Master Procurement Agreement for Materials
(Maine Power Reliability Program)

This Agreement ("Agreement") is made between Central Maine Power Corporation, ("Owner"), a Maine corporation with offices located at 83 Edison Drive, Augusta, Maine 04336 and [redacted] a Delaware corporation ("Supplier"), with offices located at [redacted]. In consideration of the covenants herein, the parties agree as follows:

1. Definitions

"Affiliate" means with respect to each party to this Agreement any person or entity directly or indirectly controlled by, controlling, or under common control with such party.

"Change Order" shall mean a written order pursuant to Section 6, signed by Owner and Supplier authorizing a Change.

"Day" or "day" shall mean a calendar day and shall include Saturdays, Sundays and holidays.

"Final Acceptance" shall mean the receipt of material by Owner and acceptance by Owner of a certificate from an officer of Supplier substantially in the form set forth in Schedule B (the "Final Acceptance Certificate")

"Material(s)" means materials, supplies, equipment, services, machinery, tools, and all other items and facilities to be furnished or delivered pursuant to this Agreement.

"Program Manager" shall have the meaning set forth in Section 38

"Purchase Order" means a purchase order issued on behalf of Owner for Materials and services purchased in accordance with this Agreement.

"Work" means any, services, design, engineering, installation, construction, modification, and/or testing to be furnished and/or performed by Supplier as described in the Purchase Order and the other contract documents.

2. Term and Scope

The term of this Agreement shall commence upon the date the Agreement has been fully executed and shall continue until all Materials listed in Schedule D have been satisfactorily delivered, but provisions of the Agreement on warranties, insurance, spare parts, and such other provisions as by their terms would survive termination of the Agreement, shall survive termination.

Owner will issue a Purchase Order to Supplier for each Material or group of Materials to be delivered by Supplier pursuant to this Agreement. Supplier shall furnish Materials specified in the Purchase Orders and any specifications attached thereto in accordance with the provisions of this Agreement. If any terms of this Agreement and one or more of the other contract documents are inconsistent between and among themselves, the document with the more stringent requirement, as determined by the Owner, will control unless the Owner waives the more stringent requirement. This Agreement shall serve as the blanket or master agreement covering all Purchase Orders submitted by the Owner hereunder. The Owner through its Purchase Order shall establish delivery destination, quantities and other similar specific terms.

3. Alteration of Terms

None of the terms and conditions contained in this Agreement may be waived, altered, modified, or added to unless such waiver, alteration, modification or addition is in writing and signed by authorized representatives of Owner and Supplier. Except as set forth in the previous sentence, each shipment from Supplier to Owner shall be only upon the terms and conditions set forth in this Agreement, notwithstanding any terms and conditions that may be contained in any acknowledgment, invoice, or other form of Supplier, and notwithstanding Owner's act of accepting or paying for any shipment or any similar act of Owner.

4. Compliance with Laws and Indemnification

4.1. Supplier warrants that it will comply with all applicable federal, state and local laws, statutes, ordinances, rules, regulations and orders, and that it will defend, indemnify and hold harmless the Owner from and against any and all liabilities, claims, costs, expenses, losses and judgments arising from Supplier's failure to so comply.

4.2 Without limiting the scope of Section 4.1, above, Supplier shall comply, to the extent applicable, with Executive Order 11246, the Vietnam Era Veterans Readjustment Assistance Act of 1974, the Rehabilitation Act of 1973, as amended, and its or their implementing regulations, and reporting requirements thereunder. The Equal Opportunity and Affirmative Action clauses contained in Title 41, Chapter 60, Sections 1.4, 250.4, and 741.3 of the Regulations of the U.S. Department of Labor, Office of Federal Contract Compliance, and any section or sections superseding or amending the same, are hereby incorporated herein by reference and made a part hereof as though fully set forth where applicable.

5. Drawings, Design, Data, Creative Work and Inventions

Subject to Seller's prior approval, drawings, sketches, design data, and specifications, prepared or completed by Supplier and paid for by Owner pursuant to this Agreement shall be subject to inspection by Owner at all reasonable times (for which inspection the proper facilities shall be afforded Owner by the Supplier) shall be deemed to have been prepared by the Supplier for Owner on a work-made-for-hire basis, shall be the property of Owner, may be used by its employees or agents, or its subcontractors or vendors, and shall be delivered to Owner, or otherwise disposed of by the Supplier, either as Owner may from time to time direct or in any event as Owner shall direct upon completion or termination of this Agreement

Drawings, specifications, and all other information provided hereunder shall be treated by the Supplier as strictly confidential, and shall not be disclosed, copied, or used on behalf of any third party without the prior written consent of Owner Pursuant to Clause 30.

6. Changes

6.1 Owner shall have the right to make changes in the drawings or specifications. No changes shall be made except under the written order of an authorized representative of Owner.

6.2 If Supplier claims that any instructions, by drawings, specifications or otherwise, approved or issued by Owner after the date of the relevant Purchase Order involve extra cost or time for performance under this Agreement, the Supplier shall give written notice to Owner,

including an estimate of changed cost or time thereof, within ten (10) days after the receipt of such instructions, and in any event before proceeding to perform the Work, unless otherwise directed by Owner in writing, or except in an emergency endangering life or property. No claim for additional compensation or time resulting from the Owner's instructions shall be considered unless Owner has agreed in writing to compensate the Supplier for such additional costs or provide Supplier additional time or such claim results from Work performed in an emergency. If the change as ordered by Owner increases or decreases the cost of the Material to be supplied, or time for performance established in the Agreement, a fair and reasonable amount, as agreed upon by Owner and Supplier, shall be added to or subtracted from the compensation or completion date.

6.3 If, within ten (10) days after Supplier has provided an estimate of changed cost and/or time, the parties are unable to conclude a mutually satisfactory agreement, Supplier shall proceed with supplying the Material as changed or modified until the differences are resolved. The parties shall endeavor to resolve any disputes regarding increases or decreases in costs resulting from such changes promptly through the dispute resolution procedures set forth in Section 28 of this Agreement.

6.4 Change Orders. No change shall be made except in accordance with a duly issued Change Order executed in writing by Owner and Supplier or as determined in any dispute resolution in accordance with Section 29. All Change Orders shall contain full particulars of the changes, and any adjustments of the Purchase Order price, Work, Final Acceptance, and any other modification to this Agreement.

7. Waiver

No waiver by the Owner, whether express or implied, of any of the terms or conditions of this Agreement shall be or be construed to be a continuing waiver, or deprive Owner of the right to enforce or rely upon any such terms or conditions thereafter.

8. Delivery; Schedule; Delays

"TIME IS OF SIGNIFICANT IMPORTANCE" in the Supplier's performance of this Agreement. Deliveries are to be made according to Owner's terms on time, quantities, and location. Owner reserves the right to cancel, reject or refuse any delivery made; prior to or subsequent to the times specified; if the quantities are not as specified; or if the delivery has been made to an improper location. If delivery as specified cannot be made, Supplier must notify Owner immediately. Upon Supplier's failure to make delivery and failure to cure within [redacted] of that date, Owner reserves the right to procure the Materials and/or services elsewhere, in whole or in part, and charge Supplier with any additional costs incurred.

Owner and Supplier agree that the failure of Supplier to meet a scheduled delivery date will cause substantial damage to Owner, which damage is incapable of exact measurement or prediction. Therefore, the Parties agree that the liquidated damages set forth in this Section may be assessed against Supplier. In the event Supplier fails to deliver the Materials in compliance with the dates specified on the face of the Purchase Order, Supplier shall pay to Owner, as liquidated damages the amounts specified in Schedule C until the delivery is completed and accepted by Owner. It is understood and agreed between the Parties that the terms, conditions and amounts fixed hereunder as liquidated damages for failure to achieve a scheduled delivery date are reasonable, considering the damages that Owner would sustain in such event, and that these amounts are agreed upon and fixed as liquidated damages because of the difficulty of ascertaining the exact amount of damages that would be sustained as a result of delay. Payment of such liquidated damages shall not relieve

Supplier of its obligations hereunder. Notwithstanding any other provision herein, in no event shall liquidated damages hereunder exceed the amount identified in Schedule C. Supplier's payment of liquidated damages shall be Owner's sole and exclusive remedy for Supplier's late shipments, provided, however, that if Owner seeks liquidated damages and Supplier contests the enforceability of the liquidated damages provided by this Agreement, and such damages are deemed unenforceable, then Owner may recover from Supplier any actual damages incurred as a result of the circumstances giving rise to Owner's claim for liquidated damages based on Supplier's delay, and this Section shall not act as a bar on such recovery.

9. Prices

Supplier agrees that the prices stated on the face of the Purchase Order shall be expressed in US dollars and considered firm unless otherwise noted, Prices shall remain fixed during the term of this Agreement, based on the year shipment per pricing table in Schedule D, and shall not be subject to escalation

10. Payment

10.1 Within [redacted] after receipt of each invoice, Owner shall review the invoice to verify (i) the Materials covered by the invoice have been satisfactorily delivered and any Work for which payment is sought has been satisfactorily completed; (ii) that the Materials and/or Work conform to the specifications; (iii) that the invoice and supporting documentation have been properly submitted; and (iv) that the invoice otherwise complies with this Agreement. Upon verification, Owner shall approve the invoice or shall advise Contractor if all or any portion of the invoice is not approved; Owner shall provide specific reasons for any disapproval of an invoice or portion thereof. If Owner cannot approve a portion of an invoice, Owner shall nonetheless approve payment of the remaining portion of the invoice for Materials delivered or Work performed in accordance with this Agreement. Unless payment is withheld by Owner in accordance with the terms of this Agreement, Owner shall pay the undisputed amount of each Supplier invoice within [redacted] following the date Owner receives such invoice. In no case shall any invoice be paid later than [redacted] from date of issue. Progress payments will be paid according to the following schedule:

- Submittal of purchase order - [redacted] of Purchase Order value
- Approval of Design Drawings – [redacted] of Purchase Order value
- Major Materials arrive at factory - [redacted] of Purchase Order value
- Completion after Delivery – [redacted] of purchase order no later than [redacted]

10.2 Invoices shall be submitted in accordance with Schedule D.

10.3 The Owner shall provide written notice of any of the following events. If Supplier fails to provide remedy thereof within [redacted] from receipt of written notice. In certain situations, to protect itself from loss due to Supplier's fault, the Owner may reject the whole or part of any invoice until the nonconformance is cured. Such situations shall include, but not be limited to, discovery of:

a. defective Materials or services;

b. third party claims filed or reasonable evidence indicating probable filing of such claims;

c. failure of the Supplier to make payments due to subcontractors, material suppliers or employees;

d. reasonable indication that Materials will not be delivered, or Work will not be completed, within the time specified in the purchase order;

e. Work by Supplier that fails to comply with the contract specifications;

f. invoicing that is incorrect; or

g. overcharges in violation of the terms and conditions of this Agreement.

Payment does not constitute acceptance of any defective or non-conforming product or otherwise relieve Supplier of any obligation under the contract.

11. Delegations; Subcontracts; Assignment

11.1 Supplier shall not, without the prior written authorization of Owner, assign this Agreement or any of its rights under this Agreement in whole or in part, or delegate any of its duties. Any attempt to do so will be void. Supplier shall not without the written consent of the Owner make any agreement with any third party for furnishing any of the completed or substantially completed items covered by this Agreement. Such consent shall not be unreasonably withheld by Owner.

11.2 Owner may assign this Agreement, in whole or in part, upon written notification to Supplier(i) to a successor to all or substantially all of Owner's relevant assets, or (ii) in connection with a reorganization of the Owner that results in the separation of the power generation, distribution, and transmission functions, or any combination thereof, currently performed by the Owner, in which case assignment shall be allowed to a resulting corporation organized from such separation and/or sale of the power generation, distribution and transmission functions, or any combination thereof. Otherwise, neither party shall, without the consent of the other, which consent shall not be unreasonably withheld, conditioned or delayed, assign this Agreement in whole or in part.

12. Set-Off

Owner may set off against any amount payable to the Supplier, the named entity in this agreement solely, under this Agreement any claim or charge it may have against Supplier pursuant to this agreement.

13. Inspection

The Owner (and/or its designee) reserves the right to inspect the Materials prior to shipment. Such inspection does not relieve the Supplier of its guarantees or responsibility to furnish satisfactory Materials or services. It is furthermore understood to be Owner's and/or Owner's designee's privilege to waive inspection at point of manufacture without prejudice to its right to decline acceptance. Except as to items purchased from stock, items supplied hereunder and materials and components incorporated therein shall be subject to inspection at Owner's option by Owner or its designee during and after manufacture. All Material and/or services are subject to inspection and acceptance tests at place of manufacture, or at destination, or at both places, by the Owner's representative. Nonconforming Material shall not be submitted for acceptance without concurrent notice of its prior rejection.

14. Warranty

14.1 Supplier warrants that all Materials and services furnished under this Agreement shall be new; will be free from defects, errors or omissions under proper and normal use, will pass without objection in the trade under the Agreement description and will perform in accordance with manufacturer's published literature and specifications. Material or services not conforming to manufacturer's published literature and specifications and to the specifications that are part of this Agreement may be considered defective. To the extent they are assignable, Supplier shall assign to Owner all warranties of Supplier's vendors and subcontractors with respect to Equipment, Materials or supplies used in the Work or Services or any part thereof. All warranties of vendors and subcontractors hereby assigned to Owner shall be in addition to, and not in lieu of, all warranties of Supplier provided in this Agreement, and shall not relieve Supplier of its obligations under this Agreement.

14.1.1 In the event of a breach of warranty, Supplier may, at its option, and at its cost, modify, repair, or replace the defective Material and/or services, by making available DDP point of delivery as indicated in the purchase order any necessary repaired or replacement parts. If Supplier is unable to provide the modification or repair plan within [redacted] replacement equipment must be provided at Supplier's sole cost and expense.. In the event Supplier is unable to satisfactorily correct the defect through modification, repair or replacement, the Owner may return the defective Material and/or services to the extent the modification, repair or replacement does not diminish the intended utility of the material or services. Owner, by notice to Supplier, may elect to accept nonconforming or defective Work instead of requiring its removal or correction, in which case the Contract Price shall be reduced by an amount at least equal to the cost to complete or correct the nonconforming or defective Work, as reasonably agreed to by the Parties. Such election shall be exercised only by written notice to Supplier and shall not be implied by any action or inaction of Owner.

14.1.2 The Supplier shall be responsible for all removal, reinstallation and transportation costs associated with the replacement, repair, modification, or return of defective Parts and Materials within [redacted] after shipment, not to exceed [redacted] of the price of the unit giving rise to the claim. The Owner will guarantee that the Supplier will have free access for repair or removal of the transformer. Supplier is not responsible for providing temporary power or removing structures. The Supplier may advise the Owner of any preferred routing for return of nonconforming Material or services and whether or not the shipment should be

protected by insurance or full declaration of value at the time of acceptance of this order. In the absence of such information from the Supplier regarding such shipment, the Owner reserves the right to declare full valuation or insurance (whichever is applicable) for the benefit of and at the expense of the Supplier.

14.2. The warranty is conditioned upon operation of the equipment by the Owner in accordance with generally approved industry practice, and in accordance with conditions of service and operating instructions specified by the Supplier, and proper storage, erection and maintenance of the equipment and prompt notice by the Owner of nonconformity of the equipment.

14.2.1 The Supplier's representatives shall have access at reasonable times to test and operating records, the equipment, and other information they deem necessary to satisfy themselves of the validity of a claim under this warranty. The Owner agrees to maintain sufficient written records to provide for reasonable substantiation of its compliance with the requirements and conditions of the warranty.

14.3 The Supplier's liability to remedy the breach of the warranties established in this Article shall be limited to those breaches, defects, errors or omissions reported to the Supplier within [redacted] after delivery of the material or services supplied, or services supplied pursuant to this agreement

14.4 The preceding paragraphs set forth the exclusive remedies for claims (except as to title) based on defect in or failure of products or services, whether the claim is in contract, indemnity, warranty, tort (including Supplier's negligence), strict liability or otherwise and however instituted. Upon the expiration of the warranty period, all such liability shall terminate and Owner shall have a reasonable time, within [redacted] after the warranty period, to give written notice of any defects which appeared during the warranty period. The forgoing warranties are exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED STATUTORY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY. Supplier does not warranty any products or services of others that Owner has designated.

This warranty coverage shall not include costs of providing temporary power or removing other apparatus or structures

15. Safety

Supplier warrants that upon delivery the Materials or services will conform to the applicable occupational safety and health standards promulgated pursuant to the Federal Occupational Safety and Health Act of 1970 and in effect on the date that the Supplier acknowledges Owner's Purchase Order.

16. Patents; Indemnification

Supplier guarantees that the sale or use of its Material or services will not infringe any United States patent, and Supplier shall hold Owner harmless against all claims, judgments, decrees, costs and expenses resulting from any such alleged infringement. Supplier shall at its own expense defend or settle any claim, suit or proceedings brought against Owner, so far as based on an allegation that any Material, services, or any part thereof furnished hereunder constitutes a direct or contributory infringement of any claim of any United States patent. Supplier will be notified promptly and in writing, and will be given authority, information and assistance for the defense of said claim, suit or proceeding. Supplier shall pay all damages and costs awarded in such suit or proceedings so defended. In case the Material, services, or part thereof furnished hereunder becomes the subject of any claim that such Material or part infringes any United States patent or copyright or if the use or sale of such Material, services or part is enjoined, Supplier shall, at Owner's option, and at Supplier's own expense, either: (a) procure for Owner the right to continue using said Material or part thereof; (b) replace it with a non-infringing Material; (c) modify it so it becomes non-infringing; (d) remove it and refund the purchase price plus the installation and conversion costs for the non-infringing material or services, less wear and tear. This paragraph shall not apply to any product or part specified by Owner or manufactured to Owner's design, or to the use of any product furnished hereunder in conjunction with any other product in a combination not furnished by Supplier as a part of this transaction. As to any such product, part, or use in such combination, Supplier assumes no liability whatsoever for patent infringement and Owner will hold Supplier harmless against any infringement claims arising therefrom.

Article 16 states Seller's exclusive liability for intellectual property infringement by Products and Services.

17. Termination for Cause

In the event of any default or breach of any of the terms or conditions of this Agreement by Supplier, or in the event of any proceedings by or against Supplier in bankruptcy or insolvency or for appointment of any receiver or trustee or any general assignment for the benefit or creditors, Owner may, in addition to any other remedy provided it by law or in equity or other right reserved to it elsewhere in this Agreement, without any liability to Supplier on account thereof, subject to a reasonable time to cure which shall not exceed [redacted] immediately by telegraphic or other written notice, terminate all or any part of this Agreement. Owner may procure the Material or services provided for herein elsewhere, on such terms and under such conditions as are reasonable in the discretion of the Owner, and Owner may hold Supplier liable for any excess cost of the purchased products to Owner as a result thereof.

18. Termination or Suspension for Convenience

Owner may suspend or terminate this Agreement or a Purchase Order in whole or in part, for its convenience, by giving the Supplier [redacted] written notice of such suspension or termination. In the event of a termination for Owner's convenience, Owner shall make payment to the Supplier for all costs incurred prior to such termination. Payments will be in accordance with the payment schedule provided below and tied to specific milestone dates such as issuing review drawings, completion of engineering, receiving materials, core and coil inspection, etc. and the percentage shown of the Agreement price. This provision shall not apply to or be deemed to limit or otherwise affect the Owner's right to terminate this Agreement for breach or default by the Supplier.

Milestone	**% of Contract Price**

Concept Engineering
Design Engineering (PO for long lead items)
Finish Design Eng. (all Material purchase)
Windings & Tank completion
Core completion
Final assembly completion

[redacted]

Owner may suspend a Purchase Order in whole or in part for its convenience. If Owner suspends a Purchase Order for its convenience, Supplier shall immediately cease all work on the Materials that are the subject of the Purchase Order suspended and shall store any partially completed Materials in a secure location. Within [redacted] after receipt of notice of suspension, Supplier shall provide Owner a statement of the costs to Supplier of Work on the Materials to the date of suspension, together with a reasonable allowance for overhead and profit on Work performed (but not for overhead or lost profit on Work not performed) and the incidental costs to be incurred in storing the Materials in a secure location. If Owner suspends a Purchase Order, Supplier may be entitled to an equitable adjustment to the Purchase Order price and/or the time for performance in accordance with the terms of Section 20.3 of this Agreement.

19. Insurance, Indemnification & Limitations of Liability

19.1 Supplier agrees to maintain such insurance as will protect it (i) from claims under worker's compensation or Employer's Liability Acts and (ii) from its legal liability for personal injury or property damage during the performance of this Agreement. The Supplier shall obtain and maintain in effect for the term of this Agreement the insurance coverage required by Schedule A. Such insurance shall be obtained from an insurance carrier with a Best rating of A- or higher.

19.2 The Supplier shall defend, indemnify, and hold harmless the Owner, its parent company, its affiliates, Project Manager, employees, officers, directors and assigns, from and against any and all claims, demands, damages, losses, and expenses (including reasonable attorney's fees)arising out of or resulting from the performance of this Agreement, provided that any such claim, damage, loss, or expense (a) is attributable to bodily injury or death, or to injury to or destruction of third party tangible property, and (b) to the extent it is caused in whole or in part by a negligent act or omission of the Supplier or any of its officers, , representatives, subcontractors, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable in the performance of Supplier's obligations under this agreement. In the event that any such damage or injury is caused by the joint or concurrent negligence of Supplier and Owner, the loss, expense or claim shall be borne by Supplier and Owner in proportion to their negligence. For the purposes of this Indemnification provision, neither Owner, Program Manager nor Supplier are considered a third party.

19.3 In furtherance of the foregoing indemnification and not by way of limitation thereof, the Supplier hereby waives any defenses or immunity it might otherwise have under applicable worker's compensation laws or any other statute or judicial decision (including, for Materials to be delivered or Work to be conducted in Maine, without limitation, Diamond International Corp. v Sullivan & Merritt, Inc. 493 A2d 1043 (Me 1985)) disallowing or limiting such indemnification, and the Supplier consents to a cause of action for indemnity. .

Supplier's liability for all claims of any kind whether based on contract, indemnity, warranty, tort (including Supplier's negligence), strict liability or otherwise, for all losses or damages arising out of connected with, or resulting from the contract, or from the performance or breach thereof, or from any products or services covered by or furnished under the contract, or any extension or expansion thereof (including remedial warranty efforts), shall not exceed the contract price and all such liability shall terminate upon the

expiration of the warranty period. Any such claim of liability must be filed in a court of competent jurisdiction within [redacted] from the termination of the warranty period. In no event shall either Party be liable for any indirect, special, consequential, speculative, exemplary, multiple, incidental, punitive damages including, but not limited to, loss of profit or revenues, loss of use of the products or any associated equipment, damage to associated equipment, cost of capital, cost of substitute products, facilities, services or replacement power, downtime costs, or claims of Owner's customers for such damages.

20. Force Majeure; Impracticability; Excuse

20.1 Force Majeure. For purposes of this Agreement, Force Majeure shall mean a cause or event that is not reasonably foreseeable or otherwise caused by or under the control of the Party claiming Force Majeure, including acts of God, fires, floods, explosions, riots, wars, hurricane, sabotage, terrorism, vandalism, accident, restraint of government, governmental acts, injunctions, organized labor strikes or other organized labor actions other than those affecting the labor directly employed by Supplier or its subcontractors, that prevent Supplier from obtaining materials or services necessary for the Work, and other like events that are beyond the reasonable anticipation and control of the Party affected thereby, despite such Party's reasonable efforts to prevent, avoid, delay, or mitigate the effect of such acts, events or occurrences, and which events or the effects thereof are not attributable to a Party's failure to perform its obligations under this Agreement. Any delay or failure in the performance by either Party hereunder shall be excused if and to the extent caused by the occurrence of a Force Majeure. The Parties agree to use reasonable efforts to mitigate the effects of events of Force Majeure. Force Majeure shall not include (i) economic hardship of lack of money; (ii) any labor disturbance affecting either Supplier or its subcontractors to the extent that such labor disturbance involves direct employees of Supplier or its subcontractors who are producing the Materials, except for strikes national or regional in scope; (iii) any other delay, default or failure direct or indirect in obtaining materials or commodities; or (iv) any delay, default or failure of a subcontractor of Supplier unless caused by Force Majeure as described above.

20.2 Notices. The affected Party shall promptly give written notice to the other Party of the occurrence or impending occurrence of a Force Majeure, specifying the nature of the delay, and the probable extent of the delay, if determinable. Following the receipt of any written notice of the occurrence of a Force Majeure, the Parties shall meet to determine what fair and reasonable adjustment to the Work may be necessary to compensate for the effect of the Force Majeure upon Supplier's performance of the Work. No failure to so agree shall excuse continuing delay or nonperformance.

21. Substitution

No substitution will be permitted under this Agreement except on specific written authority of the Owner.

22. Independent Contractor

Supplier shall at all times be an independent contractor and responsible for all acts or omissions of its agents, employees, and subcontractors. Supplier shall at all times control and retain the right to control its performance, and no act or order of Owner shall be deemed to be the exercise of supervision or control of performance hereunder.

23. Audit Rights

Owner reserves the right and Supplier shall allow Owner to audit, or cause to have audited, time sheets and material invoices for work performed or products provided on a cost reimbursable basis in order to assure compliance there with. This provision shall remain in effect for two (2) years following delivery and Owner's acceptance of the Materials covered under this Agreement.

24. Liens

The Supplier warrants that it has good title to all Material and/or services delivered pursuant to this Agreement, that the items to be supplied hereunder are free and clear of all liens, encumbrances and claims and that Supplier has the right to sell the Material and/or services. Upon each payment made by Owner, Supplier shall simultaneously deliver to Owner a written acknowledgement of such payment together with a waiver of Supplier's right to file, and a release by Supplier of liens with respect to the goods and services covered by the invoice(s) associated with such payment. Supplier shall, at its own expense and cost, defend (at Owner's option), indemnify, and hold harmless Owner from and against all liens, encumbrances, or claims pertaining to paid products.

25. Taxes

Seller will be responsible for billing sales tax in accordance with the instructions provided on the Purchaser's purchase order. In addition to any price specified herein, Purchaser shall pay the gross amount of any present or future sales, use, excise, value-added, or other similar tax applicable to the price, sale or delivery of any products or services furnished hereunder or to their use by Seller or Purchaser, or Purchaser shall furnish Seller with evidence of exemption acceptable to the taxing authorities..

26. Compatible Spare Parts

Supplier agrees to provide compatible spare parts at the fair market price for 5 years from the last delivery of Materials and/or services under this Agreement.

27. Severability

In the event any provision hereof shall be declared invalid, that provision shall be deemed severable from the remaining provisions of this Agreement, which shall remain in full force and effect.

28. Disputes

In the event a dispute arises out of or in connection with the Contract, including any question regarding its existence, validity or termination, shall be resolved in accordance with this paragraph and will be settled, if possible, by negotiation of the parties. If a dispute is not resolved by negotiations, either party may, by giving written notice, refer the dispute to a meeting of appropriate higher management of each party, to be held within twenty (20) business days after giving notice. If the dispute is not resolved within thirty (30) business days after the date of the meeting of higher management, or any later date to which the parties may agree, either party may submit to litigation through the court system. Any claim, legal action or proceeding (including without limitation claims for set-off or counterclaim) regarding the dispute shall be brought in the U.S. District Court for the Southern District of New York, or in the event that court lacks jurisdiction to hear the claim, in the appropriate state courts of New York County, New York, and the parties irrevocably consent to the exclusive jurisdiction of those courts for such claims. Each party submits to and accepts generally and unconditionally the jurisdiction of those courts with respect to its person and property, and irrevocably consents to the service of process in connection with any such action or proceeding by personal delivery to the party or by registered or certified mail, postage prepaid, to its address for notice under the Contract. Notwithstanding the terms above, each party has the right at any time, at its option and where legally available, to commence an action or proceeding in a court of competent jurisdiction to apply for interim or conservatory measures, but not monetary damages.

29. Complete Agreement

This Agreement, together with all attachments, appendices and Schedules listed on the cover sheet, including the Purchase Orders, shall constitute the complete agreement between the parties with respect to the subject matter of this Agreement. All prior communications with respect to this Agreement, whether oral or written, are superseded by this Agreement. This Agreement may be executed in counterparts, each of which shall be deemed to be an original, but which together shall constitute one and the same instrument.

30. Confidentiality

Supplier, its employees and agents, shall treat any information, (including any technical information, experience or data) regarding Owner or Owner's Affiliates' plans, programs, plants, processes, costs, equipment, services, operations, or customers, which may be disclosed to, or come within the knowledge of, Supplier its employees and agents in the performance of this Agreement, will maintain as confidential, and will not use or disclose this information to others without Owner's prior written consent during the term of this Agreement and for three (3) years thereafter, except as is necessary to perform the services hereunder. The provisions of this Article shall not apply to any information referred to in this Section which (i) has been published and has become public knowledge through no effort by Supplier, its employees, or agents, (ii) has been furnished or made known to Supplier or Supplier's Affiliates by third parties (other than those acting directly or indirectly for or on behalf of Owner or Owner's Affiliate) as a matter of legal right and without restriction on disclosure, (iii) was in Supplier's possession prior to disclosure by Owner or Owner's Affiliates and or is independently generated by Supplier without use of the confidential information that was acquired by Owner, its employees and agents directly or indirectly from Owner or, (iv) is required by law or by any other governmental regulatory authority to be disclosed (v) is furnished to others by Owner without restriction on disclosure.

Any information concerning Supplier's plans, programs, processes, costs or customers which is supplied by the Supplier to Owner or an Owner Affiliate under this Agreement will be similarly restricted. Owner or its Affiliates will not disclose such information to others or publish it in any form; provided, however, that notwithstanding the foregoing, Owner may disclose any such information to its Affiliates, employees, and consultants, or to any regulatory agencies or instrumentalities when such disclosure is required by law, or is otherwise necessary. Owner and its Affiliates will cooperate with the Supplier in an effort to minimize the amount of such information that will be disclosed in any such case, and make reasonable efforts to secure confidential treatment of such information.

In no event shall the names or logos of Owner or any Affiliate of Owner be used, whether in writing or orally, duplicated, or reproduced by any means whatsoever without the prior written permission of the Owner and an authorized representative of the respective Affiliate, in the case of an Affiliate.

ALL INQUIRIES BY ANY GOVERNMENTAL, BUSINESS, OR OTHER ENTITY, INCLUDING MEDIA, REGARDING ANY MATERIALS SUPPLIED OR TO BE SUPPLIED OR WORK PERFORMED OR TO BE PERFORMED BY SUPPLIER (OR ITS CONTRACTORS) FOR OWNER OR ITS AFFILIATES SHALL BE DIRECTED BY SUPPLIER (OR ITS CONTRACTOR) TO OWNER OR ITS APPLICABLE AFFILIATE FOR RESPONSE.

31. Passage of Title

Supplier warrants that it shall have title to all equipment furnished hereunder, free and clear of all liens and encumbrances, and the right to sell such equipment. Complete legal and equitable title of each item of Material covered by this Agreement shall pass to Owner immediately upon delivery for all Materials or services for which no post-delivery testing is required by the specifications, and upon Final Acceptance for all Materials for which post-delivery testing is required by the specifications. This provision shall apply irrespective of any terms of payment specified in this Agreement. Passage of title pursuant to this provision shall not release or waive any continuing or subsequent responsibility of Supplier under this Agreement. In no case shall title passage be delayed beyond 60 days from delivery.

32. Publicity

Supplier shall not issue, nor permit to be issued any press release, advertisement or literature of any kind or conduct or permit to be conducted any interview or news conference referring to the services required hereunder, except upon prior written consent of Owner.

33. Governing Law

This Agreement shall be governed by and construed according to the laws of the State of Maine without reference to its conflict of laws provisions.

34. Small Business Concerns

This is not Applicable.

35. Iberdrola USA Management Corporation Code of Conduct

Supplier shall comply with Iberdrola USA Management Corporation Code of Conduct in the performance of its obligations under this Agreement. A copy of the Iberdrola USA Management Corporation Code of Conduct has been provided to Supplier prior to its execution of this Agreement.

36. No Dispute

Supplier covenants that it is not aware of any pending billing dispute or other contractual dispute (pursuant to current contracts or contracts no longer in effect) or any pending or threatened litigation between Supplier and/or any of the Supplier's Affiliates and Owner and/or any of Owner's Affiliates.

37. Security Requirements

Supplier shall comply with the Owner's Security Requirements in the performance of its obligations under this Agreement.

Supplier shall be familiar with and shall comply with the requirements of the NERC CIP- 004 for projects or services at or relating to critical cyber assets and critical company operating facilities ("Critical Infrastructure"). The specific CIP Standard follows:

> CIP-004 Excerpt:
> R3. Personnel Risk Assessment --The Supplier shall have a documented personnel risk assessment program, in accordance with federal, state, provincial, and local laws, and subject to existing collective bargaining unit agreements, for personnel having authorized cyber or authorized unescorted physical access. A personnel risk assessment shall be conducted pursuant to that program prior to such personnel being granted such access except in specified circumstances such as an emergency. Such program shall at a minimum include:
>
> R3.1. The Supplier shall ensure that each assessment conducted include, at least, identity verification (e.g., Social Security Number verification in the U.S.) and seven- year criminal check. The Supplier may conduct more detailed reviews, as permitted by law and subject to existing collective bargaining unit agreements, depending upon the criticality of the position.
>
> R3.2. The Supplier shall update each personnel risk assessment at least every seven years after the initial personnel risk assessment or for cause.
>
> R3.3. The Supplier shall document the results of personnel risk assessments of its personnel having authorized cyber or authorized unescorted physical access to Critical Cyber Assets, and that personnel risk assessments of contractor and service vendor personnel with such access are conducted pursuant to Standard CIP-004.

38. Relationship between Owner and Program Manager

Owner has engaged [redacted] Inc. to provide oversight, support, and business advice to Owner on the MPRP. Owner shall designate a [redacted] representative as "Program Manager." The Program Manager is authorized to interact with the Supplier with respect to management and coordination of the performance of the Work, to resolve issues that may arise during the course of the Work, and to attempt to resolve issues in accordance with this Agreement. In the event there appears to be a discrepancy between a direction provided to the Supplier by the Owner and the direction provided to the Supplier by the Program Manager, the Supplier will promptly advise the Program Manager and the Owner of the discrepancy, and will not act on either direction until the Owner advises the Supplier of the final decision on the direction. The Program Manager is not authorized to make changes to the terms of this Agreement or to the quantity or price of an item to be supplied under this Agreement.

No additional terms or conditions of sale from [redacted] shall be passed through to Supplier, beyond what is contained in this agreement.

39. Environmental, Health and Safety Matters

39.1 Owner shall maintain safe working conditions at the Site, including, without limitation, implementing appropriate procedures regarding Hazardous Materials, confined space entry, and energization and de-energization of power systems (electrical, mechanical and hydraulic) using safe and effective lock-out/tag-out ("LOTO") procedures including physical LOTO or a mutually agreed upon alternative method.

39.2 Owner shall advise Seller in writing of all applicable Site-specific health, safety, security and environmental requirements and procedures. Without limiting Owner's responsibilities under Article 13, Seller has the right but not the obligation to, from time to time, review and inspect applicable health, safety, security and environmental documentation, procedures and conditions at the Site.

39.3 If, in Seller's reasonable opinion, the health, safety, or security of personnel or the Site is, or is apt to be, imperiled by security risks, terrorist acts or threats, the presence of or threat of exposure to Hazardous Materials, or unsafe working conditions, Seller may, in addition to other rights or remedies available to it, evacuate some or all of its personnel from Site, suspend performance of all or any part of the Contract, and/or remotely perform or supervise work. Any such occurrence shall be considered an excusable event. Owner shall reasonably assist in any such evacuation.

39.4 Operation of Owner's equipment is the responsibility of Owner. Owner shall not require or permit Seller's personnel to operate Owner's equipment at Site.

39.5 Owner will make its Site medical facilities and resources available to Seller personnel who need medical attention.

39.6. Seller has no responsibility or liability for the pre-existing condition of Owner's equipment or the Site. Prior to Seller starting any work at Site, Owner will provide documentation that identifies the presence and condition of any Hazardous Materials existing in or about Owner's equipment or the Site that Seller may encounter while performing under this Contract. Owner shall disclose to Seller industrial hygiene and environmental monitoring data regarding conditions that may affect Seller's work or personnel at the Site. Owner shall keep Seller informed of changes in any such conditions.

39.7 Seller shall immediately notify Owner in writing if Seller becomes aware of: (i) conditions at the Site differing materially from those disclosed by Owner, or (ii) previously unknown physical conditions at Site differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract. If any such conditions cause an increase in Seller's cost of, or the time required for, performance of any part of the work under the Contract, an equitable adjustment in price and schedule shall be made.

39.8 If Seller encounters Hazardous Materials in Owner's equipment or at the Site that require special handling or disposal, Seller is not obligated to continue work affected by the hazardous conditions. In such an event, Owner shall eliminate the hazardous conditions in accordance with applicable laws and regulations so that Seller's work under the Contract may safely proceed, and Seller shall be entitled to an equitable adjustment of the price and schedule to compensate for any increase in Seller's cost of, or time required for, performance of any part of the work. Owner shall properly store, transport and dispose of all Hazardous Materials introduced, produced or generated in the course of Seller's work at the Site.

39.9 Subject to the limitations of liability set forth in Article 19 and further provided that Owner's liability hereunder shall in no event exceed the contract price, Owner shall indemnify Seller from any and all claims, damages, losses, and expenses to the extent arising out of or relating directly to any Hazardous Materials which are or were (i) present in or about Owner's equipment or the Site prior to the commencement of Seller's work, (ii) improperly handled or disposed of by Owner or Owner's employees, agents, contractors or subcontractors, or (iii) brought, generated, produced or released on Site by parties other than Seller or any party under the direction or control of Seller.

40. Acceptance

IN WITNESS WHEREOF, the Supplier and Owner have each caused this Agreement to be signed as delivered by their duly authorized officers as of the date immediately below the officer's respective signature.

Owner

For Steven Oakes
Director of Supply Chain of Iberdrola USA Management Corporation and Authorized Representative of Central Maine Power Company
Date 4/21/11

Supplier [redacted]

Signature [redacted]

Date March/21/2011

DANIEL ALCAIN
CFO
4/21/11

SCHEDULE A

INSURANCE TO BE PROVIDED BY THE SUPPLIER

Before commencing Work, Supplier shall procure and maintain at its own expense for a period of [redacted] beyond completion of the Work, the insurance types, limits, terms, and conditions listed in section one below. The amounts as specified are minimums only. The actual amounts above the minimums shall be determined by Supplier. In addition, for any Work that is authorized to be subcontracted, Supplier shall require each Subcontractor to procure and maintain all insurance as required under law as well as any additional coverage appropriate for their work on behalf of Supplier under this Agreement.

IF YOU DO NOT HAVE A CURRENT CERTIFICATE ON FILE WITH OWNER evidencing possession of insurance required by this Agreement, prior to commencement of Work, Certificates of Insurance, Accord form or otherwise of a type and form acceptable to Owner, evidencing Supplier's and/or Subcontractor's possession of insurance as outlined herein shall be filed with Owner for its review. Certificates of Insurance should be mailed to the Procurement Department and reference this project/contract number at the following address:

Iberdrola USA Management Corporation
Procurement Department
89 East Avenue
Rochester, NY 14649-0001

1. **Required Insurance Coverages and Minimum Amounts**

Each insurance policy shall be placed with an insurance company licensed to write insurance in the State of Maine and shall have an A.M. Best's Rating of not less than "A- (minus)" and a policyholder surplus of at least [redacted]

Each insurance policy, except Workers' Compensation, Employers' Liability and Professional Liability, shall be endorsed to add Owner and Program Manager as additional insureds on a primary and non-contributory basis, but only to the extent of Supplier's indemnification obligations for third party damages as stated in this contract, and further shall include provisions for cross liability/severability of interests. In addition, Owner should be notified of any reduction in the aggregate policy limits.

Each policy shall be endorsed to provide a minimum of [redacted] prior written notice of cancellation or modification or reduction in coverage.

In the event Supplier and/ or Subcontractor has a policy(ies) written on a "claims-made" basis, such insurance shall provide for a retroactive date not later than the commencement of Work under this agreement. In addition, Supplier and/or Subcontractor will maintain such coverage for claims arising out of events occurring during the course of this agreement, for a period of [redacted] following the completion of the work.

1.1 Workers' Compensation and Employers' Liability Insurance in accordance with the statutory requirements of the State of Maine. For work that is conducted outside of Maine, the minimum limit for Employers' Liability Insurance should be [redacted] each accident, [redacted] disease-policy limit, [redacted] disease-each employee.

1.2 Automobile Liability insuring any auto, all owned autos, hired autos, and non-owned autos, used by Supplier in its performance of work under this Agreement, with a bodily injury and property damage combined single limit of [redacted] per occurrence.

1.3 General Liability, including coverage for Premises/Operations, Underground/ Explosion & Collapse Hazard, Products/Completed Operations, Contractual Liability applying to the Indemnification obligations stated in Articles 16 and 19 of this Agreement, Independent Contractors, Broad Form Property Damage, and Personal Injury, in the amount of [redacted] per occurrence and [redacted] aggregate.

The amount of insurance may be satisfied by purchasing primary coverage in the minimum (or greater) amounts specified or by purchasing a separate excess Umbrella Liability policy together with lower limit primary coverage.

Each General and/or Umbrella Liability Insurance policy shall include standard Separation of Insureds or Cross Liability language.

None of the requirements contained herein as to types, limits and approval of insurance coverage to be maintained by Suppliers or Subcontractor are intended to, nor shall they in any manner limit or qualify, nor increase the liabilities and obligations assumed by Supplier under this agreement.

1.4 Professional Liability Insurance – In the event work product requires the authorization of a Professional Engineer, Professional Liability Insurance with a limit of not less than [redacted] each claim and [redacted] in the aggregate. This is to provide coverage for claims arising out of the performance of the Work under this Agreement and caused by any negligent act, error, or omission of a Professional Engineer for which Supplier is held liable. Supplier shall maintain this insurance for a minimum period of [redacted] after the completion of the contract.

1.5 Environmental Liability Insurance – Environmental Liability Insurance with a limit of not less than [redacted] each claim and [redacted] in the aggregate, covering negligent acts or omissions of Supplier. Supplier shall maintain this insurance for a minimum period of [redacted] after the completion of the contract. Owner shall notify Seller of any instances of loss, damage or claims arising from Seller's work as soon as practical Owner becomes aware of instances of loss, damage or claims.

SCHEDULE B

CERTIFICATE OF FINAL ACCEPTANCE

Date: _____
To: Central Maine Power Corporation

Ref: Certificate of Final Acceptance – Maine Power Reliability Program Contract ("Agreement") by and between Central Maine Power Corporation ("Owner") and _____ ("Supplier")

Supplier, by and through the undersigned officer, duly authorized to represent Supplier and execute and deliver this certificate ("Certificate") to Owner, provides this Certificate to Owner under the Agreement. Capitalized terms used herein not otherwise defined shall have the meaning given such terms under the Agreement. Supplier hereby certifies to Owner as of the date hereof that the following are true and correct:

(1) Materials furnished under this Agreement have been provided per the delivery requirements of the specification in Schedule E.

(2) Owner has acknowledged that all Materials that require post-delivery testing have successfully passed the testing requirements.

Executed on the day set forth above.

_____

By:_____
Name:_____
Title:_____

CERTIFICATE ACCEPTED:

CENTRAL MAINE POWER CORPORATION
By:_____

_____
Print Name

_____
Title

SCHEDULE C

LIQUIDATED DAMAGES

In the event Supplier fails to deliver or install the Materials in compliance with the dates specified in the following schedule, Supplier shall pay liquidated damages to Owner according to the following schedule:

In the event that the Supplier fails to achieve [redacted] of the quantity by each Transformer Delivery Date specified in the following schedule, the Supplier shall pay to the Owner as delay liquidated damages, [redacted] per day for each Day from the day after that Delivery Date until [redacted] of the quantity applicable to that latest Delivery Date has been achieved up to cumulative overall maximum of [redacted] of Purchase Order price of the specific unit giving rise to the claim.

In the event that the Supplier fails to achieve [redacted] of the quantity by each Transformer Installation Date for a date that is mutually agreed prior to date of shipment, the Supplier shall pay to the Owner as delay liquidated damages [redacted] per day for each Day from the day after that Installation Date until [redacted] of the quantity applicable to that latest Installation Date has been achieved up to cumulative overall maximum of [redacted] of Purchase Order price of the specific installation price giving rise to the claim. Installation must begin no later than [redacted] days from delivery. Owner must provide free and clear access to the site twenty-four (24) hours per day, seven (7) days per week. Days may be extended without penalty for any such days affected by inclement weather, which prevents assembly, oil filling and testing.

In no event shall the maximum aggregate value of all liquidated damages exceed [redacted] of the Purchase order price of the specific unit giving rise to the claim.

Supplier's payment of Liquidated Damages should be Owner's sole and exclusive remedy for Supplier's late Shipment and will apply only if a delay affects the schedule of the project (No Harm, No Foul).

Transformer Liquidated Damages Table

Substation	Transformer Specification	Transformer Ship Date	Daily Liquidated Damages Amount
Coopers Mills	120D-36Y kV 20/26.6/33.3//37.3 MVA LTC	[redacted]	
Coopers Mills	120Y-13.2Y kV 10/12.5//14 MVA LTC		
Monmouth 115	120D-36Y kV 10/12.5//14 MVA LTC		
Monmouth 115	120Y-13.2Y kV 10/12.5//14 MVA LTC		

* For these units an order must be placed no later than March 18, 2011, to meet the shipment dates. Otherwise a new shipment date will be established for LDs for these items based on the date of receipt of the order.

SCHEDULE D

PRICING

1. Prices shall remain fixed during the term of this Agreement per pricing schedule provided, and shall not be subject to escalation.

2. Invoices are to be submitted based on [redacted] intervals starting the [redacted] through [redacted] Invoices that are submitted covering more than [redacted] of Materials will need to be resubmitted with multiple invoices showing the Materials delivered during [redacted]

3. Price schedule:

SCHEDULE D

PRICING (continued)

This contract covers the purchase, transportation, delivery, offloading and complete turnkey installation of four (4) dual winding transformers per the Specific Requirement Specification SPT-1341 Rev8 Item#1, 2, 3 and 4., Standard Requirement Specification SP-1229 and all drawings and additional specifications included within the RFP 10464 for the following substation site locations for the MPRP project in Maine:

Item 1: Coopers Mills Substations: 120D-36Y kV 20/26.6/33.3//37.3 MVA LTC
Requested delivery date [redacted]

Total Base Bid for unit:

Item 2: Cooper Mills Substations: 120Y-13.2Y kV 10/12.5//14 MVA LTC
Requested delivery date [redacted]

Total Base Bid for unit:

Item 3: Monmouth 115 Substation: 120D-36Y kV 10/12.5//14 MVA LTC
Requested delivery date [redacted]

Total Base Bid for unit:

Item 4: Monmouth 115 Substation: 120Y-13.2Y kV 10/12.5//14 MVA LTC
Requested delivery date [redacted]

Total Base Bid for unit:

[redacted]

CMP Unit#	Description	Qty	[redacted] Shipment Unit Price (U.S.D)	[redacted] Shipment Unit Price (U.S.D)	[redacted] Shipment Unit Price (U.S.D)
Monmouth	Three phase, oil immersed, transformer, 10/12.5/14 MVA, ONAN/ONAF, 60 Hz, 55/65°C temperature rise, high voltage of 120 kV Delta connection with De Energized Tap Changer, low voltage of 36 kV Wye connection with Load Tap Changer. Delivered on the pad	1	[redacted]		
Monmouth	Unit price adder for field assembly and field tests. For Non Union Site: Union Labor is NOT considered in the scope.	1			
Cooper Mills / Monmouth	Three phase, oil immersed, transformer, 10/12.5/14 MVA, ONAN/ONAF, 60 Hz, 55/65°C temperature rise, high voltage of 120 kV Wye connection with De Energized Tap Changer, low voltage of 13.2 kV Wye connection with Load Tap Changer and tertiary voltage of 7.6kV Delta connection. Delivered on the pad	1			
Cooper Mills / Monmouth	Unit price adder for field assembly and field tests. For Non Union Site: Union Labor is NOT considered in the scope.	1			
Cooper Mill / Middle St	Three phase, oil immersed, transformer, 20/26.67/33.3 MVA, ONAN/ONAF, 60 Hz, 55/65°C temperature rise, high voltage of 120 kV Delta connection with De Energized Tap Changer, low voltage of 36 kV Wye connection with Load Tap Changer. Delivered on the pad.	1			
C.Mill / Middle St	Unit price adder for field assembly and field tests. For Non Union Site: Union Labor is NOT considered in the scope.	1			
Middle St	Three phase, oil immersed, transformer, 12/16/20 MVA, ONAN/ONAF, 60 Hz, 55/65°C temperature rise, high voltage of 120 kV Wye connection with De Energized Tap Changer, low voltage of 13.2 kV Wye connection with Load Tap Changer and tertiary voltage of 7.62kV Delta connection. Delivered on the pad.	1			
Middle St	Unit price adder for field assembly and field tests. For Non Union Site: Union Labor is NOT considered in the scope.	1			

TRANSFORMER REQUIREMENTS- CMP/MPRP

VENDOR TECHNICAL PROPOSAL DATA FORM

Project			
OPCo.	CMP	SPEC. #:	SPT-1341
SUBSTATION:	Cooper Mills and MIDDLE STREET	ITEM #:	5
DESCRIPTION:	20/26.6/33.3//37.3 MVA, 120 D – 36 Y kV, with LTC		
Fill in the info requested in the green boxes below (as applicable.)			
VENDOR:	[redacted]	PROPOSAL #:	220056

Delivery -weeks After Receipt of Order (ARO)					
Time to order copper and silicon steel (weeks)					
Time to order LTC (weeks)					
Time to Submit Review Dwgs.(weeks)			12 to 14		
Time to Submit Final Dwgs.(weeks)			12 to 14		
Transformer Tests Start (weeks)					
Time to Ship Unit w/ Drawing Review (weeks)			28-32 weeks		
FOB Delivery Point (weeks)			30-34 wks		
Shipped Filled w/ Oil, Nit. Gas or Dry Air			Dry Air		
Shipped by Truck or Rail			truck		
Location of Core and Coil Manufacturing Facility			Nuevo Leon, Mex.		
Location of Assembling Facility			Nuevo Leon, Mex.		
Warranty Period (years)			see our section VI		

Excitation Losses (kW) Guaranteed					
Neutral	Reference Temp=	20°C	16 KW		
Load Losses (kW) Guaranteed					
Neutral	Reference Temp=	75°C	52 KW		

Auxiliary Losses (W)	
ONAN Rating	0 KW
First Stage Rating	1.5 KW
Second Stage Rating	3 KW
Excitation Current	
100% of Nominal Primary Voltage (%)	0.651
110% of Nominal Primary Voltage (%)	0.929
Core and Coil Design	
Transformer Type (Core/Shell)	Core
Coil Type (Rect./Circular)	
HV Winding	Circular
LV Winding	Circular
Conductor Material	
HV Winding	Copper
LV Winding	Copper
Conductor Type (Strap/Sheet)	
HV Winding	Strap
LV Winding	Strap
Core Type (Stacked/Wound)	Stacked
Weights	(Approximate)
Core and Coil	70,580 lbs
Tank and Fittings	34,670 lbs
Oil	47,840 lbs
Total Weight	153,090 lbs
Total Shipping Weight	98,690 lbs (without oil)
Weight of Largest Shipping Piece	98,690 lbs
Oil Capacity	(Approximate)
Total Oil	6,370 gal
Oil to Cover Core/Coils	Not available for quotation
Oil Type	Type II
Oil Supplier	Nynas or similar
Oil Market Name	Nytro or similar

Dimensions		
Installed (Inches)		(Approximate)
	Height	212
	Width	242
	Depth	200
	Height Over Cover	150
	Height to Live Part-HV	212
	Height to Live Part-LV	212
Shipping (Inches)		
	Height	150
	Width	242
	Depth	128
	Height Over Cover	150
Control Cabinet (Inches)		
	Base to Bottom Cab.	24 Min
	Base to Top Cab.	Not available for quotation
Winding Rating		
High Side		
	Voltage (kV)	120
	Capacity @55 (MVA)	20/26.6/33.3
	Capacity @65 (MVA)	22.4/29.9/37.3
	BIL (kV)	450
	Symmetrical Short Circuit Current Withstand (2 sec.) (A)	Approx. 733 A
Low Side		
	Voltage (kV)	36
	Capacity @55 (MVA)	20/26.6/33.3
	Capacity @65 (MVA)	22.4/29.9/37.3
	BIL (kV)	200
	Symmetrical Short Circuit Current Withstand (2 sec.) (A)	Approx. 4232 A

Tertiary		
	Voltage (kV)	N/A
	Capacity @55 (MVA)	N/A
	Capacity @65 (MVA)	N/A
	BIL (kV)	N/A
	Symmetrical Short Circuit Current Withstand (2 sec.) (A)	N/A
Neutral		
	BIL (kV)	110
Bushings		
High Side		
	Manufacturer	Pcore or ABB
	Type	Condenser
	Catalog #	POC550G0800S
	BIL (kV)	550
	Voltage Class (kV)	115
	Current Rating (A)	800
Low Side		
	Manufacturer	ABB or Pcore
	Type	Condenser
	Catalog #	034Z0412UT
	BIL (kV)	200
	Voltage Class (kV)	34.5
	Current Rating (A)	1200
Tertiary		
	Manufacturer	N/A
	Type	N/A
	Catalog #	N/A
	BIL (kV)	N/A
	Voltage Class (kV)	N/A
	Current Rating (A)	N/A
Neutral		
	Manufacturer	ABB or Pcore
	Type	Solid
	Catalog #	015J0120AP
	BIL (kV)	110
	Voltage Class (kV)	15

	Current Rating (A)	1200
Relay Accuracy CTs		
High Side		
	Manufacturer	[redacted] or similar
	Type	Bushing Type
	Qty/Bushing	2
	Ratio	600:5/1200:5
	Accuracy	C-800
	TRF	2
	Provisions Provided for Future CTs	No
Low Side		
	Manufacturer	[redacted] or similar
	Type	Bushing Type
	Qty/Bushing	2
	Ratio	1200:5/400:5
	Accuracy	C-800 / 0.3B-0.18
	TRF	2
	Provisions Provided for Future CTs	No
Tertiary		
	Manufacturer	N/A
	Type	N/A
	Qty/Bushing	N/A
	Ratio	N/A
	Accuracy	N/A
	TRF	N/A
	Provisions Provided for Future CTs	N/A
Neutral - External		
	Manufacturer	[redacted] or similar
	Type	Bushing Type
	Qty/Bushing	1
	Ratio	400:5
	Accuracy	C-200
	TRF	2

	Provisions Provided for Future CTs	No
Cooling Equipment		
Fans		
	Manufacturer	Krenz-vent or similar
	Type	Totally Enclosed
	Quantity	Approx. 4
	Voltage Rating (V)	230 (preliminary)
	Horsepower (hp)	1/8 (preliminary)
	Single Phase?	3 Phase (preliminary)
Pumps		
	Manufacturer	N/A
	Type	N/A
	Quantity	N/A
	Voltage Rating (V)	N/A
	Horsepower (hp)	N/A
	Single Phase?	N/A
Load Tap Changer		
Manufacturer		Reinhausen or similar
Style #		RMV-II
Type (Resistive vs. Reactive)		Reactive
Percent Regulation (%)		+/- 10%
Number of Tap Positions		+/-16
% Voltage per Tap (5/8%, etc.)		5/8%
Position Indicator Alternate Provided		Alternate 1
LTC Remote Indicating Device		Incon or similar
The LTC Compartment requires vacuum filling during maintenance procedure (Yes or No)		Yes

Impedance					
H-X on the ONAN, __deg C rating					
	% Resistance		0.26		
	% Reactance		7.495		
	% Impedance		7.5		
	Zero Seq. Impedance		7.5		
H-Y on the ONAN, ___deg C rating					
	% Resistance		N/A		
	% Reactance		N/A		
	% Impedance		N/A		
	Zero Seq. Impedance		N/A		
X-Y on the ONAN, ___deg C rating					
	% Resistance		N/A		
	% Reactance		N/A		
	% Impedance		N/A		
	Zero Seq. Impedance		N/A		
Sound					
Sound Level (dB): ONAN/ONAF/ ONAF	at Maximum cooling rating		74 dB		
Auxiliary Power			(Approximate)		
First Stage (A)	1ph		4 A Approx.		
Second Stage (A)	1ph		8 A Approx.		
LTC Motor (A)	1ph		15 A Approx		
Cabinet Heaters (A)			8 A Approx		
Total Aux. Power Requirement At Max. Load (kW)			Approx 10 KW		
Oil Preservation System					
Type of System			Inert Gas		

Personnel Fall Protection					
Type Proposed			Pelsue FB-SW1		
Acknowledgements					
SELLER shall acknowledge that the transformer will meet the specified Short Circuit Withstand capabilities as specified in SPT-1229, Paragraph 5.1.1 (Yes or No)			Yes		
The SELLER shall acknowledge that the tertiary shall be capable of withstanding a fault as described in SPT-1229, Paragraph 5.1.10.4 without the addition of external impedance. (Yes or No)			N/A		
The SELLER shall acknowledge that the transformer and all components parts can be loaded in accordance with IEEE C57.91. (Yes or No)			Yes		

TRANSFORMER REQUIREMENTS- CMP/MPRP					
VENDOR TECHNICAL PROPOSAL DATA FORM					
Project					
OPCo.	CMP			SPEC. #:	SPT-1341
SUBSTATION:	COOPERS MILL AND MONMOUTH 115			ITEM #:	4
DESCRIPTION:	10/12.5//14 MVA, 120 Y – 13.2 Y kV, with LTC				
Fill in the info requested in the green boxes below (as applicable.)					
VENDOR:	[redacted]			PROPOSAL #:	220056
Delivery -weeks After Receipt of Order (ARO)					
Time to order copper and silicon steel (weeks)					
Time to order LTC (weeks)					
Time to Submit Review Dwgs.(weeks)			12 to 14		
Time to Submit Final Dwgs.(weeks)			12 to 14		
Transformer Tests Start (weeks)					
Time to Ship Unit w/ Drawing Review (weeks)			28-32 weeks		
FOB Delivery Point (weeks)			32-36 wks		
Shipped Filled w/ Oil, Nit. Gas or Dry Air			oil filled		
Shipped by Truck or Rail			truck		
Location of Core and Coil Manufacturing Facility			Nuevo Leon, Mex.		
Location of Assembling Facility			Nuevo Leon, Mex.		
Warranty Period (years)			see our section VI		
Excitation Losses (kW) Guaranteed					
Neutral	Reference Temp=	20°C	8 KW		
Load Losses (kW) Guaranteed					
Neutral	Reference Temp=	75°C	44 KW		

Auxiliary Losses (W)	
ONAN Rating	0 KW
First Stage Rating	1.5 KW
Second Stage Rating	N/A
Excitation Current	
100% of Nominal Primary Voltage (%)	0.631
110% of Nominal Primary Voltage (%)	0.84
Core and Coil Design	
Transformer Type (Core/Shell)	Core
Coil Type (Rect./Circular)	
HV Winding	Circular
LV Winding	Circular
Conductor Material	
HV Winding	Copper
LV Winding	Copper
Conductor Type (Strap/Sheet)	
HV Winding	Strap
LV Winding	Strap
Core Type (Stacked/Wound)	Stacked
Weights	(Approximate)
Core and Coil	42,360 lbs
Tank and Fittings	29,750 lbs
Oil	36,360 lbs
Total Weight	108,470 lbs
Total Shipping Weight	101,650 lbs (with oil)
Weight of Largest Shipping Piece	67,360 lbs (without oil)
Oil Capacity	(Approximate)
Total Oil	4,830 gal
Oil to Cover Core/Coils	Not available for quotation
Oil Type	Type II
Oil Supplier	Nynas or similar
Oil Market Name	Nytro or similar

Dimensions		
Installed (Inches)		(Approximate)
	Height	208
	Width	218
	Depth	178
	Height Over Cover	145
	Height to Live Part-HV	208
	Height to Live Part-LV	208
Shipping (Inches)		
	Height	168
	Width	218
	Depth	115
	Height Over Cover	146
Control Cabinet (Inches)		
	Base to Bottom Cab.	24 Min
	Base to Top Cab.	Not available for quotation
Winding Rating		
High Side		
	Voltage (kV)	120
	Capacity @55 (MVA)	10/12.5
	Capacity @65 (MVA)	11.2/14
	BIL (kV)	450
	Symmetrical Short Circuit Current Withstand (2 sec.) (A)	Approx. 564 A (3-phase)
Low Side		
	Voltage (kV)	13.2
	Capacity @55 (MVA)	10/12.5
	Capacity @65 (MVA)	11.2/14
	BIL (kV)	110
	Symmetrical Short Circuit Current Withstand (2 sec.) (A)	Approx. 5474 A (3-phase)
Tertiary		
	Voltage (kV)	7.62
	Capacity @55 (MVA)	buried

	Capacity @65 (MVA)	buried
	BIL (kV)	110
	Symmetrical Short Circuit Current Withstand (2 sec.) (A)	-
Neutral		
	BIL (kV)	110 (H0 and X0)
Bushings		
High Side		
	Manufacturer	Pcore or ABB
	Type	Condenser
	Catalog #	POC550G0800S
	BIL (kV)	550
	Voltage Class (kV)	115
	Current Rating (A)	800
Low Side		
	Manufacturer	ABB or Pcore
	Type	Solid
	Catalog #	015J0120AP
	BIL (kV)	110
	Voltage Class (kV)	15
	Current Rating (A)	1200
Tertiary		
	Manufacturer	N/A
	Type	N/A
	Catalog #	N/A
	BIL (kV)	N/A
	Voltage Class (kV)	N/A
	Current Rating (A)	N/A
Neutral BT and AT		
	Manufacturer	ABB or Pcore
	Type	Solid / Condenser
	Catalog #	015J0120AP / B89493-70
	BIL (kV)	110 to X0 and 250 to H0
	Voltage Class (kV)	15 / 46

	Current Rating (A)	1200 / 1200
Relay Accuracy CTs		
High Side		
	Manufacturer	[redacted] or similar
	Type	Bushing Type
	Qty/Bushing	2
	Ratio	600:5/1200:5
	Accuracy	C-800
	TRF	2
	Provisions Provided for Future CTs	No
Low Side		
	Manufacturer	[redacted] or similar
	Type	Bushing Type
	Qty/Bushing	2
	Ratio	2000:5/1200:5
	Accuracy	C-800 / 0.3B-0.18
	TRF	2
	Provisions Provided for Future CTs	No
Tertiary		
	Manufacturer	N/A
	Type	N/A
	Qty/Bushing	N/A
	Ratio	N/A
	Accuracy	N/A
	TRF	N/A
	Provisions Provided for Future CTs	N/A
Neutral - External		
	Manufacturer	[redacted] or similar
	Type	Bushing Type
	Qty/Bushing	1
	Ratio	400:5
	Accuracy	C-200
	TRF	2

	Provisions Provided for Future CTs	No
Cooling Equipment		
Fans		
	Manufacturer	Krenz-vent or similar
	Type	Totally Enclosed
	Quantity	Approx. 2
	Voltage Rating (V)	230 (preliminary)
	Horsepower (hp)	1/8 (preliminary)
	Single Phase?	3 Phase (preliminary)
Pumps		
	Manufacturer	N/A
	Type	N/A
	Quantity	N/A
	Voltage Rating (V)	N/A
	Horsepower (hp)	N/A
	Single Phase?	N/A
Load Tap Changer		
Manufacturer		Reinhausen or similar
Style #		RMV-II
Type (Resistive vs. Reactive)		Reactive
Percent Regulation (%)		+/- 10%
Number of Tap Positions		+/-16
% Voltage per Tap (5/8%, etc.)		5/8%
Position Indicator Alternate Provided		Alternate 1
LTC Remote Indicating Device		Incon or similar
The LTC Compartment requires vacuum filling during maintenance procedure (Yes or No)		Yes
Impedance		
H-X on the ONAN, __deg C rating		
	% Resistance	0.44

	% Reactance		7.987		
	% Impedance		8		
	Zero Seq. Impedance		6.8		
H-Y on the ONAN, ___deg C rating					
	% Resistance		N/A		
	% Reactance		N/A		
	% Impedance		N/A		
	Zero Seq. Impedance		N/A		
X-Y on the ONAN, ___deg C rating					
	% Resistance		N/A		
	% Reactance		N/A		
	% Impedance		N/A		
	Zero Seq. Impedance		N/A		
Sound					
Sound Level (dB): ONAN/ONAF/ ONAF	at Maximum cooling rating		70 dB		
Auxiliary Power			(Approximate)		
First Stage (A)	1ph		2 A Approx.		
Second Stage (A)	1ph		4 A Approx.		
LTC Motor (A)	1ph		15 A Approx		
Cabinet Heaters (A)			8 A Approx		
Total Aux. Power Requirement At Max. Load (kW)			Approx 5 KW		
Oil Preservation System					
Type of System			Sealed Tank		
Personnel Fall Protection					
Type Proposed			Pelsue FB-SW1		

Acknowledgements			
SELLER shall acknowledge that the transformer will meet the specified Short Circuit Withstand capabilities as specified in SPT-1229, Paragraph 5.1.1 (Yes or No)	Yes		
The SELLER shall acknowledge that the tertiary shall be capable of withstanding a fault as described in SPT-1229, Paragraph 5.1.10.4 without the addition of external impedance. (Yes or No)	N/A		
The SELLER shall acknowledge that the transformer and all components parts can be loaded in accordance with IEEE C57.91. (Yes or No)	Yes		

TRANSFORMER REQUIREMENTS- CMP/MPRP					
VENDOR TECHNICAL PROPOSAL DATA FORM					
Project					
OPCo.	CMP			SPEC. #:	SPT-1341
SUBSTATION:	Monmouth 115			ITEM #:	1A
DESCRIPTION:	10/12.5//14 MVA, 120 D – 36 Y kV, with LTC				
Fill in the info requested in the green boxes below (as applicable.)					
VENDOR:	[redacted]			PROPOSAL #:	220056
Delivery -weeks After Receipt of Order (ARO)					
Time to order copper and silicon steel (weeks)					
Time to order LTC (weeks)					
Time to Submit Review Dwgs.(weeks)			12 to 14		
Time to Submit Final Dwgs.(weeks)			12 to 14		
Transformer Tests Start (weeks)					
Time to Ship Unit w/ Drawing Review (weeks)			28-32 weeks		
FOB Delivery Point (weeks)			30-34 wks		
Shipped Filled w/ Oil, Nit. Gas or Dry Air			oil filled		
Shipped by Truck or Rail			truck		
Location of Core and Coil Manufacturing Facility			Nuevo Leon, Mex.		
Location of Assembling Facility			Nuevo Leon, Mex.		
Warranty Period (years)			see our section VI		
Excitation Losses (kW) Guaranteed					
Neutral	Reference Temp=	20°C	9 KW		
Load Losses (kW) Guaranteed					
Neutral	Reference Temp=	75°C	33 KW		

Auxiliary Losses (W)	
ONAN Rating	0 KW
First Stage Rating	1.5 KW
Second Stage Rating	N/A
Excitation Current	
100% of Nominal Primary Voltage (%)	0.83
110% of Nominal Primary Voltage (%)	1.39
Core and Coil Design	
Transformer Type (Core/Shell)	Core
Coil Type (Rect./Circular)	
HV Winding	Circular
LV Winding	Circular
Conductor Material	
HV Winding	Copper
LV Winding	Copper
Conductor Type (Strap/Sheet)	
HV Winding	Strap
LV Winding	Strap
Core Type (Stacked/Wound)	Stacked
Weights	(Approximate)
Core and Coil	37,850 lbs
Tank and Fittings	23,470 lbs
Oil	23,480 lbs
Total Weight	84,800 lbs
Total Shipping Weight	78,660 lbs (with oil)
Weight of Largest Shipping Piece	56,850 lbs (without oil)
Oil Capacity	(Approximate)
Total Oil	3,120 gal
Oil to Cover Core/Coils	Not available for quotation
Oil Type	Type II
Oil Supplier	Nynas or similar
Oil Market Name	Nytro or similar

Dimensions		
Installed (Inches)		(Approximate)
	Height	191
	Width	200
	Depth	167
	Height Over Cover	136
	Height to Live Part-HV	191
	Height to Live Part-LV	191
Shipping (Inches)		
	Height	160
	Width	202
	Depth	106
	Height Over Cover	136
Control Cabinet (Inches)		
	Base to Bottom Cab.	24 Min
	Base to Top Cab.	Not available for quotation
Winding Rating		
High Side		
	Voltage (kV)	120
	Capacity @55 (MVA)	10/12.5
	Capacity @65 (MVA)	11.2/14
	BIL (kV)	450
	Symmetrical Short Circuit Current Withstand (2 sec.) (A)	Approx. 338 A
Low Side		
	Voltage (kV)	36
	Capacity @55 (MVA)	10/12.5
	Capacity @65 (MVA)	11.2/14
	BIL (kV)	200
	Symmetrical Short Circuit Current Withstand (2 sec.) (A)	Approx. 1951 A
Tertiary		
	Voltage (kV)	N/A
	Capacity @55 (MVA)	N/A

	Capacity @65 (MVA)	N/A
	BIL (kV)	N/A
	Symmetrical Short Circuit Current Withstand (2 sec.) (A)	N/A
Neutral		
	BIL (kV)	110
Bushings		
High Side		
	Manufacturer	Pcore or ABB
	Type	Condenser
	Catalog #	POC550G0800S
	BIL (kV)	550
	Voltage Class (kV)	115
	Current Rating (A)	800
Low Side		
	Manufacturer	ABB or Pcore
	Type	Condenser
	Catalog #	034Z0412UT
	BIL (kV)	200
	Voltage Class (kV)	34.5
	Current Rating (A)	1200
Tertiary		
	Manufacturer	N/A
	Type	N/A
	Catalog #	N/A
	BIL (kV)	N/A
	Voltage Class (kV)	N/A
	Current Rating (A)	N/A
Neutral		
	Manufacturer	ABB or Pcore
	Type	Solid
	Catalog #	015J0120AP
	BIL (kV)	110
	Voltage Class (kV)	15
	Current Rating (A)	1200
Relay Accuracy CTs		

High Side		
	Manufacturer	[redacted] or similar
	Type	Bushing Type
	Qty/Bushing	2
	Ratio	600:5/1200:5
	Accuracy	C-800
	TRF	2
	Provisions Provided for Future CTs	No
Low Side		
	Manufacturer	[redacted] or similar
	Type	Bushing Type
	Qty/Bushing	2
	Ratio	1200:5/400:5
	Accuracy	C-800 / 0.3B
	TRF	2
	Provisions Provided for Future CTs	No
Tertiary		
	Manufacturer	N/A
	Type	N/A
	Qty/Bushing	N/A
	Ratio	N/A
	Accuracy	N/A
	TRF	N/A
	Provisions Provided for Future CTs	N/A
Neutral - External		
	Manufacturer	[redacted] or similar
	Type	Bushing Type
	Qty/Bushing	1
	Ratio	400:5
	Accuracy	C-200
	TRF	2
	Provisions Provided for Future CTs	No
Cooling Equipment		
Fans		

	Manufacturer		Krenz-vent or similar		
	Type		Totally Enclosed		
	Quantity		Approx. 2		
	Voltage Rating (V)		230 (preliminary)		
	Horsepower (hp)		1/8 (preliminary)		
	Single Phase?		3 Phase (preliminary)		
Pumps					
	Manufacturer		N/A		
	Type		N/A		
	Quantity		N/A		
	Voltage Rating (V)		N/A		
	Horsepower (hp)		N/A		
	Single Phase?		N/A		
Load Tap Changer					
Manufacturer			ABB or similar		
Style #			UZ		
Type (Resistive vs. Reactive)			Resistive		
Percent Regulation (%)			+/- 10%		
Number of Tap Positions			+/-16		
% Voltage per Tap (5/8%, etc.)			5/8%		
Position Indicator Alternate Provided			Alternate 1		
LTC Remote Indicating Device			Incon or similar		
The LTC Compartment requires vacuum filling during maintenance procedure (Yes or No)			Yes		
Impedance					
H-X on the ONAN, __deg C rating					
	% Resistance		0.1089		
	% Reactance		8.243		
	% Impedance		8.25		
	Zero Seq. Impedance		8.25		
H-Y on the ONAN, ___deg C rating					
	% Resistance		N/A		

	% Reactance		N/A		
	% Impedance		N/A		
	Zero Seq. Impedance		N/A		
X-Y on the ONAN, ___deg C rating					
	% Resistance		N/A		
	% Reactance		N/A		
	% Impedance		N/A		
	Zero Seq. Impedance		N/A		
Sound					
Sound Level (dB): ONAN/ONAF/ ONAF	at Maximum cooling rating		70 dB		
Auxiliary Power			(Approximate)		
First Stage (A)	1ph		2 A Approx.		
Second Stage (A)	1ph		4 A Approx.		
LTC Motor (A)	1ph		15 A Approx		
Cabinet Heaters (A)			8 A Approx		
Total Aux. Power Requirement At Max. Load (kW)			Approx 5 KW		
Oil Preservation System					
Type of System			Sealed Tank		
Personnel Fall Protection					
Type Proposed			Pelsue FB-SW1		

Acknowledgements					
SELLER shall acknowledge that the transformer will meet the specified Short Circuit Withstand capabilities as specified in SPT-1229, Paragraph 5.1.1 (Yes or No)			Yes		
The SELLER shall acknowledge that the tertiary shall be capable of withstanding a fault as described in SPT-1229, Paragraph 5.1.10.4 without the addition of external impedance. (Yes or No)			N/A		
The SELLER shall acknowledge that the transformer and all components parts can be loaded in accordance with IEEE C57.91. (Yes or No)			Yes		

SCHEDULE E

SPECIFICATIONS

Technical Specification SPT-1341 Rev. 8

Technical
Specification Spec Atl

Standard Reqirement SPT-1229

Standard
Specification SPT-122

TRANSFORMER, SMALL and MEDIUM POWER

SPECIFIC REQUIREMENTS SPECIFICATION

SPECIFICATION: SPT-1341

PROJECTS: MPRP – CMP- Coopers Mills Substation / Monmouth 115 Substation/ Middle Street Substation

REVISION 8-MPRP:

PREPARED BY:	Brenton Hill	DATE:	September 6, 2010
CHECKED BY:	Brenton Hill & Jose Lugo	DATE:	September 9, 2010
REVIEWED BY:		DATE:	

This specification contains a specific description of technical requirements to which the SELLER and SELLER's product shall conform for the transformer(s) to be supplied under this unique specification number. In addition, the SELLER and SELLER's product shall conform to the Standard Requirements identified in Specification SPT-1229.

The PROPOSAL REQUIREMENTS pages contain a detailed, formatted listing of technical, performance and commercial product related data the SELLER is to supply with the proposal. This data shall be considered guaranteed data and SELLER shall assume all responsibility for CMP incurred costs should the actual performance of the transformer supplied under this specification deviate from the performance indicated by the above guaranteed technical performance and commercial data.

The SELLER SHALL BE REQUIRED to provide the following information:

(a) Make copies of the subsequent pages marked "PROPOSAL REQUIREMENTS" and fill in the commercial data requested.
(b) Provide discount rates for purchasing multiple items as requested on the "SUMMARY" page. The SELLER may also offer additional discount rate packages.
(c) Access the MS Excel spreadsheet file: "Vendor Technical Proposal Data Form.xls", open the file, fill in the technical data requested, save the file, and return the file by reply e-mail to the sender. This data shall be considered part of the SELLER'S proposal.

If alternates are requested and result in proposal requirements different from the base proposal, then the SELLER shall submit copies of the subsequent pages for each alternate as necessary.

CMP MAY REJECT THE PROPOSAL OF ANY SELLER PROVIDING INCOMPLETE PROPOSAL DATA.

The SELLER shall attach the following information to the proposal:
Attachment #1 - The SELLER shall attach the latest catalog information describing the transformer proposed. Include technical and commercial information.

Attachment #2 - The SELLER shall attach short circuit test history that demonstrates that transformers of similar core and coil design and construction has passed the short circuit test per ANSI C57.12.90. The rating of the bank, magnitude of the short circuit current, percent impedance change, pass/fail results and the date of the test shall be included.

Attachment #3 - The SELLER shall attach a complete list of all tests proposed to be performed on the transformer. Include a complete description of all test details, test voltages, and duration of tests.

Attachment #4 - The SELLER shall attach a individually priced list of recommended spare parts.

Attachment #5 - The SELLER shall attach a complete description of the warranty specified.

Attachment #6 - The SELLER shall provide a complete description of any requirements needed to correct any physical conditions that would prevent the tractor and low-boy trailer to drive into the substation (or crane, if applicable).

Attachment #7 - Provide cancellation schedule consistent with promised lead-time and milestones identified in the production status report.

SUMMARY of REQUIREMENTS

Below is a summary of the transformers included in this specification (quantity is one unless noted otherwise):

Item #	OPCo.	Substation	Description	Required Date
1	CMP	Coopers Mills	1@120D-36Y kV 10/12.5//14 MVA LTC	5/2/2013
2	CMP	Coopers Mills	1@36D-13.2 Y kV 5/6.25//7 MVA non-LTC	5/16/2013
3	CMP	Monmouth 115	1@120D-36Y kV 10/12.5//14 MVA LTC	10/13/2011
4	CMP	Monmouth 115	1@120Y-13.2Y kV 10/12.5//14 MVA LTC	10/13/2011
5	CMP	Middle Street	1@120D-36Y kV 20/26.6/33.3//37.3 MVA LTC	06/1/2012
6	CMP	Middle Street	1@ 120Y-13.2Y kV 12/16/20///22.4 MVA LTC	06/1/2012
7	CMP	Middle Street	1@ 120Y-13.2Y kV 12/16/20//22.4 MVA LTC	06/1/2012

Discount Rates for Multiple Purchases:

(Discount rates shall be applied to the Net Unit Price provided on the "PROPOSAL REQUIREMENTS" sheets for each item):

Purchase of Any:	% Discount
2 Items:	
3 Items:	
4 Items:	
5 Items:	
6 Items:	
7 Items:	
8 Items:	
9 Items:	
10 Items:	
11 Items:	

_____ % Discount for the purchase of Items _____.

(SELLER to offer their best economic package).

Shipping, installation and testing of all items by the SELLER in addition to SPT-1229 sections 16 & 17

a. The transformers shall be shipped FOB Destination to pad and set within one half inch of the centering marks.
b. Central Maine Power Company Project Site Manager shall be notified
    i. by SELLER when the transformer is loaded at the factory for shipping and
    ii. by SELLER or their shipper two full working days prior to the time of delivery that delivery is to take place. The first notice shall give quantities, approximate weights, name of carrier, bill of lading number, point of origin, destination and expected time of arrival.

c. SELLER shall be responsible for all road and transportation permits required.
d. Shock Indicator (all shipments) - Each transformer shall be equipped with two (2) separately concealed "Omni-G" shock indicator (by Impact-O-Graph Corp.) with ratings of two (2) G. Chart recorders are required for transformers of 20 MVA and over base ONAN rating.
e. CMP shall verify compliance with the Doble T.O.P.S. oil standard at point of delivery. The oil shall preferably be shipped in the transformer when possible. A dew point test shall be done if not shipped in oil. The minimum dew point is -55C.
f. CMP shall verify compliance for core ground limits of 1000 Mohm minimum at the point of delivery on the pad.
m. Seller shall be responsible for the turn-key unloading, installation, testing at site and connection of the transformer. The Seller shall perform the entire field assembly or "dress out" of the transformer by mounting and connecting all bushings, arresters, radiators, accessories, auxiliary transformer, etc. The Seller shall also provide the mineral oil required, vacuum fill the transformer and perform the comparison on site sweep frequency response test and acceptance-after-assembly tests. Operational checks shall be done for the LTC, LTC control, Calisto Monitor, and Qualitrol 509 or 505.

Item #1 & Item #3 :

1.0 Three-phase, 10/12.5 MVA at 55°C, 11.2/14 MVA at 65°C,
Cooling Classification: ONAN/ONAF, CMP Power Classification: Medium Power

2.0 Two windings, step-down operation:
1. Primary (H) Nominal= 120 kV, Connection: Delta
2. Primary (H) Maximum System Voltage: 121 kV
3. Secondary (X) Nominal = 36.0/20.785 kV, Connection: Wye

3.0 Winding BIL Ratings
1. H winding = 450 kV
2. X winding = 200kV

Neutral (XO) winding = 110 kV

4.0 Impedance = **8.25% at 10** MVA at 55°C at rated voltage.

5.0 Sound level at nominal voltage and the maximum cooling rating shall not exceed NEMA TR-1 levels of 73 dB reduced by 3 dB to 70 dB maximum.

Seller shall also propose as an option in their quote, a noise isolation mounting system with a description of its benefits. CMP has previously used Fabcel 50 psi pads by Fabreeka International. Seller shall install the noise isolation system if that option is accepted.

6.0 Oil Preservation

The oil preservation system shall be of the sealed type.

7.0 Load Tap Changer

- **The LTC shall be capable of manual operation from its control cabinet and remotely.**

1. An LTC shall be provided
2. The LTC shall regulate the 36 kV bus
3. Specification SPT-1229 Section 9.5 Alternate 1 LTC indicator scheme.

- The following switches shall be provided as described in the Standard Specification:
  - __X__ Raise/Lower
  - __X__ Remote/Local
  - __X__ Auto/Manual: The LTC auto/manual switch shall not be spring-loaded to the "OFF" position to accommodate SCADA control.
- **Notwithstanding Specification SPT-1229 section 9.5.1.3, the LED digital display receiver shall be the latest model 1250 LTC and not the prior model 1250B.**

8.0 Bushings

	Primary	**Secondary**	**Tertiary**	**HV Neutral**	**XV Neutral**
BIL - kV	550	200			110
Min. Amps	**200**	**400**			**400**
Segment	3	1			
Location (Side/Cover)	cover	cover			cover
Cable Compartment					

- 46kV bushings are not required or preferred.
- PRC bushings are not acceptable.
- Core Ground Bushings:

All internal core grounds including series and reactor windings shall be grounded externally through an outdoor type apparatus bushing, Warco #45A0000299, Molony 701314-51, Waukesha part no. 0614104R0700 or Purchaser approved equivalent, located on the transformer cover or on the transformer sidewall above the oil level. The bushing shall be grounded by a strap connected to a copper faced 2-hole pad welded to the tank. Reference ANSI C57.12.10-1997 5.5.1 for dimensions. For cover mounting, a raised gasket surface shall be provided. Physical protection shall at least be provided on three sides of the bushing within 2". The barrier shall extend to the outer end of the bushing stud. Steel box covers are acceptable. For sidewall mounting, physical protection shall be provided above and on each side of the bushing within 2". The barrier shall extend to the outer end of the bushing stud.

9.0 Current Transformers

	Primary	**Secondary**	**Tertiary**	**HV Neutral**	**XV Neutral External**
Quantity	6	6			1
No. per Bushing	2	2			1
Ratio	600:5 MR 1200:5 MR	1200:5 MR (Relay) 400:5 (Meter)			400:5
Relay Accuracy	C800	C800			200
Metering Accuracy		0.3B-0.18			

9.1 The Neutral CT must be externally mounted.

Surge Arresters

SELLER shall provide high side Station-class polymer surge arresters and the HV surge arrester mounting brackets with the plates drilled for 10" & 8 ¾" bolt circles. High side arresters shall be 96 kV duty cycle, 76 kV MCOV arresters of either Siemens, GE, Ohio Brass or Joslyn.

10.0 Radiators shall be **fixed or removable.**

11.0 SELLER shall not provide the spare gaskets as stated in the Standard Requirements Specification.

12.0 SELLER shall provide Type I or Type II insulating oil.

13.0 CMP will supply auxiliary power as follows:
1. 120 VAC, single phase (cabinet lighting, receptacle, LTC control)
2. 240 VAC, single phase (cooling fans, oil pumps and cabinet heaters)
3. 125 VDC (sudden pressure relay)
4. 240 VAC LTC Motor Voltage
5. An alarm relay shall be required for the loss of AC power to the fans and pumps. Provide a normally open and normally closed contact wired to a terminal block.

14.0 Control Cabinet shall be located in segment 1 or 4.

15.0 Tests
1. Impulse test shall be performed.
2. Temperature test shall be performed on the first unit or a comparable unit.
3. Two Sweep frequency response tests for 115 kV transformers using the Doble method shall be performed 1) at the factory with the assembled transformer and 2) at first installation on site. Provide comparable sweep frequency response test results using the same configuration (in oil, with bushings, mid tap DETC, 16R LTC tap) for both tests. Peaks and nulls should overlay well.

16.0 CMP Loss Data (ONAN Rating)
- No Load Losses = $7,900 /kW
- Load Losses= $3,700 /kW

17.0 Monitoring and Accessories Required (required if indicated by "X")
_____ Morgan Schaffer Systems Calisto dissolved hydrogen and water monitor, standard features.
_____ Provisions Only for a Syprotec Hydran Model 201.
_____ GE-Reuter Stokes Harley LTC Map 2130.
_____ Provisions Only for an LTC Monitor.
_____ Rochester Instrument Systems Co., Model AN-6100B, 26 Point Annunciator.
__X___ Qualitrol IED 505 Electronic Temperature Monitor for main tank top oil, winding and LTC
_____ Advanced Power Technologies TTC-1000-07404. To include LTC temperature and LTC differential monitoring and also RS-232 connection
_____ Provisions Only for Bottom Oil Temperature Gauge.
_____ Bushing Potential Devices: Quantity _____, Bushing _____.
__X__ Paralleling Using the Beckwith M-0115 Parallel Balancing Module & Beckwith M-0127A AC Current Relay.
__X___ Provide Aluminum Nitrogen Tanks (2 large per transformer)

18.0 Base height shall be a minimum of 6 inches with a 45 degree angle plate on each member to allow use of 4 inch diameter 4 foot long wooden rollers.

PROPOSAL REQUIREMENTS	
Item #:1 and Item 3	
OPCo:	**CMP/MPRP**
Division:	
Substation:	
SELLER Name:	
SELLER Proposal Number:	

Net unit price of one transformer delivered FOB Destination on pad.	$
Supply the following price adders that shall apply to any of the alternates:	
	$NA
	$NA
Noise Isolation Pad installed	$
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA

Item #2:

1. Three-phase, 5/6.25 MVA at 55°C, 5.6/7 MVA at 65°C,
   Cooling Classification: ONAN/ONAF, CMP Power Classification: Small Power

2. Two windings, step-down operation:
   1. Primary (H) Nominal= 36.0 kV, Connection: Delta
   2. Primary (H) Maximum System Voltage: 39.8kV
   3. Secondary (X) Nominal = 13.2Y/7.62 kV, Connection :Grounded Y
   4. **Rectangular core and windings are not allowed**.

3. Winding BIL Ratings
   5. H winding = 200 kV
   6. X winding = 110kV
   7. Neutral (XO) winding = 110 kV

4. Impedance = **7.0% at 5** MVA at 55°C at rated voltage.

5. Sound level at nominal voltage and the maximum cooling rating shall not exceed NEMA TR-1 levels of 68 dB reduced by 3 dB to 65 dB maximum.

   Seller shall also propose as an option in their quote, a noise isolation mounting system with a description of its benefits. CMP has previously used Fabcel 50 psi pads by Fabreeka International. Seller shall install the noise isolation system if that option is accepted.

6. Load Tap Changer
   - An LTC shall not be provided

7. Bushings

	Primary	**Secondary**	**Tertiary**	**HV Neutral**	**8. XV Neutral**
BIL	200	110		None	110
Min. Amps	**200**	**650**			**650**
Segment	3	1			1
Location (Side/Cover)	Cover	Cover			Cover
Cable Compartment	None	None			None

   - 46kV bushings are not required or preferred.
   - Low side bushings may be solid or bulk type.
   - PRC bushings are not acceptable.
   - **Low side bushing spacing must be a minimum of 24 inches on center**

   Core Ground Bushings:
   - All internal core grounds including series and reactor windings shall be grounded externally through an outdoor type apparatus bushing, Warco #45A0000299, Molony 701314-51, Waukesha part no. 0614104R0700 or Purchaser approved equivalent, located on the transformer cover or on the transformer sidewall above the oil level. The bushing shall be grounded by a strap connected to a copper faced 2-hole pad welded to the tank. Reference ANSI C57.12.10-1997 5.5.1 for dimensions. For cover mounting, a raised gasket surface shall be provided. Physical protection shall at least be provided on three sides of the bushing within 2". The barrier shall extend to the outer end of the bushing stud. Steel box covers are acceptable. For sidewall mounting, physical protection shall be provided above and on each side of the bushing within 2". The barrier shall extend to the outer end of the bushing stud.

9. Current Transformers-None Required

Item #2 : (continued)

10. Surge Arresters

    SELLER shall provide Intermediate-class polymer surge arresters and the HV surge arrester mounting brackets with the plates drilled with a 8 ¾" bolt circle. Arresters shall be 27 kV duty cycle, 22 kV MCOV either Siemens, GE, Ohio Brass or Joslyn.

11. Radiators shall be welded to tank.

12. SELLER shall not provide the spare gaskets as stated in the Standard Requirements Specification.

13. SELLER shall provide Type I or Type II insulating oil.

14. CMP will supply auxiliary power as follows:
    a. 120VAC, single phase (cabinet lighting, receptacle)
    b. 240VAC, single phase (cooling fans, oil pumps and cabinet heaters)
    c. An alarm relay shall not be required for the loss of AC power to the fans and pumps. If required, provide a normally open and normally closed contact wired to a terminal block.

15. Control Cabinet shall be located in segment 1 or 4.

16. Tests
    a. Impulse test shall not be performed.
    b. Temperature test shall be performed on the first unit or a similar unit.

17. CMP Loss Data (ONAN Rating)
    a. Excitation Losses = $8,200 /kW
    b. Load Losses= $3,400 /kW

18. Monitoring and Accessory Options (required if indicated by "X".) **None Required**

19. Base height shall be a minimum of 6 inches with a 45 degree angle plate on each member to allow use of 4 inch diameter 4 foot long wooden rollers.

    a.

PROPOSAL REQUIREMENTS	
Item #: **2**	
OPCo:	**CMP**
Division:	
Substation:	
SELLER Name:	
SELLER Proposal Number:	
Net unit price of one transformer delivered FOB Destination on pad	$
Supply the following price adders that shall apply to any of the alternates:	
Noise Isolation Pad installed	$
	$ N/A
	$ N/A
	$ N/A
	$ N/A

	$ N/A
	$ N/A
	$ N/A
	$ N/A
	$ N/A
	$ N/A
	$ N/A
	$ N/A
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$ NA
	$ NA

Item #4:

1.0 Three-phase, 10/12.5 MVA at 55°C, 11.2/14 MVA at 65°C,
Cooling Classification: ONAN/ONAF, CMP Power Classification: Medium Power

2.0 Three windings, step-down operation:
8. Primary (H) Nominal= 120 kV, Connection: **Wye**
9. Primary (H) Maximum System Voltage: 121 kV
10. Buried stabilizing tertiary
11. Secondary (X) Nominal = 13.2/7.62 kV, Connection: **Wye**

19.0 Winding BIL Ratings
1. H winding = 450 kV
2. X winding = 110kV
Neutral (XO) winding = 110 kV

20.0 Impedance = **8.0% at 10 MVA** at 55°C at rated voltage.

21.0 Sound level at nominal voltage and the maximum cooling rating shall not exceed NEMA TR-1 levels reduced by 3 dB from 73 to 70 dB.

The Seller shall also propose as an option in their quote, a noise isolation mounting system with a description of its benefits. CMP has previously used Fabcel 50 psi pads by Fabreeka International.

Seller shall install the noise isolation system if that option is accepted.

22.0 Oil Preservation

The oil preservation system shall be sealed type.

23.0 Load Tap Changer

1. An LTC shall be provided
2. The LTC shall regulate the 13.2 kV bus
3. Specification SPT-1229 Section 9.5 Alternate 1 LTC indicator scheme.

- The following switches shall be provided as described in the Standard Specification:
  - __X__ Raise/Lower
  - __X__ Remote/Local
  - __X__ Auto/Manual: The LTC auto/manual switch shall not be spring-loaded to the "OFF" position to accommodate SCADA control.
- **Notwithstanding Specification SPT-1229 section 9.5.1.3, the LED digital display receiver shall be the latest model 1250 LTC and not the prior model 1250B.**

24.0 Bushings

	Primary	Secondary	Tertiary	HV Neutral	XV Neutral
BIL - kV	550	110			110
Min. Amps	**200**	**1200**			**1200**
Segment	3	1			
Location (Side/Cover)	cover	cover			cover
Cable Compartment					

- Core Ground Bushings:

All internal core grounds including series and reactor windings shall be grounded externally through an outdoor type apparatus bushing, Warco #45A0000299, Molony 701314-51, Waukesha part no. 0614104R0700 or Purchaser approved equivalent, located on the transformer cover or on the transformer sidewall above the oil level. The bushing shall be grounded by a strap connected to a copper faced 2-hole pad welded to the tank. Reference ANSI C57.12.10-1997 5.5.1 for dimensions. For cover mounting, a raised gasket surface shall be provided. Physical protection shall at least be provided on three sides of the bushing within 2". The barrier shall extend to the outer end of the bushing stud. Steel box covers are acceptable. For sidewall mounting, physical protection shall be provided above and on each side of the bushing within 2". The barrier shall extend to the outer end of the bushing stud.

25.0 Current Transformers

	Primary	Secondary	Tertiary	HV Neutral	XV Neutral External
Quantity	6	6			1
No. per Bushing	2	2			1
Ratio	600:5 MR 1200:5 MR	**2000:5 MR** (Relay) 1200:5 (Meter)			400:5
Relay Accuracy	C800	C800			C200
Metering		0.3B-0.18			

Accuracy					

26.1 The Neutral CT must be externally mounted.

26.0 Surge Arresters

SELLER shall provide Station-class polymer surge arresters and the HV surge arrester mounting brackets with the plates drilled for 10" & 8 ¾" bolt circles The surge arresters shall be 96 kV duty cycle, 76 kV MCOV polymer, either Siemens, GE, Ohio Brass or Joslyn.

27.0 Radiators shall be **fixed or removable**.

28.0 SELLER shall not provide the spare gaskets as stated in the Standard Requirements Specification.

29.0 SELLER shall provide Type I or Type II insulating oil.

30.0 CMP will supply auxiliary power as follows:
1. 120 VAC, single phase (cabinet lighting, receptacle, LTC control)
2. 240 VAC, single phase (cooling fans, oil pumps and cabinet heaters)
3. 125 VDC (sudden pressure relay)
4. 240 VAC LTC Motor Voltage
5. An alarm relay shall be required for the loss of AC power to the fans and pumps. Provide a normally open and normally closed contact wired to a terminal block.

31.0 Control Cabinet shall be located in segment 1 or 4.

32.0 Tests
1. Impulse test shall be performed.
2. Temperature test shall be performed on the first unit or a comparable unit.
3. Two Sweep frequency response tests for 115 kV transformers using the Doble method shall be performed 1) at the factory with the assembled transformer and 2) at first installation on site. Provide comparable sweep frequency response test results using the same configuration (in oil, with bushings, mid tap DETC, 16R LTC tap) for both tests. Peaks and nulls should overlay well.

33.0 CMP Loss Data
1. No Load Losses = $8,200/kW
2. Load Losses= $3,400 /kW

34.0 Monitoring and Accessories Required (required if indicated by "X")
_____ Morgan Schaffer Systems Calisto dissolved hydrogen and water monitor, standard features.
_____ Provisions Only for a Syprotec Hydran Model 201.
_____ GE-Reuter Stokes Harley LTC Map 2130.
_____ Provisions Only for an LTC Monitor.
_____ Rochester Instrument Systems Co., Model AN-6100B, 26 Point Annunciator.
__X___ Qualitrol IED 505 Electronic Temperature Monitor for maint tank top oil, winding and LTC
_____ Advanced Power Technologies TTC-1000-07404. To include LTC temperature and LTC differential monitoring and also RS-232 connection
_____ Provisions Only for Bottom Oil Temperature Gauge.
_____ Bushing Potential Devices: Quantity _____, Bushing _____.
__X__ Paralleling Using the Beckwith M-0115 Parallel Balancing Module & Beckwith M-0127A AC Current Relay.
_____ Provide Aluminum Nitrogen Tanks (2 large per transformer)

35.0 Base height shall be a minimum of 6 inches with a 45 degree angle plate on each member to allow use of 4 inch diameter 4 foot long wooden rollers.

PROPOSAL REQUIREMENTS	
Item #:4	
OPCo:	**CMP**
Division:	
Substation:	
SELLER Name:	
SELLER Proposal Number:	

Net unit price of one transformer delivered FOB Destination on pad.	$
Supply the following price adders that shall apply to any of the alternates:	
	$NA
	$NA
Noise Isolation Pad	$
	NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA

Item #5 :

36.0 Three-phase, 20/26.6/33.3 MVA at 55°C, 22.4/29.9/37.3 MVA at 65°C,
Cooling Classification: ONAN/ONAF/ONAF, CMP Power Classification: Medium Power

37.0 Two windings, step-down operation:
1. Primary (H) Nominal= 120 kV, Connection: Delta
2. Primary (H) Maximum System Voltage: 121 kV
3. Secondary (X) Nominal = 36.0/20.785 kV, Connection: Wye

38.0 Winding BIL Ratings
1. H winding = 450 kV
2. X winding = 200kV

Neutral (XO) winding = 110 kV

39.0 Impedance = **7.5% at 20** MVA at 55°C at rated voltage.

40.0 Sound level at nominal voltage and the maximum cooling rating shall not exceed NEMA TR-1 levels of 77 dB reduced by 3 dB to 74 dB maximum.

Seller shall also propose as an option in their quote, a noise isolation mounting system with a description of its benefits. CMP has previously used Fabcel 50 psi pads by Fabreeka International. Seller shall install the noise isolation system if that option is accepted.

41.0 Oil Preservation

The oil preservation system shall be of the automatic gas seal type to prevent direct breathing to or from the atmosphere, including alarm contacts suitable for monitoring the proper functioning of the system. Sufficient gas space shall be designed to allow normal cycling without undue usage of nitrogen.

A weatherproof cabinet shall be furnished with each transformer for housing a vendor provided K size nitrogen gas **aluminum cylinder**, pressure vacuum switch, gas sampling valve, pressure vacuum gauge, cylinder pressure gauge, alarm contacts and other necessary gas pressure equipment. It shall have space and provisions for installing and connecting a second nitrogen gas cylinder. The cabinet door or doors shall be arranged for padlocking. The cabinet shall have no bottom to allow the nitrogen tanks to set on the transformer pad.

42.0 Load Tap Changer

- **The LTC shall be capable of manual operation from its control cabinet and remotely**.

1. An LTC shall be provided
2. The LTC shall regulate the 36 kV bus
3. Specification SPT-1229 Section 9.5 Alternate 1 LTC indicator scheme.

- The following switches shall be provided as described in the Standard Specification:
  - __X__ Raise/Lower
  - __X__ Remote/Local
  - __X__ Auto/Manual: The LTC auto/manual switch shall not be spring-loaded to the "OFF" position to accommodate SCADA control.
- **Notwithstanding Specification SPT-1229 section 9.5.1.3, the LED digital display receiver shall be the latest model 1250 LTC and not the prior model 1250B.**

43.0 Bushings

	Primary	Secondary	Tertiary	HV Neutral	XV Neutral
BIL - kV	550	200			110
Min. Amps	**200**	**400**			**400**

Segment	3	1			
Location (Side/Cover)	cover	cover			cover
Cable Compartment					

- 46kV bushings are not required or preferred.
- Low side bushings may be solid or bulk type.
- PRC bushings are not acceptable.
- Core Ground Bushings:

All internal core grounds including series and reactor windings shall be grounded externally through an outdoor type apparatus bushing, Warco #45A0000299, Molony 701314-51, Waukesha part no. 0614104R0700 or Purchaser approved equivalent, located on the transformer cover or on the transformer sidewall above the oil level. The bushing shall be grounded by a strap connected to a copper faced 2-hole pad welded to the tank. Reference ANSI C57.12.10-1997 5.5.1 for dimensions. For cover mounting, a raised gasket surface shall be provided. Physical protection shall at least be provided on three sides of the bushing within 2". The barrier shall extend to the outer end of the bushing stud. Steel box covers are acceptable. For sidewall mounting, physical protection shall be provided above and on each side of the bushing within 2". The barrier shall extend to the outer end of the bushing stud.

44.0 Current Transformers

	Primary	**Secondary**	**Tertiary**	**HV Neutral**	**XV Neutral External**
Quantity	6	6			1
No. per Bushing	2	2			1
Ratio	600:5 MR 1200:5 MR	1200:5 MR (Relay) 400:5 (Meter)			400:5
Relay Accuracy	C800	C800			200
Metering Accuracy		0.3B-0.18			

9.1 The Neutral CT must be externally mounted.

Surge Arresters

SELLER shall provide Station-class surge arresters and the HV surge arrester mounting brackets with the plates drilled for 10" & 8 ¾" bolt circles

45.0 Radiators shall be **removable.**

46.0 SELLER shall not provide the spare gaskets as stated in the Standard Requirements Specification.

47.0 SELLER shall provide Type I or Type II insulating oil.

48.0 CMP will supply auxiliary power as follows:

1. 120 VAC, single phase (cabinet lighting, receptacle, LTC control)
2. 240 VAC, single phase (cooling fans, oil pumps and cabinet heaters)
3. 125 VDC (sudden pressure relay)
4. 240 VAC LTC Motor Voltage
5. An alarm relay shall be required for the loss of AC power to the fans and pumps. Provide a normally open and normally closed contact wired to a terminal block.

49.0 Control Cabinet shall be located in segment 1 or 4.

50.0 Tests

1. Impulse test shall be performed.
2. Temperature test shall be performed on the first unit or a comparable unit.
3. Two Sweep frequency response tests for 115 kV transformers using the Doble method shall be performed 1) at the factory with the assembled transformer and 2) at first installation on site. Provide comparable sweep frequency response test results using the same configuration (in oil, with bushings, mid tap DETC, 16R LTC tap) for both tests. Peaks and nulls should overlay well.

51.0 CMP Loss Data (ONAN Rating)

- No Load Losses = $7,900 /kW
- Load Losses= $3,700 /kW

52.0 Monitoring and Accessories Required (required if indicated by "X")

__X__ Morgan Schaffer Systems Calisto dissolved hydrogen and water monitor, standard features.
_____ Provisions Only for a Syprotec Hydran Model 201.
_____ GE-Reuter Stokes Harley LTC Map 2130.
_____ Provisions Only for an LTC Monitor.
_____ Rochester Instrument Systems Co., Model AN-6100B, 26 Point Annunciator.
__X___ Qualitrol IED 509 ITM-100 Electronic Temperature Monitor for ambient(B module), Bottom oil (B module), top oil (B module), winding (C mouule), LTC differential (D2 module) with 100 Ohm 3 wire RTD sensors.
_____ Advanced Power Technologies TTC-1000-07404. To include LTC temperature and LTC differential monitoring and also RS-232 connection
_____ Provisions Only for Bottom Oil Temperature Gauge.
_____ Bushing Potential Devices: Quantity _____, Bushing _____.
__X__ Paralleling Using the Beckwith M-0115 Parallel Balancing Module & Beckwith M-0127A AC Current Relay.
__X___ Provide Aluminum Nitrogen Tanks (2 large per transformer)

53.0 Base height shall be a minimum of 6 inches with a 45 degree angle plate on each member to allow use of 4 inch diameter 4 foot long wooden rollers.

PROPOSAL REQUIREMENTS		
Item #:5		
OPCo:	**CMP/MPRP**	
Division:		
Substation:		
SELLER Name:		
SELLER Proposal Number:		
Net unit price of one transformer delivered FOB Destination on pad.		$
Supply the following price adders that shall apply to any of the alternates:		
		$NA
		$NA
Noise Isolation Pad installed		$
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA
		$NA

Item #6 & Item #7 :

54.0 Three-phase, 12/16/20 MVA at 55°C, 13.4/17.9/22.4 MVA at 65°C,
Cooling Classification: ONAN/ONAF/ONAF, CMP Power Classification: Medium Power

55.0 Three windings, step-down operation:
1. Primary (H) Nominal= 120 kV, Connection: **Wye**
2. Primary (H) Maximum System Voltage: 121 kV
3. Buried stabilizing tertiary
4. Secondary (X) Nominal = 13.2/7.62 kV, Connection: **Wye**

56.0 Winding BIL Ratings
1. H winding = 450 kV
2. X winding = 110kV

Neutral (XO) winding = 110 kV

57.0 Impedance = **7.75% at 12** MVA at 55°C at rated voltage.

58.0 Sound level at nominal voltage and the maximum cooling rating shall not exceed NEMA TR-1 levels of 75 dB reduced by 3 dB to 72 dB maximum.

Seller shall also propose as an option in their quote, a noise isolation mounting system with a description of its benefits. CMP has previously used Fabcel 50 psi pads by Fabreeka International. Seller shall install the noise isolation system if that option is accepted.

59.0 Oil Preservation

The oil preservation system shall be of the automatic gas seal type to prevent direct breathing to or from the atmosphere, including alarm contacts suitable for monitoring the proper functioning of the system. Sufficient gas space shall be designed to allow normal cycling without undue usage of nitrogen.

A weatherproof cabinet shall be furnished with each transformer for housing a vendor provided K size nitrogen gas **aluminum cylinder**, pressure vacuum switch, gas sampling valve, pressure vacuum gauge, cylinder pressure gauge, alarm contacts and other necessary gas pressure equipment. It shall have space and provisions for installing and connecting a second nitrogen gas cylinder. The cabinet door or doors shall be arranged for padlocking. The cabinet shall have no bottom to allow the nitrogen tanks to set on the transformer pad.

60.0 Load Tap Changer
- **The LTC shall be capable of manual operation from its control cabinet and remotely.**

1. An LTC shall be provided
2. The LTC shall regulate the 13.2 kV bus
3. Specification SPT-1229 Section 9.5 Alternate 1 LTC indicator scheme.

- The following switches shall be provided as described in the Standard Specification:
  - __X__ Raise/Lower
  - __X__ Remote/Local
  - __X__ Auto/Manual: The LTC auto/manual switch shall not be spring-loaded to the "OFF" position to accommodate SCADA control.
- **Notwithstanding Specification SPT-1229 section 9.5.1.3, the LED digital display receiver shall be the latest model 1250 LTC and not the prior model 1250B.**

61.0 Bushings

	Primary	Secondary	Tertiary	HV Neutral	XV Neutral
BIL - kV	550	200			110

Min. Amps	**200**	**400**			**400**
Segment	3	1			
Location (Side/Cover)	cover	cover			cover
Cable Compartment					

- 46kV bushings are not required or preferred.
- Low side bushings may be solid or bulk type.
- PRC bushings are not acceptable.
- Core Ground Bushings:

All internal core grounds including series and reactor windings shall be grounded externally through an outdoor type apparatus bushing, Warco #45A0000299, Molony 701314-51, Waukesha part no. 0614104R0700 or Purchaser approved equivalent, located on the transformer cover or on the transformer sidewall above the oil level. The bushing shall be grounded by a strap connected to a copper faced 2-hole pad welded to the tank. Reference ANSI C57.12.10-1997 5.5.1 for dimensions. For cover mounting, a raised gasket surface shall be provided. Physical protection shall at least be provided on three sides of the bushing within 2". The barrier shall extend to the outer end of the bushing stud. Steel box covers are acceptable. For sidewall mounting, physical protection shall be provided above and on each side of the bushing within 2". The barrier shall extend to the outer end of the bushing stud.

62.0 Current Transformers

	Primary	**Secondary**	**Tertiary**	**HV Neutral**	**XV Neutral External**
Quantity	6	6			1
No. per Bushing	2	2			1
Ratio	600:5 MR 1200:5 MR	1200:5 MR (Relay) 400:5 (Meter)			400:5
Relay Accuracy	C800	C800			200
Metering Accuracy		0.3B-0.18			

9.1 The Neutral CT must be externally mounted.

Surge Arresters

SELLER shall provide Station-class polymer surge arresters and the HV surge arrester mounting brackets with the plates drilled for 10" & 8 ¾" bolt circles. Arresters shall be 96 kV duty cycle, 76 kV MCOV either Siemens, GE, Ohio Brass or Joslyn.

63.0 Radiators shall be **fixed or removable.**

64.0 SELLER shall not provide the spare gaskets as stated in the Standard Requirements Specification.

65.0 SELLER shall provide Type I or Type II insulating oil.

66.0 CMP will supply auxiliary power as follows:

1. 120 VAC, single phase (cabinet lighting, receptacle, LTC control)
2. 240 VAC, single phase (cooling fans, oil pumps and cabinet heaters)
3. 125 VDC (sudden pressure relay)
4. 240 VAC LTC Motor Voltage

5. An alarm relay shall be required for the loss of AC power to the fans and pumps. Provide a normally open and normally closed contact wired to a terminal block.

67.0 Control Cabinet shall be located in segment 1 or 4.

68.0 Tests

1. Impulse test shall be performed.
2. Temperature test shall be performed on the first unit or a comparable unit.
3. Two Sweep frequency response tests for 115 kV transformers using the Doble method shall be performed 1) at the factory with the assembled transformer and 2) at first installation on site. Provide comparable sweep frequency response test results using the same configuration (in oil, with bushings, mid tap DETC, 16R LTC tap) for both tests. Peaks and nulls should overlay well.

69.0 CMP Loss Data (ONAN Rating)

- No Load Losses = $8,200 /kW
- Load Losses= $3,400 /kW

70.0 Monitoring and Accessories Required (required if indicated by "X")

__X__ Morgan Schaffer Systems Calisto dissolved hydrogen and water monitor, standard features.
_____ Provisions Only for a Syprotec Hydran Model 201.
_____ GE-Reuter Stokes Harley LTC Map 2130.
_____ Provisions Only for an LTC Monitor.
_____ Rochester Instrument Systems Co., Model AN-6100B, 26 Point Annunciator.
__X___ Qualitrol IED 505 Electronic Temperature Monitor for top main tank top oil, winding and LTC.
_____ Advanced Power Technologies TTC-1000-07404. To include LTC temperature and LTC differential monitoring and also RS-232 connection
_____ Provisions Only for Bottom Oil Temperature Gauge.
_____ Bushing Potential Devices: Quantity _____, Bushing _____.
__X__ Paralleling Using the Beckwith M-0115 Parallel Balancing Module & Beckwith M-0127A AC Current Relay.
__X___ Provide Aluminum Nitrogen Tanks (2 large per transformer)

71.0 Base height shall be a minimum of 6 inches with a 45 degree angle plate on each member to allow use of 4 inch diameter 4 foot long wooden rollers.

PROPOSAL REQUIREMENTS	
Item # 6 & 7	
OPCo:	**CMP/MPRP**
Division:	
Substation:	
SELLER Name:	
SELLER Proposal Number:	

Net unit price of one transformer delivered FOB Destination on pad.	$
Supply the following price adders that shall apply to any of the alternates:	
	$NA
	$NA
Noise Isolation Pad for Item #3	$
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA
	$NA

Central Maine Power

TRANSFORMER, SMALL AND MEDIUM POWER

STANDARD SPECIFICATION

SPECIFICATION:	SPT-1229
REVISION:	Rev. CMP-6
DATE:	February 17, 2010

PREPARED BY: Brenton Hill DATE: February 17, 2010

TRANSFORMERS, SMALL AND MEDIUM POWER
STANDARD SPECIFICATION

ATTACHMENTS
"Reference Transformer Schematic" Dwg. 31622-801 SH1 to SH4
"Transformer Fall Protection-115kV" Dwg. 01105-602
"Transformer Fall Protection-34kV" Dwg. 01005-603
"Drawing & Document Control"
"01330 Submittal"

When Specified:
"Pressure-Vacuum Bleeder/Gauge Gassing Device & Pressure Transmitter" Dwg. # 01105-600
"LTC Back-up Control and Alarm" Dwg. # 01105-601
"Elementary Diagram-LTC Control" Dwg. LTC_MVAJED and DDR-1847 Sh 2 &3

1.0 DEFINITIONS

1.1 CMP or Central Maine Power– an Iberdrola USA Operating Company, purchaser of the transformer detailed in this specification.

1.2 SELLER - The manufacturer and supplier of the transformer detailed in this specification.

1.3 TRANSFORMER - The power transformer(s) and all accessories to be supplied according to the requirements of this specification.

1.4 SMALL POWER TRANSFORMERS - Single-Phase maximum base nameplate ONAN rating of 5 MVA, three-phase maximum base ONAN rating of 10 MVA and with a high voltage winding of Nominal System Voltage of 46kV or below.

1.5 MEDIUM POWER TRANSFORMERS - Single-Phase maximum nameplate ONAN rating from 5 MVA through 33.3 MVA and three-phase ONAN rating from 10 MVA through 100 MVA and the primary winding rating from Nominal System Voltage of 34.5 kV to 115 kV.

2.0 SCOPE

2.1 The transformer will be applied in an outdoor electrical substation on CMP's power system. Unless otherwise specified, the transformer will be used for step-down and step-up operation. The transformer will not be applied as a generator step-up.

2.2 This specification defines the design, manufacture, test and delivery requirements for all Small and Medium power transformers supplied to CMP. It is not the intent of this specification to specify all technical requirements for transformers adequately covered by applicable codes and standards, but rather to insure that the SELLER provides a high quality transformer specific to CMP's needs.

3.0 STANDARDS

3.1 Unless specified to the contrary, the transformer supplied under this specification shall conform to the latest revision of all applicable ANSI (American National Standards Institute), IEEE (Institute of Electrical and Electronic Engineers), NEMA (National Electrical Manufacturers Association) standards and NESC (National Electrical Safety Code).

3.2 In the event of conflict, the transformer supplied under this specification shall conform first to this specification, followed by ANSI, NEMA and then NESC.

3.3 SELLER shall obtain written permission from CMP, in the form of an addendum to this specification, to deviate from this specification or the standards noted above.

3.4 Specific standards include, but are not limited to, the latest revision of:

3.4.1 ANSI C57.12.00 - General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

3.4.2 ANSI C57.12.10 - Safety Requirements for Transformers 230,000 Volts and Below; 833/958 Through 8,333/10,417 kVA Single-Phase and 750/862 Through 60,000/80,000/100,000 kVA Three-Phase without Load Tap Changing; 3,750/4,687 Through 60,000/80,000/100,000 kVA Three-Phase with Load Tap Changing.

3.4.3 ANSI C57.12.70 - Terminal Markings and Connections for Distribution and Power Transformers

3.4.4 ANSI C57.12.80 - Standard Terminology for Power and Distribution Transformers

3.4.5 ANSI C57.12.90 - Standard Test Code for Liquid-Immersed Distribution, Power and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers

3.4.6 ANSI C57.91 - Guide for Loading Mineral-Oil-Immersed Power Transformers

3.4.7 ANSI C57.98 - Guide for Transformer Impulse Tests

3.4.8 ANSI C57.131- IEEE Standard Requirements for Load Tap Changers

3.4.9 ANSI C57.19.00 - Standard General Requirements and Test Procedure for Outdoor Power Apparatus Bushings

3.4.10 ANSI C57.19.01 - Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings

3.4.11 ANSI/IEEE 100 - IEEE Standard Dictionary of Electrical and Electronics Terms

3.4.12 IEEE Std. 1538- IEEE Guide for the Determination of Maximum Winding Temperature Rise in Liquid-Filled Transformers

3.4.13 NEMA TR1-Transformers, Regulators, Reactors

3.4.14 NESC- National Electrical Safety Code

4.0 ENVIRONMENTAL AND SERVICE CONDITIONS

4.1 Transformer shall be designed for outdoor operation on a three-phase, 60-Hertz system.

4.2 The transformer shall be capable of satisfactory operation under the following outdoor operating and service conditions:

4.2.1 Winds - The basic wind speed associated with an annual probability of 0.02 is 70 miles per hour. At this velocity (and less), equipment will be exposed to blowing dust, sand, and precipitation.

4.2.2 Temperature - A range of -40 degrees C to +40 degrees C.

4.2.3 Elevation - Altitude will be less than 3300 feet above sea level.

4.2.4 Humidity - A range of 0% to 100%.

4.2.5 Seismic Loading -The equipment shall be designed to withstand damages or loss of function and shall remain operational during and after an earthquake in a Zone 2A area where a major destructive earthquake may occur as defined by the latest edition of the Uniform Building Code published by the International Conference of Building Officials. The transformer will not be bolted to the pad.

5.0 PHYSICAL DESIGN & CONSTRUCTION

5.1 GENERAL

5.1.1 Transformer shall be designed and constructed to withstand the mechanical and thermal stresses produced by external short circuits in accordance with ANSI/IEEE C57.12.00 Section 7, except that the symmetrical short circuit withstand be

determined using the transformer impedance only. This requirement shall be confirmed by the SELLER on the transformer nameplate and in the proposal.

5.1.2 The transformer shall be designed to withstand short circuit forces such that the change in leakage impedance on a per phase basis measured before and after a series of short circuit tests per ANSI C57.12.90 shall be less than 2%.

5.1.3 Transformer and all component parts (including bushings, CTs, leads, tap changers, etc.) shall be designed to carry short time and long-time emergency overloads in accordance with ANSI C57.91. The SELLER shall note this capability on the transformer nameplate.

5.1.4 The transformer shall be designed to carry the full nameplate rating in the step-down and step-up mode. There is no requirement for the load tap changer to regulate voltage in the step-up mode.

5.1.5 The transformer shall be capable of continuous operation at the capacities specified independent of the no-load tap changer position.

5.1.6 All transformer windings shall be of copper conductor. All transformer cores shall be laminated stacked steel with step lap joints.

5.1.7 All Medium Power Transformer windings shall be disk windings of circular construction. For Small Power Transformers and reactive LTC designs, the windings and reactors may be of layer rectangular construction.

5.1.8 All common hardware items such as light bulbs for the control cabinet, electrical fuses and fuse holders, etc., shall be standard components readily available in the U.S. Any exception to this must be clearly explained in the SELLER's proposal.

5.1.9 The transformer shall be constructed so that all electrical live parts meet the clearances described in the latest version of the National Electrical Safety Code (NESC), Section 12, "Requirements for Vertical Clearance of Unguarded Parts", Table 124-1 as noted below. Also the minimum height from the base of the transformer to the bottom of the bushing shall be 102".

Nominal Voltage	Min. Height to Electrical Live Part
115kV	139"
46kV	118"
34.5kV	114"
15kV	108"

5.1.10 Tertiary Windings

Transformers designed with a tertiary winding shall meet the additional following requirements:

5.1.10.1 The voltage output at the tertiary terminals shall lag the voltage input at the high-voltage terminals by 30 degrees.

5.1.10.2 The design of the tertiary windings shall properly suppress third harmonics and provide neutral stabilization.

5.1.10.3 One corner of the delta winding shall be accessible in the tank and tagged for testing. The corner of the tertiary winding is to be normally grounded. The cover of the transformer shall have a label identifying the tertiary winding test point location.

5.1.10.4 If specified that the tertiary winding will supply system loads, the transformer shall be capable of having the tertiary connected to a source that will contribute current to a fault on the primary or secondary side of the transformer. The SELLER on the transformer nameplate and in the proposal shall confirm these requirements.

5.1.10.5 If specified that the tertiary winding will supply system or station service loads, the tertiary shall be capable of withstanding three-phase, single-line-to-ground, double-line-to-ground, and line-to-line faults without sustaining damage according to ANSI/IEEE C57.12.00 Section 7. Additionally, the tertiary windings shall be designed to withstand induced or electrostatically transferred voltages from primary or secondary windings. The SELLER on the transformer nameplate and in the proposal shall confirm this.

5.2 HANDLING FACILITIES

5.2.1 Provide facilities for jacking the completely assembled, oil-filled transformer. Jacking facilities shall be located near the extreme ends of the junctions of the segments. Tank projections and foundation shall not interfere with jacking operation. Pulling holes shall be a minimum of 1.5" and shall be located at least 4" from the tank wall.

5.2.2 Lifting eyes or lugs shall be supplied to enable lifting the tank cover, core and coil assembly, and complete oil-filled transformer. The lifting eyes shall have a minimum 1.5" tie down holes. The bearing surfaces of the lifting means shall be free from sharp edges. Facilities for securing the transformer during shipment by truck or rail (as required) shall be provided.

5.3 TANK CONSTRUCTION

5.3.1 If vacuuming filling is required, the transformer shall be designed to withstand full vacuum experienced during vacuum oil filling in the field with all required arresters installed.

5.3.2 Tank cover shall be equipped with manholes. Manholes for Small Power transformers shall have a minimum diameter of 18 inches, if circular; and rectangular or oval manholes shall have minimum dimensions of 15 inches by 24 inches. Manholes for Medium Power transformers shall have a minimum diameter of 24 inches, if circular and rectangular or oval manholes shall have minimum dimensions of 21 inches by 27 inches. Manhole covers shall be of the same material as tank cover. Sheet metal covers are not acceptable.

5.3.3 The transformer base shall be constructed of channel iron with channel spacing separation of no more than 36 inches such that the unit may be rolled in either axis with four foot wooden rollers. The channel shall be installed flat side down. It shall be cut and welded at a 45 degree angle at the sides of the transformer to present a full width flat bottomed channel surface for insertion of the rollers on any side. A flat base is unacceptable.

5.3.4 The manufacturer shall show recommended location for pier supports on outline drawings.

5.4 OIL PRESERVATION SYSTEM

For transformers with a ONAN rating below 10MVA, a sealed tank preservation system shall be provided to protect the transformer oil from the atmosphere. For transformers with a ONAN rating 10MVA or above, an inert gas preservation system or a conservator with diaphragm shall be provided. These preservation systems shall be as described in C57.12.80.

5.5 PAINT

5.5.1 All exposed steel surfaces of the equipment shall receive a thorough painting. Painted surfaces shall not crack, chip, peel, or otherwise deteriorate due to normal operating conditions such as temperature change, exposure to weather, or contact with insulating liquid.

5.5.2 Surfaces to be painted shall be clean and free of moisture, oil, dirt, rust and foreign material. Surfaces shall be prepared for optimum paint adhesion by sand or shot blasting prior to painting.

5.5.3 Paint shall include one coat of rust inhibiting primer applied as soon as possible following surface preparation. After the primer is thoroughly dried, at least two coats of ANSI No. 70 gray finish paint shall be applied.

5.5.4 Top surface of transformer shall be painted with non-skid paint.

5.5.5 On Medium Power transformers, the tank internals shall be painted white.

5.5.6 One pint of touch-up paint and instructions for repairing scratches to the finish shall be furnished with this order.

6.0 COOLING SYSTEM

6.1 GENERAL

6.1.1 Forced cooling systems shall operate as defined in ANSI C57.12.10.

6.1.2 Each cooling stage shall have its own contactor and thermal circuit breaker.

6.1.3 A minimum of two (2) fans shall be provided.

6.2 CONSTRUCTION

6.2.1 Radiators

6.2.1.1 Unless otherwise specified, all Small Power transformer radiators shall be welded to the transformer tank if permitted by physical constraints. However, to avoid special shipping permits, either the width or depth should be not exceed twelve (12) feet. If both the width and depth of the transformer will exceed twelve (12) feet, then removable radiators shall be provided.

6.2.1.2 Radiators shall be capable of withstanding the same vacuum levels as the main tank, including full vacuum experienced during vacuum oil filling in the field.

6.2.1.3 If due to physical constraints the radiators must be the removable type, then all radiators shall be removable without draining oil from the main tank. Each radiator shall be equipped with shut-off valves at the top and bottom connections of the radiator piping system between the flange connections and the main tank, to allow the radiator to be removed without draining oil from any other part. Each removable radiator shall be equipped with a bottom drain globe-type valve with plug and a top vent plug.

6.2.1.4 All removable radiators shall be installed on the transformer by the SELLER prior to testing to verify that the radiator headers are in alignment with the radiator valves on the main tank. When disassembling the radiators, the SELLER shall label both the radiators and respective radiator valves to which they were installed at the factory. This will allow CMP to field install the radiators to the same radiator valves on the main tank.

6.2.2 Fan and Pump Motors

6.2.2.1 All fan and pump motors shall be rated 230 VAC single-phase, 60 Hz unless otherwise specified.

6.2.2.2 Each motor shall have self-resetting thermal overload protection.

6.2.2.3 All motors shall be connected to terminal blocks in the control cabinet described in Paragraph 7.0 below. The voltage source is to be supplied by CMP.

6.2.2.4 All fans shall be equipped with guards having not more than 1/2 inch spacing in accordance with OSHA requirements.

6.3 CONTROL

6.3.1 For Small Power Transformers, cooling system control in the automatic mode shall be provided by the top oil temperature indication.

6.3.2 For Medium Power Transformers, cooling system control in the automatic mode shall be provided by an Electronic Temperature Monitor. Acceptable devices are either Qualitrol 509-100 or Advanced Power Technologies TTC-1000. RTD probes are required. Monitor the top oil temperature, bottom oil temperature, simulated winding temperature and LTC oil temperature (if specified). (See Section 11.6 for details)

6.3.3 Each stage of cooling shall be capable of being controlled manually. Provide an auto-manual switch to select either automatic or manual mode of control of cooling equipment. Selection of the manual mode shall block automatic control. Provide a normally open alarm contact to close when the manual switch position is selected.

7.0 CONTROL CABINET

7.1 GENERAL

7.1.1 A control cabinet shall be supplied for the purpose of housing all auxiliary wiring and devices for the control, operation and monitoring of the equipment.

7.1.2 The control cabinet shall be mounted on ANSI segment No. 1 unless otherwise specified.

7.2 CONSTRUCTION

7.2.1 The cabinet supplied shall be a NEMA 3R weatherproof enclosure as defined in ANSI/IEEE 100 and NEMA standard 250.

7.2.2 Cabinet shall be fabricated of steel plate with sufficient thickness to prevent warping and buckling. Cabinets for Small Power Transformers shall be not less than No. 14 US Gauge steel and Medium Power shall be not less than No. 12 US Gauge steel.

7.2.3 The minimum height from the base of the transformer to the bottom of the control cabinet shall be 24".

7.2.4 The maximum height from the base of the transformer to the center line of control cabinet shall be 60". All interior parts shall be readily accessible from base level.

7.3 DOORS AND PANELS

7.3.1 All doors shall be vertically hinged allowing full access to all equipment inside and shall have a latching device to lock it in the full open position. The door shall latch close and have provision for padlocking.

7.3.2 Double doors hinged for center opening and properly braced shall be provided when necessary to maintain maximum individual door width of 50 inches.

7.3.3 The cabinet door shall have a pocket on the inside, away from the cabinet heater, where one copy of the instruction book and one set of prints may be stored.

7.3.4 Control cabinet panel shall be hinged to allow full access to all equipment.

7.4 CONDUIT ENTRANCE

7.4.1 The bottom of the control cabinet shall be provided with knockouts or a removable plate for the termination of a minimum of 3-3" conduits for Small Power Transformers and 4 - 3" conduits for Medium Power Transformers.

7.5 CONTENTS

7.5.1 Layout

7.5.1.1 Provide a minimum of 6" of unused space at the bottom of the cabinet, which is completely clear of any devices, terminal blocks or internal wiring. This space is required to maneuver CMP-installed control cables that enter from the bottom of the cabinet to their respective terminal block positions.

7.5.2 Terminal Blocks

7.5.2.1 All bushing current transformer secondary leads shall be wired to short circuit type terminal blocks. A "States" sliding link terminal deck shall be provided for the CMP provided potential for the LTC controls. Insulating barrier-type terminal blocks shall be provided for all other control wiring. All

terminal blocks shall be a minimum of 600 Volt, 30 Amp, with #10-32 washerhead binding screws.

7.5.2.2 Every terminal block and every terminal point shall be clearly identified and labeled with permanent labels corresponding to SELLER supplied drawings. Current transformer secondary leads shall be identified per NEMA SG-4.

7.5.2.3 Terminal blocks shall be provided for all wiring that requires external connection to CMP control and power cables.

7.5.2.4 A sufficient number of blocks shall be used such that no more than two wires need be terminated under one screw.

7.5.2.5 A minimum of ten percent spare terminal block connection points shall be provided for CMP use.

7.5.2.6 Terminal blocks shall be conveniently mounted such that there is a minimum of four inches of clear unobstructed space adjacent to the terminal blocks for routing and connection of CMP supplied control cables. There shall be a minimum of eight inches of clear unobstructed space if the terminal blocks are mounted in two rows or columns such that CMP-supplied control cables may be routed and terminated between the terminal blocks.

7.5.2.7 Separate terminal blocks, equipped with a hinged cover or other means to prevent direct contact, shall be provided for connecting AC and DC auxiliary power. Terminal blocks shall be located remote from all control and monitoring terminations. CMP will provide AC and DC auxiliary power as specified. SELLER shall specify auxiliary AC and DC power requirements on SELLER-supplied drawings.

7.5.2.8 Terminal blocks for BCT wiring shall be installed in the control cabinet in a position where they are easily accessible by CMP technicians. The location of other equipment in the control cabinet shall not impede access to these terminal blocks.

7.5.3 Wiring

7.5.3.1 Control and heater circuit wiring shall be sized for load current and voltage drop but shall not be smaller than #14 AWG stranded copper.

7.5.3.2 Current transformer secondary wiring shall be a minimum of #12 AWG copper.

7.5.3.3 All low voltage circuit conductors shall have an insulated covering that is flame, oil, heat and moisture resistant. Wire insulation shall be rated for a conductor maximum operating temperature of 90°C. SELLER shall identify wire insulation type to be used in their proposal.

7.5.3.4 All electrical control circuit wiring and mechanical cables between ancillary devices, or between ancillary devices and the control cabinet shall be routed in rigid steel conduit or metallic wireways.

7.5.3.5 Ring type terminal lugs shall be used for all wiring.

7.5.3.5 The conductor shall be extra flexible copper for hinge wiring. Flexible connections between stationary and hinged panels or doors shall be made between terminals blocks or clamps in such a manner as to afford flexibility without damage to the wires or insulation.

7.5.3.6 The SELLER shall design the control cabinet to accommodate the termination of the following control and power cables to be supplied by CMP. All cables are stranded copper.

AC Power - #10 to #6 AWG (single conductor)

DC Power - #10 to #6 AWG (single conductor)

Control - #10 AWG (multiple conductor)

Alarm - #14 AWG (multiple conductor)

7.5.4 Heaters

7.5.4.1 Thermostatically controlled heater(s) shall be furnished in the main control cabinet and all other enclosures to prevent condensation. Provide a shield to prevent direct contact with the heater element. Heater(s) shall be protected by a properly sized low voltage circuit breaker or a pull-out type BUSS fuse.

7.5.5 Lighting

7.5.5.1 Lighting shall be provided, at 120 Volts, to illuminate all work areas inside the control cabinet. Lamp(s) shall be controlled by a door switch and shall light only when control cabinet door is open. Lamp(s) shall be protected by a removable guard. Standard US lamp sockets shall be supplied.

7.5.6 Receptacle

7.5.6.1 Provide a 120 V, 20 A, three-wire, UL approved, GFI (Ground Fault Interrupting) duplex convenience receptacle. Receptacle shall be located on the control cabinet and shall be protected by a properly sized low voltage circuit breaker or a pull-out type BUSS fuse.

7.5.7 Potential Circuit Protection

7.5.7.1 Dead front, fusible disconnect blocks shall be used for all potential circuits. Fuse block caps shall be fastened to the mounting bolt of the associated block with 1/8 inch braided nylon rope with a terminal ring lug and barrel connector. A nameplate shall be affixed and indicate the function of the fuse block.

7.5.7.2 Dead front, fusible disconnect blocks are obtained from H.C. Zang Agency Inc., 64 Prairie Ave, Buffalo, N.Y., Phone (716-877-3882) shall be used for all potential and control circuits. Only the following fuse blocks are approved:

30 Amp, single pole, Cat# PFS3311

30 Amp, double pole, Cat# PFS3322

30 Amp, three pole, Cat# PFS 3333

60 Amp, double pole, Cat# C60-2

8.0 TRANSFORMER ACCESSORIES

8.1 NO-LOAD TAP CHANGER (S)

8.1.1 The ratio adjuster(s) for de-energized operation shall be manually operated and should be located above the core and coil assembly. The no-load tap Changer shall have a handle brought out through the tank wall at a height convenient to transformer design.

8.1.2 For Medium Power Transformers, if the no load tap changer must be located on the side of the core and coil assembly, a minimum of 18" between the no- load tap changer and tank wall must be provided. If this requirement cannot be met, removable inspection plates shall be furnished. Inspection plates shall be bolted in place and have a heat resistant gasket between the plate and flange.

8.1.3 The operating handle shall have provision for padlocking in any position. Tap position indication shall be visible without unlocking.

8.1.4 Unless otherwise specified, no-load taps shall be provided in the high voltage winding at +/-5% and +/-2.5% of the nominal voltage rating.

8.2 BUSHINGS

8.2.1 All bushings shall be supplied from either LAPP, ABB or Haefley-Trench. LAPP and ABB are preferred.

8.2.2 All bushings rated 23kV and above shall be oil impregnated, condenser type bushings with oil level gauge or oil sight glass. Bushings shall meet or exceed all requirements detailed in ANSI C57.19.00 and C57.19.01, and shall be interchangeable between equipment. The electrical and dimensional characteristics of the bushings shall be as specified for the appropriate insulation class in IEEE 24.

8.2.3 All bushings assemblies supplied shall have continuous, short term emergency, and long term emergency current ratings and BIL ratings such that the bushing will not limit the associated equipment ratings.

8.2.4 The manufacturer shall furnish "draw lead" or "draw rod" type bushings wherever possible for the high voltage, low voltage and neutral bushings. The transformer leads shall be secured to the bushing cover plate for easy access without removing transformer oil. If a "bottom connected" bushing is to be supplied, it shall be so noted on the outline diagram. Type and wire size of draw lead shall be noted on the outline diagram.

8.2.5 A bushing test tap to facilitate power factor testing shall be supplied on all oil-filled, condenser-type bushings. All bushings rated 450 kV BIL and above shall be supplied with bushing potential taps. Bushing potential taps shall be equipped with a filling plug to facilitate refilling the chamber with oil after testing. Bushing outline drawings shall show a detail or description of the taps.

8.2.6 Power factor and bushing capacitance tests are required on all completely assembled bushings to determine the power factor and capacitance of the bushings. The power factor shall not exceed 0.5% when corrected to 20 degrees

C. The actual power factor, capacitance and test temperature shall appear on the bushing nameplates.

8.2.7 The actual bushings to be supplied with the transformer shall be used in all transformer tests.

8.2.8 All porcelain column assemblies shall be constructed of good commercial grade porcelain with all surfaces free from imperfections. All surfaces that are exposed to the atmosphere shall be glazed. Each porcelain component shall be tested according to ANSI C29.1. All porcelain components having an internal pressure shall comply with requirements specified in ANSI C37.076, including provisions for pressure relief devices. Porcelain shall be ANSI No. 70 sky gray.

8.2.9 CMP will approve only current catalog model number bushings. Specific supplier and model numbers shall be stated in the Bid Proposal.

8.2.10 The terminal brazed to the draw lead shall have 1-1/4" -12 thread for 115kV and above and 3/4" - 12 thread below 115kV. This thread is not to be confused with the external terminal thread.

8.2.11 When tank cover mounted bushings are specified, the minimum phase spacing of115kV- 60 inches, 34.5kV-36 inches and 18" for 15kV or below shall be provided as measured from the center line of the bushing stud.

8.2.12 When tank wall mounted bushings are specified, bushings shall be enclosed in an air terminal chamber (cable compartment) mounted on the side of the transformer. Refer to Air Terminal Chamber specifications in Section 8.9.

8.2.13 Each bushing shall be supplied with a standard NEMA four-hole terminal pad.

8.3 BUSHING CURRENT TRANSFORMERS

8.3.1 GENERAL

8.3.1.1 Current Transformer's shall be bushing type and shall meet or exceed all requirements set forth in ANSI C57.13.

8.3.1.2 Thermal rating factor of these CTs shall be 2.0 on all taps.

8.3.1.3 The CTs shall not affect BIL rating of equipment in which they are installed.

8.3.1.4 When provisions for the future addition of CTs are specified, SELLER shall furnish bushings of sufficient size to install the future CTs, space in the control cabinet for future CT terminal blocks, and space for routing leads from the CT to the terminal block.

8.3.1.5 Six terminal points shall be supplied per CT secondary (i.e. one spare terminal point shall be supplied directly adjacent to and between each group of five CT secondary leads, the spare terminal point shall be grounded and permanently affixed to the short circuiting strip).

8.3.1.6 The conductor runs from the current transformer junction box to the short circuiting blocks within the main control cabinet shall be continuous.

8.3.1.7 Terminal blocks for CT wiring shall be arranged so as to terminate all secondary windings of each CT in consecutive fashion in accordance with

the bushing on which the CT is mounted. See "Sample CT Terminal Block Position Diagram for CT Secondary Wiring" attached to this specification.

8.3.2 Relay Accuracy Class Current Transformers

8.3.2.1 Relay Accuracy CTs shall be five-lead multi-ratio type with fully distributed secondary windings. Secondary resistance shall not exceed 0.0025 ohms/turn.

8.3.2.2 The excitation voltage at the knee of the full-winding secondary excitation characteristic shall be minimum of 2 volts/turn for CTs specified as C800 and a minimum of 0.75 volts/turn for CT's specified as C400. The knee of the curve shall be defined by a 45° tangent drawn on the full-winding excitation curve plotted on log-log paper. CTs specified as C200 and below shall have excitation voltage characteristics as defined by ANSI C57.13.

8.3.3 Metering Accuracy Class Current Transformers

8.3.3.1 Metering accuracy CTs shall be single or dual ratio. Thermal rating factor, independent of the specified metering accuracy current transformer continuous current rating, shall not limit the current carrying capability of the transformer. This includes the short time emergency, long time emergency and the continuous current carrying capabilities of the transformer.

8.3.3.2 All metering accuracy CTs shall be rated 0.3B-1.8 according to ANSI C57.13. This rating shall apply to both taps when dual ratio CTs are specified. Each CT shall be tested for actual phase angle correction factors and ratio correction factors measured at B-0.1 through B-1.8 ohm burdens at each standard tap. These measurements shall be made at 10%, 50%, 100%, and maximum rated current (based on the primary thermal rating factor specified), and the measurements should be made at .9 power factor.

8.3.3.3 Metering accuracy CT's shall be mounted closest to the bottom of the bushing.

8.4 GROUNDING

8.4.1 General

8.4.1.1 Any metal non-current-carrying parts that are to serve as grounding conductors shall be effectively bonded to assure electrical continuity to conduct safely any fault current likely imposed on them. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces or be connected by means of fittings so designed as to make such removal unnecessary. (Reference NEC article 250-75).

8.4.1.2 All grounding requirements specified herein shall be clearly detailed on review and final drawings.

8.4.2 Tank

8.4.2.1 Provide a total of two stainless steel or copper-faced pads on diagonally opposite corners near of the equipment base for grounding purposes. Each pad shall have a two-hole NEMA standard drilling of 1/2-13UNC-2A (tapped holes) a minimum of 1/2" deep.

8.4.3 Control Cabinet

8.4.3.1 The inside of each control cabinet shall be equipped with a copper ground bus bar, located so as to facilitate control cable installation. It shall have minimum dimensions of 1/4" thick by 1" width. The length shall be sufficient for equipment wiring requirements or to provide a minimum of 10 (ten) drilled and tapped holes approximately 1-1/2" apart. Provide washer head binding screws (#10-32) for each hole. Provide any standoff necessary to allow proper seating of the screws. The ground bus shall be electrically bonded to a servit post or equivalent type connector mounted on the outside of the control cabinet. The external connector shall accept a minimum of a 4/0 cu. cable and the bond to the ground bus shall be equivalent.

8.4.4 Ground Bus

The following is the preferred Ground Bus arrangement:

8.4.4.1 Provide one ground bus in segment 1 and one ground bus segment 3, routed conveniently for the purpose of grounding surge arresters and any neutral bushings. If a tertiary is specified, an additional ground bus shall be supplied for grounding the tertiary surge arresters. Each ground bus shall be constructed of copper bar and be equivalent to at least 1-4/0 awg copper wire. Each shall begin near the base of the transformer, run up the side of the transformer tank to the cover height, span the entire length of the transformer, run down the transformer tank and conclude near the base of the transformer.

8.4.4.2 Provide a two-hole NEMA drilling near each surge arrester location and (2) two-hole NEMA drillings near each neutral bushing. The end of each ground bus shall also have a two-hole NEMA drilling to provide for a connection to the substation ground grid. CMP will provide the material to connect to the ground bus in all cases listed above.

The following is the acceptable Ground Bus arrangement for Small Power Transformers only:

8.4.4.3 Welded nuts which can accept ½" - 13TPI bolts shall be provided on the tank for the attachment of high and low voltage surge arrester and neutral bushing grounding leads. Nuts for the surge arresters shall be provided to allow grounding leads to be looped up to the arresters and back down to the station ground grid.

8.4.4.4 Provide a two-hole NEMA drilling near each surge arrester location and (2) two-hole NEMA drillings near each neutral bushing.

8.4.5 Transformer Core

8.4.5.1 The transformer core(s) shall be grounded to the tank using disconnectable strap(s). Each strap shall be identified.

8.4.5.2 Connection bolts shall be captive and ground strap(s) shall be of slotted spade design.

8.4.5.3 The core(s) ground connection shall be external to allow for testing of the core(s) ground without opening the oil preservation system and exposing core/coil assembly to the atmosphere. The external connection shall be provided by a porcelain grounding bushing.

8.4.5.4 The core ground connection shall be located near the top of the main tank. Details and location of core ground connection(s) shall appear on the outline drawings.

8.4.5.5 The core ground connection shall be provided with a metal cover to protect the bushing from damage.

8.5 VALVES AND FITTINGS-Main Tank

8.5.1 Tank shall be supplied with 2" NPT valves at the top and bottom for filter press connections. Lower valve shall be suitable for complete tank drainage and equipped with a 3/8" sampler.

8.5.2 If removable type radiators are provided, the tank shall be equipped with upper and lower valves to facilitate radiator attachment or removal.

8.5.3 All vacuum connections shall be 3" NPT nipple welded to the tank with a 3" NPT cap as a cover.

8.6 SURGE ARRESTER BRACKETS

8.6.1 General

8.6.1.1 Provide brackets for mounting intermediate or station class surge arresters adjacent to the high, low, and tertiary voltage bushings.

8.6.1.2 Arresters mounting shall be a 10" diameter bolt circle for Station Class arresters and 8 ¾" for Intermediate Class arresters.

8.6.1.3 The transformer shall be designed to allow the installation (by CMP) of any of the surge arresters specified.

8.6.2 High Voltage

8.6.2.1 Locate brackets such that arrester tops shall be approximately the same height as the associated terminals.

8.6.3 Low and Tertiary Voltage

8.6.3.1 Unless otherwise noted, locate brackets so their center to center spacing exceeds the bushing center to center spacing by at least seven inches.

8.7 ANCILLARY DEVICES/GAUGES

8.7.1 General

8.7.1.1 All devices and gauges supplied with the transformer shall be included in SELLER's warranty.

8.7.1.2 All gauges, counters, fluid level indicators, and running time indicators shall be readable from ground level without the use of a ladder.

8.7.1.3 When re-settable devices are specified, the reset shall be operable from grade level.

8.7.1.4 All alarm contacts shall be wired to terminal blocks in the control cabinet.

8.7.1.5 All exposed wiring and cables shall be routed as close as possible to the tank wall in rigid conduit.

8.7.1.6 When any compartment (LTC, etc.) is equipped with a dehydration type breather, the breather shall be located so that it can be serviced from grade level.

8.7.2 Main tank of the transformer shall be equipped with the following:

8.7.2.1 The main tank shall have one (1) magnetic oil-level indicator to monitor liquid level conditions. The indicator shall be installed and adjusted to alarm at low liquid level before the BIL of the transformer is reduced.

8.7.2.2 Mechanical Pressure Relief Device - with mechanical target and alarm contact.

8.7.2.3 Provide Bottom Oil Temperature Gauge- with resettable drag indicator.

8.7.3 Additional Devices/Gauges for Small Power Transformers:

8.7.3.1 Top Oil Temperature Gauge - with re-settable drag indicator and adjustable alarm contacts. Adjustable contacts for automatic control of each stage of forced cooling shall also be provided.

8.7.4 Additional Devices/Gauges for Medium Power Transformers:

8.7.4.1 Electronic Temperature Monitor- Qualitrol IED 509 or Advanced Power Technologies TCC-1000. (See Section 11.6 for details)

8.7.4.2 Sudden Pressure Relay - Qualitrol Model 900-004-03 (with vent type VNT-602-1) mounted on a shut-off valve near the base of the unit under oil is preferred. ABB Sudden Pressure Relay or Qualitrol Model 910-005-03 (with vent type VNT-601-1 for vertical mounting or VNT-602-1 for horizontal mounting) mounted above the maximum oil level in the gas space is acceptable. Device to be used in conjunction with a DC operated seal-in circuit. Furnish alarm and trip contacts, a manual reset switch and an amber lamp to indicate circuit operation.

8.7.5 Additional Devices/Gauges for Sealed Tank System:

8.7.5.1 Pressure Vacuum Bleeder Device - This device shall provide relief for excessive internal gas pressure resulting from gradual changes (ie., load or ambient conditions). Mechanism shall operate below minimum setting of mechanical pressure relief device located in the main tank of the transformer. The device shall be located at eye level.

8.7.5.2 Pressure-Vacuum Gauge with Sample Valve - The gauge and sample valve shall be located at eye level.

8.7.6 Additional Devices/Gauges for Inert Gas Pressure System:

8.7.6.1 Bottle of Nitrogen Gas. If specified, the nitrogen tanks shall be made of aluminum.

8.7.6.2 High/Low gas detection system with alarm contact on main tank.

8.7.6.3 A low gas pressure detection system with alarm on nitrogen bottle.

8.8 BUSHING POTENTIAL DEVICES

8.8.1 When specified, mounting space and provisions shall be included for the field addition of a General Electric or ABB bushing potential device off of each primary bushing (where primary side is 115 kV only). The space and mounting provisions shall be located such that no device center line shall be higher than 60" above the transformer base. Dead front pull fuses shall be supplied in the control cabinet for these devices.

8.9 AIR TERMINAL CHAMBER

Air terminal chambers (cable compartments) are to be provided when wall mounted bushings are specified. Power cables are to be installed by others in these air terminal chambers.

8.9.1 The cable compartment shall be fully enclosed, ventilated and extend at least half way down the height on the transformer. It must have removable cable supports and removable bolted cover(s) which when weighing more than 45 pounds shall be hinged and removable with lifting eyes. Cover(s) weighing less than 45 pounds shall have hinges or handles for use in removal. Also, a lowering hoist support eye shall be installed on the top of the transformer in line with the cover lifting eyes. A removable plate shall be provided in the bottom of the compartment to connect conduit during field installation.

8.9.2 The cable supports and bushing bus bar system shall be sized to accept 6-750KCM or 4-1000KCM EPR insulated cables per phase. The bushing bus bar system shall be supported from the cable compartment. Surge arresters within a cable compartment shall not be used to support the bushing bus bar system. Support of the bushing bus bar system from the bushing itself is not acceptable. Cable terminations that will connect to the bushing bus bar will be crimp type, 2 hole flat, with standard NEMA spacing. Sufficient space between the cable terminations shall be supplied to allow for skirted cable terminations. Provisions for lighting arresters shall be provided even though they may not be specified. See Cable Compartment Details, DWG. No. 01105-607.

8.9.3 A 4/0 Cu ground wire shall be run up the inside of the compartment through the connections (ground and/or neutral) and down the other side. Sufficient length of ground wire shall be coiled up from both ends to provide connections to the site grid. The manufacturer shall attach this ground conductor to the transformer tank wall by drilling 9/16 holes and installing Burndy GB-29 connector or equivalent. Attachments should be 30 inches apart and shown on the outline drawing. See Cable Compartment Details, DWG. No. 01105-607.

8.10 SPARE PARTS

8.10.1 When specified, the following spare parts shall be supplied:

One - Manhole Gasket

One - High-Voltage Bushing Gasket

One - Low-Voltage Bushing Gasket

One - Tertiary Bushing Gasket

Two - Radiator Gaskets

One - Load Tap Changer Door Gasket(s)

One - Oil Pump Gasket

8.10.2 Provide all special tools required for installation, maintenance, or adjustment of transformer. Identify and mark all special tools by name and number. Cross-reference all drawings and instructions with these names and numbers so that the application of these tools is easily understood and replacements can be ordered if necessary.

8.10.3 All spare or special parts shall be identified and packed in a secure storage box for shipment with the transformer.

9.0 LOAD TAP CHANGER

9.1 LTC DEFINITIONS

9.1.1 Raise: an increase in the voltage on the secondary terminals.

9.1.2 Lower: a decrease in the voltage on the secondary terminals.

9.1.3 Remote Control: operation of the load tap changer from CMP's switchboard in the substation control house or any controls external to the transformer control cabinet.

9.1.4 Local Control: operation of the load tap changer from the transformer controls within the control cabinet.

9.1.5 Automatic Operation: the voltage regulating equipment of the load tap changer control to monitor the secondary voltage and operate the load tap changing mechanism as necessary.

9.1.6 Manual Operation: the RAISE/LOWER commands are to be initiated by a human operator either at the transformer (local) or from a remote location.

9.1.7 Non-Sequential Operation: the load tap changing mechanism comes to a complete stop at the completion of each step, and a new or repeat command shall be required to raise or lower the mechanism to the next step and each subsequent step.

9.1.8 Sequential Operation: the load tap changing mechanism is to operate continuously (no time delay between subsequent steps) as directed by the voltage regulating equipment. Sequential control circuitry shall incorporate an

initial time delay (adjustable from 0-120 seconds) prior to the first load tap changer operation.

9.2 GENERAL

9.2.1 The LTC provided shall utilize a vacuum interrupter design. The preferred load tap changer is Reinhausen Type RMV. Other acceptable LTC's are PTTI's V1 or V2A, Waukesha's UZD and ABB's UZE and UZF.

9.2.2 The load tap changer shall operate in 32 equal (5/8%) steps (33 positions) total, 16 above and 16 below nominal, and it shall provide 20 percent total voltage range.

9.2.3 The load tap changer shall be provided with reduced capacity taps for taps below the rated voltage as described in ANSI C57.12.10.

9.3 CONTROLS

9.3.1 Automatic LTC control equipment shall include a Beckwith model M2001BC2 tap-changer control unit with the M-2067/Modification 299 (to provide local and remote voltage reduction). Provision made to support inter-tap- time delay feature of the M2001BC2 shall be made.

9.3.2 Automatic LTC control shall include a Beckwith LTC backup control, Model #M0329B, to electrically block LTC operation for voltage output levels outside a preset range of 105 to 130 volts. For voltages below 105 volts, the LTC lower operation shall be blocked. For voltages above 130 volts, the LTC raise operation shall be blocked. The M0329B alarm output shall be installed into a time delay alarm relay circuit, which alarms if the out of range voltage condition exists for more than three (3) minutes. This delay alarm circuit shall also monitor the LTC drive motor and control voltage. A .0047 microfarad capacitor shall be applied across terminals 15 and 16 of the M0329B. The LTC backup control and alarm scheme shall be in accordance with the attached drawing 01105-601. The run back feature of the M0329B is not to be wired out. The voltage sensed by the backup control shall be direct from the source of potential. This voltage shall not be affected by either the compensation circuit of the LTC control or operation of the voltage reduction unit. Manual operation shall override LTC control blocking with the exception of critical low oil level blocking. LTC backup control unit shall be mounted to be fully visible when cabinet door is open.

9.3.3 Manufacturer shall insure that loss of potential to the voltage regulating control will also prevent operation of the tap-changing drive mechanism. The LTC control circuit shall be designed so a loss of LTC sensing potential (furnished by CMP) shall not be considered a low voltage condition. Furnish an alarm to indicate loss of sensing potential.

9.3.4 (If specified) Paralleling Using the Circulating Current Method shall utilize the following components:

Beckwith M-0115 Parallel Balancing Module

Beckwith M-0127A AC Current Relay

The single output contact of the Beckwith M-0127A requires a contact multiplier auxiliary relay with output contacts blocking the tap changer and alarming the transformer annunciator for excessive circulating current.

9.3.5 If specified, the LTC controls shall operate in conjunction with the devices and controls indicated on the CMP drawing DDR-1847. Drawing DDR-1847 shall be incorporated into the SELLER's LTC elementary diagram. If supervisory control is not presently required, indicate jumper connections required for proper operation.

9.3.6 Provide an incomplete step alarm. The normally open, time delayed alarm contacts shall close if the tap changer fails to make a complete tap change. These contacts shall not close for a normal raise-lower operation or during a momentary loss of AC power.

9.4 CONSTRUCTION

9.4.1 Compartments

9.4.1.1 All current carrying and all interrupting contacts of the load tap changer shall be located in sealed compartment(s) separate from the main transformer.

9.4.1.2 Compartment(s) and barrier(s) shall be designed to allow the periodic draining and refilling of oil from the LTC compartment(s) without removing oil from the main tank.

9.4.1.3 If vacuum filling is required, then the compartment(s) and barrier(s) shall be designed and braced to withstand full vacuum without removing oil from the main tank.

9.4.2 Valves and Fittings

9.4.2.1 One 1" minimum NPT valve shall be located on the underside of each compartment to facilitate complete oil drainage. Valve shall be equipped with a 3/8" side-sampling valve. One top vent plug shall be provided unless vacuum connections are required.

9.4.2.2 If vacuum filling is required, provide a 1" minimum NPT type threaded connection point.

9.4.3 Hand Crank

9.4.3.1 Provide a hand crank for operation of the load tap changing mechanism. A safety switch shall be provided, interlocked with the hand crank mechanism, so the motor circuit is opened when using the hand crank. The hand crank mechanism shall be marked to show the direction of operation for raise and lower.

9.4.4 Operation Counter

9.4.4.1 A load tap changer operation counter shall be furnished.

9.4.5 Switches

When specified, the following switches shall be provided:

9.4.5.1 A Raise/Lower switch shall be furnished for control of the load tap changer. Switch shall be spring loaded to the center "OFF" position. Switch action shall be up for raise and down for lower operations, or the pointer shall

move to the left for raise and to the right for lower operations, per the Escutcheon.

9.4.5.2 A Remote/Local switch at the transformer shall be furnished so the transformer may be operated from CMP's remote switchboard. This switch will prevent remote operation from control room or by supervisory control equipment when in the local position and will prevent local operation when in the remote position.

9.4.5.3 An Auto/Manual switch shall be furnished to select either automatic or manual operating mode. The switch shall either have two positions or will be spring-loaded to a center "OFF" position depending on the need for supervisory control as specified. A latching auto/manual relay will be supplied by CMP when the three-way switch is required. Provide two lamps at transformer to indicate position of the AUTO/MANUAL relay.

9.4.5.4 The raise/lower and the remote/local switches shall be either General Electric type SB-1 or SBM ElectroSwitch Series 24.

9.4.6 Line Drop Compensating Current Transformer

9.4.6.1 A current transformer shall be supplied to input to the LTC voltage regulating relay to compensate for voltage drop in feeder lines supplied by the transformer.

9.4.7 Ancillary Devices/Gauges

Load tap changer shall be equipped with the following:

9.4.7.1 Oil Level Gauge- The LTC compartment shall have one (1) magnetic liquid level indicator, to monitor liquid level conditions. Alarm shall be provided at low oil condition. Electrical operation of the LTC, (both automatic and manual) shall be blocked at critical low oil level. This is to prevent LTC operation with an inadequate level of oil

9.4.7.2 Mechanical Pressure Relief Device - with mechanical target and alarm contact.

9.4.7.3 Sudden Pressure Relay - If the LTC compartment is sealed (no vent or breather), then a sudden pressure relay shall be supplied. Qualitrol Model 900-004-03 (with vent type VNT-602-1) mounted on a shut-off valve near the base of the unit under oil is preferred. ABB Sudden Pressure Relay; or Qualitrol Model 910-005-03 (with vent type VNT-601-1 for vertical mounting or VNT-602-1 for horizontal mounting); or ABB Pressure Control Contact for Load Tap Changers mounted above the maximum oil level in the gas space are acceptable. Device to be used in conjunction with a DC operated seal-in circuit. Furnish alarm and trip contacts, a manual reset switch and an amber lamp to indicate circuit operation.

9.4.7.4 Pressure Vacuum Bleeder Device - For sealed LTC compartments, a pressure vacuum bleeder device shall be supplied. This device shall provide relief for excessive internal gas pressure resulting from gradual changes (i.e., load or ambient conditions). The mechanism shall operate below minimum setting of the mechanical pressure relief device located in

the LTC compartment. The device shall be located at eye level.

9.4.7.5 Pressure-Vacuum Gauge with sampling valve - For sealed LTC compartments, a pressure-vacuum gauge with sampling valve shall be supplied and shall be located at eye level.

9.5 LTC POSITION INDICATOR

One of the following LTC Position Indicator Schemes as indicated in the Specific Specification shall be provided:

9.5.1 Alternate 1:

9.5.1.1 Local Indication

A mechanical tap position indicator shall be located such that it is clearly visible to the operator when the tap changer is operated using the hand crank. Indicator shall be at highest tap position when the controlled winding is at the highest output voltage. The indicator shall operate as described in ANSI C57.12.10 Section 6.4.

9.5.1.2 Transmitter

The tap position indicator assembly shall include a selsyn or equivalent device for output to the remote LTC position indicating device specified below. A 90 VAC L-L maximum output shall be provided.

9.5.1.3 Receiver

Provide an LED digital display receiver with analog tap position output for SCADA (INCON Model 1250 LTC 0-I, 0-1mA output with the Input Isolation option or equivalent) to indicate tap changer position at CMP's remote switchboard. The device shall be suitable for mounting on a 1/8" thick steel panel.

9.5.2 Alternate 2:

9.5.2.1 Tap Position by Positive Knowledge (current loop) shall consist of the following arrangement: A 1280 ohm pot - MM4003 Potentiometer Transmitter with a 0-1 mA output range made by Wilkerson Instrument Co. with a Beckwith M-2025B current loop interface module.

10.0 SUMMARY OF ALARMS

The following is a summary of the devices/gauges and functions that require an alarm contact. The alarm shall be dry-contacts; "C" form and have a rating of 120 VDC and ½ amps.

10.1 MAIN TANK

Low Oil Level
Top Oil Temperature
Pressure Relief Device
Vacuum/Pressure Gauge (Sealed Tank)
High/Low Gas (Inert Gas)
Low Gas Pressure (Inert Gas)
Medium Power Only:
Winding Temperature Indicator
Sudden Pressure Relay

10.2 COOLING EQUIPMENT CONTROLS

Auto/Manual Switch Position
Loss of AC Power

10.3 LOAD TAP CHANGER

Low Oil Level
Pressure Relief Device
Sudden Pressure Relay
Incomplete Step
Loss of LTC Sensing Potential
Loss of Vacuum for Vacuum Interrupter Bottles
Medium Power Only:
LTC Oil Temperature
LTC/Main Tank Oil Delta

11.0 MONITORING

When specified the following equipment shall be provided:

11.1 GE-REUTER STOKES SYPROTECH HYDRAN

11.1.1 The manufacturer shall furnish a Hydran Model 201Ti Sensor/Transmitter with 4-20mA output. The sensor/transmitter shall be installed with 1-1/2 inch diameter pipe and isolating ball valve for ease of servicing. The Hydran sensor shall be no more than 9 inches from the transformer tank. A flexible weather tight conduit shall be used to link the sensor to the Harley unit.

11.1.2 The outputs are as follows:

Gas in Oil (ppm) 4-20ma to Harley LTC Map 2130
Combustible Gas Alarm Hi to Transformer Annunciator
Combustible Gas Alarm Hi-Hi to Transformer Annunciator
System Failure Alarm to Transformer Annunciator
The Hydran sensor shall be connected in accordance with GE Reuter Stokes Syprotech Installation Instructions and attached, "Transformer Monitoring Connections, DWG. No. 31622-800."

11.2 GE-REUTER STOKES SYPROTECH HYDRAN PROVISIONS ONLY

11.2.1 Provide a 1 ½" pipe and isolating ball valve for the future installation of a Hydran device.

11.3 GE-REUTER STOKES HARLEY LTC MAP

11.3.1 A Harley LTC Map 2130 with modem-20046MPB shall be included and mounted on the side of the control cabinet. This monitor shall be installed and connected as per GE Reuter Stokes Harley Installation Instructions and attached "Transformer Monitoring Connections, DWG. No. 31622-800.

11.3.2 A Harley split CT-T821026 monitoring the LTC drive motor current shall be provided.

11.3.3 For Sealed Tank oil preservation system, a Pressure Transmitter (Cole Parmer Model # 316-SS; Catalog #U-68072-00) shall be provided with the Pressure-Vacuum Bleeder Gauge per CMP drawing 01105-600.

11.3.4 The inputs are as follows:

LV A Phase Current (A) from Harley CT # T821026
LV B Phase Current (A) from Harley CT # T821026
LV C Phase Current (A) from Harley CT # T821026
Main Tank Oil Temperature (° C) from Qualitrol IED 509
Winding Temperature (° C) from Qualitrol IED 509
LTC Oil Temperature (° C) from Qualitrol IED 509
Voltage input (V) from LTC Pot (load side of pot fuse)
Gas in Oil (ppm) from Hydran 201 Ti Sensor
Phone Line from deck in control cabinet
AC Supply fused (2 pole 1 phase) from control cabinet
Heater from control cabinet LTC Motor Current (A) from Harley CT # T821026
Fan Bank 1 Current (A) from Harley CT # T821027
Fan Bank 2 Current (A) from Harley CT # T821027
House Service Volts (V) from control cabinet
Nitrogen Blanket Pressure (+/- psi) from Cole Parmer Model # 316-SS; Catalog #U-68072-00

11.4 LTC MONITOR PROVISIONS ONLY

11.4.1 The SELLER shall provide provisions for the installation of an LTC monitor system to be provided by CMP. Provisions shall include a 16 point, 600V terminal block and a "knockout" for a 2" conduit in the transformer control cabinet, and two mounting rails installed on the side of the tank for a Hoffman enclosure catalog # A-16R166HCR adjacent to the control cabinet.

11.5 ANNUNCIATOR

11.5.1 All alarms shall be wired to a Rochester Instrument Systems Co. Model AN-6100B-7HX1W-INT-M-26-W-LPWS-A-N\O-F125-26-FOD-C2-FP-LPR-N 26 point annunciator mounted in LTC control cabinet. The monitor shall be visible upon opening the cabinet door without interference by other components and mounted so that the long dimension is vertical. All Lamp Covers Shall be White. (The DC voltage for the monitor will be indicated on Bid Statistic Sheet.) e.g. (F125 in the model number specifies 125V DC, F48 in the model number specifies 48V DC).

11.5.2 For Alarm Point Assignment refer to Transformer Annunciator Point Configuration

and Labeling DWG. No. 01105-606.

11.5.3 The annunciator shall be factory set to provide the common contact follower option with the output contact terminations on the common service module. In addition, any of the alarm points not needed on a particular transformer shall be spares.

11.5.4 All wires terminating at the annunciator shall have a crimped ferrule connector installed on the end of the wire to ensure a secure connection. The following are acceptable connectors: 10-12 AWG.

11.6 QUALITROL IED 509 ELECTRONIC TEMPERATURE MONITOR

When specified, the Qualitrol IED 509 Electronic Temperature Monitor shall meet the following requirements:

11.6.1 A dedicated CT, 0 – 10 Amps shall supply the input to the Qualitrol IED 509 Electronic Temperature Monitor. (CT output not to exceed 10 Amps as recommended by Qualitrol).

11.6.2 A Qualitrol IED 509 (panel mount w/digital display and 120 VAC supply power) Electronic Temperature Monitor (4-20mA output), shall be located in the control cabinet and monitor the main tank oil temperature, winding temperature, LTC oil temperature and LTC/Main tank differential temperature.

11.6.3 In addition, the Qualitrol IED 509 shall activate the two stage cooling control, top oil, winding, LTC oil and LTC/Main Tank oil delta temperature alarms. Temperature settings shall be specified on transformer outline drawings. The 4-20mA top oil temperature, winding temperature and LTC Oil temperature outputs shall be input into the Harley LTC Map 2130. (if specified) *Note: the 4-20ma winding temperature and LTC Oil temperature signals must have isolation provided by "Mighty Modules", Wilkerson Instrument Co.,* Model MM4300A.

11.6.4 The Qualitrol IED 509 Electronic Temperature Monitor shall be connected as per attached, "PT Monitoring Connections diagram."

11.6.5 The Qualitrol IED 509 Relay outputs shall be "Non-Fail Safe". The SELLER shall submit for CMP review and acceptance the settings for each relay described below:

Relay 1- Operates from liquid temperature; Output is used to activate "Top Oil" alarm in the annunciator

Relay 2- Operates from winding temperature; Output is used to activate "Winding Temperature" alarm in the annunciator

Relay 3- Operates from winding temperature; Output is used to activate First Stage Fans

Relay 4- Operates from winding temperature; Output is used to activate Second Stage Fans

Relay 5 – Operates from LTC oil temperature; Output is used to activate "LTC Oil" alarm in the annunciator

Relay 6 – Operates from LTC/Main Tank oil differential temperature; Output is used

to activate "LTC/MT Delta" alarm in the annunciator

11.6.6 Time-delayed alarms shall be furnished to indicate loss of power supply to fan motors and/or pump motors together with a time-delayed alarm for failure of pumps to produce proper oil flow. Time delay settings shall be adjustable in a range of 0-3 minutes.

12.0 NAMEPLATES

12.1 Provide a stainless steel nameplate on the main tank containing all information specified in ANSI C57.12.00, Section 5.12 (Nameplate C). In addition, on the nameplate note the volume of oil, in gallons, required to cover the core and coils.

12.2 Provide a stainless steel nameplate on each bushing containing all information specified in ANSI C76.1, Section 6.3. Nameplates shall be permanently attached to bushings prior to final testing of transformer.

12.3 All devices within the control cabinet shall be identified with permanent nameplates.

12.4 Actual capabilities and ratings of equipment in excess of the requirements of the specification must appear on the nameplate.

12.5 Nameplate shall also be stamped with the CMP specification number, CMP purchase order number.

12.6 Nameplate information shall be coordinated with equipment drawings and instruction books.

12.7 Nameplate shall be stamped to note that all insulating oil (if supplied) in the equipment is "NON-PCB at the time of shipment".

12.8 Additional nameplates shall be provided for any other ancillary devices furnished with the equipment.

13.0 INSULATING OIL

13.1 The insulating oil type to be provided shall be noted in the Specific Specification. SELLER shall request CMP's approval prior to supplying an oil type other than that specified.

13.2 If Type I oil is specified, it must be in accordance with the latest Doble Oil Purchase Specification, Type I and ASTM D3487, Type I. If obtaining Type I oil will delay shipment due to its availability, then ASTM D3487 Type II will be acceptable for Small Power transformers only. CMP shall be notified if Type II oil is being supplied.

13.3 If Type II oil is being specified, it shall be ERGON HYVOLT II, Cross 206 or Voltesso N36. Insulating oil must be in accordance with the latest Doble Oil Purchase Specification, Type II and ASTM D3487 Type II and inhibited with DBPC to 0.15% maximum by weight, (revision 1979 or latest).

13.4 When oil to be supplied cannot meet the prescribed specification, CMP must approve such oil prior to shipment.

13.5 All insulating oil being supplied shall be in accordance with CMP's Specification SP-1229.

13.6 The manufacturer shall list intended oil supplier(s) and market name(s) of oil to be supplied. CMP reserves the right to refuse oil from one or more of these suppliers if CMP believes the product is not acceptable.

13.7 PCB content shall be certified by the manufacturer to be less than 1 ppm. Such certification shall be included in the test report and on the transformer nameplate.

13.8 Delivery of all "make-up" oil (field installed) not shipped in the equipment shall be coordinated with the specified CMP Storekeeper.

14.0 TEST REQUIREMENTS

14.1 GENERAL

14.1.1 Transformer shall be completely assembled prior to testing with the same ancillary equipment (i.e., bushings, radiators, pumps, etc.) that will be supplied for field installation. The SELLER shall verify that all ancillary equipment is in alignment and operates properly to prevent field installation problems. "Test devices" (i.e., bushings, radiators, etc.) are not acceptable.

14.1.2 The SELLER shall furnish all labor, materials, testing facilities, power, instrumentation, and replacement parts for production tests. If parts fail or are replaced during production tests, a full description and explanation shall be sent to CMP. All successfully tested equipment shall be shipped with the transformer.

14.1.3 Testing shall be performed in accordance with ANSI C57.12.90.

14.1.4 The SELLER's overall test equipment for the measurement of losses shall be calibrated to hold the measurement errors to less than ± 3% based on National Bureau Standards NBS 1204.

14.1.5 All Routine tests shall be performed as defined by ANSI C57.12.00.

14.1.6 The SELLER shall submit a Test Plan for CMP review and acceptance. The Test Plan shall in one or two pages, list all tests proposed by the SELLER, in the proposed sequence, with pertinent test parameters stated.

14.2 TESTS

14.2.1 Insulation Power Factor - shall be measured between windings and from each winding to ground. The insulation power factor shall not exceed 0.5% when corrected to 20 degrees C.

14.2.2 Audible Sound - Transformer shall be tested for audible sound as defined in ANSI C57.12.90, Section 13, except that the nominal primary voltage specified, shall be used instead of reference to "rated voltage". When multiple power ratings are specified, test shall be performed at the base and top cooling rating.

14.2.3 Zero Sequence Impedance - shall be measured on all three-phase transformers.

14.2.4 Core Ground - shall be tested using a 1,000-Volt megger or better.

14.2.5 Leak and Pressure Test - shall be performed on tank, bushings, radiators, pumps and piping.

14.2.6 Bushings - Routine tests shall be performed on all high, low, and tertiary voltage,

and neutral bushings as defined in ANSI C57.19.00.

14.2.7 Current Transformers - Routine accuracy tests shall be performed on all bushing current transformers as defined in ANSI C57.13.

14.2.8 Impulse Test - For transformers with a primary rating of 115 kV and above, the transformer shall receive a reduced full wave, two chopped waves, a full wave impulse test on all terminals (high-voltage, low-voltage, and tertiary), and a reduced wave followed by two full wave impulse test on the neutral in accordance with ANSI C57.12.90. Tap positions shall be made with minimum effective turns in the winding under test.

14.2.9 Excitation Current - shall be measured at 100% and 110% of rated voltage. Excitation (no-load) losses shall be measured before and after the impulse tests.

14.2.10 LTC and controls shall be functionally tested by varying a voltage source to simulate automatic operation through all 32 steps. Manual non-sequential operation and all alarm functions shall be confirmed.

14.2.11 Temperature Test (Heat Run) - Data from a comparable unit may be acceptable. SELLER shall furnish nameplate data from comparable unit for CMP review at least four weeks prior to final test of transformer. If comparable unit is not available, temperature test shall be performed to provide top oil rise at full load, bottom oil rise at full load, average and maximum copper gradient at full load, copper losses at full load, pump losses at full load and core losses at no load. Also SELLER shall provide the transformer Thermal Time Constant (τ_o), Exponential Power of Total Losses versus Top-Oil Temperature Rise (n), and Exponential Power of Winding Loss Versus Winding Temperature Rise (m) as defined in ANSI C57.91. Heat run shall precede applied and induced potential, partial discharge (corona) tests and impulse test (when specified).

14.2.12 Partial Discharge- For Small Power and Class I Transformers, partial discharge (corona) shall be measured during the Induced Potential Test as described in ANSI C57.12.90, Section 10.7. For Medium Power Class II Transformers, partial discharge (corona) shall be measured during the Induced Potential Test as described in ANSI C57.12.90, Section 10.8 with the following clarifications:

14.2.12.1 Equipment and connections shall be as defined in NEMA 107.

14.2.12.2 RIV shall be recorded at the system maximum voltage at the start and at the conclusion of the test.

14.2.12.3 All readings shall appear on the certified test report.

14.2.12.4 SELLER shall guarantee RIV level not to exceed 500 microvolts during the enhancement level and 100 microvolts during the one-hour test.

14.2.13 Hot Spot Temperature- The manufacturer shall calculate the maximum winding/lead hotspot temperature using an analytical method in accordance with IEEE Std 1538, Section 5.0. The calculation method should be verified by tests performed on a similar unit. These calculations shall be performed for windings/leads at each voltage level of the transformer and shall be reported on the transformer test report.

14.3 FAILURE

14.3.1 If transformer fails to pass any specified test, SELLER shall determine cause of failure and repair defect.

14.3.2 Tests shall then be repeated to ensure repaired transformer will satisfy all requirements of this specification.

14.3.3 Repair and re-testing shall be done at SELLER's expense.

14.4 WITNESSING

14.4.1 CMP reserves the rights to inspect core and coil assembly immediately prior to tanking and to witness any tests specified herein.

14.4.2 SELLER shall schedule testing and inspections to occur from noon Monday through noon Friday only.

14.4.3 SELLER shall confirm dates and itinerary for testing and inspection with CMP at least two weeks prior to event.

14.4.4 If CMP elects to not witness tests, a copy of the certified test reports shall be Faxed to the CMP. Test reports shall be reviewed and accepted by CMP prior to releasing the transformer for shipment.

14.4.5 After delivery and installation, CMP reserves the right to make tests on the transformer and accessories, at CMP expense, to demonstrate the correctness of operation and overall conformance to the requirements of the specification and SELLER's guaranteed performance data. Within the guarantee period and at no cost to CMP, the SELLER will make all necessary adjustments, repairs, and changes to any portion of the transformer as a result of field tests or operating experience of CMP which indicate inability of the transformer to perform properly as specified and guaranteed.

15.0 DOCUMENTATION

The SELLER's documentation shall conform to the requirements specified in Attachment 5, 01330. In addition, the SELLER's documentation shall include the following requirements.

15.1 REVIEW DRAWINGS AND DOCUMENTATION

The SELLER shall submit the following drawings and documentation for review:

15.1.1 Transformer Outline, to include:

details of all four sides

shipping and installed dimensions and weights in English units

location of center of gravity in at least two views.

top view showing exact bushing terminal locations and all ancillary equipment locations

base detail suitable for foundation design and recommended location for pier supports

control cabinet dimensions and height of knockouts or removable plate above the tank base

location and identification of the mounting space, provisions, and the length of cable leads from each bushing potential device.

bill of material including description, quantity, rating, SELLER, and catalog or part number for all equipment on the transformer outline

"bottom connected" notation for bushings, if applicable

details and location of core ground connections

15.1.2 Bushing Outline, one for each type of bushing supplied with the transformer to include:

all dimensions and weights

"bottom connected" notation, if applicable

detail of bushing test tap

15.1.3 Nameplate Diagrams, for:

transformer (include notes as required by Paragraphs 5.1.1, 5.1.2 and 5.1.3)

current transformers (one for each unique set of ratings)

bushings (one for each type of bushing, can be included on bushing outline)

15.1.4 Schematic (Elementary) Diagram

Schematic Diagrams created in a "Point to Point" style are preferred. The electrical schematics should represent the actual physical wiring of the equipment. General nodes and other shortcut representations used to simplify the drawing layout and/or construction of the equipment should not be provided. The actual physical wiring of the equipment should be exactly as shown on the electrical schematics.

Information to be included on the Schematic Diagram includes:

winding temperature gauge contact settings for alarm and each stage of forced cooling

amount of AC and DC auxiliary power required

all fuse and breaker sizes and types

cam development chart for LTC control showing the operational sequence of all cam switches

a legend describing each device and its function

configuration/operation tables for all switches

show points for CMP connections

15.1.5 Connection (Wiring) Diagram, including:

all transformer connections

all current transformer connections and ratio diagram

individual wire identifiers as they will actually appear on the terminal blocks

Connection diagrams shall be physically correct and there shall be a minimum of two inches of unobstructed space for CMP use to show incoming wire designations on diagrams showing terminal blocks used for terminating CMP control, power, and current transformer cables. Four inches of unobstructed space between adjacent rows of terminal blocks shall be provided for CMP's use.

Devices and connections shall be shown only once. Separate diagrams showing the internal and external relay connections are not acceptable.

Connection diagrams shall be in accordance with CMP Drawing SR-1786, attached. Wire lists are not acceptable.

15.1.6 Current Transformer Curves, includes (for each BCT rating supplied):

Excitation Characteristic

Ratio Correction Factor

15.1.7 LTC Indicating Device Mounting Detail showing the mounting hole locations and dimensions for the remote position-indicating device to be installed at CMP's switchboard.

15.1.8 Parts List of all devices for the cooling control, LTC control and alarm circuits. The list shall include all relays, motor contactor, gauges, indicators and switches. All parts shall be cross-referenced to the transformer drawings and to OEM part numbers.

15.1.9 Test Plan as described under "Test Requirements, General."

15.2 PRODUCTION STATUS REPORT

The SELLER's status report shall include the following milestones per Attachment 5, 01330

Coils complete date

Core complete date

Core and coil inspection

Tank construction complete

Tanking of core and coils

15.3 TEST REPORTS

15.3.1 The SELLER shall supply the actual short time over-excitation characteristic curve for the transformer.

15.3.2 The SELLER shall supply all oscillograms for the impulse and switching surge tests (when specified).

15.4 PHOTOGRAPHS

15.4.1 SELLER shall furnish two sets of photographs of the core and coil assembly.

15.4.2 Pictures shall be taken immediately prior to tanking.

15.4.3 Photographs shall be taken at such angles so as to maximize view of design and construction of the components.

15.4.4 SELLER shall furnish two sets of photographs of the completely assembled transformer with cooling equipment in place.

15.5 PROCEDURES

15.5.1 If it is specified that the SELLER perform internal inspections after delivery, the SELLER shall provide their procedures for emergency extraction of the individual and for working in confined space.

16.0 SHIPPING

16.1 Physical conditions permitting, shipment shall be made by truck. The SELLER should attempt to limit the shipping height to 13' - 6" maximum. Otherwise, special permitting is required.

16.2 If size precludes shipment by truck, shipment shall be by rail.

16.2.1 The SELLER should attempt to limit the shipping height (when loaded on rail car) to 19' maximum. Otherwise, special clearance will be required from the railroad companies in the State of New York

16.2.2 Rail car shall be equipped with a two-axis impact recorder measuring both vertical and longitudinal forces.

16.2.3 Representatives for the SELLER and railroad shall be present to inspect the shipment, and impact recorders upon arrival of the unit at the rail siding.

16.3 Physical conditions permitting, the transformer shall be shipped oil-filled. If it is not possible to ship the transformer filled with oil, then it shall be shipped filled with grade D breathable dry air with a minimum dew point of -55° C.

16.4 Ancillary devices may be removed as required for shipping, however, pressure/vacuum gauge shall remain installed and operational.

16.5 All ancillary equipment shall be shipped simultaneously with main transformer tank.

16.6 All removed equipment shall be securely packaged and labeled so as to permit easy identification for assembly in the field. Any parts which could be weather damaged are to be shipped in weatherproof packages. A detailed packing slip shall accompany each shipment.

16.7 All exposed wiring and loose cables shall be securely fastened prior to shipment.

16.8 A shipping list shall accompany the shipment, citing the CMP Purchase Order number, name of SELLER, shipping destination, name of CMP substation, and materials list with itemized parts and quantity of each item.

16.9 Shipment shall be made completely assembled to the extent possible and shall be protected from damage and contamination in transit. Large and heavy items shall have suitable skids, and crating shall be suitable for lifting with slings.

16.10 All shipping braces and clamps that must be removed prior to installation must be adequately marked and identified. All crated parts shall have a list of contents clearly marked on both the shipping container and on its covering, including the Serial Number.

16.11 All shipments to CMP shall be made F.O.B destination unless otherwise stated. When specified, shipment shall be made F.O.B. "Pad". F.O.B. Pad indicates that it shall be the SELLER 's responsibility to off load the transformer on to CMP's foundation and to off load all transformer accessories not assembled during shipment. See attachment 2, Spec. # SPT-1341, Sites and Delivery dates.

16.12 Prior to Shipment, CMP shall review and accept all test results.

17.0 TURN-KEY DELIVERY & INSTALLATION

When specified, SELLER will provide a separate cost for turnkey installation of the transformer, which includes the following requirements:

17.1 SELLER shall coordinate transformer delivery and off-loading the transformer to the designated CMP substation foundation.

17.2 Prior to unloading, the SELLER shall inspect the transformer for damage and perform core ground test(s). A dew point test will be taken if necessary.

17.3 SELLER shall off-load and assemble all items removed for shipment, which include radiators, bushings, arrester brackets, etc.

17.4 SELLER shall provide the oil, labor, tools, equipment, dry air, nitrogen, and all materials required for field assembly and vacuum oil fill (if required) of the transformer.

17.5 CMP prefers to do all on-site transformer testing of the assembled transformer, with exceptions as noted. CMP pre-energization testing includes turns ratio tests, exciting current tests, bushing power factor tests, winding power factor tests, and transformer oil tests. The SELLER is required to include in the proposal and perform only those tests needed to satisfy quality assurance procedures, to validate warranty, etc. If the SELLER performs testing, then copies of all test reports shall be provided to CMP.

17.6 SELLER shall perform ratio tests of all bushing current transformers (BCT) at all taps. CMP personnel will witness the BCT tests.

17.7 If applicable, CMP will perform an inspection of the load tap changer. CMP personnel will do the following: various manual and automatic operational checks, visual internal inspection of mechanism, vacuum bottle mechanical snap test, manual hand crank test, verify various tolerances, hi-pot test of vacuum bottles and operational trip test. To accommodate the LTC inspection, SELLER will provide the labor and equipment to do the following: remove/store the LTC oil, remove the LTC door, disconnect vacuum bottle for

testing, allow CMP use of the current injection equipment used for the CT ratio test (Item 16.6 described above), to test the loss of vacuum protection circuit. Reassemble upon completion of inspection by CMP.

17.8 SELLER will clean up the transformer area site after tests are completed.

18.0 LOSS EVALUATION

18.1 The transformer shall be evaluated based on the specified CMP cost of losses.

18.2 If the actual tested losses exceed the guaranteed losses then the SELLER shall be penalized based on the following formula:

Penalty = (Tested Excitation Losses - Guaranteed Excitation Losses)* CMP Excitation Cost of Losses + (Tested Load Losses - Guaranteed Load Losses)* CMP's Load Cost of Losses

The Penalty shall be based on Excitation Losses measured after the impulse tests.

18.3 All transformer loss values submitted in the proposal shall be at the base ONAN power capacity rating and all losses shall be submitted at 75°C for 55°C/65°C rated transformers and at 85°C for 65°C rated transformers.

18.4 Losses for this transformer shall be evaluated separately from all other units and no averaging of similar units shall occur.

19.0 SAFETY REQUIREMENTS

Seller shall place the highest priority on the safety of its own and Company's workers, and the public; to include planning safety into every aspect of its work; and to provide necessary safety items, equipment and devices. MPRP Project Safety & Health Documents are included as Attachment 1.

19.1 Personnel Fall Protection System

19.1.1 A unihoist fall protection anchor base plate Model No. PNUH4000-2 or approved equivalent shall be welded to the top of the transformer in accordance with the attached fall protection configuration diagrams.

19.2 Confined Space Entry

If the SELLER's Service Representatives are required to enter the transformer on CMP's premises, the following requirements shall be followed:

19.2.1 The SELLER shall provide a written procedure for "Confined Space Entry". The procedure shall comply with OSHA regulations.

19.2.2 The SELLER shall have an emergency plan for quick removal of a worker in the transformer. The SELLER shall provide a written procedure describing their emergency plan.

19.2.3 While working inside the transformer, the SELLER shall circulate breathing quality air, grade D or better (Oxygen content >19.5%) and the oxygen content shall be continuously monitored. CAUTION: NITROGEN GAS CAN CAUSE ASPHYXIATION. THE SELLER SHALL TAKE EVERY PRECAUTION TO

INSURE THE TRANSFORMER HAS BEEN PROPERLY PURGED PRIOR TO ENTRY.

ATTACHMENTS

1. MPRP Safety and Health
2. Spec. # SPT-1341, Specific Requirements Specification
3. Site Plans - A. Coopers Mills, B. Monmouth, C. Middle Street
4. Drawing and Document Control Revision 8
5. General Requirements
6. Elementary Diagram – LTC Control, Dwg. # LTC_MVAJED Rev. D, SH 1 (Replaces DDR-1847 SH 1)
7. Elementary Diagram – LTC Position Analogs to SCADA, Dwg. # DDR-184703, SH 3
8. Elementary Diagram – LTC Control, Dwg. # DDR-184702, SH 2
9. Reference Transformer Schematic, Dwg. # D31622-801, SH 4
10. Reference Transformer Schematic, Dwg. # D31622-801, SH 3
11. Reference Transformer Schematic, Dwg. # D31622-801, SH 2
12. Reference Transformer Schematic, Dwg. # D31622-801, SH 1
13. LTC Backup Control and Alarm, Dwg. # A01105-601
14. Transformer Fall Protection-115kV" Dwg. 01105-602
15. Transformer Fall Protection-34kV" Dwg. 01005-603
16. One Line Diagrams - A. Coopers Mills, B. Monmouth, C. Middle Street
17. Vendor Technical Proposal Data