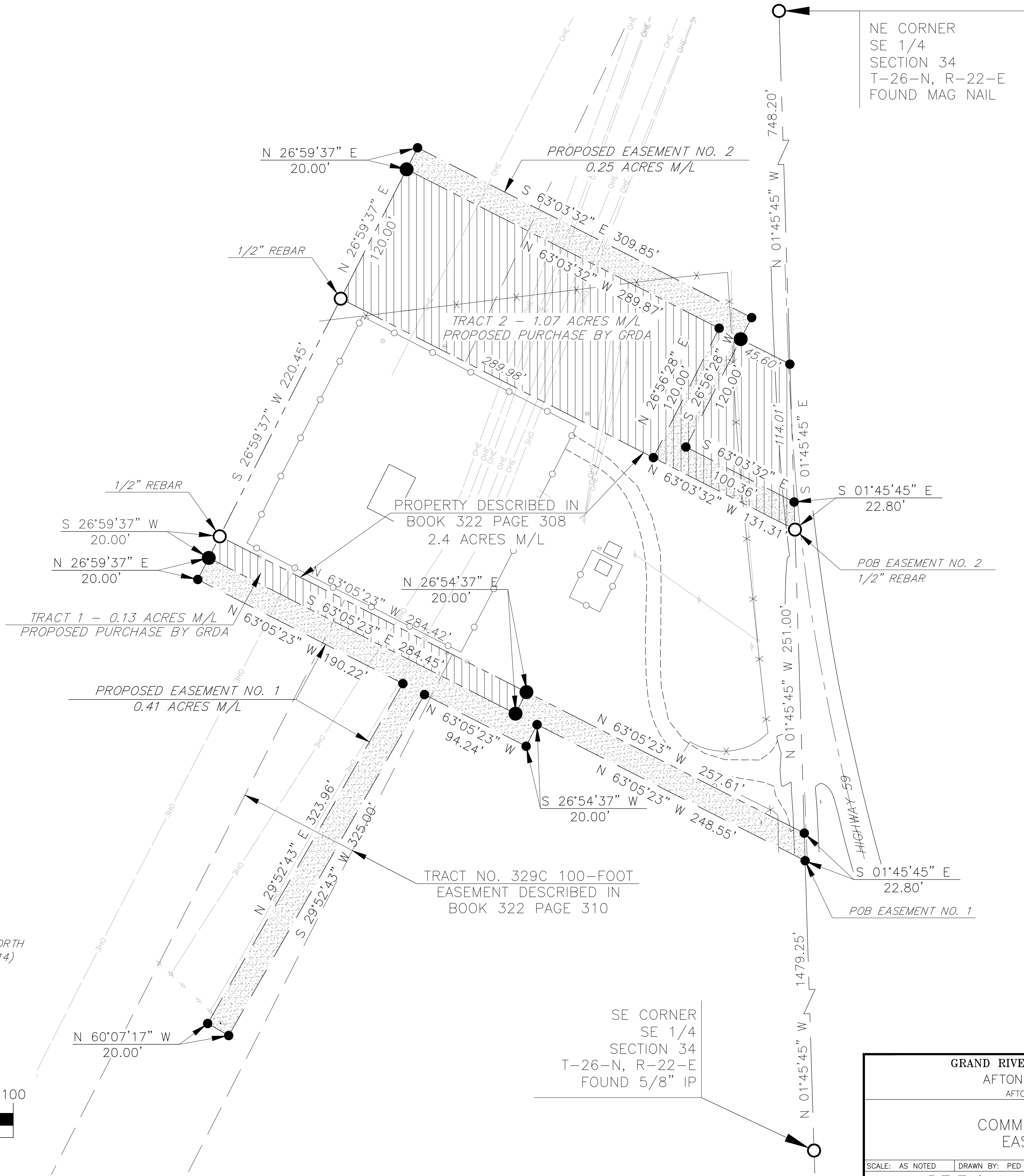
**Easement No. 2 Description**

A part of the Southeast Quarter of Section Thirty-four (34), Township Twenty-six (26) North, Range Twenty-two (22) East, Ottawa County, Oklahoma, being more particularly described as follows:  
 Commencing at the Southeast corner of the Southeast Quarter of said Section Thirty-four (34): thence N 01°45'45" W along of the East line of said Southeast Quarter 1753.05 feet to a found iron pin at the Northeast corner of the property described in Book 322, Page 308 for the POINT OF BEGINNING; thence leaving said East line N 63°03'32" W along the North line of said property 131.31 feet; thence leaving said North line thence N 26°56'28" E - 120.00 feet; thence N 63°03'32" W - 289.87 feet; thence N 26°59'37" E - 20.00 feet; thence S 63°03'32" E - 309.85 feet; thence S 26°56'28" W - 120.00 feet; thence S 63°03'32" E - 100.36 feet; thence S 01°45'45" E - 22.80 feet to the POINT OF BEGINNING containing 10,714 sq ft, 0.25 acres more or less.

**Certification**

I hereby certify that to the best of my professional knowledge and ability I have this day completed this Easement Plat as shown hereon.

Date: \_\_\_\_\_ Paul E. Davis, PLS 1565



NE CORNER  
 SE 1/4  
 SECTION 34  
 T-26-N, R-22-E  
 FOUND MAG NAIL

POB EASEMENT NO. 2  
 1/2" REBAR

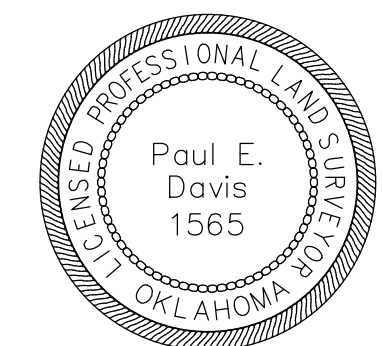
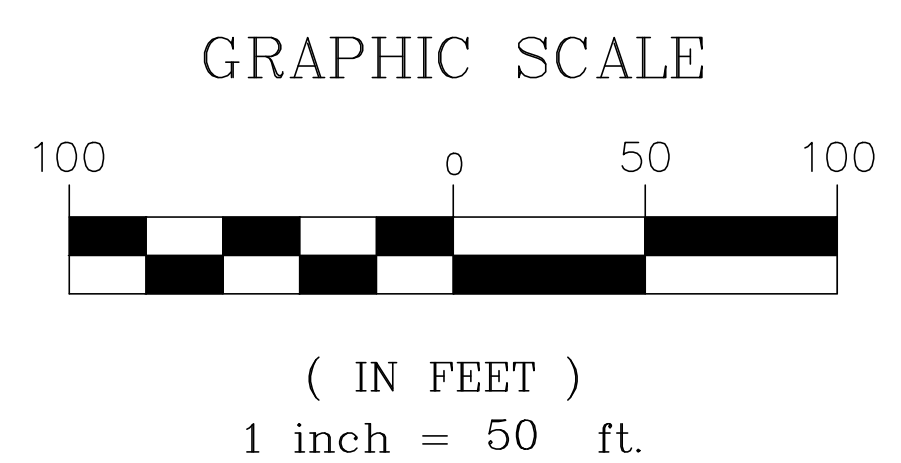
POB EASEMENT NO. 1

SE CORNER  
 SE 1/4  
 SECTION 34  
 T-26-N, R-22-E  
 FOUND 5/8" IP

**LEGEND**

- COMPUTED POINT
- SET 1/2" REBAR WITH CAP (PLS 1565)
- FOUND MONUMENT (AS NOTED)
- PROPERTY LINE
- SECTION LINE
- EXISTING EASEMENT LINE
- PROPOSED EASEMENT LINE

BEARINGS ARE OKLAHOMA STATE PLANE NORTH  
 BASED ON NGS MONUMENT AFTON (GG0714)  
 JULY 29, 2010.



OK COA #4193  
 EXPIRES 6/30/2012

<b>GRAND RIVER DAM AUTHORITY</b>			
AFTON SUBSTATION S294		AFTON, OKLAHOMA	
161/69KV			
<b>COMMUNICATIONS EASEMENTS</b>			
SCALE: AS NOTED	DRAWN BY: PED	ENGR:	APPD: PED
CH:	DATE: 4/26/11	DRAWING No. S294PG03	REV. 0
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			

REV	DATE	REVISION DESCRIPTION	DPT	ENG
0	5/11/12	ISSUED FOR BID		

**NOTES:**

- INSTALL EROSION CONTROLS IN ACCORDANCE WITH DETAILS ON SHEET S294PG12.
- ALL GRADED AND OTHERWISE DISTURBED AREAS SHALL BE STABILIZED WITHIN 15 DAYS IMMEDIATELY AFTER THE GRADING IS COMPLETED.
- NO WETLANDS HAVE BEEN DISCOVERED ON THIS SITE.
- THE CONTRACTOR IS RESPONSIBLE FOR THE PROPER INSTALLATION OF THESE DEVICES AS SHOWN ON THIS SHEET. ADDITIONAL EROSION CONTROL AND/OR ADJUSTMENT OF LOCATIONS FOR EROSION CONTROL MAY BE REQUIRED.
- SILT FENCES SHALL BE INSTALLED PER MANUFACTURER RECOMMENDATIONS AND ACCORDING TO THESE PLANS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL EROSION CONTROL DEVICES. CONTRACTOR SHALL REMOVE AND REPLACE EROSION CONTROL AS NEEDED FOR CONSTRUCTION OR ACCESS. ALL EROSION CONTROL MUST BE IN PLACE AT ALL TIMES DURING CONSTRUCTION.
- IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO USE WHATEVER MEANS NECESSARY TO CONTROL AND LIMIT SILT AND SEDIMENT LEAVING THE SITE. SPECIFICALLY, THE CONTRACTOR SHALL PROTECT ALL PARKING AREAS, STREAMS, CREEKS, STORM DRAIN SYSTEMS AND INLETS FROM EROSION DEPOSITS.
- WHERE EXCESSIVE DUST MAY BECOME A PROBLEM, A PLAN FOR SPRAYING WATER ON HEAVILY TRAVELED DIRT AREAS SHALL BE ADDRESSED.
- NATURAL VEGETATION. THE POTENTIAL FOR SOIL LOSS SHALL BE MINIMIZED BY RETAINING NATURAL VEGETATION WHEREVER POSSIBLE.
- ANY DEBRIS, SOIL, OR MUD FROM THE SITE REACHING A PUBLIC STREET SHALL BE IMMEDIATELY REMOVED.
- CONTRACTOR SHALL SALVAGE AND REINSTALL ANY EXISTING SIGNAGE ON THE EXISTING CHAINLINK FENCE WHERE DIRECTED BY THE ENGINEER.

ERECT SILT FENCE ON INSIDE OF PROPOSED BARBED WIRE FENCE ON SOUTH AND WEST PROPERTY LINES AS SHOWN.

REMOVE AND DISPOSE OF EXISTING CHAINLINK SECURITY FENCE AFTER NEW CHAINLINK SECURITY FENCE IS INSTALLED.

REMOVE AND DISPOSE OF THIS SECTION OF EXISTING BARBED WIRE FENCE AS DIRECTED.

INSTALL 7' CHAINLINK SECURITY FENCE WITH TWO 20' GATES AS SHOWN. CONNECT TO EXISTING FENCE AROUND COMMUNICATIONS TOWER.

EXISTING CONTROL BUILDING TO REMAIN

PROPOSED CONCRETE FOUNDATIONS (TYPICAL)

PROPOSED TRANSFORMERS AND OIL CONTAINMENT

MATERIAL STORAGE AREA

EXISTING COMM. TOWER, BUILDINGS, AND FENCE TO REMAIN.

CONCRETE WASHOUT AREA

INSTALL 6 STRAND BARBED WIRE FENCE ON PROPERTY LINE AS SHOWN. REMOVE AND DISPOSE OF SECTIONS OF EXISTING BARBED WIRE FENCE AS DIRECTED.

REMOVE AND DISPOSE OF EXISTING ENTRANCE GATE AND INSTALL NEW 20 FT. WIDE - 7' CHAINLINK SECURITY GATE.

TRACT "B" EASEMENT  
BK 322 PG 310

TRACT "C" EASEMENT  
BK 322 PG 310

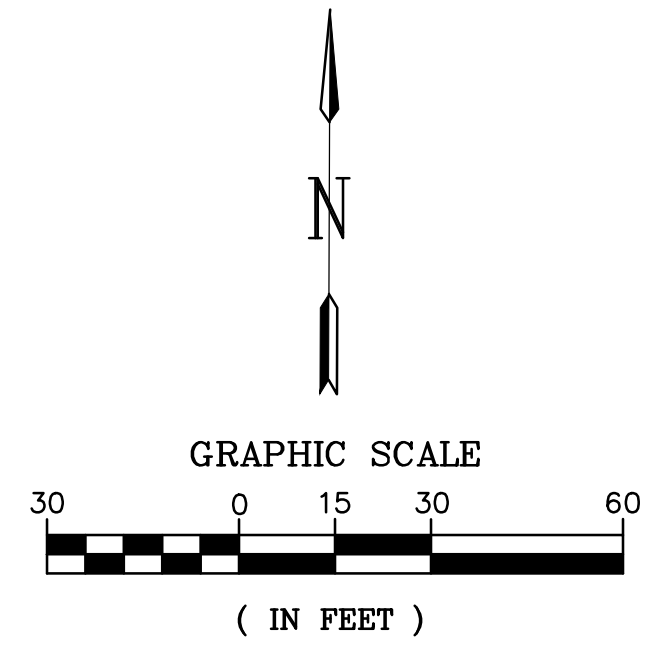
HORIZONTAL CONTROL BASED ON NGS MONUMENT AFTON PID#GG0714 AND NGS CORS STATIONS OKTU,ARHR,AND ICT1. VERTICAL IS BASED ON Q 163 PID#GG0254 AND THE NGS CORS STATIONS ABOVE. HORIZONTAL DATUM IS OKLAHOMA NORTH NAD 83 GRID AND THE VERTICAL DATUM IS NAVD 88.

**PROJECT CONTROL POINTS (CP#)**

PT. NO.	NORTHING	EASTING	ELEV.	DESCRIPTION
1	629238.0498	2869192.5976	788.91	CAPPED IRON ROD
2	629450.7428	2869202.3256	785.65	CAPPED IRON ROD
3	629591.4259	2869056.2469	----	60D NAIL W/DISC
4	629597.0451	2869216.5966	----	60D NAIL W/DISC
5	629508.9255	2869038.0240	----	60D NAIL W/DISC
6	629479.6440	2868953.3958	----	60D NAIL W/DISC
7	629159.5479	2869007.6451	----	60D NAIL W/DISC
8	629175.1824	2868844.1891	----	60D NAIL W/DISC

**LEGEND:**

- STRIP AND STOCKPILE TOPSOIL TO A MINIMUM DEPTH OF 1.0 FT. AND UNDERCUT AREA 1.0 FT. (TYPICAL) BELOW THE STRIPPING DEPTH AND CONSTRUCT 6" OF AGGREGATE BASE COURSE COMPACTED TO 95% MODIFIED PROCTOR OVER APPROVED SUBGRADE MATERIAL COMPACTED TO 95% STANDARD PROCTOR.
- REMOVE AND DISPOSE OF EXISTING GRAVEL DRIVEWAY AND PLACE 4" OF TOPSOIL AND SEED AND MULCH OUTSIDE OF THE PROPOSED FENCE.
- CONTRACTOR SHALL GRADE THE EXISTING GRAVEL DRIVE AS AN EVEN CROSS SLOPE AND PLACE AN ADDITIONAL 6" OF AGGREGATE BASE COURSE COMPACTED TO 95% MODIFIED PROCTOR.
- STRIP AND STOCKPILE TOPSOIL TO A MINIMUM DEPTH OF 1.0 FT. AND UNDERCUT AREA 1.0 FT. (TYPICAL) BELOW THE STRIPPING DEPTH AND CONSTRUCT 6" OF 3/4" WASHED GRAVEL OVER APPROVED SUBGRADE MATERIAL COMPACTED TO 95% STANDARD PROCTOR.
- 785 --- EXISTING CONTOUR
- 785 --- PROPOSED CONTOUR
- X 785 SPOT ELEVATION
- EXISTING BREAKLINE
- PROPERTY LINE
- OHE--- EXISTING OVERHEAD ELECTRIC
- EXISTING CHAINLINK FENCE
- X--- EXISTING BARBED WIRE FENCE
- PROPOSED CHAINLINK FENCE
- X--- PROPOSED BARBED WIRE FENCE
- SILT FENCE
- DIRECTION OF DRAINAGE FLOW
- DISTURBED AREA = 3.40 AC



**SEQUENCE OF CONSTRUCTION:**

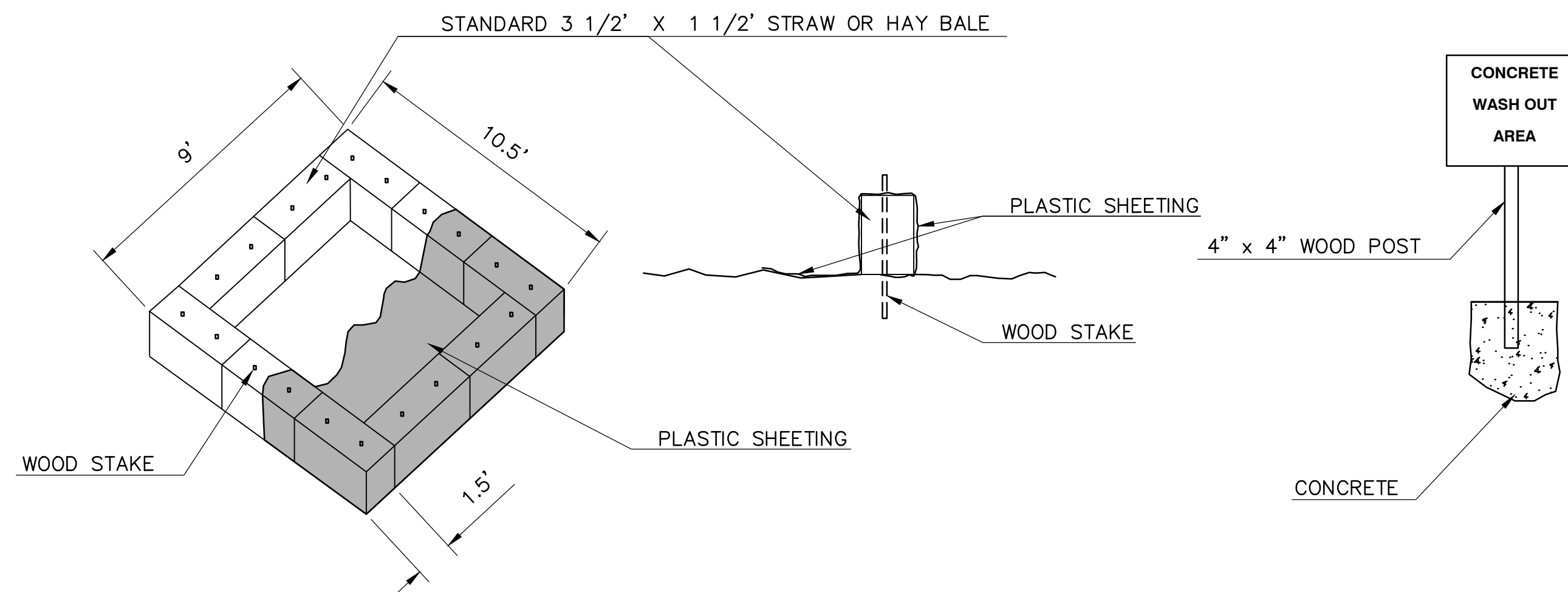
- INSTALL ALL EROSION CONTROL DEVICES.
- CONSTRUCT DIRTWORK FOR SUBSTATION PAD.
- GRADE ALL AREAS TO FINAL GRADE.
- STABILIZE ALL DISTURBED AREAS.
- FINAL SITE CLEANUP.



**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69 KV			
<b>SITE GRADING PLAN</b>			
SCALE: 1" = 30'	DRAWN BY: DJW	ENGR: DJW	APPD: BA
CH: MW	DATE: 3/7/2011	DRAWING No. S294PG11	
REV	DATE	REVISION DESCRIPTION	DFT ENG
0	5/29/12	ISSUED FOR BID	AS BA
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			REV. 0

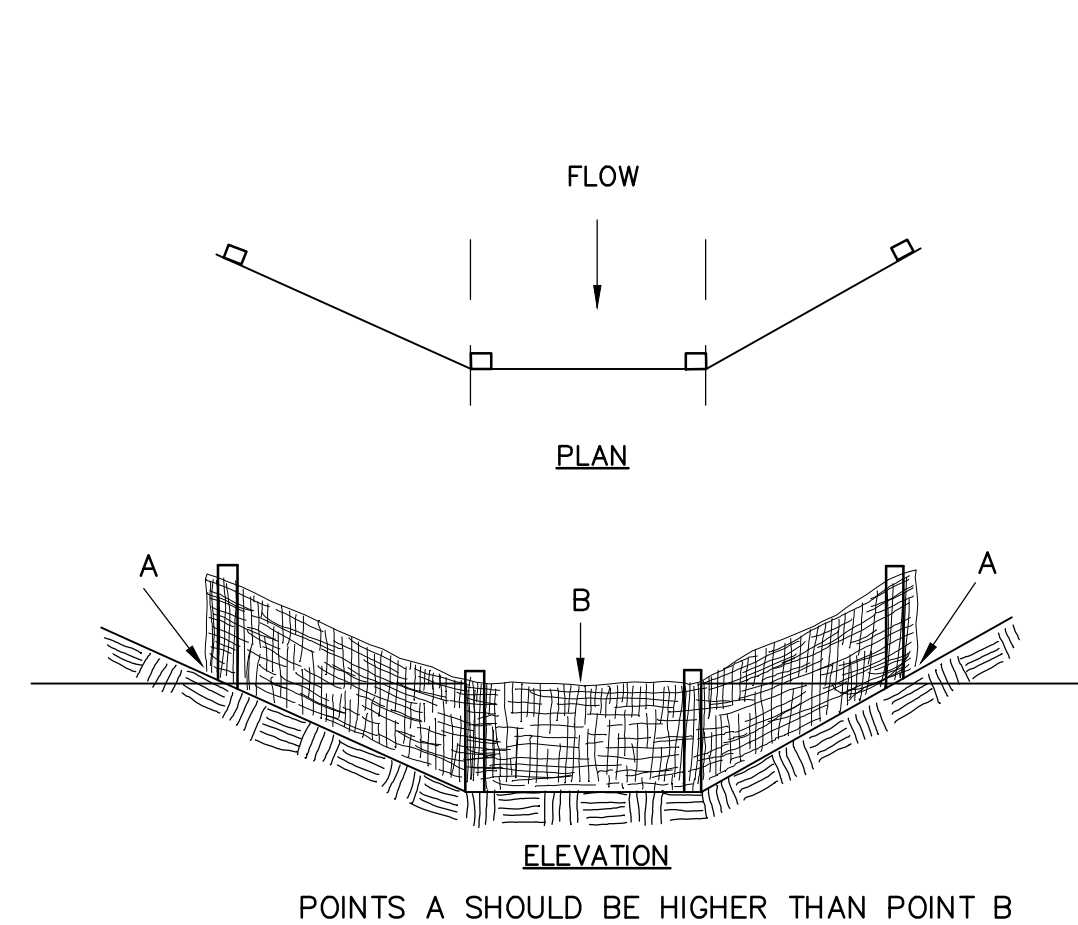
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 Last Plotted by: Shults, Ariene Plot Style: Carver Standard Full.ctb Plot Date: 5/29/2012 12:42 PM Plotter used: DWG To PDF.pc3



1. PLASTIC MUST BE 10 MIL THICK OR TWO 6 MIL PIECES OVERLAPPED.
2. ONCE CONCRETE DRIES, IT CAN BE ROLLED UP IN THE PLASTIC.
3. HAY BALES MUST BE STAKED WITH STAKE HOLDING PLASTIC LINER IN PLACE AND PLASTIC LINER COVER ALL BALES. WOODEN STAKES MUST BE 3 FEET IN LENGTH.
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ESTABLISH A WASH OUT AREA.
5. THE CONCRETE TRUCK DRIVER AND CONTRACTOR CAN BE CITED FOR WASH OUTS CONDUCTED IN A NON-DESIGNATED AREA.
6. AFTER THE DESIGNATED AREA FOR THE WASH OUT IS DETERMINED, SIGNAGE INDICATING CONCRETE WASH OUT AREA SHALL BE INSTALLED THAT IS VISIBLE TO EXITING VEHICLES. THE SIGN SHALL BE PLACED ON A WOOD POST AND ANCHORED IN CONCRETE.

### CONCRETE WASH OUT AREA

NO SCALE

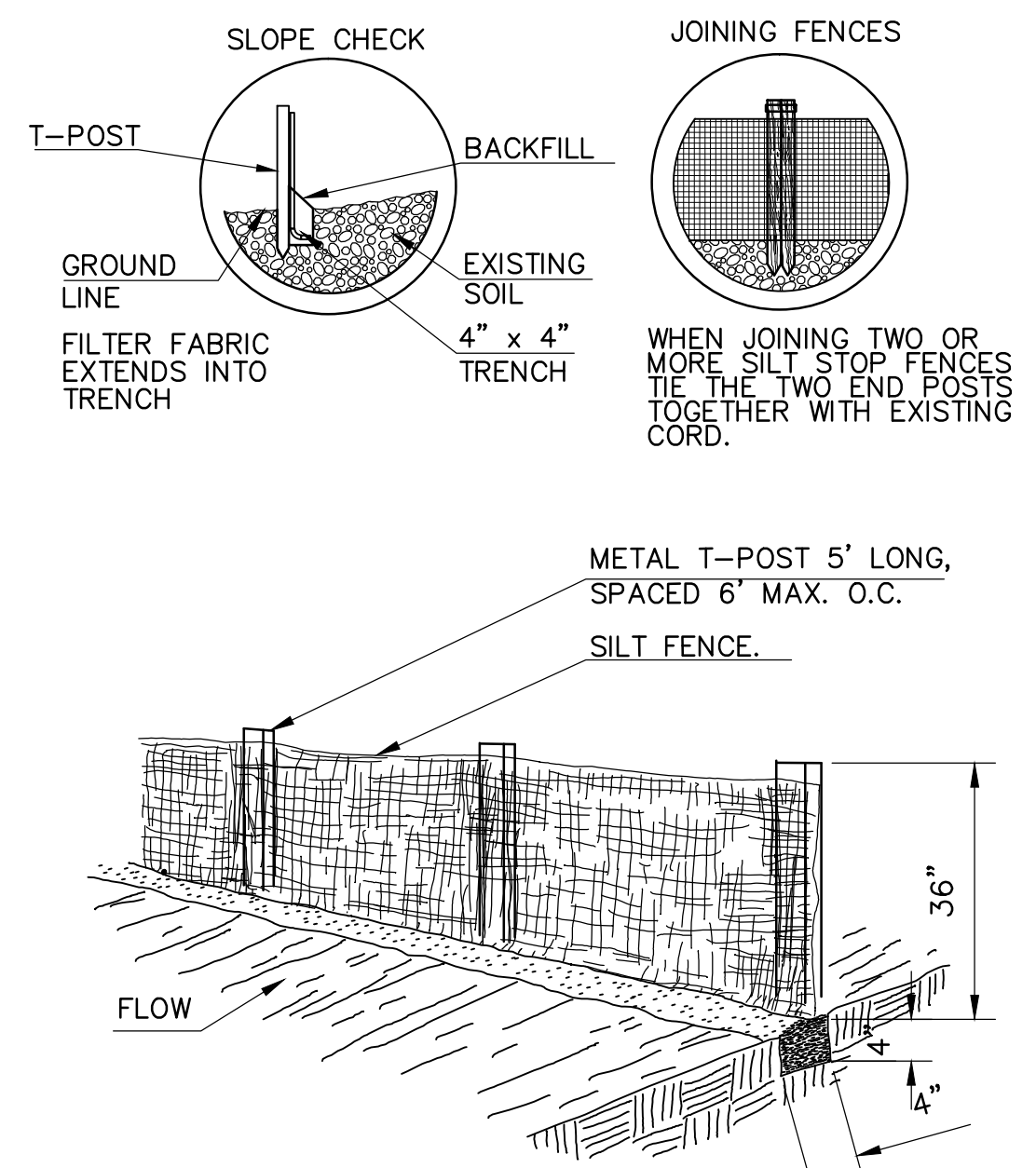


### PROPER PLACEMENT OF A FILTER

NO SCALE

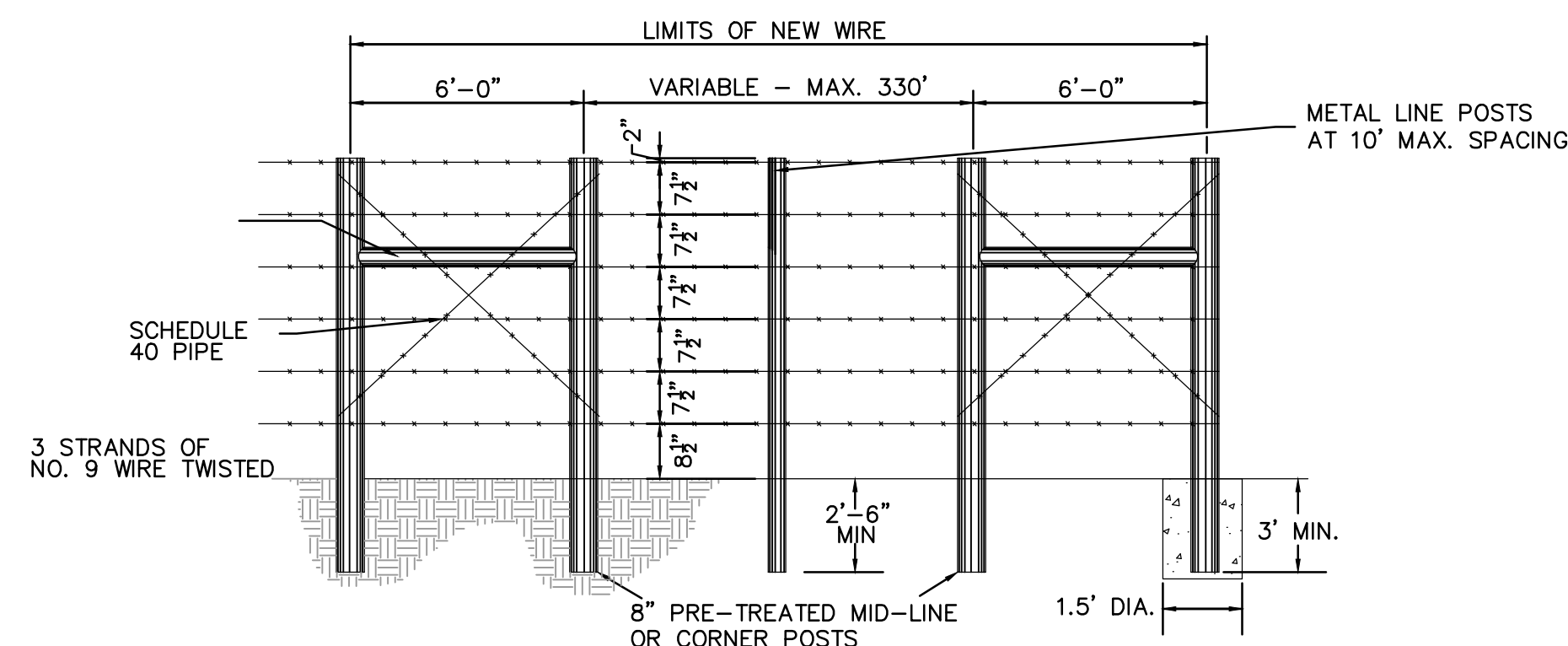
**NOTES:**

1. EXCAVATE 4" X 4" TRENCH.
2. INSTALL STAKES AND FILTER MATERIALS IN TRENCH. FILTER MATERIAL SHOULD BE PULLED TIGHT BETWEEN STAKES.
3. METAL T-POSTS SHALL BE USED FOR STAKING.
4. STAKES SHALL BE INSTALLED BEHIND FILTER MATERIAL.
5. BACKFILL AND COMPACT EXCAVATED AREAS.



### SILT FENCE DETAIL

NO SCALE



**NOTE:**

1. H-BRACE UNITS SHALL BE INSTALLED PRIOR TO CUTTING EXISTING FENCE.
2. HEIGHT OF POSTS SHALL BE A MINIMUM HEIGHT OF 4'-0" ABOVE GRADE.
3. MID-LINE AND CORNER POSTS SHALL BE INSTALLED WITH A CLASS-A CONCRETE FOOTING.

### 6-STRAND BARBED WIRE FENCE DETAIL

NO SCALE

**NOTE:** THE CHAINLINK FENCE DETAILS CAN BE FOUND ON SHEET S294PE30.



### GENERAL EROSION CONTROL NOTES:

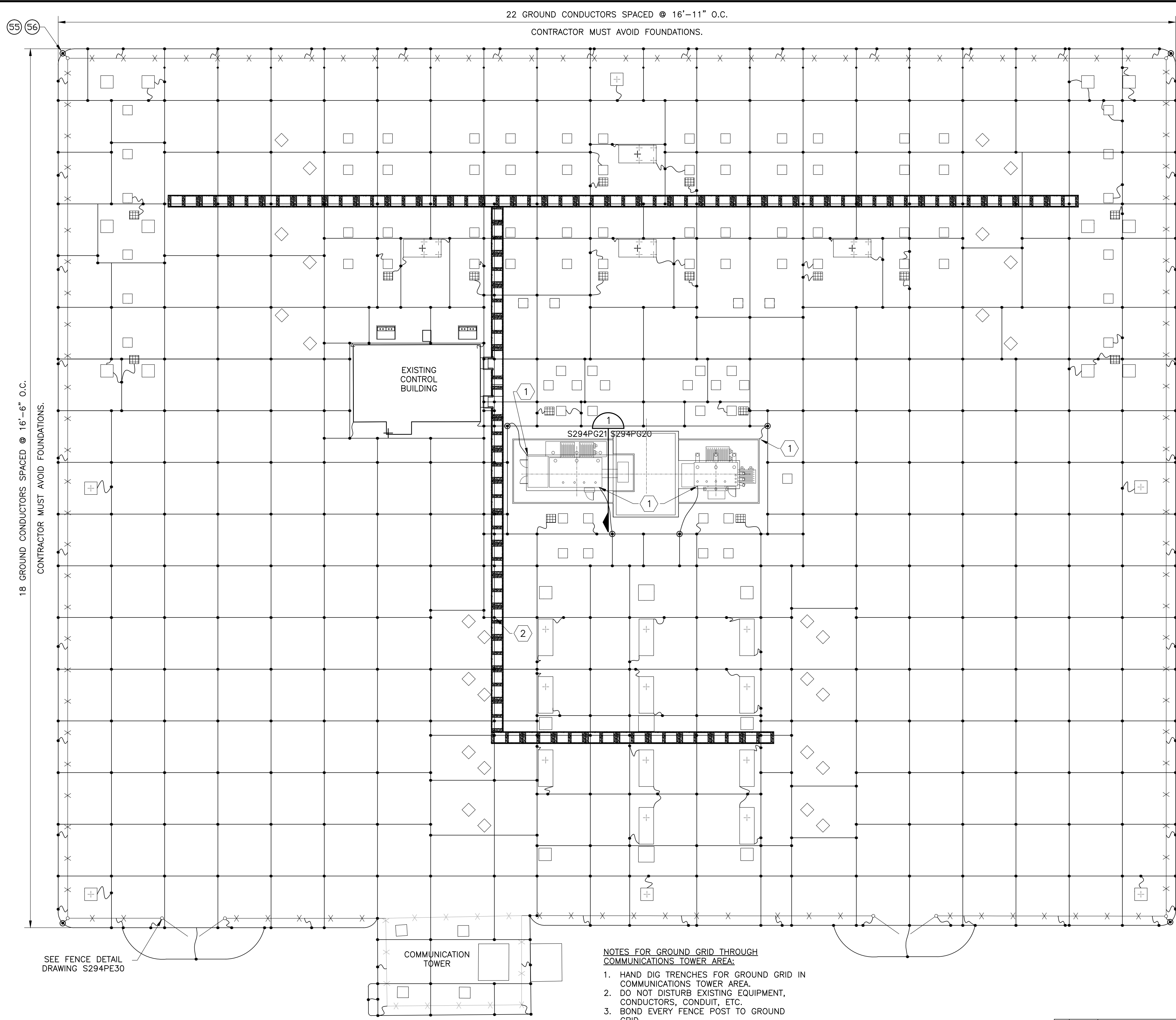
1. CAUTION: UNDERGROUND UTILITIES EXIST WITHIN AND ADJACENT TO THE LIMITS OF CONSTRUCTION. AN ATTEMPT HAS BEEN MADE TO LOCATE THESE UTILITIES ON THE PLANS; HOWEVER, ALL EXISTING UTILITIES MAY NOT BE SHOWN AND THE ACTUAL LOCATIONS OF THE UTILITIES MAY VARY FROM THE LOCATIONS SHOWN. SOME UTILITIES MAY HAVE BEEN RELOCATED SINCE THE TIME OF DESIGN AND THE CONTRACTOR'S NOTICE TO PROCEED. PRIOR TO BEGINNING ANY TYPE OF EXCAVATION, THE CONTRACTOR SHALL CONTACT THE UTILITIES INVOLVED AND MAKE ARRANGEMENTS FOR THE LOCATION OF THE UTILITIES ON THE GROUND. THE CONTRACTOR SHALL MAINTAIN THE UTILITY LOCATION MARKINGS UNTIL THEY ARE NO LONGER NECESSARY. OKLAHOMA STATE LAW, THE UNDERGROUND FACILITIES DAMAGE PREVENTION ACT, REQUIRES TWO WORKING DAYS ADVANCE NOTIFICATION THROUGH THE OKLAHOMA ONE-CALL SYSTEM CENTER BEFORE EXCAVATING USING MECHANIZED EQUIPMENT OR EXPLOSIVES (EXCEPT IN THE CASE OF EMERGENCY). THE ONE-CALL SYSTEM PHONE NUMBER IS 1-800-522-6543. THE CONTRACTOR IS ADVISED THAT THERE IS A SEVERE PENALTY FOR NOT MAKING THIS CALL. NOT ALL UTILITY COMPANIES ARE MEMBERS OF THE OKLAHOMA ONE-CALL SYSTEM; THEREFORE, THE CONTRACTOR IS ADVISED TO CONTACT ALL NON-MEMBER UTILITIES AS WELL AS THE ONE-CALL SYSTEM. THE LOCATION OF THE EXISTING UTILITIES SHOWN IN THE PLANS ARE APPROXIMATE, AND ARE THE LOCATIONS AT THE TIME OF DESIGN.
2. THE CONTRACTOR IS RESPONSIBLE FOR THE PROPER INSTALLATION OF THESE DEVICES AS SHOWN ON THIS SHEET. ADDITIONAL EROSION CONTROL AND/OR ADJUSTMENT OF LOCATIONS FOR EROSION CONTROL MAY BE REQUIRED.
3. SILT FENCES SHALL BE INSTALLED PER MANUFACTURER RECOMMENDATIONS AND ACCORDING TO THESE PLANS.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL EROSION CONTROL DEVICES. CONTRACTOR SHALL REMOVE AND REPLACE EROSION CONTROL AS NEEDED FOR CONSTRUCTION OR ACCESS. ALL EROSION CONTROL MUST BE IN PLACE AT ALL TIMES DURING CONSTRUCTION.
5. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO USE WHATEVER MEANS NECESSARY TO CONTROL AND LIMIT SILT AND SEDIMENT LEAVING THE SITE. SPECIFICALLY, THE CONTRACTOR SHALL PROTECT ALL STREAMS, CREEKS, STORM DRAIN SYSTEMS AND INLETS FROM EROSION DEPOSITS.

### ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> AFTON SUBSTATION S294 AFTON, OKLAHOMA			
<b>EROSION CONTROL AND SITE DETAILS</b>			
SCALE: -	DRAWN BY: DJW	ENGR: DJW	APPD: BA
	CH: MW	DATE: 3/7/2011	
<b>GRDA</b> <small>Grand River Dam Authority</small> P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294PG12</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

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**NOTES:**

1. INSTALL GROUND GRID 30" BELOW TOP OF ROCK SURFACING (24" BELOW EARTH GRADE).
2. ALL ABOVE GRADE GROUNDING TO BE 19#9 CCS #40 DSA. (4/0 COPPERWELD)
3. BOND GROUND GRID TO FENCE AT INTERVALS NOT TO EXCEED 30'. SEE DWG. S294PE30 FOR FENCE DETAILS.
4. FORM ALL FOUNDATION GROUND TAILS CLOSE TO FOUNDATION SURFACES.
5. GROUND GRID IS DESIGNED FOR A PRIMARY FAULT CURRENT OF 15KA.
6. WHEN INSTALLING GROUND GRID UNDER TRENCH SECTIONS, CONTRACTOR IS TO ACCOMMODATE FOR THE DEPTH OF THE TRENCH. (SEE DWG S294PG51)
7. CONTRACTOR TO INSTALL #4/0 GROUNDING CABLE IN TRENCH. BOND TO GROUND GRID AT EVERY OTHER INTERSECTION POINT UNDER TRENCH.
8. INSTALL GROUND GRID 3' BEYOND THE SWING OF ANY DOORS & GATES.
9. ALL SWITCHMATS, SWITCHES, STEEL EQUIPMENT TO BE BONDED TO GROUND GRID IN TWO PLACES.

**KEYED NOTES:**

- ① ATTACH GROUNDING CABLE TO GROUNDING PAD ON TRANSFORMER.
- ② BOND GROUND GRID TO GROUND IN TRENCH AT EVERY OTHER INTERSECTION POINT.

**LEGEND**

- FOUNDATIONS
- CADWELD CONNECTION
- TAIL TO EQ. GROUND
- GROUND GRID CONDUCTOR
- GROUND ROD
- SWITCH OPERATOR PLATFORM
- FENCE

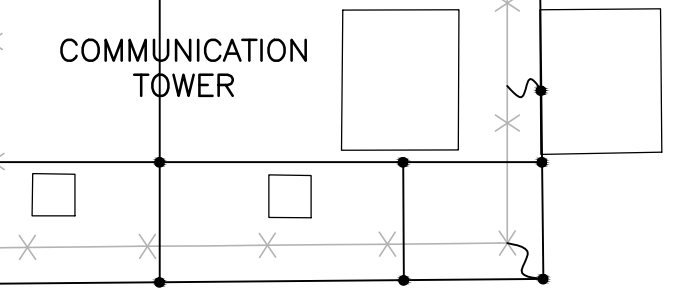
**REFERENCE DRAWINGS**

- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3
- S294PE30 FENCE DETAILS
- S294PG21 GROUNDING DETAILS
- S294PG51 RACEWAY CABLE & CONDUIT DETAILS

18 GROUND CONDUCTORS SPACED @ 16'-6" O.C.  
 CONTRACTOR MUST AVOID FOUNDATIONS.

22 GROUND CONDUCTORS SPACED @ 16'-11" O.C.  
 CONTRACTOR MUST AVOID FOUNDATIONS.

SEE FENCE DETAIL  
 DRAWING S294PE30

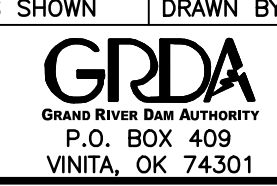


- NOTES FOR GROUND GRID THROUGH COMMUNICATIONS TOWER AREA:**
1. HAND DIG TRENCHES FOR GROUND GRID IN COMMUNICATIONS TOWER AREA.
  2. DO NOT DISTURB EXISTING EQUIPMENT, CONDUCTORS, CONDUIT, ETC.
  3. BOND EVERY FENCE POST TO GROUND GRID.

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b>			
<b>AFTON SUBSTATION</b>		S294	
AFTON, OKLAHOMA 161kV			
<b>GROUNDING PLAN</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BRF
CH: MWSRF		DATE: 3/7/2011	
DRAWING No. S294PG20			REV. 0

REV	DATE	REVISION DESCRIPTION	AS	BA	DFT	ENG
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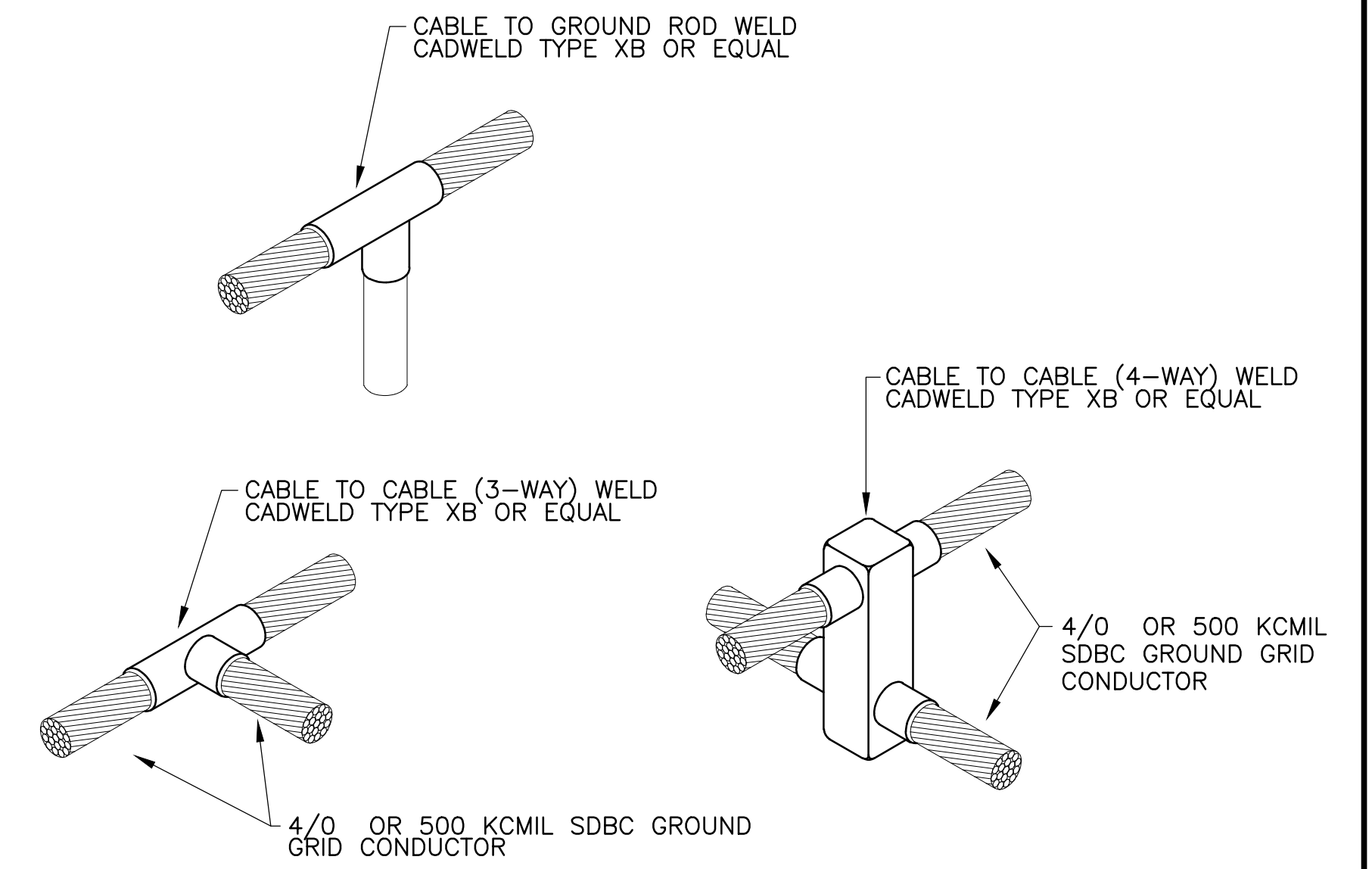
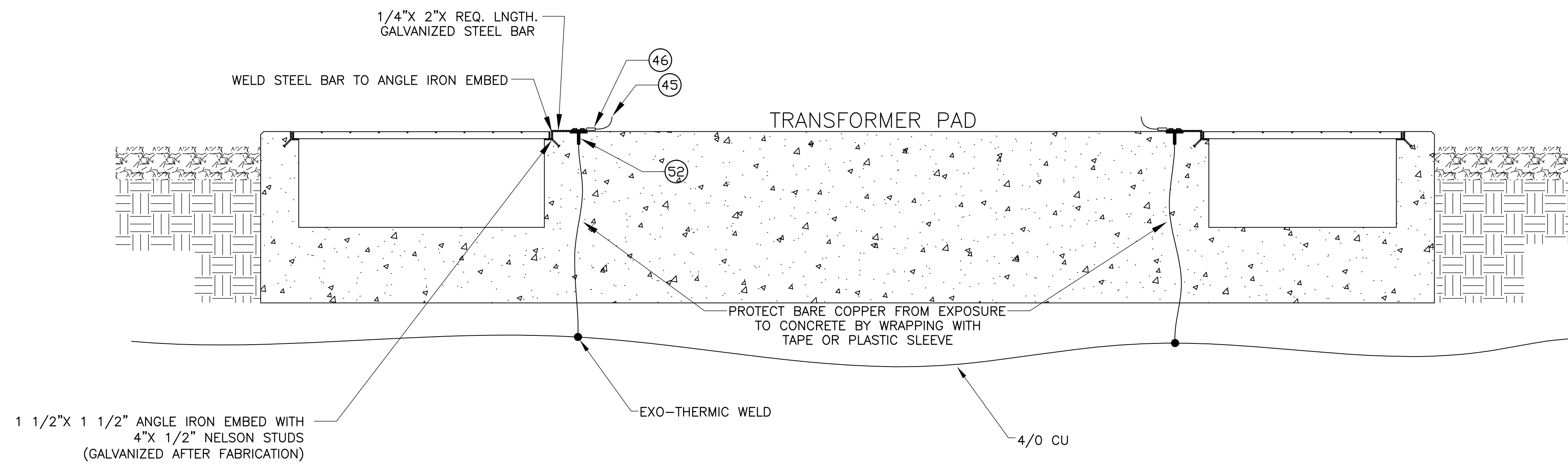




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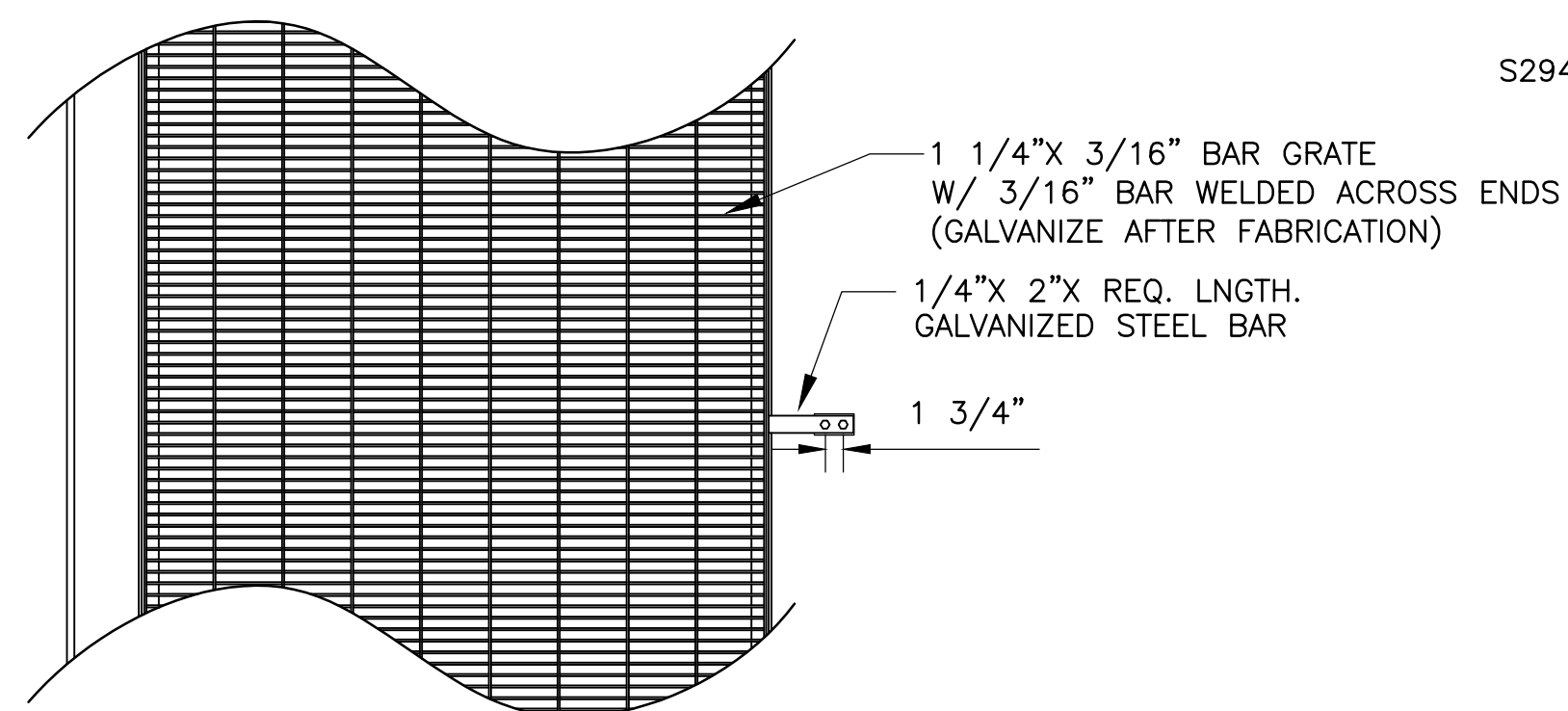
**REFERENCE DRAWINGS**

S294DE01 BILL OF MATERIALS SHEET 1 OF 3  
 S294DE02 BILL OF MATERIALS SHEET 2 OF 3  
 S294DE03 BILL OF MATERIALS SHEET 3 OF 3  
 S294PG20 GROUNDING PLAN



**1 TRANSFORMER GROUNDING DETAIL**  
 S294PG20\S294PG21

**2 CADWELD DETAILS**  
 S294PG21\S294PG21



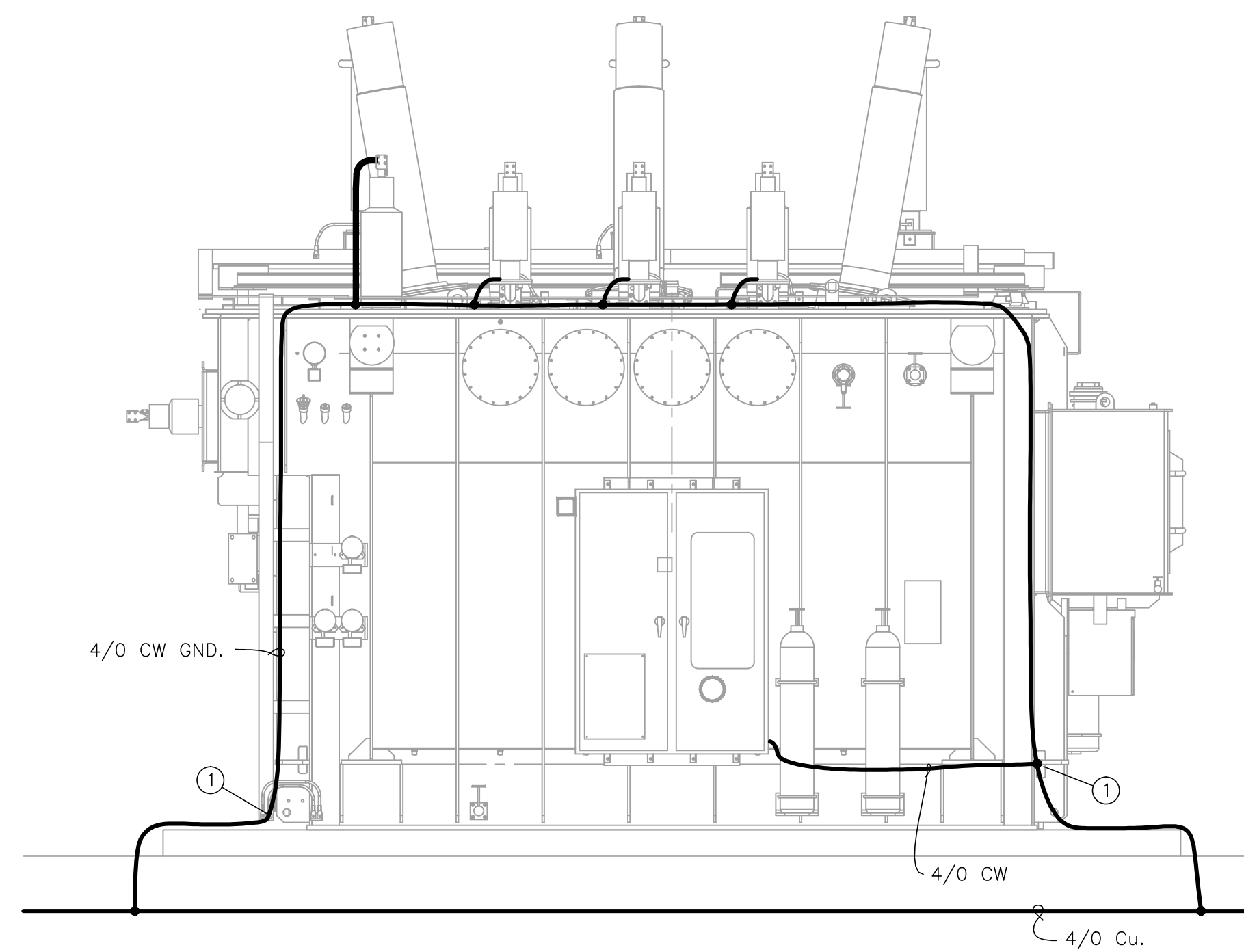
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>GROUNDING DETAILS</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
DRAWING No. S294PG21			REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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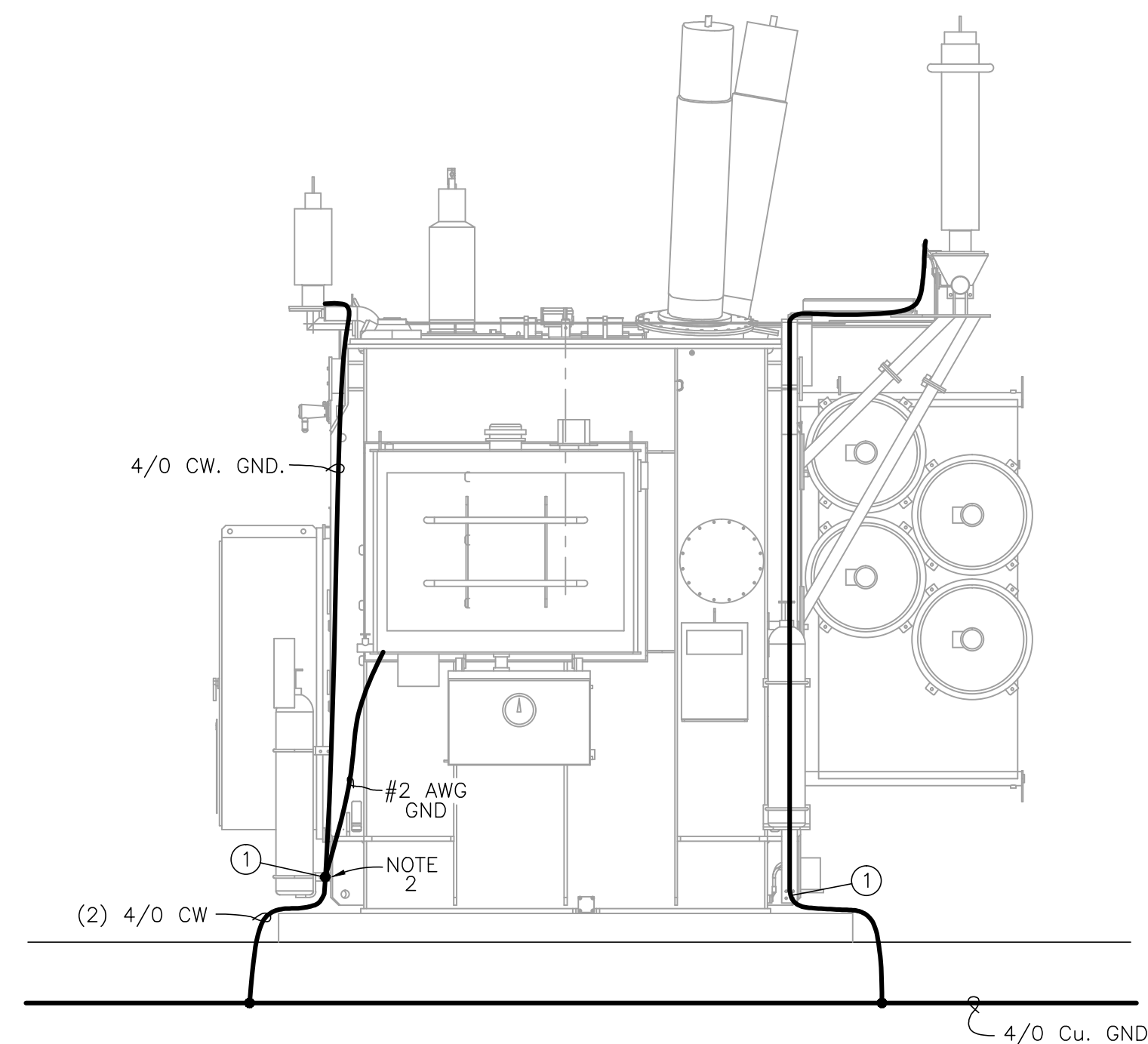


GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301



**TRANSFORMER GROUNDING**

ITEM	MATERIAL
1	PARALLEL GROOVE GROUNDING CLAMP
2	THREADED TRANSFORMER GROUNDING STUD



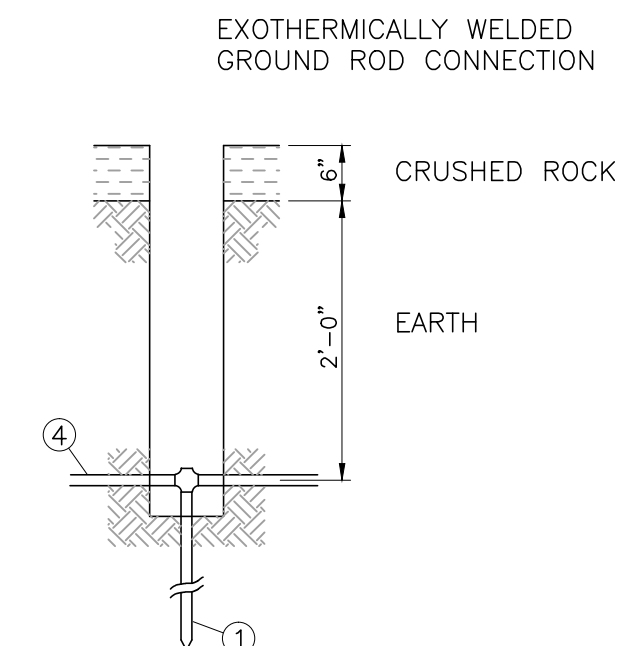
**TRANSFORMER GROUNDING**

ITEM	MATERIAL
1	4/0 Cu. COMPRESSION TERMINAL (2 HOLE)

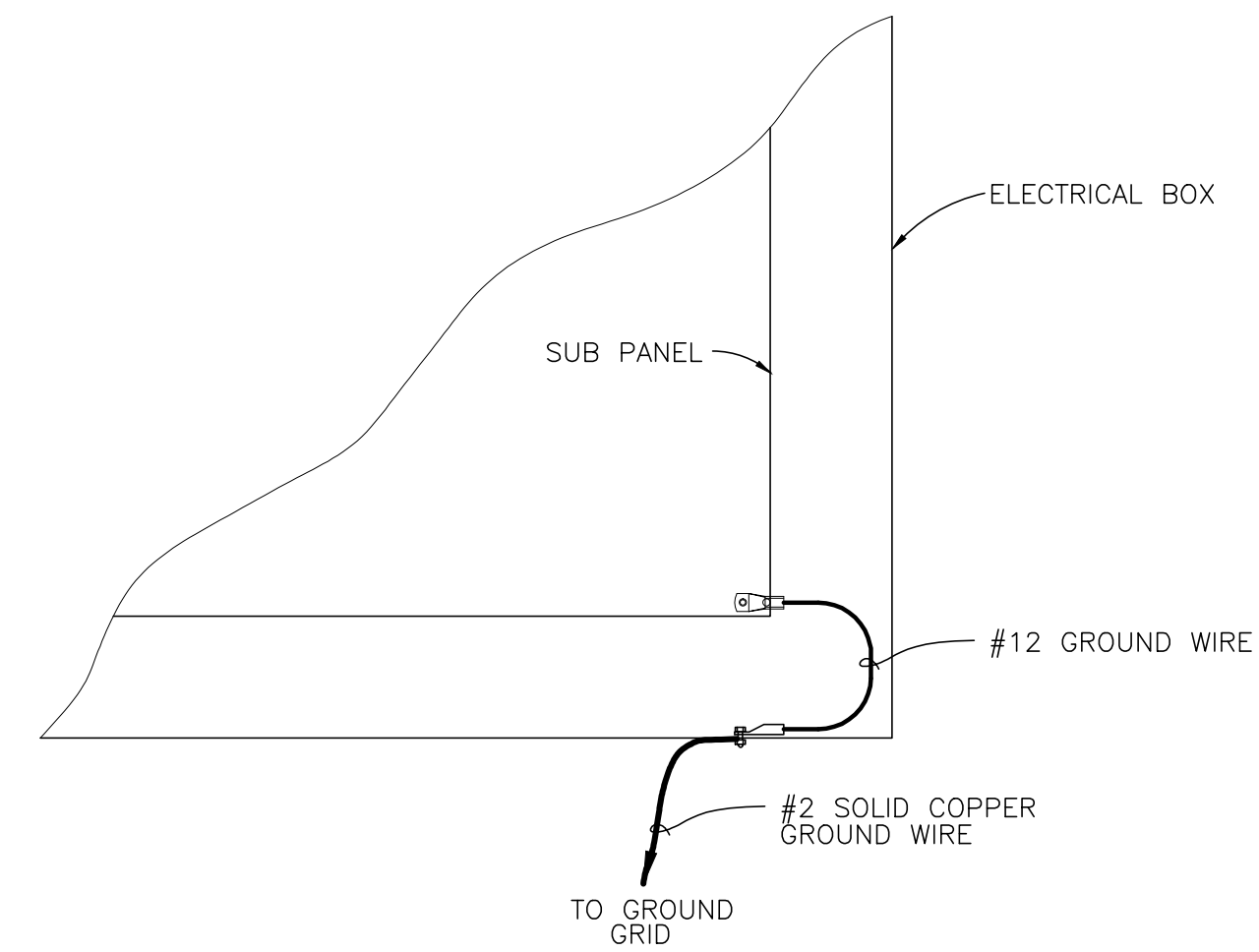


**TYP. GRID OR TAIL CONNECTION**

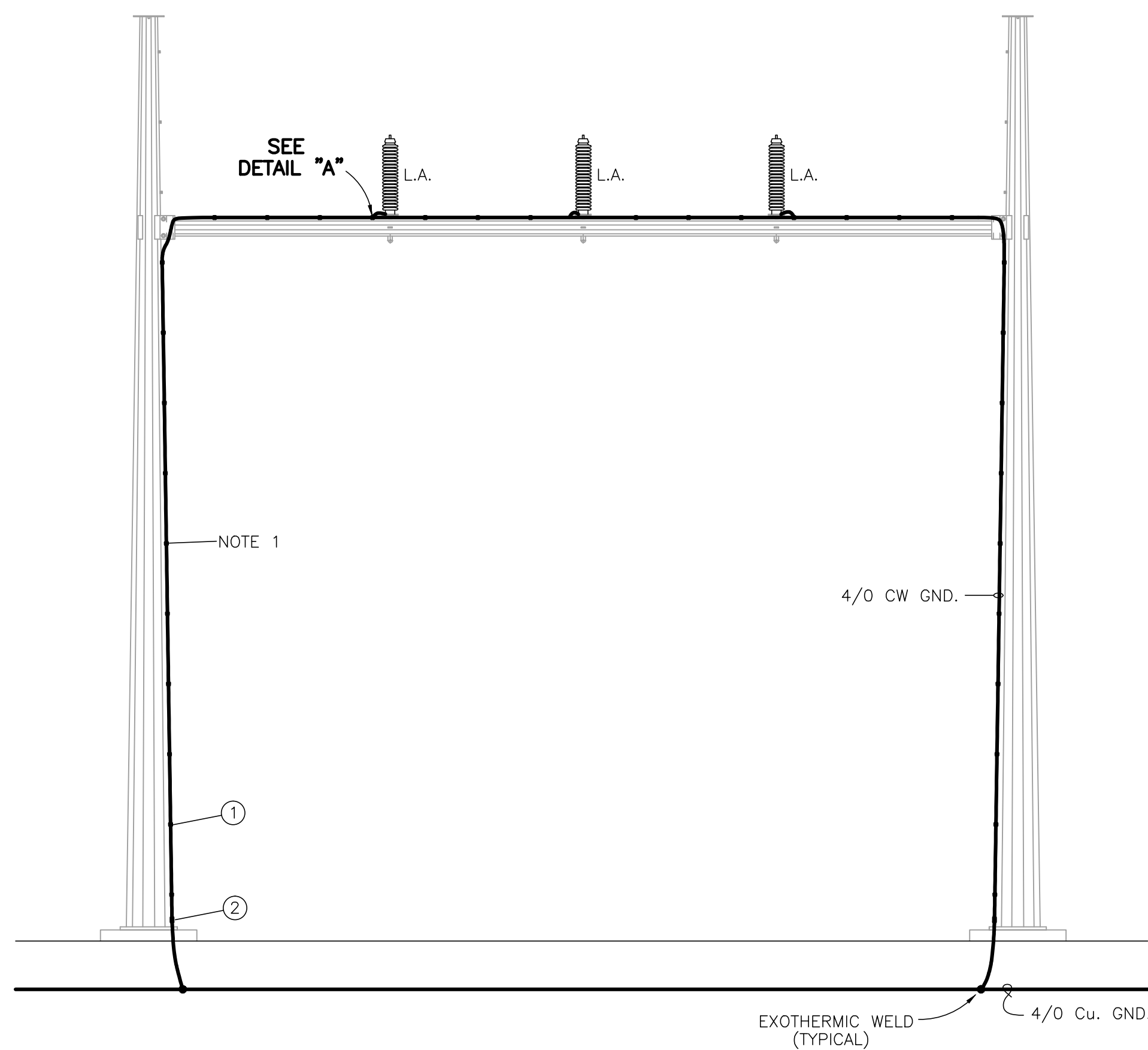
**CABLE TO 3/4" GROUND ROD TYPICAL**



- NOTES:**
1. 10'-0", 3/4" GROUND ROD
  2. GROUND ROD COUPLING
  3. DRIVING STUD
  4. #4/0 COPPER CABLE
  5. EVERY STRUCTURE SHALL BE ATTACHED TO THE GRID WITH A MINIMUM OF TWO 4/0 COPPER WIRE

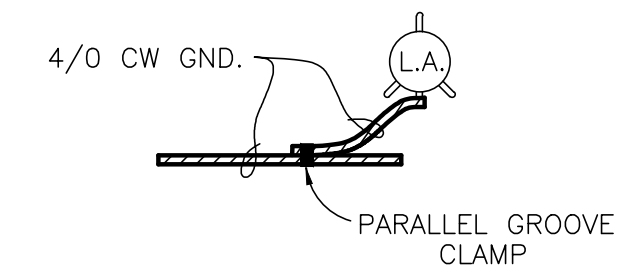


**ELECTRICAL BOX GROUNDING**



**ARRESTOR GROUNDING**

ITEM	MATERIAL
1	SINGLE GROOVE GROUNDING CLAMP
2	PARALLEL GROOVE GROUNDING CLAMP

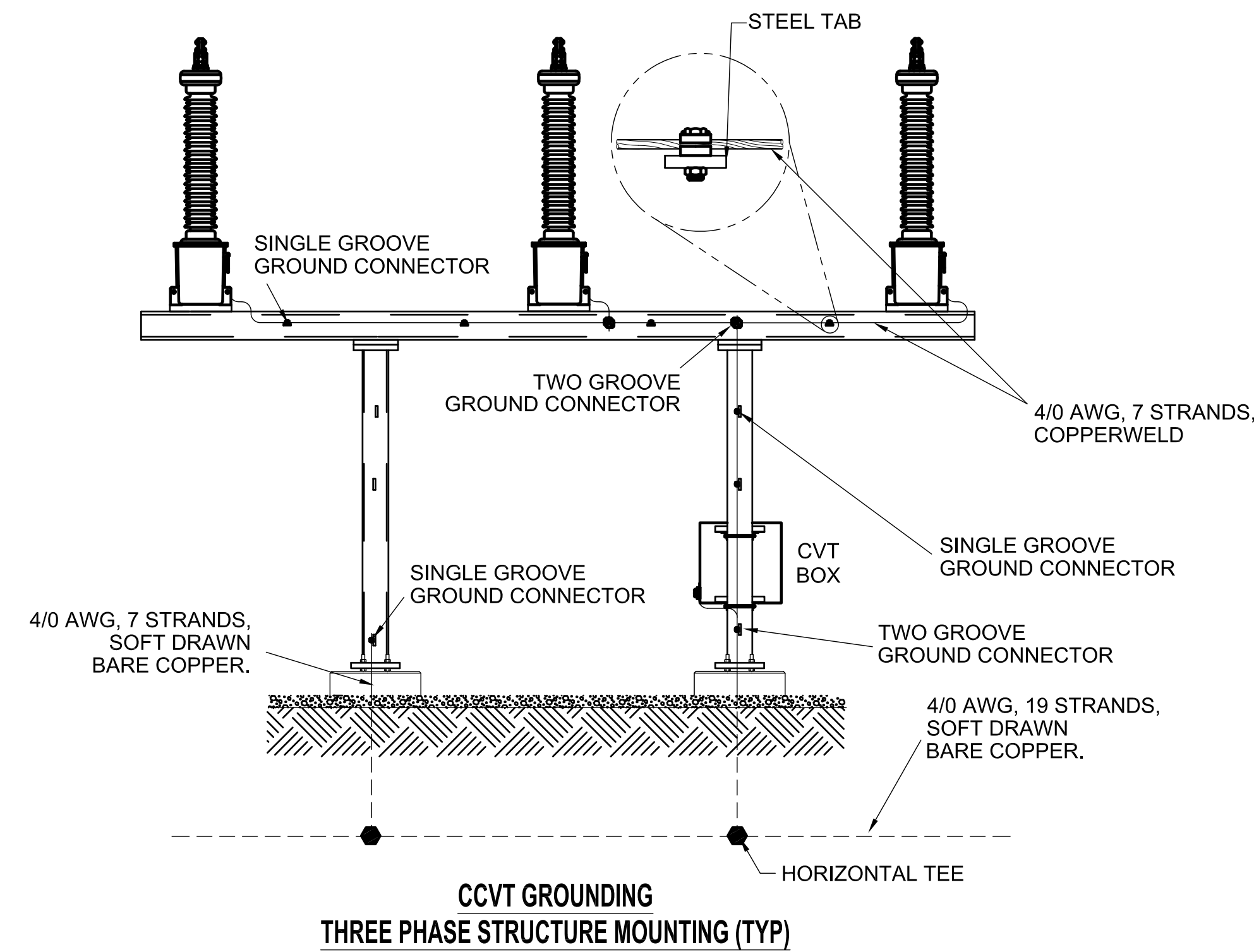
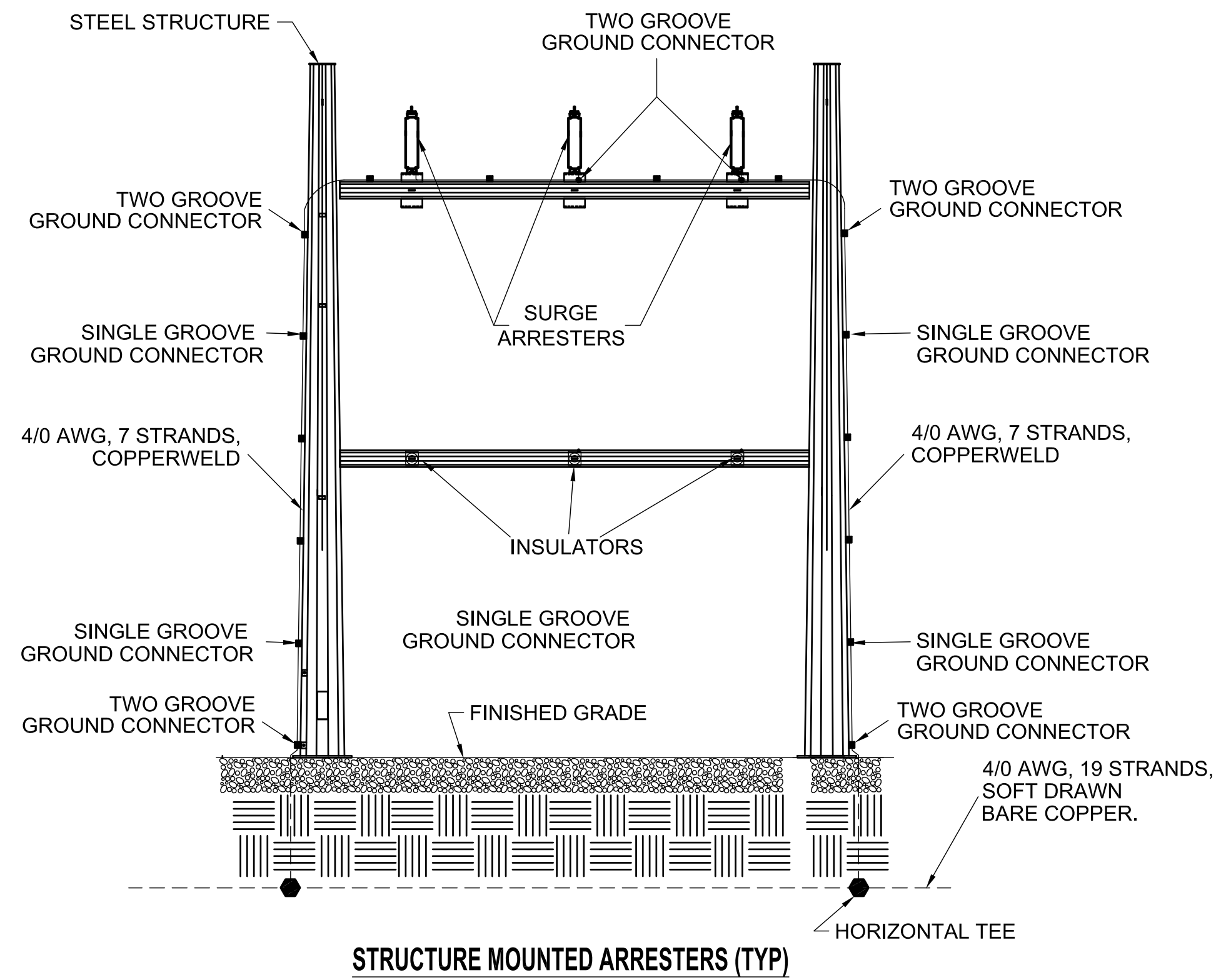
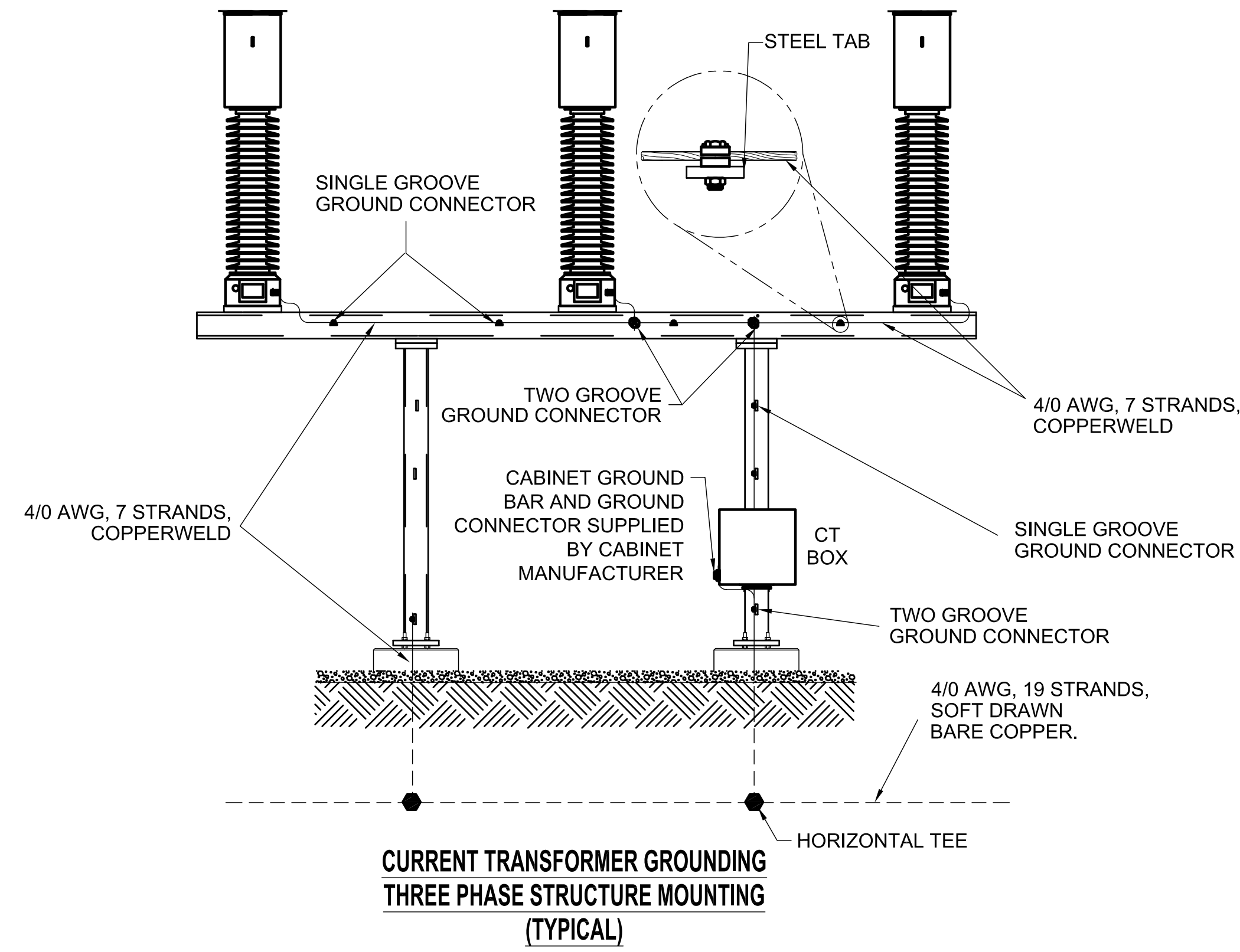
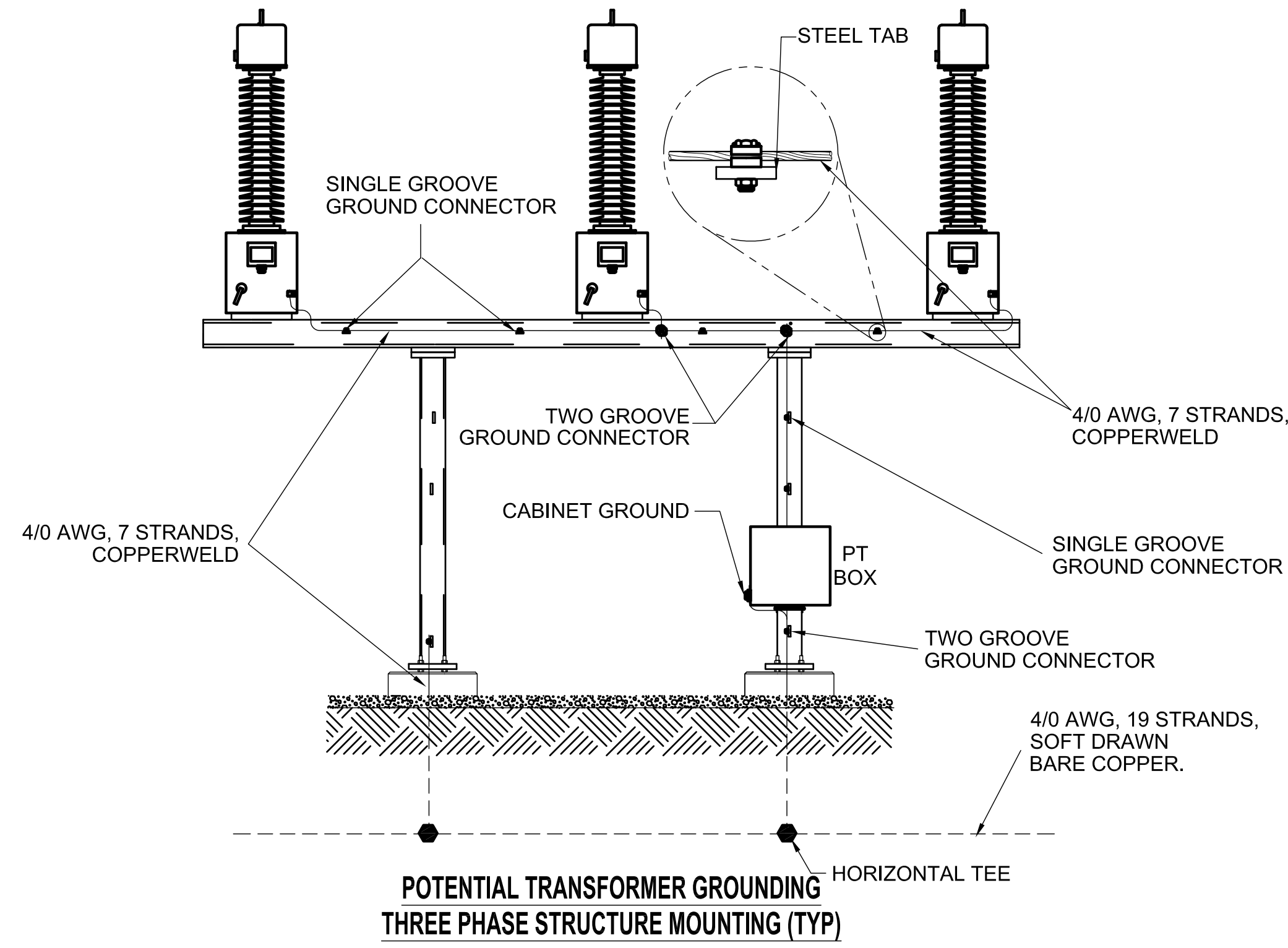


**DETAIL "A"**  
N.T.S.

**NOTES:**

1. ATTACH GROUND WIRE TO STEEL MAXIMUM 6' APART.
2. VARIES PER TRANSFORMER SPECIFICATIONS.
3. ABOVE GRADE GROUNDS TO BE 4/0 COPPERWELD.
4. ALL BELOW GRADE CONNECTIONS TO BE EXOTHERMIC.
5. SWITCH OPERATING HANDLE WILL BE GROUNDED WITH FLEXIBLE STRAP FURNISHED BY SWITCH MFR. AND ATTACHED TO GROUNDING PLATFORM GROUNDING WIRE.
6. EXTEND GROUND WIRE UP STRUCTURE TO GROUND CONNECTION ON BASE OF LIGHTNING ARRESTOR.
7. POWER CABLES MUST BE INSTALLED IN CONFIGURATION SHOWN.
8. TRANSFORMER XO BUSHING, LIGHTNING ARRESTORS, INSTRUMENT TRANSFORMER (CT, PT, PD) HO BUSHINGS WILL BE GROUNDED WITH A SINGLE CONDUCTOR EXTENDING TO THE GROUND GRID.

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69KV			
GROUNDING DETAILS			
TRANSFORMER & LIGHTNING ARRESTOR			
SCALE: NONE	DRAWN BY: JT	ENGR: BA	APPD: BA
CH: BA	DATE: 09MAY12		
DRAWING No.		REV.	
S294PG22		0	
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			



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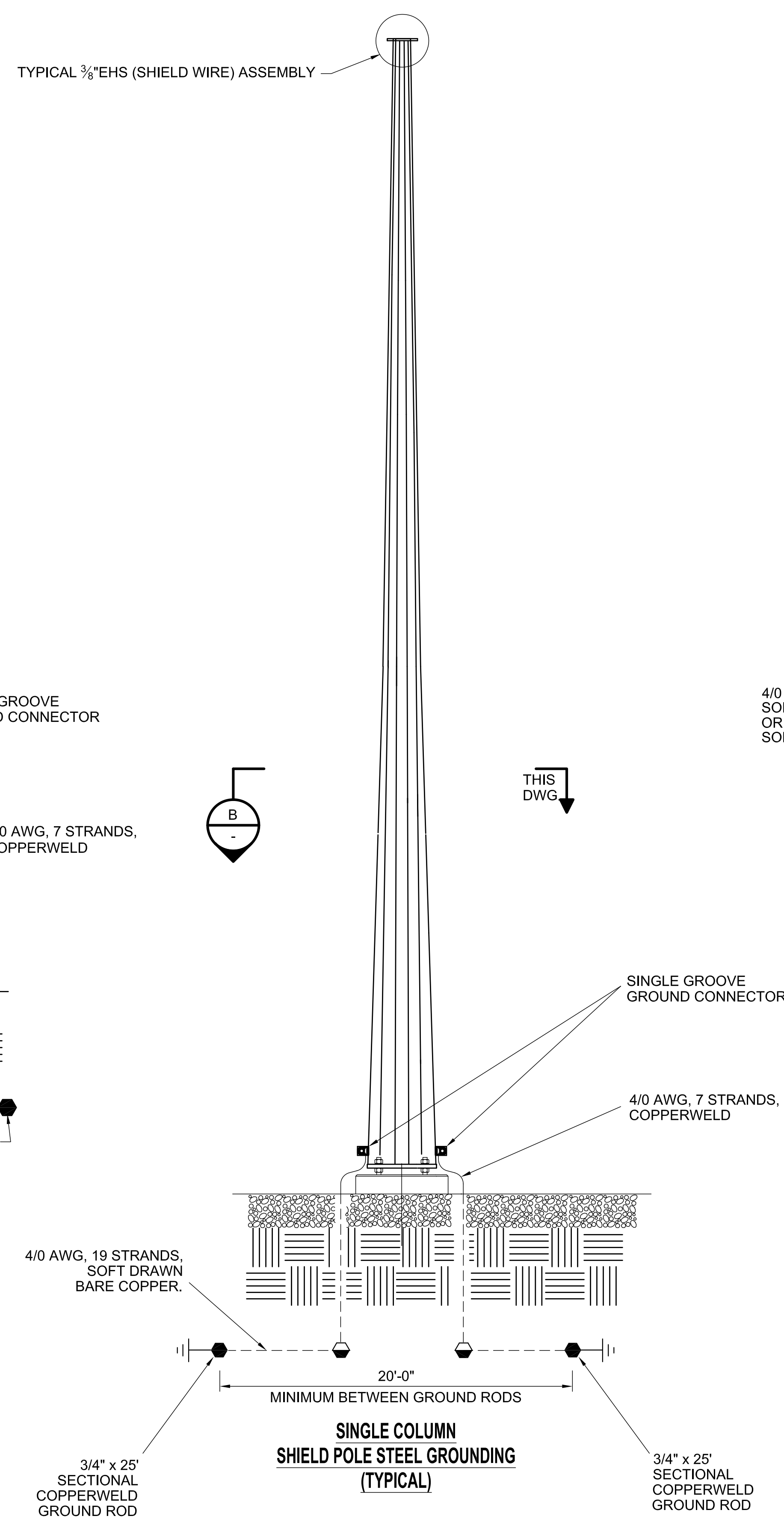
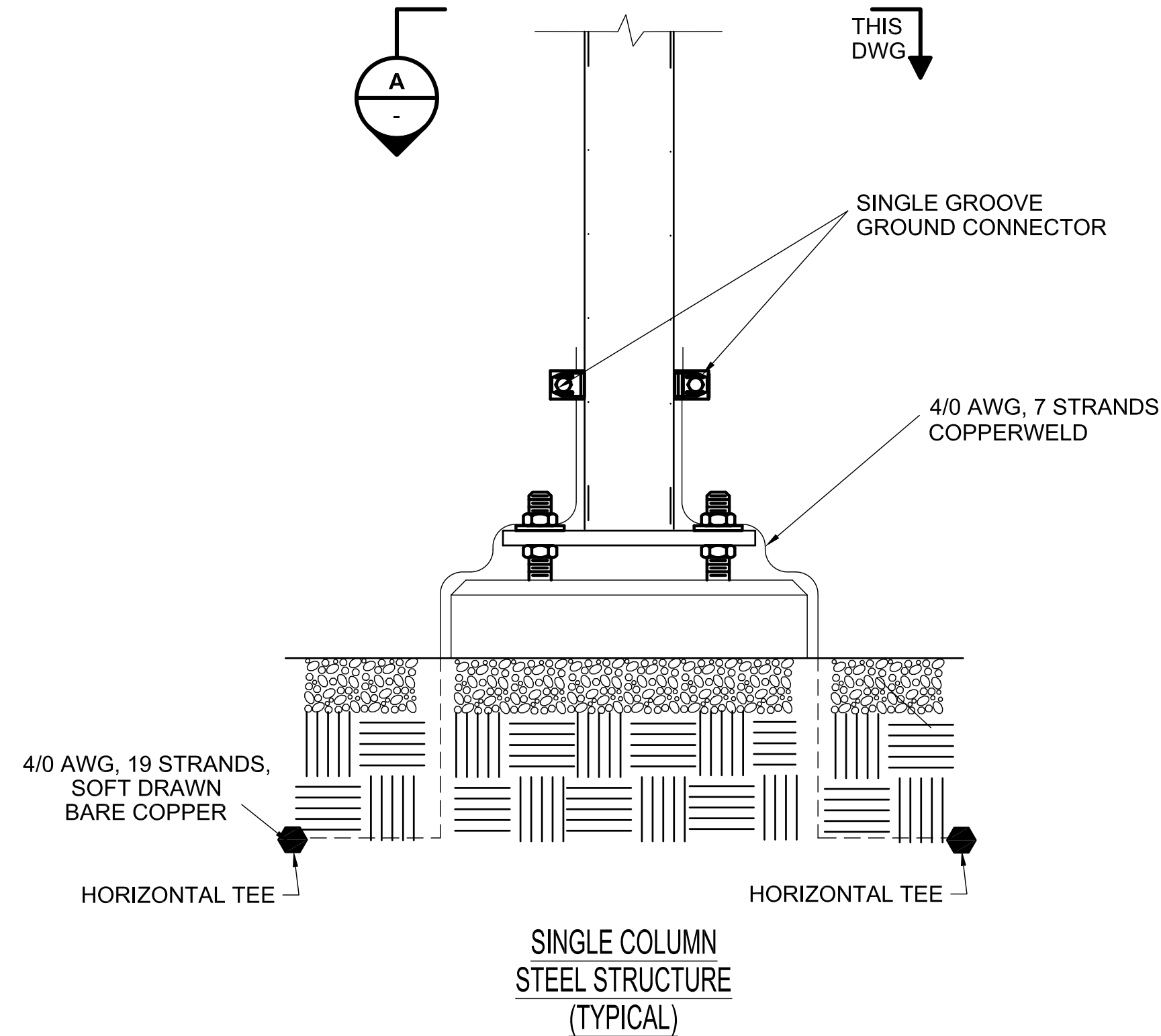
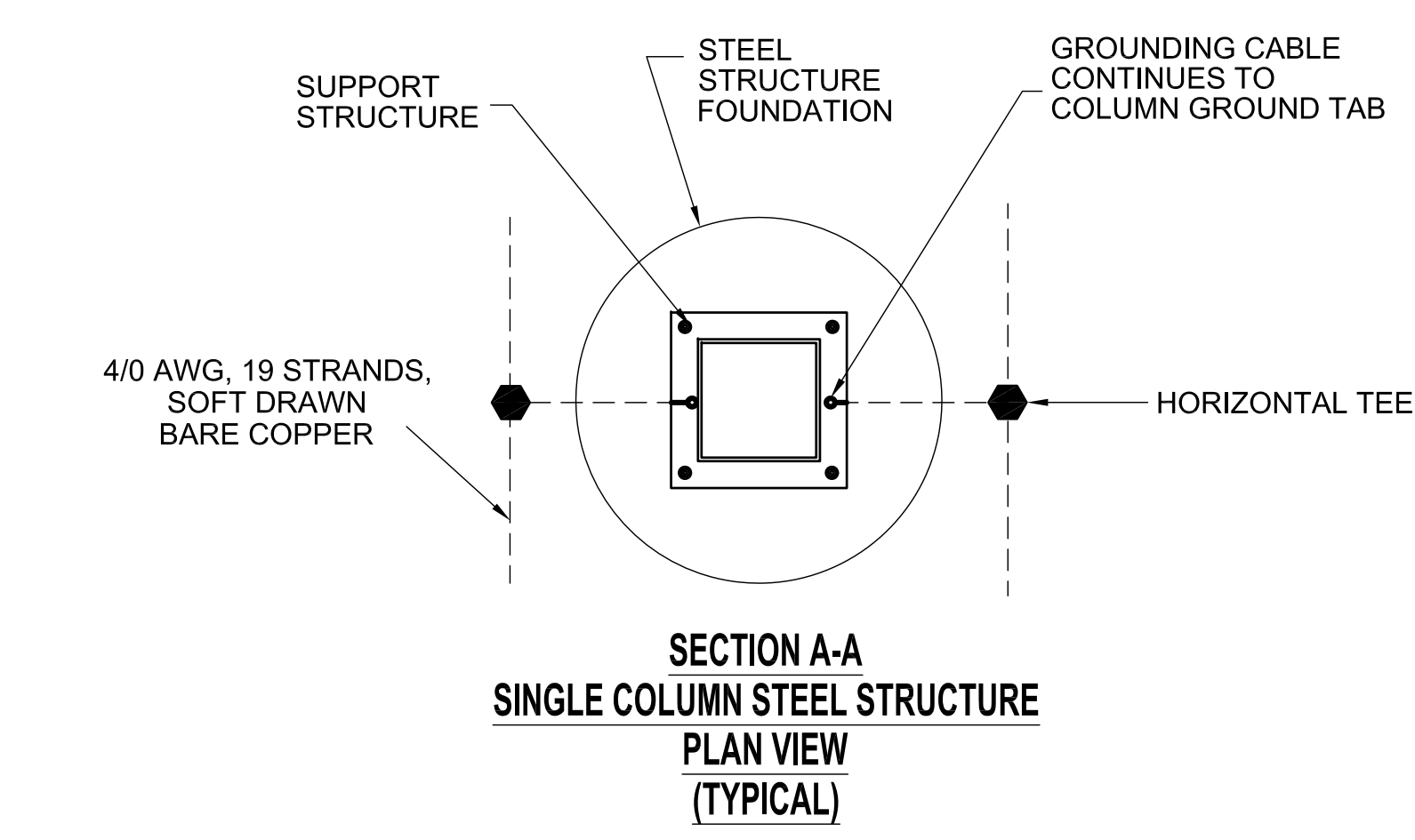
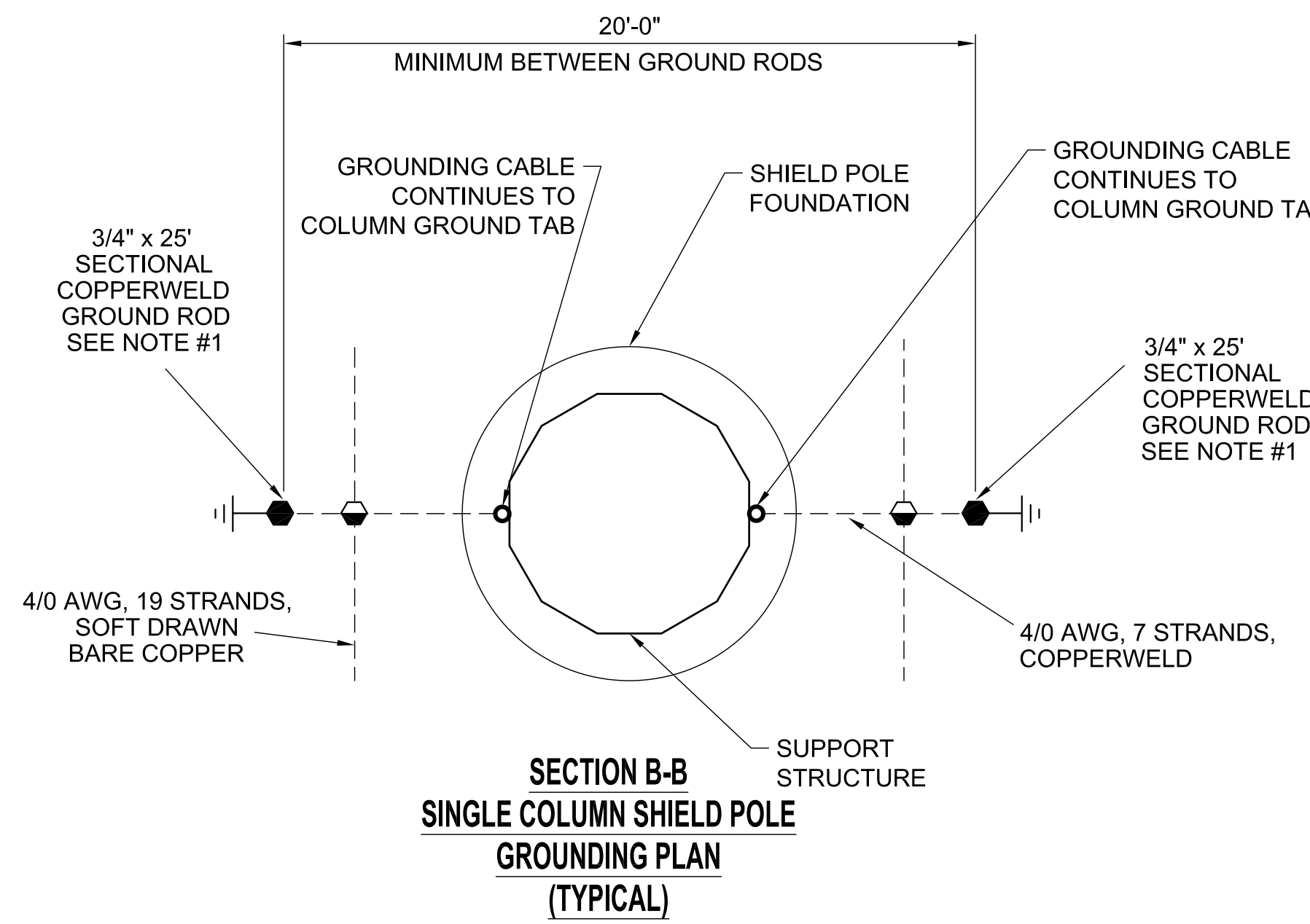
SYM	DESCRIPTION
---	BELOW GRADE 4/0 AWG, 19 STRANDS, SOFT DRAWN BARE BARE COPPER, (ABOVE GRADE SHOWN SOLID)
---	BELOW GRADE 4/0 AWG, 7 STRANDS, SOFT DRAWN BARE BARE COPPER, (ABOVE GRADE SHOWN SOLID)
⊥	GROUND ROD, COPPERWELD 3/4" X 25' SECTIONAL
⊕	CABLE CROSS CONNECTION,
⊕	CABLE HORIZONTAL TEE CONNECTION,

**GENERAL NOTES:**

- USE #80 GRIT EMERY CLOTH FOR BRIGHT CLEANING OF SOLID CONDUCTOR SURFACES, AND WIRE BRUSH FOR ALL STRANDED CONDUCTORS BEFORE EXOTHERMICALLY CONNECTING.
- PREHEAT THE MOLD AS PER MANUFACTURERS GUIDELINES PRIOR TO MAKING THE FIRST EXOTHERMIC CONNECTION.
- REFER TO MANUFACTURERS INSTRUCTIONS FOR PREPARATION AND PROCEDURES FOR PERFORMING EXOTHERMIC WELDS.
- A NO-OX-ID (SEPORT #611) ELECTRICAL JOINT COMPOUND (A CORROSION INHIBITOR FURNISHED BY CONTRACTOR) SHALL BE USED FOR THE FOLLOWING APPLICATIONS:
  - BETWEEN ALL CONNECTOR CONTACT SURFACES.
  - TO LUBRICATE UNLUBRICATED BOLTS MADE OF BRONZE, STAINLESS STEEL OR ALUMINUM USED WITH ELECTRICAL CONNECTORS.
  - TO IMPROVE CONNECTIONS AND PREVENT CORROSION OF GROUND BUS CONNECTIONS.
 ALL ALUMINUM CONTACT AREAS ARE TO BE WIRE BRUSHED PRIOR TO APPLYING THE ELECTRICAL JOINT COMPOUND.
- GROUND WIRE SHALL BE CONTINUOUS FROM POINT OF ORIGIN TO GRID. SPLICING OF GROUND WIRE WITH MECHANICAL CONNECTORS IS NOT PERMITTED. GROUND WIRE SHALL BE COPPER AND BE EXOTHERMICALLY CONNECTED TO GRID AT TWO DIFFERENT GRID RUNS.
- CONTRACTOR SHALL COIL UP ENOUGH OF THE GROUNDING JUMPER SO AS TO REACH THE CABINET CONNECTION POINT WITHOUT HAVING TO INSTALL A SPLICE.

**ISSUED FOR BID**

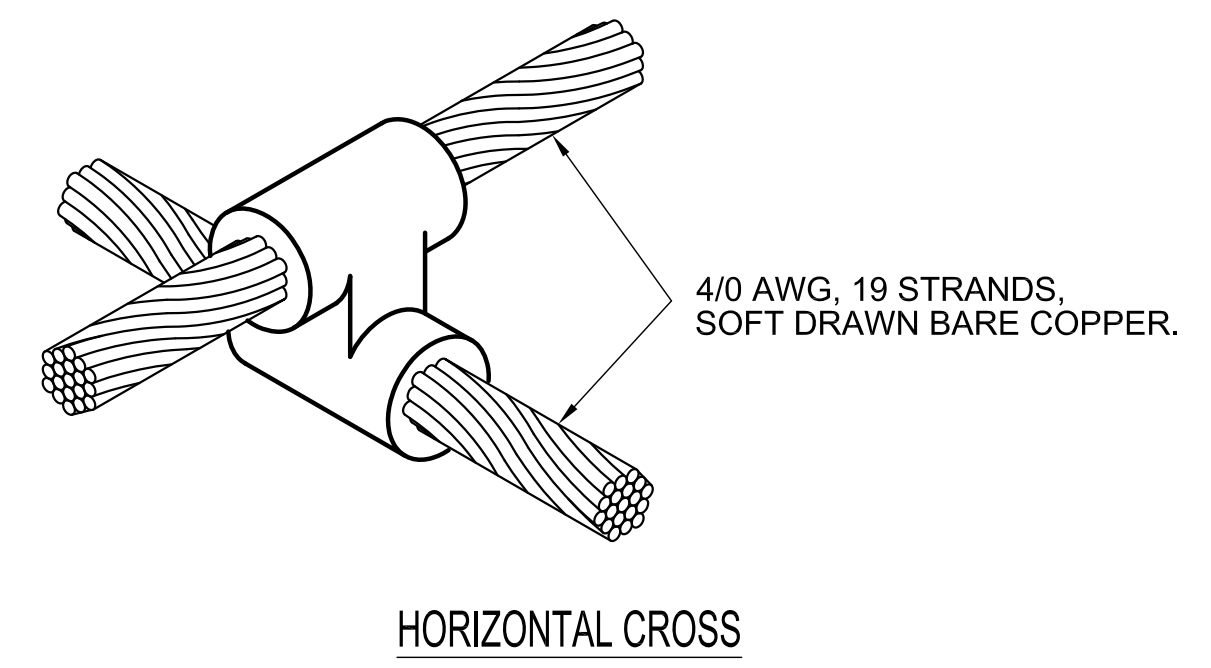
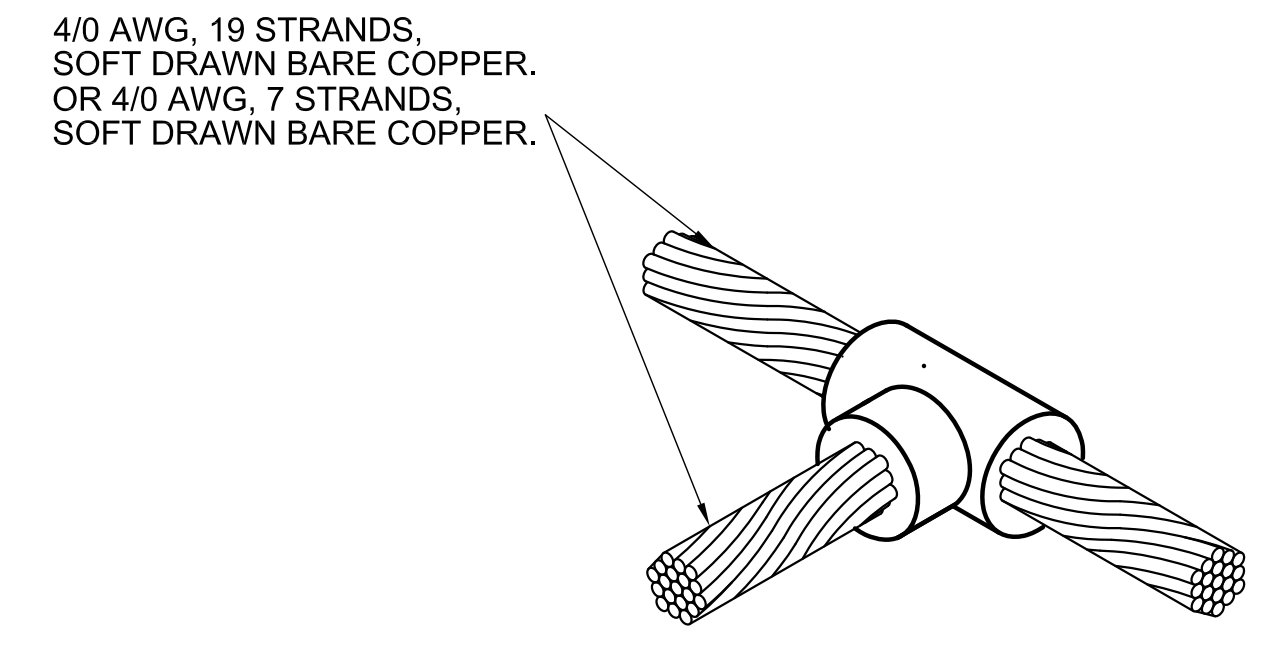
GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69KV			
GROUNDING DETAILS 3			
SCALE: NONE	DRAWN BY: JT	ENGR: BA	APPD: BA
	CH: BA	DATE: 09MAY12	
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294PG23</b>	REV. <b>0</b>



**LEGEND:**

SYM	DESCRIPTION
—	BELOW GRADE 4/0 AWG, 19 STRANDS, SOFT DRAWN BARE COPPER, (ABOVE GRADE SHOWN SOLID)
—	BELOW GRADE 4/0 AWG, 7 STRANDS, SOFT DRAWN BARE COPPER, (ABOVE GRADE SHOWN SOLID)
	GROUND ROD, COPPERWELD 3/4" X 25' SECTIONAL
⊕	CABLE CROSS CONNECTION,
⊕	CABLE HORIZONTAL TEE CONNECTION,

- GENERAL NOTES:**
- USE #80 GRIT EMERY CLOTH FOR BRIGHT CLEANING OF SOLID CONDUCTOR SURFACES, AND WIRE BRUSH FOR ALL STRANDED CONDUCTORS BEFORE EXOTHERMICALLY CONNECTING.
  - PREHEAT THE MOLD AS PER MANUFACTURERS GUIDELINES PRIOR TO MAKING THE FIRST EXOTHERMIC CONNECTION.
  - REFER TO MANUFACTURERS INSTRUCTIONS FOR PREPARATION AND PROCEDURES FOR PERFORMING EXOTHERMIC WELDS.
  - A NO-OX-ID (SEPORT #611) ELECTRICAL JOINT COMPOUND (A CORROSION INHIBITOR FURNISHED BY CONTRACTOR) SHALL BE USED FOR THE FOLLOWING APPLICATIONS:
    - BETWEEN ALL CONNECTOR CONTACT SURFACES,
    - TO LUBRICATE UNLUBRICATED BOLTS MADE OF BRONZE, STAINLESS STEEL OR ALUMINUM USED WITH ELECTRICAL CONNECTORS,
    - TO IMPROVE CONNECTIONS AND PREVENT CORROSION OF GROUND BUS CONNECTIONS.
 ALL ALUMINUM CONTACT AREAS ARE TO BE WIRE BRUSHED PRIOR TO APPLYING THE ELECTRICAL JOINT COMPOUND.
  - EXOTHERMIC CONNECTION SHOWN IN DETAIL G15 MUST BE "SHOT" IN HORIZONTAL POSITION BEFORE BEING INSTALLED IN ANY OTHER POSITION.



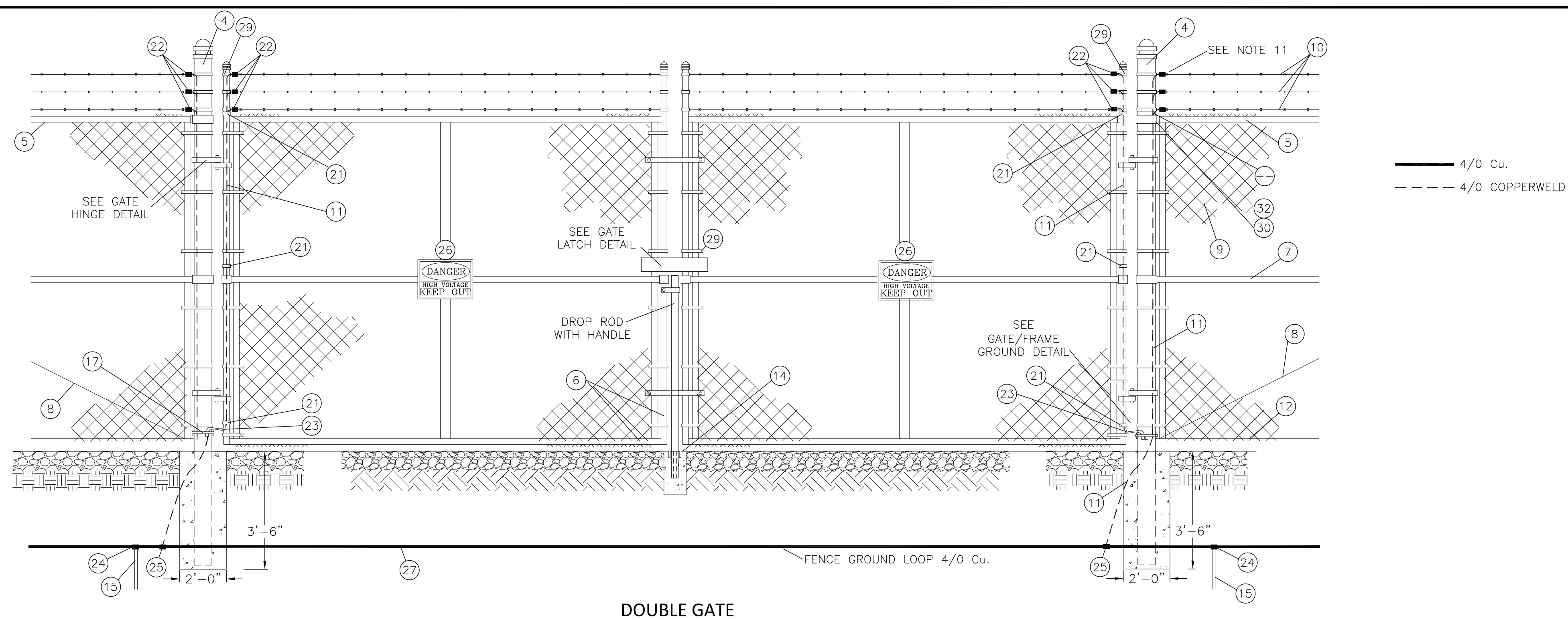
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
**AFTON SUBSTATION S294**  
 AFTON, OKLAHOMA  
 161/69KV  
**GROUNDING DETAILS 4**

SCALE: NONE	DRAWN BY: JT	ENGR: BA	APPD: BA
		CH: BA	DATE: 09MAY12
DRAWING No. <b>S294PG24</b>			REV. <b>0</b>

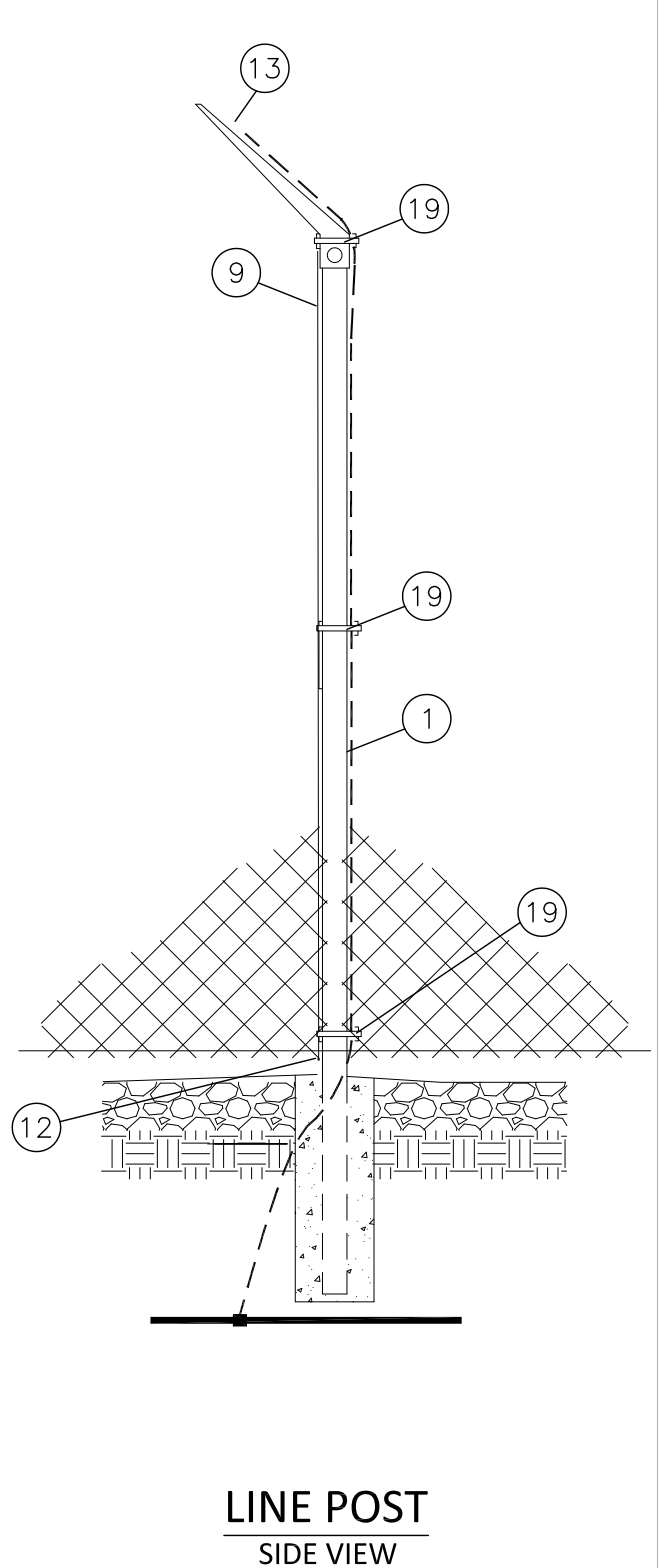
Grand River Dam Authority  
 P.O. BOX 409  
 VINITA, OK 74501

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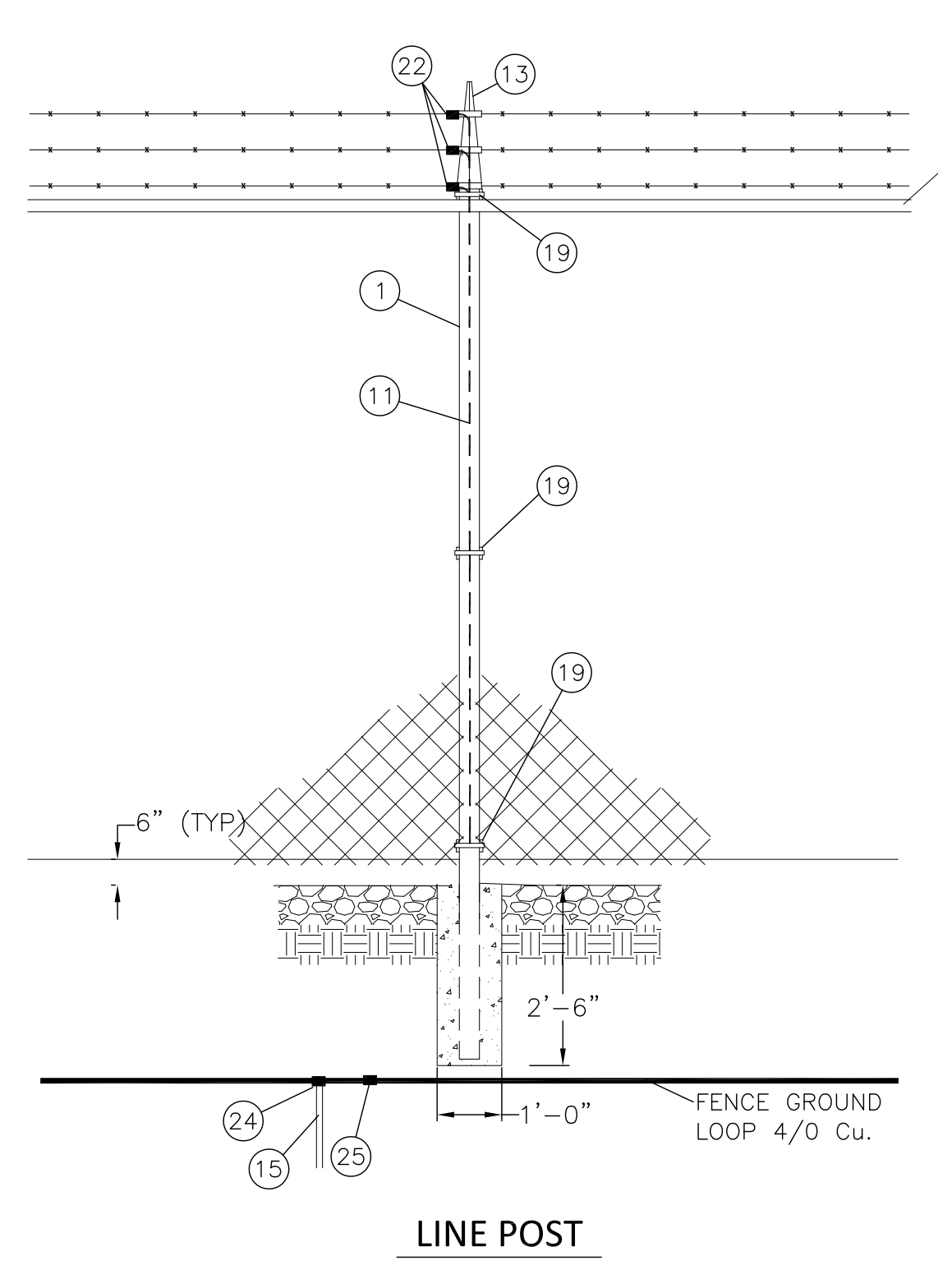


ITEM #	DESCRIPTION
1	LINE POST: 2" NPS (2.375" O.D.), GALVANIZED, SCHEDULE 40
2	CORNER POST: 3" NPS (3.50" O.D.), GALVANIZED, SCHEDULE 40
3	GATE POST: 3" NPS (3.50" O.D.), GALVANIZED, SCHEDULE 40
4	GATE POST: 3-1/2" NPS (4.00" O.D.), GALVANIZED, SCHEDULE 40
5	TOP RAIL: 1-1/4" NPS (1.660" O.D.), GALVANIZED, SCHEDULE 40
6	GATE FRAME: 1-1/2" NPS (1.90" O.D.), GALVANIZED, SCHEDULE 40
7	HORIZONTAL BRACE: 1-1/4" NPS (1.660" O.D.), GALVANIZED, SCHEDULE 40
8	TRUSS BRACE: 3/8" GALVANIZED ROD WITH TRUSS TIGHTENER
9	WOVEN FABRIC: 2" DIAMOND SHAPED "CHAIN LINK" MESH, GALVANIZED, #9 GAUGE
10	BARBED WIRE: #12-1/2 GAUGE, TWISTED, GALVANIZED
11	WIRE: 4/0 AWG BARE, 19 STRANDED; 40% COPPERWELD; TO BE INSTALLED ON THE INSIDE FACE OF POST (#046-0087-006)
12	BOTTOM TENSION WIRE: #9 GAUGE, STEEL, GALVANIZED
13	EXTENSION ARMS: #11 GAUGE, 45 DEGREE, GALVANIZED
14	ROADWAY PLATE: WITH ROD CHANNEL, GALVANIZED
15	GROUND ROD: 3/4" x 10', SECTIONAL, WITH COUPLING, COPPERWELD (#030-0291-006, COUPLING #030-0291-003)
16	GROUND CLAMP: U-BOLT: GATE POST (3 1/2" O.D.) TO 4/0 Cu. AND FLEXIBLE GROUND BRAID (#48-16-008; #48-11-001)
17	GROUND CLAMP: U-BOLT: GATE POST (4" O.D.) FOR 4/0 Cu. AND FLEXIBLE GROUND BRAID (#48-16-010)
18	GROUND CLAMP: U-BOLT: CORNER POST (4" O.D.) TO (3) 4/0 Cu. (#48-16-010)
19	GROUND CLAMP: U-BOLT: LINE POST (2 1/2" O.D.) TO 4/0 Cu. (#48-16-003)
20	GROUND CLAMP: U-BOLT: TOP RAIL/GATE FRAME (1.75" O.D.) TO 4/0 Cu.
21	GROUND CLAMP: U-BOLT: GATE FRAME (1.90" O.D.) TO 4/0 Cu. (#48-11-0)
22	GROUND CONNECTOR U-BOLT: SPLIT BOLT #12-1/2 GAUGE BARBED WIRE 4/0 STRANDED
23	FLEXIBLE GROUND BRAID: COPPER, TINNED, 18" LENGTH (#42-9-2)
24	MOLD EXOTHERMIC CONNECTION: WELD METAL, 4/0 Cu. TO 3/4" GROUND ROD (#20-51-2)
25	MOLD EXOTHERMIC CONNECTION: WELD METAL, 4/0 Cu. TO 4/0 Cu. (#20-51-8)
26	DANGER SIGNS: HIGH VOLTAGE, FENCE MOUNTED (#32-275-0) (TO BE PROVIDED BY GRDA)
27	4/0 WIRE, BARE, STRANDED (#46-104-001)
28	TENSION BAR: 1/4" X 3/4", #11 GAUGE, GALVANIZED
29	BAND FOR TENSION BAR, BARBED WIRE, TRUSS ROD, TENSION WIRE
30	BAND FOR RAIL
31	SOCKET FOR BRACE, RAIL & TRUSS
32	SOCKET FITTING, OFFSET LUG
33	GATE STOP

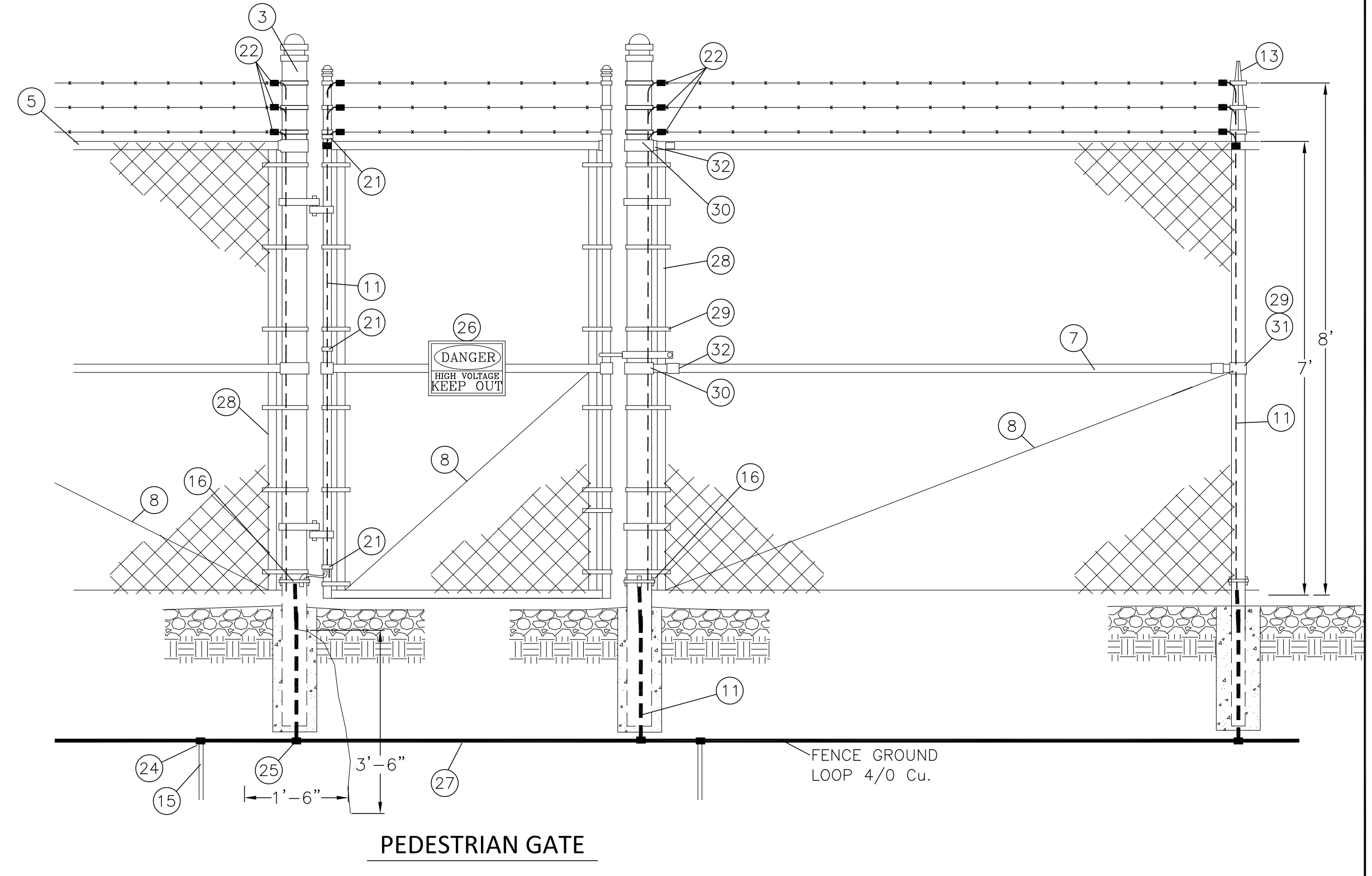
DOUBLE GATE



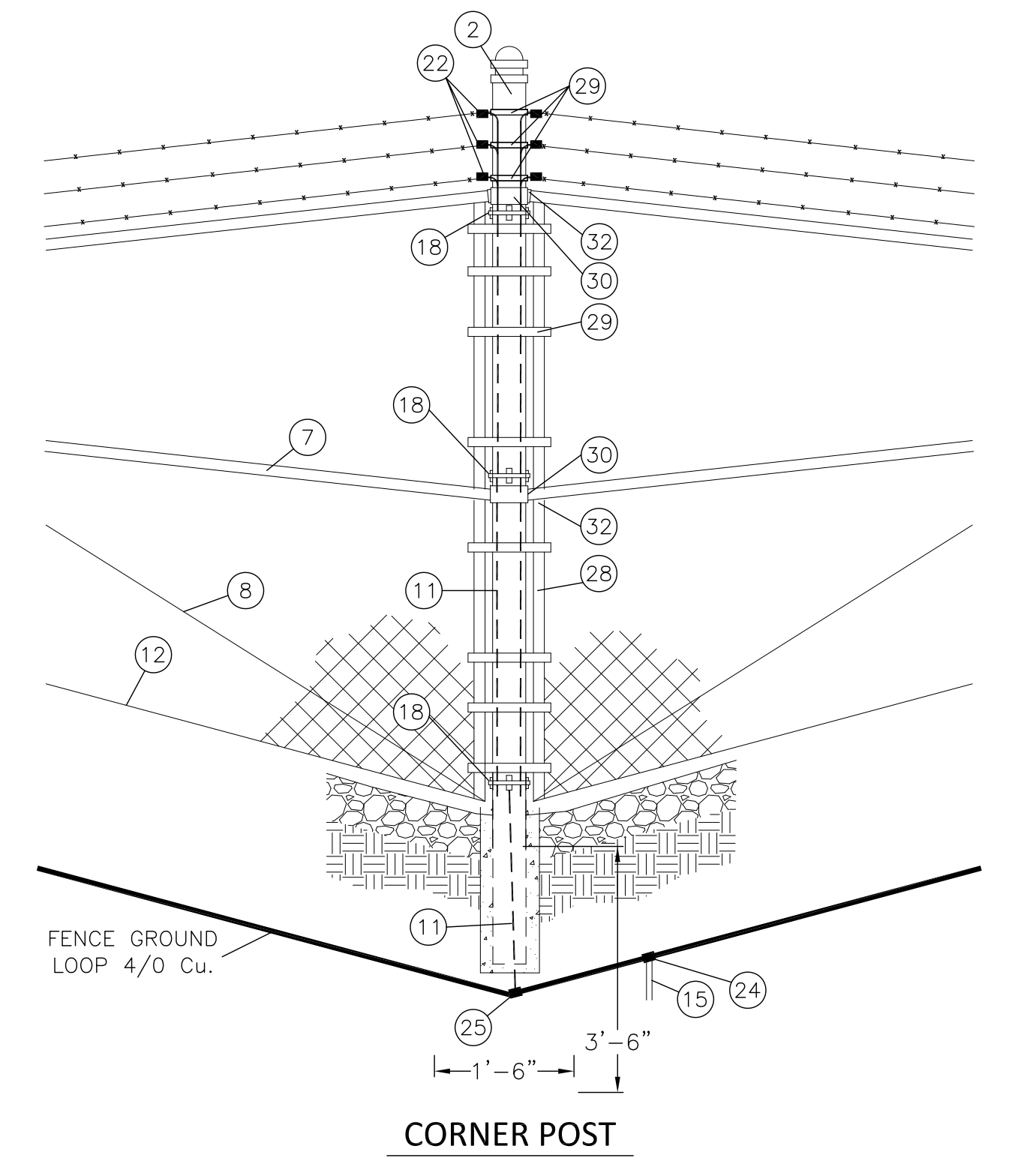
LINE POST  
SIDE VIEW



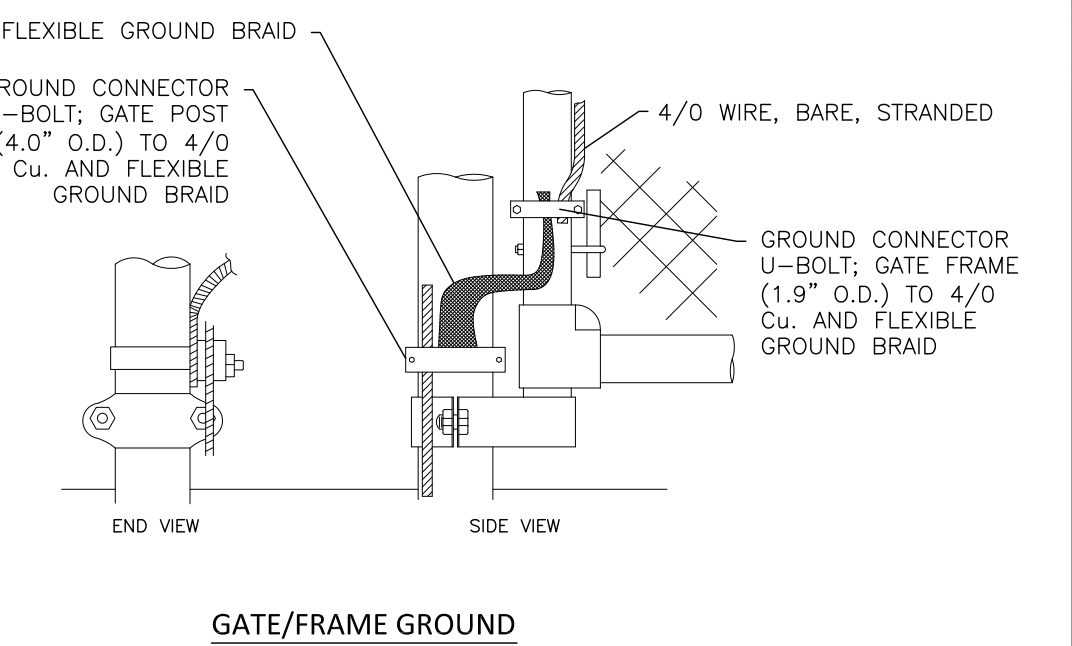
LINE POST



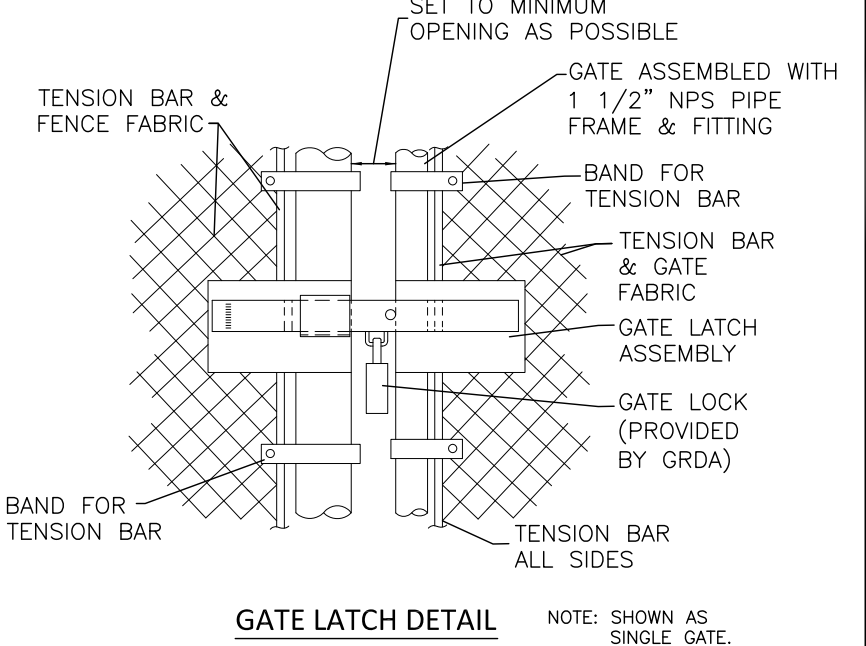
PEDESTRIAN GATE



CORNER POST

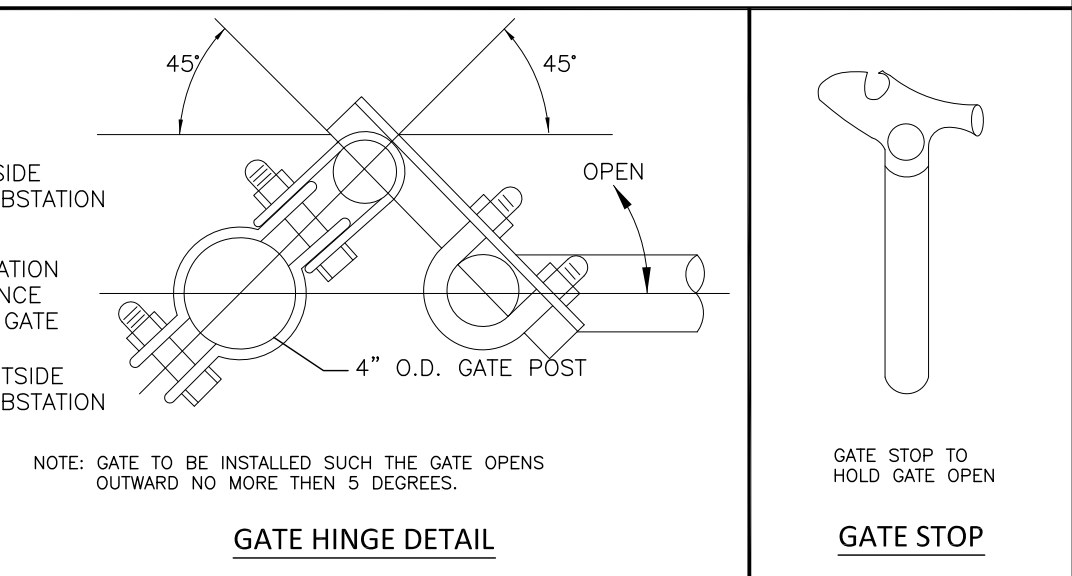


GATE/FRAME GROUND

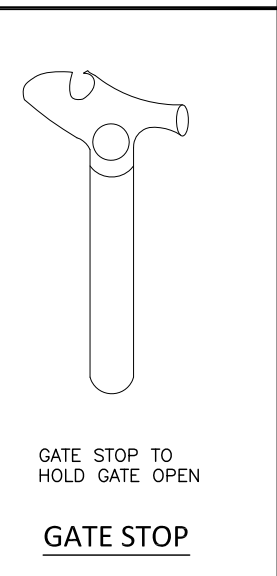


GATE LATCH DETAIL

NOTE: SHOWN AS SINGLE GATE.



GATE HINGE DETAIL



GATE STOP

- NOTES:
- GROUND FENCE AT EVERY CORNER.
  - GROUND FENCE AT MINIMUM (FIFTY) 50' INTERVALS.
  - AT LEAST ONE PAIR OF DANGER SIGNS SHALL BE PLACED ON EACH SIDE OF A SUBSTATION FENCE THAT ENCLOSES OPERATING ELECTRICAL EQUIPMENT. FOR FENCE LENGTHS BETWEEN 100' AND 150'; A SIGN IS TO BE LOCATED 25' FROM EACH CORNER OR END. FOR FENCE LENGTHS EXCEEDING 150' ADDITIONAL SIGNS SHALL BE MOUNTED SO THAT THE DISTANCE BETWEEN SIGNS DOES NOT EXCEED 100'.
  - GROUND WIRE SHALL BE ATTACHED TO INSIDE FACE OF LINE POST WITH MINIMUM THREE (3) U-BOLT-GROUND CONNECTORS.
  - BOTTOM TENSION WIRE TO BE SECURED TO CORNER AND GATE POST WITH TENSION BAND.
  - FABRIC TENSION BAR IS TO BE SECURED TO POST IN A MINIMUM OF FOUR (4) PLACES WITH CLAMP.
  - BANDS FOR TENSION BAR ARE TO BE INSTALLED EVERY FIFTEEN INCHES (15").
  - BOTTOM TENSION WIRE IS TO BE FASTENED WITH HOG RINGS ONTO FENCE FABRIC EVERY TWO FEET (2') INTERVALS.
  - BOTTOM OF FENCE FABRIC IS TO BE 6" (TYP.) ABOVE GRADE.
  - USE 4/0 COPPERWELD FOR ABOVE GRADE GROUNDING.
  - SPLIT STRANDING OF COPPERWELD AND ATTACH TO BARBED WIRE USING SPLIT BOLTS.
  - THE GAP BETWEEN GATE AND GATE POST AND THE GAP BETWEEN GATES SHALL HELD TO A MINIMUM DISTANCE.
  - GROUNDING CONNECTIONS TO FENCE TO BE ON SUBSTATION SIDE OF FENCE.
  - ITEM NUMBERS ON THIS DRAWING ARE FOR IDENTIFICATION ONLY. NUMBERS DO NOT MATCH BILL OF MATERIAL DRAWINGS.

**ISSUED FOR BID**

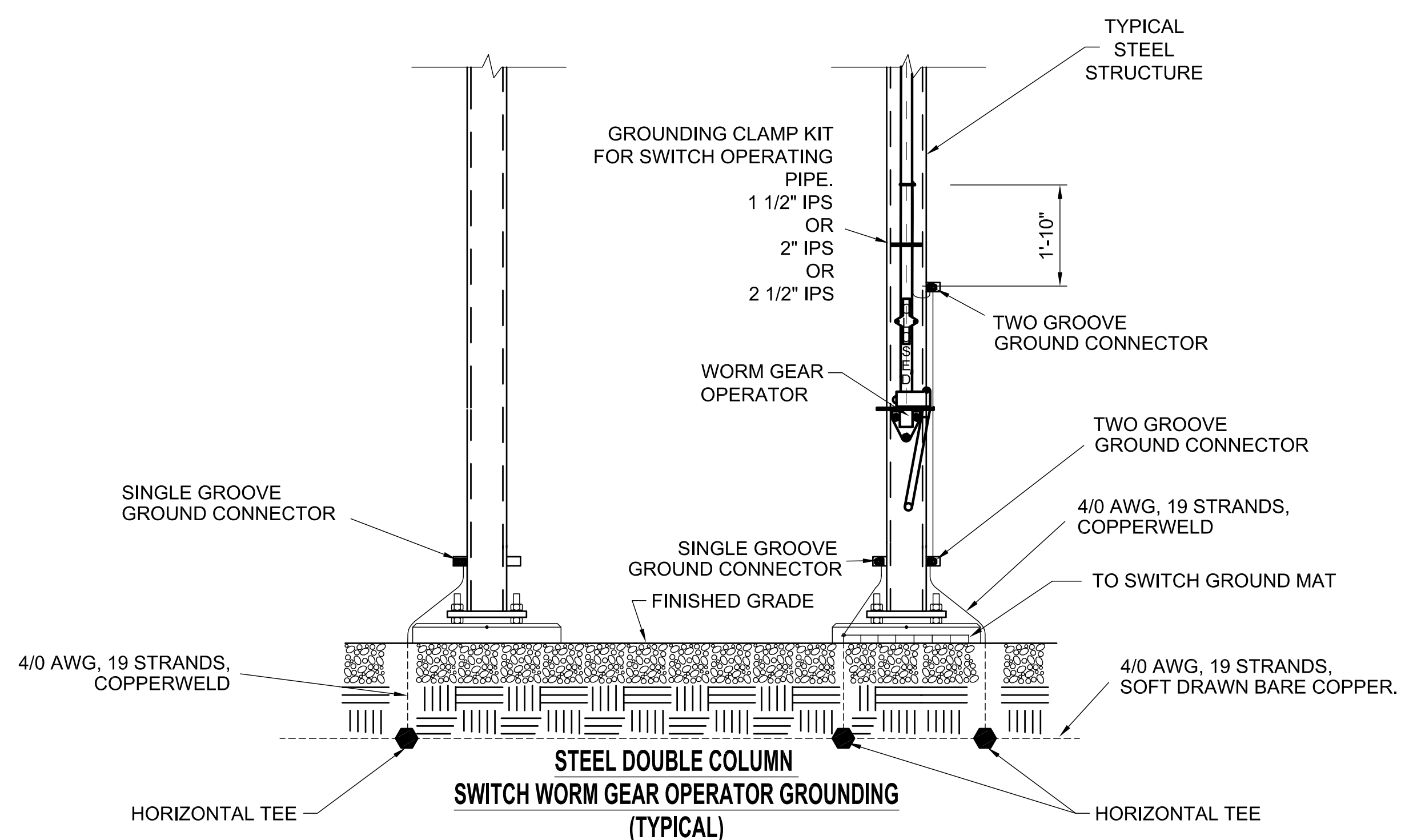
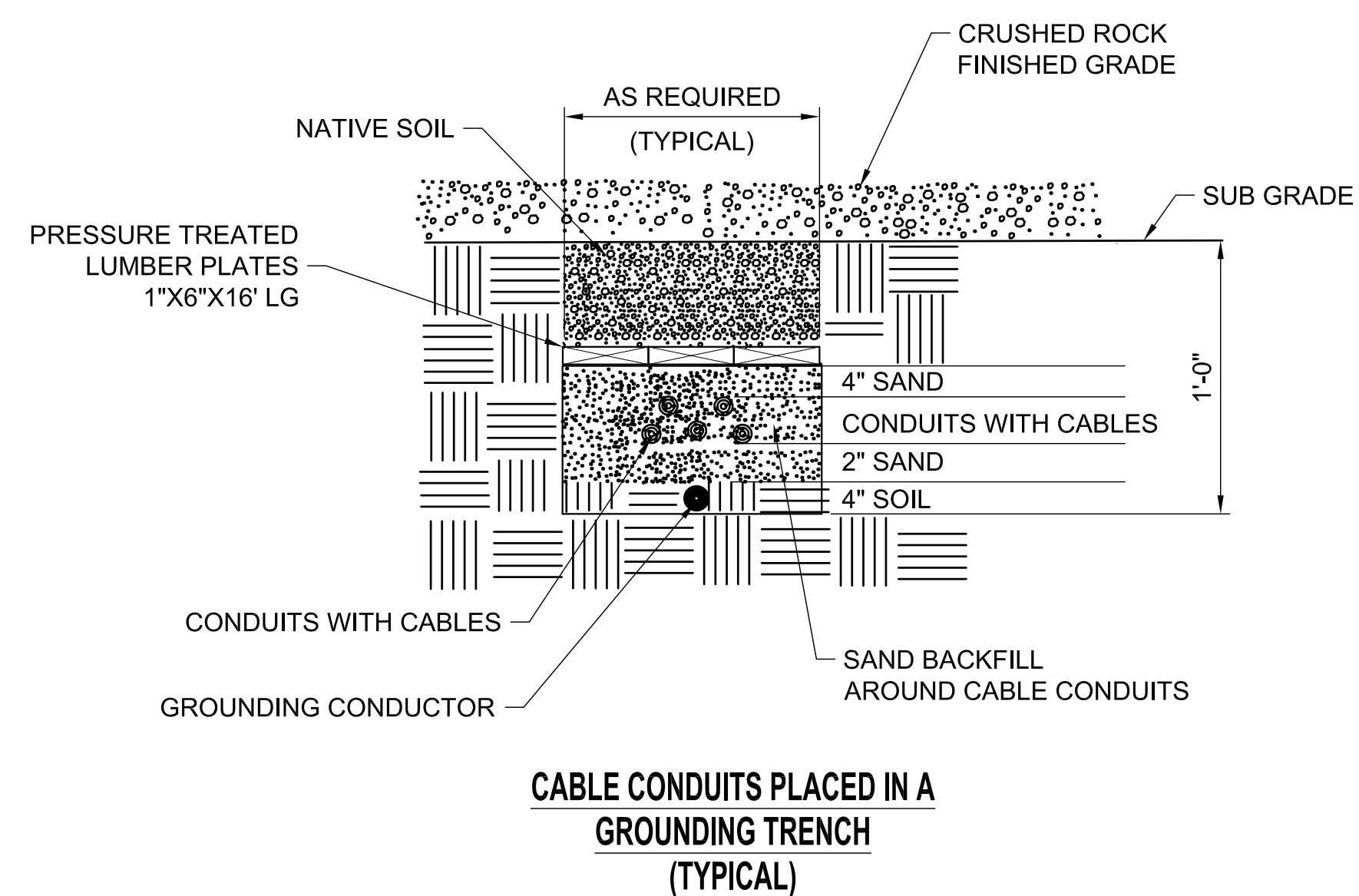
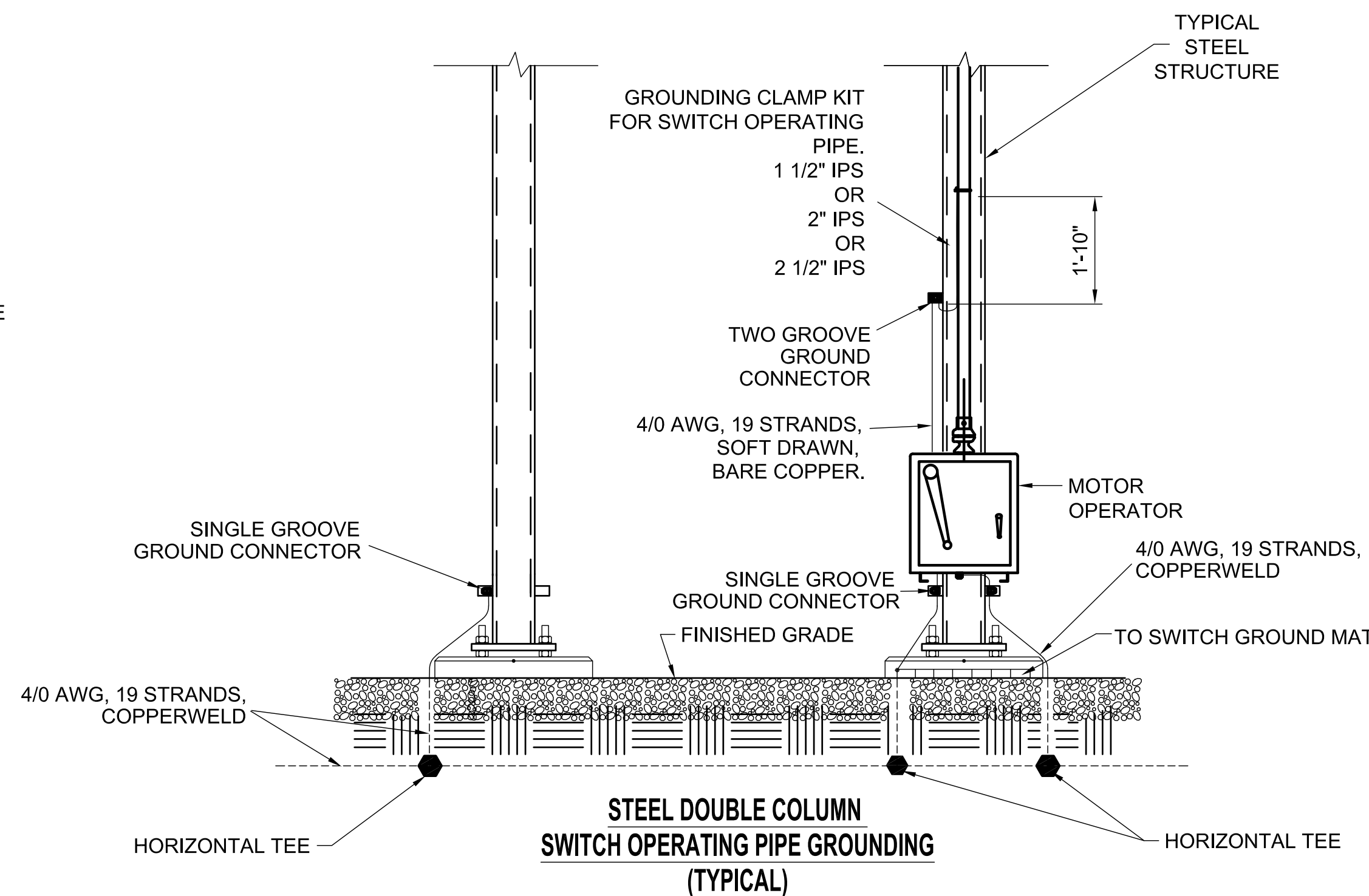
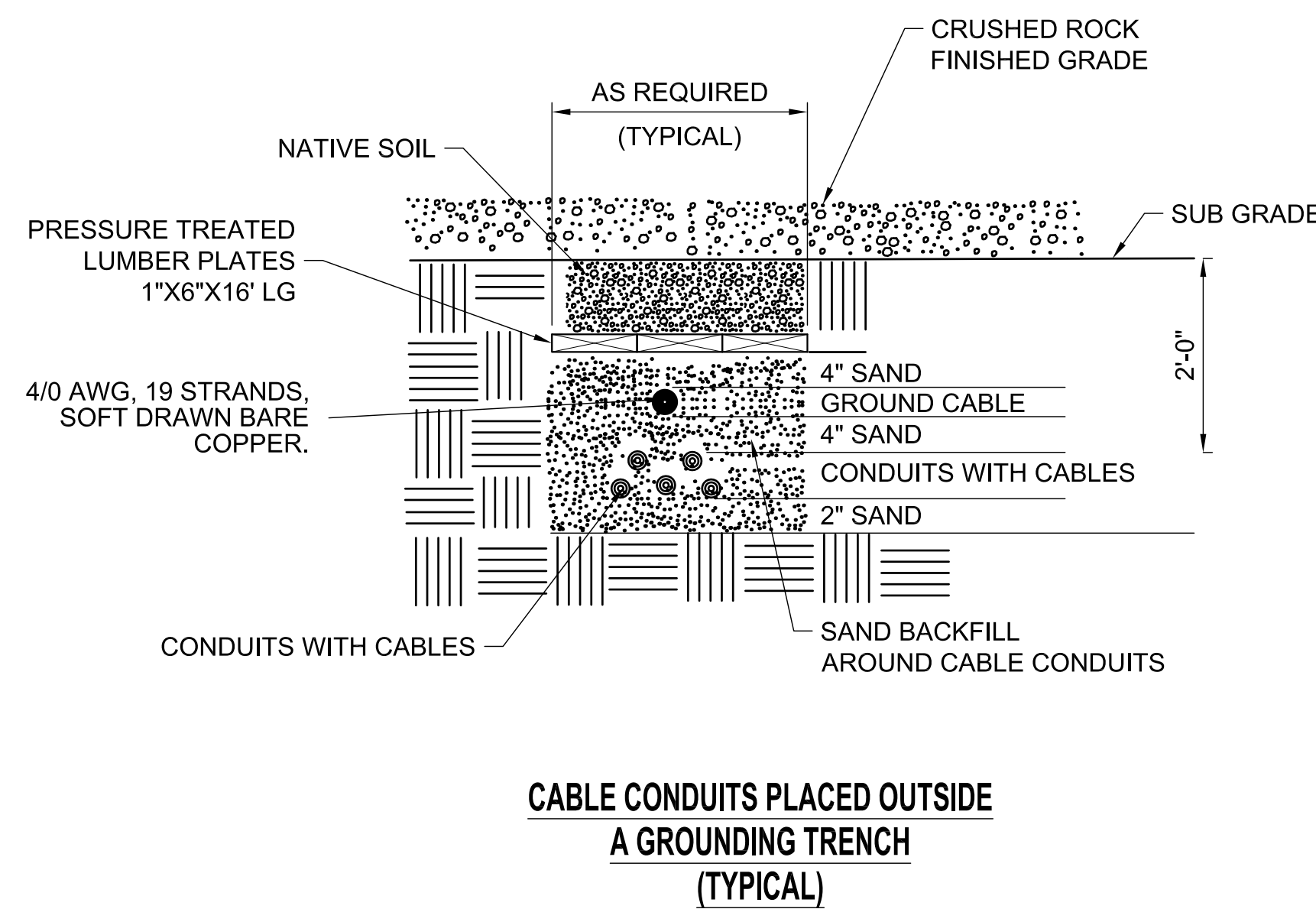
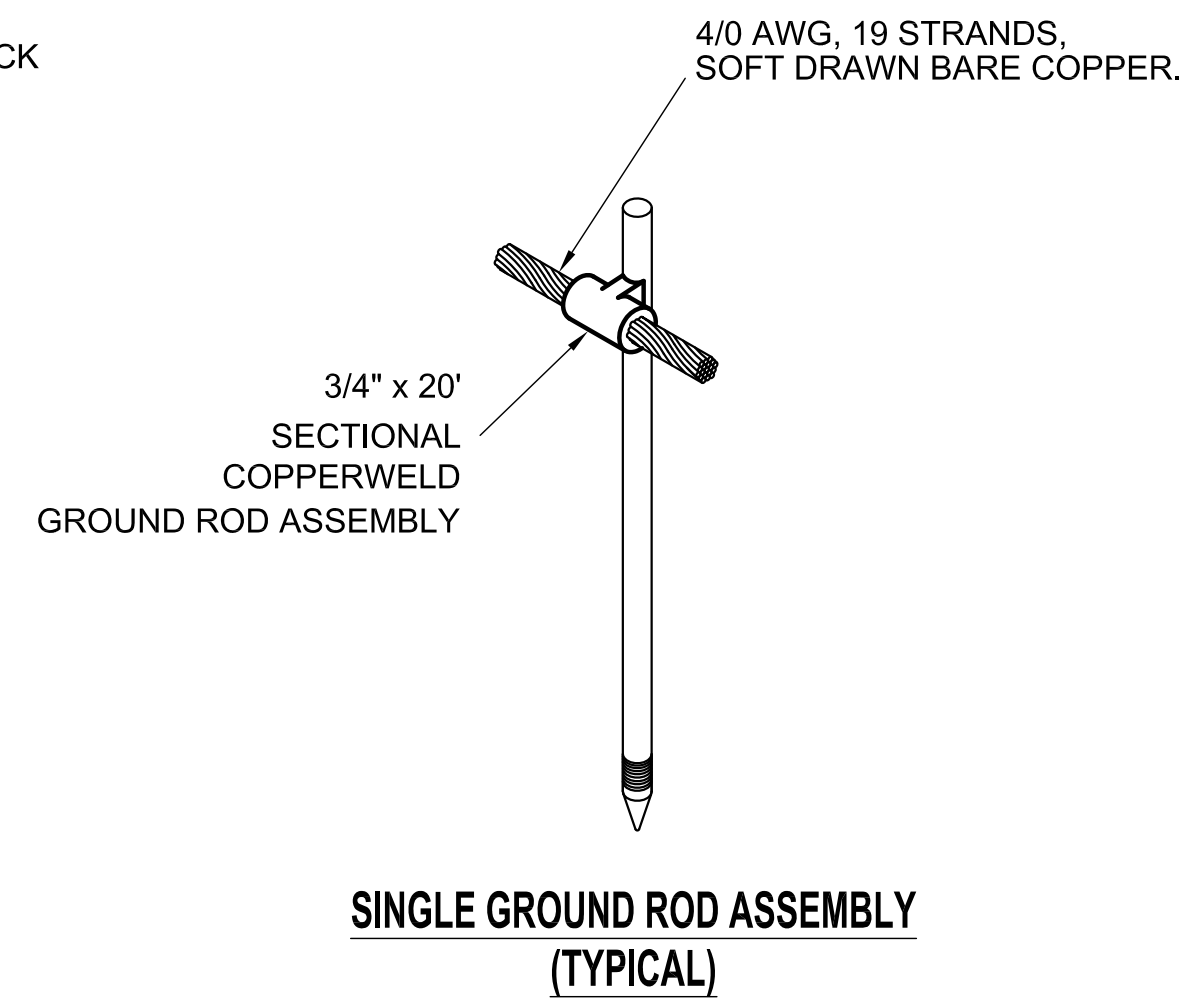
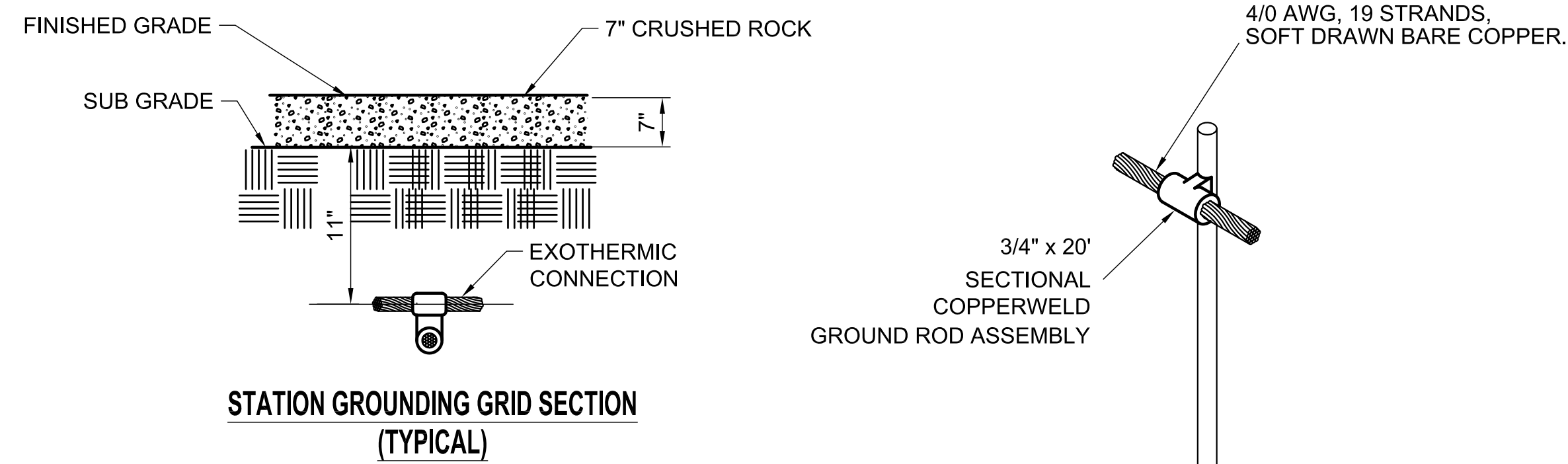
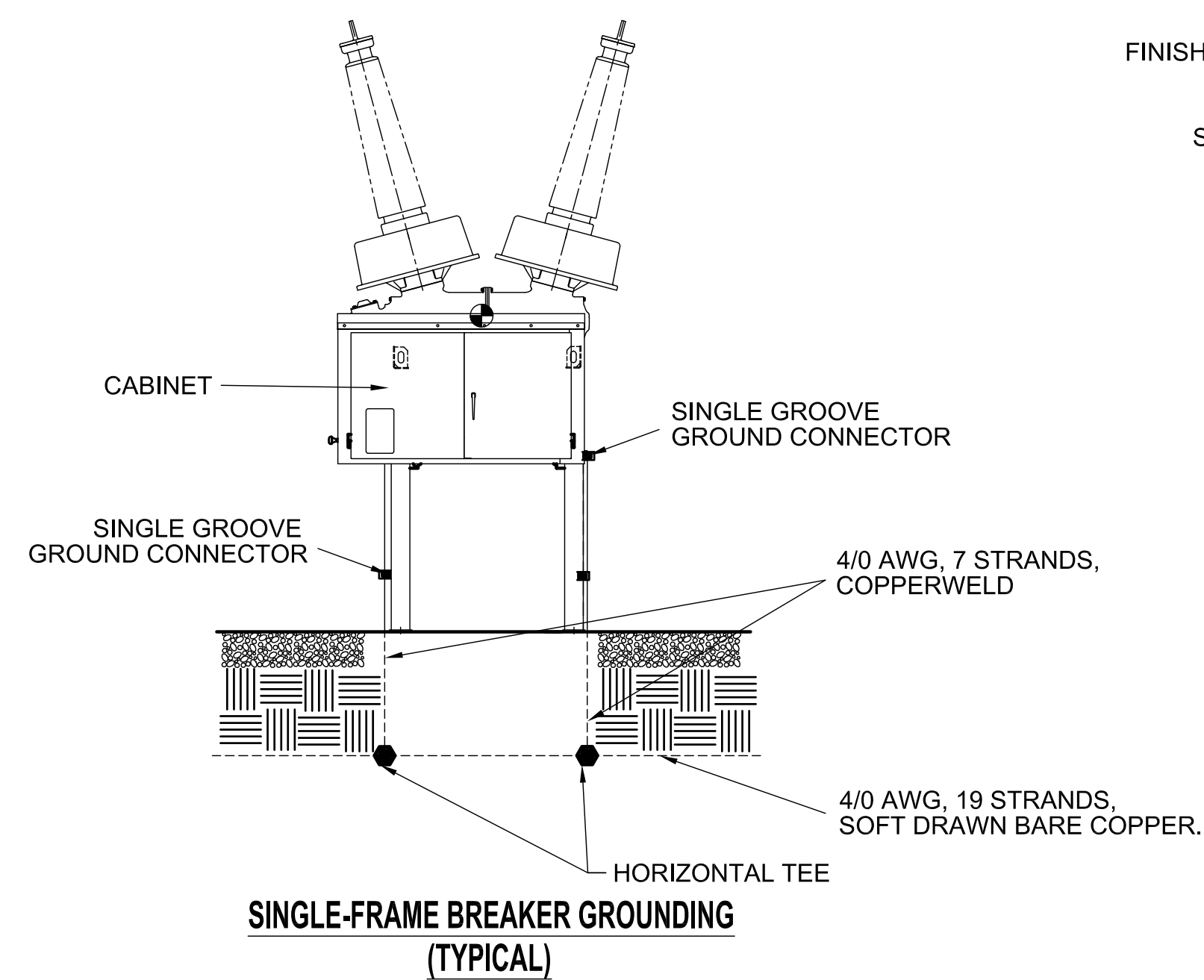
GRAND RIVER DAM AUTHORITY  
**STANDARD FENCE DETAIL S294**  
 AFTON, OKLAHOMA  
 161/69kV

**SUBSTATION FENCE AND  
 FENCE GROUNDING DETAILS**

SCALE: NONE	DRAWN BY: AS	ENGR: BA	APPD: BA
0	5/29/12	ISSUED FOR BID	AS BA
REV	DATE	DESCRIPTION	DFT ENG

GRDA  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

DRAWING No. **S294PC25** REV. **0**



**LEGEND:**

SYM	DESCRIPTION
---	BELOW GRADE 4/0 AWG, 19 STRANDS, SOFT DRAWN BARE COPPER, (ABOVE GRADE SHOWN SOLID)
---	BELOW GRADE 4/0 AWG, 7 STRANDS, SOFT DRAWN BARE COPPER, (ABOVE GRADE SHOWN SOLID)
○	CABLE CROSS CONNECTION,
●	CABLE HORIZONTAL TEE CONNECTION,

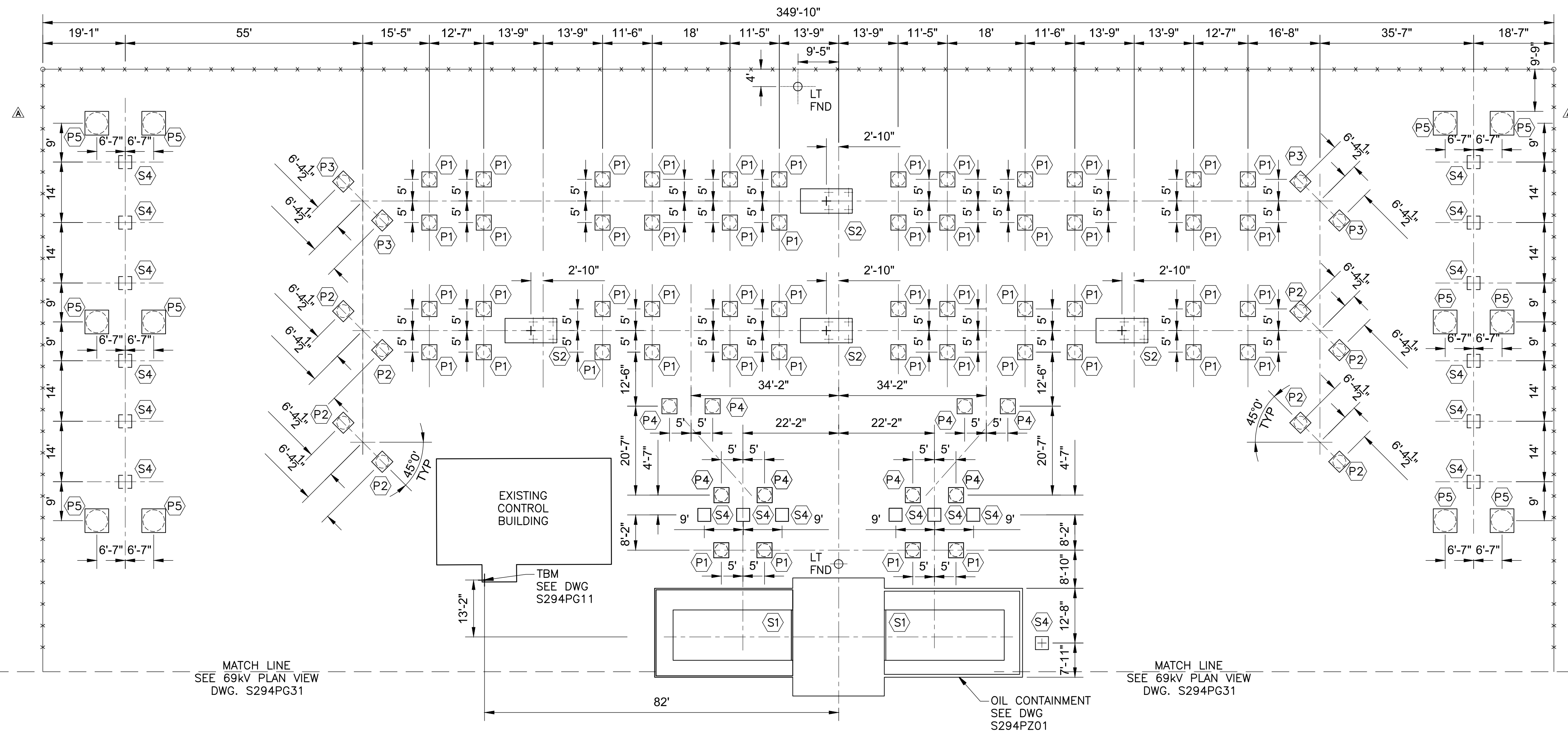
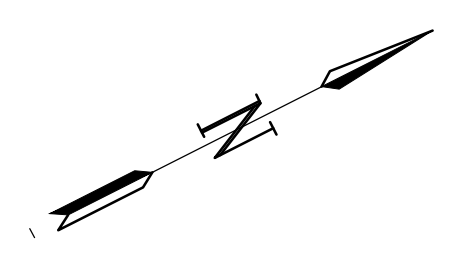
**GENERAL NOTES:**

- USE #80 GRIT EMERY CLOTH FOR BRIGHT CLEANING OF SOLID CONDUCTOR SURFACES, AND WIRE BRUSH FOR ALL STRANDED CONDUCTORS BEFORE EXOTHERMICALLY CONNECTING.
- PREHEAT THE MOLD AS PER MANUFACTURERS GUIDELINES PRIOR TO MAKING THE FIRST EXOTHERMIC CONNECTION.
- REFER TO MANUFACTURERS INSTRUCTIONS FOR PREPARATION AND PROCEDURES FOR PERFORMING EXOTHERMIC WELDS.
- A NO-OX-ID (SEPORT #611) ELECTRICAL JOINT COMPOUND (A CORROSION INHIBITOR FINISHED BY CONTRACTOR) SHALL BE USED FOR THE FOLLOWING APPLICATIONS:
  - BETWEEN ALL CONNECTOR CONTACT SURFACES,
  - TO LUBRICATE UNLUBRICATED BOLTS MADE OF BRONZE, STAINLESS STEEL OR ALUMINUM USED WITH ELECTRICAL CONNECTORS,
  - TO IMPROVE CONNECTIONS AND PREVENT CORROSION OF GROUND BUS CONNECTIONS,
 ALL ALUMINUM CONTACT AREAS ARE TO BE WIRE BRUSHED PRIOR TO APPLYING THE ELECTRICAL JOINT COMPOUND.
- THE CABINET GROUND CAN BE RUN INSIDE THE CONDUIT TO THE GROUND BAR INSIDE THE CABINET OR UP THE SIDE OF THE STRUCTURE TO THE GROUND LUG ON THE SIDE OF THE CABINET.
- CONTRACTOR SHALL COIL UP ENOUGH OF THE GROUNDING JUMPER SO AS TO REACH THE CABINET CONNECTION POINT WITHOUT HAVING TO INSTALL A SPLICE.
- BACKFILL-
  - OBTAIN BACKFILL MATERIALS FROM TRENCHES AND OTHER EXCAVATION IN THIS CONTRACT AND/OR FROM THE SITE BORROW AREAS AS DESIGNATED BY THE RESIDENT PROJECT REPRESENTATIVE.
  - BACKFILL MATERIALS INCLUDE MATERIAL THAT IS FREE OF DEBRIS, ROOTS, ORGANIC MATTER, REFUSE, CINDERS, FROZEN MATTER AND ALSO FREE OF ROCK WITH A DIMENSION GREATER THAN 2 INCHES.
- COMPACTION-
  - PLACE BACKFILL MATERIAL IN LEVEL LAYERS NOT EXCEEDING 4 TO 8 INCHES.
  - USE APPROVED MECHANICAL METHODS WHERE HAND BACKFILL IS NOT REQUIRED.
  - FOR BACKFILL COMPACTION AND MOISTURE CONTENT REQUIREMENTS, SEE SITEWORK PREPARATION AND EARTHWORK SPECIFICATIONS.

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69KV			
<b>GROUNDING DETAILS 5</b>			
SCALE: NONE	DRAWN BY: JT	ENGR: BA	APPD: BA
		CH: BA	DATE: 09MAY12
		DRAWING No.	REV.
		<b>S294PG26</b>	<b>0</b>

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**REFERENCE DRAWINGS**

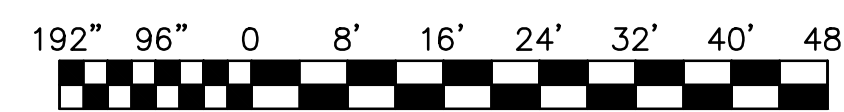
- S294PE30 FENCE & GROUNDING DETAILS
- S294PG11 SITE GRADING PLAN
- S294PG31 69kV FOUNDATION PLAN
- S294PG32 STATION CENTERLINE CONTROL POINT
- S294PG33 FOUNDATION DETAILS
- S294PG34 FOUNDATION DETAILS
- S294PZ01 OIL CONTAINMENT PLAN

**NOTE:**

1. SEE DRAWING S294PE30 FOR LIGHT FIXTURE FOUNDATION

**LEGEND:**

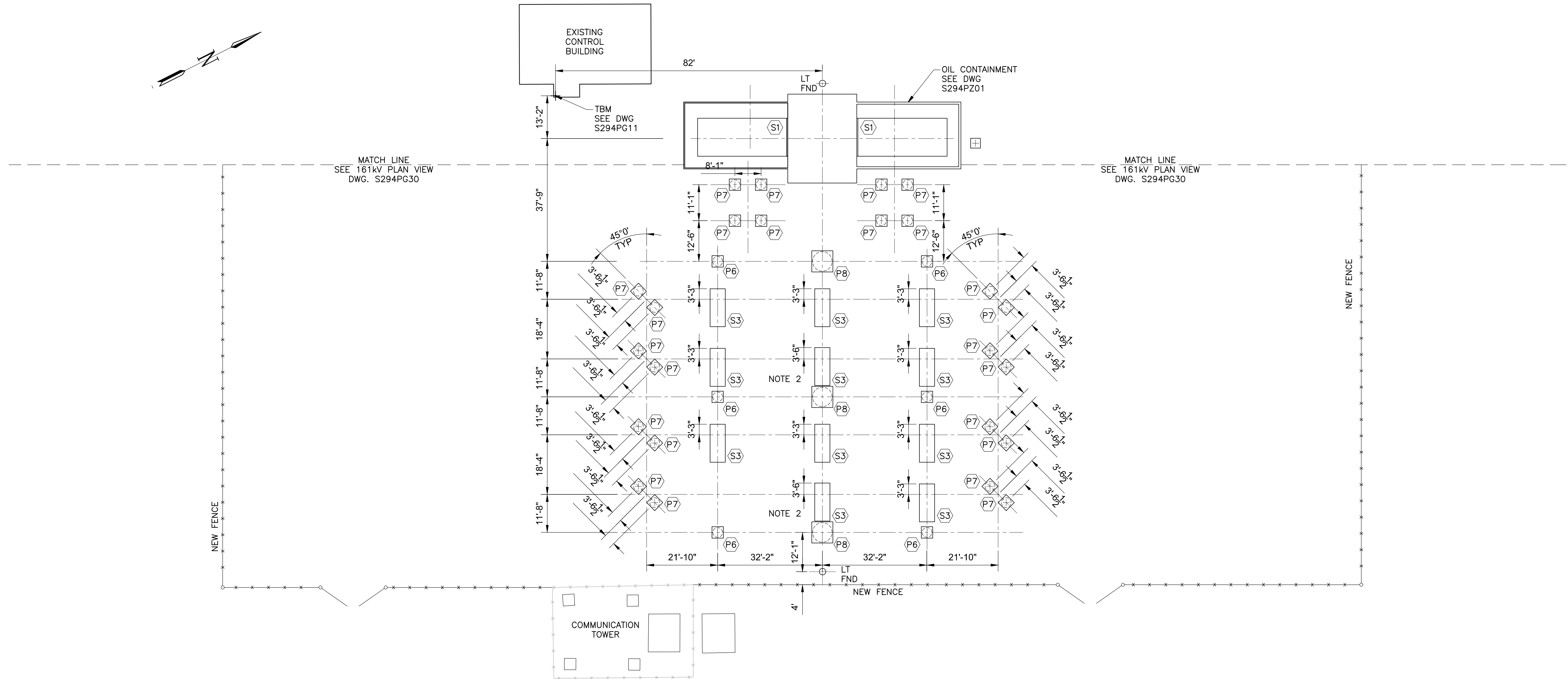
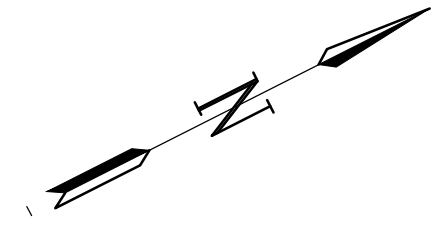
- (P#) REFER TO DRILLED PIER SCHEDULE AND DETAILS SHEET S294PG33
- (S#) REFER TO EQUIPMENT PAD SCHEDULE AND DETAILS SHEET S294PG33



**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69kV</small>	
<b>161kV</b> <b>FOUNDATION PLAN VIEW</b>	
SCALE: AS SHOWN	DRAWN BY: SAC
ENGR: AEM	APPD: BA
CH: MW	DATE: 3/7/2011
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>	DRAWING No. <b>S294PG30</b>
REV	REV
DATE	DFT ENG
ISSUED FOR BID	AS MW
RELOCATE FOOTINGS 5' SE	AS MW
REVISION DESCRIPTION	DFT ENG

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**REFERENCE DRAWINGS**

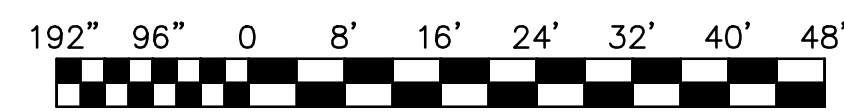
- S294PG11 SITE GRADING PLAN
- S294PG30 161kV FOUNDATION PLAN
- S294PG32 STATION CENTERLINE CONTROL POINT
- S294PG33 FOUNDATION DETAILS
- S294PG34 FOUNDATION DETAILS
- S294PZ01 OIL CONTAINMENT PLAN

**NOTE:**

1. SEE DWG S294PG30 FOR LIGHT FOUNDATION
2. TWO BREAKER FOUNDATIONS SHIFTED FOR CLEARANCE.

**LEGEND:**

- P# REFER TO DRILLED PIER SCHEDULE AND DETAILS SHEET S294PG33
- S# REFER TO EQUIPMENT PAD SCHEDULE AND DETAILS SHEET S294PG33



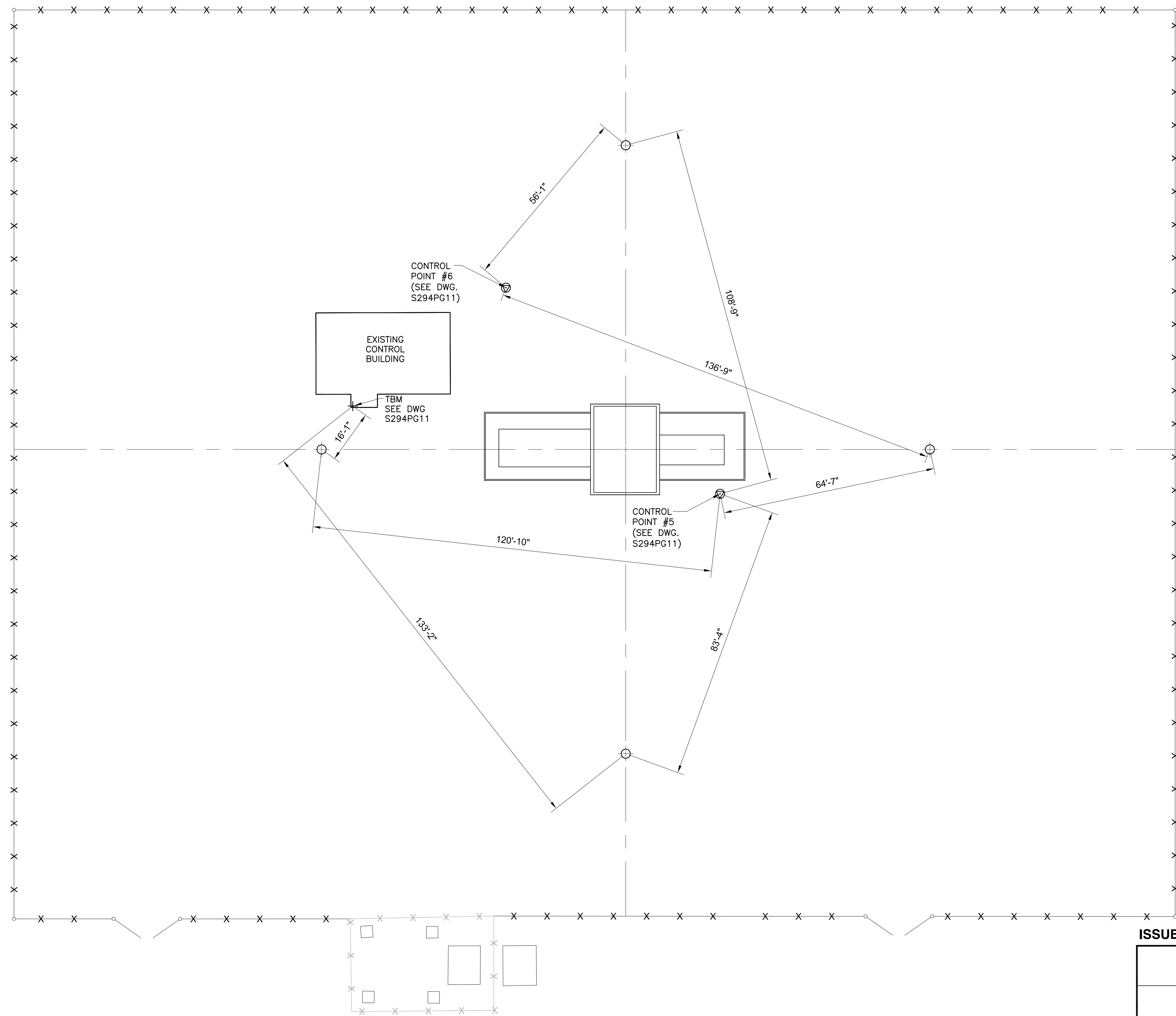
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69kV</small>			
<b>69kV</b> <b>FOUNDATION PLAN VIEW</b>			
SCALE: AS SHOWN	DRAWN BY: SAC	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>			DRAWING No. <b>S294PG31</b> REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	AS	BA



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**LEGEND:**  
 ⊗ - CONTROL POINT SET BY GARVER  
 ⊕ - CONTRACTOR SHALL ESTABLISH LOCATION IN ORDER TO LOCATE LINE IN FIELD

**REFERENCE DRAWINGS**  
 S294PG11 SITE GRADING PLAN

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69kV

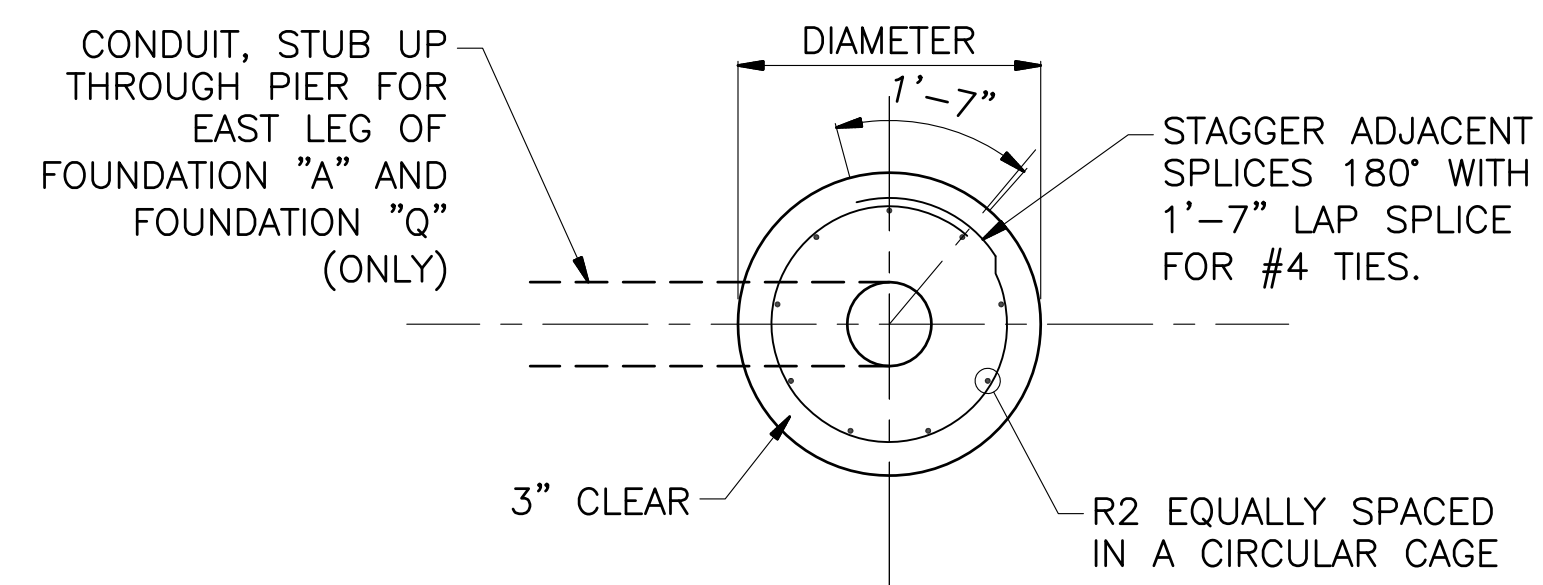
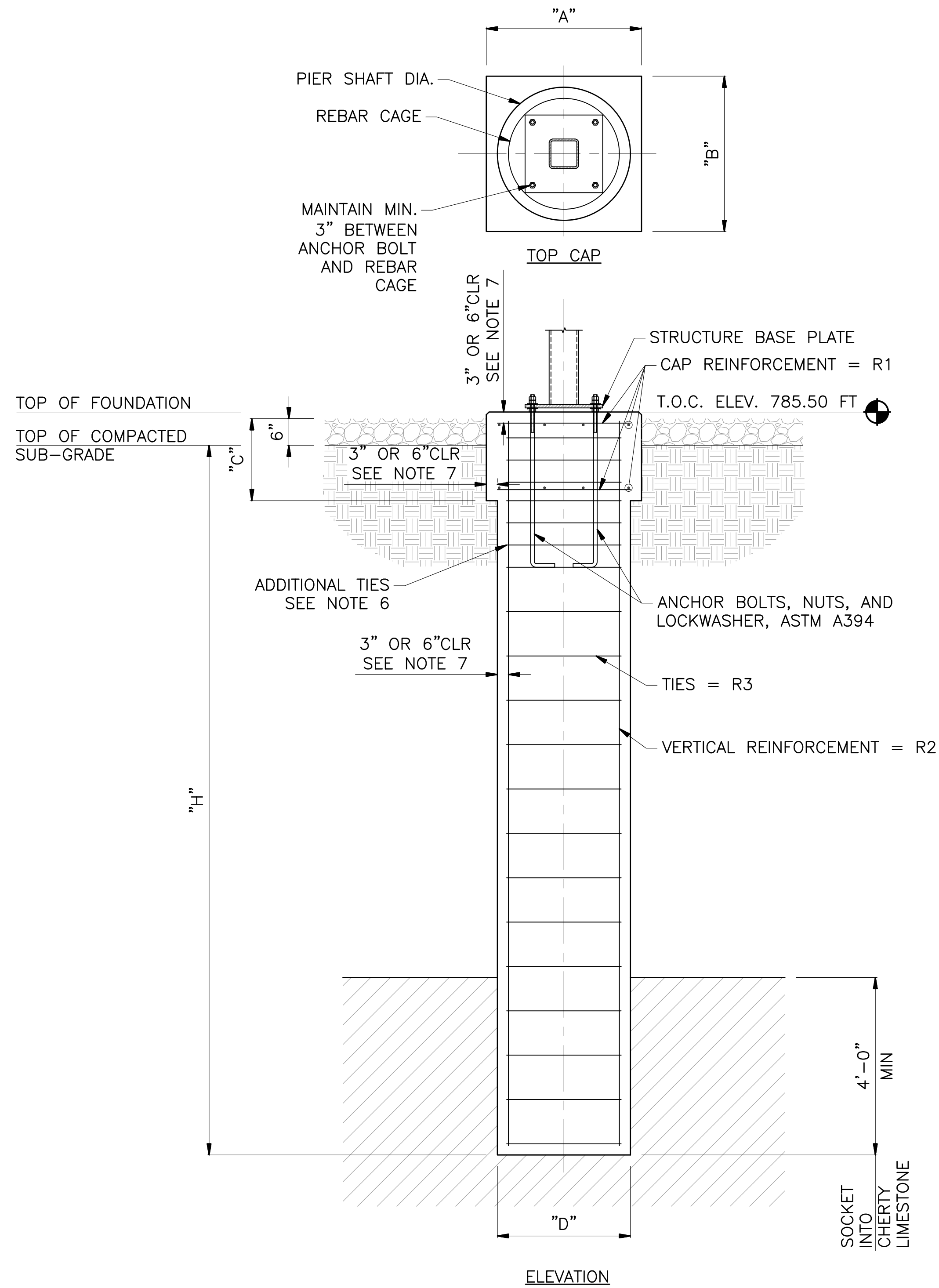
**STATION CENTERLINE CONTROL POINTS**

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DRAWING No. S294PG32		REV. 0	

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

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1 TYPICAL DRILLED PIER FOUNDATION  
S294PG30IS294PG33 SCALE: NONE

REFERENCE DRAWINGS

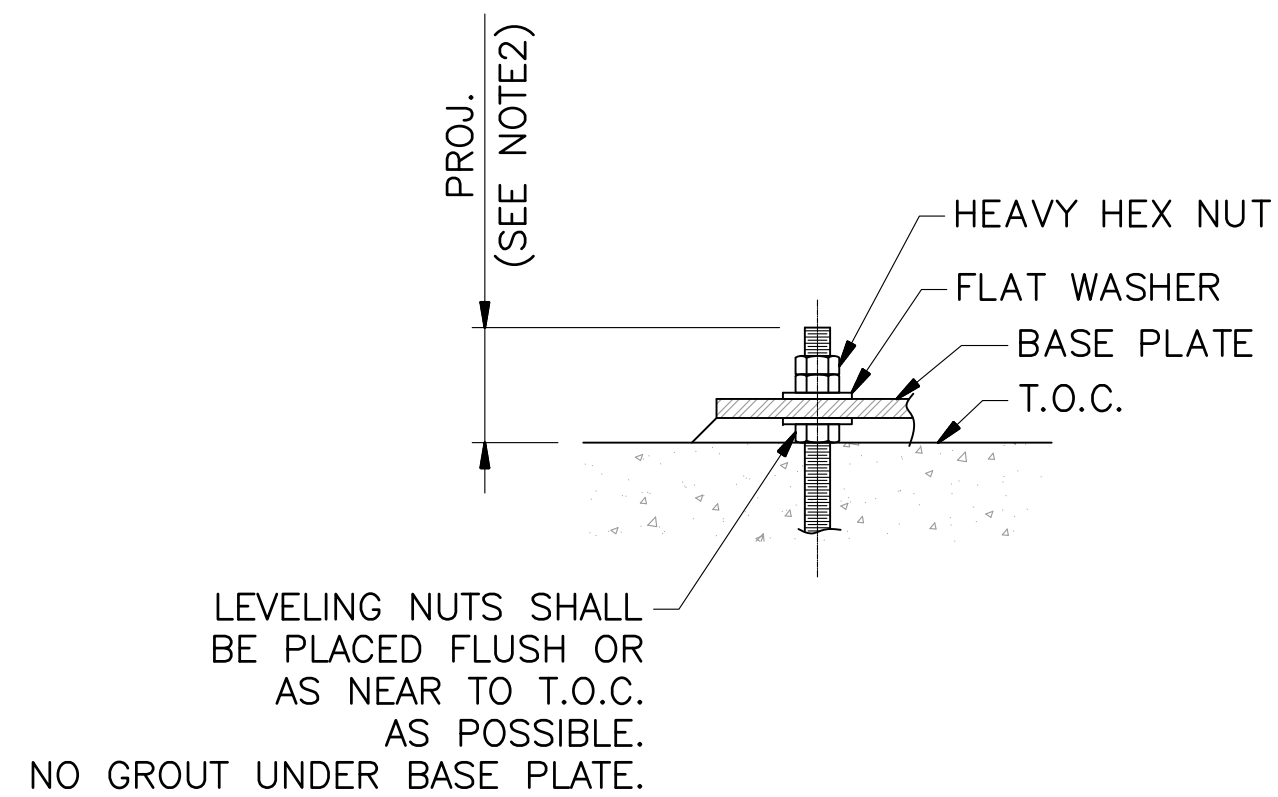
S294PG30 161KV FOUNDATION PLAN VIEW  
S294PG31 69KV FOUNDATION PLAN VIEW

DRILLED PIER FOUNDATIONS SCHEDULE

FDN. ITEM NO.	DESCRIPTION	QTY	D(in)	H(ft)	A(in)	B(in)	C(in)	CU.YD. TOTAL	R1	R2	R3	ANCHOR BOLT DETAILS	COMMENTS
P1	161 kV Buss Support	52	36	16	42	42	24	4.5	#6 @ 12" EW T&B	(12) #9	#4 @ 12"	See Vendor Drawing	
P2	161 kV Angled Buss Support High	8	36	16	42	42	24	4.5	#6 @ 12" EW T&B	(12) #9	#4 @ 12"	See Vendor Drawing	
P3	161 kV Angled Buss Support Low	4	36	16	42	42	24	4.5	#6 @ 12" EW T&B	(12) #9	#4 @ 12"	See Vendor Drawing	
P4	161 kV Angled Buss Support Narrow	8	36	16	42	42	24	4.5	#6 @ 12" EW T&B	(12) #9	#4 @ 12"	See Vendor Drawing	
P5	161 kV Dead End Structure	12	60	25	66	66	24	18.2	#6 @ 12" EW T&B	(24) #11	#4 @ 12"	See Vendor Drawing	
P6	69 kV Breaker Structure	6	36	16	42	42	24	4.5	#6 @ 12" EW T&B	(12) #9	#4 @ 12"	See Vendor Drawing	
P7	69 kV Buss Support	24	36	16	42	42	24	4.5	#6 @ 12" EW T&B	(12) #9	#4 @ 12"	See Vendor Drawing	
P8	69 kV Dead End Structure	3	72	25	78	78	24	26.2	#6 @ 12" EW T&B	(32) #11	#4 @ 12"	See Vendor Drawing	

NOTES:

- CONCRETE FOR DRILLED PIERS SHALL HAVE A 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI.
- SEE SOILS REPORT "SOIL AND FOUNDATION INVESTIGATION AFTON SUBSTATION IMPROVEMENTS, AFTON, OKLAHOMA" DATED JANUARY 2011, BY GRUBBS, HOSKYN, BARTON & WYATT, INC. FOR FURTHER INFORMATION.
- PIER CONTRACTOR SHALL REVIEW THE GEOTECHNICAL REPORT BEFORE COMMENCEMENT OF CONSTRUCTION.
- PROVIDE ADDITIONAL TIES #4 @ 6" AT TOP OF PIER; FULL LENGTH OF ANCHOR BOLTS.
- PIER REINFORCEMENT TO MAINTAIN 6" EDGE CLEARANCE FOR P5 AND P8 ONLY. ALL OTHER PIERS TO MAINTAIN 3" EDGE CLEARANCE.



2 TYPICAL LEVELING BASE DETAIL  
S294PG30IS294PG33 SCALE: NONE

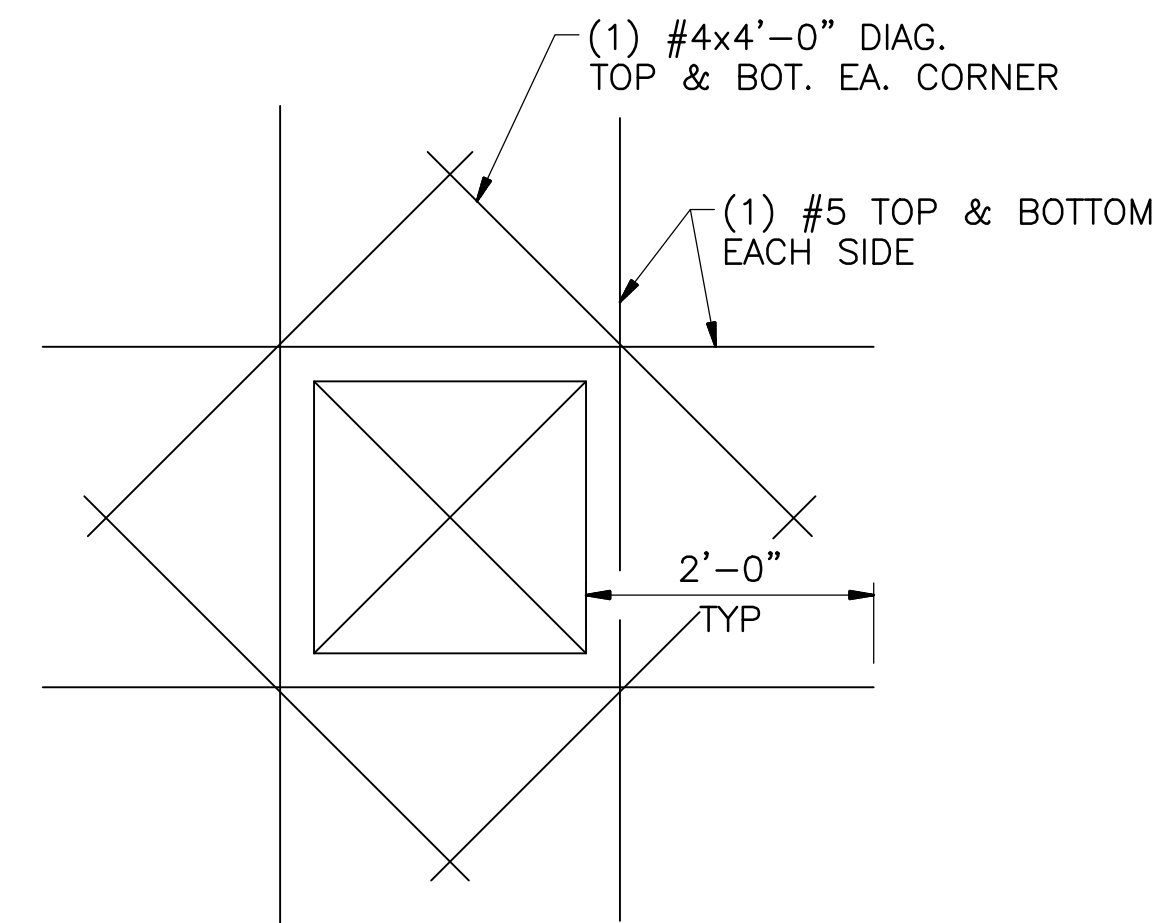
ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69KV			
<b>TYPICAL FOUNDATION</b> <b>DETAILS</b>			
SCALE: AS SHOWN	DRAWN BY: EGB	ENGR: AEM	APPD: BA
	CH: MW	DATE: 3/7/2011	
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294PG33</b>	REV. <b>0</b>

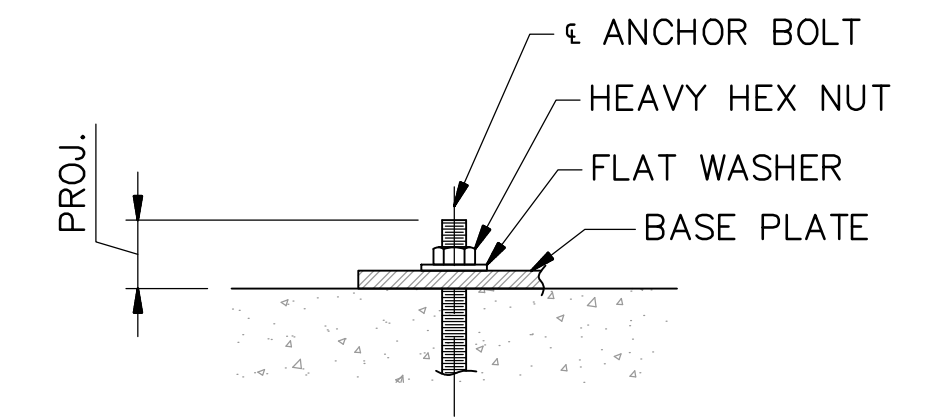
REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	AS	BA

EQUIPMENT PAD FOUNDATION SCHEDULE

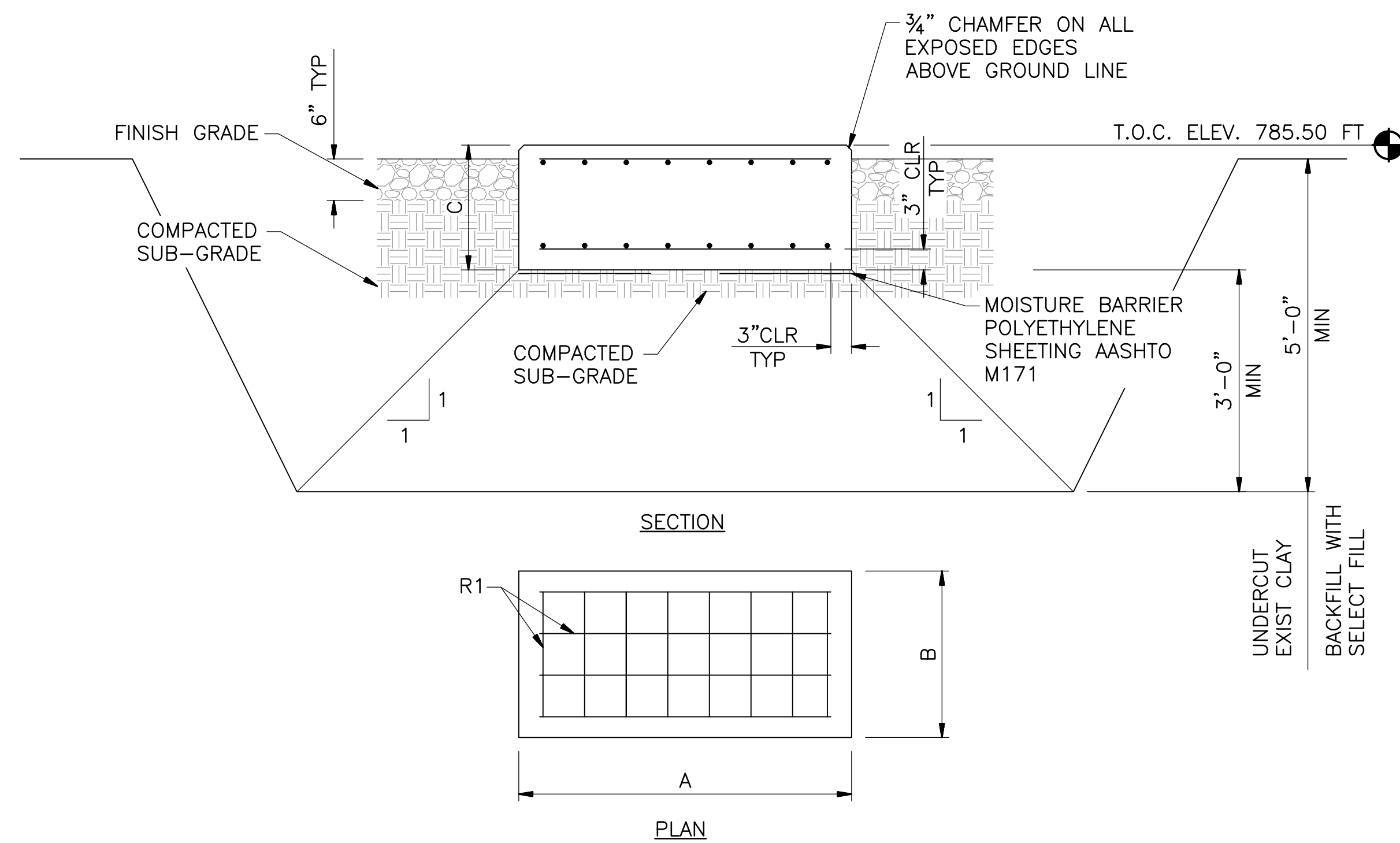
FDN. ITEM NO.	DESCRIPTION	QTY	A(ft)	B(ft)	C(in)	CU. YD. TOTAL	R1	ANCHOR BOLT DETAILS	COMMENTS
S1	TRANSFORMER FOUNDATION SLAB	2	27'-9"	11'-8"	36"	35.27	#6 @ 12" O.C. E.W. TOP&BOTTOM	SEE VENDOR DRAWING	
S2	161KV BREAKER FOUNDATION SLAB	4	12'-0"	5'-8"	24"	5.04	#6 @ 12" O.C. E.W. TOP&BOTTOM	SEE VENDOR DRAWING	
S3	69KV BREAKER FOUNDATION SLAB	11	11'-8"	4'-8"	24"	4.03	#6 @ 12" O.C. E.W. TOP&BOTTOM	SEE VENDOR DRAWING	
S4	161KV FOUNDATION SLAB	19	3'-0"	3'-0"	24"	0.67	#6 @ 12" O.C. E.W. TOP&BOTTOM	SEE VENDOR DRAWING	



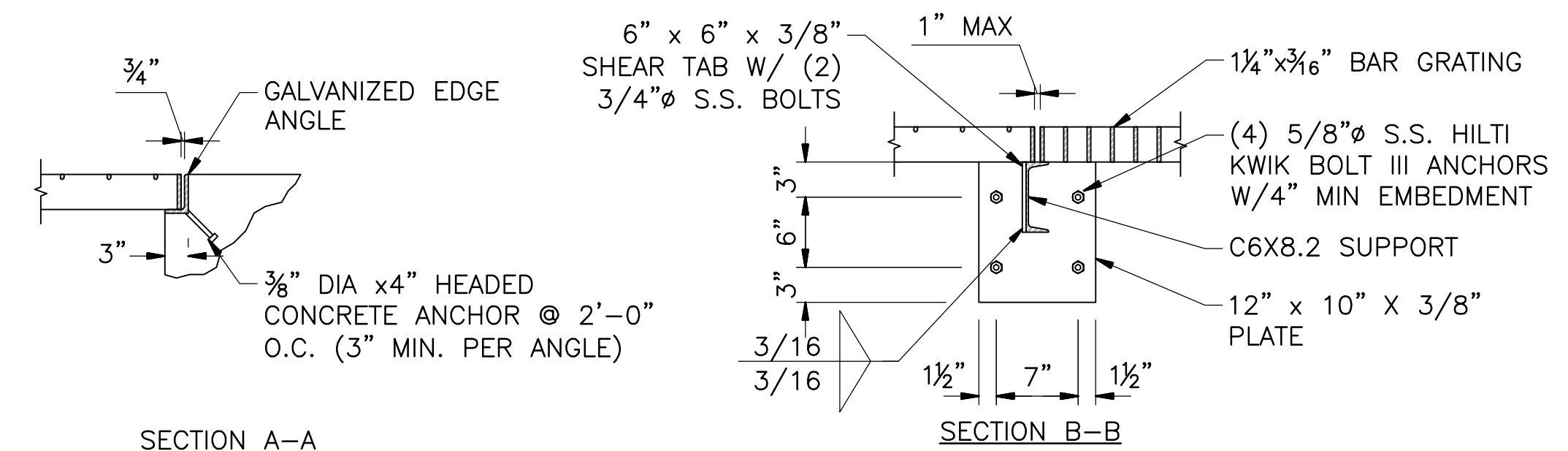
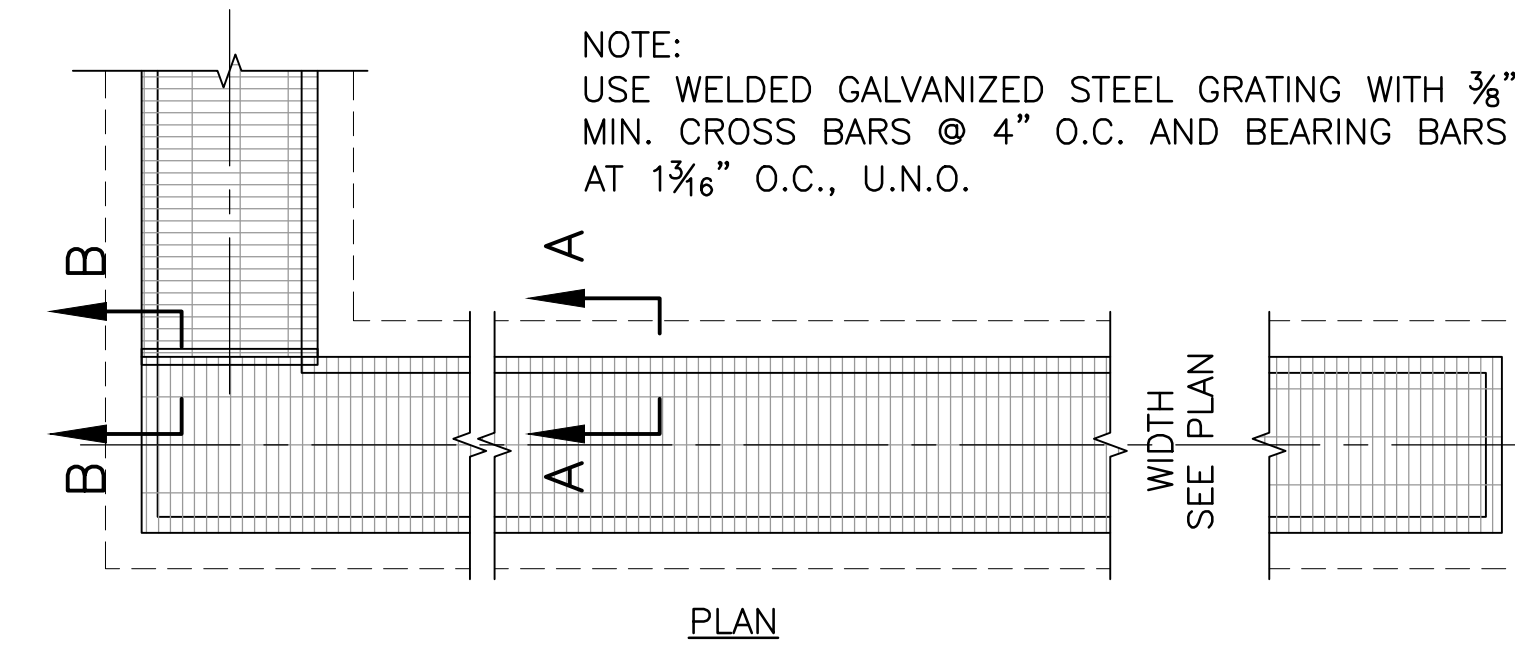
2 TYPICAL SMALL OPENING AT SLAB DETAIL  
S294PZ01S294PG34 SCALE: NONE



3 TYPICAL EQUIPMENT PAD ANCHOR DETAIL  
S294PZ01S294PG34 SCALE: NONE



1 TYPICAL EQUIPMENT PAD DETAIL  
S294PG30S294PG34 SCALE: NONE

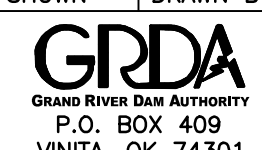


4 OIL CONTAINMENT BAR GRATING DETAIL  
S294PZ01S294PG34 SCALE: NONE

REFERENCE DRAWINGS

- S294PG30 161KV FOUNDATION PLAN VIEW
- S294PG31 69KV FOUNDATION PLAN VIEW
- S294PZ01 OIL CONTAINMENT PLAN
- S294PZ02 OIL CONTAINMENT DETAILS

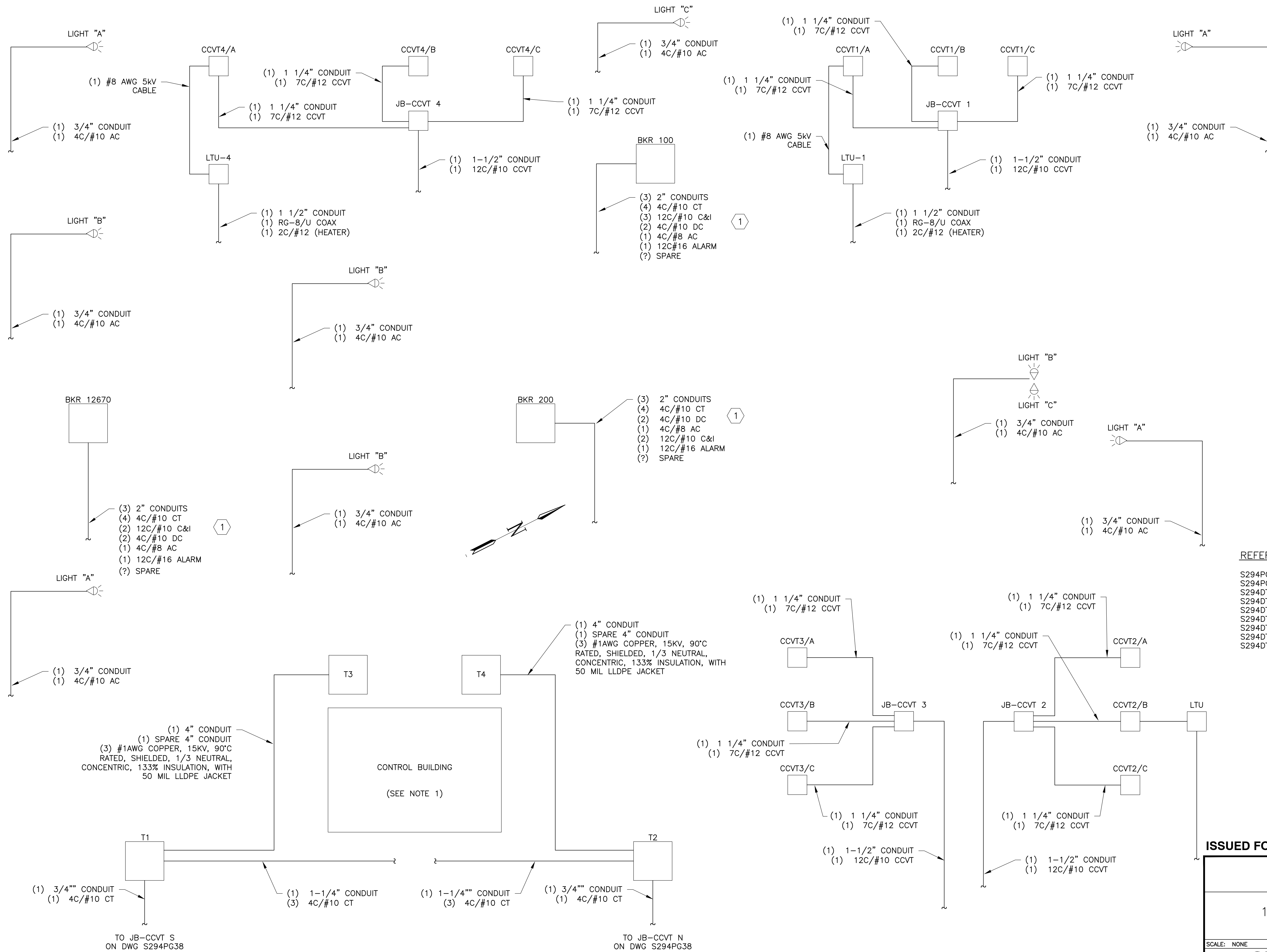
ISSUED FOR BID

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>TYPICAL FOUNDATION</b> <b>DETAILS</b>			
SCALE: AS SHOWN	DRAWN BY: EGB	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294PG34</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

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- NOTES:**
- SEE CABLE SCHEDULE FOR FINAL DESTINATIONS OF CONDUCTORS.
  - TO MINIMIZE CONDUIT RUNS, ROUTE CABLES THROUGH CLOSEST CABLE TRENCH LOCATION. (SEE DWG S294PG50 FOR TRENCH LAYOUT)
  - SIZE CONDUITS TO MEET NEC, 2008 EDITION, FILL TABLES CH9.
  - LIGHT "A" IS A HOLOPHANE PRISMBEAM II 1000W.
  - LIGHT "B" IS A HOLOPHANE PREDATOR 175W.
  - LIGHT "C" IS A HOLOPHANE PREDATOR 400W.

- KEYED NOTES:**
- ① GROUP AC & DC CIRCUITS & C&I CIRCUITS TOGETHER AND CT CIRCUITS SEPARATELY.

- REFERENCE DRAWINGS**
- S294PG41 69kV CABLE & CONDUITS
  - S294PG50 TRENCH LAYOUT PLAN
  - S294DT101 CABLE SCHEDULE BUSHING CT'S
  - S294DT102 CABLE SCHEDULE BUSHING CT'S
  - S294DT201 CABLE SCHEDULE BUSHING CCVT'S
  - S294DT202 CABLE SCHEDULE BUSHING CCVT'S
  - S294DT401 CABLE SCHEDULE CONTROL & INDICATION
  - S294DT501 CABLE SCHEDULE 125VDC
  - S294DT502 CABLE SCHEDULE 125VDC

**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69kV

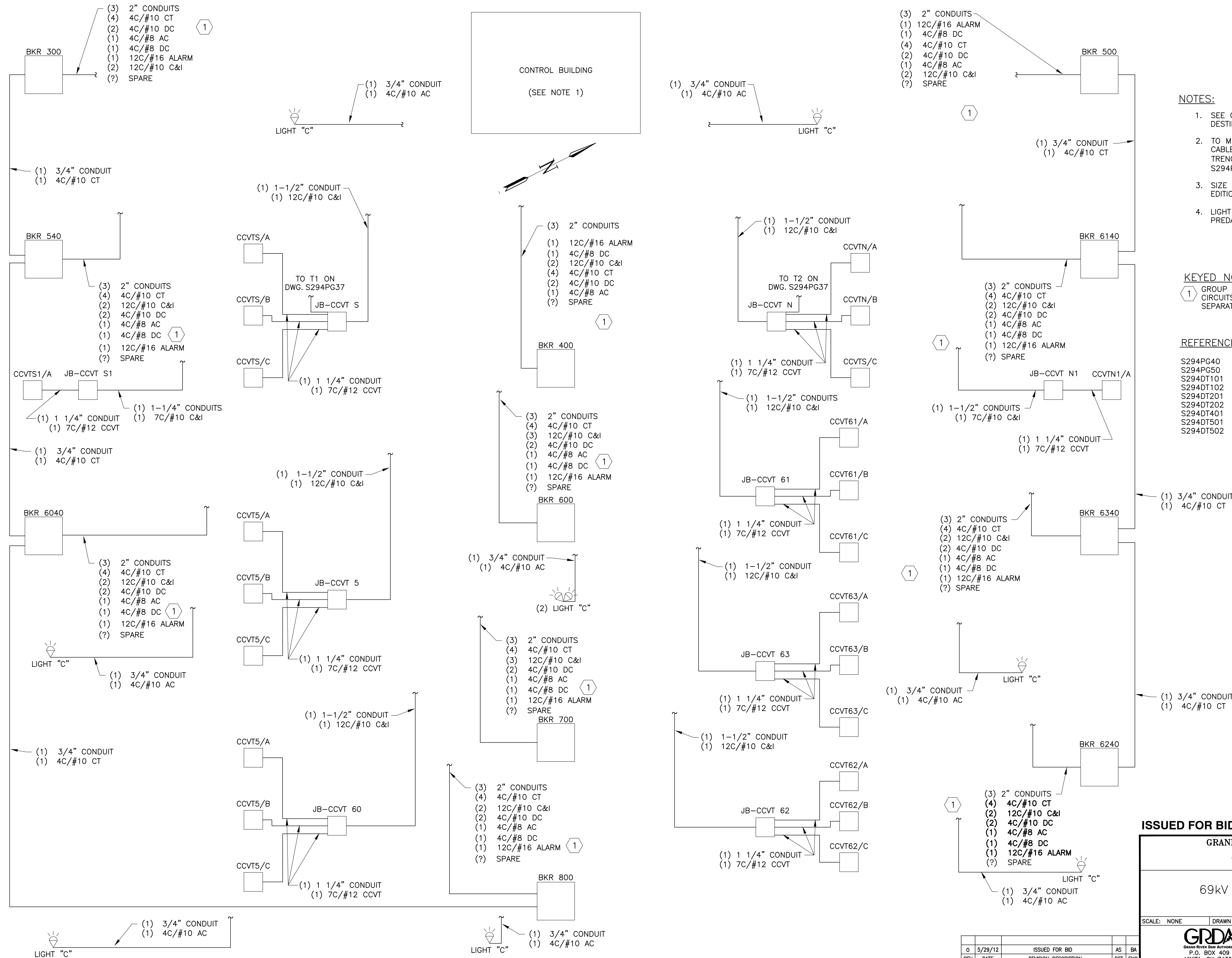
**161kV CABLE & CONDUITS**

SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
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DRAWING No. S294PG40		REV. 0	

**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

0	5/29/12	ISSUED FOR BID	AS	BA
REV	DATE	REVISION DESCRIPTION	DFT	ENG

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- NOTES:**
- SEE CABLE SCHEDULE FOR FINAL DESTINATIONS OF CONDUCTORS.
  - TO MINIMIZE CONDUIT RUNS, ROUTE CABLES THROUGH CLOSEST CABLE TRENCH LOCATION. (SEE DWG S294PG50 FOR TRENCH LAYOUT)
  - SIZE CONDUITS TO MEET NEC, 2008 EDITION, FILL TABLES CH9.
  - LIGHT "C" IS A HOLOPHANE PREDATOR 400W MH.

**KEYED NOTES:**

① GROUP AC & DC CIRCUITS & C&I CIRCUITS TOGETHER AND CT CIRCUITS SEPARATELY.

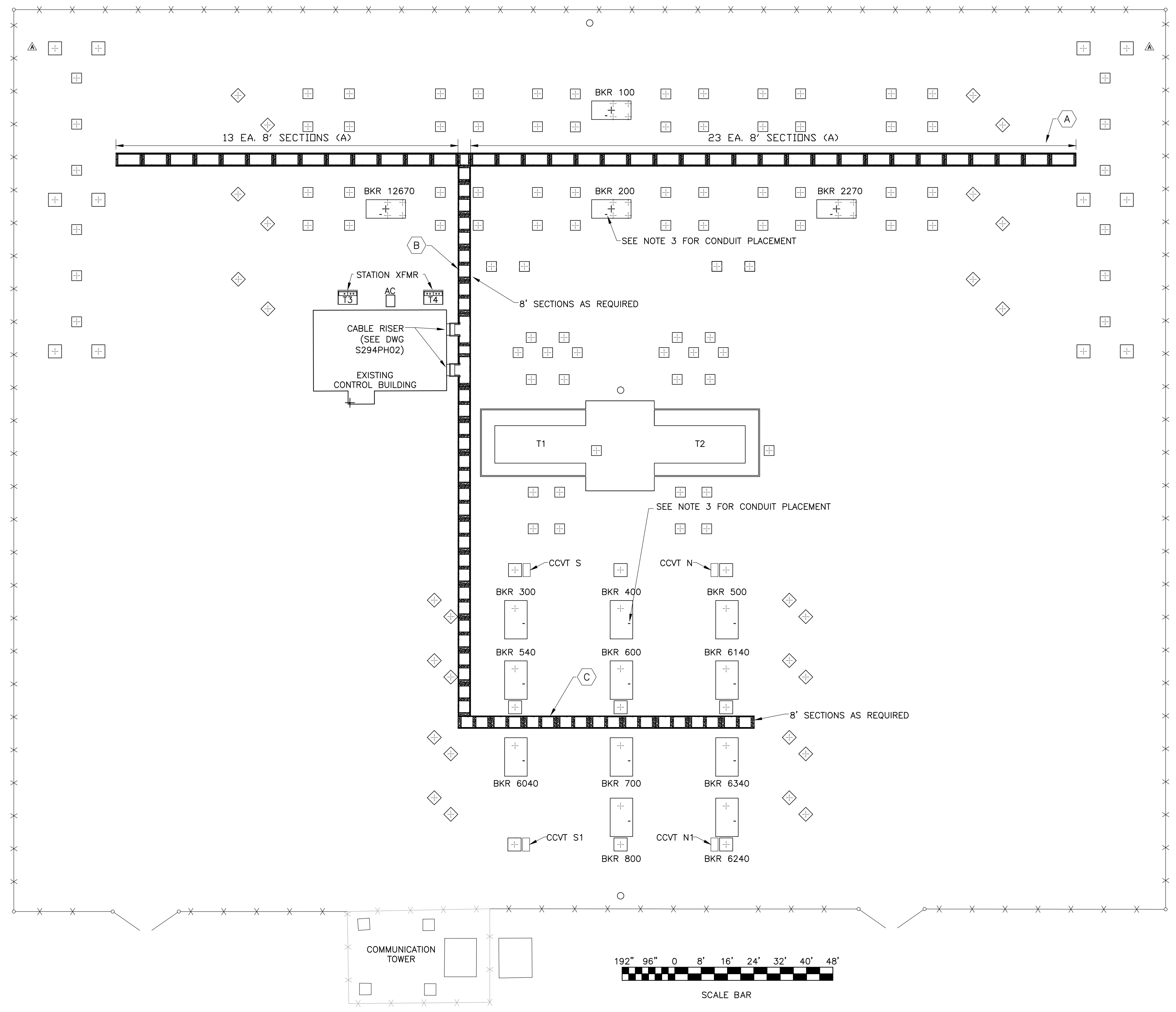
- REFERENCE DRAWINGS**
- |           |                                     |
|-----------|-------------------------------------|
| S294PG40  | 161kV CABLE & CONDUITS              |
| S294PG50  | TRENCH LAYOUT PLAN                  |
| S294DT101 | CABLE SCHEDULE BUSHING CT'S         |
| S294DT102 | CABLE SCHEDULE BUSHING CT'S         |
| S294DT201 | CABLE SCHEDULE BUSHING CCVT'S       |
| S294DT202 | CABLE SCHEDULE BUSHING CCVT'S       |
| S294DT401 | CABLE SCHEDULE CONTROL & INDICATION |
| S294DT501 | CABLE SCHEDULE 125VDC               |
| S294DT502 | CABLE SCHEDULE 125VDC               |

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b>			
<b>AFTON SUBSTATION</b> S294			
AFTON, OKLAHOMA 161/69kV			
<b>69kV CABLE &amp; CONDUITS</b>			
SCALE: NONE	DRAWN BY: DJR	ENGR: RGS	APPD: BA
<b>GRDA</b> GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		CH: MW	DATE: 3/7/2011
DRAWING No. S294PG41		REV. 0	

REV	DATE	REVISION DESCRIPTION	AS	BA	DFT	ENG
0	5/29/12	ISSUED FOR BID				

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 Last\_plotted\_by: Shults, Arlene Plot\_Style: Garver Standard Half.ctb Plot\_Scale: 1:2 Plot\_Date: 5/29/2012 9:45 AM Plotter\_used: Adobe PDF



- NOTES:**
- TRENCH & LIDS SHALL MEET OR EXCEED AASHTO H-10 LIGHT EQUIPMENT REQUIREMENT OF 16,000 LBS AXLE LOAD.
  - TRENCH VENDOR SHALL SUBMIT FINAL LAY-OUT & SPECIFICATIONS TO GRDA FOR APPROVAL.
  - CONDUIT PLACEMENT IN BREAKER FOUNDATION TO BE SPOTTED IN FIELD.

**REFERENCE DRAWINGS**

S294PE01	161kV EQUIPMENT PLAN VIEW
S294PE02	69kV EQUIPMENT PLAN VIEW
S294PE15	PARTS LIST 161kV EQUIPMENT PLAN VIEW
S294PE16	PARTS LIST 69kV EQUIPMENT PLAN VIEW
S294PG20	GROUNDING PLAN
S294PG51	TRENCH DETAILS
S294PH01	CONTROL HOUSE LAYOUT REMOVAL PLAN
S294PH02	EXISTING CONTROL HOUSE LAYOUT INSTALLATION PLAN
S294PH09	CABLE RACEWAY DETAIL

**TRENCH DIMENSIONS (INTERNAL DIMENSIONS)**

A	24" W X 16" D
B	40" W X 16" D
C	30" W X 16" D



**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
 AFTON SUBSTATION S294  
 AFTON, OKLAHOMA  
 161/69kV

**TRENCH LAYOUT PLAN**

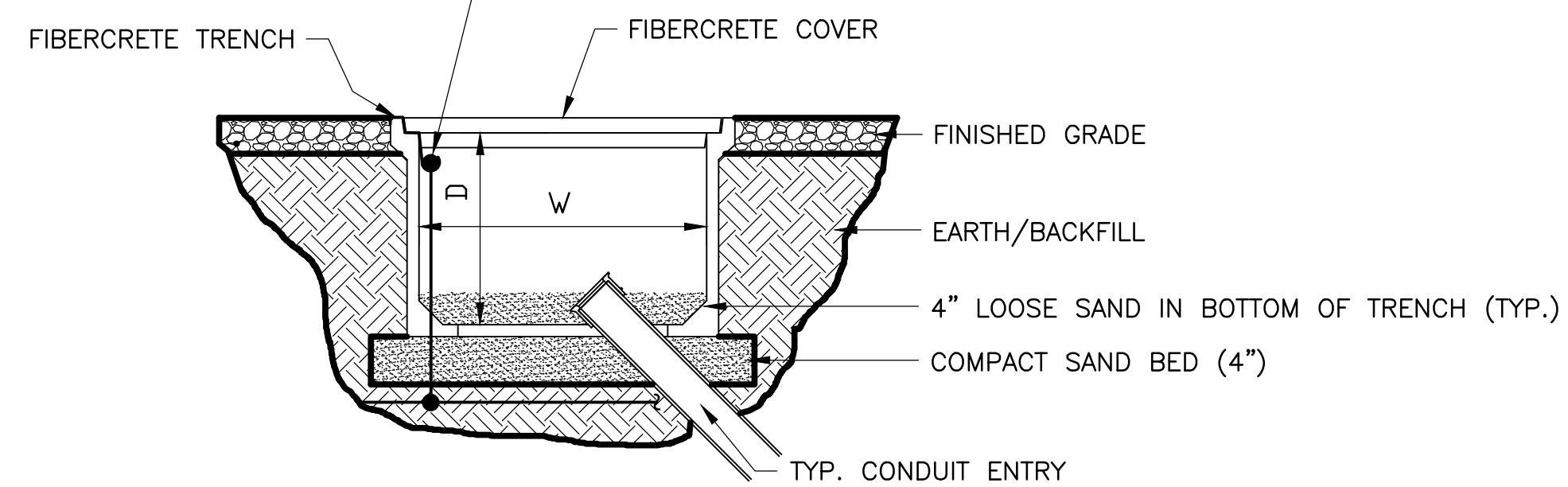
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**GRDA**  
 GRAND RIVER DAM AUTHORITY  
 P.O. BOX 409  
 VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	DWT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA
A	5/21/12	RELOCATE FOOTINGS 5' SE	AS	MW

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⚠(62) 4/0 GROUNDING CABLE. EXTEND FULL LENGTH OF TRENCH. CONNECT TO GROUND GRID AT EVERY OTHER CROSSING AND AT ENDS OF TRENCH.



TYPICAL CROSSSECTION VIEW  
 TRAFFIC RATED TRENCH W/ COVER FLUSH  
 BOTTOM CONDUIT ENTRY

1 TRENCH DETAIL  
 S294PG52|S294PG51 SCALE: NONE

**NOTES:**

1. TRENCH & LIDS SHALL MEET OR EXCEED MASHTO H-10 LIGHT EQUIPMENT REQUIREMENT OF 16,000 LBS AXLE LOAD.
2. TRENCH VENDOR SHALL SUBMIT FINAL LAY-OUT & SPECIFICATIONS TO GRDA FOR APPROVAL.


**TRENCH DIMENSIONS**  
 (INTERNAL DIMENSIONS)

- A. 24"W X 16"D
- B. 40"W X 16"D
- C. 30"W X X 16"D

**REFERENCE DRAWINGS**

- S294PG50 TRENCH LAYOUT PLAN
- S294PH02 CONTROL HOUSE LAYOUT
- S294PH09 CABLE RACEWAY DETAIL

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>TRENCH DETAILS</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: MW
		CH: BA	DATE: 3/7/2011
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PG51	REV. 2

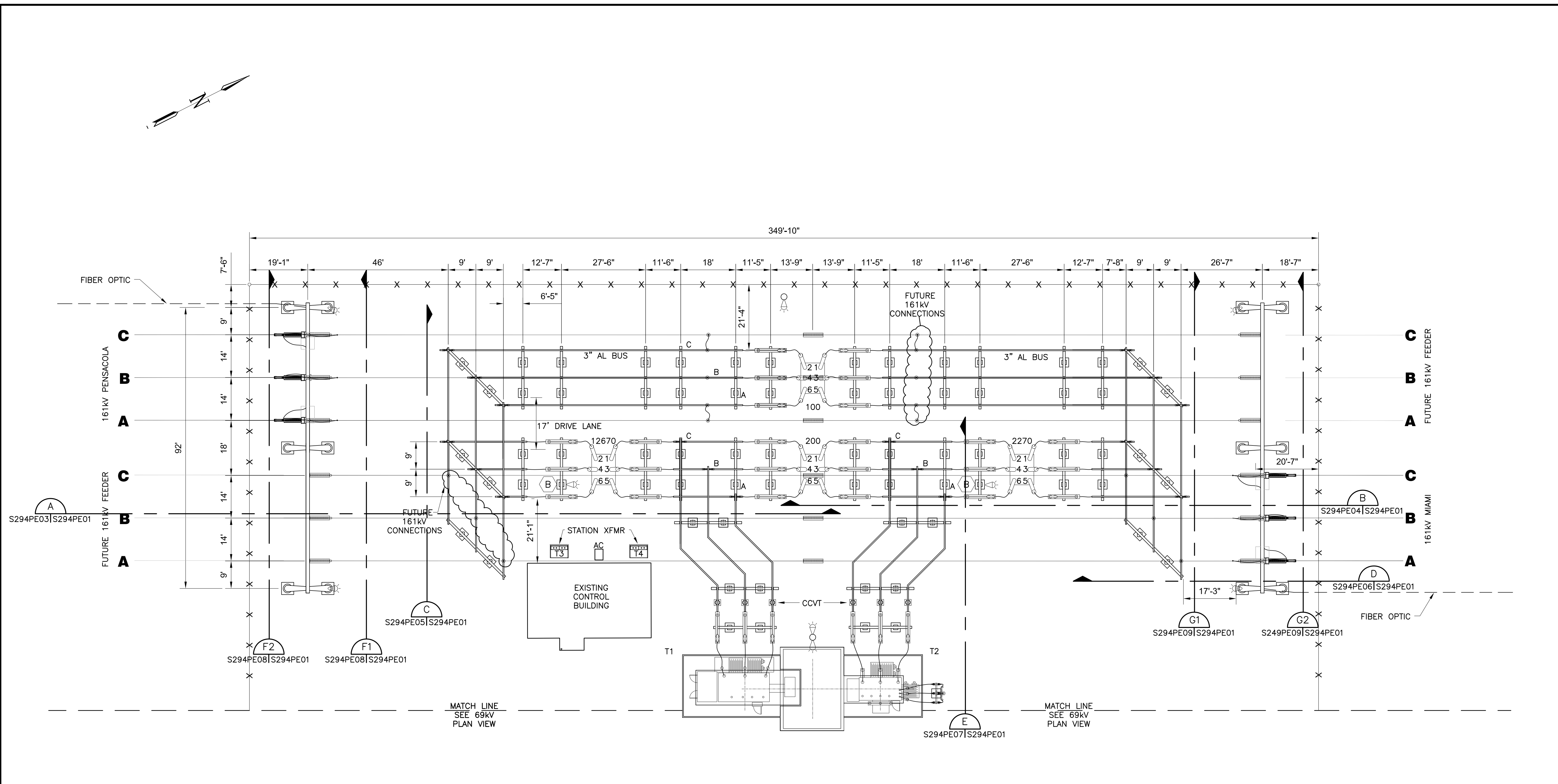
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⚠	1/13/12	UPDATED PER COMMENTS/CORRECTIONS		

## Afton Substation

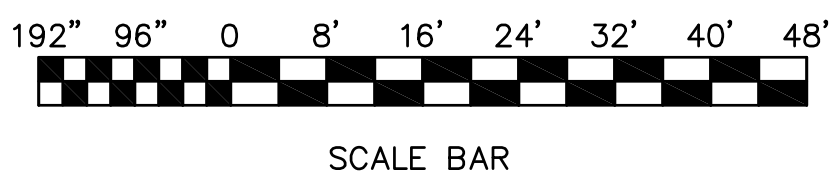
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S294PE02	69kV EQUIPMENT PLAN VIEW
S294PE03	161kV ELEVATION VIEW A
S294PE04	161kV ELEVATION VIEW B
S294PE05	161kV ELEVATION VIEW C
S294PE06	161kV ELEVATION VIEW D
S294PE07	161kV ELEVATION VIEW E
S294PE08	161kV ELEVATION VIEW F1 & F2
S294PE09	161kV ELEVATION VIEW G1 & G2
S294PE10	69kV ELEVATION VIEW H
S294PE11	69kV ELEVATION VIEW J
S294PE12	69kV ELEVATION VIEW K
S294PE13	69kV ELEVATION VIEW L
S294PE14	69kV ELEVATION VIEW M
S294PE15	PARTS LIST 161kV EQUIP PLAN VIEW
S294PE16	PARTS LIST 69kV EQUIP PLAN VIEW
S294PE17	PARTS LIST 161kV ELEVATION VIEW A
S294PE18	PARTS LIST 161kV ELEVATION VIEW B
S294PE19	PARTS LIST 161kV ELEVATION VIEW C
S294PE20	PARTS LIST 161kV ELEVATION VIEW D
S294PE21	PARTS LIST 161kV ELEVATION VIEW E
S294PE22	PARTS LIST 161kV ELEVATION VIEW F1 & F2
S294PE23	PARTS LIST 161kV ELEVATION VIEW G1 & G2
S294PE24	PARTS LIST 69kV ELEVATION VIEW H
S294PE25	PARTS LIST 69kV ELEVATION VIEW J
S294PE26	PARTS LIST 69kV ELEVATION VIEW K
S294PE27	PARTS LIST 69kV ELEVATION VIEW L
S294PE28	PARTS LIST 69kV ELEVATION VIEW M
S294PE29	NOT USED
S294PE30	FENCE DETAILS
S294PE31	NOT USED
S294PE32	NOT USED
S294PE33	NOT USED
S294PE34	NOT USED
S294PE35	NOT USED
S294PE36	NOT USED
S294PE37	NOT USED
S294PE38	NOT USED
S294PE39	NOT USED
S294PE40	LIGHTING PLAN VIEW
S294PE41	NOT USED
S294PE42	NOT USED
S294PE43	NOT USED
S294PE44	NOT USED
S294PE45	NOT USED
S294PE46	NOT USED
S294PE47	NOT USED
S294PE48	NOT USED
S294PE49	NOT USED
S294PE50	AFTON SUB BEFORE CONSTRUCTION
S294PE51	AFTON SUB PHASE I
S294PE52	AFTON SUB PHASE II
S294PE53	AFTON SUB PHASE III
S294PE54	AFTON SUB PHASE IV
S294PE55	AFTON SUB PHASE V
S294PE56	AFTON SUBSTATION TRANSMISSION LINE PLAN
S294PE57	TRANSMISSION LINE STRUCTURE DETAILS



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- REFERENCE DRAWINGS**
- S294PE02 69kV EQUIPMENT PLAN VIEW
  - S294PE03 161kV ELEVATION VIEW A
  - S294PE04 161kV ELEVATION VIEW B
  - S294PE05 161kV ELEVATION VIEW C
  - S294PE06 161kV ELEVATION VIEW D
  - S294PE07 161kV ELEVATION VIEW E
  - S294PE08 161kV ELEVATION VIEW F1 & F2
  - S294PE09 161kV ELEVATION VIEW G1 & G2



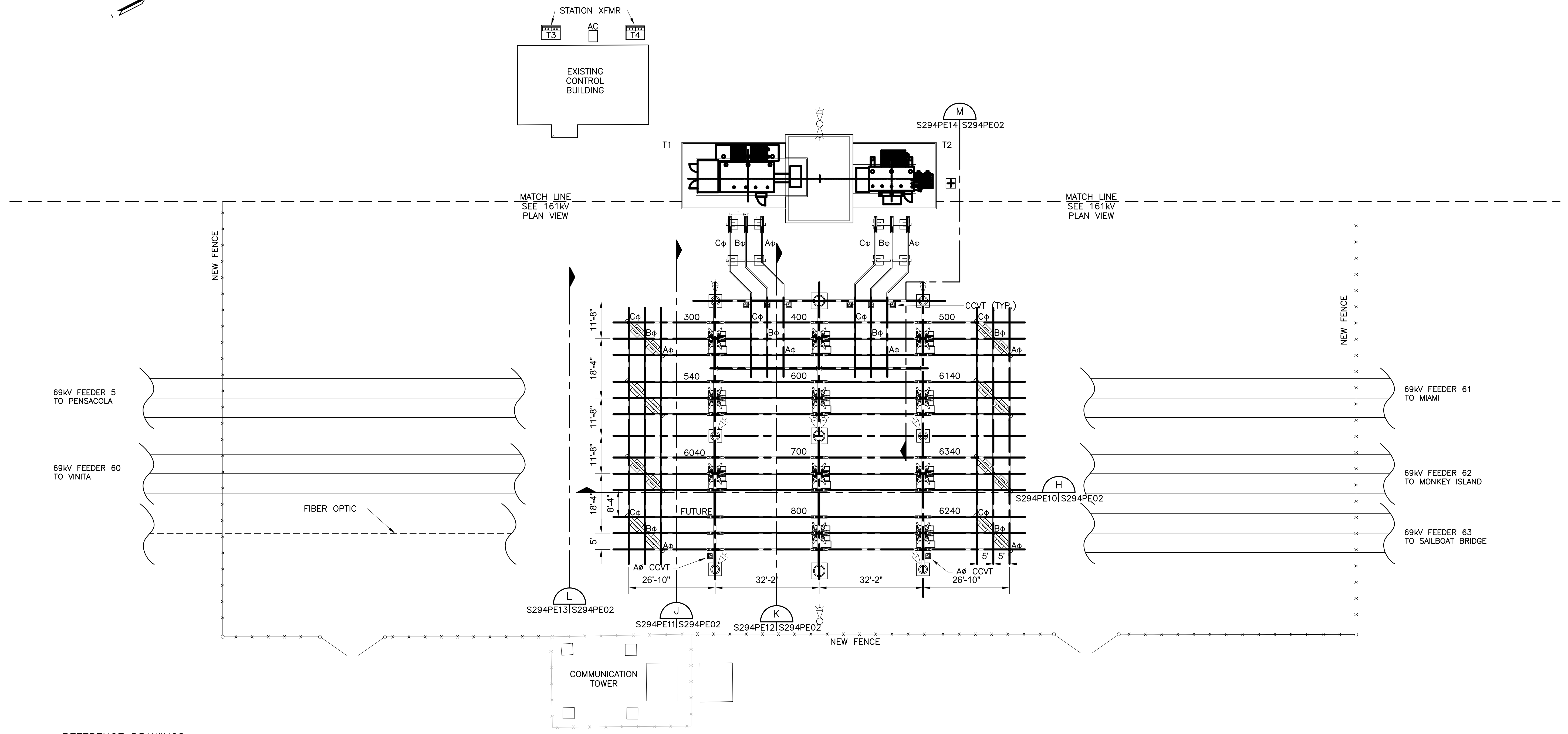
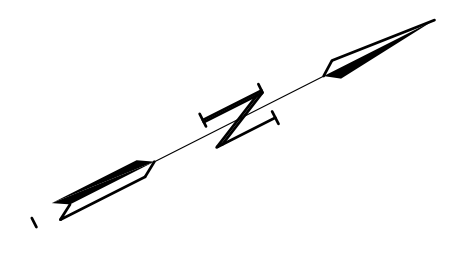
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**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
AFTON, OKLAHOMA  
161/69kV  
**161kV EQUIPMENT**  
**PLAN VIEW**

SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294PE01</b>	REV. <b>0</b>

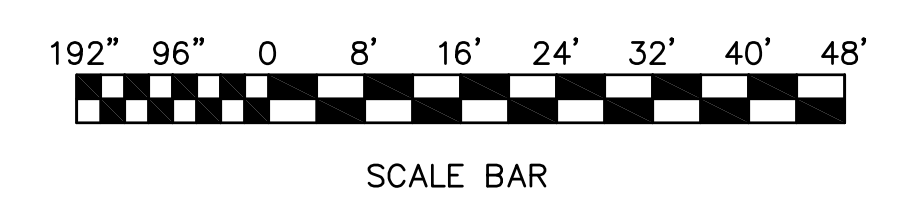
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**REFERENCE DRAWINGS**

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S294PE10	69kV ELEVATION VIEW H
S294PE11	69kV ELEVATION VIEW J
S294PE12	69kV ELEVATION VIEW K
S294PE13	69kV ELEVATION VIEW L
S294PE14	69kV ELEVATION VIEW M



**ISSUED FOR BID**

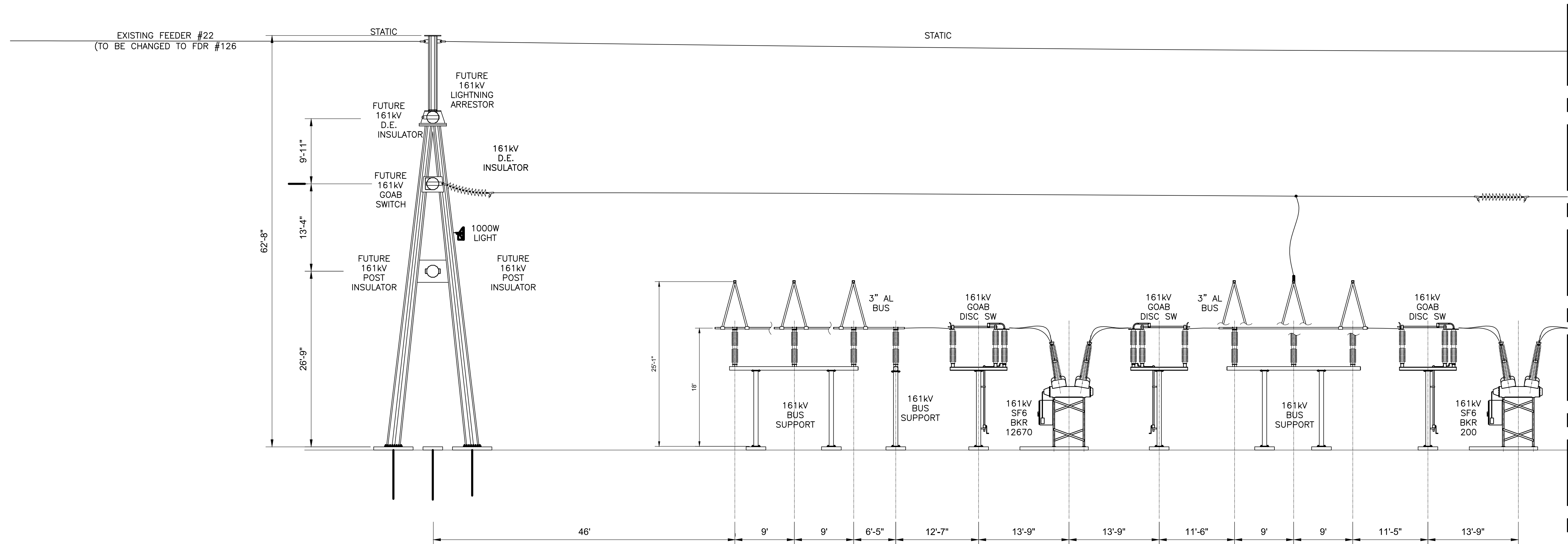
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**AFTON SUBSTATION** S294  
 AFTON, OKLAHOMA  
 161/69kV

**69kV EQUIPMENT  
 PLAN VIEW**

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		CH: MW	DATE: 3/7/2011
		DRAWING No. S294PE02	REV. 0
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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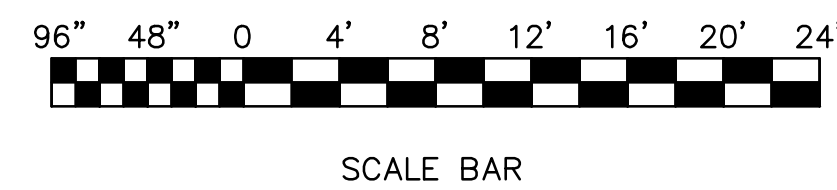
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1  
 161kV VIEW A  
 S294PE01|S294PE03

REFERENCE DRAWINGS

- S294PE01 161kV EQUIPMENT PLAN VIEW
- S294PE04 161kV ELEVATION VIEW B

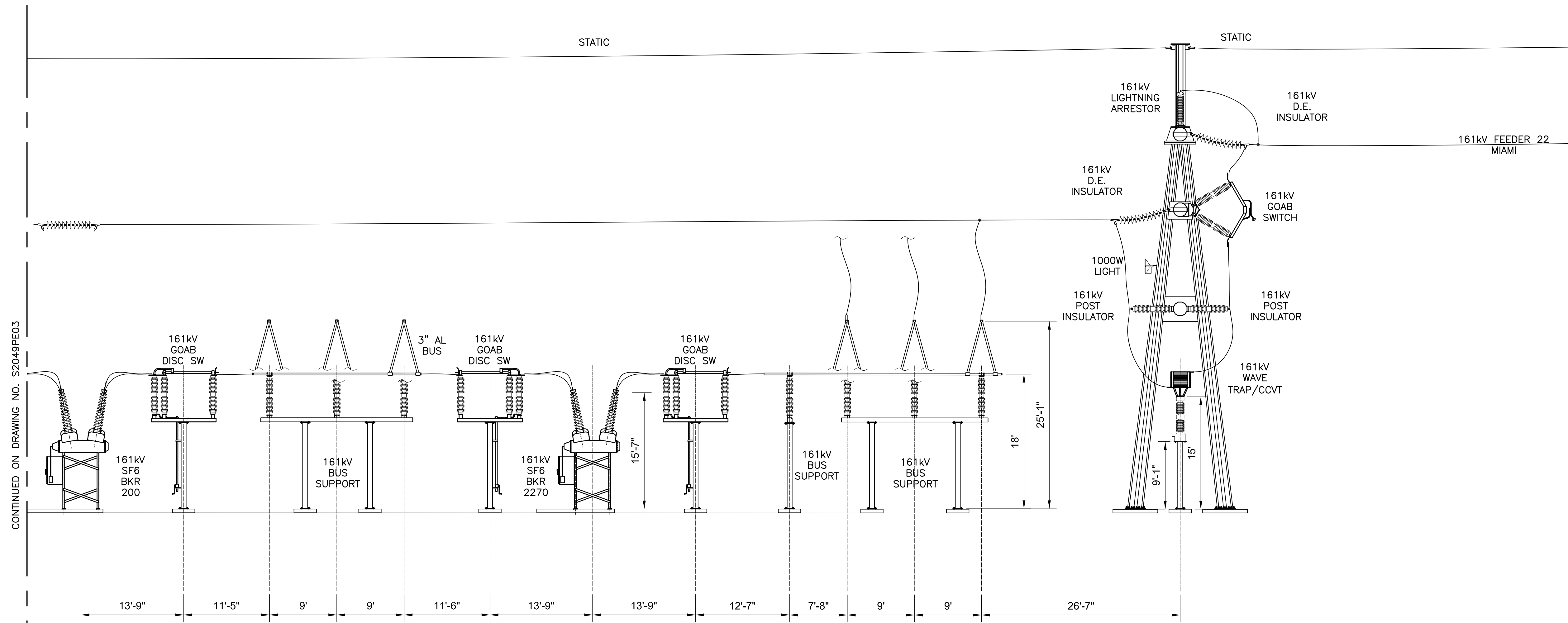


ISSUED FOR BID

GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69kV</small>			
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CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>			DRAWING No. <b>S294PE03</b> REV. <b>0</b>

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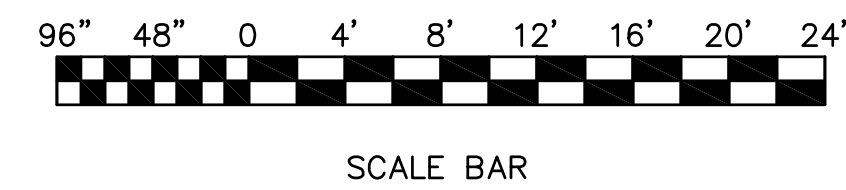


CONTINUED ON DRAWING NO. S2049PE03

1 161kV VIEW B  
S294PE01|S294PE04

REFERENCE DRAWINGS

- S294PE01 161kV EQUIPMENT PLAN VIEW
- S294PE03 161kV ELEVATION VIEW A

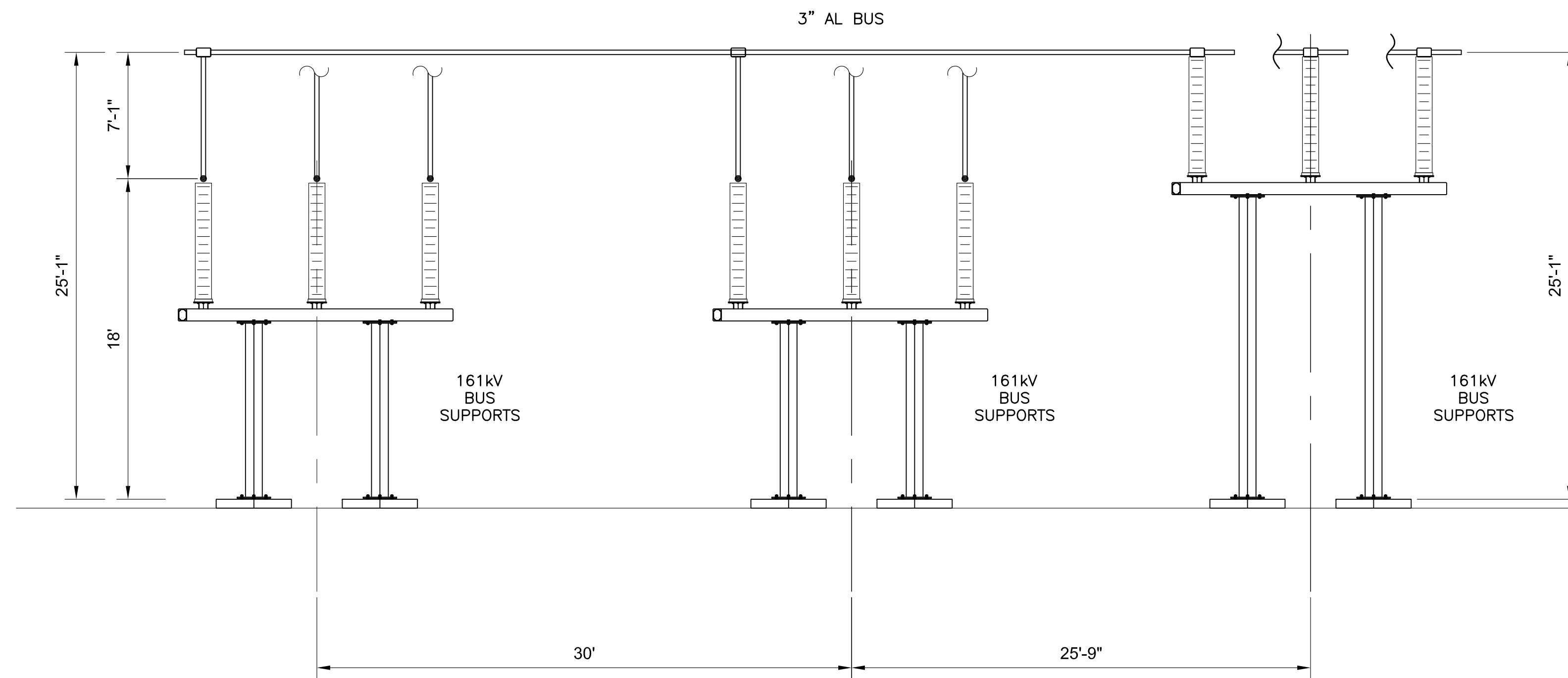


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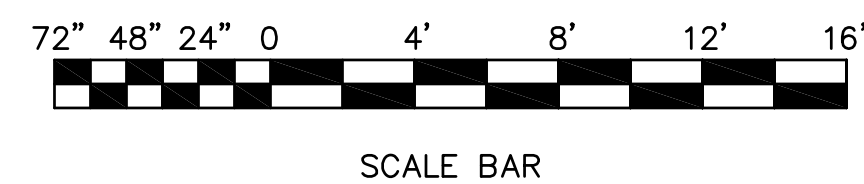
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<b>161kV ELEVATION</b> <b>VIEW B</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
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161kV VIEW C  
 S294PE01/S294PE05



REFERENCE DRAWINGS

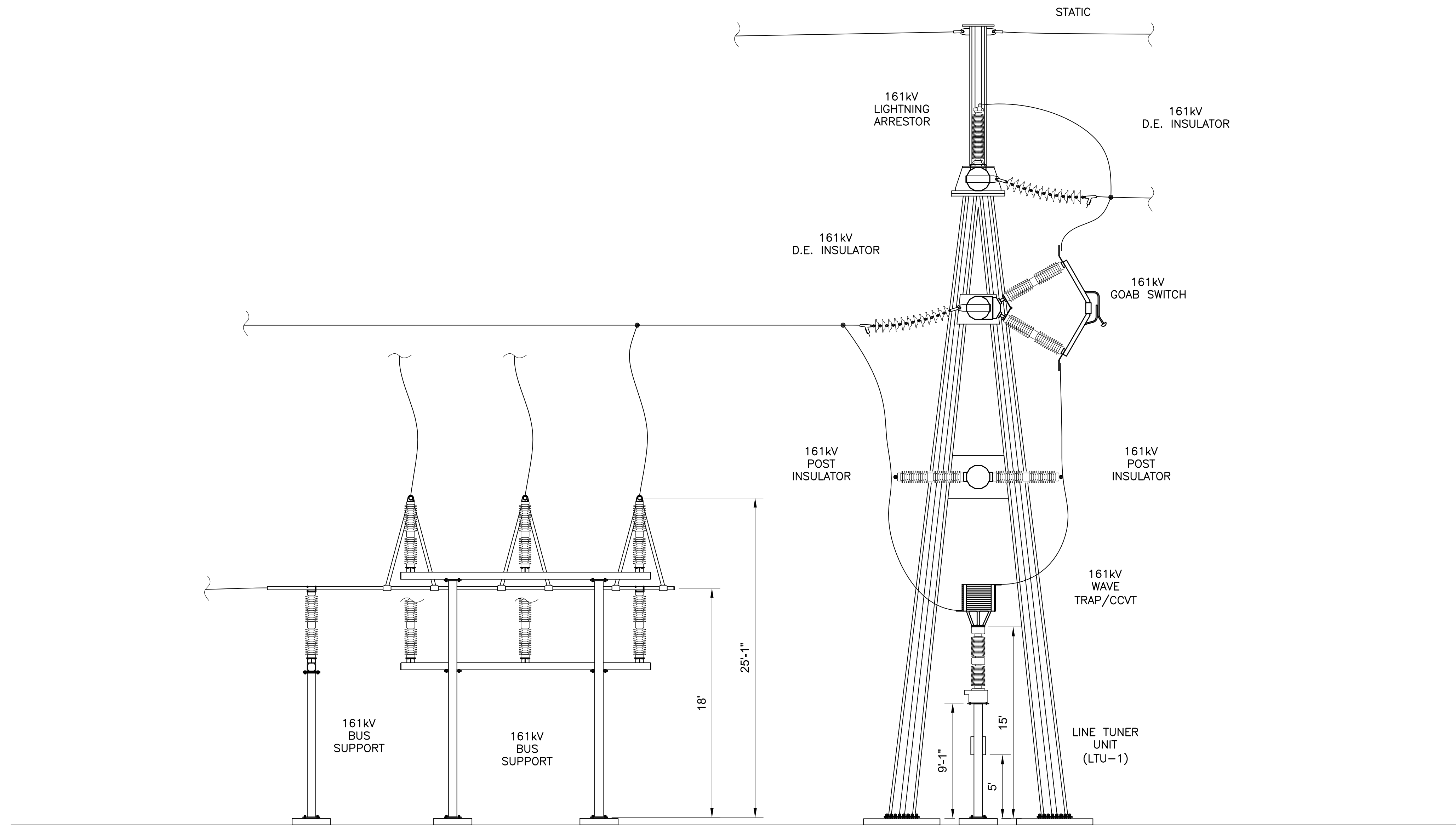
S294PE01 161kV EQUIPMENT PLAN VIEW

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69kV</small>			
<b>161kV ELEVATION</b> <b>VIEW C</b>			
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CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. S294PE05	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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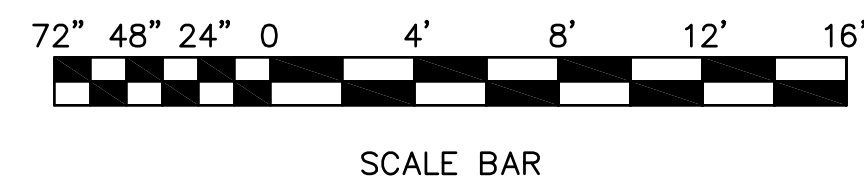
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REFERENCE DRAWINGS

S294PE01 161kV EQUIPMENT PLAN VIEW

1 161kV VIEW D  
S294PE01/S294PE06

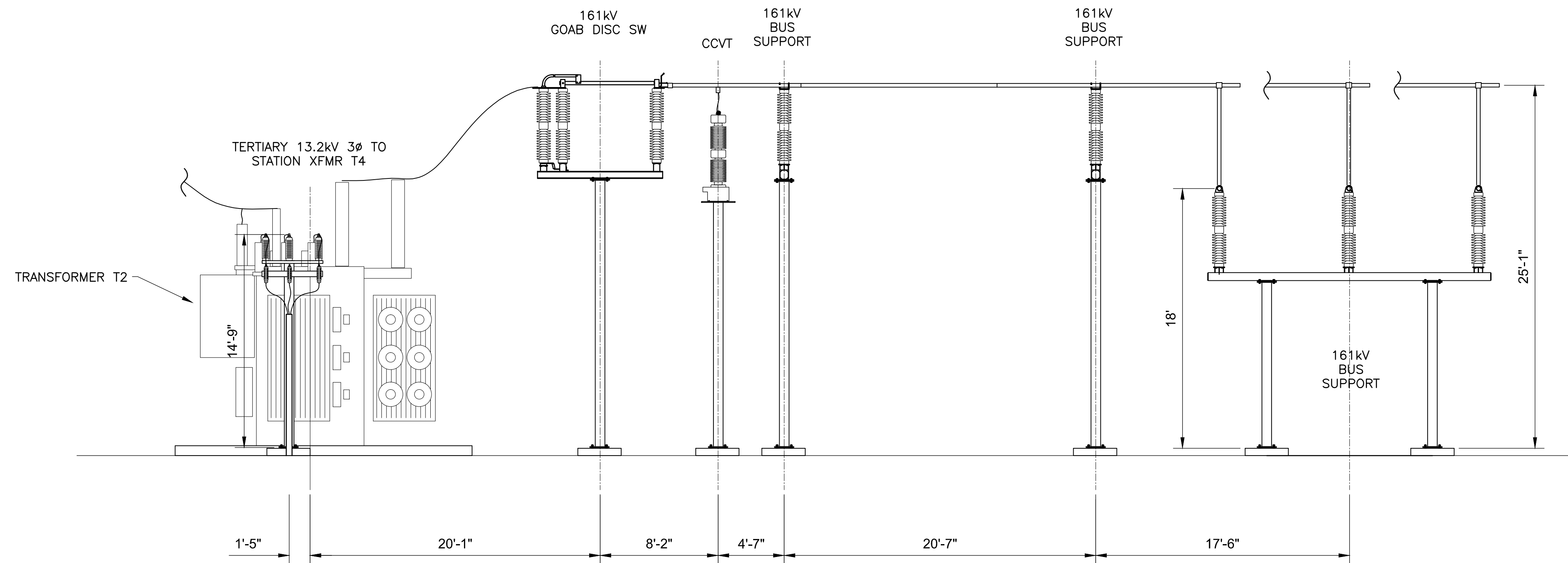


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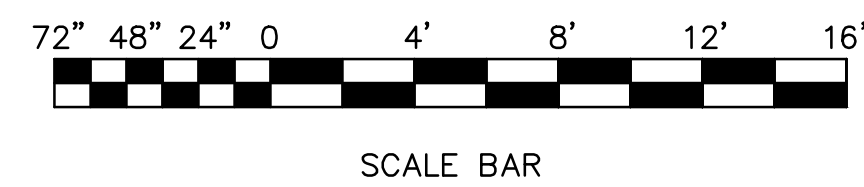
GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69kV			
161kV ELEVATION VIEW D			
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CH: MW		DATE: 3/7/2011	
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GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		S294PE06	0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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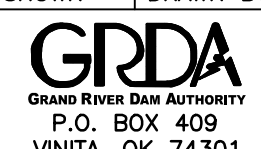
1 161kV VIEW E  
 S294PE01\S294PE07



REFERENCE DRAWINGS

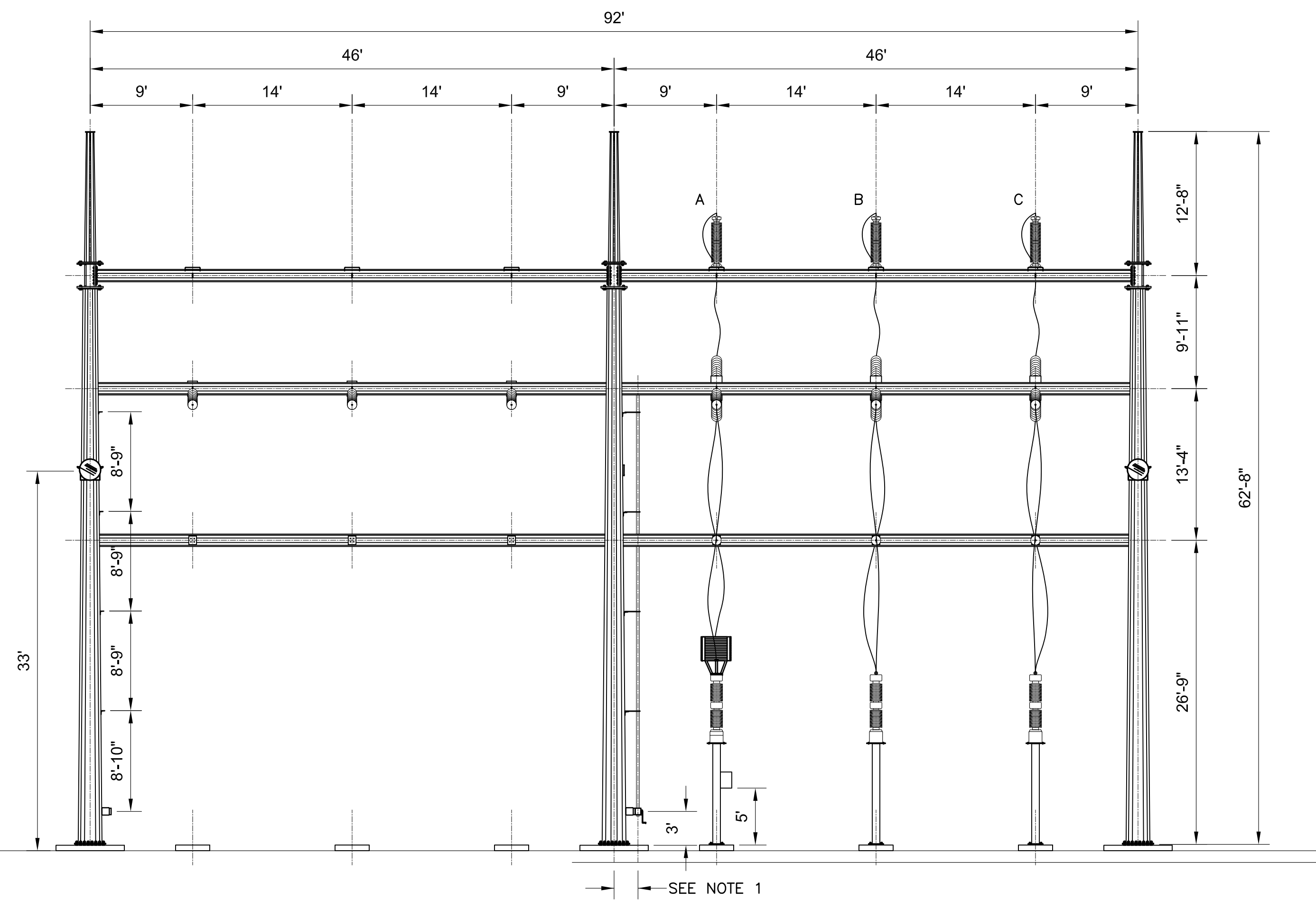
S294PE01 161kV EQUIPMENT PLAN VIEW

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> 161/69kV			
161kV ELEVATION VIEW E			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINTA, OK 74301</small>		DRAWING No. <b>S294PE07</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

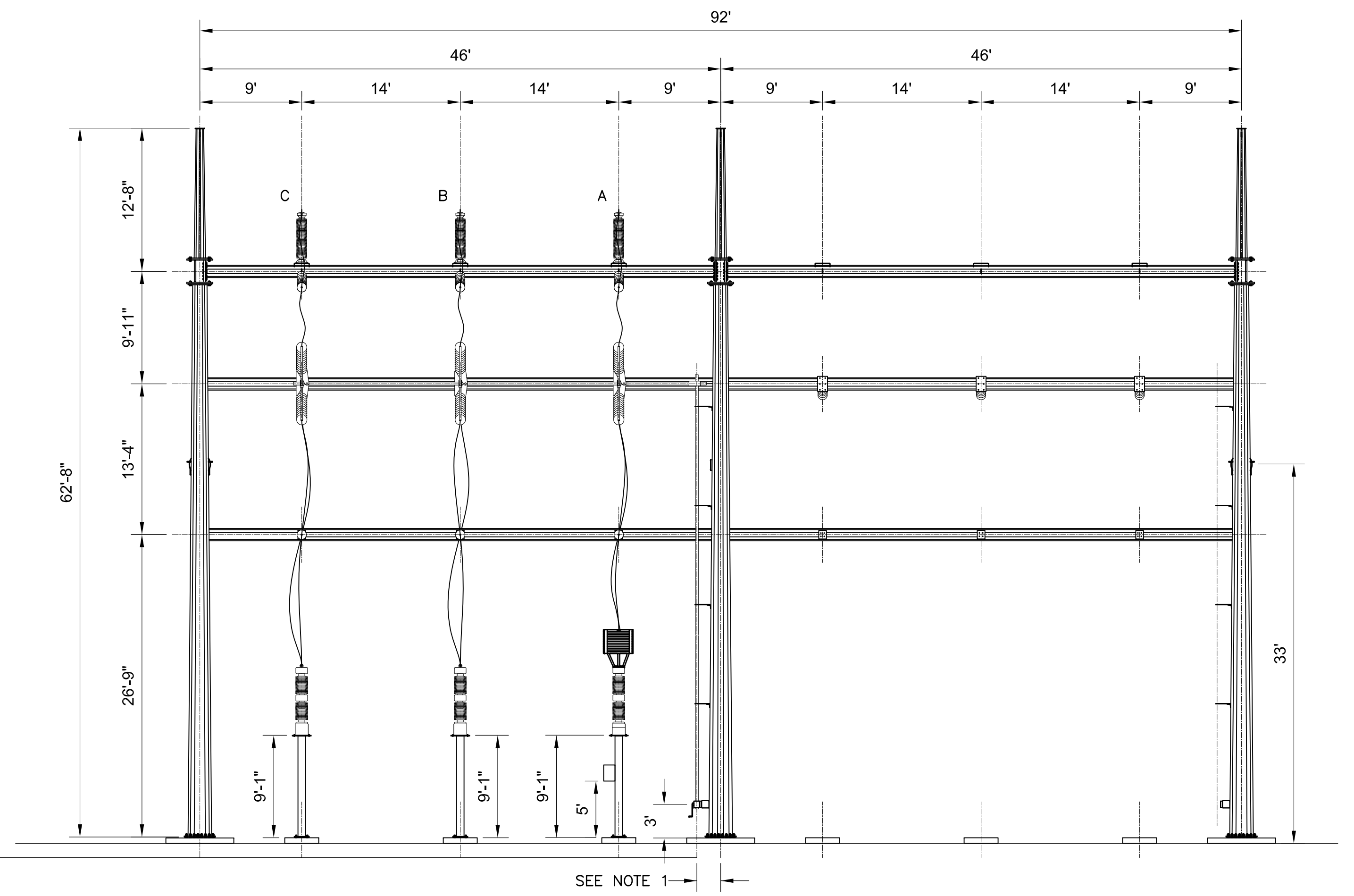
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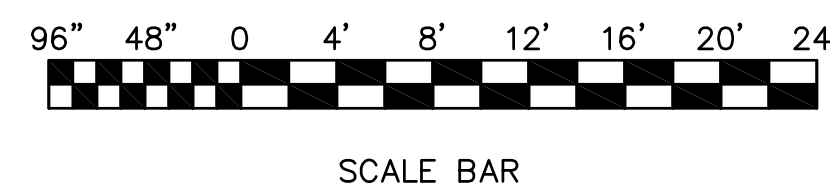
1 161kV VIEW F1  
 S294PE01\S294PE08

**NOTES:**  
 1. VERIFY DIMENSION FROM SHOP DRAWINGS.

**REFERENCE DRAWINGS**  
 S294PE01 161kV EQUIPMENT PLAN VIEW



2 161kV VIEW F2  
 S294PE01\S294PE08



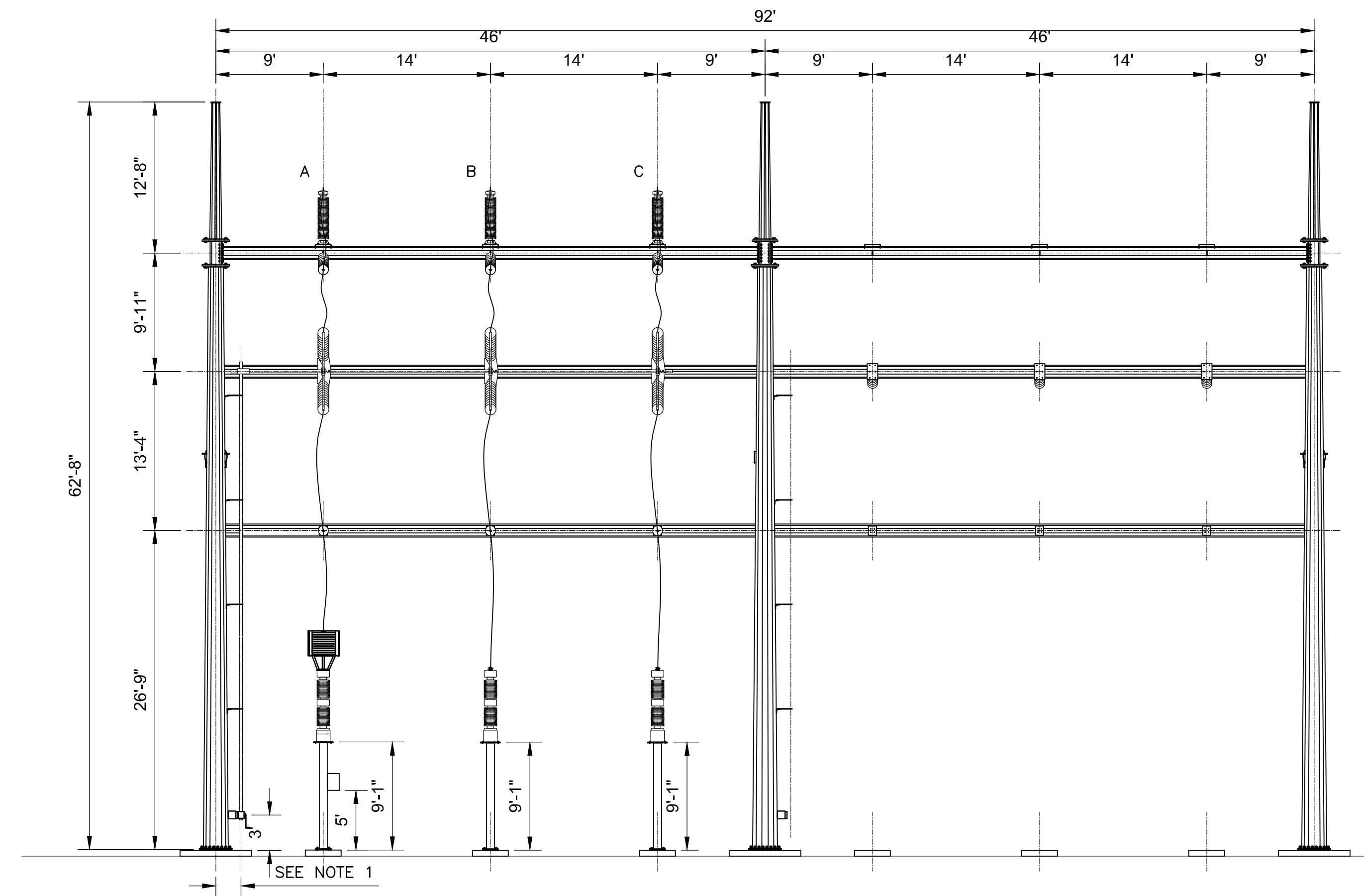
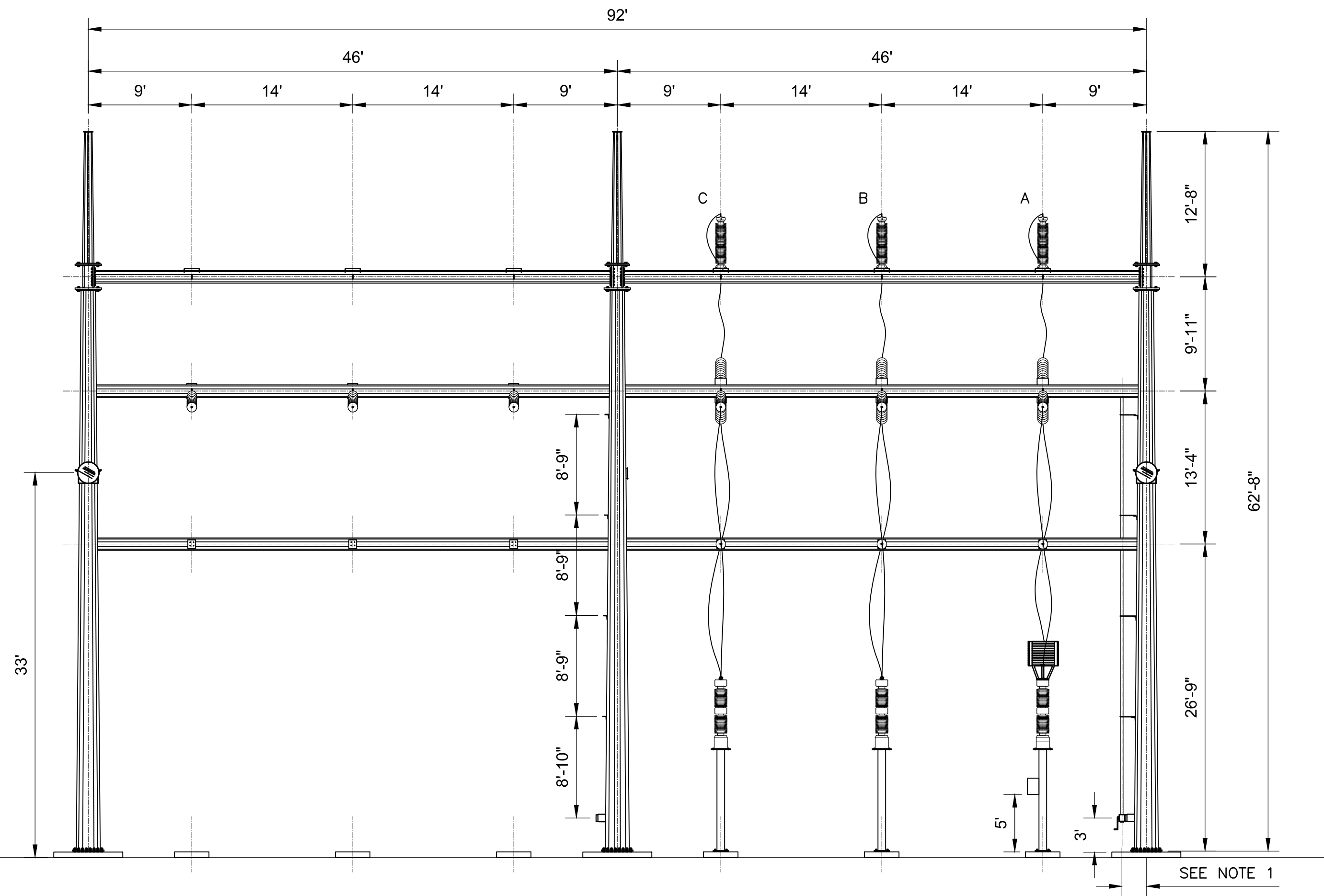
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69kV</small>			
<b>161kV ELEVATION</b> <b>VIEW F1 &amp; F2</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
DRAWING No. S294PE08			REV. 0
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>			

REV	DATE	REVISION DESCRIPTION	AS	BA	DFT	ENG
0	5/29/12	ISSUED FOR BID				



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**NOTES:**

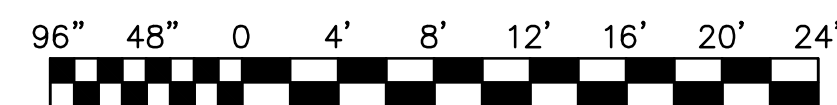
- 1. VERIFY DIMENSION FROM SHOP DRAWINGS.

1 161KV VIEW G1  
 S294PE01|S294PE09

2 161KV VIEW G2  
 S294PE01|S294PE09

**REFERENCE DRAWINGS**

S294PE01 161KV EQUIPMENT PLAN VIEW



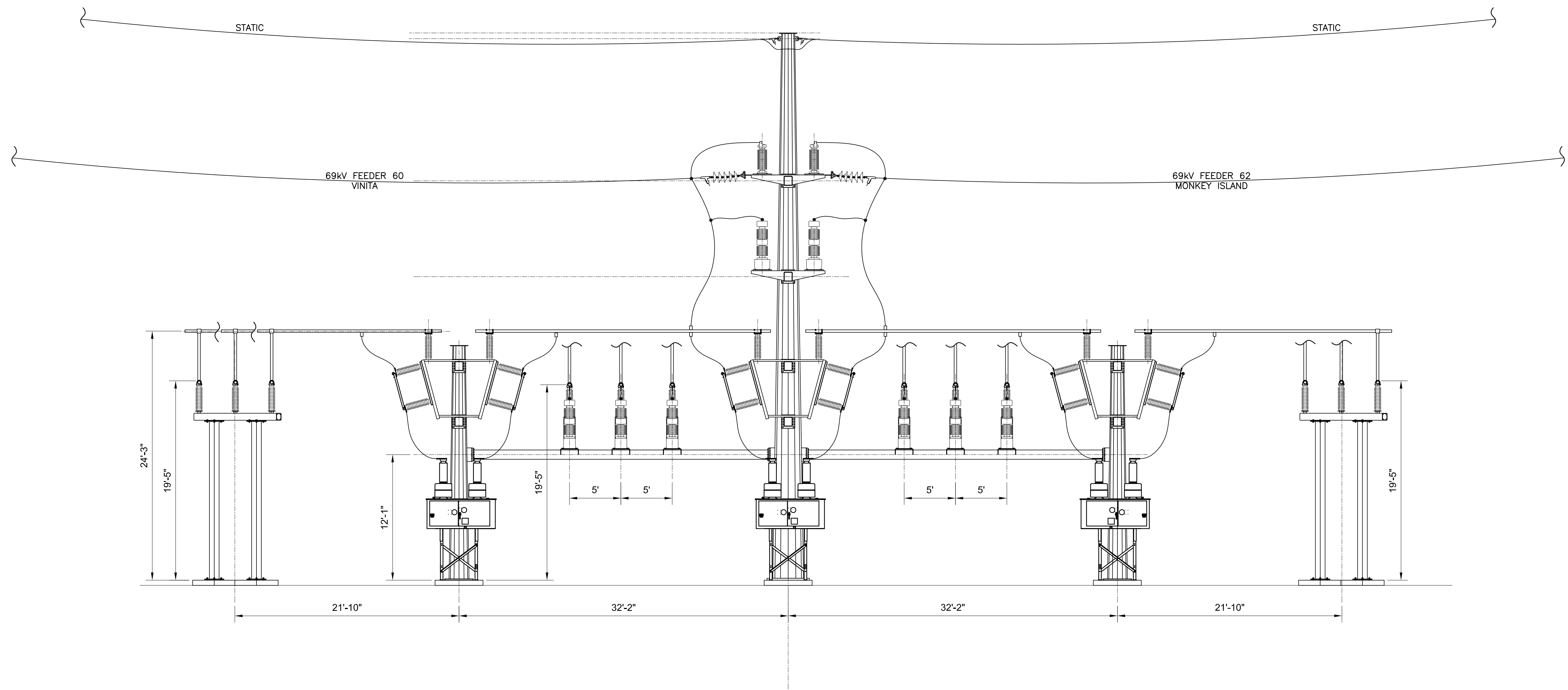
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**ISSUED FOR BID**

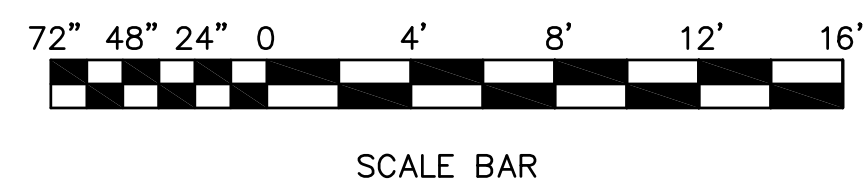
<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>161KV ELEVATION</b> <b>VIEW G1 &amp; G2</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
		<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>	DRAWING No. <b>S294PE09</b> REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

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1 69kV VIEW H  
 S294PE02 | S294PE10



REFERENCE DRAWINGS

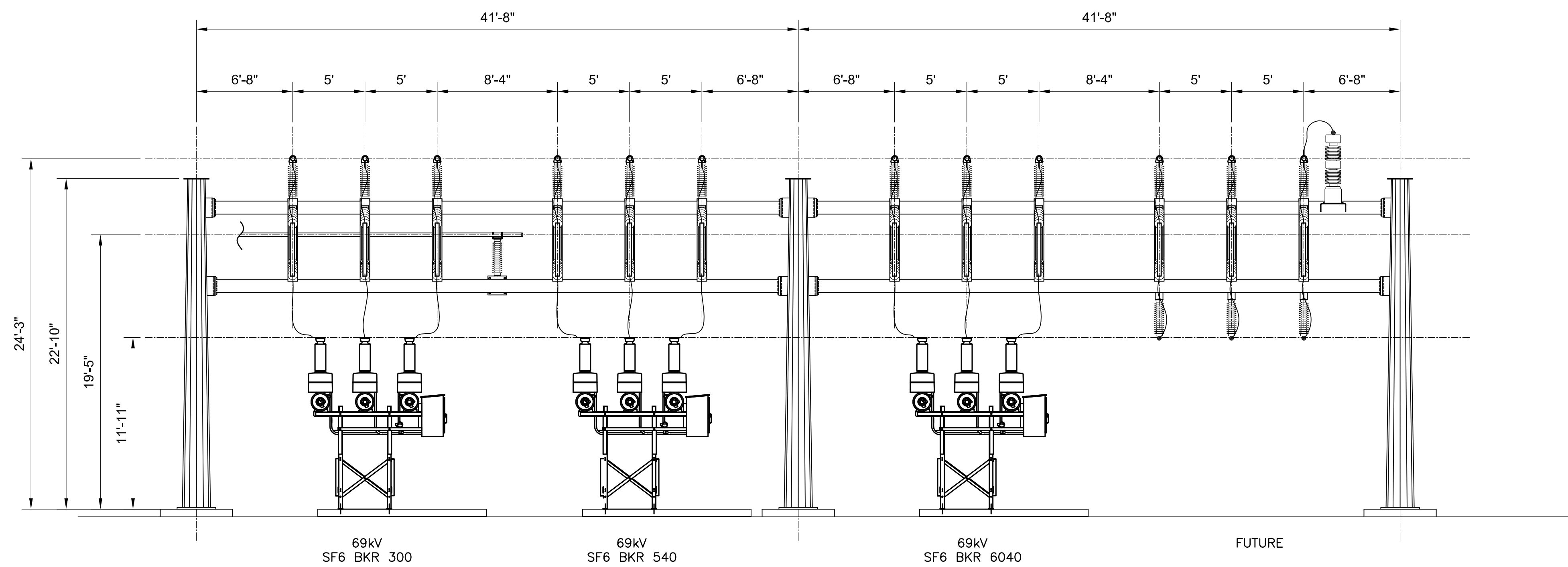
S294PE02 69kV EQUIPMENT PLAN VIEW

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69kV 69kV ELEVATION VIEW H			
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CH: MW		DATE: 3/7/2011	
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REV	DATE	REVISION DESCRIPTION	DFT	ENG
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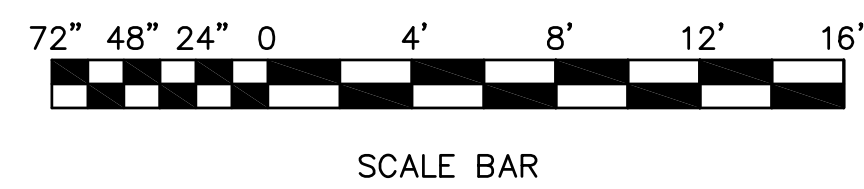
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1 69kV VIEW J  
 S294PE02|S294PE11

REFERENCE DRAWINGS

S294PE02    69kV EQUIPMENT PLAN VIEW

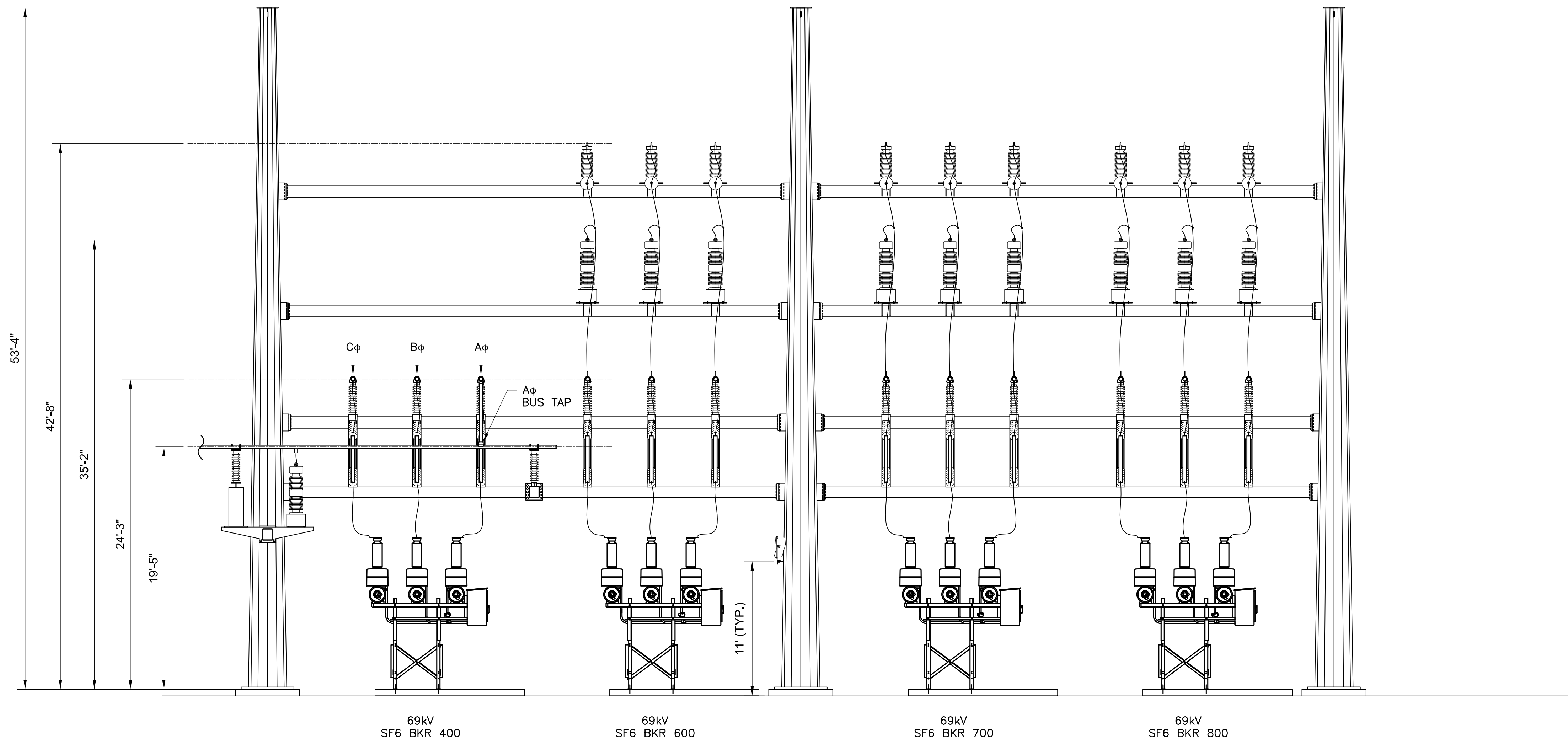


ISSUED FOR BID

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION    S294 AFTON, OKLAHOMA 161/69kV			
69 kV ELEVATION VIEW J			
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CH: MW		DATE: 3/7/2011	
DRAWING No. S294PE11		REV. 0	
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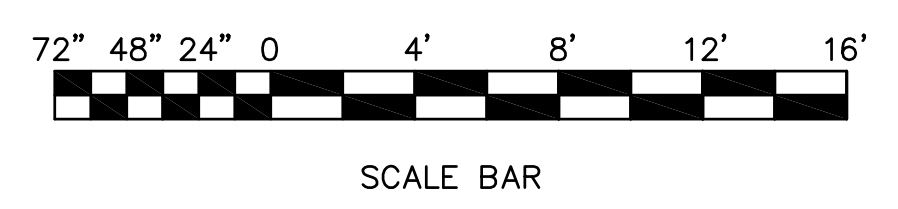
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1 69kV VIEW K  
S294PE02/S294PE12

REFERENCE DRAWINGS  
S294PE02 69kV EQUIPMENT PLAN VIEW



**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69kV

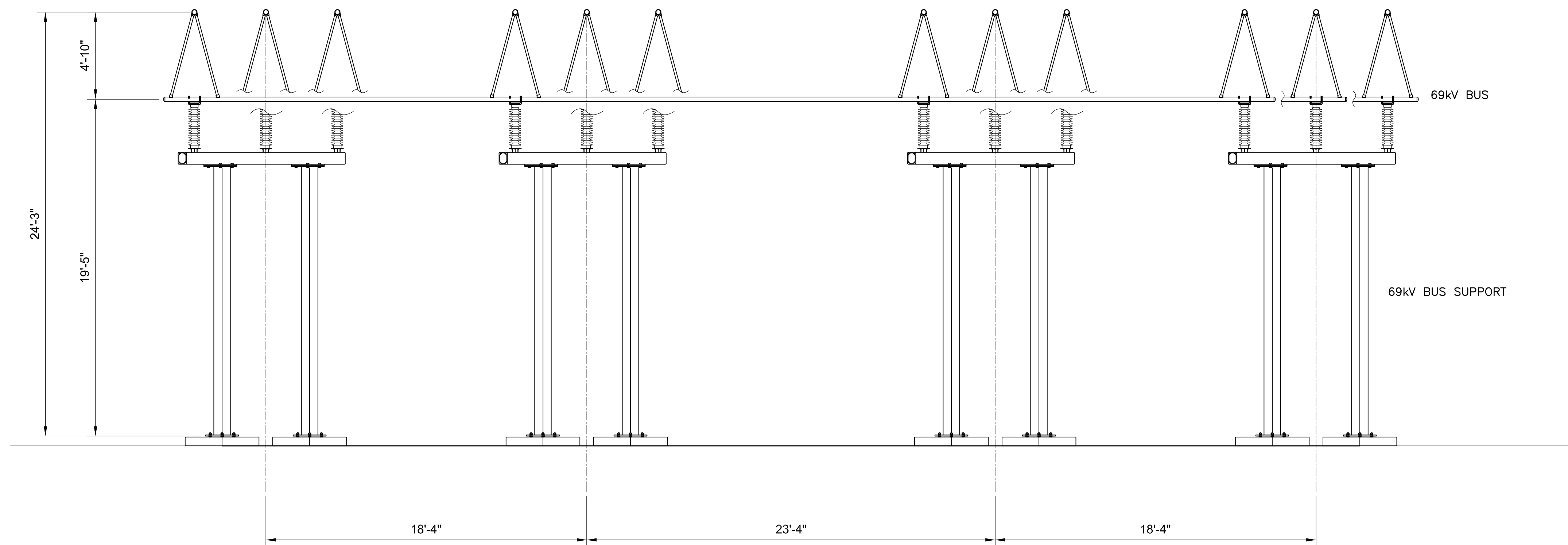
69kV ELEVATION  
VIEW K

SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
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**GRDA**  
GRAND RIVER DAM AUTHORITY  
P.O. BOX 409  
VINITA, OK 74301

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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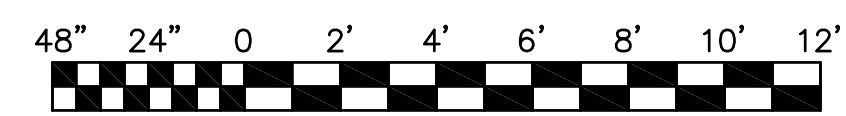
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1  
 69kV VIEW L  
 S294PE02/S294PE13

REFERENCE DRAWINGS

S294PE02 69kV EQUIPMENT PLAN VIEW



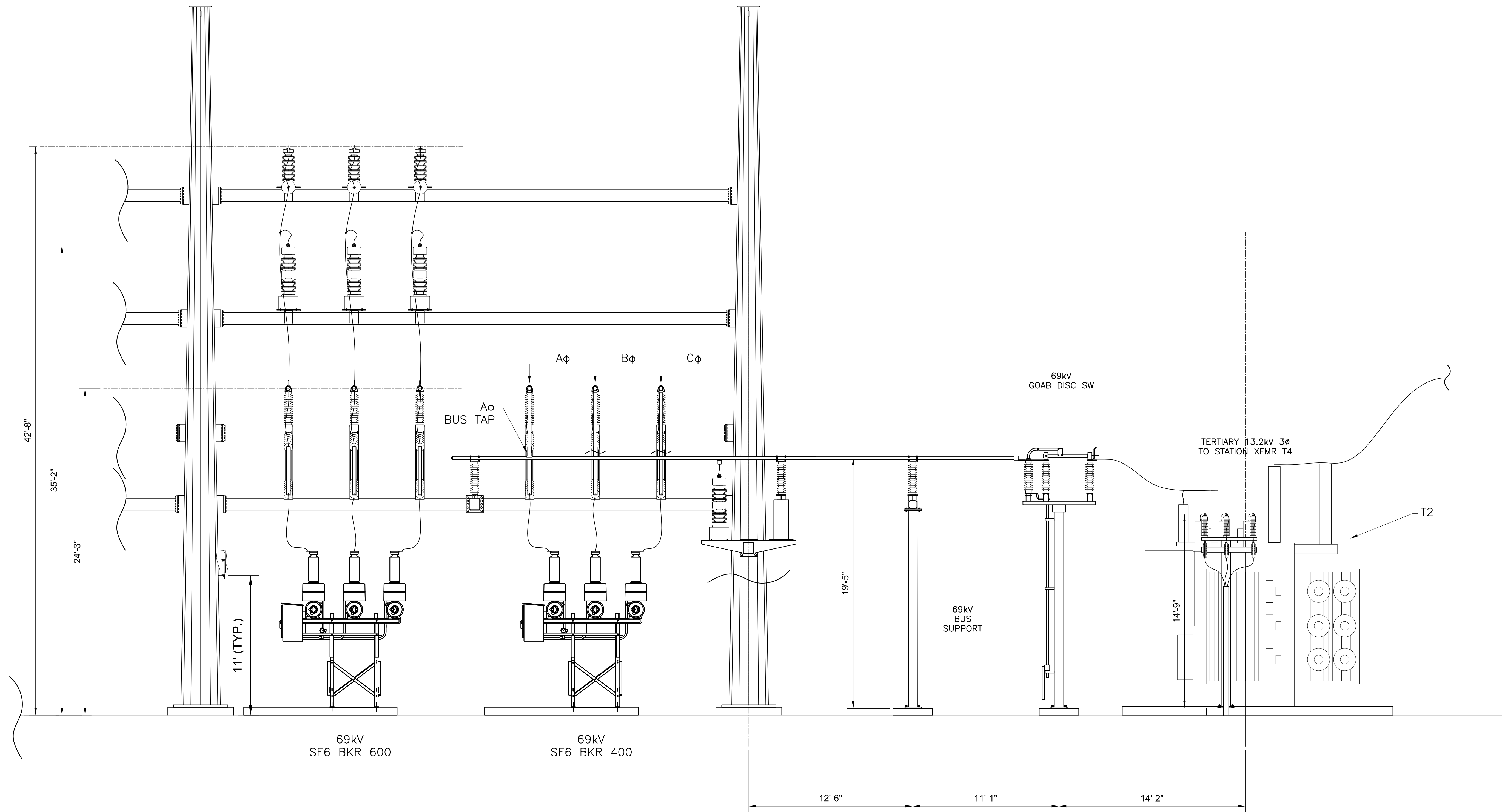
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ISSUED FOR BID

GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69kV</small>			
<b>69kV ELEVATION VIEW L</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
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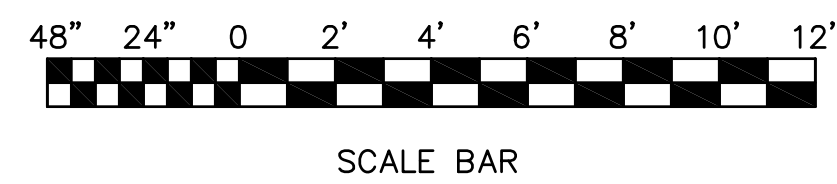
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**REFERENCE DRAWINGS**  
 S294PE02 69kV EQUIPMENT PLAN VIEW

1 69kV VIEW M  
 S294PE02/S294PE14

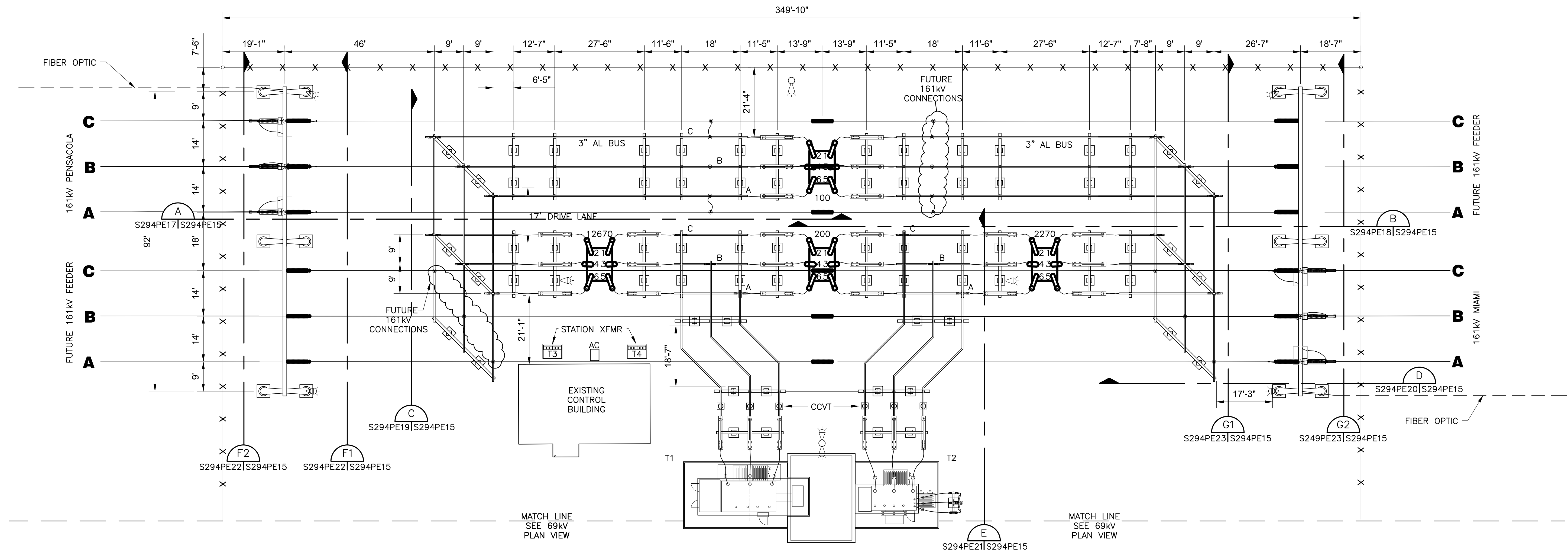


**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>69kV ELEVATION</b> <b>VIEW M</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
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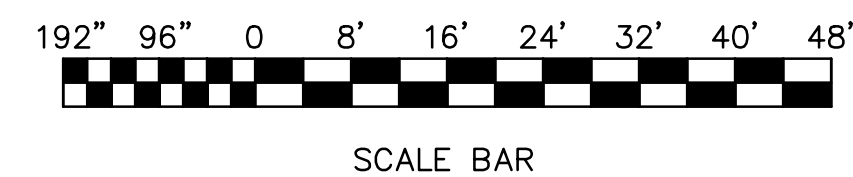
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0	5/29/12	ISSUED FOR BID	AS	BA

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**REFERENCE DRAWINGS**

- S294PE16 69kV EQUIPMENT PLAN VIEW
- S294PE17 161kV ELEVATION PARTS LIST VIEW A
- S294PE18 161kV ELEVATION PARTS LIST VIEW B
- S294PE19 161kV ELEVATION PARTS LIST VIEW C
- S294PE20 161kV ELEVATION PARTS LIST VIEW D
- S294PE21 161kV ELEVATION PARTS LIST VIEW E
- S294PE22 161kV ELEVATION PARTS LIST VIEW F1 & F2
- S294PE23 161kV ELEVATION PARTS LIST VIEW G1 & G2
- S294DE01 BILL OF MATERIALS SHEET 1 OF 4
- S294DE02 BILL OF MATERIALS SHEET 2 OF 4
- S294DE03 BILL OF MATERIALS SHEET 3 OF 4
- S294DE04 BILL OF MATERIALS SHEET 4 OF 4

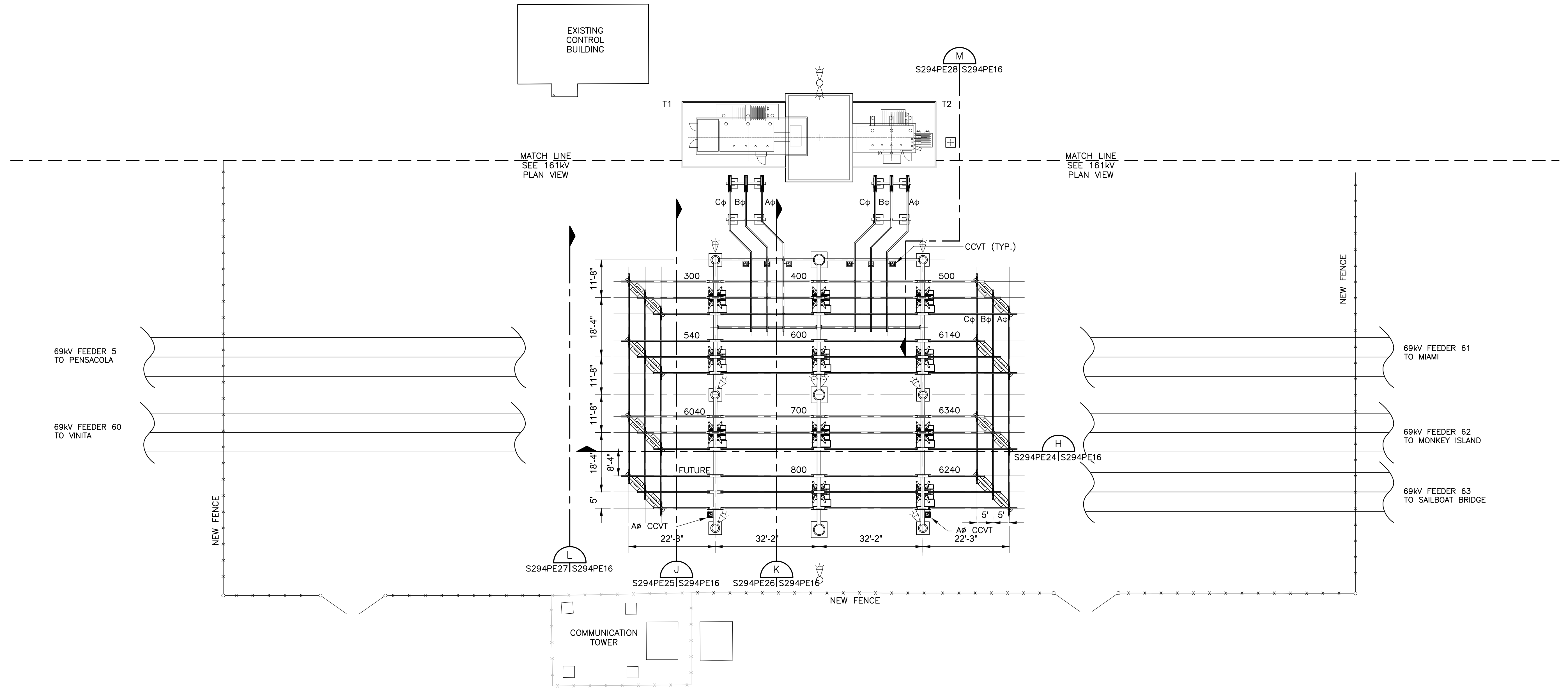
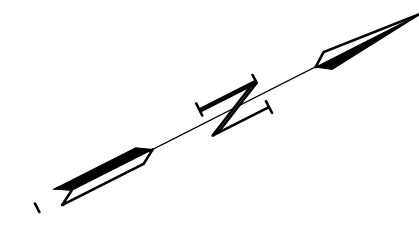


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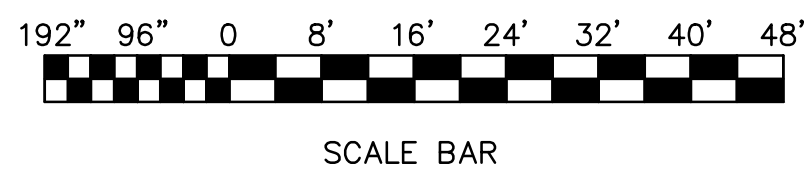
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SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
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- REFERENCE DRAWINGS**
- S294PE15 161kV EQUIPMENT PLAN VIEW
  - S294PE24 69kV ELEVATION PARTS LIST VIEW H
  - S294PE25 69kV ELEVATION PARTS LIST VIEW J
  - S294PE26 69kV ELEVATION PARTS LIST VIEW K
  - S294PE27 69kV ELEVATION PARTS LIST VIEW L
  - S294PE28 69kV ELEVATION PARTS LIST VIEW M
  - S294DE01 BILL OF MATERIALS SHEET 1 OF 3
  - S294DE02 BILL OF MATERIALS SHEET 2 OF 3
  - S294DE03 BILL OF MATERIALS SHEET 3 OF 3



**ISSUED FOR BID**

**GRAND RIVER DAM AUTHORITY**  
**AFTON SUBSTATION** S294  
AFTON, OKLAHOMA  
161/69KV

**PARTS LIST 69kV EQUIPMENT**  
**PLAN VIEW**

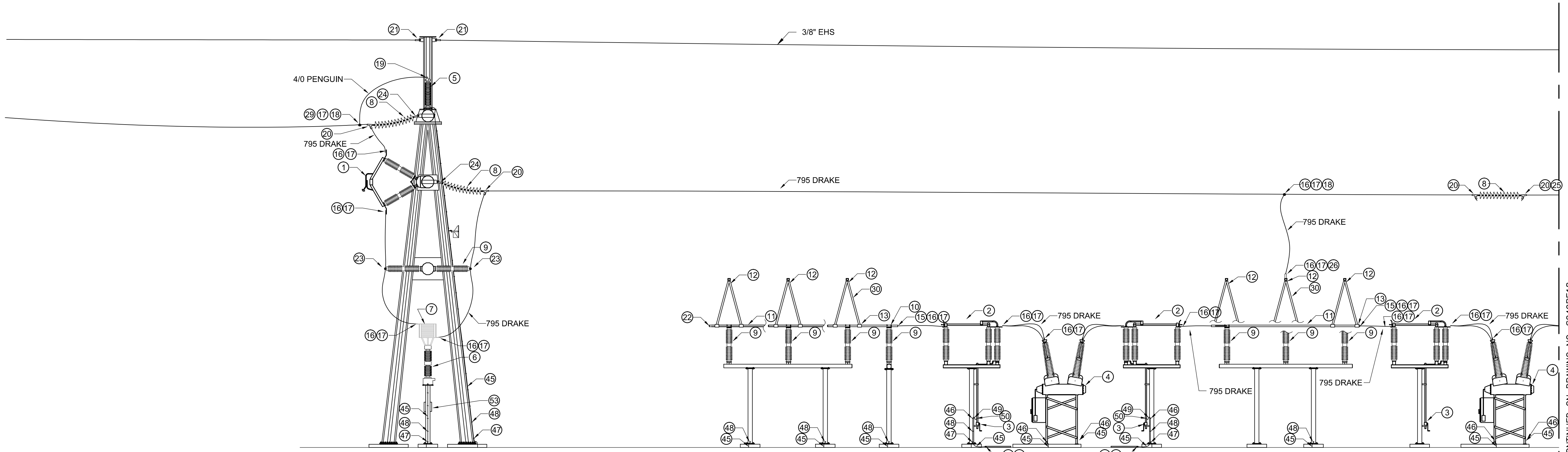
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<b>GRDA</b> <small>Grand River Dam Authority</small> P.O. BOX 409 VINITA, OK 74301	DRAWING No. <b>S294PE16</b>	REV. <b>0</b>
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REV	DATE	REVISION DESCRIPTION	DFT	ENG
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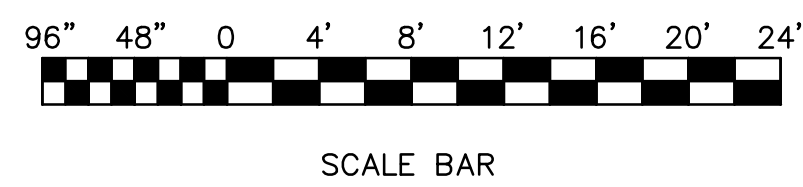


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CONTINUED ON DRAWING NO. S249PE18

1 161kV VIEW A  
S294PE15/S294PE17



**REFERENCE DRAWINGS**

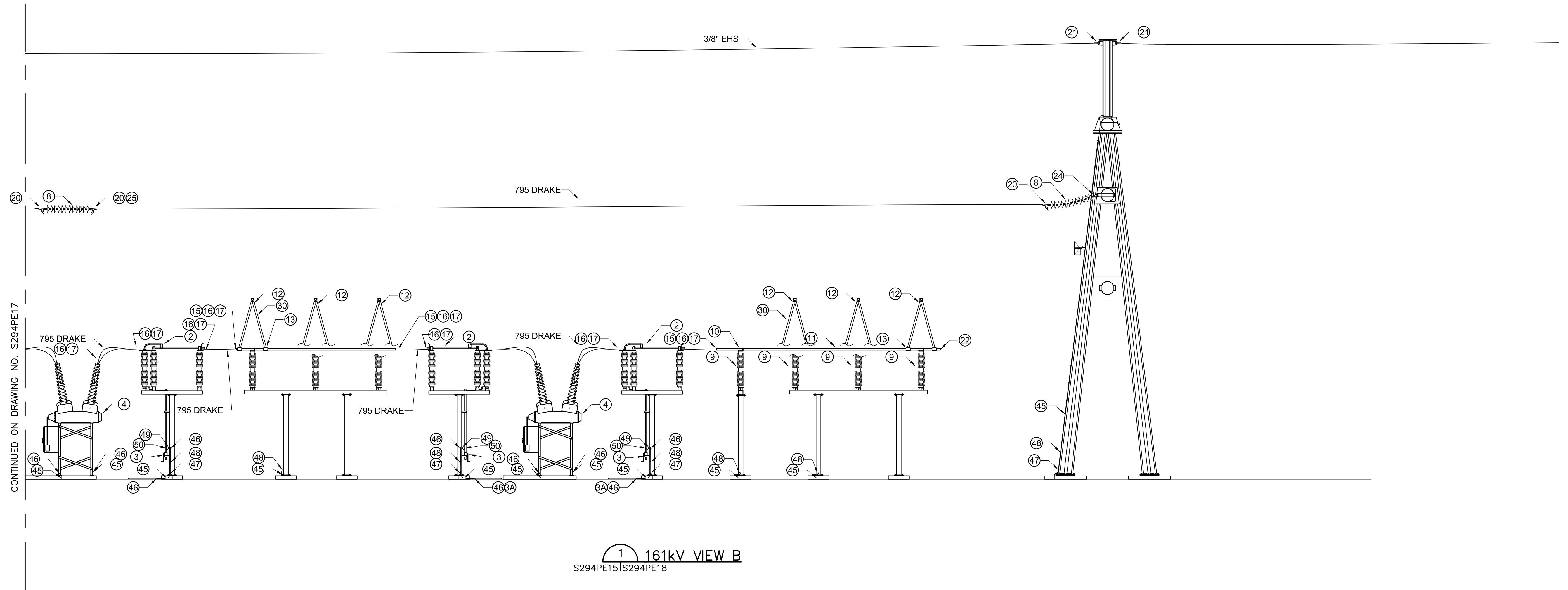
- S294PE15 PARTS LIST 161KV EQUIP. PLAN VIEW
- S294PE18 161KV ELEVATION PARTS LIST VIEW B
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69KV			
<b>161kV ELEVATION</b> <b>PARTS LIST VIEW A</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
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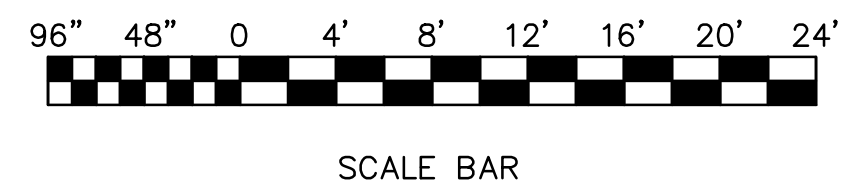
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1 161kV VIEW B  
S294PE15|S294PE18

REFERENCE DRAWINGS

- S294PE15 PARTS LIST 161kV EQUIP. PLAN VIEW
- S294PE17 161kV ELEVATION PARTS LIST VIEW A
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3

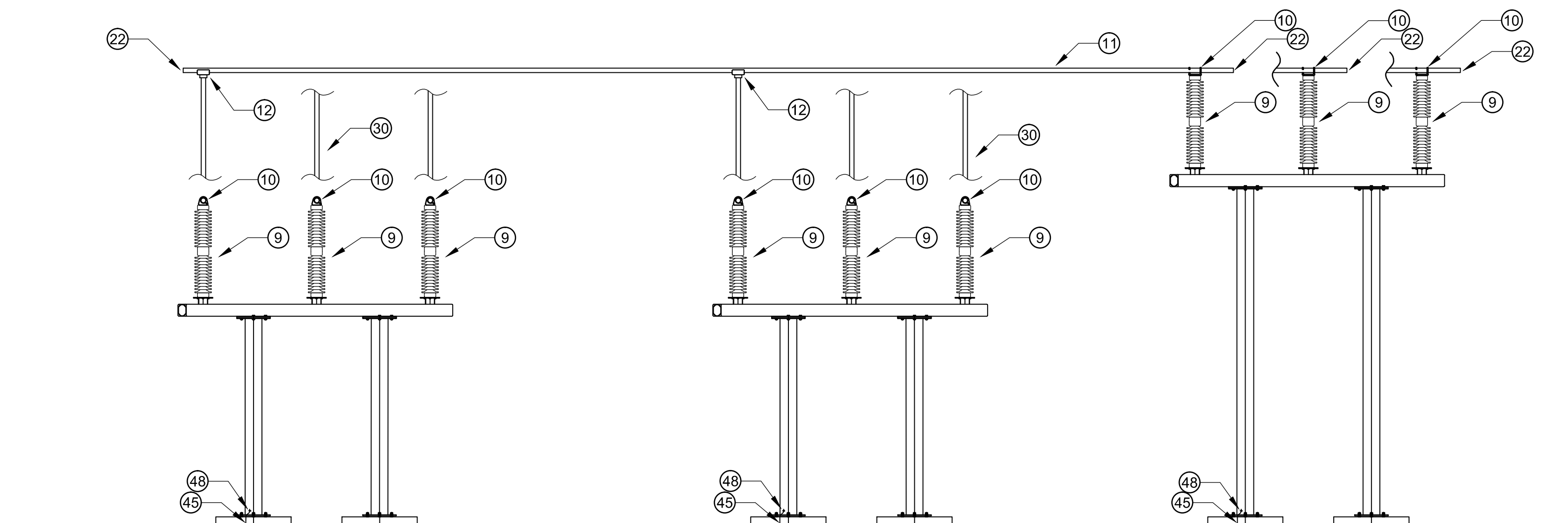


ISSUED FOR BID

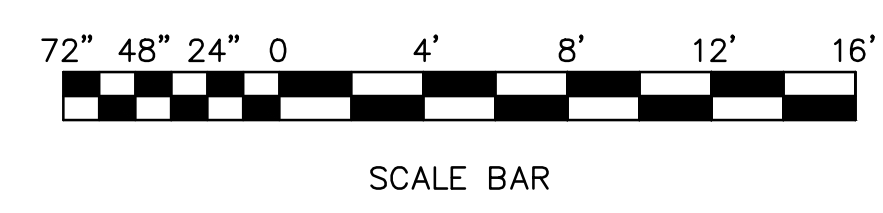
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REV	DATE	REVISION DESCRIPTION	DFT	ENG
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1  
 161kV VIEW C  
 S294PE15|S294PE19



REFERENCE DRAWINGS

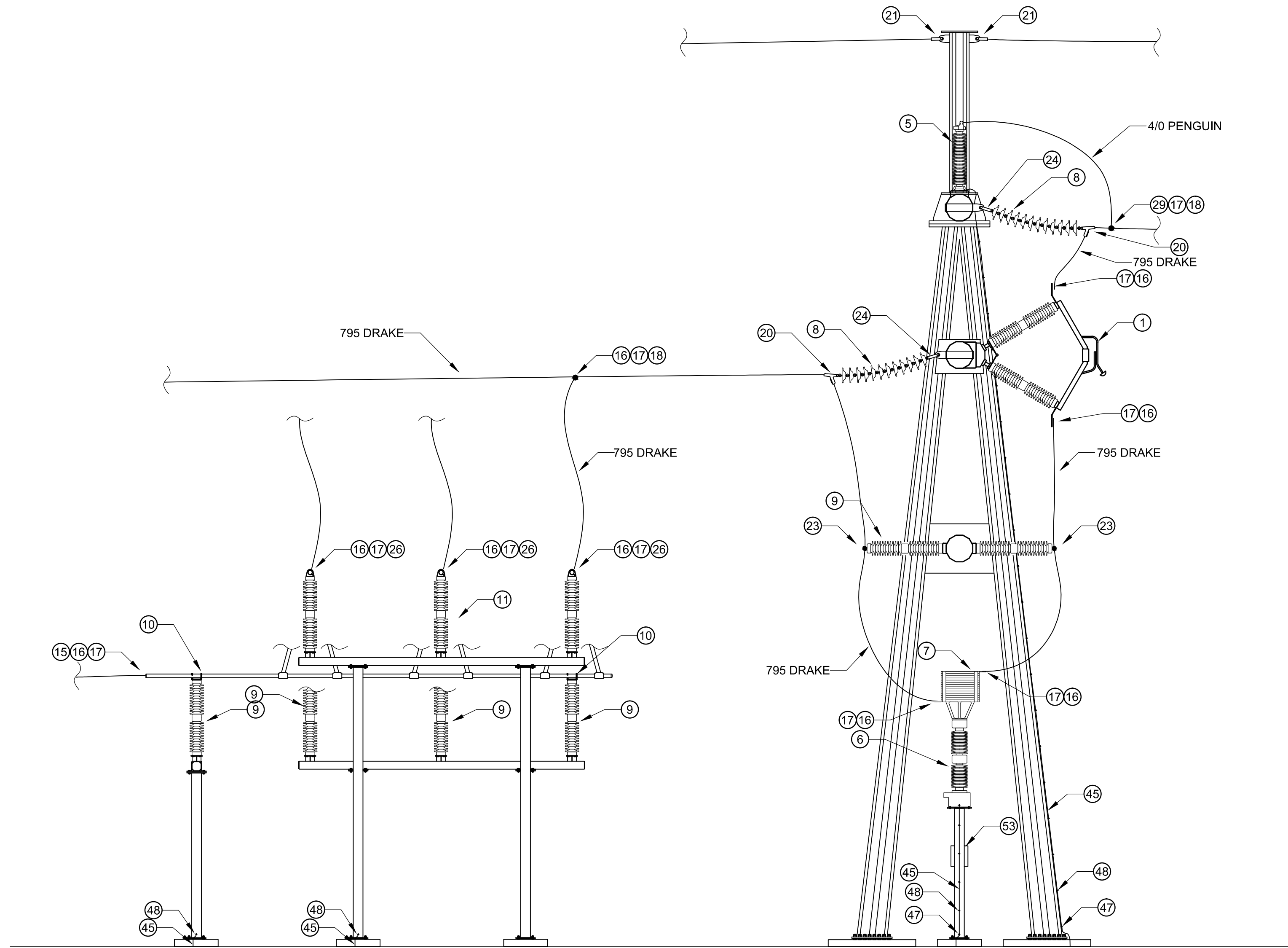
- S294PE15 PARTS LIST 161kV EQUIP. PLAN VIEW
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69kV</small>			
<b>161kV ELEVATION</b> <b>PARTS LIST VIEW C</b>			
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REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

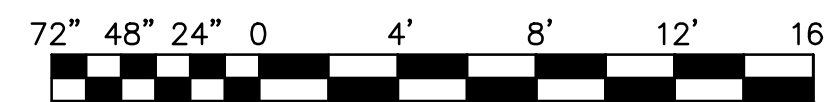
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 Last Plotted by: Shults; Arlene Plot Style: Conver Standard Full.ctb Plot Scale: 1/8" = 1'-0" Plot Date: 5/29/2012 1:00 PM Plotter used: DWG to PDF.pc3



**REFERENCE DRAWINGS**

- S294PE15 PARTS LIST 161KV EQUIP. PLAN VIEW
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3

1 161kV VIEW D  
 S294PE15/S294PE20

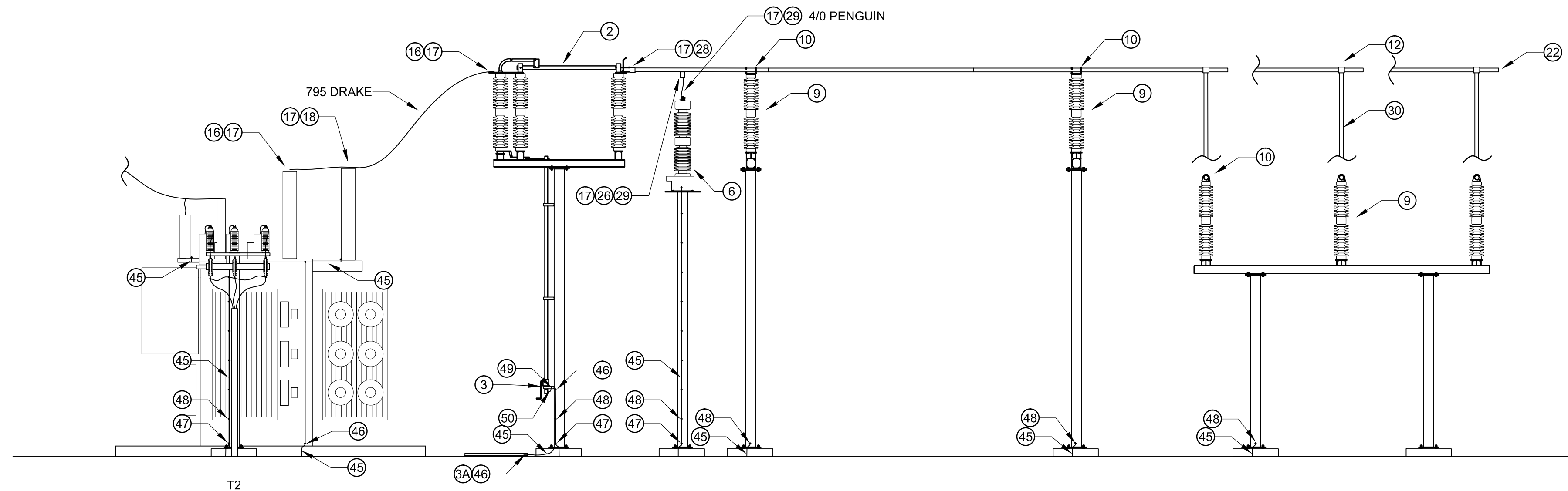


**ISSUED FOR BID**

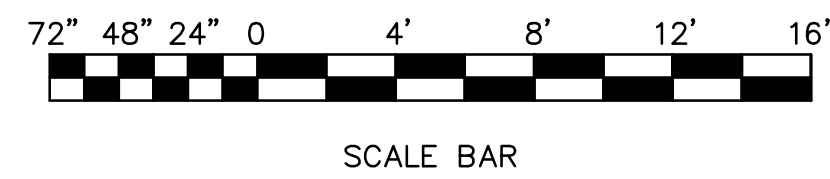
<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>161kV ELEVATION</b> <b>PARTS LIST VIEW D</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294PE20</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

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 Last plotted by: Shults, Ariene Plot Style: Garver Standard Full.ctb Plot Date: 5/29/2012 1:01 PM Plotter used: DWG To PDF.pc3



161kV VIEW E  
 S294PE15|S294PE21



**REFERENCE DRAWINGS**

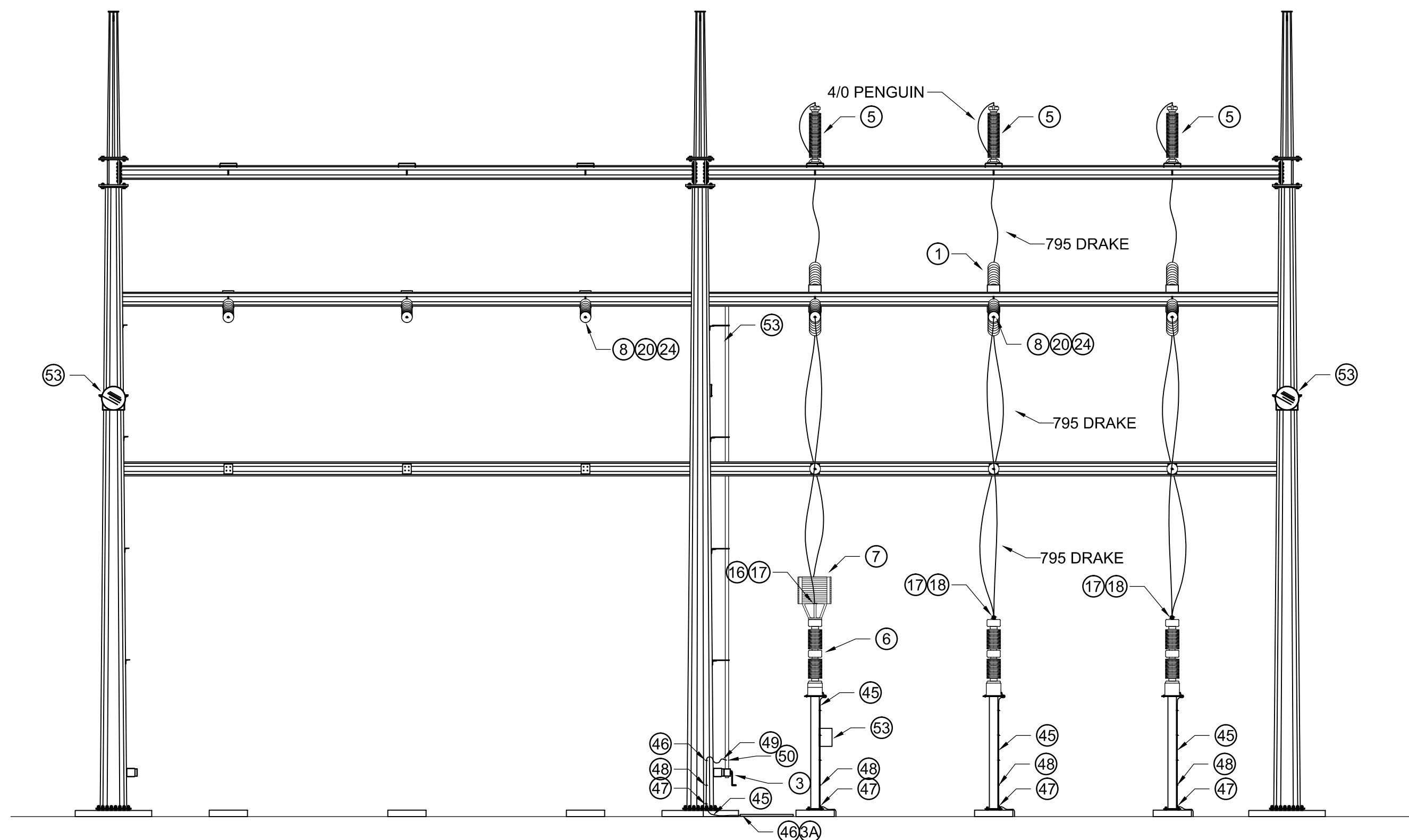
- S294PE15 PARTS LIST 161KV EQUIP. PLAN VIEW
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3

**ISSUED FOR BID**

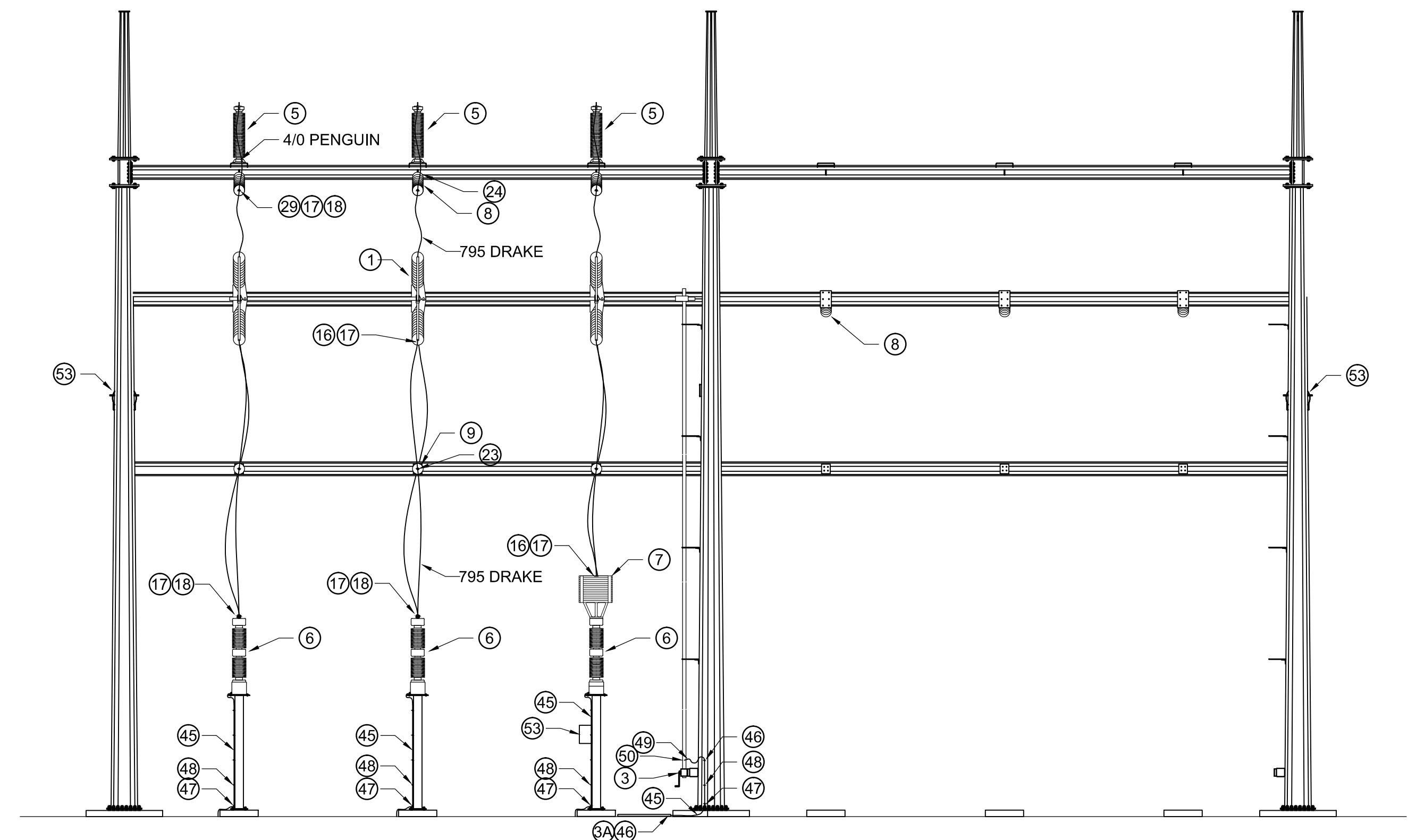
<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>161kV ELEVATION</b> <b>PARTS LIST VIEW E</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294PE21</b>	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

File: W:\Drafting\Drawings\Substation\AFTON\Garver CAD Drawings 2-16-12\S294PE22\_161KV ELEVATION PARTS LIST VIEW F1 & F2.dwg Last Save: 5/29/2012 1:02 PM Last saved by: Ashults  
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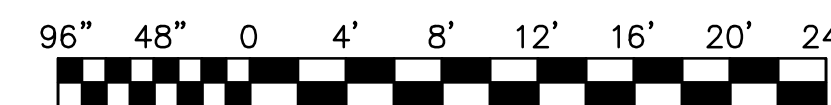
1 161kV VIEW F1  
 S294PE15|S294PE22



2 161kV VIEW F2  
 S294PE15|S294PE22

**REFERENCE DRAWINGS**

- S294PE15 PARTS LIST 161KV EQUIP. PLAN VIEW
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3



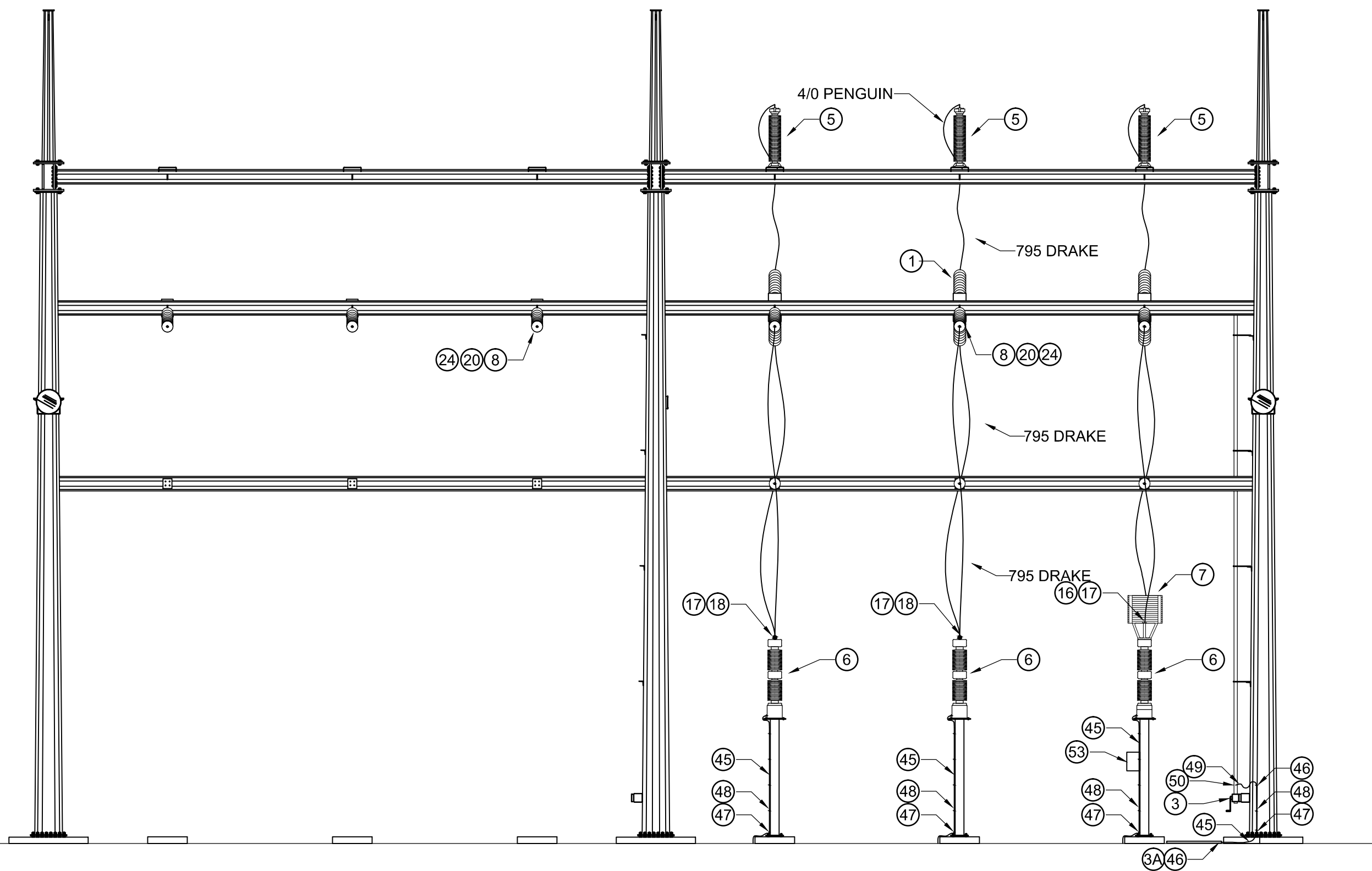
SCALE BAR

**ISSUED FOR BID**

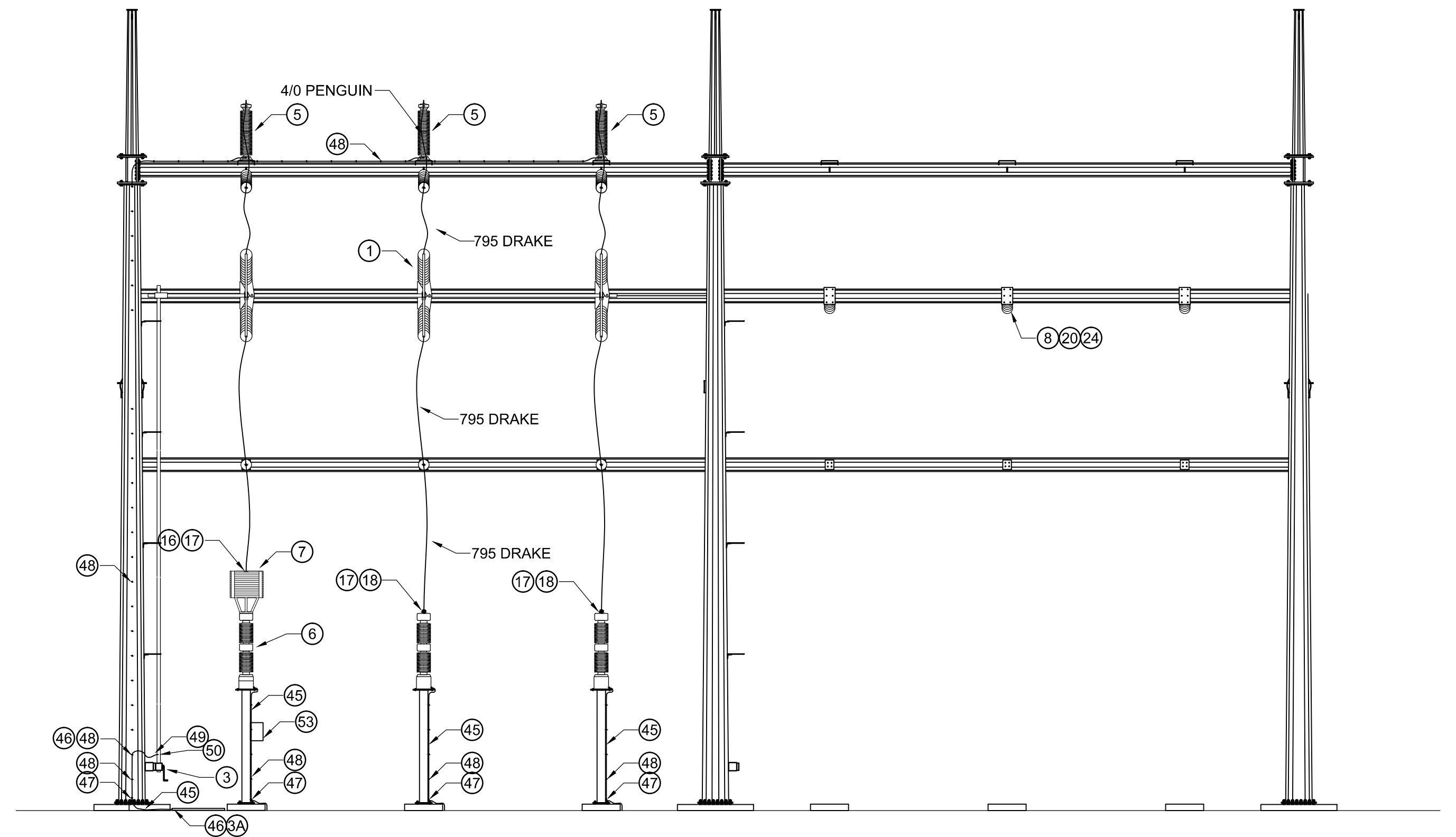
<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>161kV ELEVATION</b> <b>PARTS LIST VIEW F1 &amp; F2</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>		DRAWING No. <b>S294PE22</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

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 Last plotted by: Shults, Arlene Plot Style: Garver Standard Full.ctb Plot Date: 5/29/2012 1:15 PM Plotter used: DWG To PDF.pc3



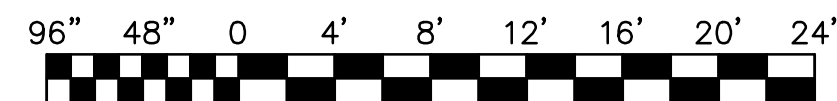
1 161kV VIEW G1  
 S294PE15|S294PE23



2 161kV VIEW G2  
 S294PE15|S294PE23

**REFERENCE DRAWINGS**

- S294PE15 PARTS LIST 161KV EQUIP. PLAN VIEW
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3



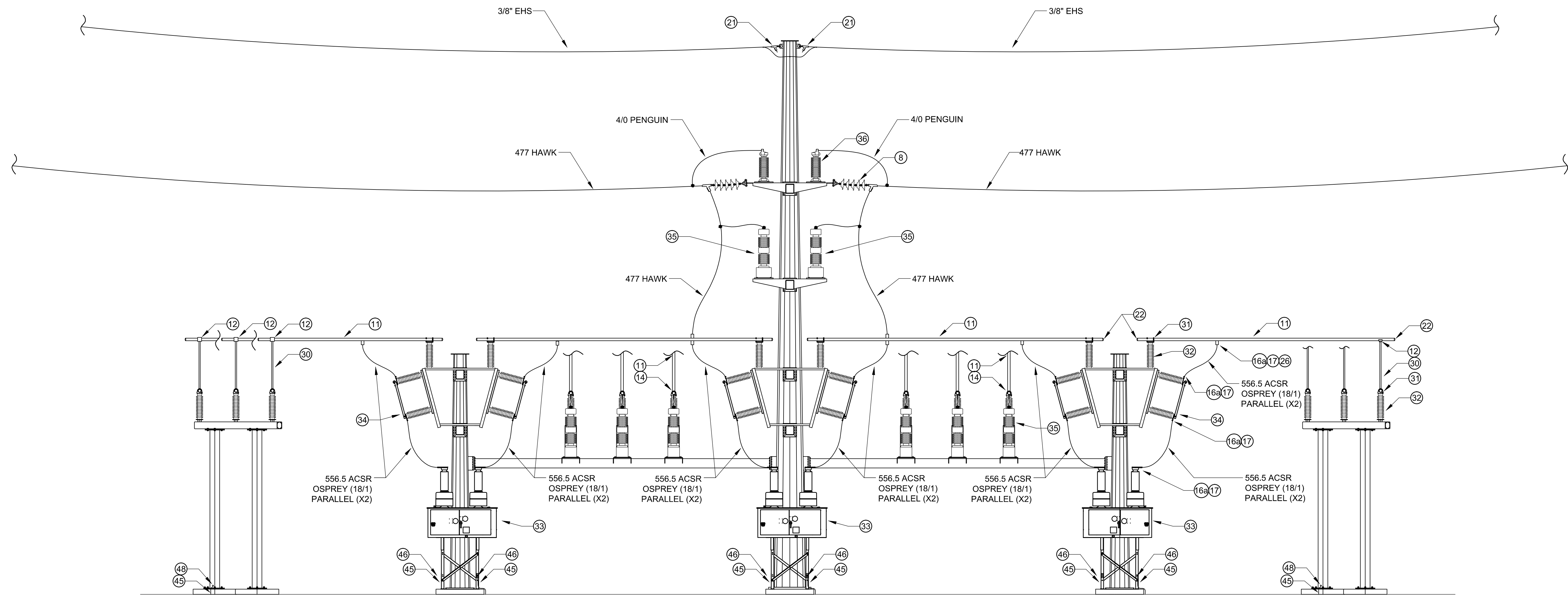
SCALE BAR

**ISSUED FOR BID**

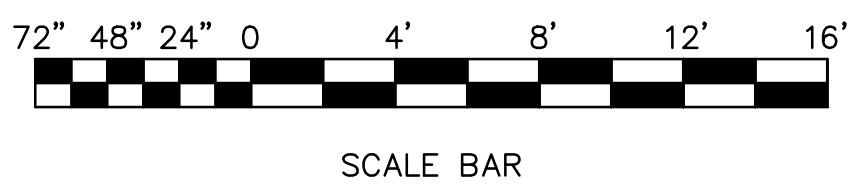
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<b>161KV ELEVATION</b> <b>PARTS LIST VIEW G1 &amp; G2</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
		<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY</small> <small>P.O. BOX 409</small> <small>VINITA, OK 74301</small>	DRAWING No. <b>S294PE23</b>
			REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

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1 69kV VIEW H  
 S294PE16\S294PE24 SCALE: NONE



**REFERENCE DRAWINGS**

- S294PE16 PARTS LIST 69KV EQUIP. PLAN VIEW
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3

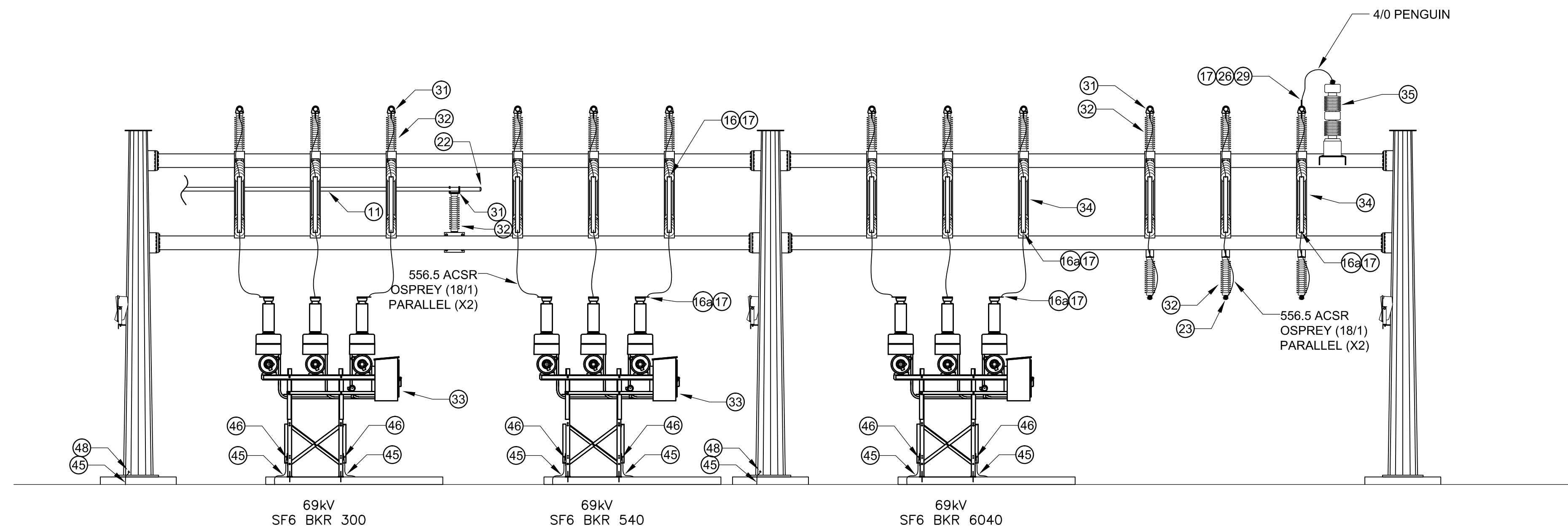
**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA</small> <small>161/69KV</small>			
<b>69kV ELEVATION</b> <b>PARTS LIST VIEW H</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
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		REV.	REV.
		0	0

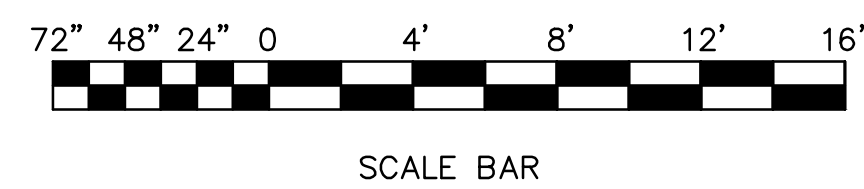
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1 69kV VIEW J  
 S294PE16|S294PE25



REFERENCE DRAWINGS

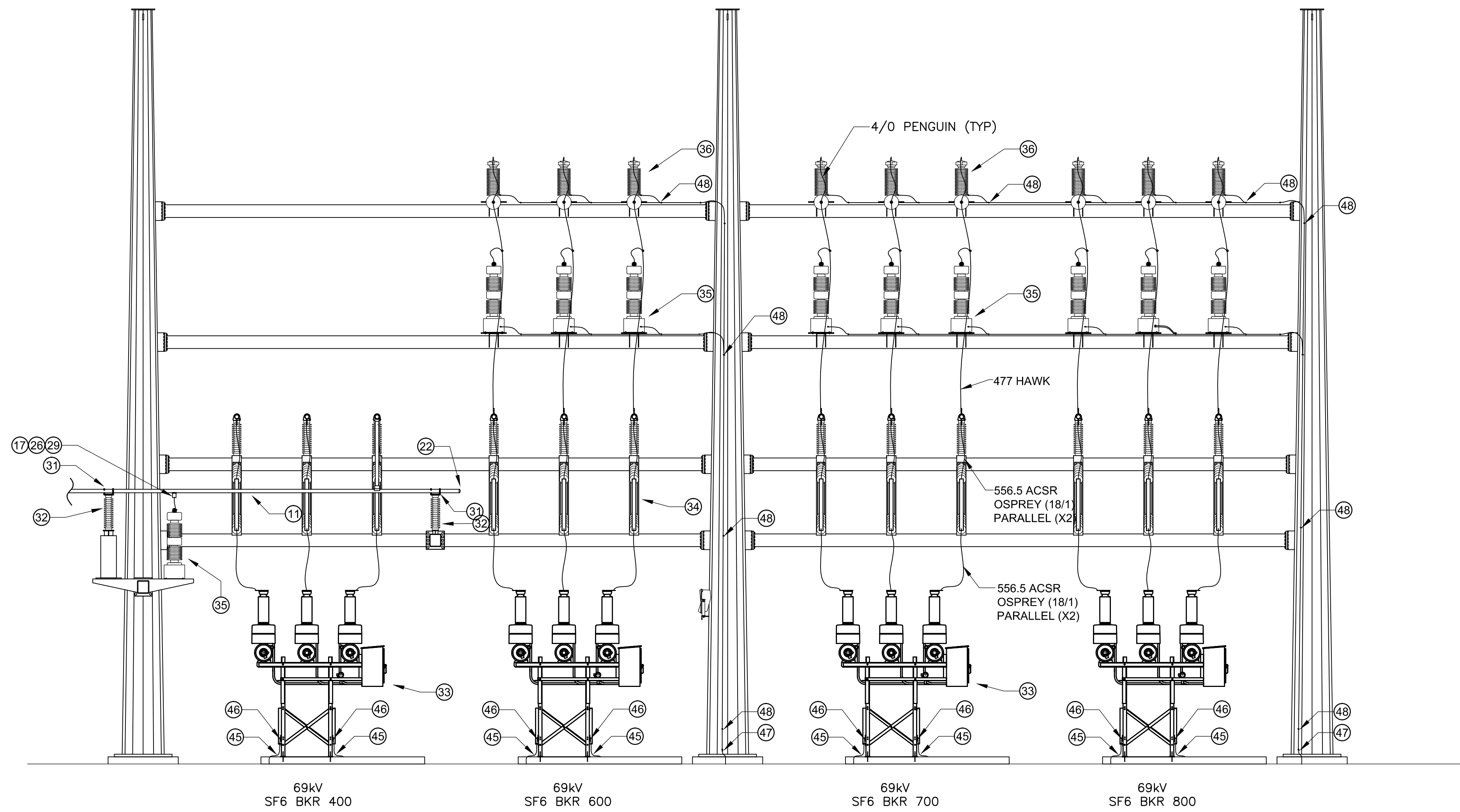
- S294PE16 PARTS LIST 69kV EQUIP. PLAN VIEW
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3

ISSUED FOR BID

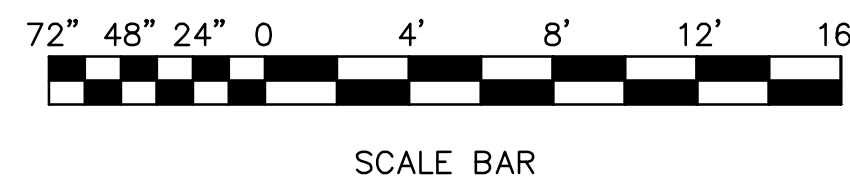
GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA          161/69kV</small>			
<b>69kV ELEVATION</b> <b>PARTS LIST VIEW J</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY          P.O. BOX 409          VINITA, OK 74301</small>			DRAWING No. <b>S294PE25</b>
			REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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1 69kV VIEW K  
 S294PE16|S294PE26



REFERENCE DRAWINGS

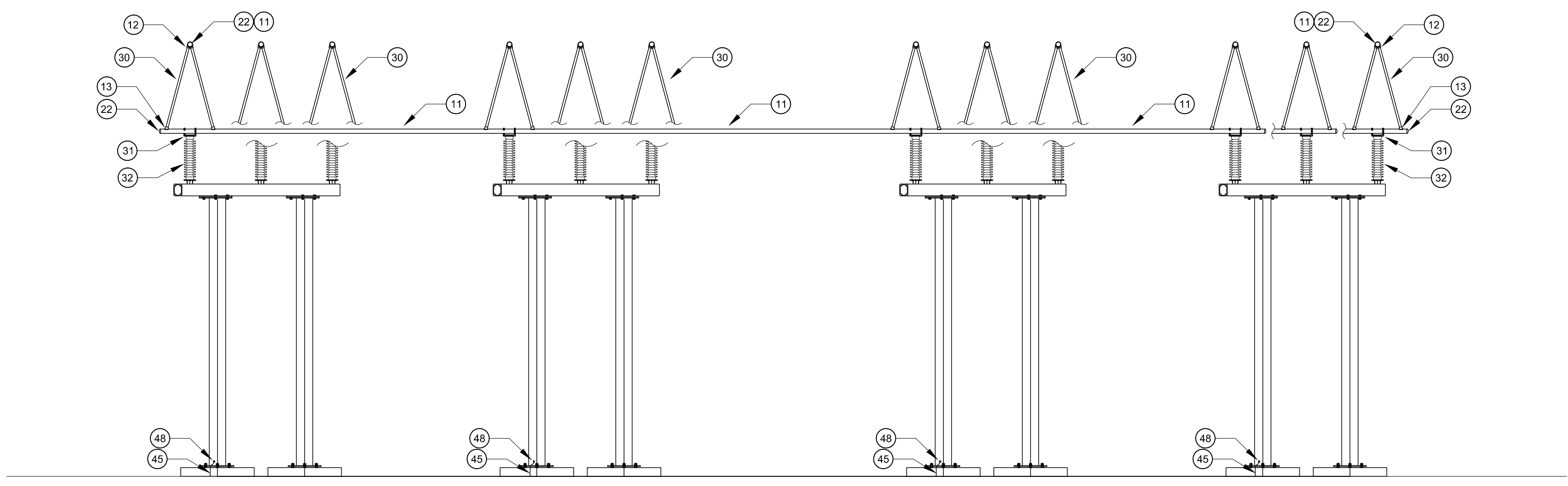
- S294PE16 PARTS LIST 69kV EQUIP. PLAN VIEW
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3

ISSUED FOR BID

GRAND RIVER DAM AUTHORITY <b>AFTON SUBSTATION</b> S294 <small>AFTON, OKLAHOMA 161/69kV</small>			
<b>69kV ELEVATION</b> <b>PARTS LIST VIEW K</b>			
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CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. S294PE26	REV. 0

REV	DATE	REVISION DESCRIPTION	DFT	ENG
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 Last plotted by: Shults, Arlene Plot Style: Garver Standard Full.ctb Plot Scale: 1:48 Plot Date: 5/29/2012 2:31 PM Plotter used: DWG To PDF.pc3



1  
 69kV VIEW L  
 S294PE16 | S294PE27



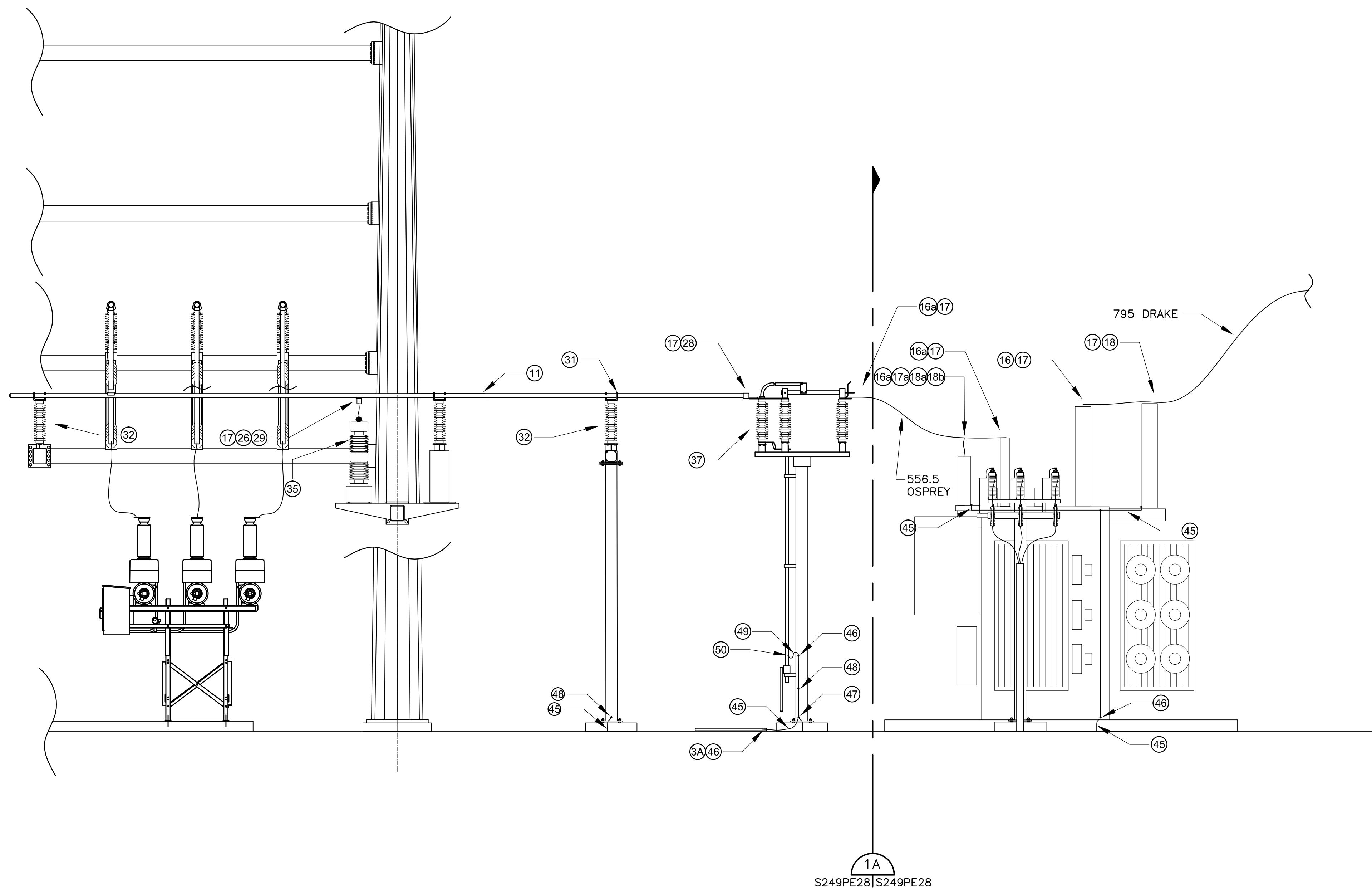
- REFERENCE DRAWINGS**
- S294PE16 PARTS LIST 69kV EQUIP. PLAN VIEW
  - S294DE01 BILL OF MATERIALS SHEET 1 OF 3
  - S294DE02 BILL OF MATERIALS SHEET 2 OF 3
  - S294DE03 BILL OF MATERIALS SHEET 3 OF 3

**ISSUED FOR BID**

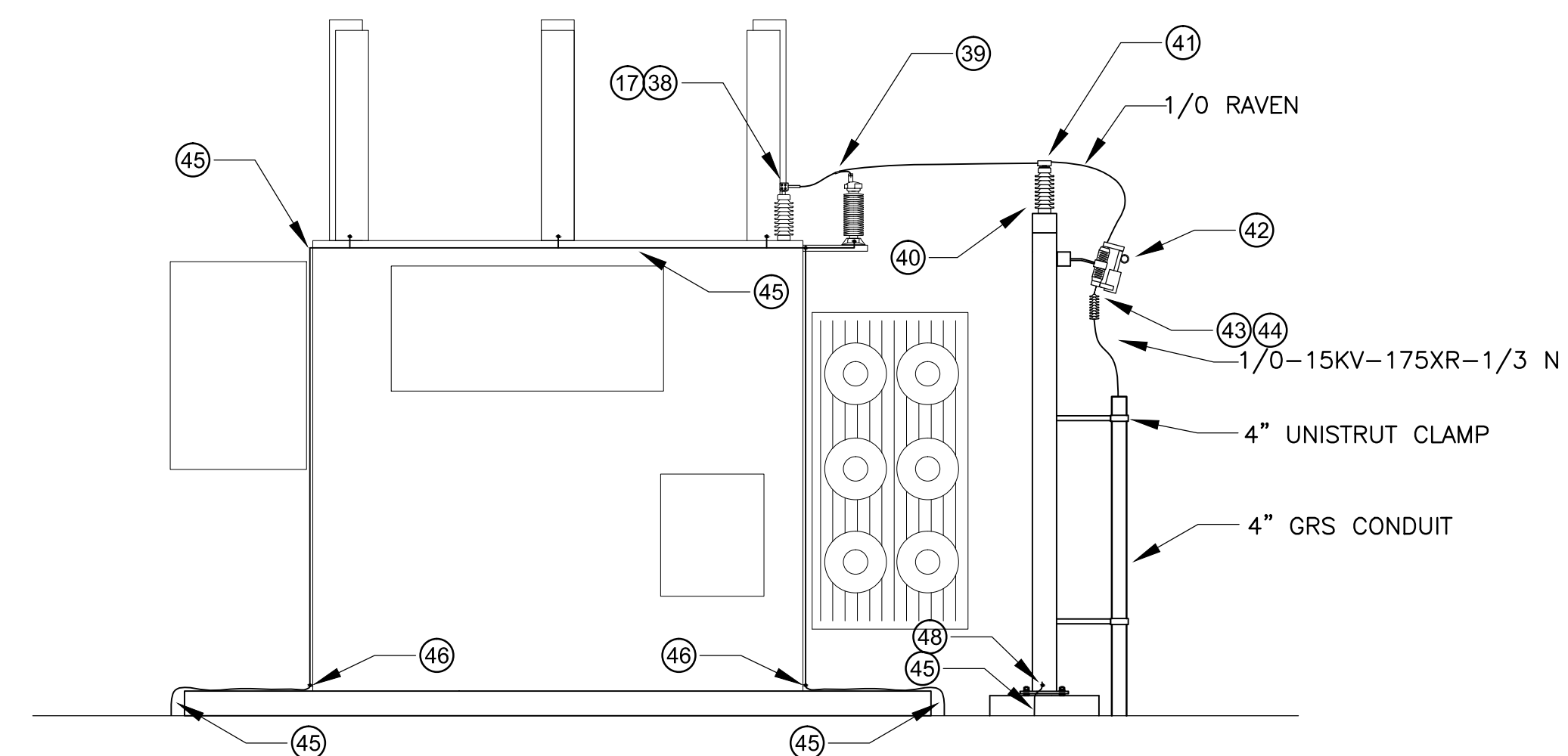
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<b>69kV ELEVATION PARTS LIST VIEW L</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
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REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/11/12	ISSUED FOR BID	AS	BA

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1 69kV VIEW M  
 S294PE16|S294PE28



2 69kV VIEW 1A  
 S249PE28

**REFERENCE DRAWINGS**

- S294PE16 PARTS LIST 69KV EQUIP. PLAN VIEW
- S294DE01 BILL OF MATERIALS SHEET 1 OF 3
- S294DE02 BILL OF MATERIALS SHEET 2 OF 3
- S294DE03 BILL OF MATERIALS SHEET 3 OF 3



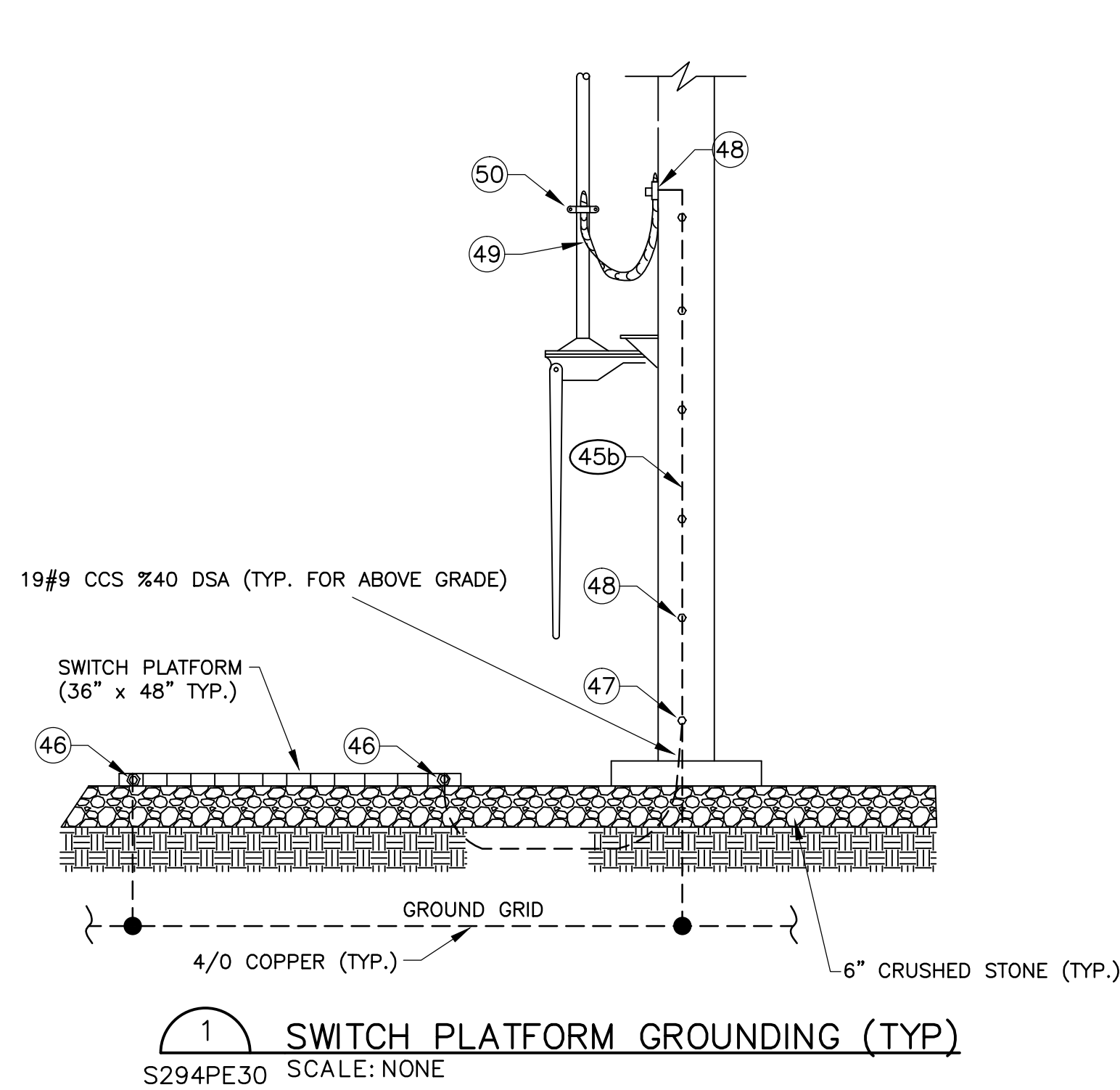
SCALE BAR

**ISSUED FOR BID**

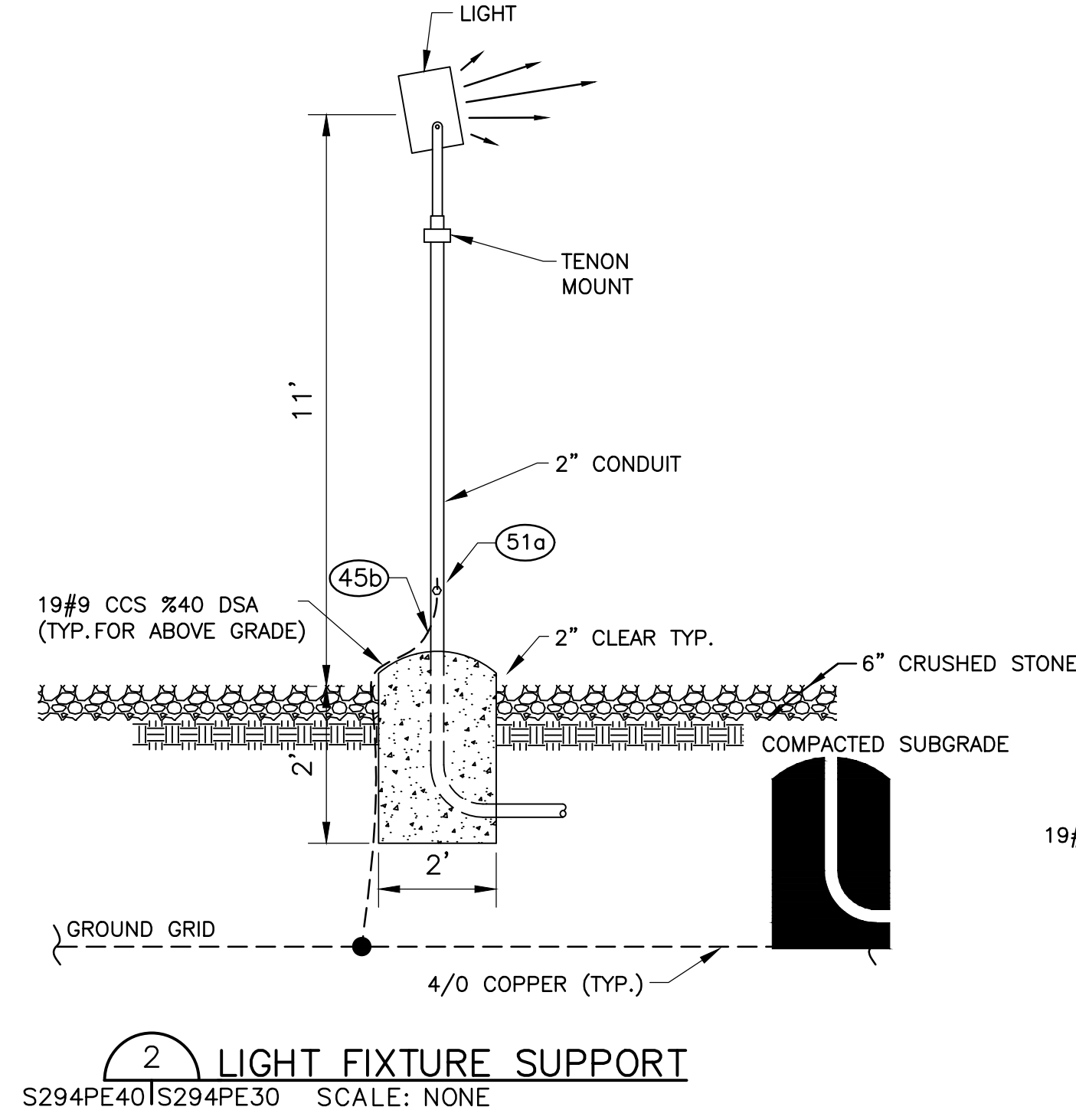
<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>69kV ELEVATION</b> <b>PARTS LIST VIEW M</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
<b>GRDA</b> <small>GRAND RIVER DAM AUTHORITY</small> P.O. BOX 409 VINITA, OK 74301		DRAWING No. <b>S294PE28</b>	REV. <b>0</b>

REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	AS	BA

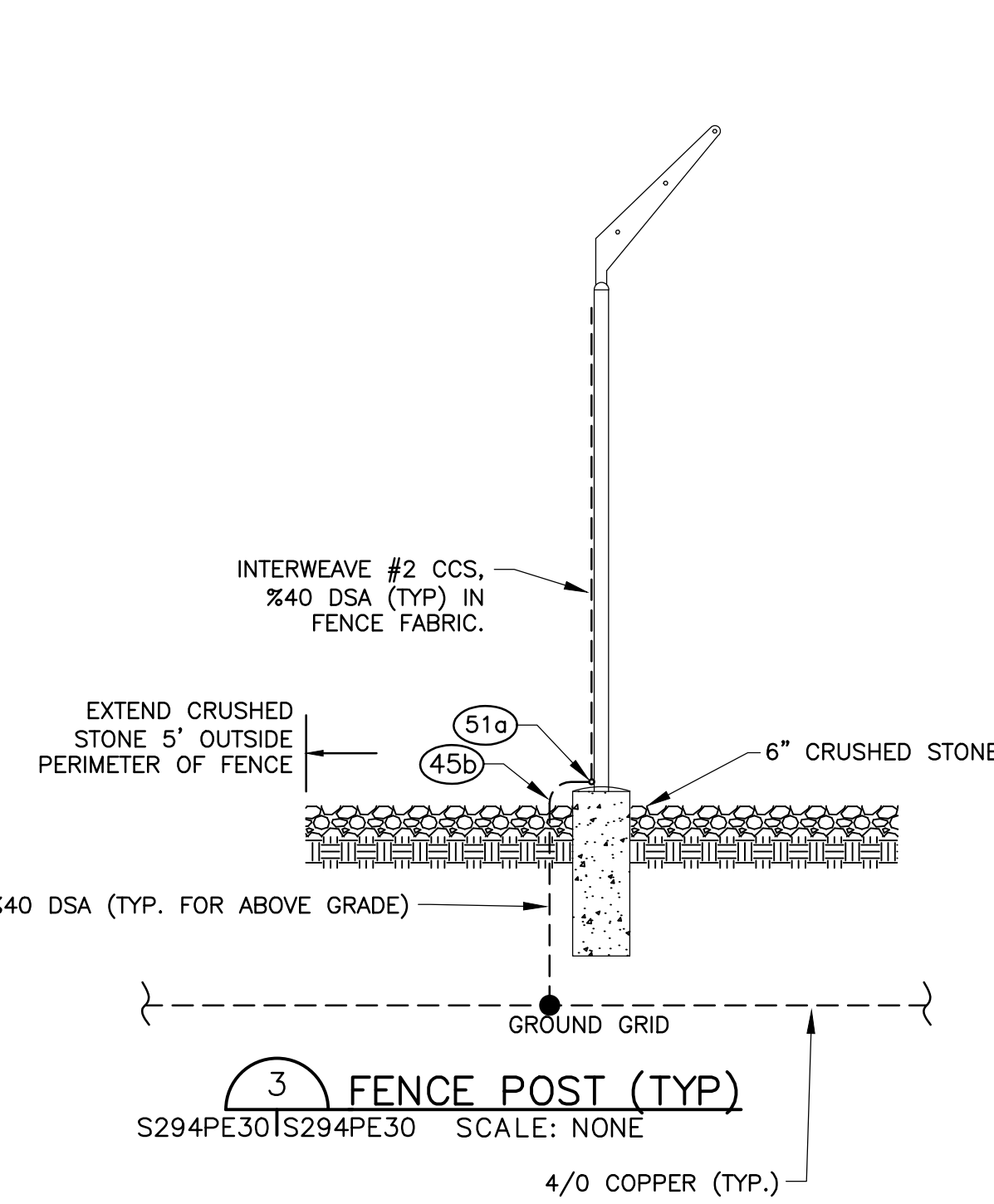
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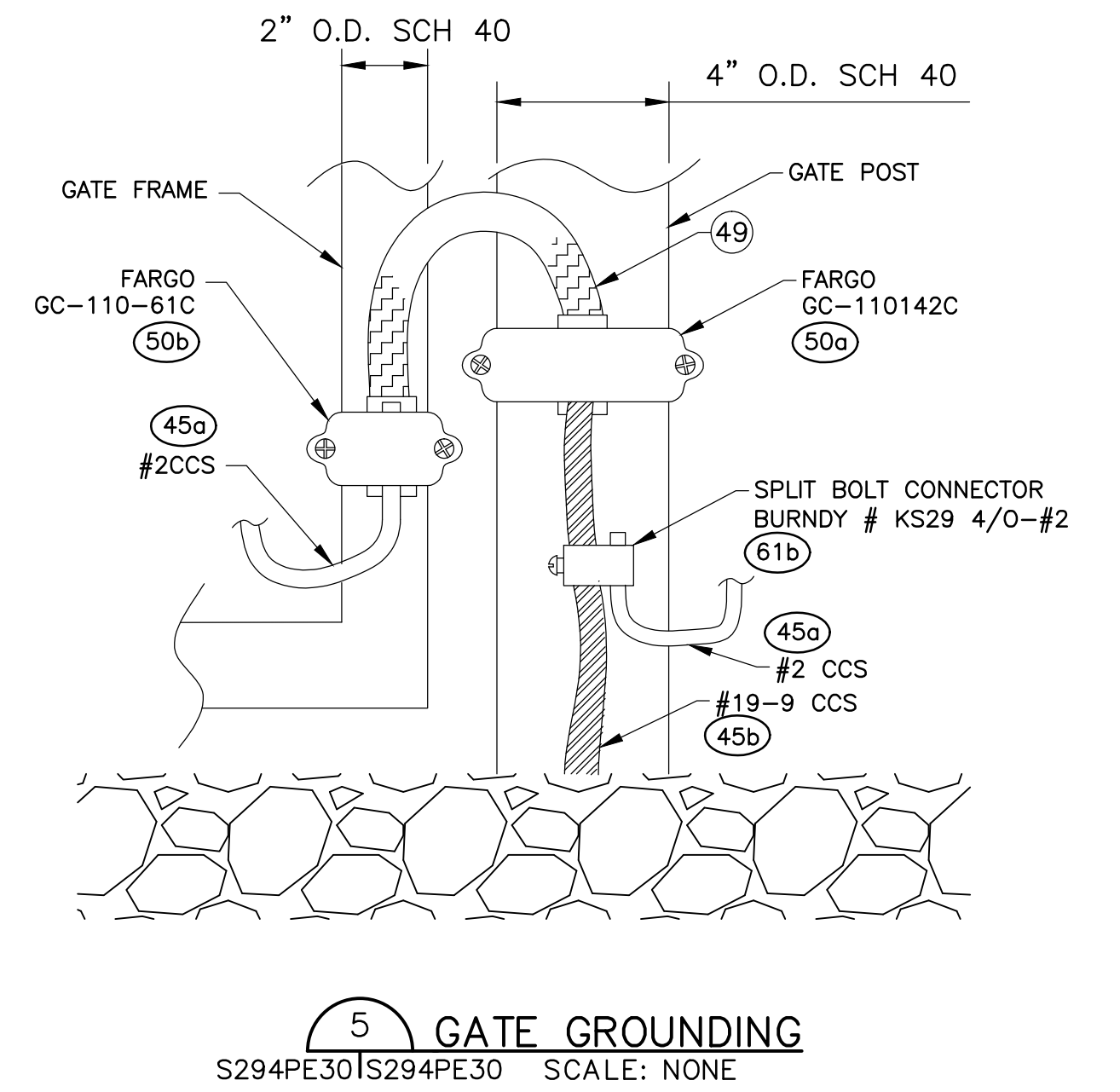
**1 SWITCH PLATFORM GROUNDING (TYP)**  
S294PE30 SCALE: NONE



**2 LIGHT FIXTURE SUPPORT**  
S294PE40\S294PE30 SCALE: NONE



**3 FENCE POST (TYP)**  
S294PE30\S294PE30 SCALE: NONE

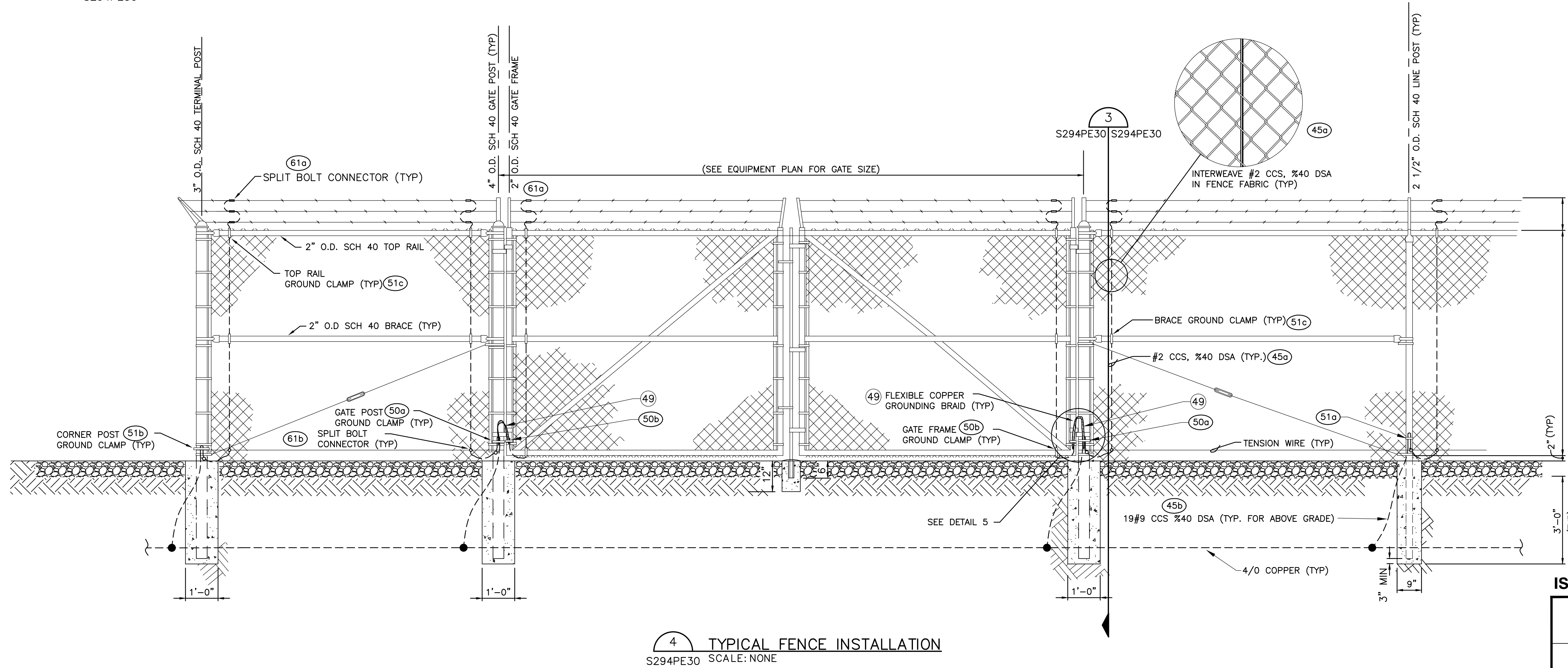


**5 GATE GROUNDING**  
S294PE30\S294PE30 SCALE: NONE

**REFERENCE DRAWINGS**

- S294PE01 161kV EQUIPMENT PLAN VIEW
- S294PE02 69kV EQUIPMENT PLAN VIEW
- S294PE15 PARTS LIST 161kV EQUIPMENT PLAN VIEW
- S294PE16 PARTS LIST 69kV EQUIPMENT PLAN VIEW
- S294PG20 GROUNDING PLAN
- S294PG21 GROUNDING DETAILS
- S294PG50 TRENCH LAYOUT PLAN
- S294DE01 BILL OF MATERIALS SHEET 1 OF 4
- S294DE02 BILL OF MATERIALS SHEET 2 OF 4
- S294DE03 BILL OF MATERIALS SHEET 3 OF 4

**REFERENCE DRAWINGS**



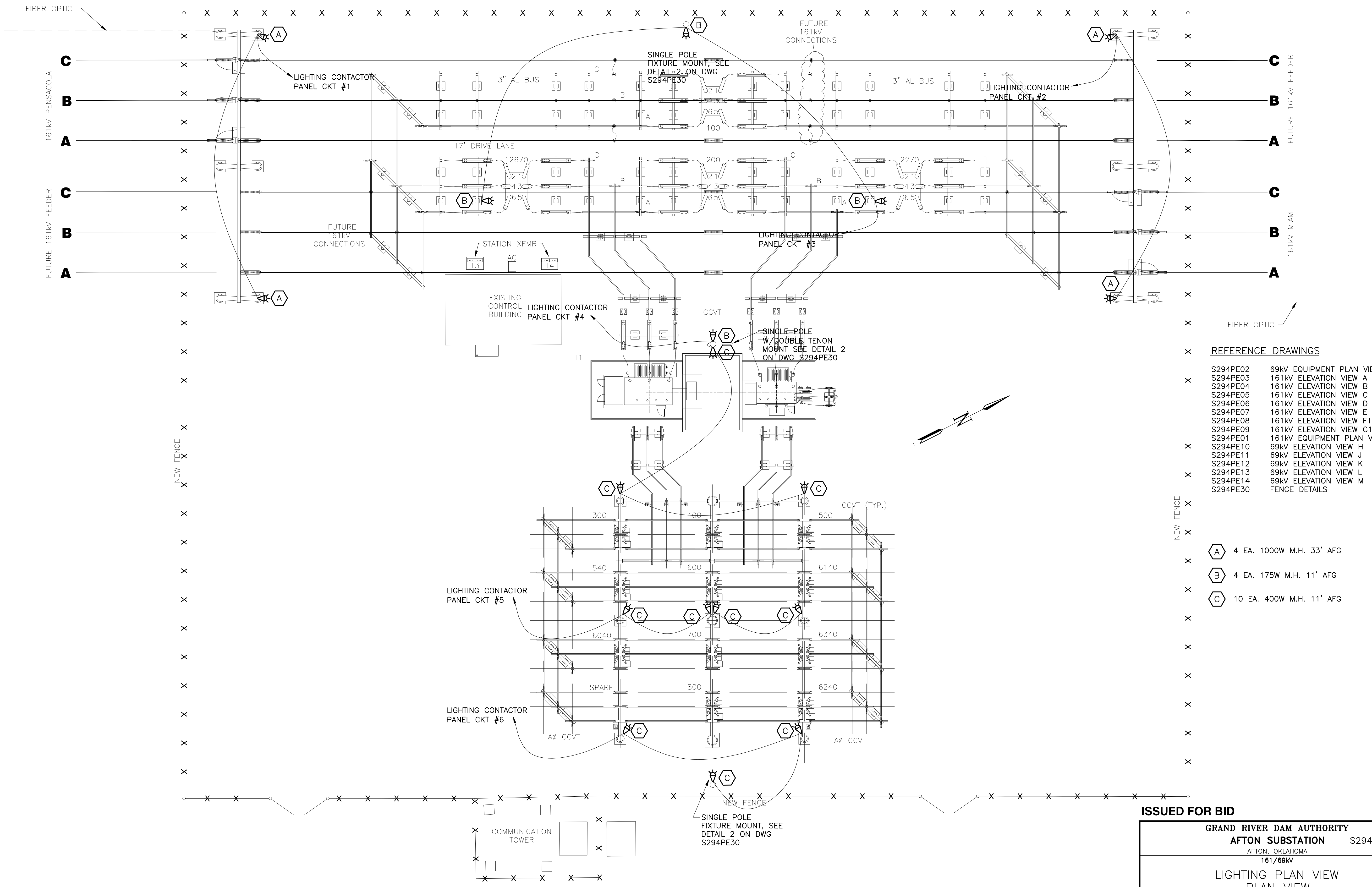
**4 TYPICAL FENCE INSTALLATION**  
S294PE30 SCALE: NONE

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b>			
<b>AFTON SUBSTATION</b>		S294	
AFTON, OKLAHOMA 161/69kV			
<b>FENCE &amp; GROUNDING DETAILS</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW	DATE: 3/7/2011		REV. 0
 <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		<small>DRAWING No.</small> <b>S294PE30</b>	<small>REV.</small> <b>0</b>

REV	DATE	REVISION DESCRIPTION	AS	BA
0	5/29/12	ISSUED FOR BID	AS	BA
			DFT	ENG

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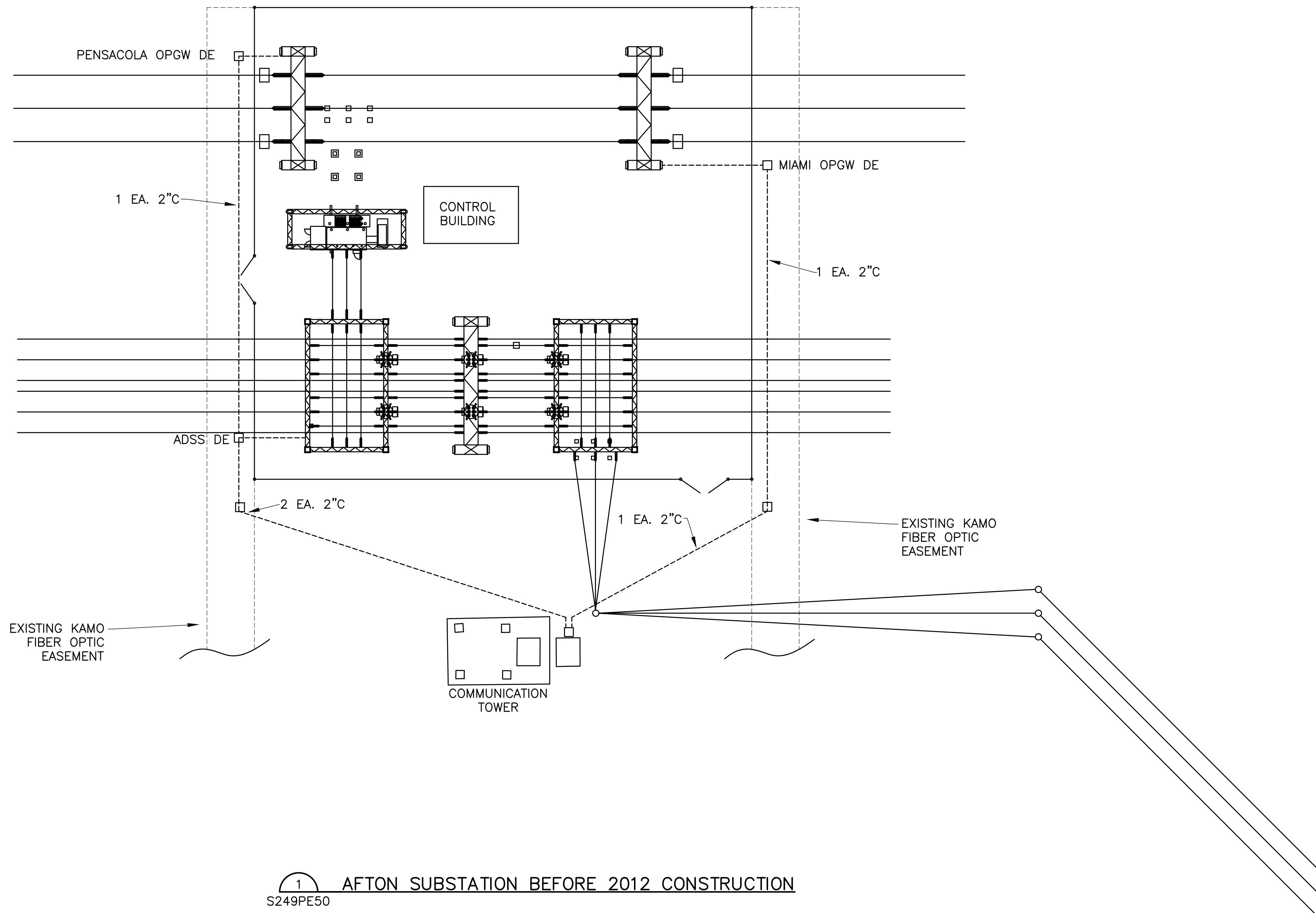
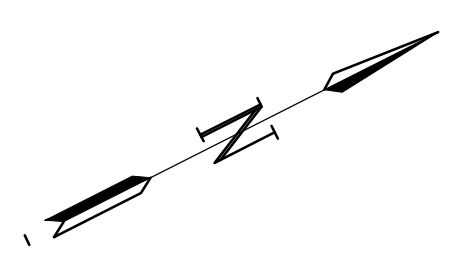
- REFERENCE DRAWINGS**
- S294PE02 69kV EQUIPMENT PLAN VIEW
  - S294PE03 161kV ELEVATION VIEW A
  - S294PE04 161kV ELEVATION VIEW B
  - S294PE05 161kV ELEVATION VIEW C
  - S294PE06 161kV ELEVATION VIEW D
  - S294PE07 161kV ELEVATION VIEW E
  - S294PE08 161kV ELEVATION VIEW F1 & F2
  - S294PE09 161kV ELEVATION VIEW G1 & G2
  - S294PE01 161kV EQUIPMENT PLAN VIEW
  - S294PE10 69kV ELEVATION VIEW H
  - S294PE11 69kV ELEVATION VIEW J
  - S294PE12 69kV ELEVATION VIEW K
  - S294PE13 69kV ELEVATION VIEW L
  - S294PE14 69kV ELEVATION VIEW M
  - S294PE30 FENCE DETAILS

- ⬡ 4 EA. 1000W M.H. 33' AFG
- ⬡ 4 EA. 175W M.H. 11' AFG
- ⬡ 10 EA. 400W M.H. 11' AFG

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b>			
<b>AFTON SUBSTATION</b>		S294	
AFTON, OKLAHOMA			
161/69kV			
<b>LIGHTING PLAN VIEW</b>			
<b>PLAN VIEW</b>			
SCALE: AS SHOWN	DRAWN BY: DKG	ENGR: AEM	APPD: BA
		CH: MW	DATE: 3/7/2011
<b>GRDA</b> Grand River Dam Authority P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PE40	REV. 0

REV	DATE	REVISION DESCRIPTION	AS	BA	DFT	ENG
0	5/29/12	ISSUED FOR BID				

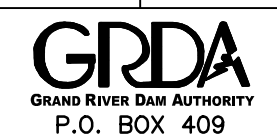


**NOTES:**

1. LOCATE AND PROTECT EXISTING U.G. KAMO FIBER OPTIC RACEWAY AND CABLE DURING CONSTRUCTION. LOCATIONS SHOWN ARE APPROXIMATE.

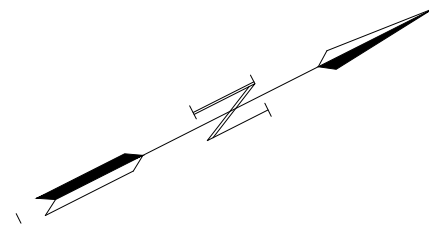
1 AFTON SUBSTATION BEFORE 2012 CONSTRUCTION  
S249PE50

**ISSUED FOR BID**

<b>GRAND RIVER DAM AUTHORITY</b> <b>AFTON SUBSTATION</b> S294 AFTON, OKLAHOMA 161/69kV			
<b>AFTON SUBSTATION</b> <b>BEFORE 2012 CONSTRUCTION</b>			
SCALE: NONE	DRAWN BY: DKG	ENGR: AEM	APPD: BA
CH: MW		DATE: 3/7/2011	
 <small>GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301</small>		DRAWING No. <b>S294PE50</b>	REV. <b>0</b>

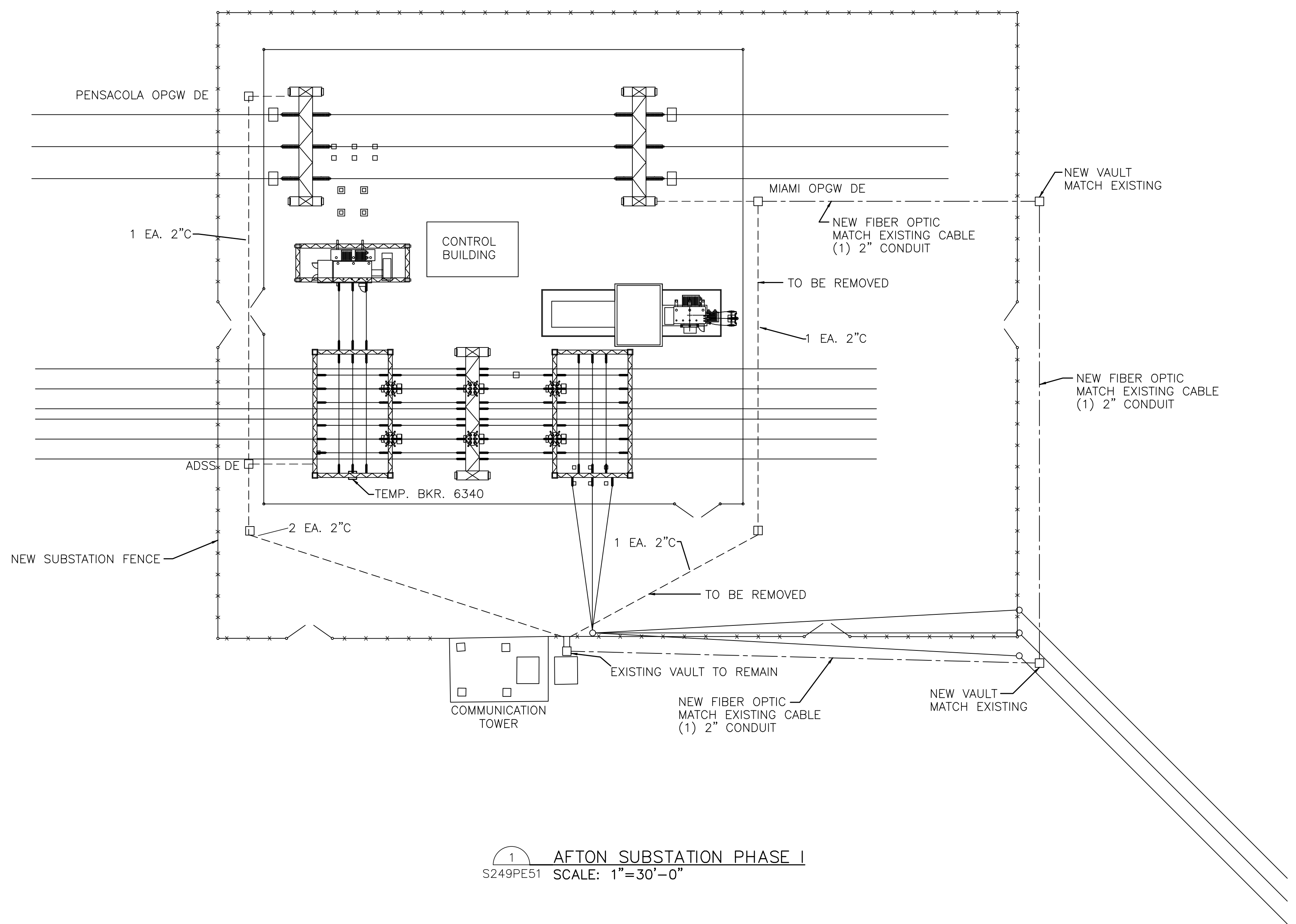
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**PHASE I CONSTRUCTION SCHEDULE**

1. BEGIN CONSTRUCTION - AUGUST 01, 2012
2. SITE PREPARATION, REMOVE AND REPLACE FENCE, INSTALL NEW FIBER OPTIC, REMOVE EXISTING FIBER OPTIC (CABLE, VAULTS, AND CONDUITS), INSTALL PERIMETER GROUNDING, FENCE GROUNDING, INSTALL TRANSFORMER #1, #2, #3, & #4 FOUNDATIONS, INSTALL TRANSFORMER OIL CONTAINMENT, 15kV RISER FOUNDATIONS, MODIFICATIONS TO CONTROL HOUSE (AS PRACTICAL), BREAKER 6340 TEMPORARY FOUNDATION, CONDUIT FOR TEMPORARY BREAKER 6340 POSITION, 161kV BREAKER FOUNDATIONS, TRANSFORMER #2, ALL PIERS THAT CAN SAFELY BE INSTALLED (DUE TO OVERHEAD ENERGIZED LINES) NEAR TRANSFORMER #1 AND TRANSFORMER #2 POSITIONS, CABLE TRENCH FOR 161kV SECTION OF SUBSTATION, CONDUIT FROM 161kV BREAKER FOUNDATIONS TO CABLE TRENCH, UNDERGROUND GROUNDING FOR 161kV SECTION OF SUBSTATION, AND ANY OTHER WORK THAT CAN BE SAFELY PERFORMED IN SUBSTATION BEFORE RE-LOCATION OF OVERHEAD TRANSMISSION LINES.
3. THIS WORK TO BE COMPLETED BY OCTOBER 01, 2012.



- NOTES:**
1. REFER TO DRAWING S294PG50 FOR TRENCH LAYOUT.
  2. REFER TO DRAWING S294PG20 FOR GROUNDING PLAN.
  3. REFER TO DRAWING S294PG30 FOR 161kV FOUNDATION PLAN.
  4. REFER TO DRAWING S294PH02 FOR NEW LAYOUT OF CONTROL HOUSE PLAN.
  5. TRANSFORMER #2 TO BE DELIVERED TO SITE AND PLACED ON FOUNDATION BY CONTRACTOR.

**AFTON SUBSTATION PHASE I**  
S249PE51 SCALE: 1"=30'-0"

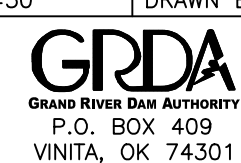
**FIBER OPTIC NOTES:**

1. LOCATE AND PROTECT EXISTING UNDERGROUND KAMO FIBER OPTIC RACEWAY AND CABLE DURING CONSTRUCTION. LOCATIONS SHOWN ARE APPROXIMATE.
2. THE UNDERGROUND FIBER MUST BE INSTALLED IN THE NEW DUCT WITH AT LEAST 200 FEET OF EXTRA CABLE IN EACH VAULT. THE NEW UNDERGROUND CABLE WILL HAVE TO BE TERMINATED INTO THE FIBER OPTIC BUILDING IN PREPARATION FOR REMOVING THE OPGW FROM ITS PRESENT POSITION ON THE SUBSTATION STEEL AND TO CLEAR THE AREA IN WHICH THE NEW 69kV SUBSTATION CONSTRUCTION WILL TAKE PLACE.
3. THIS WORK MUST BE DONE IN THE "MAINTENANCE WINDOW" WHICH IS FROM 12:00 A.M. TO 06:00 A.M. AFTER THE UNDERGROUND FIBER IS RELOCATED, THE FIBER WILL THEN BE SPLICED TO THE OPGW TO RESTORE SERVICE. THIS WORK MUST BE SCHEDULED AT LEAST 2 WEEKS IN ADVANCE. THE CONTRACTOR IS TO SUPPLY ALL LABOR AND MATERIALS FOR THE FIBER OPTIC RE-LOCATION AND SPLICING.
4. INSTALLATION OF THE FIBER OPTIC MUST BE COORDINATED WITH GRDA AND KAMO.
5. EXISTING OPGW IS ALCOA DNO-1440 SC-65/588", 48 FIBER CABLE.
6. THE FOLLOWING ITEMS SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR TO MAKE THE CONNECTION FROM THE NEW FIBER OPTIC CABLE TO THE FINAL STEEL STRUCTURES.
  - A. PREFORMED #2801310 FORMED WIRE DEAD-END 0.546--0.562"
  - B. PREFORMED #4300110 FORMED WIRE SUSPENSION 0.537--0.559"
  - C. PREFORMED #5050106 SPIRAL DAMPER .564--.760"
  - D. PREFORMED #8003268H1 DOWNLEAD CLAMP, ALUM. W/LAG BOLT .563--.609"
  - E. PREFORMED #9003268LT1 DOWNLEAD CLAMP, ALUM. W/TOWER ATTACHMENT .563--.609"
  - F. WINDSOR FOSC-6559 SPLICE ENCLOSURE (S06S-2F-557-378)
  - G. WINDSOR VERTICAL COIL BRACKET #720-VCB
  - H. WINDSOR COIL BRACKET #720-CB

**REFERENCE DRAWINGS**

S294PE30	FENCE AND GROUNDING DETAILS
S294PE50	AFTON SUBSTATION BEFORE CONSTRUCTION
S294PE52	AFTON SUBSTATION PHASE II
S294PE53	AFTON SUBSTATION PHASE III
S294PE54	AFTON SUBSTATION PHASE IV
S294PE55	AFTON SUBSTATION PHASE V
S294PG20	GROUNDING PLAN
S294PG30	161kV FOUNDATION PLAN
S294PG34	TYPICAL FOUNDATION DETAILS
S294PG50	TRENCH LAYOUT PLAN
S294PZ01	OIL CONTAINMENT PLAN

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69kV			
AFTON SUBSTATION			
PHASE I			
SCALE: 1"=30'	DRAWN BY: JT	ENGR: BA	APPD: BA
		CH: MW	DATE: 02MAY12
		DRAWING No.	REV.
		S294PE51	0

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**PHASE II CONSTRUCTION SCHEDULE**

- OCTOBER 03, 2012 TO OCTOBER 10, 2012.
- CHECK PHASING AND INSTALL TEMPORARY JUMPERS TO ENERGIZED 69 kV LINES (FEEDER 63 AND FEEDER 62) AT A POINT WHERE THEY CROSS, APPROXIMATELY 3 MILES EAST OF AFTON SUBSTATION. NEARBY CROSSING STRUCTURES ARE: FEEDER 63 - STRUCTURE 3-8 AND FEEDER 62 - STRUCTURE 60-3.
- INSTALL 3 (1 PER PHASE) AMPACT LINE SWITCHES ON ENERGIZED 69 kV LINE - FEEDER 63 - WEST OF STRUCTURE 3-8.
- OPEN BREAKER 6240.
- OPEN NEWLY INSTALLED LINE SWITCHES, THUS DE-ENERGIZING SECTION OF FEEDER 63 FROM OPEN SWITCHES TO AFTON SUBSTATION. FEEDER 63 NOW BEING ENERGIZED FROM FEEDER 62.
- INSTALL NEW TEMPORARY LINE FOR FEEDER 63 FROM LOCATION EAST OF EXISTING SOUTH DEAD-END BAY TO NEW VERTICAL DEAD-END STRUCTURE 1-1.
- INSTALL TEMPORARY BREAKER 6340 AND SWITCHES ON EAST SIDE OF EXISTING SOUTH 69kV BAY FOR BREAKER 6340.
- REMOVE SECTION OF FEEDER 63 FROM NEWLY INSTALLED STRUCTURE 1-1 TO PRESENT POSITION ON EAST END OF NORTH SIDE OF EXISTING 69kV DEAD-END.
- CLOSE NEWLY INSTALLED LINE SWITCHES. CHECK PHASING AND INSTALL JUMPERS TO ENERGIZED 69kV BUS TO TEMPORARY FEEDER 63. CLOSE TEMPORARY BREAKER SWITCHES AND BREAKER 6340.
- OPEN BREAKER 6140 AND OLD BREAKER 6240.
- REMOVE ENERGIZED JUMPERS AT STRUCTURE 65-3 ON FEEDER 62. FEEDER 62 NOW BEING ENERGIZED FROM NEW LOCATION OF FEEDER 63 AT AFTON SUBSTATION.
- INSTALL PERMANENT GUYED 3-POLE STRUCTURE (DESIGNATE 1-A) AND ANCHORS. THIS SECTION OF FEEDER 62 HAS 795 ACSR CONDUCTORS.
- TRANSFER FEEDER 62 TO NEWLY INSTALLED STRUCTURE 1-A.
- REMOVE SECTION OF FEEDER 62 FROM NORTH-EAST SIDE OF EXISTING 69kV SUBSTATION DEAD-END.
- THIS WORK TO BE COMPLETED BY OCTOBER 10, 2012.


**NOTES:**

- CONDUCTORS ON FEEDER 63 - STR. 3-8 AND FEEDER 62 - STR. 60-3 ARE 4/0 ACSR.
- CONDUCTORS ON FEEDER 62 - STR. 65-3 ARE 4/0 ACSR.
- CONDUCTORS ON FEEDER 62 FROM EXISTING SUBSTATION DEAD-END TO STRUCTURE 1-1 ARE 795 ACSR.
- USE ONLY QUALIFIED JOURNEYMAN LINEMAN EXPERIENCED IN WORKING ENERGIZED 69KV TRANSMISSION LINES TO PERFORM ALL TRANSMISSION LINE WORK.
- GRDA TO PROVIDE POLES, ANCHORS, LINE HARDWARE, SWITCHES, CONDUCTOR AND SLEEVES FOR TEMPORARY LINE WORK.
- THE HEIGHT OF THE TEMPORARY STRUCTURES IS UNKNOWN AT THIS TIME. IT IS ANTICIPATED STRUCTURE 1-A WILL BE (3) 70' CLASS 1 POLES AND STRUCTURE 1-1 WILL BE (1) 90' CLASS H1 POLE.

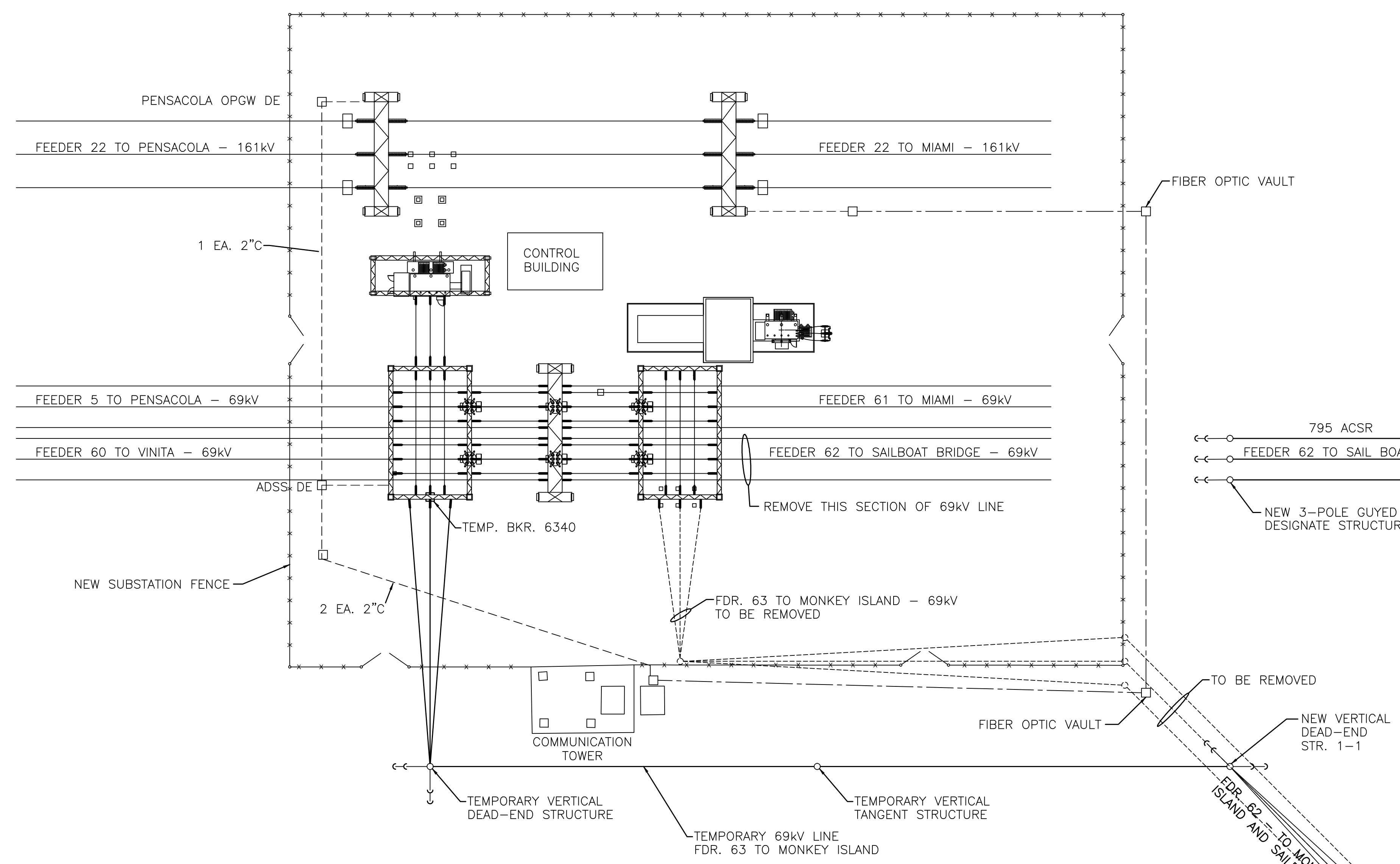
**REFERENCE DRAWINGS**

- S294PE30 FENCE AND GROUNDING DETAILS
- S294PE50 AFTON SUBSTATION BEFORE CONSTRUCTION
- S294PE51 AFTON SUBSTATION PHASE I
- S294PE53 AFTON SUBSTATION PHASE III
- S294PE54 AFTON SUBSTATION PHASE IV
- S294PE55 AFTON SUBSTATION PHASE V

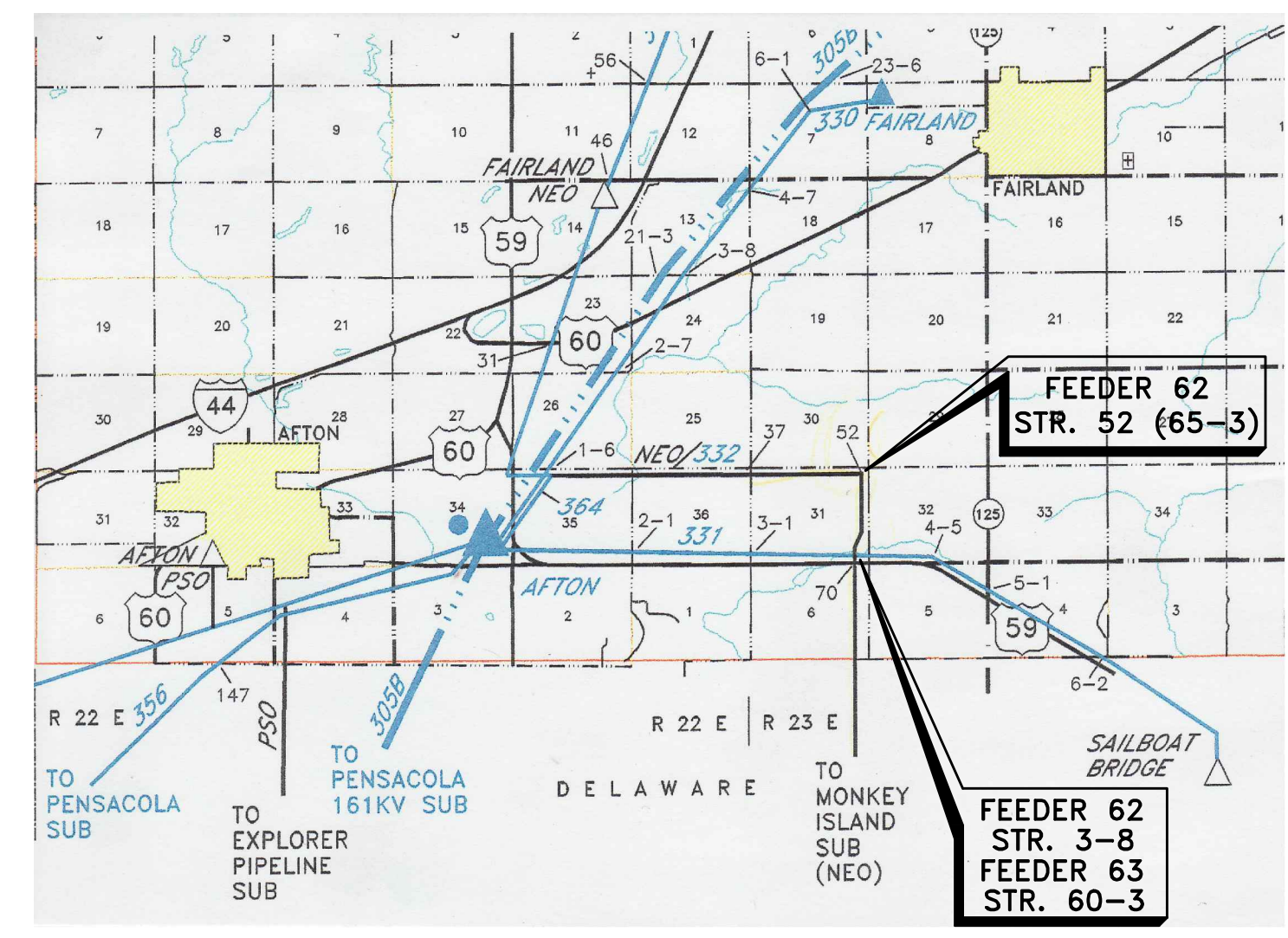
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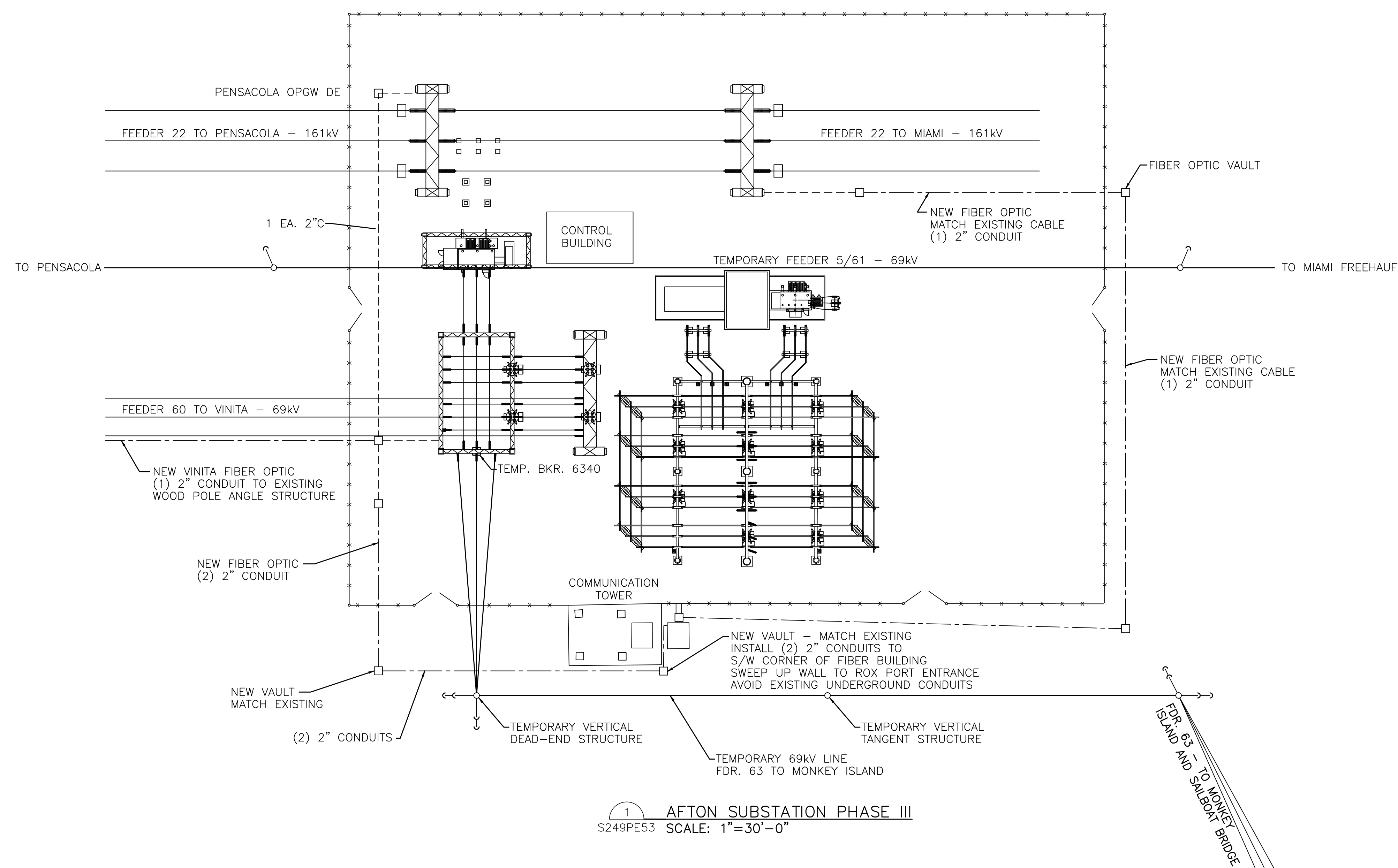
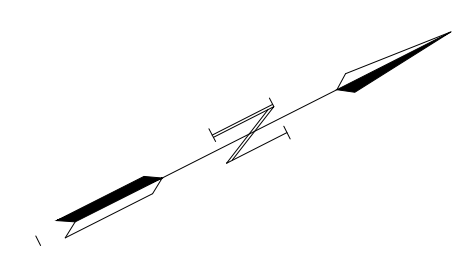
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AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69kV			
AFTON SUBSTATION			
PHASE II			
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		CH: MW	DATE: 02MAY12
DRAWING No.		REV.	
S294PE52		0	
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301			

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**1 AFTON SUBSTATION PHASE II**  
S249PE52 SCALE: 1"=30'-0"





**PHASE III CONSTRUCTION SCHEDULE**

1. CONSTRUCT TEMPORARY 69KV TRANSMISSION LINE ACROSS SUBSTATION TO SLIGHTLY EAST OF TRANSFORMER #1 AND CONTROL BUILDING. THIS WORK TO BE PERFORMED OVER AN ENERGIZED 161/69KV TRANSFORMER AND BUS TO TEMPORARY VERTICAL POLE DEAD-END STRUCTURES LOCATED TO SOUTH AND NORTH OF NEW SUBSTATION FENCE. TEMPORARY ANCHORS MUST BE INSTALLED FOR CONDUCTOR TERMINATIONS.
2. CLEARANCE ON FEEDER 5 - OCTOBER 15 & 16, 2012 TO ALLOW TRANSFER OF FEEDER 5 TO TEMPORARY STRUCTURE SOUTH OF SUBSTATION.
3. CLEARANCE ON FEEDER 61 - OCTOBER 16, 2012 TO ALLOW TRANSFER OF FEEDER 61 TO TEMPORARY STRUCTURE NORTH OF SUBSTATION.
4. REMOVE TEMPORARY ANCHORS, ATTACH GUYS TO BISSECTOR ANCHORS, AND INSTALL JUMPERS AT STRUCTURES SOUTH AND NORTH OF SUBSTATION, TYING FEEDER 5 TO FEEDER 61.
5. INSTALL NEW RELAY SETTINGS FOR FEEDER 5/61.
6. RE-ENERGIZE FEEDER 5/61 FROM PENSACOLA TO MIAMI FREEHAUF (BY-PASSING AFTON SUBSTATION) BY END OF DAY - OCTOBER 16, 2012.
7. BEGIN CONSTRUCTION OF NEW 69KV SECTION OF SUBSTATION - OCTOBER 17, 2012.
8. INSTALL NEW FIBER OPTIC (AS NOTED), OTHER MODIFICATIONS TO CONTROL HOUSE, CONSTRUCT 69KV SECTION OF SUBSTATION INCLUDING, BUT NOT LIMITED TO, 69KV SECTION OF CABLE TRENCH, GROUNDING, FOUNDATIONS, BREAKER INSTALLATION, BUS, SWITCHES, CONTROL CABLE, OTHER MODIFICATIONS TO CONTROL BUILDING, RELAY PANEL CHANGE-OUT, AND 69KV CONNECTIONS TO TRANSFORMER #2.
9. THIS WORK TO BE COMPLETED BY JANUARY 11, 2013.

**NOTES:**

1. REFER TO NOTES ON THIS DRAWING FOR FIBER OPTIC INSTALLATION.
2. GRDA TO FURNISH TEMPORARY POLES, LINE HARDWARE, ANCHORS, CONDUCTOR AND SHIELD WIRE FOR TEMPORARY LINE RE-ROUTE OF FEEDERS 5 & 61.
3. ALL LINE OUTAGES MUST BE KEPT TO A MINIMUM. A HOLD-ORDER WILL BE PLACED ON 69KV SECTION OF BUS NEAR TRANSFORMER #1 WHEN STRINGING OVER ENERGIZED BUS.
4. USE ONLY QUALIFIED JOURNEYMAN LINEMAN EXPERIENCED IN WORKING OVER ENERGIZED CIRCUITS WHEN PERFORMING WORK ON TRANSMISSION LINES.

**1 AFTON SUBSTATION PHASE III**  
S249PE53 SCALE: 1"=30'-0"

**FIBER OPTIC NOTES:**

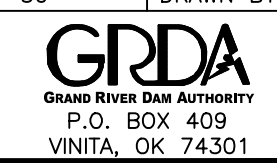
1. LOCATE AND PROTECT EXISTING UNDERGROUND KAMO FIBER OPTIC RACEWAY AND CABLE DURING CONSTRUCTION. LOCATIONS SHOWN ARE APPROXIMATE.
2. NEW VAULTS AND DUCTS FOR VINITA AND PENSACOLA FIBER OPTIC CABLES MUST BE INSTALLED BEFORE MOVING THE TRANSMISSION LINES.
3. PULL IN AND TERMINATE THE TWO FIBER OPTIC CABLES IN PREPARATION FOR THE POWER LINE MOVES. THE PENSACOLA LINE WILL NEED TO HAVE AT LEAST 200 FEET OF EXTRA CABLE STORED IN THE VAULT IN PREPARATION FOR THE PENSACOLA TRANSMISSION LINES MOVE TO THE NEW STEEL.
4. RELOCATE THE VINITA FIBER OPTIC TO UNDERGROUND IN ADVANCE OF THE PENSACOLA FIBER OPTIC RE-LOCATION.
5. THIS WORK MUST BE SCHEDULED AT LEAST 2 WEEKS IN ADVANCE. THE CONTRACTOR IS TO SUPPLY ALL LABOR AND MATERIALS FOR THE FIBER OPTIC RE-LOCATION AND SPLICING.
6. INSTALLATION OF THE FIBER OPTIC MUST BE COORDINATED WITH GRDA AND KAMO.

**REFERENCE DRAWINGS**

- S294PE02 69KV EQUIPMENT PLAN VIEW
- S294PE50 AFTON SUBSTATION BEFORE CONSTRUCTION
- S294PE51 AFTON SUBSTATION PHASE I
- S294PE52 AFTON SUBSTATION PHASE II
- S294PE54 AFTON SUBSTATION PHASE IV
- S294PE55 AFTON SUBSTATION PHASE V
- S294PG20 GROUNDING PLAN
- S294PG31 69KV FOUNDATION PLAN
- S294PG33 TYPICAL FOUNDATION DETAILS
- S294PG34 TYPICAL FOUNDATION DETAILS
- S294PG50 TRENCH LAYOUT PLAN

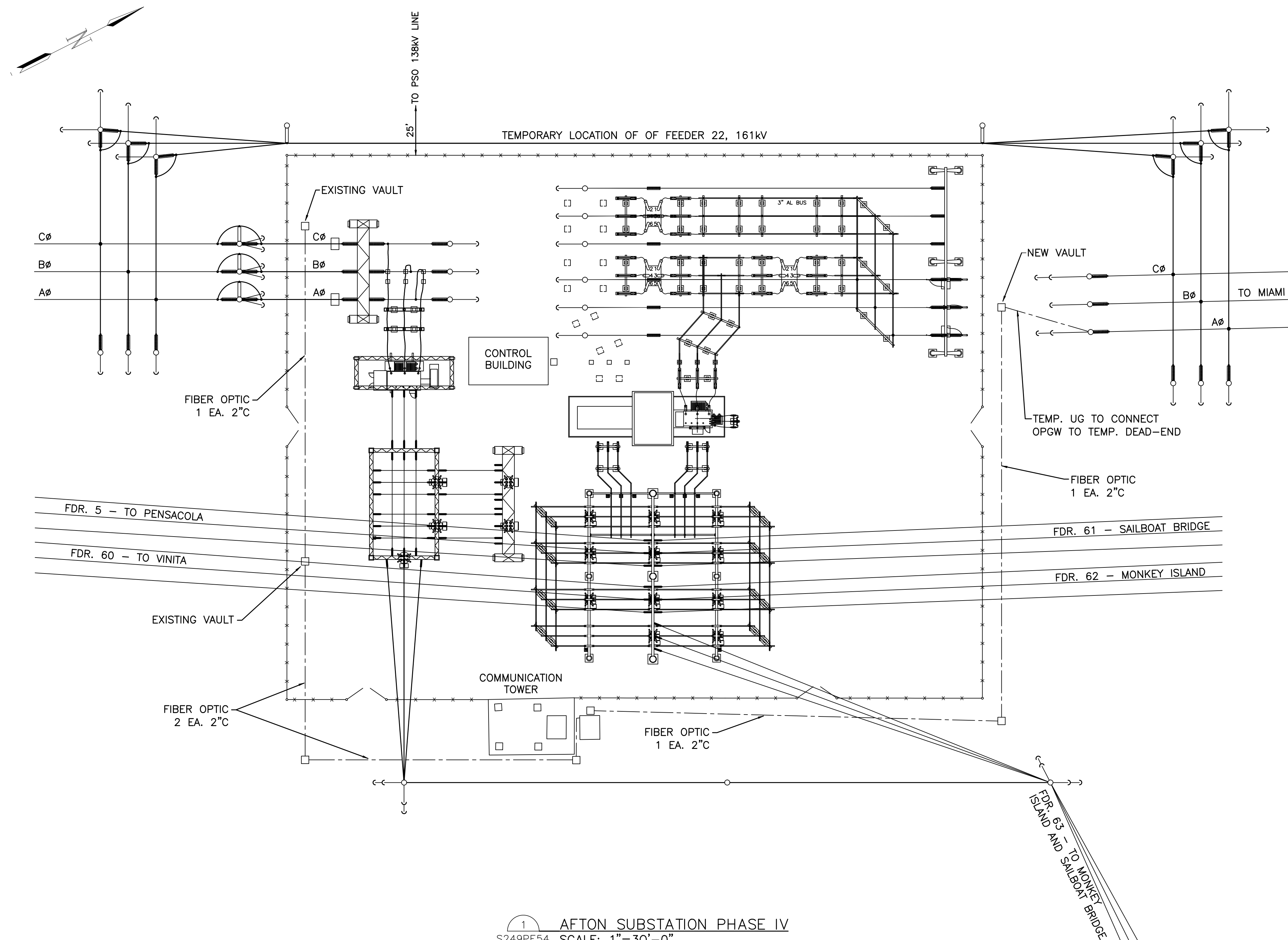
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GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
161/69KV			
AFTON SUBSTATION PHASE III			
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**PHASE IV CONSTRUCTION SCHEDULE**



1. CONSTRUCT TEMPORARY 161KV TRANSMISSION LINE TO RE-ROUTE FEEDER 22 FROM SOUTH OF NEW SUBSTATION FENCE TO WEST SIDE OF FENCE, THEN NORTHWARD ALONG FENCE TO NORTHWEST OF FENCE, THEN EASTWARD TO TEMPORARY 3-POLE STRUCTURE LOCATED EAST OF SECTION OF FEEDER 22 TO MIAMI FREEHAUF. TEMPORARY ANCHORS MUST BE INSTALLED FOR CONDUCTOR TERMINATIONS. THIS SECTION OF LINE WILL BE INSTALLED UNDER EXISTING FEEDER 22 AND EAST OF PSO 138KV TRANSMISSION LINE.
2. CLEARANCE ON FEEDER 22 AND EXISTING 161KV TRANSFORMER (TRANSFORMER #1) BEGINNING JANUARY 28, 2013 TO FEBRUARY 01, 2013.
3. INSTALL TEMPORARY 3-POLE STRUCTURE AND ANCHORS TO NORTH OF EXISTING SOUTH SUBSTATION DEAD-END STRUCTURE.
4. TRANSFER SECTION OF OVERHEAD CONDUCTOR ACROSS 161KV SECTION OF SUBSTATION TO TEMPORARY 3-POLE STRUCTURE.
5. CONNECT TEMPORARY JUMPERS TO CIRCUIT SWITCHER #71.
6. REMOVE REMAINDER OF OVERHEAD CONDUCTOR AND SHIELD WIRE TO EXISTING NORTH SUBSTATION DEAD-END STRUCTURE.
7. INSTALL TEMPORARY 3-POLE STRUCTURE AND ANCHORS TO NORTH OF SUBSTATION FENCE.
8. TRANSFER EXISTING NORTH SECTION OF FEEDER 22 AND FIBER OPTIC TO TEMPORARY 3-POLE STRUCTURE.
9. INSTALL JUMPERS TO TEMPORARY 3-POLE STRUCTURES NORTH AND SOUTH OF FENCE.
10. CHECK PHASING AND ENERGIZE FEEDER 22 AND 161KV TRANSFORMER #1 BY END OF DAY, FEBRUARY 01, 2013.
11. BEGINNING ON FEBRUARY 01, 2013, CONSTRUCT NORTH SECTION OF 161KV SUBSTATION FROM SWITCH 133 AND SWITCH 129. CONSTRUCTION INCLUDES, BUT NOT LIMITED TO, INSTALLING THREE 161KV BREAKERS, SWITCHES, STEEL DEAD-ENDS, BUS SUPPORTS, BUS, CONDUIT, GROUNDING, MODIFICATIONS TO CONTROL HOUSE, RELAY PANELS, TRANSFORMER PANEL, CONNECTIONS TO TRANSFORMER #2, TERMINATIONS FROM RISER POLE OF 161KV TRANSFORMER #2 TO STATION SERVICE TRANSFORMER #4, INSTALL TWO 3-POLE STRUCTURES AND TEMPORARY ANCHORS TO SOUTH OF SWITCH 133 AND SWITCH 129, INSTALL CONDUCTORS, ISOLATION INSULATORS, AND SHIELD WIRE TO TEMPORARY 3-POLE STRUCTURES, INSTALL JUMPERS FROM OVERHEAD CONDUCTOR TO EAST SIDE OF 161KV BUS AND INSTALL SECTION OF FEEDER 62 FROM TEMPORARY DEAD-END STRUCTURE TO PERMANENT LOCATION ON NEW 69KV DEAD-END STEEL.
12. THIS WORK TO BE COMPLETED BY MAY 01, 2013.
13. CLEARANCE OF FEEDER 22 - MAY 02, 2013.
14. REMOVE JUMPERS FROM TEMPORARY 161KV LINE TO FEEDER 22 NEAR 3-POLE LOCATED NORTH OF NEW SUBSTATION DEAD-END. INSTALL NEW SECTION OF CONDUCTOR AND SPLICE IN TO EXISTING FEEDER 22. TRANSFER CONDUCTOR AND SHIELD WIRE TO NEW LOCATION ON NORTHEAST SUBSTATION STEEL DEAD-END. RE-INSTALL JUMPERS FROM TEMPORARY LINE TO NEW LOCATION OF FEEDER 22. ENERGIZE FEEDER 22.
15. ENERGIZE AND PERFORM CHECK-OUT ON TRANSFORMER #2 - MAY 03, 2013 TO MAY 10, 2013.
16. CLEARANCE ON FEEDER 5/61 - MAY 13, 2013 AND MAY 14, 2013.
17. INSTALL ADDITIONAL CONDUCTOR AND SHIELD WIRE, TRANSFER FEEDER 5 TO PERMANENT LOCATION ON SOUTH 69KV SUBSTATION DEAD-END, TRANSFER FEEDER 61 TO PERMANENT LOCATION ON NORTH 69KV SUBSTATION STEEL, REMOVE TEMPORARY 69KV TRANSMISSION LINE, AND ENERGIZE FEEDER 5 AND FEEDER 61 FROM WEST SIDE OF NEW 69KV BUS.
18. INSTALL SECTION OF NEW CONDUCTOR, AND TRANSFER FEEDER 62 TO PERMANENT LOCATION ON NEW 69KV SUBSTATION STEEL DEAD-END. ENERGIZE FEEDER 62 ON NORTH SECTION OF NEW 69KV BUS.
19. RE-INSTALL JUMPERS TO ENERGIZED 69KV FEEDER 62 AT STRUCTURE 65-3. OPEN LINE-SWITCHES PREVIOUSLY INSTALLED ON FEEDER 63 WEST OF STRUCTURE 3-8.
20. OPEN TEMPORARY BREAKER 6340. TRANSFER FEEDER 63 TO PERMANENT LOCATION ON NORTHEAST 69KV SUBSTATION STEEL DEAD-END.
21. CLOSE LINE-SWITCHES NEAR STRUCTURE 3-8 ON FEEDER 63 AND ENERGIZE FEEDER 63 NOW LOCATED AT PERMANENT POSITION ON NORTH 69KV BUS.
22. CHECK OPEN SWITCH 6054 AND INSTALL SECTION OF FEEDER 60 TO PERMANENT LOCATION ON SOUTH SIDE OF NEW 69KV BUS. ENERGIZE FEEDER 60 FROM NEW 69KV BUS.

**NOTES:**

1. REFER TO NOTES ON THIS DRAWING FOR FIBER OPTIC INSTALLATION.
2. GRDA TO FURNISH POLES, LINE HARDWARE, ANCHORS, CONDUCTOR AND SHIELD WIRE FOR TEMPORARY AND PERMANENT TRANSMISSION LINE CONSTRUCTION.
3. ALL LINE OUTAGES MUST BE KEPT TO A MINIMUM. A HOLD-ORDER WILL BE PLACED ON ENERGIZED LINES OR BUS WHEN PERFORMING WORK NEAR ENERGIZED CIRCUITS.
4. USE ONLY QUALIFIED JOURNEYMAN LINEMAN EXPERIENCED IN WORKING ON OR NEAR ENERGIZED CIRCUITS WHEN PERFORMING WORK ON TRANSMISSION LINES.

**1** AFTON SUBSTATION PHASE IV  
S249PE54 SCALE: 1"=30'-0"

**FIBER OPTIC NOTES:**

1. BEFORE THE MIAMI FIBER LINE CAN BE TRANSFERRED TO THE SUBSTATION STEEL OFF OF THE TEMPORARY DEAD-END STRUCTURE, A SINGLE 2" CONDUIT MUST BE RUN FROM THE VAULT TO THE NEW DEAD-END POSITION ON THE NEW SUBSTATION STEEL.
2. INSTALL NEW OPGW STORAGE RACK AND DOWN-LEAD CLAMPS ON THE NEW SUBSTATION DEAD-END.
3. THE OPGW SPLICE CLOSURE ON THE TEMPORARY STRUCTURE, AND THE UNDERGROUND CABLE AT THE TEMPORARY STRUCTURE WILL BE RE-ROUTED TO THE NEW SUBSTATION STEEL DEAD-END. THE EXTRA SLACK ON THE COIL RACK OF THE TEMPORARY DEAD-END STRUCTURE WILL BE USED TO EXTEND THE CABLE TO THE NEW SUBSTATION STEEL.
4. THE TRANSFER OF THE OPGW WILL NEED TO BE MADE IN THE "MAINTENANCE WINDOW" FROM 12:00 A.M. TO 06:00 A.M.
5. THIS WORK MUST BE SCHEDULED AT LEAST 2 WEEKS IN ADVANCE.
6. THE CONTRACTOR IS TO SUPPLY ALL LABOR AND MATERIALS FOR THE FIBER OPTIC RE-LOCATION AND SPLICING.
7. INSTALLATION OF THE FIBER OPTIC MUST BE COORDINATED WITH GRDA AND KAMO.

**REFERENCE DRAWINGS**

- S294PE01 161KV EQUIPMENT PLAN VIEW
- S294PE50 AFTON SUBSTATION BEFORE CONSTRUCTION
- S294PE51 AFTON SUBSTATION PHASE I
- S294PE52 AFTON SUBSTATION PHASE II
- S294PE53 AFTON SUBSTATION PHASE III
- S294PE55 AFTON SUBSTATION PHASE V
- S294PG20 GROUNDING PLAN
- S294PG30 69KV FOUNDATION PLAN
- S294PG35 TYPICAL FOUNDATION DETAILS
- S294PG34 TYPICAL FOUNDATION DETAILS
- S294PG50 TRENCH LAYOUT PLAN

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV AFTON SUBSTATION PHASE IV													
SCALE: 1"=30'	DRAWN BY: JT	ENGR: BA	APPD: BA										
GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PE54	REV. 0										
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REV	DATE	REVISION DESCRIPTION	DFT	ENG									
0	5/29/12	ISSUED FOR BID	JT	BA									

**PHASE V CONSTRUCTION SCHEDULE**

1. CLEARANCE ON FEEDER 22 AND EXISTING 161KV TRANSFORMER (TRANSFORMER #1) ON MAY 21, 2013 TO REMOVE SECTION OF LINE FROM TEMPORARY 3-POLE STRUCTURE SOUTH OF EXISTING STEEL LATTICE DEAD-END TO TEMPORARY 3-POLE STRUCTURE IN 161KV SUBSTATION. LINE TO BE RE-ENERGIZED AT END OF DAY
2. REMOVE EXISTING LATTICE TOWER, CIRCUIT SWITCHER #71, 161KV PT'S, CCVT'S, AND PRE-EXISTING 69KV STEEL, BREAKERS AND EQUIPMENT.
3. MOVE TRANSFORMER #1 TO NEW LOCATION.
4. CONSTRUCT SECTION OF 161KV SUBSTATION SOUTH OF SWITCH 133 AND SWITCH 129.
5. INSTALL POWER CABLE FROM RISER POLE FOR TRANSFORMER #1 TO STATION SERVICE TRANSFORMER #3.
6. COMPLETE INSTALLATION OF FINAL RELAY AND TRANSFORMER PANELS AND COMMUNICATION RACKS. COMPLETE FINAL MODIFICATION TO CONTROL BUILDING.
7. THIS WORK TO BE COMPLETED BY JUNE 25, 2013.
8. CLEARANCE ON FEEDER 22 AND TRANSFORMER #2 - JUNE 27, 2013.
9. REMOVE JUMPERS FROM TEMPORARY 161KV TRANSMISSION LINE ON NORTH AND SOUTH END OF SUBSTATION. SPlice IN SECTION OF CONDUCTOR AND SHIELD WIRE AND TRANSFER FEEDER 126 (FORMERLY FEEDER 22) TO NEW LOCATION ON SOUTH-WEST STEEL SUBSTATION DEAD-END. INSTALL JUMPERS, CHECK PHASING, AND RE-ENERGIZE FEEDER 126, FEEDER 22, TRANSFORMER #1 AND TRANSFORMER #2.
10. SUBSTATION NOW FULLY ENERGIZED - JUNE 27, 2013.
11. REMOVE TEMPORARY 161KV TRANSMISSION LINE AND ANCHORS, RESTORE DISTURBED AREA AROUND SUBSTATION, REMOVE EXISTING FOUNDATIONS, RETURN EXCESS AND SURPLUS MATERIAL TO WAREHOUSE, INSTALL FINAL LAYER OF ROCK, AND COMPLETE ALL WORK RELATED TO PROJECT BY JULY 31, 2013.

**NOTES:**

1. REFER TO NOTES ON THIS DRAWING FOR FIBER OPTIC INSTALLATION.
2. GRDA TO FURNISH POLES, LINE HARDWARE, ANCHORS, CONDUCTOR AND SHIELD WIRE FOR TEMPORARY AND PERMANENT TRANSMISSION LINE CONSTRUCTION.
3. ALL LINE OUTAGES MUST BE KEPT TO A MINIMUM. A HOLD-ORDER WILL BE PLACED ON ENERGIZED LINES OR BUS WHEN PERFORMING WORK NEAR ENERGIZED CIRCUITS.
4. USE ONLY QUALIFIED JOURNEYMAN LINEMAN EXPERIENCED IN WORKING ON OR NEAR ENERGIZED CIRCUITS WHEN PERFORMING WORK ON TRANSMISSION LINES.

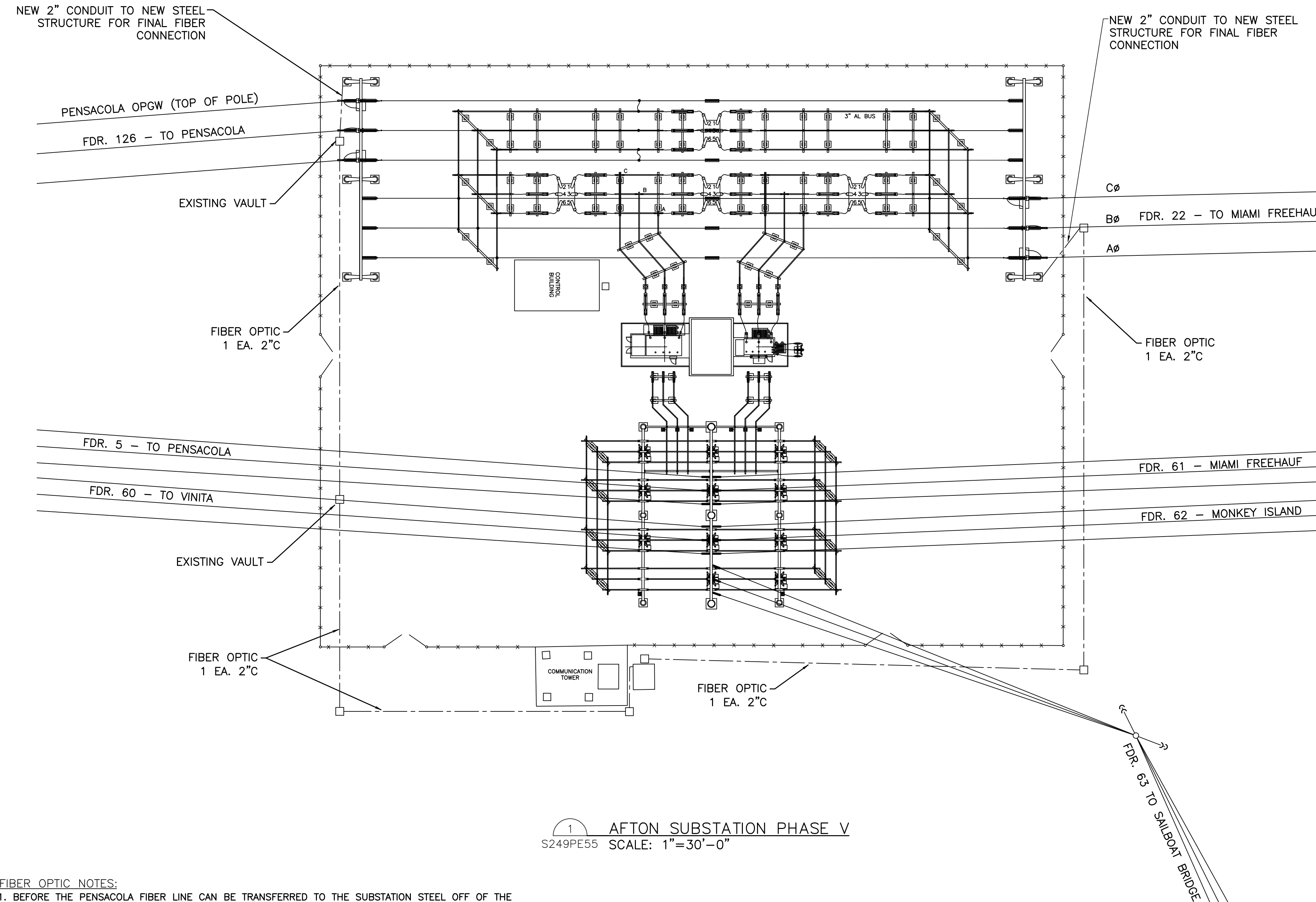
**REFERENCE DRAWINGS**

S294PE01	161KV EQUIPMENT PLAN VIEW
S294PE50	AFTON SUBSTATION BEFORE CONSTRUCTION
S294PE51	AFTON SUBSTATION PHASE I
S294PE52	AFTON SUBSTATION PHASE II
S294PE53	AFTON SUBSTATION PHASE III
S294PE54	AFTON SUBSTATION PHASE IV
S294PG20	GROUNDING PLAN
S294PG30	161KV FOUNDATION PLAN
S294PG33	TYPICAL FOUNDATION DETAILS
S294PG34	TYPICAL FOUNDATION DETAILS
S294PG50	TRENCH LAYOUT PLAN

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69KV			
AFTON SUBSTATION PHASE V			
100% COMPLETE			
SCALE: 1"=30'	DRAWN BY: JT	ENGR: BA	APPD: BA
CH: MW	DATE: 01MAY12	DRAWING No. S294PE55	
REV. 0		REV. 0	

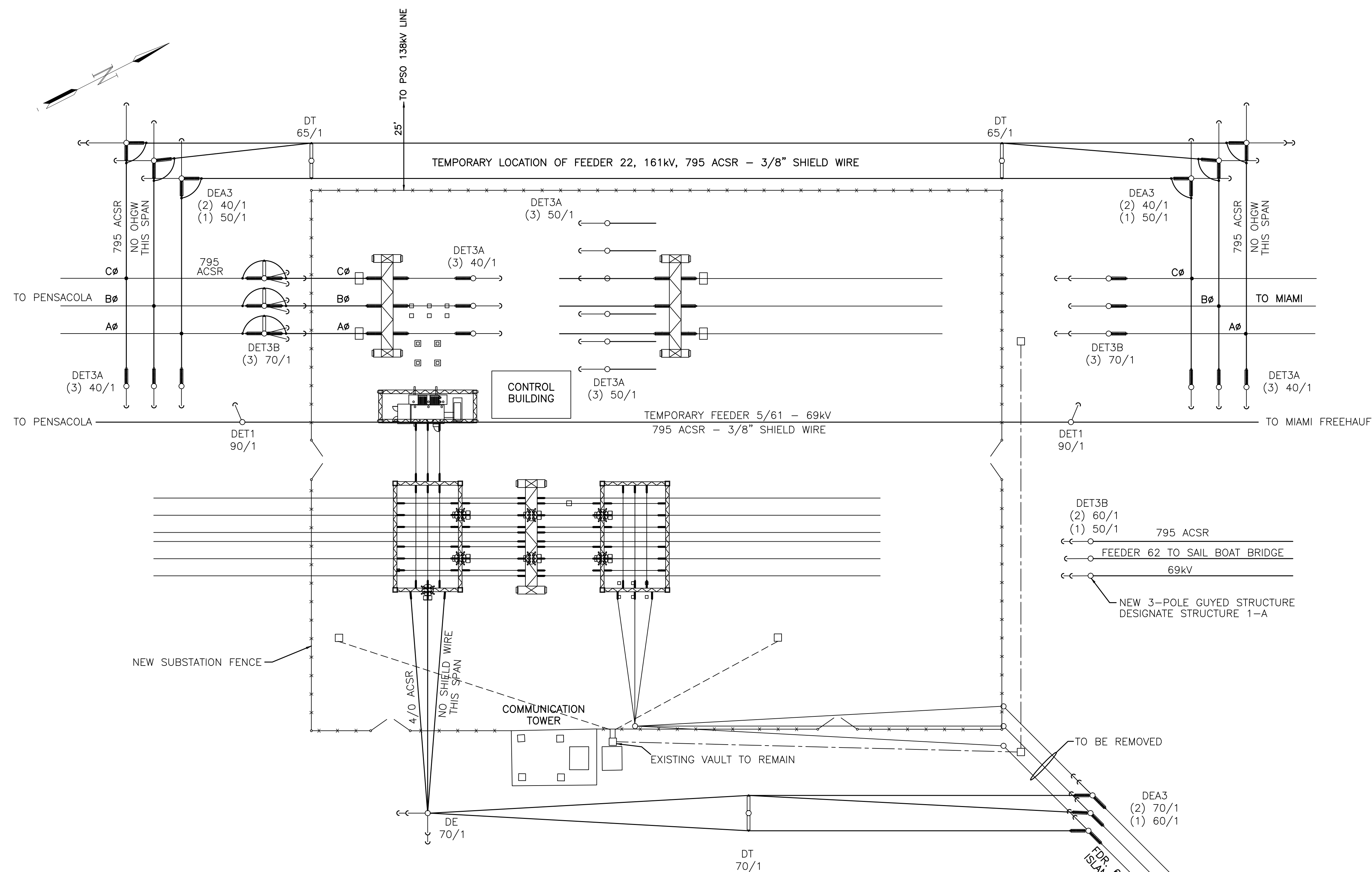
REV	DATE	REVISION DESCRIPTION	DFT	ENG
0	5/29/12	ISSUED FOR BID	JT	BA



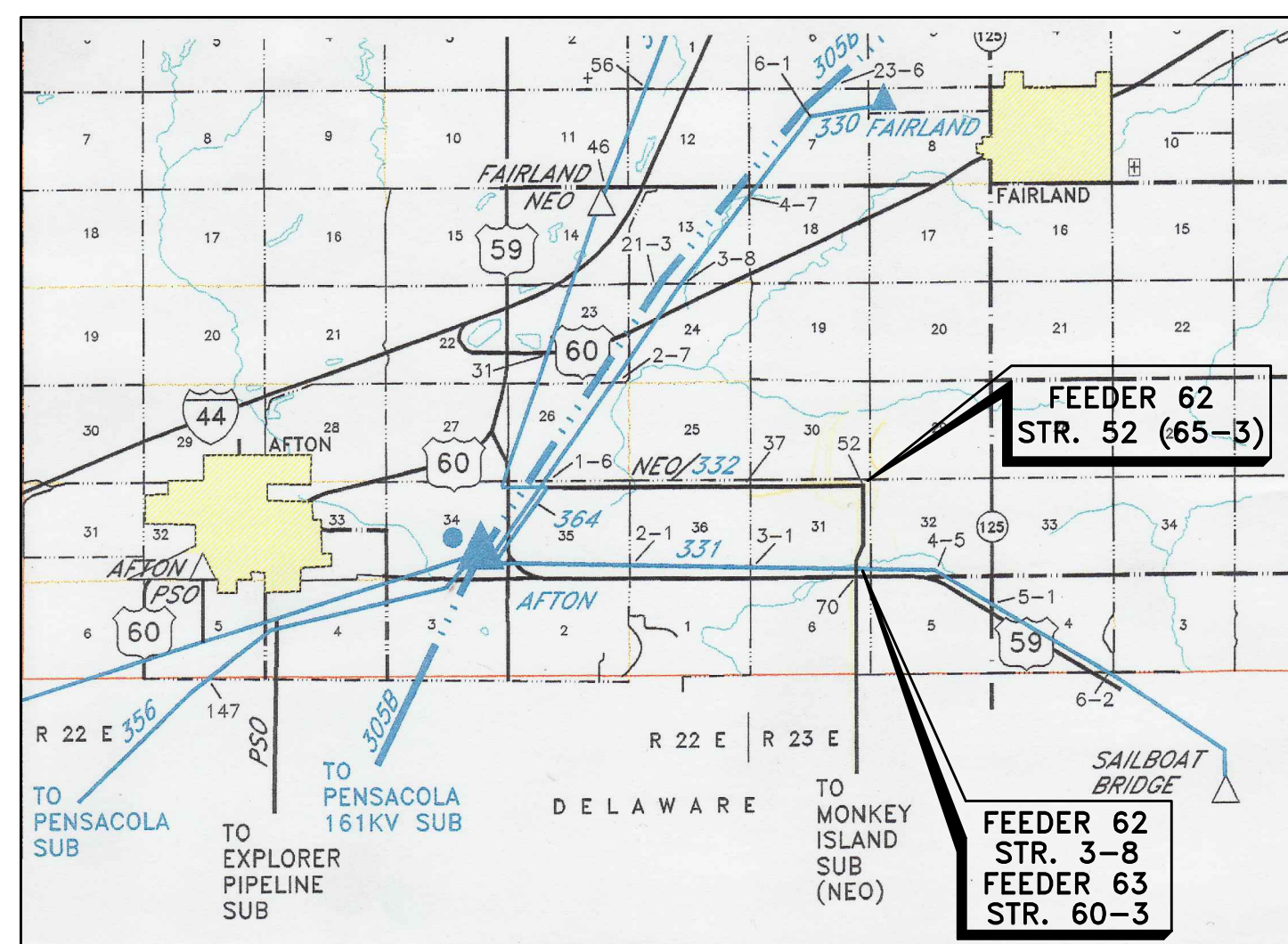
**1 AFTON SUBSTATION PHASE V**  
S249PE55 SCALE: 1"=30'-0"

**FIBER OPTIC NOTES:**

1. BEFORE THE PENSACOLA FIBER LINE CAN BE TRANSFERRED TO THE SUBSTATION STEEL OFF OF THE TEMPORARY DEAD-END STRUCTURE, A SINGLE 2" CONDUIT MUST BE RUN FROM THE VAULT TO THE NEW DEAD-END POSITION ON THE NEW SUBSTATION STEEL.
2. INSTALL NEW OPGW STORAGE RACK AND DOWN-LEAD CLAMPS ON THE NEW SUBSTATION DEAD-END.
3. THE OPGW SPLICE CLOSURE ON THE TEMPORARY STRUCTURE, AND THE UNDERGROUND CABLE AT THE TEMPORARY STRUCTURE WILL BE RE-ROUTED TO THE NEW SUBSTATION STEEL DEAD-END. THE EXTRA SLACK ON THE COIL RACK OF THE TEMPORARY DEAD-END STRUCTURE WILL BE USED TO EXTEND THE CABLE TO THE NEW SUBSTATION STEEL.
4. THE TRANSFER OF THE OPGW WILL NEED TO BE MADE IN THE "MAINTENANCE WINDOW" FROM 12:00 A.M. TO 06:00 A.M.
5. THIS WORK MUST BE SCHEDULED AT LEAST 2 WEEKS IN ADVANCE.
6. THE CONTRACTOR IS TO SUPPLY ALL LABOR AND MATERIALS FOR THE FIBER OPTIC RE-LOCATION AND SPLICING.
7. INSTALLATION OF THE FIBER OPTIC MUST BE COORDINATED WITH GRDA AND KAMO.



- NOTES:**
1. STRUCTURE LOCATIONS ARE APPROX. POLE AND ANCHOR LOCATIONS TO BE STAKED IN FIELD BY GRDA.
  2. SEE TRANSMISSION LINE "BILL OF MATERIAL" FOR HARDWARE.
  3. INSTALL (2) 40/1 POLES AND (2) ANCHORS AT INTERSECTION OF FEEDER 62 AND FEEDER 63 FOR PHASING ROTATION (NOT SHOWN ON THIS DRAWING - SEE PHASE II CONSTRUCTION INSTRUCTIONS).



1 AFTON SUBSTATION  
S249PE54 SCALE: 1"=30'-0"

- REFERENCE DRAWINGS**
- S294PE51 AFTON SUBSTATION PHASE I
  - S294PE52 AFTON SUBSTATION PHASE II
  - S294PE53 AFTON SUBSTATION PHASE III
  - S294PE54 AFTON SUBSTATION PHASE IV
  - S294PE55 AFTON SUBSTATION PHASE V
  - S294PE57 TRANSMISSION LINE STRUCTURES & DETAILS
  - S294DE05 BILL OF MATERIALS SHEET 5

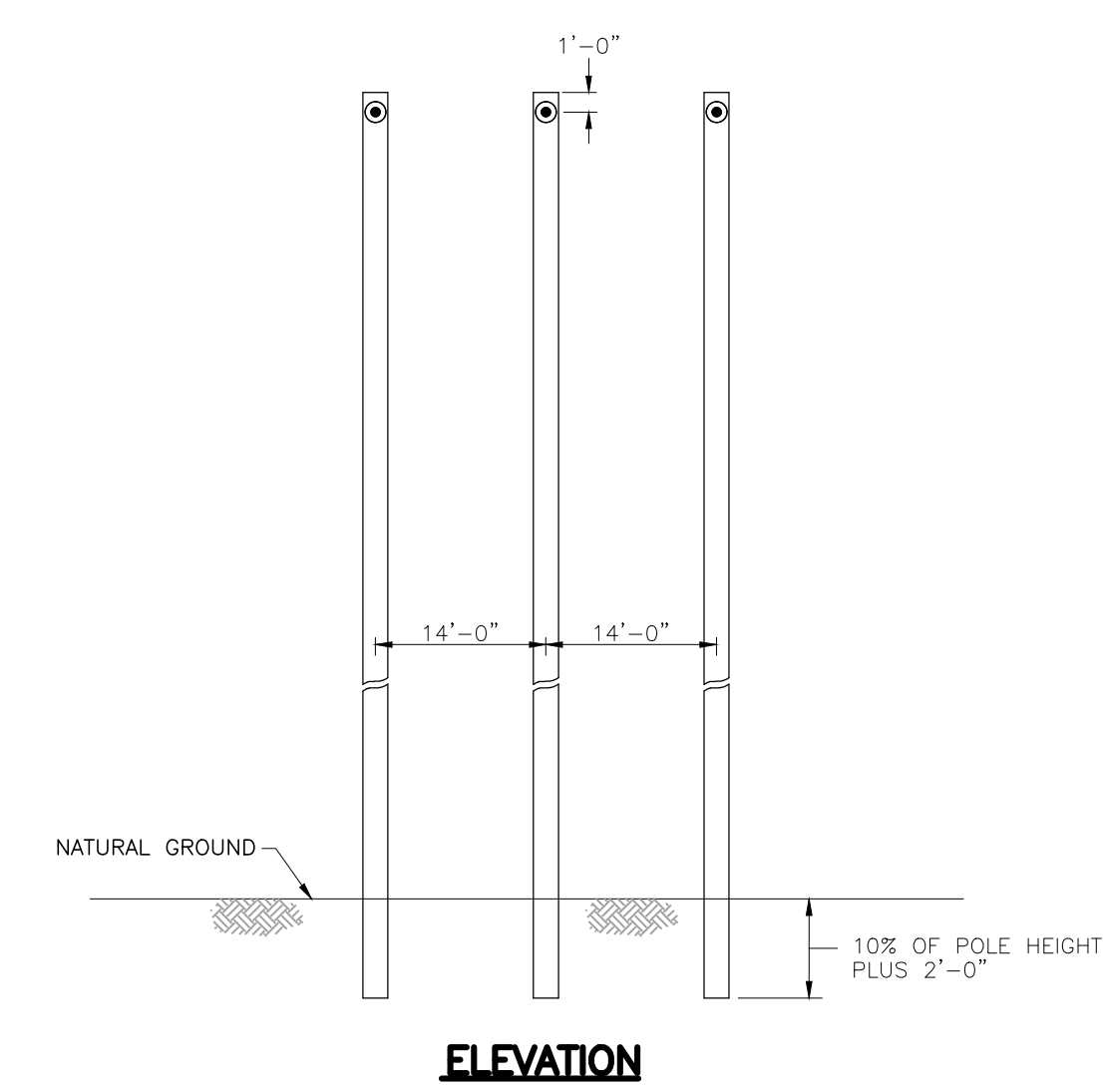
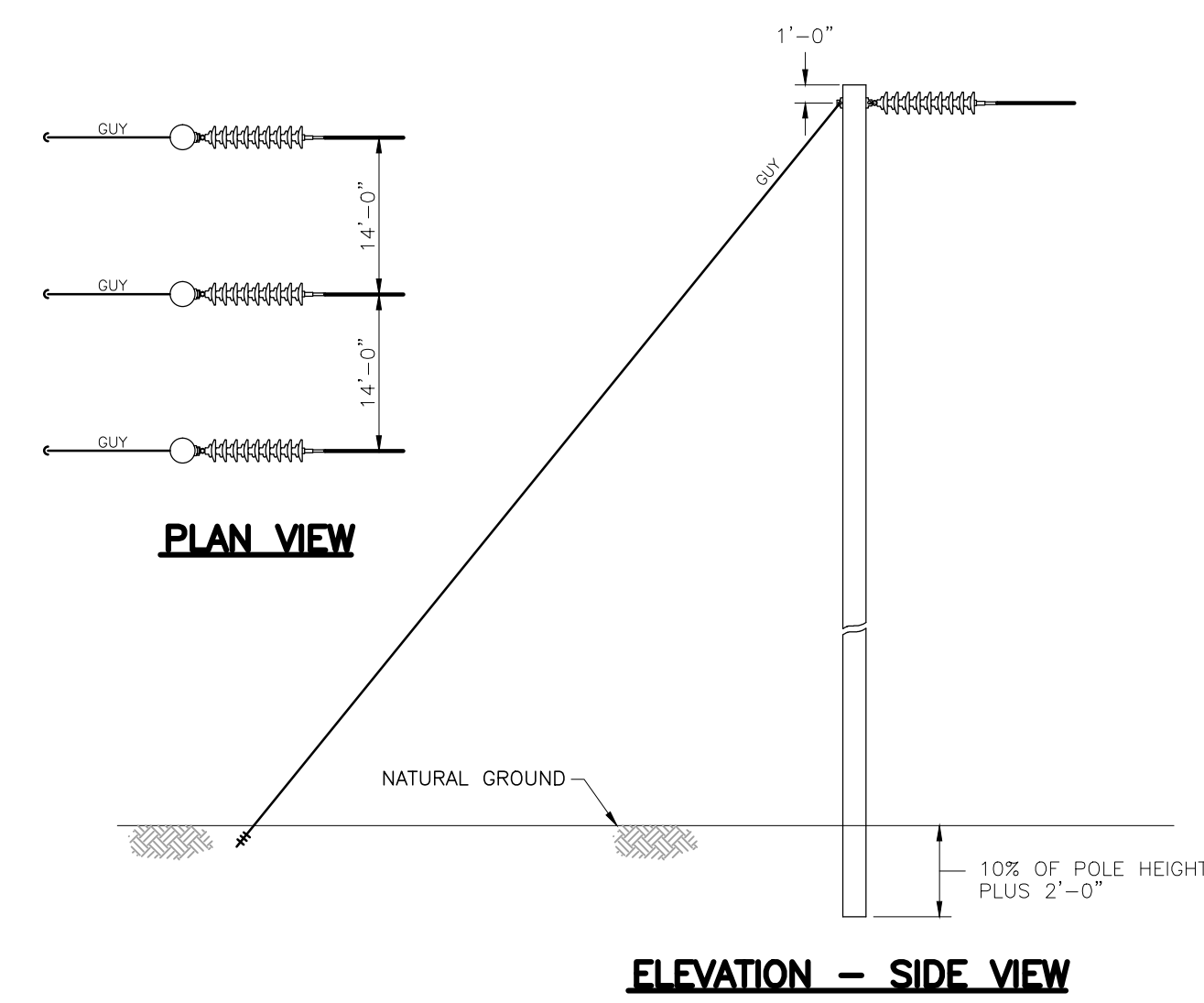
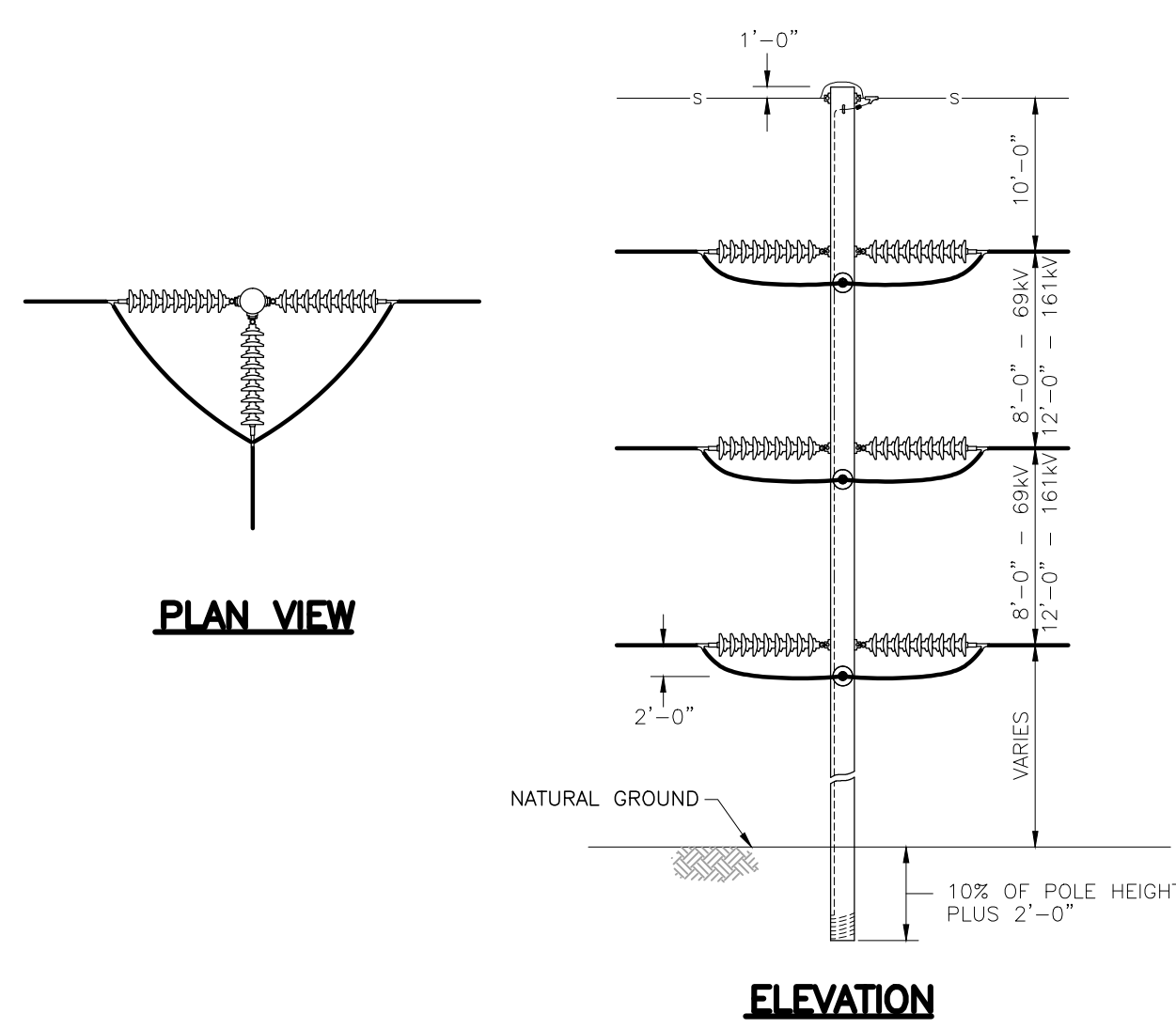
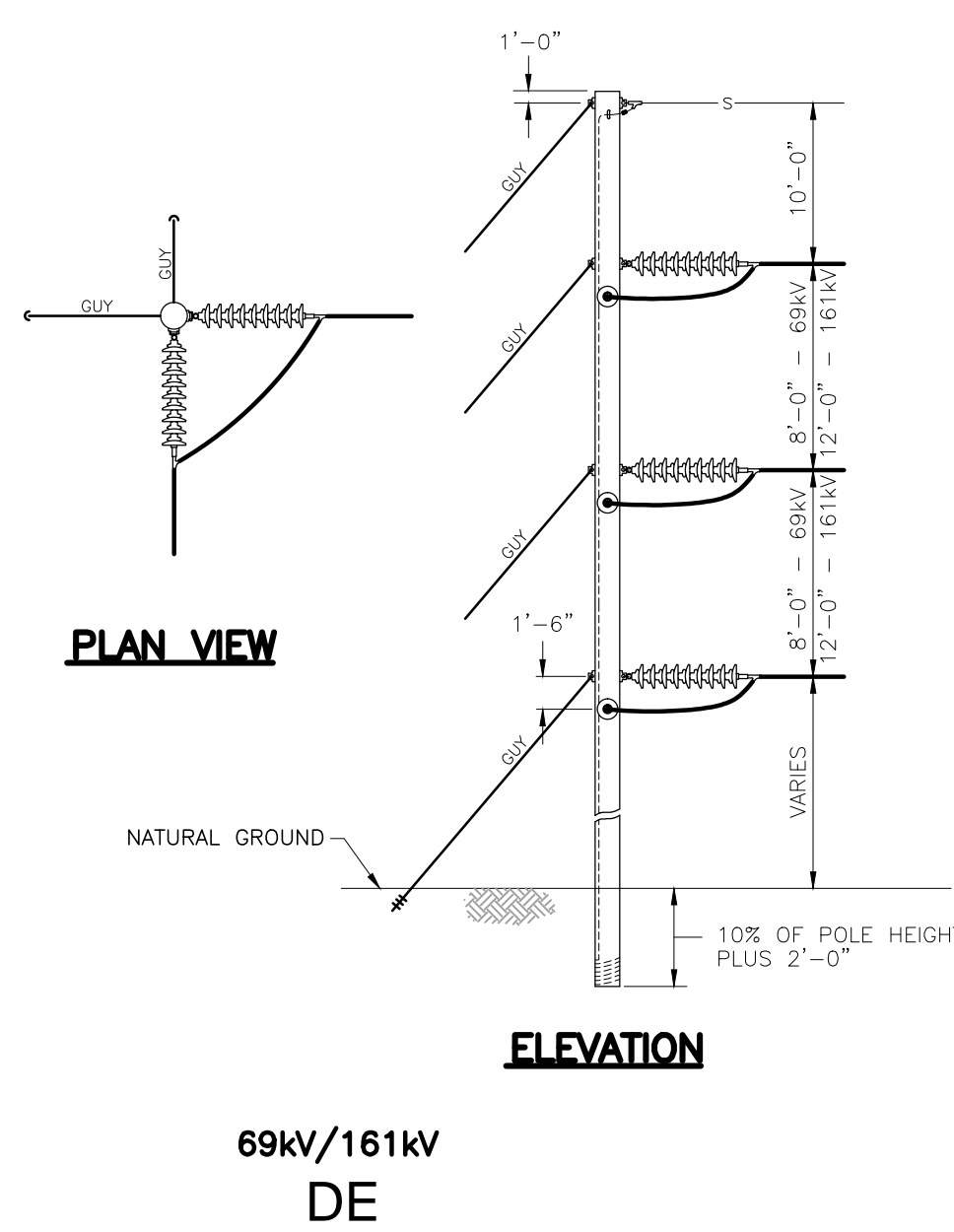
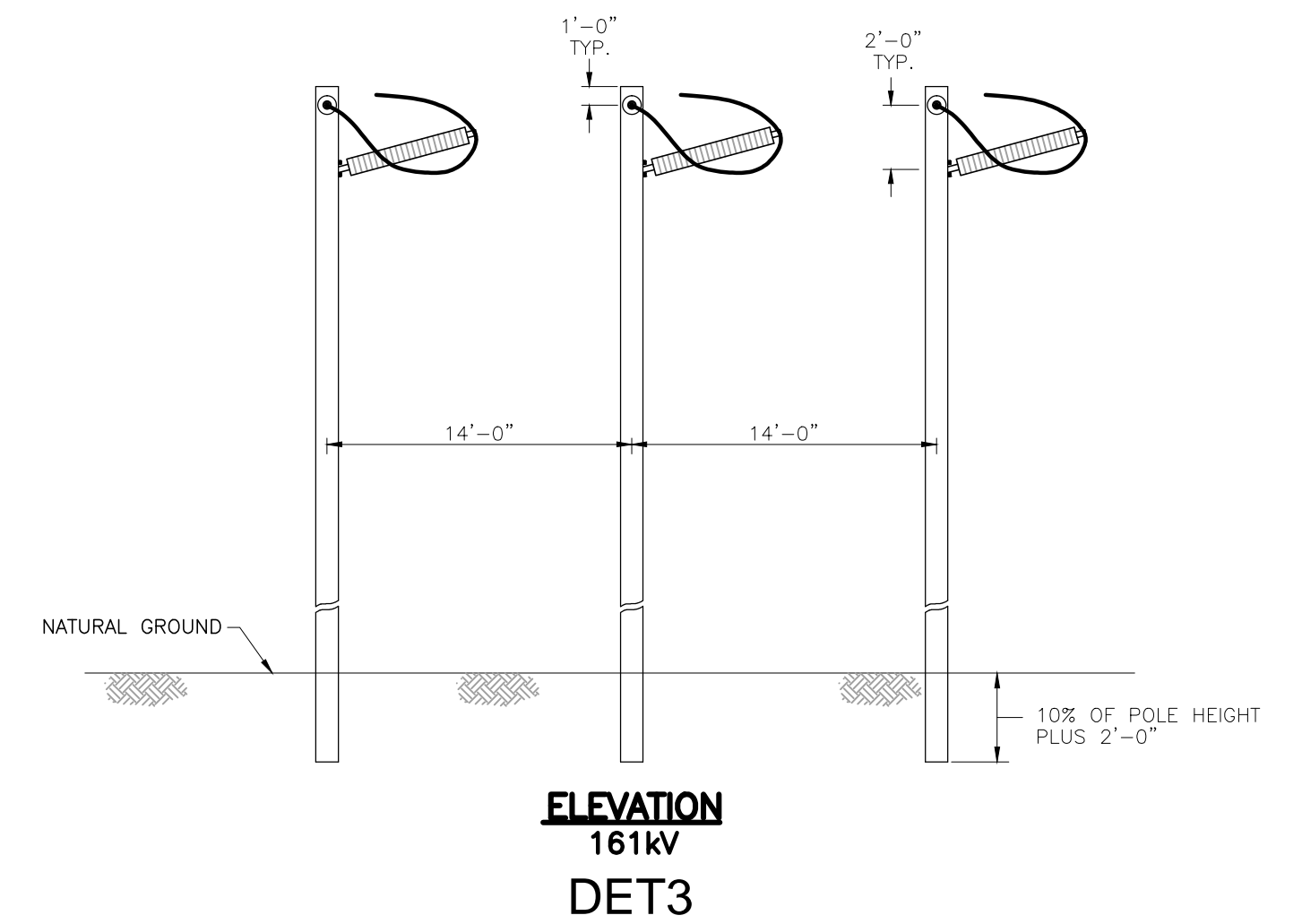
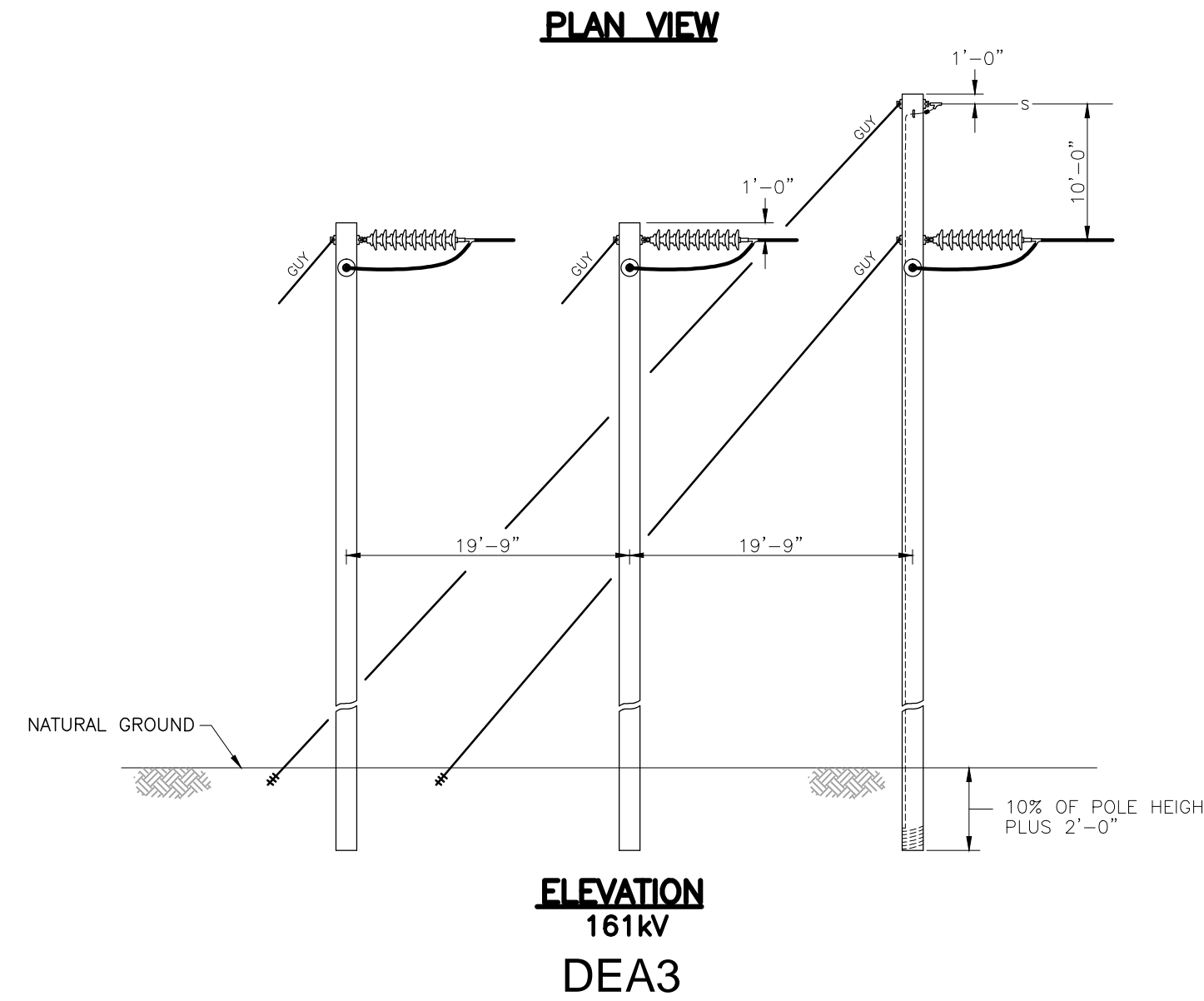
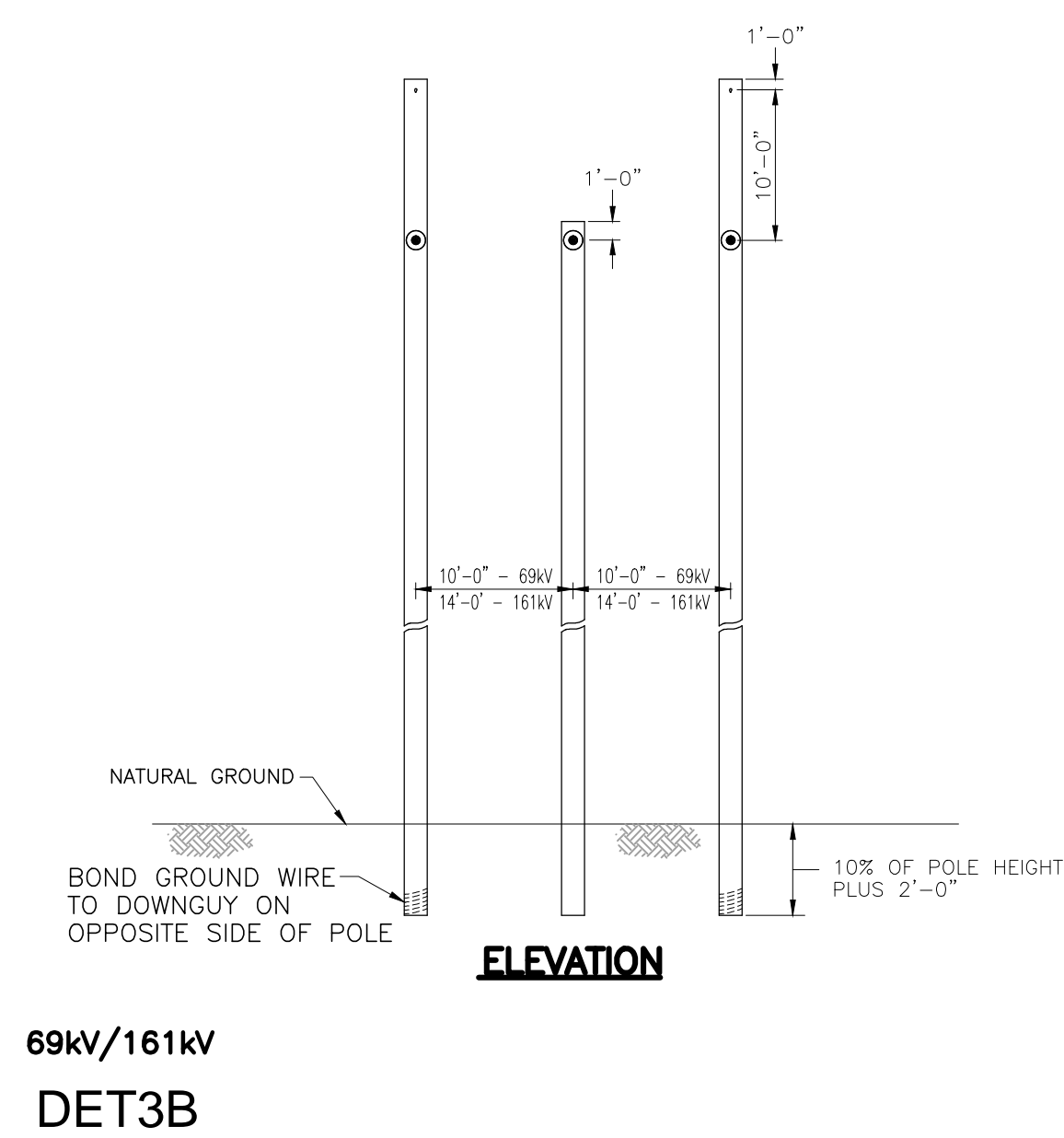
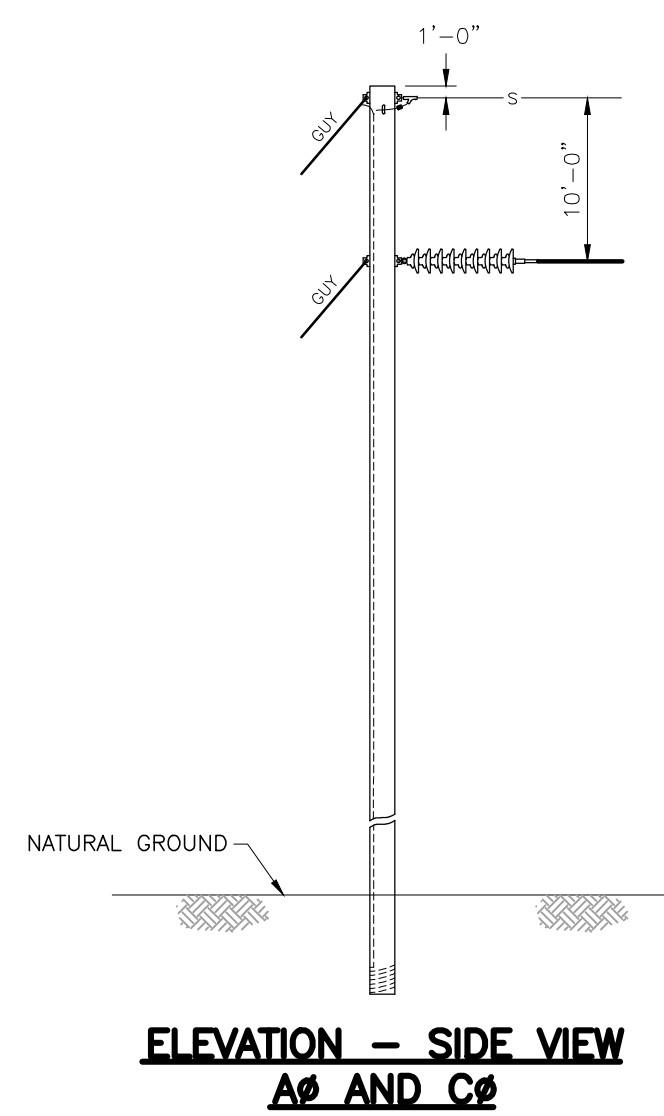
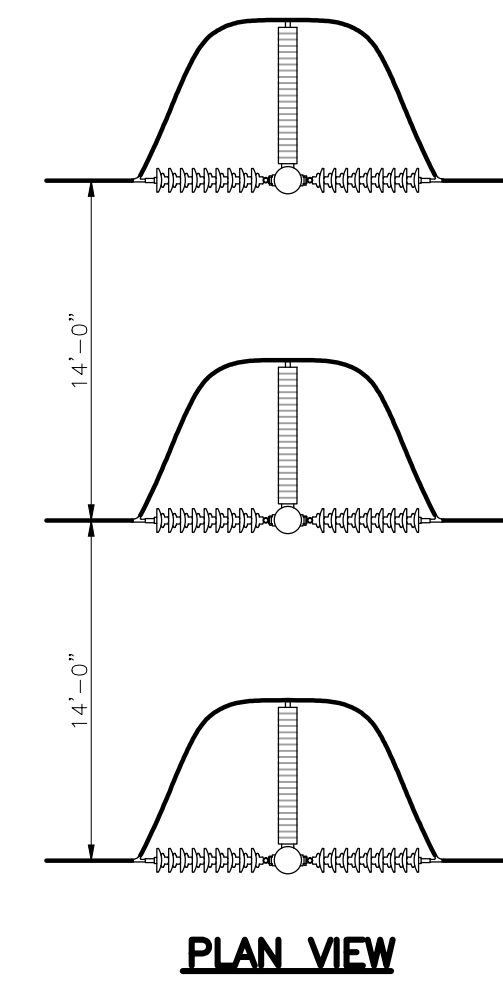
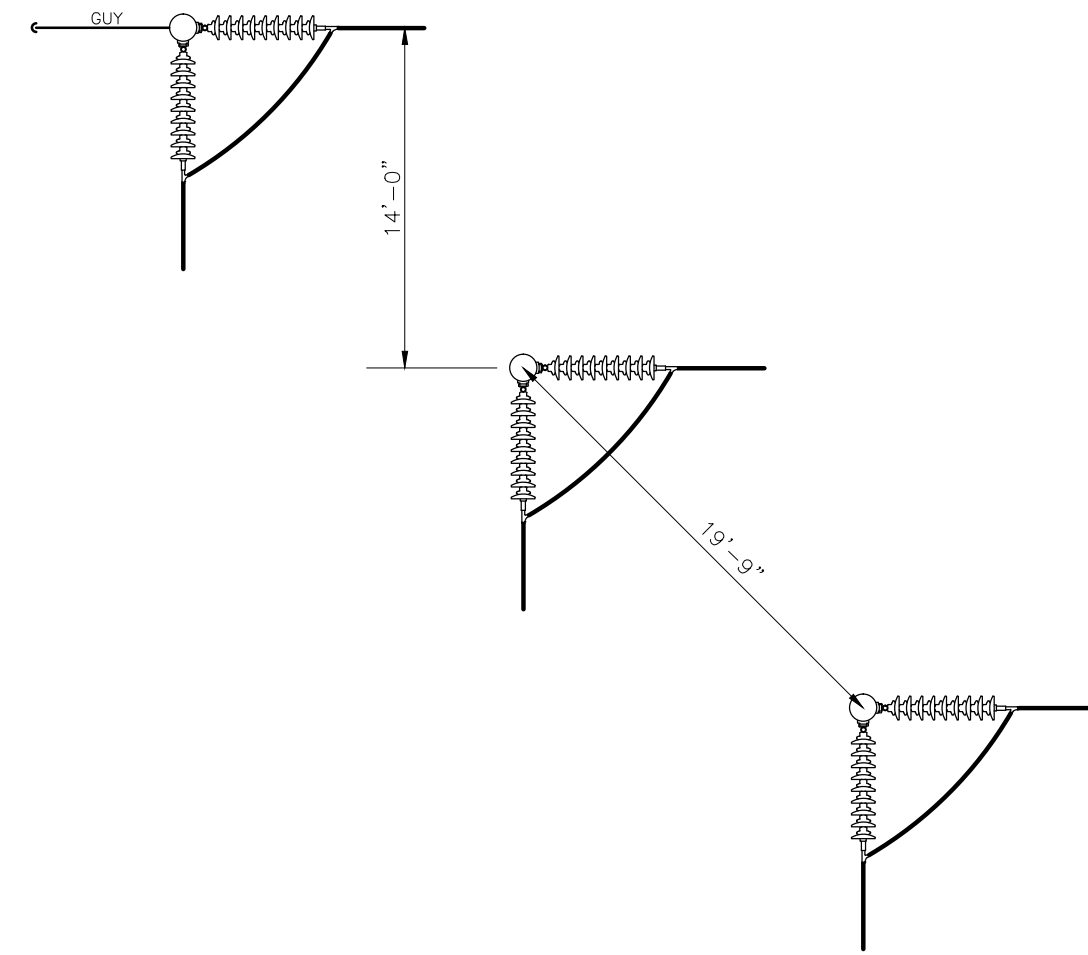
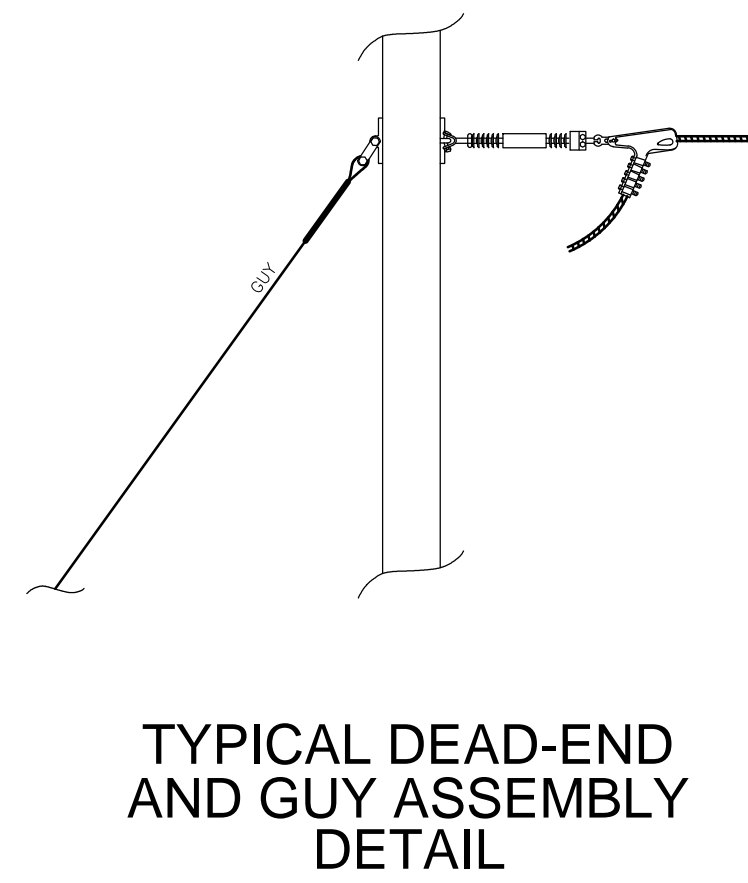
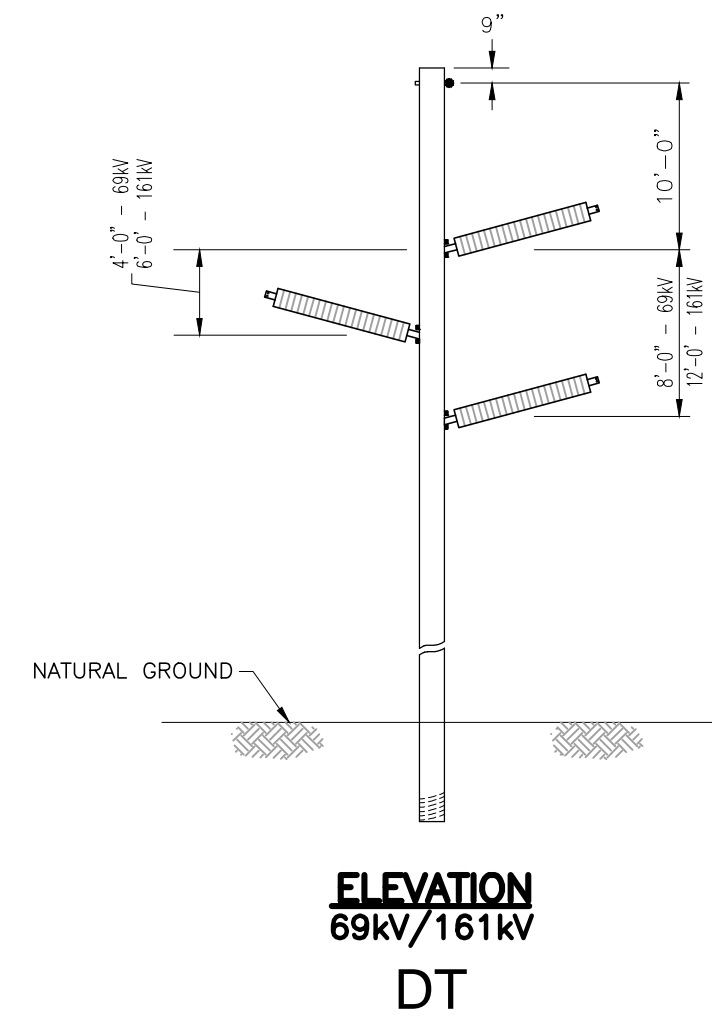
**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69KV

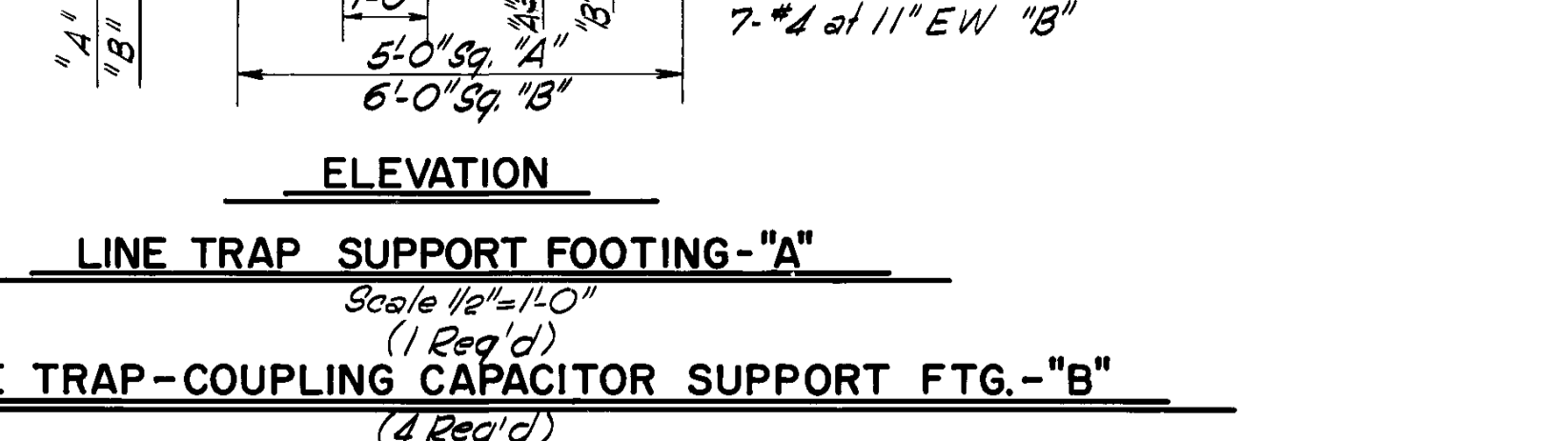
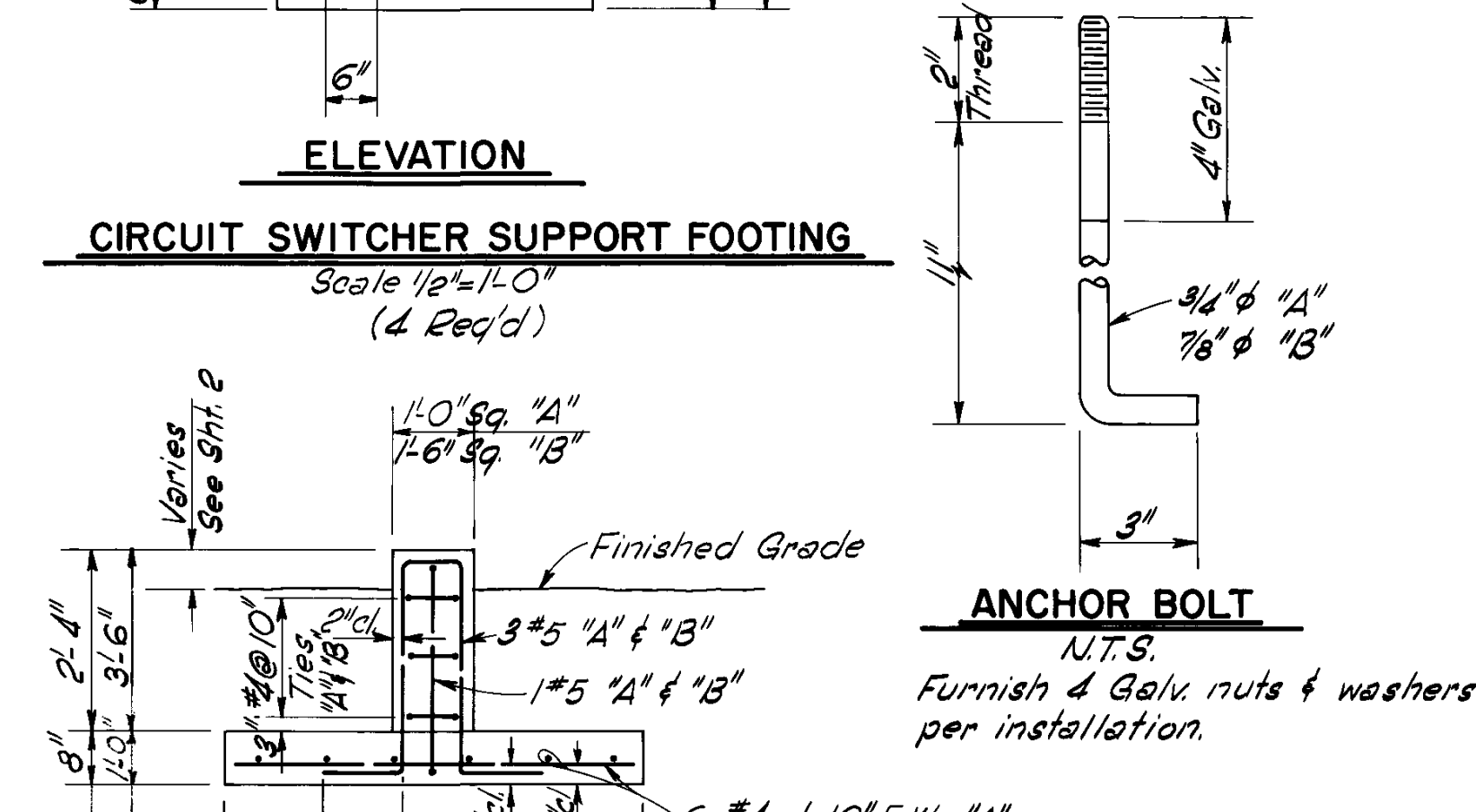
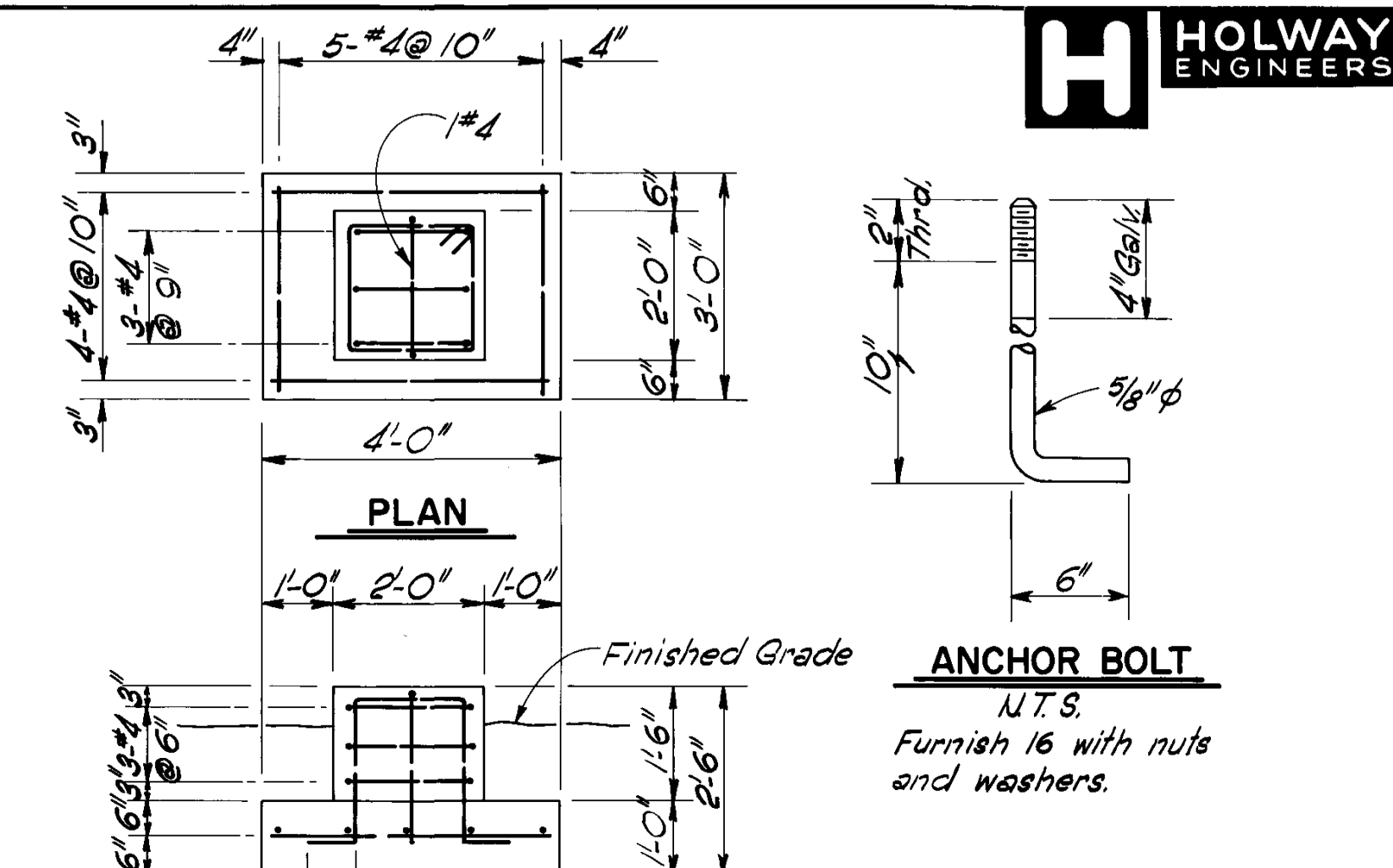
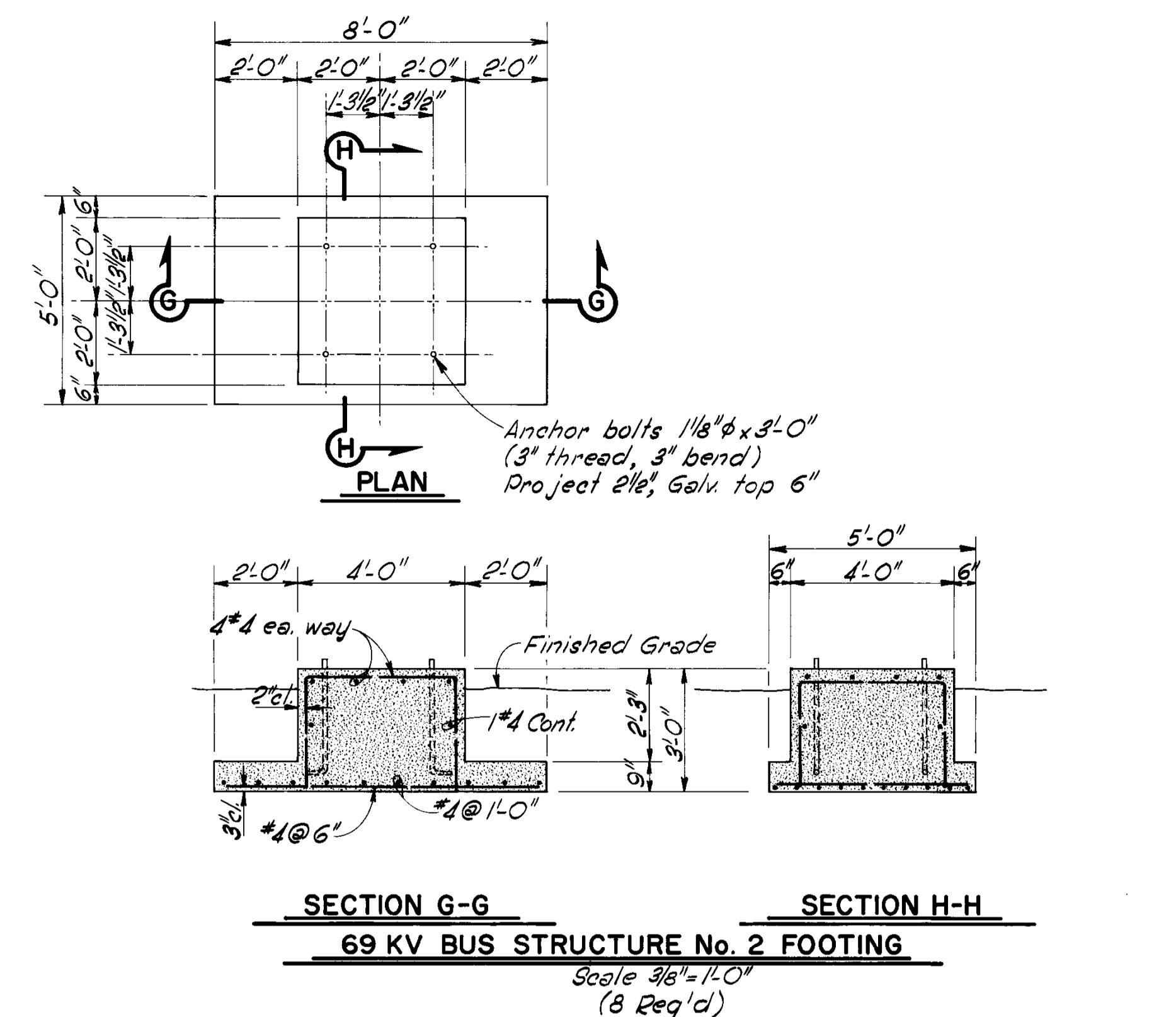
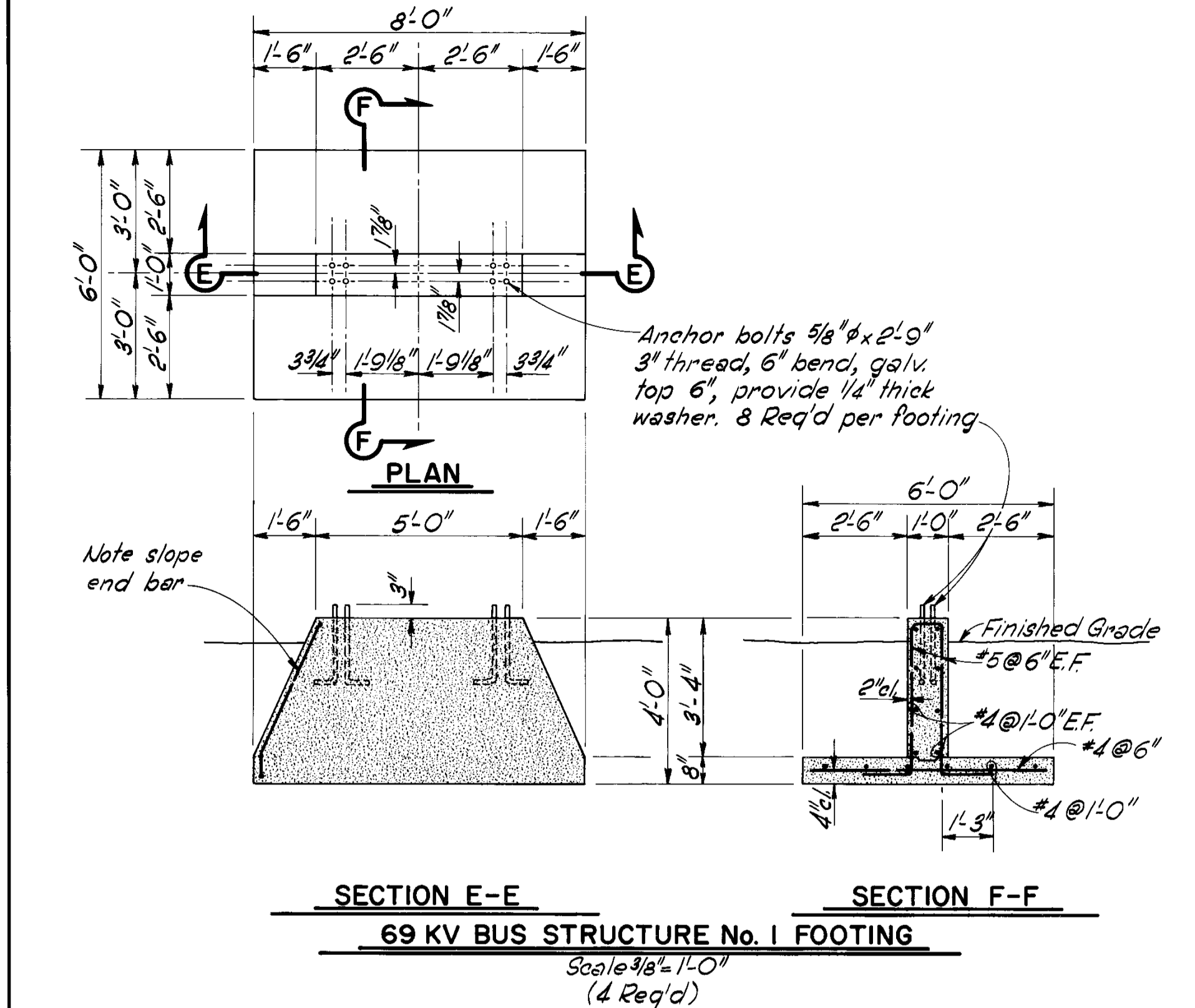
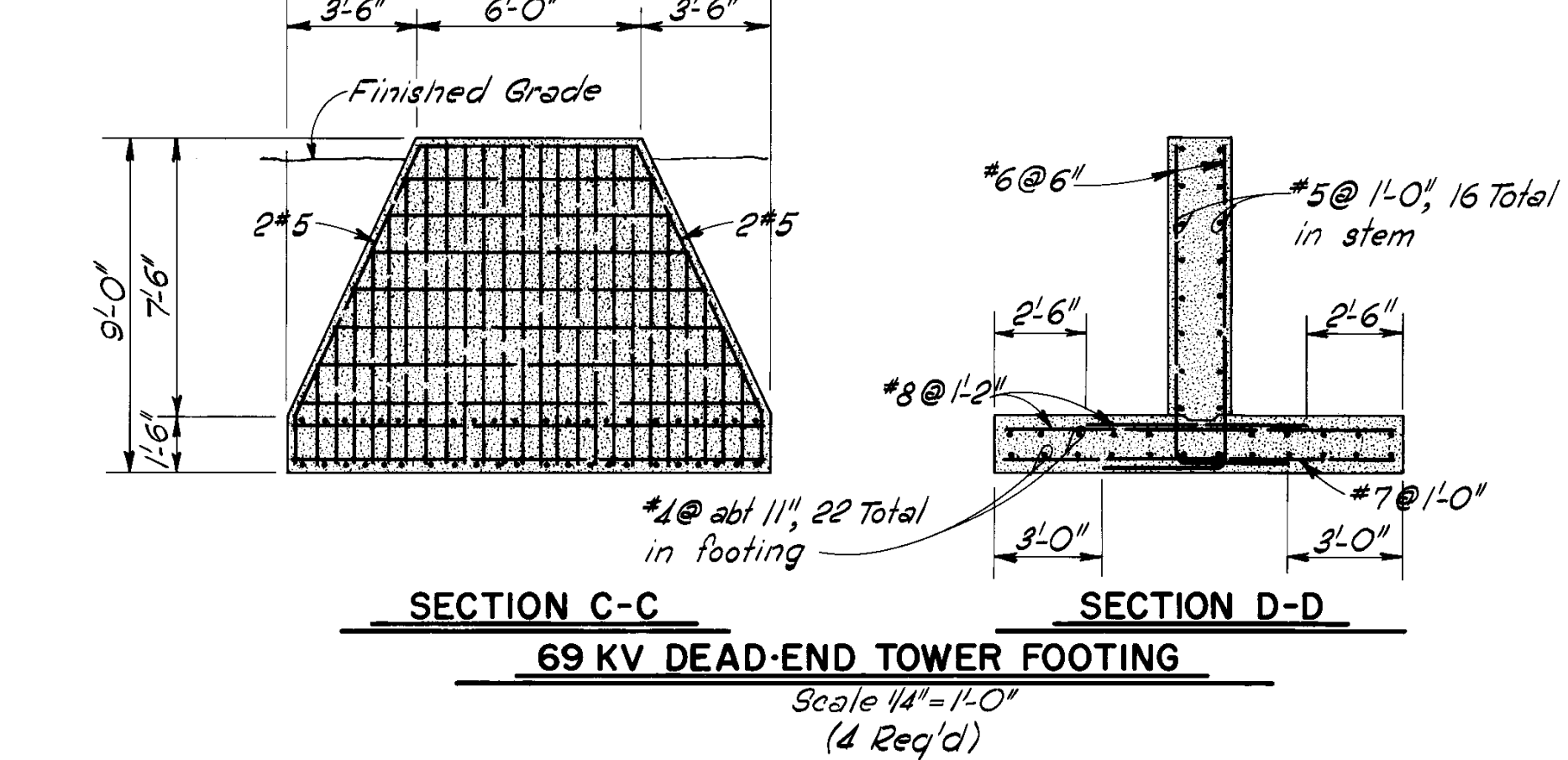
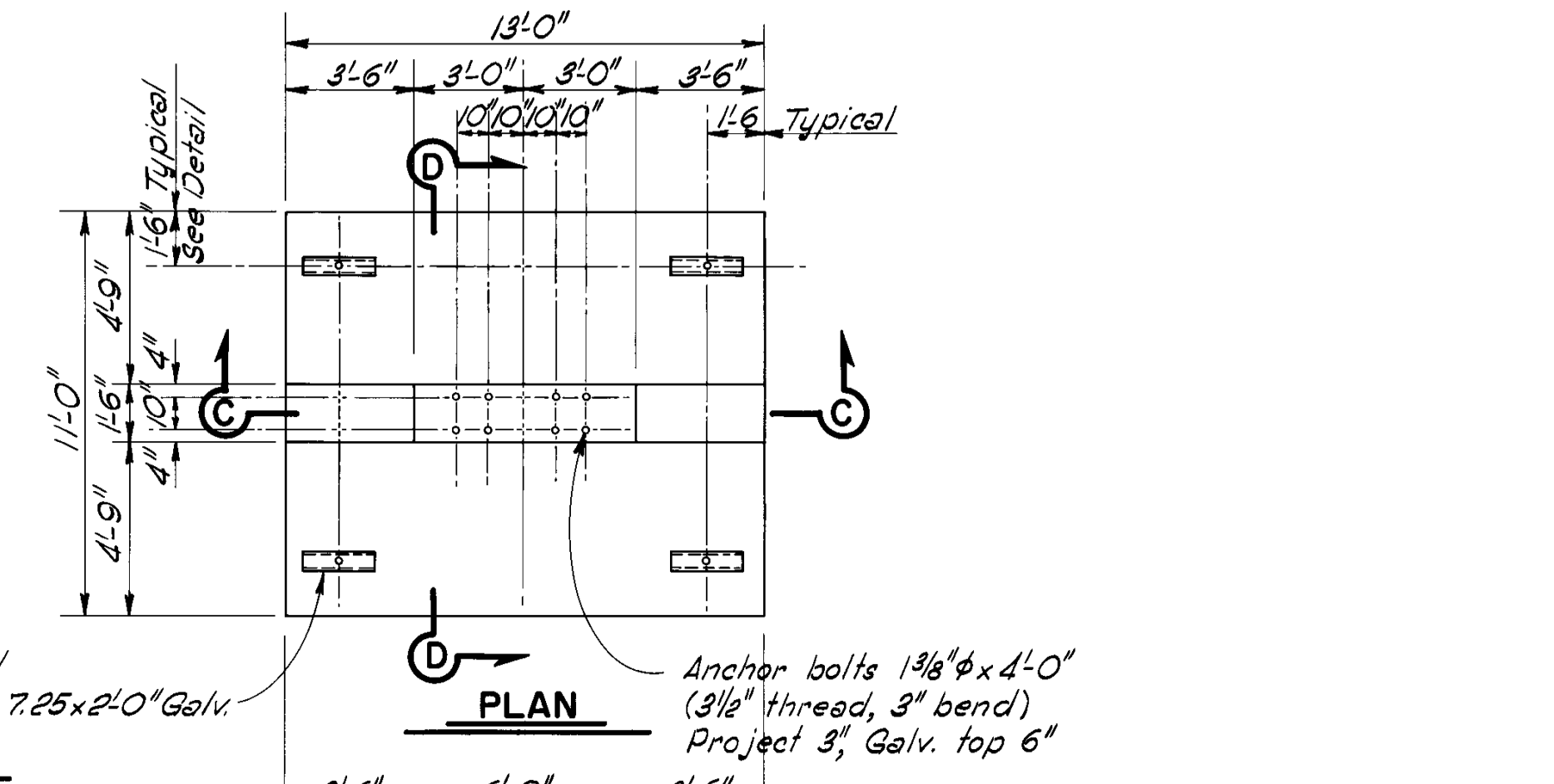
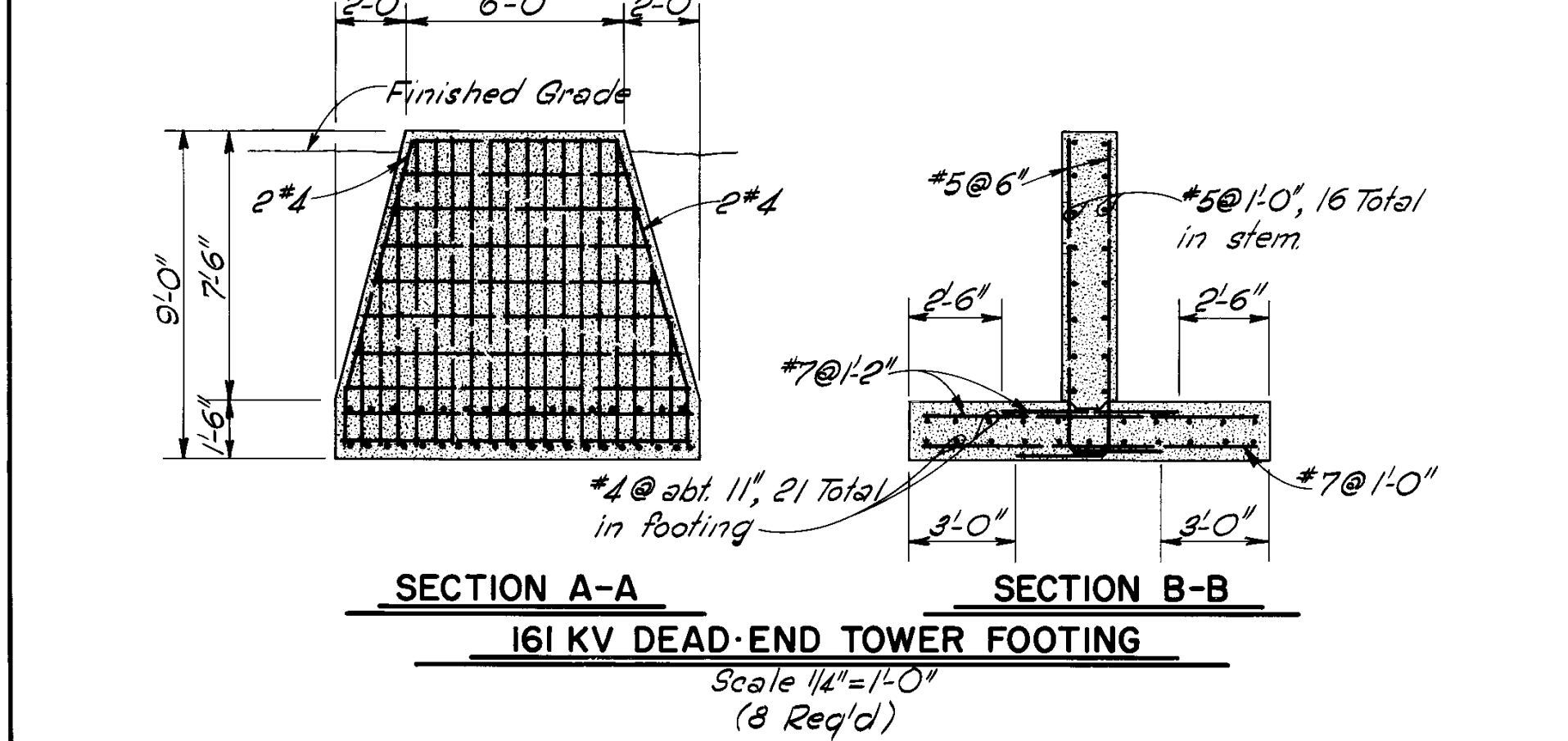
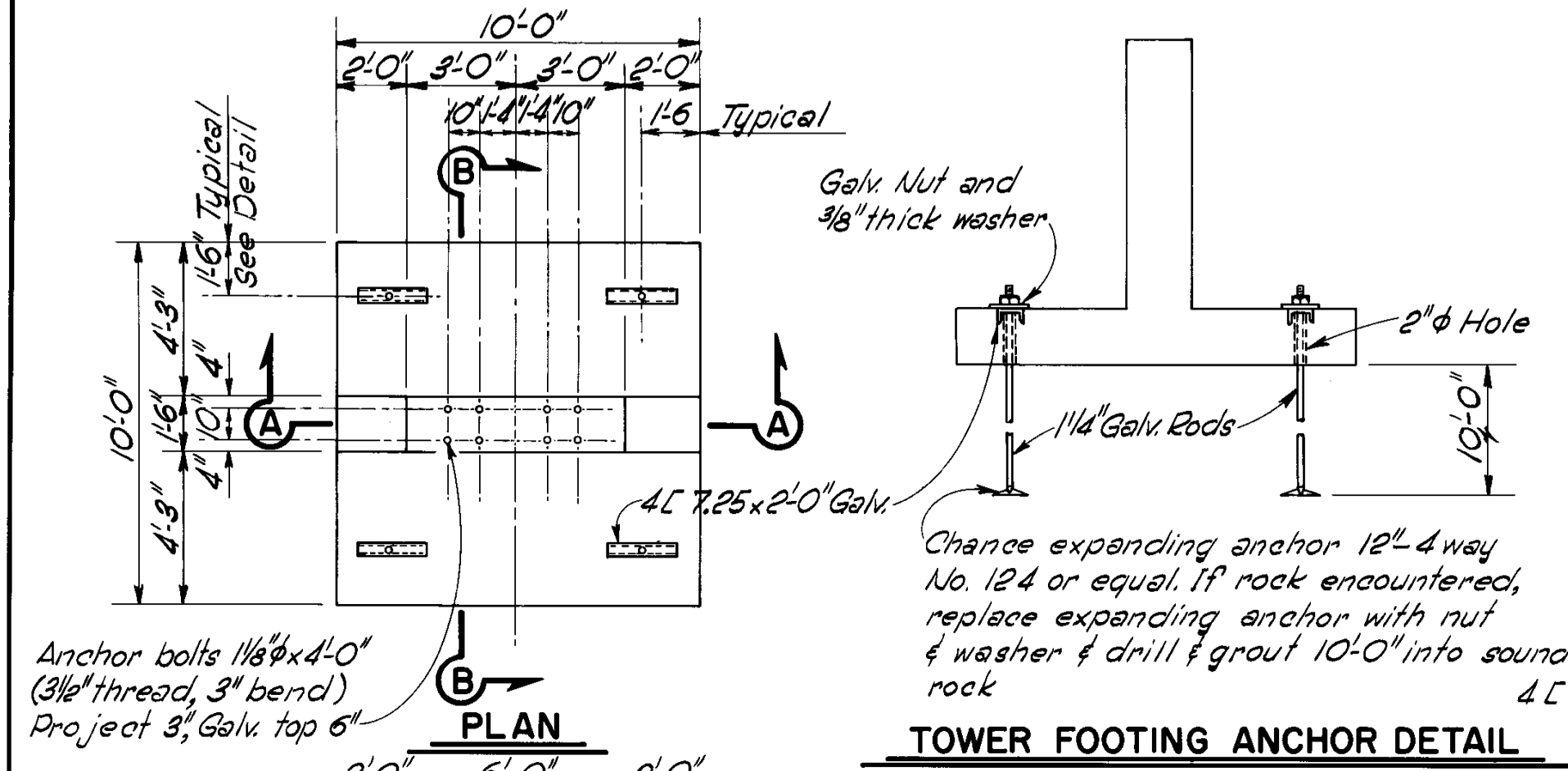
AFTON SUBSTATION  
TRANSMISSION LINE PLAN

SCALE: 1"=30'	DRAWN BY: JT	ENGR: BA	APPD: BA
CH: MW	DATE: 11MAY12	DRAWING No. S294PE56	
REV. 0	DATE 5/29/12	ISSUED FOR BID	JT BA
REV. 1	DATE	REVISION DESCRIPTION	DFT ENG

GRDA  
Grand River Dam Authority  
P.O. BOX 409  
VINITA, OK 74301



GRAND RIVER DAM AUTHORITY			
AFTON SUBSTATION		S294	
AFTON, OKLAHOMA			
161/69kV			
TRANSMISSION LINE			
STRUCTURE DETAILS			
SCALE: NONE	DRAWN BY: JT	ENGR: BA	APPD: BA
GRDA Grand River Dam Authority P.O. BOX 409 VINITA, OK 74301		DRAWING No. S294PE57	REV. 0



Notes:  
1. The cost of drilling and grouting shall be included in the cost of the concrete.  
2. See sheet 2 for top footing elevations.

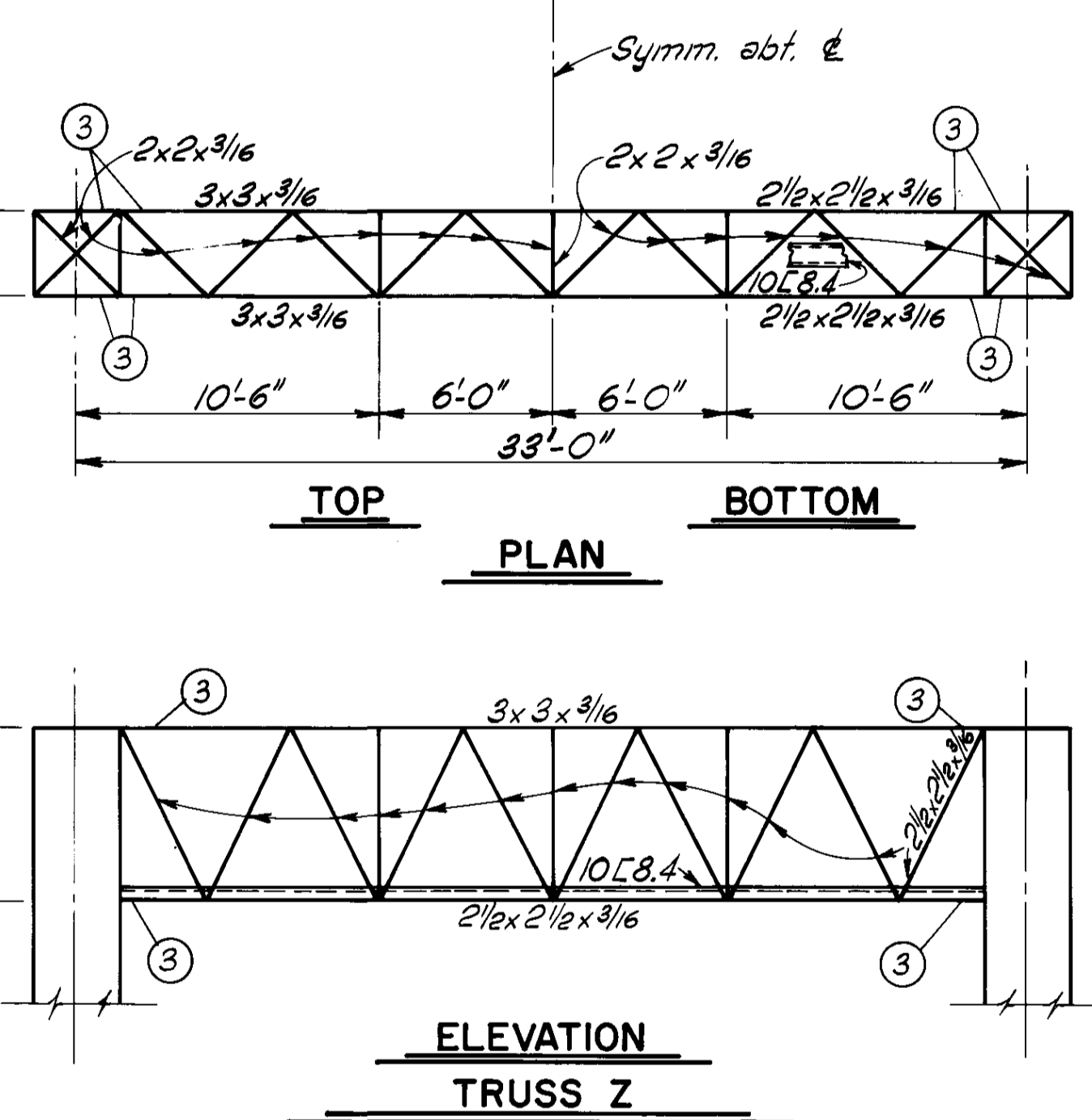
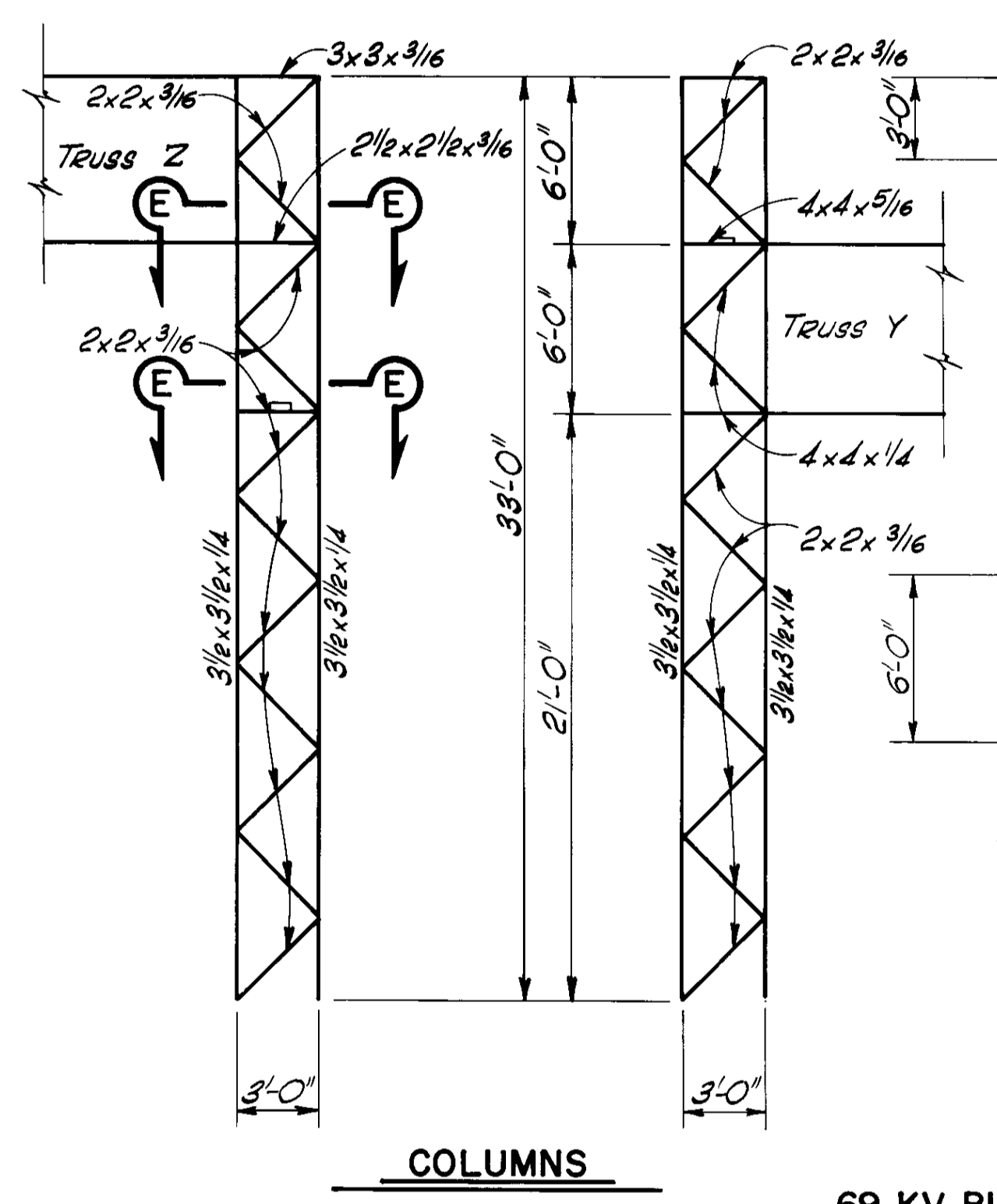
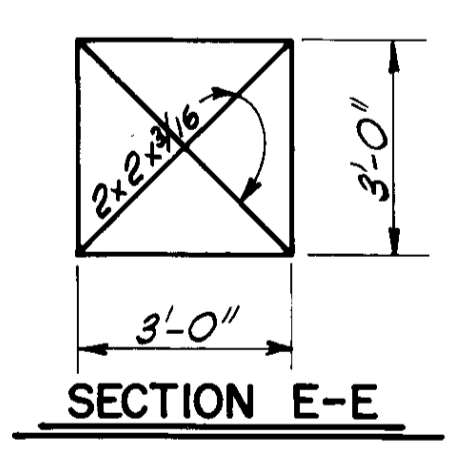
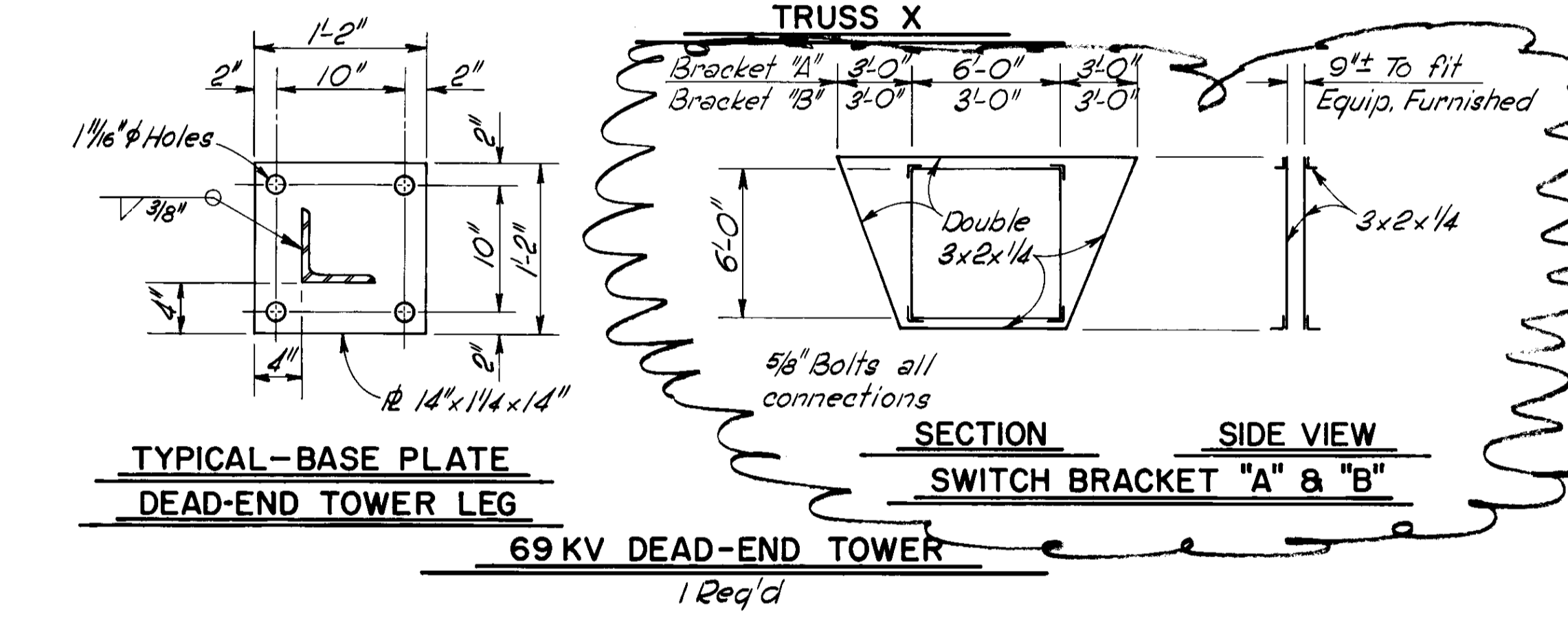
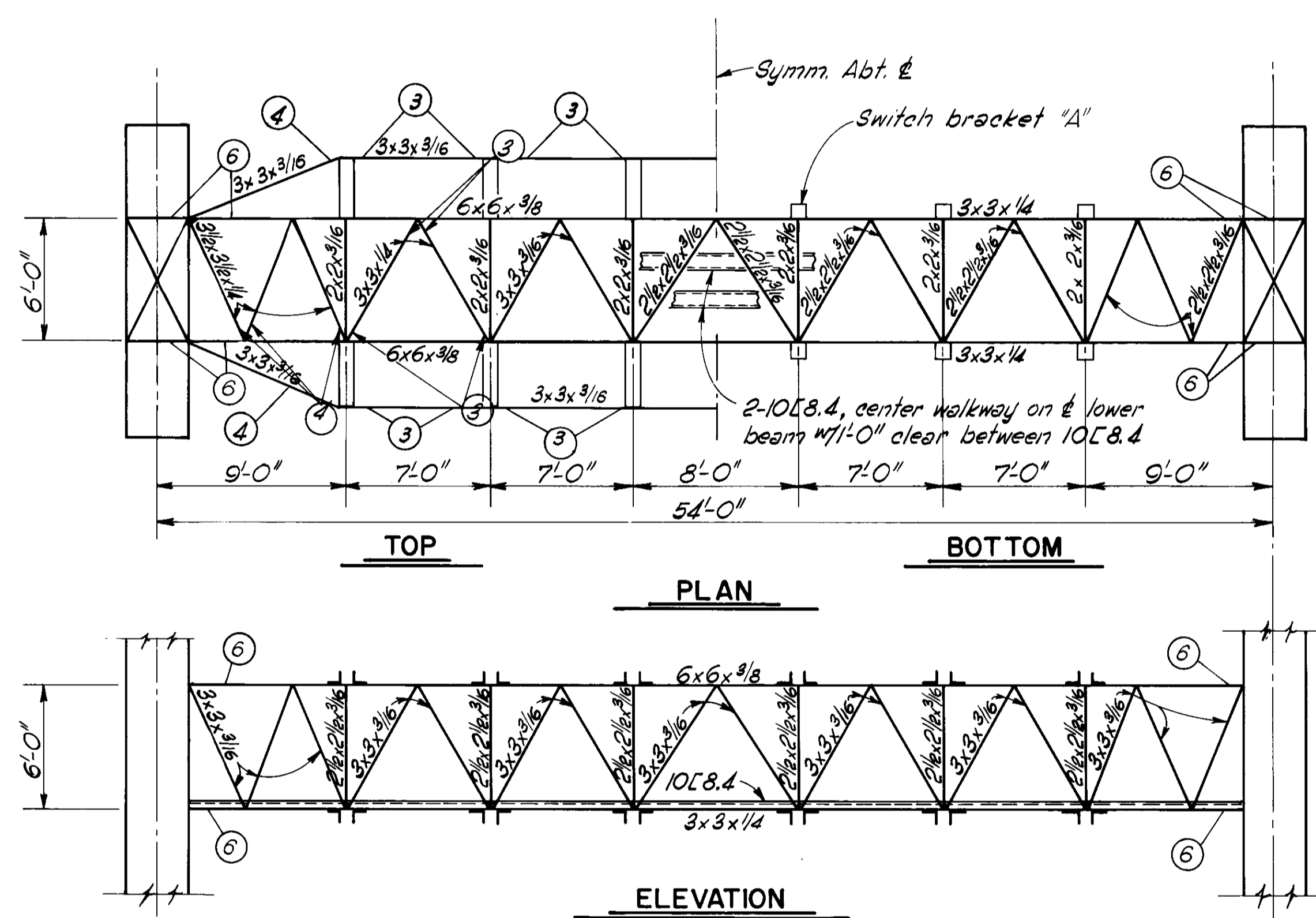
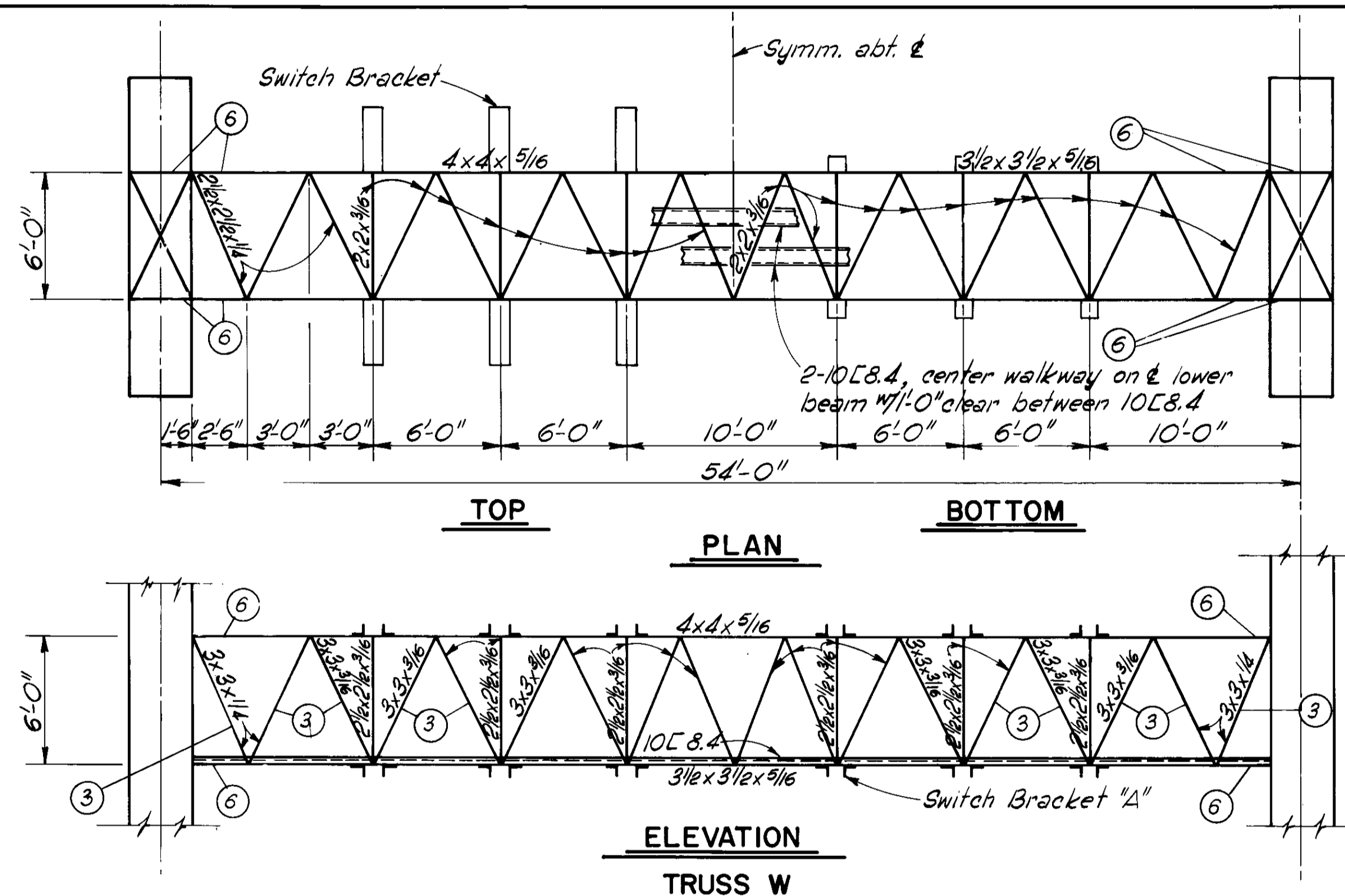
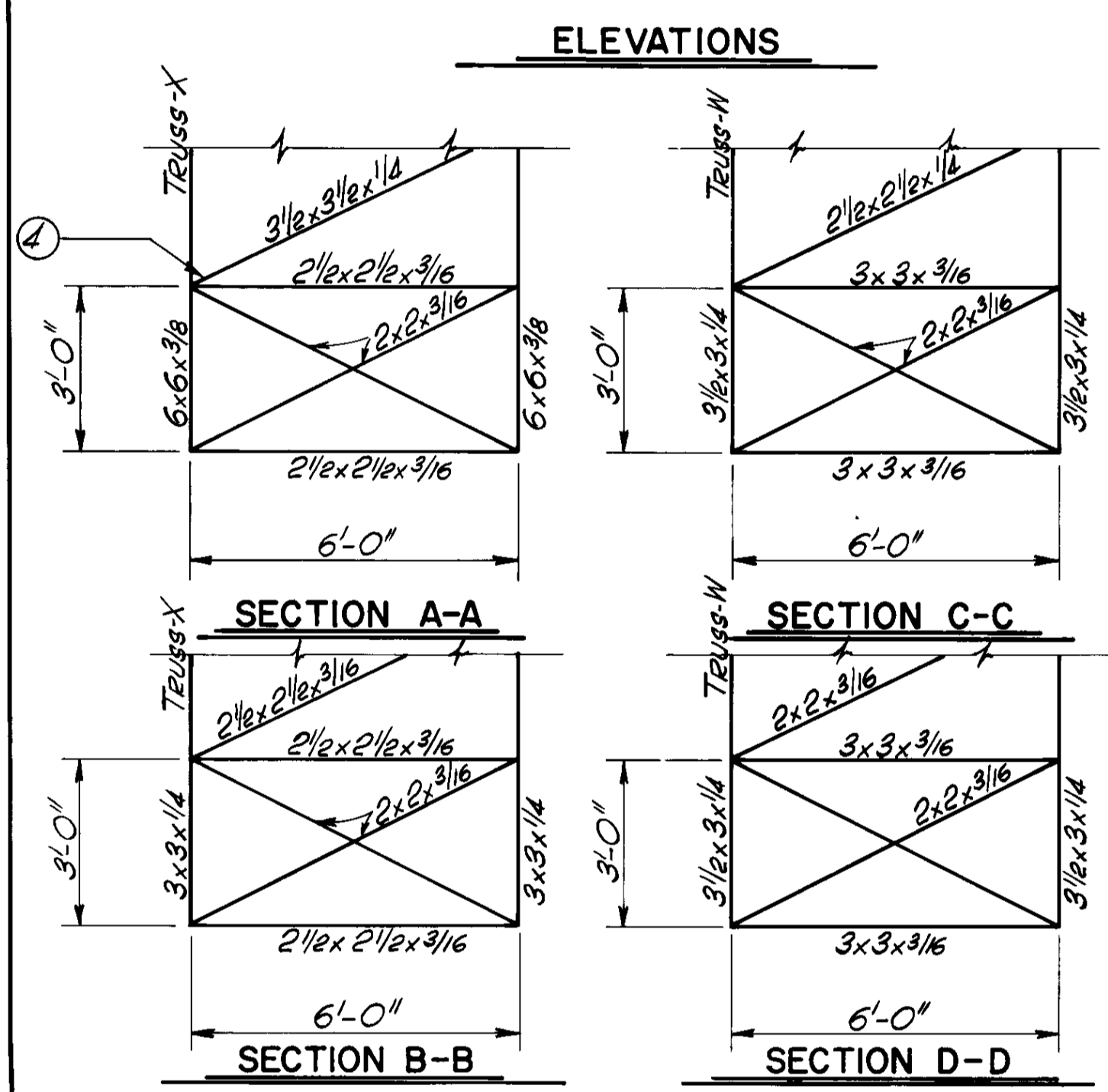
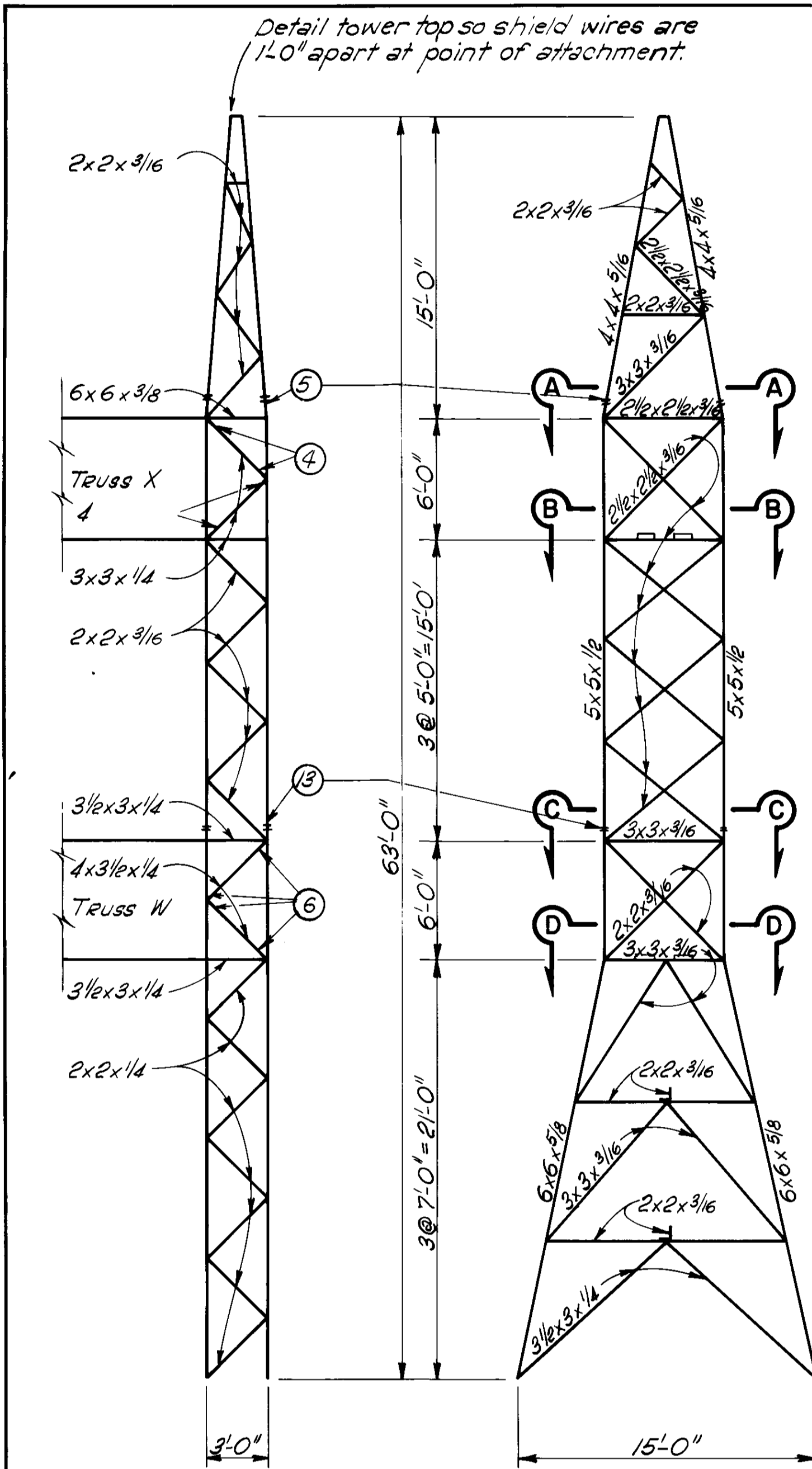


"AS BUILT"

<b>GRAND RIVER DAM AUTHORITY</b>	
SALINA PUMPED-STORAGE PROJECT	
SECOND 130,000 kw INSTALLATION	
AFTON SWITCHING STATION	
FOUNDATIONS	
TOWERS, BUS STRUCTURES, AND SUPPORTS	
W.R. HOLWAY & ASSOCIATES, INC.	Scale: As shown
CONSTRUCTION ENGINEER	Date: 1970
TULSA, OKLAHOMA	Contract No. 11
	Sheet 12 of 13 sheets

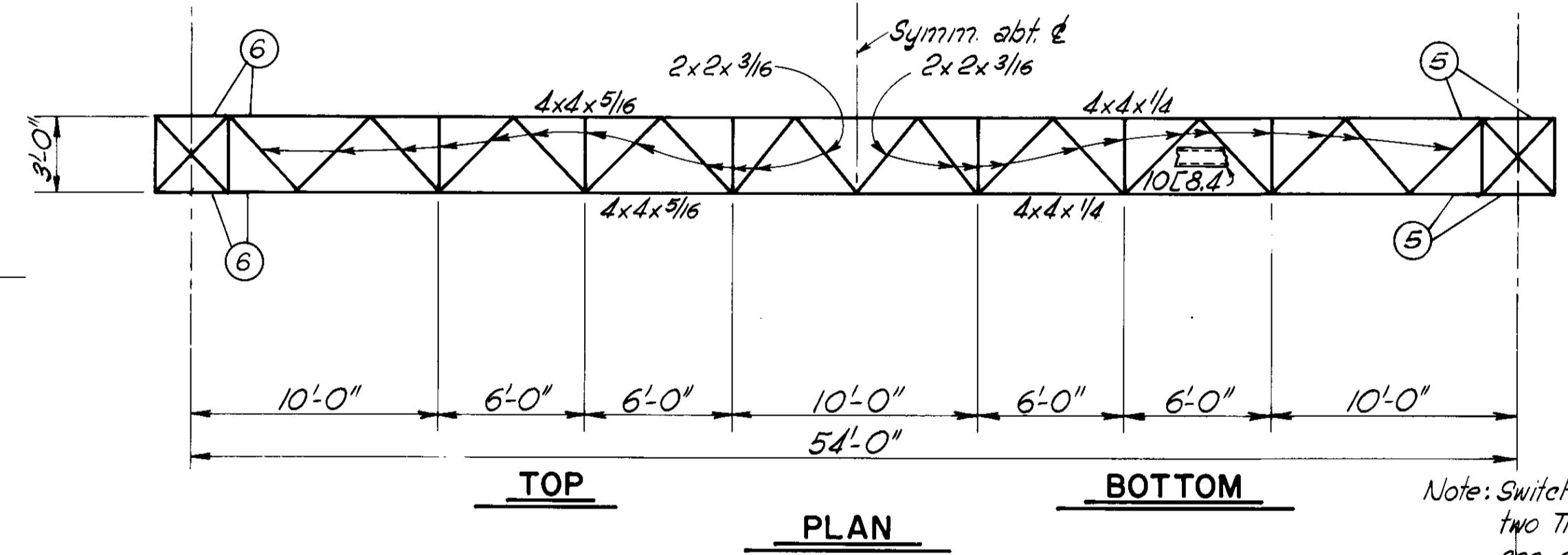




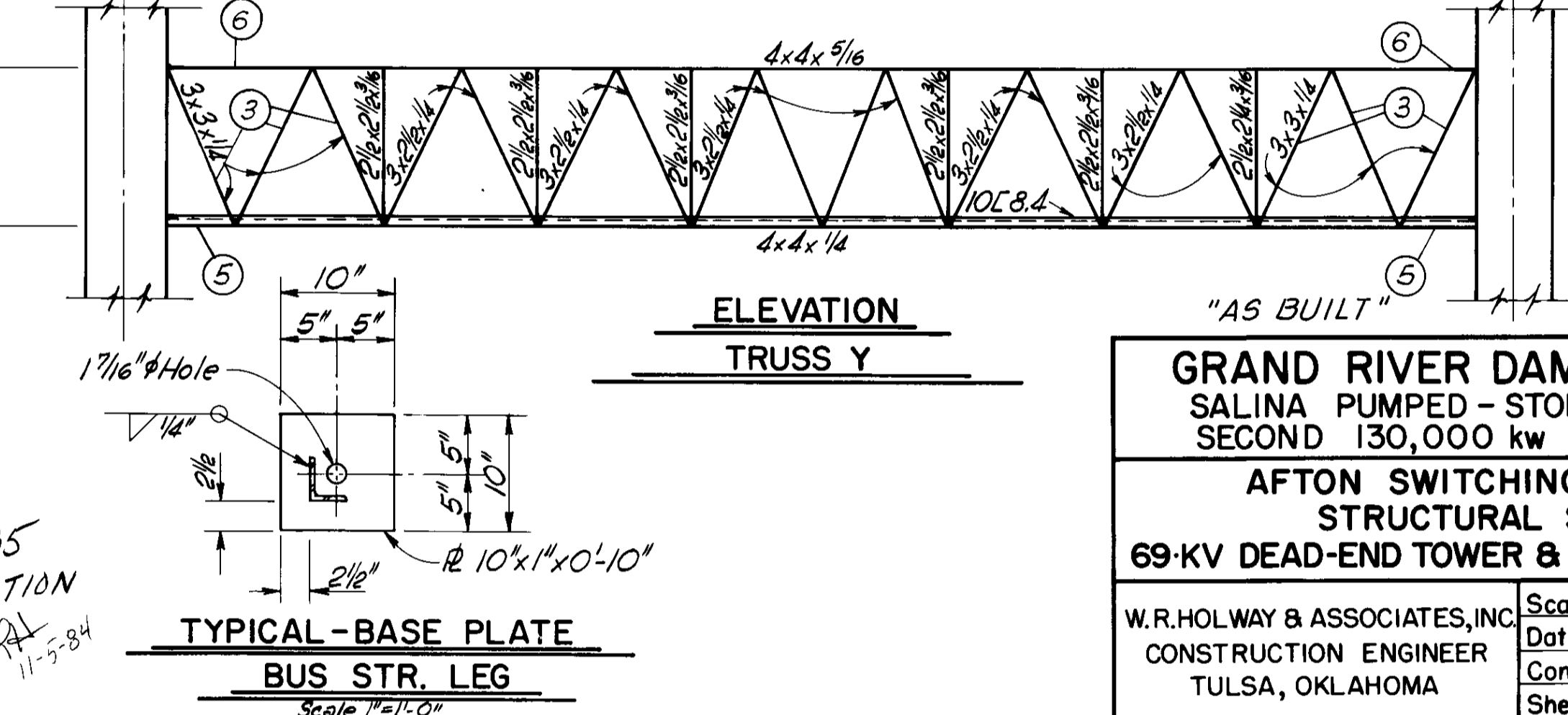


Notes:  
1- See structural steel notes - Sheet No. 9

**69 KV BUS STRUCTURE No. 2**  
2 Req'd



Note: Switch Brackets 'B' Req'd on two Truss Y's, for location see sheet 6



**GRAND RIVER DAM AUTHORITY**  
SALINA PUMPED - STORAGE PROJECT  
SECOND 130,000 kw INSTALLATION  
**AFTON SWITCHING STATION**  
STRUCTURAL STEEL  
**69-KV DEAD-END TOWER & 69-KV BUS STR. No. 2**

W.R.HOLWAY & ASSOCIATES, INC.  
CONSTRUCTION ENGINEER  
TULSA, OKLAHOMA

Scale: 3/16"=1'-0" & 3/8"=1'-0"  
Date: 1970  
Contract No. 11  
Sheet 10 of 13 sheets

P.O. L150139 REQ. 421-10604

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING:			TITLE	CONT. ON SHEET	SH. NO.
APPLIED PRACTICES	SURFACES	TOLERANCES ON MACHINED DIMENSIONS	FIRST MADE FOR		
		FRACTIONS DECIMALS ANGLES			

(7) .250 HOLES  
(4 HOLES LOCATED IN BLACK BAND AT TOP, 3 IN BOTTOM BAND)

.188 R.2

12.000

11.375

FOLD

C

D

E

NP 254625

# GENERAL ELECTRIC

## AUTOTRANSFORMER

NO. CLASS OA/FA/FOA THREE-PHASE 60 CYCLES

VOLTAGE RATING 161000GR, Y/92956-69000GR, Y/39838-13200  
 KVA RATING 30000 (OUTPUT) CONTINUOUS 65 C RISE SELF-COOLED  
 KVA RATING 40000 (OUTPUT) CONTINUOUS 65 C RISE FORCED-AIR-COOLED  
 KVA RATING 50000 (OUTPUT) CONTINUOUS 65 C RISE FORCED-OIL AND FORCED-AIR-COOLED

"X" WINDING CONNECTIONS			
LINES ON 4, 5, 6		NEUTRAL ON 7	
VOLTS	KVA	DIAL POS.	MECHANISM CONNECTS
LINE	AMP	A TO	B TO M TO
75900	380	33	L L
75470	383	32	L K
75040	385	31	K K
74610	387	30	K H
74180	389	29	H H
73740	391	28	H G
73310	394	27	G G
72880	396	26	G F
72450	398	25	F F
72020	401	24	F E
71590	403	23	E E
71160	406	22	E D
70730	408	21	D D
70290	411	20	D C
69860	413	19	C C
69430	416	18	C M
69000		17	M M
68570		16	M L
68140		15	L L
67710		14	L K
67280		13	K K
66840		12	K H
66410		11	H H
65980		10	H G
65550	418	9	G G
65120		8	G F
64690		7	F F
64260		6	F E
63830		5	E E
63390		4	E D
62960		3	D D
62530		2	D C
62100		1	C C

"Y" WINDING CONNECTIONS			
LINES ON 1, 2, 3		NEUTRAL ON 7	
VOLTS	AMP	MECHANISM	
LINE TO LINE	50000 KVA	A TO	B TO M TO
161000	180		

"Y" WINDING CONNECTION			
LINES ON 8, 9, 10			
VOLTS	AMP	MECHANISM	
10750	470		
13200			

BASIC INSULATION LEVELS			
ITEM	IMPULSE LEVEL FULL WAVE KV		
H1 H2 H3	650		
X1 X2 X3	350		
HOX0	110		
Y1 Y2 Y3	110		

SUITABLE FOR OPERATION WITH THE NEUTRAL EITHER SOLIDLY GROUNDED OR GROUNDED THROUGH AN IMPEDANCE WHICH WILL LIMIT THE LOW FREQUENCY AND IMPULSE VOLTAGES FROM NEUTRAL TO GROUND TO VALUES CONSISTENT WITH THE INSULATION LEVELS SHOWN ON THIS NAMEPLATE.

SUITABLE FOR SIMULTANEOUS THREE-WINDING OPERATION PROVIDED THAT THE KVA RATING OF ANY PARTICULAR SET OF TERMINALS IS NOT EXCEEDED, THAT THE ARITHMETICAL SUM OF THE OUTPUTS DOES NOT EXCEED 50000 KVA AND THAT THE CURRENT IN THE COMMON WINDING DOES NOT EXCEED 257 AMPERES.

TRANSFORMER OPERATING PRESSURE RANGE IS 0.6 PSI POSITIVE TO 0 PSI.

TRANSFORMER TANK SUITABLE TO WITHSTAND 10 PSI PRESSURE AND FULL VACUUM WITH ALL TANK BRACING IN PLACE.

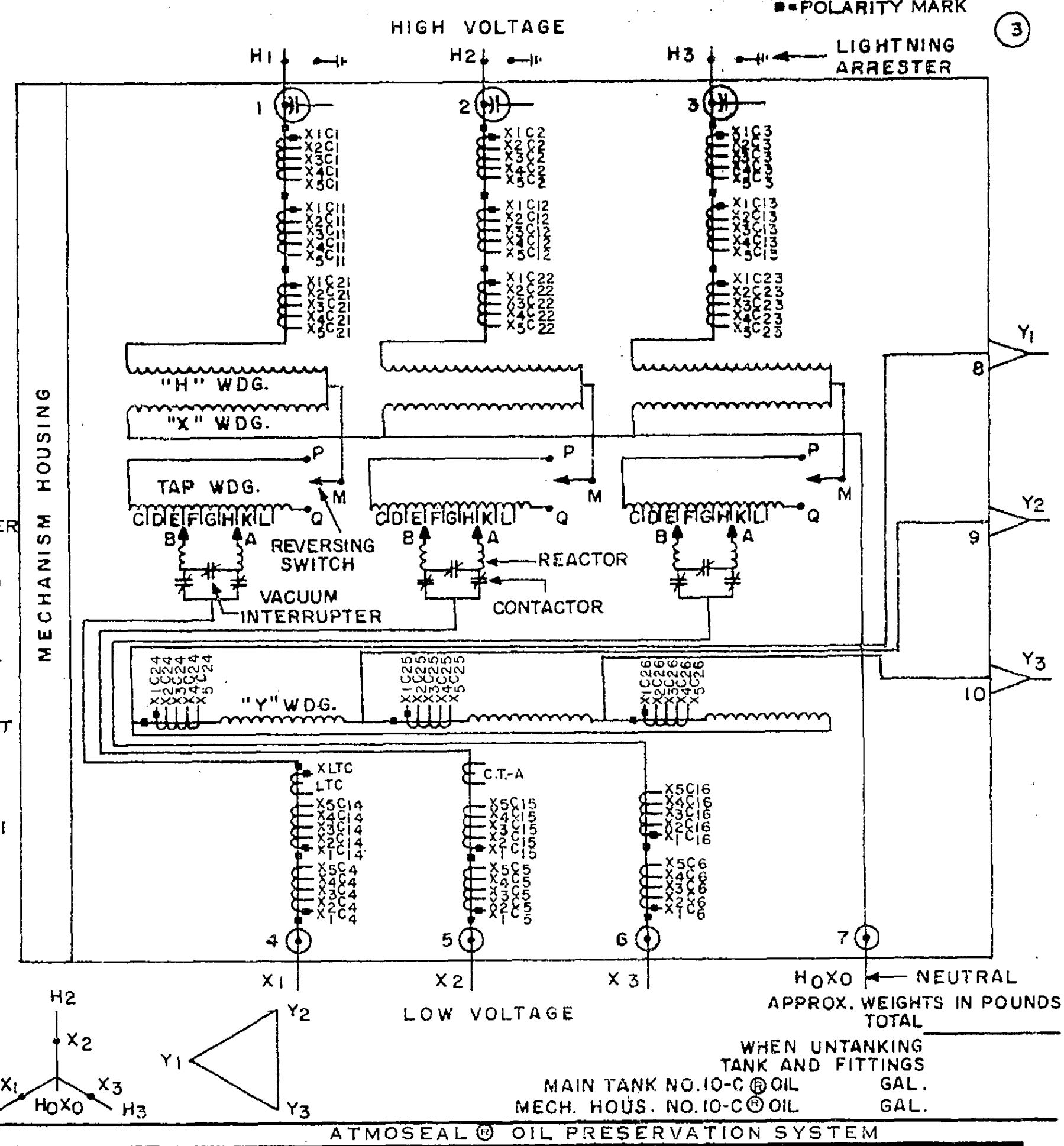
C. T. 'S NO. 1, 2, 3, 21, 22, 23, 24, 25, 26 ARE 600/5 AMP.

C. T. 'S NO. 4, 5, 6, 11, 12, 13, 14, 15, 16 ARE 1200/5 AMP.

REFER TO C. T. NAMEPLATE FOR CONNECTIONS AND RATIOS.

C. T. -A IS FOR USE WITH INDICATING THERMAL RELAY.

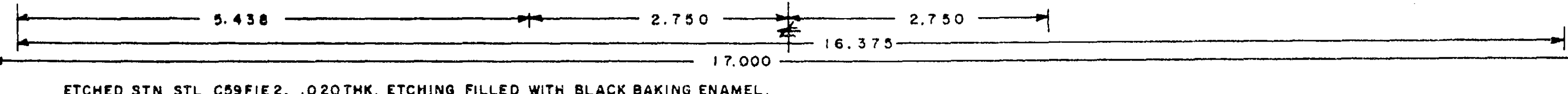
LTC C. T. IS 500/0.2 AMP.



IMPEDANCE VOLTS PER CENT 161000GR, Y-69000GR, Y VOLTS AT 30000 KVA  
 IMPEDANCE VOLTS PER CENT 161000GR, Y-13200 VOLTS AT 6450 KVA  
 IMPEDANCE VOLTS PER CENT 69000GR, Y-13200 VOLTS AT 6450 KVA

CAUTION! BEFORE INSTALLING OR OPERATING READ INSTRUCTIONS GEK-29020

PITTSFIELD MASS. MADE IN U.S.A.



ETCHED STN. STL. C59FIE2, .020THK. ETCHING FILLED WITH BLACK BAKING ENAMEL.

AREA: 204.000 SQ. IN.

REVISIONS:	PRINTS TO
1	358 B
2	358 A
3	350 F
	QC-100
	656

MADE BY: *J. Talan 1-27-70*

ISSUED: 1-30-70

APPROVALS:

DIV OR DEPT: NP 254625

LOCATION: CONT ON SHEET

SH. NO.:

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SWITCHING STATION S294  
AFTON, OKLAHOMA  
161/69KV

**TRANSFORMER #1**  
NAMEPLATE

SCALE: N.T.S.	DRAWN BY: JT	ENGR: BA	APPD: BA
CH: BA	DATE: 12MAR12		

**GRDA**  
Grand River Dam Authority  
P.O. BOX 409  
VINITA, OK 74301

DRAWING No. S249DX01	REV. 0
-------------------------	-----------

H 2109 124

TITLE FIRST MADE FOR

(4) .188 HOLES

8.000 7.500

.188 R.

GENERAL ELECTRIC

CONNECTIONS FOR CURRENT TRANSFORMERS NP 234520  
OBTAIN C.T. NUMBER, RATIO, FREQUENCY AND LOCATION FROM TRANSFORMER NAMEPLATE

8.000 7.500

TYPE BR-5 LEAD C.T.'S	CT CURRENT RATIO	600:5	1200:5	2000:5	3000:5	4000:5
	CT TAP CONN.					
X1 - X5	600:5	1200:5	2000:5	3000:5	4000:5	
X2 - X5	500:5	1000:5	1600:5	2500:5		
X3 - X5	450:5	900:5		1000:5		
X1 - X4	400:5	800:5	1500:5	2600:5	3500:5	
X2 - X4	300:5	600:5	1100:5	2100:5	2500:5	
X3 - X4	250:5	500:5	300:5	600:5		
X4 - X5	200:5	400:5	500:5	400:5	500:5	
X1 - X3	150:5	300:5	1200:5	2000:5	3000:5	
X1 - X2	100:5	200:5	400:5	500:5	1000:5	
X2 - X3	50:5	100:5	800:5	1500:5	2000:5	

ETCHED STN. STL. C59F1E2, .032 THK,  
ETCHING FILLED WITH BLACK BAKING  
ENAMEL.

AREA: 64.000 SQ. IN.

TYPE BR-5 LEAD C.T.'S	CT CURRENT RATIO	5000:5	6000:5	7000:5	8000:5	9000:5
	CT TAP CONN.					
X1 - X5	5000:5	6000:5	7000:5	8000:5	9000:5	
X2 - X5	2000:5	4000:5	5000:5		6500:5	
X3 - X5		1000:5	1000:5		2000:5	
X1 - X4	4500:5	5500:5	6500:5	7000:5	8000:5	
X2 - X4	1500:5	3500:5	4500:5	5000:5	5500:5	
X4 - X5	500:5	500:5	500:5	1000:5	1000:5	
X1 - X3	4000:5	5000:5	6000:5	6000:5	7000:5	
X1 - X2	3000:5	2000:5	2000:5	2000:5	2500:5	
X2 - X3	1000:5	3000:5	4000:5	4000:5	4500:5	

TYPE BM-2 LEAD C.T.'S					
TAPS	CURRENT RATIO	ACCURACY CLASS	TAPS	CURRENT RATIO	ACCURACY CLASS
X1 - X2			X1 - X2		

CAUTION! READ INSTRUCTIONS GEI-70360

REVISIONS	PRINTS TO
1. REVISION Aug 6, 1964	055 B
	055 A

MADE BY: *J. Johnson* APPROVALS: *J. Johnson* DEPT: NP 234520  
ISSUED: *Jan 22, 1963* LOCATION:

*A 400,184*

GRAND RIVER DAM AUTHORITY  
AFTON SWITCHING STATION S294  
AFTON, OKLAHOMA  
161/69KV  
TRANSFORMER #1  
CT RATIO CONNECTIONS

SCALE: N.T.S. DRAWN BY: JT ENGR: BA APPD: BA  
CH: BA DATE: 12MAR12  
DRAWING No. S249DX02a REV. 0

GRDA  
Grand River Dam Authority  
P.O. BOX 409  
VINETA, OK 74301

RECONDITION BY **SOUTHWEST ELECTRIC CO.**  
OKLAHOMA CITY, OKLAHOMA CITY, OKLAHOMA, USA

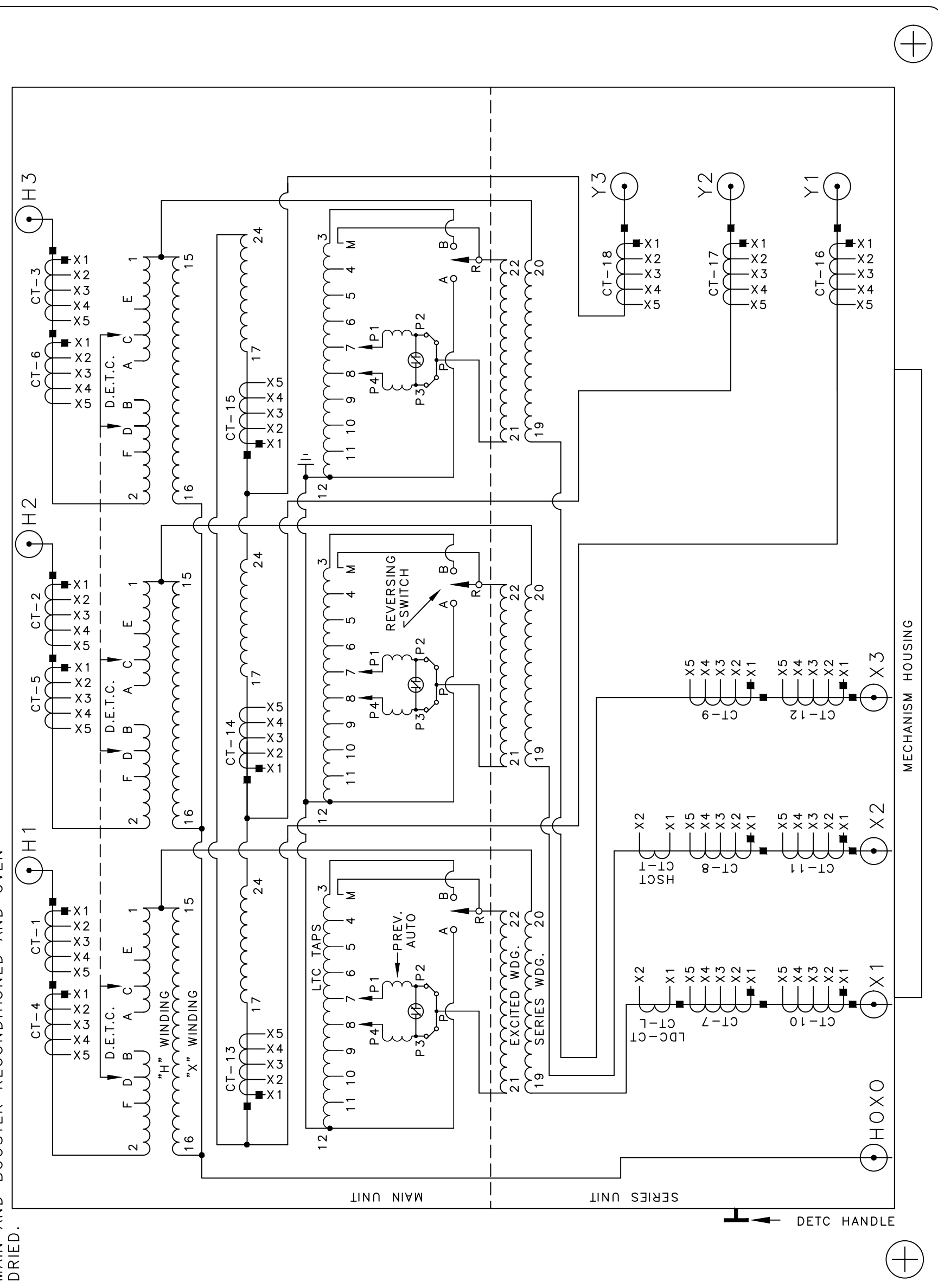
LOAD TAP CHANGING AUTOTRANSFORMER  
 SERIAL NO. E-71790783  
 SWE R.O. NO. 0912401894  
 CUSTOMER REF. NO. 17909

RECOND. DATE: 3-2011  
 THREE PHASE 60 HERTZ 55°C/65°C RISE CLASS: ONAN/ONAF/ONAF  
 VOLTAGE RATING: 161000GRDY/92955-69000GRDY/39840-13200  
 HV-LV KVA RATING: 30000/40000/50000 AT 55°C RISE  
 HV-LV KVA RATING: 33600/44800/56000 AT 65°C RISE  
 IMPEDANCE: 8.63% 30000 KVA, 161000 - 69000 VOLTS  
 IMPEDANCE: 22.90% 30000 KVA, 161000 - 13200 VOLTS  
 IMPEDANCE: 13.80% 30000 KVA, 69000 - 13200 VOLTS  
 TV KVA RATING: 6000/11200 KVA AT 55/65°C RISE

ORIGINALLY MANUFACTURED IN 1983 BY H.K. PORTER  
 SERIAL NO. E-71790783  
 REFER TO ORIGINAL H.K. PORTER INSTRUCTION BEFORE PLACING THE TRANSFORMER IN SERVICE.

**CAUTION:**  
 THE TRANSFORMER MUST NOT BE ENERGIZED FROM ANY VOLTAGE SOURCE WHEN THE DE-ENERGIZED TAP CHANGER [DETC] IS OPERATED.

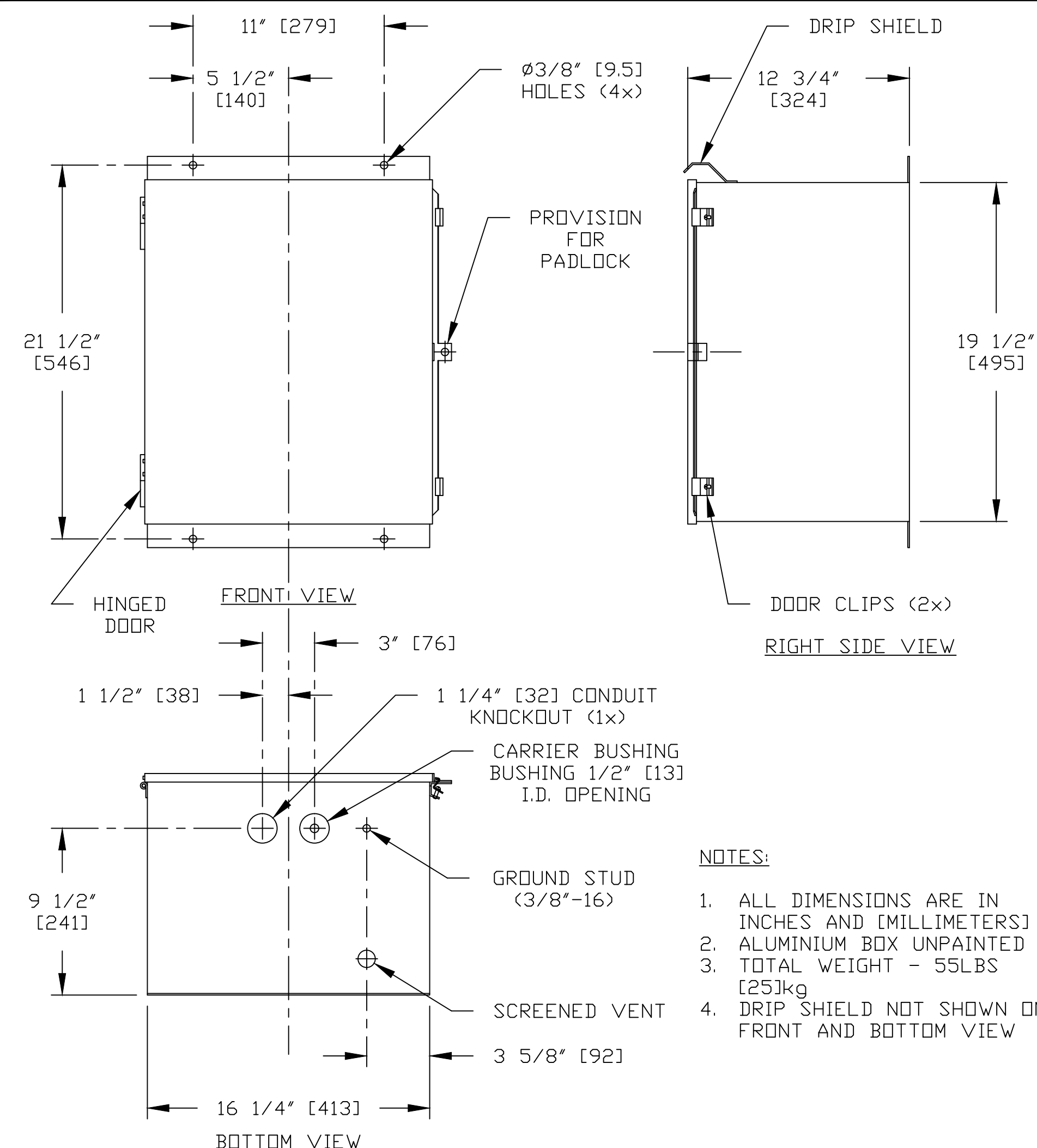
APPROXIMATE WEIGHTS IN POUNDS		CORE & COIL: ----- 85000**	
TANK AND FITTINGS: ----- 48700		OIL MAIN TANK:(6950 GAL.) - 52150	
LTC COMPT:(345 GAL.) - 2590		RADIATOR:(690 GAL.) - 5200	
TOTAL WEIGHT: ----- 193640		UNTANKING:(HEAVIEST PIECE) 85000	
TRANSFORMER TANK TO WITHSTAND FULL VACUUM AND 15LBF/IN <sup>2</sup> POSITIVE PRESSURE.			
OIL LEVEL BELOW TOP OF MANHOLE FLANGE AT 25°C IS 13.67 INCHES.			
THE LIQUID LEVEL CHANGES 0.75 INCHES FOR EACH 10°C CHANGE IN AVERAGE LIQUID TEMPERATURE.			
CT-L FOR LOAD TAP CHANGER CONTROL IS 500:5 SR.			
HSCT-T FOR X2 WINDING, HOT-SPOT TEMPERATURE IS 500:5 SR.			
CONTAINS NO DETECTABLE LEVEL OF PCB (LESS THAN 2PPM) AT THE TIME OF RECONDITION.			
TRANSFORMER FILLED WITH UNINHIBITED OIL.			
** INCLUDES 1200LB BOOSTER TRANSFORMER AND 2000LB PREVENTIVE AUTO-TRANSFORMER.			
ALL WINDINGS ARE COPPER CONDUCTOR. YNyn0 - YNd1			
■ = POLARITY MARK.			
SWE REPLACED OEM LTC TLH-21 WITH NEW REINHOLDEN RMV-II-1500 AND REDESIGNED PREVENTIVE AUTOTRANSFORMER.			
MAIN AND BOOSTER RECONDITIONED AND OVEN DRIED.			



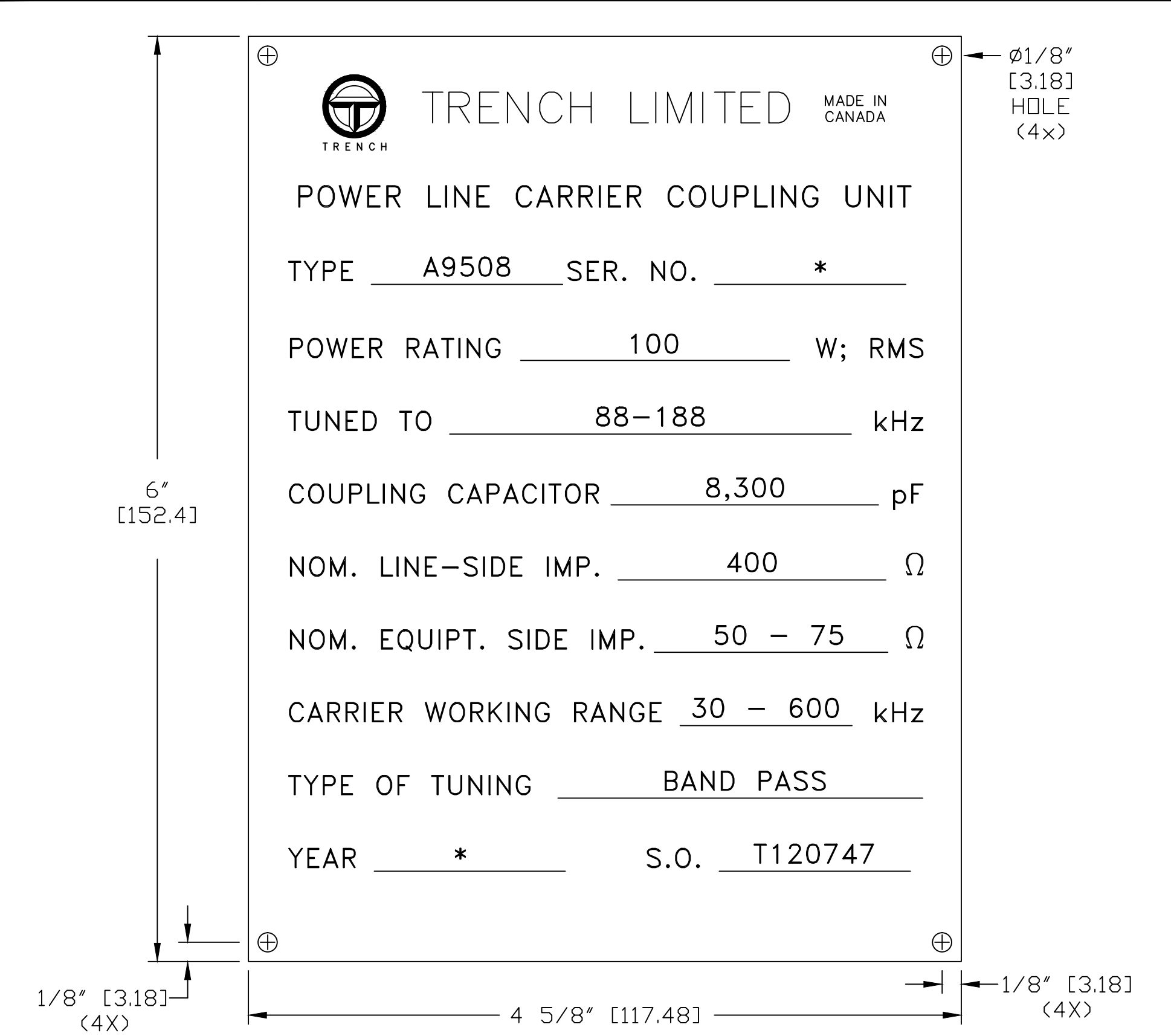
GRAND RIVER DAM AUTHORITY  
 AFTON SWITCHING STATION S294  
 AFTON, OKLAHOMA  
 161/69kV

TRANSFORMER #2 NAMEPLATE

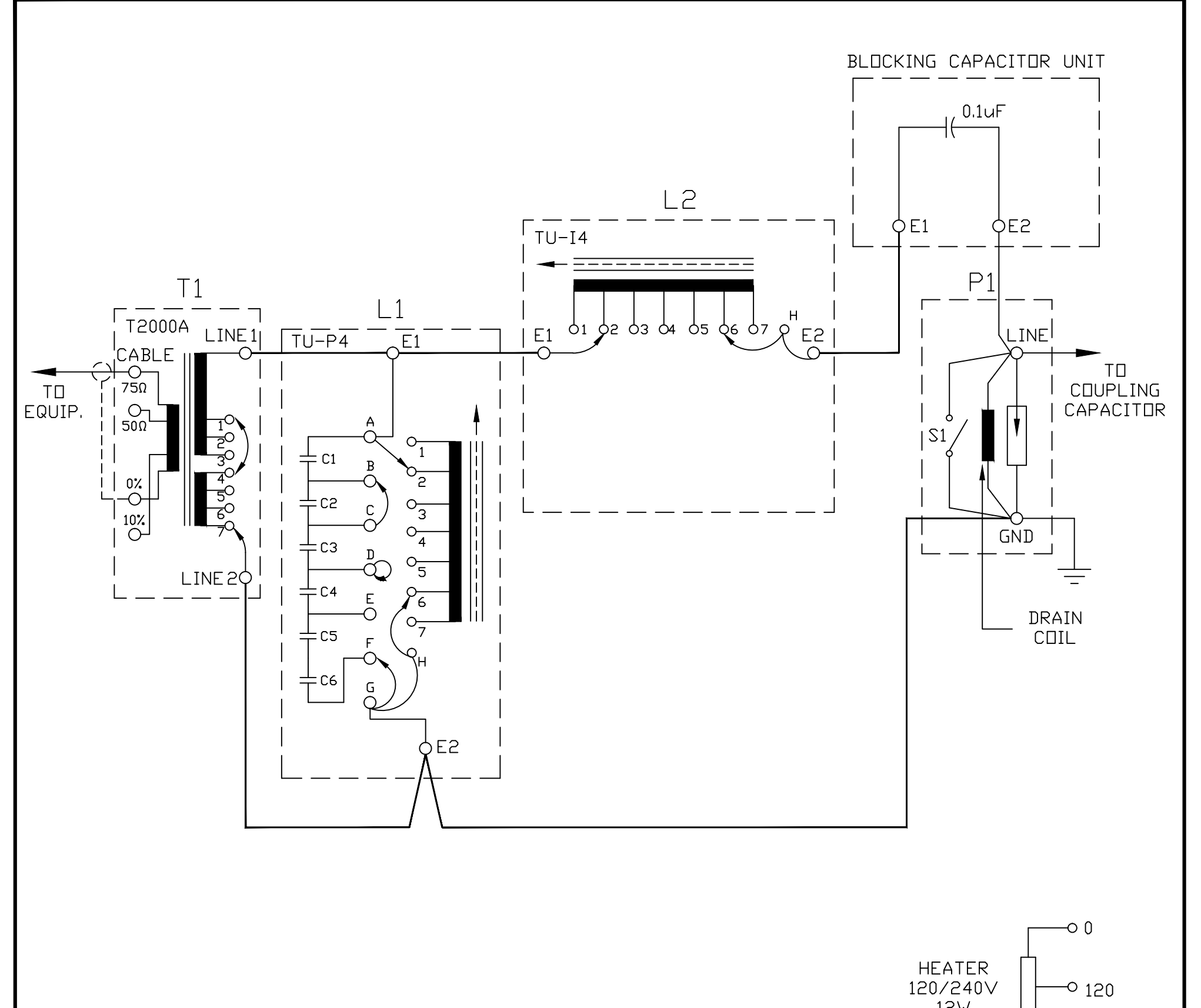
SCALE: N.T.S.	DRAWN BY: JT	ENGR: BA	APPD: BA
 GRAND RIVER DAM AUTHORITY P.O. BOX 409 VINITA, OK 74301		CH: BA	DATE: 22FEB12
		DRAWING No. S294DX02	REV. 0



- NOTES:
1. ALL DIMENSIONS ARE IN INCHES AND [MILLIMETERS]
  2. ALUMINIUM BOX UNPAINTED
  3. TOTAL WEIGHT - 55LBS [25]kg
  4. DRIP SHIELD NOT SHOWN ON FRONT AND BOTTOM VIEW



MATERIAL: 1/32" THICK ALUMINUM ANODIZED  
DIMENSIONS ARE IN INCHES [MILLIMETERS]  
\* - ACTUAL VALUES FOR EACH UNIT ON EVERY NAMEPLATE  
\*\* - TO BE FILED TUNED



TOLERANCES UNLESS OTHERWISE SPECIFIED		REVISION		TRENCH LIMITED	
0-12"(305)±1/32"(0.8)		1 CUSTOMER INFO. CORRECTED. REVISED APRIL 3/12 S.B.		COPYRIGHT, ALL RIGHTS RESERVED	
12"(305)-24"(610)±1/16"(1.6)				LINE TUNER BOX	
24"(610)-36"(914)±3/32"(2.4)				TRENCH	
36"(914)-48"(1219)±1/8"(3.2)				DESIG. DRN. APPD. DATE SCALE W.O.	
48"(1219) AND UP ±3/16"(4.8)				MAR 26/12 1:8 T120747	
WEIGHT±10%				GRAND RIVER DAM AUTHORITY DWG. 1-T120747	
ANGULAR±2°					

REV. 1

TOLERANCES UNLESS OTHERWISE SPECIFIED		REVISION		TRENCH LIMITED	
0-12"(305)±1/32"(0.8)		1 CUSTOMER INFO. CORRECTED. REVISED APRIL 3/12 S.B.		COPYRIGHT, ALL RIGHTS RESERVED	
12"(305)-24"(610)±1/16"(1.6)				MAIN NAMEPLATE	
24"(610)-36"(914)±3/32"(2.4)				TRENCH	
36"(914)-48"(1219)±1/8"(3.2)				DESIG. DRN. APPD. DATE SCALE W.O.	
48"(1219) AND UP ±3/16"(4.8)				MAR 26/12 1:1 T120747	
WEIGHT±10%				GRAND RIVER DAM AUTHORITY DWG. 1-T120747-A	
ANGULAR±2°					

REV. 1

TOLERANCES UNLESS OTHERWISE SPECIFIED		REVISION		TRENCH LIMITED	
0-12"(305)±1/32"(0.8)		1 CUSTOMER INFO. CORRECTED. REVISED APRIL 3/12 S.B.		COPYRIGHT, ALL RIGHTS RESERVED	
12"(305)-24"(610)±1/16"(1.6)				CONNECTION DIAGRAM FOR POWER LINE	
24"(610)-36"(914)±3/32"(2.4)				CARRIER COUPLING UNIT A9508	
36"(914)-48"(1219)±1/8"(3.2)				TRENCH	
48"(1219) AND UP ±3/16"(4.8)				DESIG. DRN. APPD. DATE SCALE W.O.	
WEIGHT±10%				MAR 26/12 1:1 T120747	
ANGULAR±2°				GRAND RIVER DAM AUTHORITY DWG. 1-T120747-B	

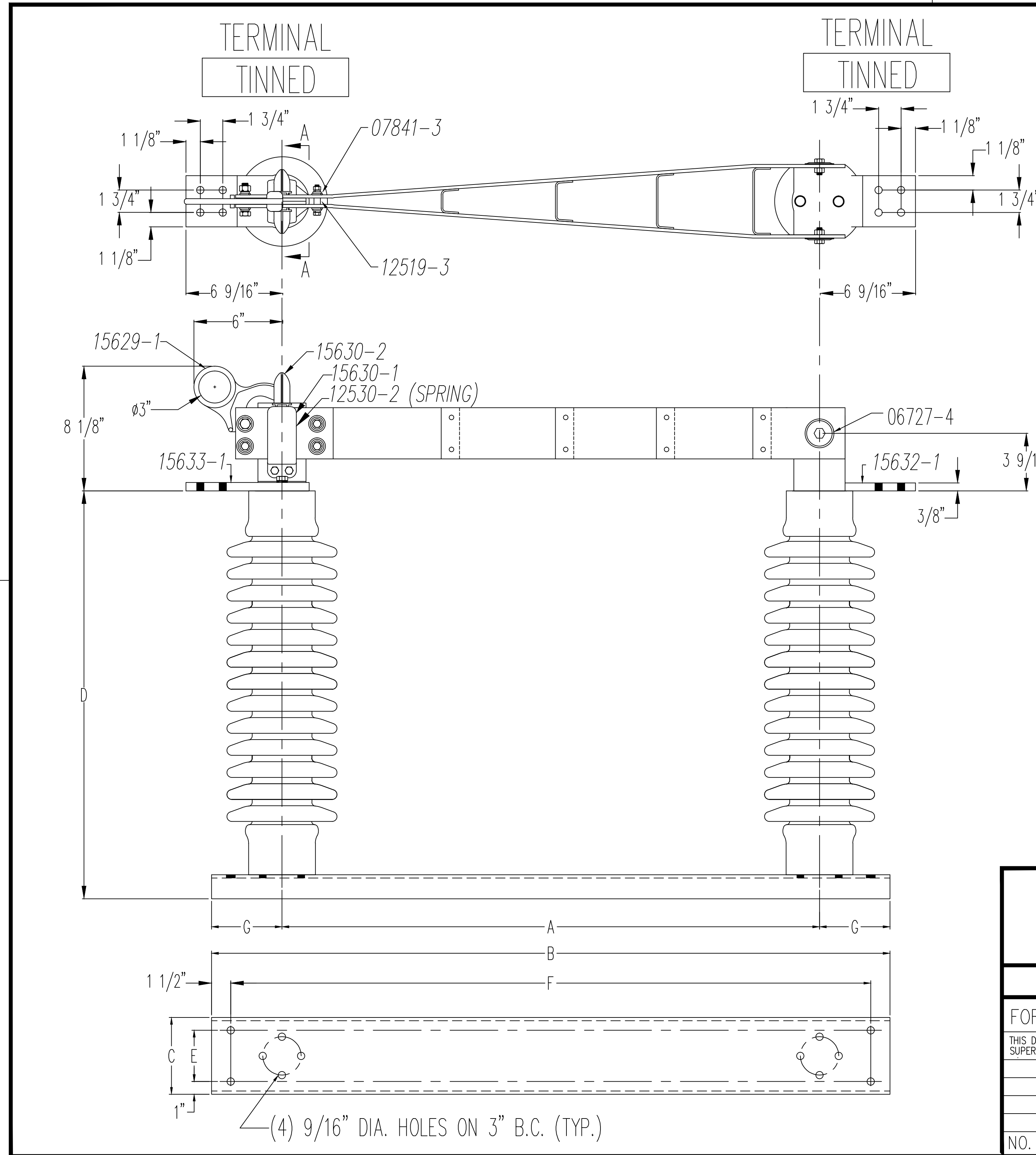
REV. 1

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY  
AFTON SUBSTATION S294  
AFTON, OKLAHOMA  
161/69kV

LINE TUNER DATA  
CARRIER SYSTEM

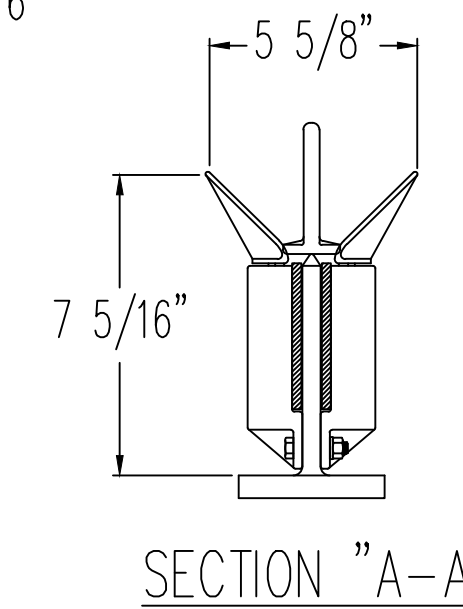
SCALE: N.T.S.	DRAWN BY: JT	ENGR: BA	APPD: BA
CH: BA	DATE: 23APR12	DRAWING No. S294DZ01	
GRDA Grand River Dam Authority P.O. BOX 409 VINNIE, OK 74301		REV. 0	



CATALOG NUMBER	KV RATING	INSULATOR	DIMENSIONS IN INCHES							BASE NO
			A	B	C	D	E	F	G	
18231	69	TR216	42	53	6	31 7/8	4	50	5 1/2	B069390BTSTD

NOTES:

1. SWITCH FURNISHED WITH INSULATORS ABOVE OR EQUAL (ASA 70).
2. SWITCH RATED 100,000A MOMENTARY.
3. ALL FERROUS MATERIAL GALVANIZED AFTER FABRICATION.
4. LIVE PARTS ARE CU., CU ALLOY, OR STAINLESS STEEL.
5. HINGE, JAW, & BLADE CONTACTS ARE SILVER TO SILVER.
6. SWITCH DESIGNED FOR 53°C TEMPERATURE RISE.
7. ALL HOLES 9/16" DIA. UNLESS NOTED.
8. REFERENCE ROYAL DRAWING B16962.
9. BASE MATERIAL: 6" X 8.2# STEEL CHANNEL 53" LG.



CUSTOMER:	GRAND RIVER DAM AUTH.
ITEM NO.:	18231CGRD100.A
S.O. NO.:	
CUSTOMER P.O. NO.:	
QTY REQ'D:	DATE REQ'D:

**ROYAL SWITCHGEAR MANUFACTURING CO.**  
 3995 PINE LANE S.E. BESSEMER, ALABAMA 35022

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FOR:		TITLE: ASSY. OF TYPE "BT" S.P.S.T. 2000A DISC. SWITCH 3" B.C. STATION POST INSULATOR, 69KV VERTICAL MOUNTED	
THIS DRAWING SUPERSEDES		DRAWN: B.SHOTTS DATE: 04-02-12 (CHECKED: DATE: )	
DATED		ENGINEER: DATE:	
SEE BOM		SCALE: NTS	
SEE BOM		PART DRAWING NUMBER	
TOLERANCE UNLESS SPEC'D		ISSUE	
1 PLC DEC +/- .0015"		B 18231CGRD100.A	
2 PLC DEC +/- .0010"		1	
3 PLC DEC +/- .0005"			
FRACTIONS +/- 1/16"			
DEGREES +/- .2°			

FILE: W:\DRAFTING\DRAWINGS\SUBSTATION\AFTON\GARVER CAD DRAWINGS 2-16-12\S294PC01 69KV MANUAL DISCONNECT SWITCHES.DWG

**ISSUED FOR BID**

GRAND RIVER DAM AUTHORITY AFTON SUBSTATION S294 AFTON, OKLAHOMA 161/69KV			
69KV MANUAL DISCONNECT SWITCHES			
SCALE: N.T.S.	DRAWN BY: JT	ENGR: BA	APPD: BA
<b>GRDA</b> <small>Grand River Dam Authority P.O. BOX 409 VINITA, OK 74301</small>		CH: BA	DATE: 24APR12
		DRAWING No. S294PC01	REV. 0