INVITATION TO BID
FAIRHOPE PUBLIC UTILITIES
FAIRHOPE, ALABAMA

BID OPENING DATE: November 1 , 2018

ITEMS: POWER TRANSFORMERS

THE ATTACHED "GENERAL INSTRUCTIONS TO BIDDERS" TO BE CONSIDERED A PART OF THE INVITATION TO BID.

1. Two (2) – Power Transformers, Three-Phase, 30/40/50 MVA (55 Degrees C)
   ONAN/ONAF/ONAF 55/65 K Rise
   110 KV WYE – 44 KV WYE
   Tertiery Voltage 12.47 KV DELTA, 1/3 of Base KVA
2. Three (3) – Power Transformers, Three-Phase, 15/20/25 MVA (55 Degrees C)
   ONAN/ONAF/ONAF 55/65 K Rise
   43.8 KV – 12.47/7.2 KV DELTA-WYE
3. One (1) – Power Transformer, Three-Phase, 10/12.5 MVA (55 Degrees C)
   ONAN/ONAF 55/65 K Rise
   43.8 KV – 12.47/7.2 KV DELTA-WYE

- See attached Specifications for details.

NOTE: All bids must be sealed. All prices quoted to be F.O.B. delivered to Fairhope Public Utilities in Fairhope, Alabama, unless specified otherwise. Fairhope Public Utilities reserves the right to reject any or all bids when in the opinion of Fairhope Public Utilities the best interest of Fairhope Public Utilities will be served. Bids must be received no later than 2:00 P.M. on the Bid Due Date as indicated. If you have any inquiries about this particular Bid, please contact:

Lance Junkin - Stewart Engineering, Inc. - Telephone 256-237-0891 or
Jeremy Morgan - Fairhope Public Utilities - Telephone 251-928-8003

BIDS MUST BE CLEARLY MARKED ON THE ENVELOPE AND WILL BE OPENED AS FOLLOWS:

FAIRHOPE PUBLIC UTILITIES
555 SOUTH SECTION STREET (PO BOX 429)
FAIRHOPE, AL 36532 (36533)
BID ON POWER TRANSFORMERS
NOVEMBER 1, 2018 AT 2:00 P.M.

All bid items will be expected to be delivered promptly upon receipt of Fairhope Public Utilities purchase order therefore, unless otherwise indicated above.

SIGNED _____ NAME OF BIDDER _____

TYPED SIGNATURE _____ STREET OR PO BOX _____

TELEPHONE NUMBER _____ CITY & STATE _____ ZIP _____

INVITATION TO BID
FAIRHOPE PUBLIC UTILITIES
FAIRHOPE, ALABAMA

GENERAL INSTRUCTION TO BIDDERS

1. Fairhope Public Utilities will open and read bids on the date stated in the attached Invitation To Bid, at Fairhope Public Utilities, 555 South Section Street, Fairhope, AL 36532. Bidders or their authorized representatives are invited to be present at bid opening.

2. Prices and notations must be in ink or typewritten on the form provided by Fairhope Public Utilities. All bid prices must be fully extended. Bids must conform to any attached detailed specifications to be eligible for consideration. Please state brand and delivery date of each item quoted.

3. No taxes of any kind are to be included in the bid prices unless requested. Fairhope Public Utilities will furnish tax exemption certificates when necessary.

4. All prices must be firm for a minimum of 60 days.

5. Factors to be considered in awarding bids will be delivery, price and suitability for use by Fairhope Public Utilities. Fairhope Public Utilities reserves the right to:

   (a) Award bids by Lump Sum or individual items unless otherwise noted by bidder. NOTE: No purchase will be made on Lump Sum awards until individual item prices are furnished.

   (b) Reject any or all bids and to waive technicalities when in the opinion of Fairhope Public Utilities the best interest of Fairhope Public Utilities will be served.

   (c) Make null and void the purchase order with the successful bidder if delivery cannot be made at the specified time.

6. If you do not quote, please return the specifications sheet to Fairhope Public Utilities and state reason for not quoting. Otherwise, your name may be removed from our mailing list.

7. Bid awards will not be official until bidder is formally notified by receipt of purchase order.

8. All prices quoted are to be F.O.B. Fairhope, Alabama.

9. These "General Instructions To Bidders" are hereby made an official part of all bids. Please observe the above instructions and conditions, as failure to do so may constitute grounds for rejection of your bid.

10. All Federal, State, and Local License and Fee requirements will be applicable.

11. Bidder shall complete, and submit with bid, the attached Affidavit for Business Entity/Employer/Contractor (EXHIBIT A). No bid shall be awarded to a Bidder prior to receipt of this document.

12. A cashier's check or bid bond (EXHIBIT B) payable to CITY OF FAIRHOPE in an amount not less than five (5) percent of the amount of the bid, but not to exceed $10,000.00 must accompany the Bidder's proposal.

13. Due to the time sensitivity of this project, Liquidated Damages shall be enforced, as described in EXHIBIT C.

14. Due to the magnitude of this project, and the extended time period associated with the construction of this equipment, the Bidder(s) to which the associated Purchase Orders are awarded shall be required to provide a Performance Bond, in the full amount of the Purchase Order, as described in EXHIBIT D.

BID FORM
(ITEM 1 – Delivery September 2019)

FAIRHOPE PUBLIC UTILITIES
FAIRHOPE, ALABAMA

Power Transformers, Three-Phase, 60 hertz, oil filled with the following rating:

2 – 30/40/50 MVA (55 Degrees C) ONAN/ONAF/ONAF @ 115,641, 112,820, 110,000, 107,179, and 104,359 Volts WYE (ANSI Standard Tap values)
550 KV BIL.
44,000 Volts WYE, 250 KV BIL.
Tertiery Voltage 12.47 KV DELTA, 110 KV BIL, 1/3 Bank KVA.

See attached Specifications for details.

(2) @ $_____ ea. $_____
Total

Brand Quoted: _____

No Load Losses (KW): _____

Load Losses (KW): _____

Auxiliary Losses (KW): _____

Are all accessories shipped with transformers (YES/NO)? _____

Onsite Testing Quoted (YES/NO)? _____

Warranty Quoted (Time): _____

Shipment Quoted (Time): _____

Acknowledge and accept pricing terms and delivery requirements as defined on Page 6 of 6 of this Bid Form (YES/NO)? _____

Exceptions: _____

_____

BID FORM
(ITEM 2a – Delivery October 2019)

FAIRHOPE PUBLIC UTILITIES
FAIRHOPE, ALABAMA

Power Transformers, Three-Phase, 60 hertz, oil filled with the following rating:

2 – 15/20/25 MVA (55 Degrees C) ONAN/ONAF/ONAF @ 46,200, 45,000, 43,800, 42,600, and 41,400 Volts DELTA (ANSI Standard Tap values)
250 KV BIL.
12,470/7,200 Volts WYE, 110KV BIL.

See attached Specifications for details.

(2) @ $_____ ea. $_____
Total

Brand Quoted: _____

No Load Losses (KW): _____

Load Losses (KW): _____

Auxiliary Losses (KW): _____

Are all accessories shipped with transformers (YES/NO)? _____

Onsite Testing Quoted (YES/NO)? _____

Warranty Quoted (Time): _____

Shipment Quoted (Time): _____

Acknowledge and accept pricing terms and delivery requirements as defined on Page 6 of 6 of this Bid Form (YES/NO)? _____

Exceptions: _____

_____

BID FORM
(ITEM 2b – Delivery February 2020)

FAIRHOPE PUBLIC UTILITIES
FAIRHOPE, ALABAMA

Power Transformers, Three-Phase, 60 hertz, oil filled with the following rating:

1 – 15/20/25 MVA (55 Degrees C) ONAN/ONAF/ONAF @ 46,200, 45,000, 43,800, 42,600, and 41,400 Volts DELTA (ANSI Standard Tap values)
250 KV BIL.
12,470/7,200 Volts WYE, 110KV BIL.

See attached Specifications for details.

(1) @ $_____ ea. $_____
Total

Brand Quoted: _____

No Load Losses (KW): _____

Load Losses (KW): _____

Auxiliary Losses (KW): _____

Are all accessories shipped with transformers (YES/NO)? _____

Onsite Testing Quoted (YES/NO)? _____

Warranty Quoted (Time): _____

Shipment Quoted (Time): _____

Acknowledge and accept pricing terms and delivery requirements as defined on Page 6 of 6 of this Bid Form (YES/NO)? _____

Exceptions: _____

_____

BID FORM
(ITEM 3 – Delivery October 2020)

FAIRHOPE PUBLIC UTILITIES
FAIRHOPE, ALABAMA

Power Transformer, Three-Phase, 60 hertz, oil filled with the following rating:

1 – 10/12.5 MVA (55 Degrees C) ONAN/ONAF @ 46,200, 45,000, 43,800, 42,600, and 41,400 Volts DELTA (ANSI Standard Tap values)
250 KV BIL.
12,470/7,200 Volts WYE, 110KV BIL.

See attached Specifications for details.

(1) @ $_____ ea. $_____
Total

Brand Quoted: _____

No Load Losses (KW): _____

Load Losses (KW): _____

Auxiliary Losses (KW): _____

Are all accessories shipped with transformers (YES/NO)? _____

Onsite Testing Quoted (YES/NO)? _____

Warranty Quoted (Time): _____

Shipment Quoted (Time): _____

Acknowledge and accept pricing terms and delivery requirements as defined on Page 6 of 6 of this Bid Form (YES/NO)? _____

Exceptions: _____

_____

BID FORM
(PRICING SUMMARY)

FAIRHOPE PUBLIC UTILITIES
FAIRHOPE, ALABAMA

ITEM 1	(2 TRANSFORMERS TOTAL)	$
ITEM 2a	(2 TRANSFORMERS TOTAL)	$
ITEM 2b	(1 TRANSFORMER)	$
ITEM 3	(1 TRANSFORMER)	$ _____
	GRAND TOTAL	$ _____

BID FORM
(DELIVERY AND PAYMENT TERMS)

FAIRHOPE PUBLIC UTILITIES
FAIRHOPE, ALABAMA

1. Delivery Terms
   a. Item 1 - (2) 30/40/50 MVA (110 KV/44 KV) Transformers – September 2019
   b. Item 2a - (2) 15/20/25 MVA (44 KV/12 KV) Transformers – October 2019
   c. Item 2b - (1) 15/20/25 MVA (44 KV/12 KV) Transformer – February 2020
   d. Item 3 - (1) 10/12.5 MVA (44 KV/12 KV) Transformer – October 2020

2. Payment Terms
   a. All six transformers are being Bid at the same time, and ordered at the same time.
   b. All prices must be 100% firm. No increases for commodity cost or regulatory changes will be accepted. Manufacturers must provide pricing based on 100% due 30 days after transformer is on site, assembled, tested, and ready for energization. This price, in conjunction with 3.b. below, will be the basis for determining the low Bidder.

      If Manufacturer desires to provide an additional Alternate Bid, with a progress payment schedule methodology, this pricing will be taken into consideration.

3. Bid Award
   a. Owner reserves the right to award different Items to different Manufacturers.
   b. If Bidder is willing to offer any discount for receiving an order for multiple Items, this should be stated clearly, with a price separate and apart from the price requested in 2.b. above.

I. ITEM 1 – GENERAL SPECIFICATIONS FOR POWER TRANSFORMERS

A. General

These specifications are intended to cover the design and construction of two (2) three-phase power transformers to be installed at Fairhope Twin Beach Substation.

The transformers shall be designed and built in accordance with the latest rating, manufacturing, and testing standards of I.E.E.E., NEMA, ANSI, ASA, ASTM, AWS (American Welding Society), CGA (Compressed Gas Association), NESC, NFPA, SSPC, and USEPA, and shall be complete with bushings, oil, cooling equipment, ratio adjusters, filtering connections, and other accessories.

Bushings, leads, and ratio adjusters shall be designed or sized to carry full transformer rated load.

Transformers shall be designed to withstand a short circuit at the transformer terminals, with an infinite bus source.

B. Material, Workmanship and Warranty

All workmanship and material shall be of high quality and all material shall be free from defects affecting appearance or serviceability of equipment.

The vendor shall furnish a warranty that the transformer and its equipment will be in accordance with these specifications and with the latest I.E.E.E., NEMA, ANSI, ASA, ASTM, AWS (American Welding Society), CGA (Compressed Gas Association), NESC, NFPA, SSPC, and USEPA standards insofar as shall be consistent with the Purchaser's specifications.

Warranty period shall be for Five Years. In the event of a failure of the transformer or any component in the first year of service, in/out costs, (transportation and rigging) shall be covered.

C. Design Requirements and Equipment

1. Impedance

Unless otherwise specified, the transformer shall have minimum standard Positive Sequence Impedance @ 55 K ONAN base rating.

2. Insulation Levels

(a) The insulation on the line and neutral ends of the winding shall meet all dielectric requirements for their voltage class, both low frequency and impulse, as outlined in the latest edition of ANSI Standard C57.12.

(b) The following table lists the required BIL ratings for the corresponding rated line to line terminal voltage:

(1) RATED LINE-TO LINE TERMINAL VOLTAGE, KV	(2) BIL KV RATING
110 KV line end	550
110 KV neutral end	550
44 KV line end	250
44 KV neutral end	250
15 KV (tertiery)	110

The winding line and neutral terminals, with line-to-line terminal voltage ratings as given in column (1) shall be insulated at the BIL ratings as specified on the corresponding line in column (2).

3. Windings and Leads

(a) Make all bolted connections with a minimum of two (2) bolts. Lock washers are acceptable if fully retained.

(b) All leads to bushings shall be of flexible conductors. Proper tolerances shall be supplied in the bushing leads to prevent undue strain on the bushings and winding anchorage during installation and to prevent excess lead lengths which may constitute insulation hazards when not properly installed. Where leads run directly into the windings they shall be properly supported at the winding end within plain view to facilitate field inspection. Winding magnet wire shall not be extended past the anchorage point.

(c) All internal structural members shall be metal, except where insulating functions are required. Use of lebonite is not permissible.

(d) In the interest of oil preservation, the use of varnish or other materials not compatible with oil shall be prohibited.

(e) Core grounding strap shall be brought out to a convenient position on the side of the tank to facilitate field testing. The core ground shall be brought out through an adequately insulated bushing and bolted to the transformer tank. This core ground shall be shrouded with a bolted cover and the cover shall be clearly marked "CORE GROUND".

(f) Where bolted connections are made through panels, an insulating sleeve or spacer shall be used on both sides of the panel to reduce the electric field concentration and mitigate the precipitation of suspended solids at this point.

(g) Internal arresters are not permissible.

(h) All conductors shall be copper.

(i) All coils shall include full circumference clamping rings. Clamping rings shall be manufactured of non-conductive material.

(j) High voltage, low voltage, and tertiery windings shall be of circular construction and windings shall be of Helical or Disc design. Tapped layer windings are not permissible.

(k) Autotransformer design shall not be permitted.

(l) Maximum current density in all windings shall be 1,340 Amps per square inch at the base 55 K ONAN rating.

(m) Maximum designed induction rate shall be 1.73 Tesla at 100% excitation in all HV taps.

(n) Tertiery winding (DELTA), 1/3 of Base KVA, shall be corner grounded (no bushings).

4. Cooling Equipment

(a) The transformer shall be equipped with detachable coolers with provisions to permit drainage of oil and removal of self coolers without loss of oil from the main tank.

(b) The transformer cooling class shall be as specified and shall consist of one of the following types:

(1) Class ONAN-Self-Cooled: Self-cooled transformers shall be supplied with detachable coolers, and shall be equipped with provisions to permit drainage of oil and removal of coolers without loss of oil from the main transformer tank. Unless otherwise stated, all self-cooled transformers shall be equipped with the necessary provisions for future addition of forced cooling equipment. All radiators required for forced cooled ratings shall be provided initially with the power transformer.

(2) Class ONAN/ONAF - Self-Cooled, Forced-Air Cooled: Transformers of this cooling class shall be equipped as described in item 4(b) (1) and shall include a sufficient number of fans equipped with 240 volt, 60 Hertz, single-phase motors.

(3) Class ONAN/ONAF/ONAF - Self-Cooled, Forced-Air Cooled, Forced-Air Cooled: Transformers of this cooling class shall be equipped as described in item 4(b) (1) and 4(b) 2. Where multi-stage cooling is supplied, a throwover switch shall be provided to alternate duty of each stage of cooling equipment. Air blast equipment shall be controlled from winding temperature equipment specified in Section D.

(c) Transformer cooling fans employed on ONAN/ONAF and ONAN/ONAF/ONAF rated transformers shall satisfy the following criteria:

(1) The interior of fan motors shall have no unprotected steel surfaces. Unpainted steel surfaces shall have thin coat of baked varnish or other suitable material applied to prevent rusting. All fan motor housings shall have drainage holes for draining of condensate or other liquid.

(2) Fans shall be free of excessive vibration. Headers or radiator tubes used for mounting fans shall be sufficiently rigid or adequately braced to prevent excessive vibration.

(3) Fans required for each stage of cooling shall be divided among the radiator banks.

(4) Single voltage motors are preferred.

(5) Fans mounted on top of radiators are not acceptable.

(6) Purchaser will supply a 240 Volt, single phase, 60 Hertz power source.

5. Bushings

(a) Full line voltage outdoor terminal bushings shall be furnished for all windings. Standard ASA bushings shall be furnished where applicable. The type of bushings furnished shall be subject to approval by purchaser. Bushing porcelain glaze shall be light gray (ANSI No. 70).

All bushings shall be equipped with standard threaded stud type terminals and with stud connectors to 4 hole flat pad, Anderson Electric type HDSF or Penn-Union type SLB.

(b) All bushings shall project into the oil at its lowest level, distance being sufficient as to positively prevent flashover from the inside end of the bushing to the tank or cover.

(c) Minimum external clearances metal to metal between adjacent phases shall be as follows, or as recommended in the latest National Standards, whichever is more stringent:

Phase to Phase Voltage (KV)	BIL (KV)	Clearance (in.)	Quantity
110	550	45	4
44	250	22	4

Note: No bushings for tertiary.

(d) All transformer bushings above 25KV (150KV BIL) shall be shipped detached from the transformer for on-site insertion into the tank.

(e) Provide bushings manufactured by Hubbell (PCORE) (or purchaser approved equivalent).

6. Tanks

(a) Transformer tanks shall be equipped with welded-on covers, and braced for a full vacuum. Split tank construction is not desirable, but may be used when required by shipping limitations. Unless specifically requested, there is no restriction on the assembled height, width, or depth of transformers.

(b) The tank shall be equipped with a base capable of being skidded in any direction. It shall be equipped with rounded pulling eyes not less than 2.5 inches in diameter and suitable for pulling in any direction. Pulling eyes shall be located approximately 6 inches above the bottom of the transformer for maximum pulling efficiency.

(c) Lugs shall be provided on the transformer for lifting the entire unit filled with oil and for the removal of cover and tank sections.

(d) Jack bosses shall be provided at not less than four locations for using hydraulic jacks. Jack lugs shall be mounted at a minimum height of 12 inches above base.

(e) Grounding pads shall be provided at two points on the tank and shall be complete with clamp type grounding terminal fittings for 2/0 AWG to 250 MCM copper cable (Anderson Electric #SWH-025B, or equal).

The two ground pads shall be located on opposite sides of the transformer. Flat steel lugs shall be provided on the tank to provide for attaching one-bolt clamps for the purpose of supporting copper cable neutral and lightning arrester grounds to be installed by the Purchaser. These lugs shall be installed down all four (4) corners of the transformer.

(f) Constant pressure type tank construction shall be used, unless otherwise specified or approved, and equipment shall be provided for automatically maintaining a cushion of inert gas over the oil. This equipment shall include pressure gauge(s), three-stage gas regulator, gas cylinder and other necessary equipment mounted in a suitable cabinet attached to the transformer tank and located such that the bottom of the cabinet is a maximum of twelve inches above the transformer base. Nitrogen inert-gas pressure system shall be in accordance with ANSI C57.12.00-2000 per Section 6.6.3 or latest revision. The nitrogen for use in the system shall be in accordance with ASTM D1933-1997, Type III. Nitrogen control equipment shall be mounted in an easily accessible, weatherproof, lockable enclosure with adequate space for the nitrogen bottles mounted on transformer tank. Nitrogen tank shall be provided with a certificate of ownership. Pressure switches indicating high/low tank pressure, and low cylinder pressure are to be provided.

(g) A mechanical pressure relief device without frangible diaphragm and equipment with resealing device, indicator visible from the ground and alarm contacts suitable for 48 volt ungrounded DC shall be installed on top of the tank. This device may be mounted in manhole covers if the design so dictates.

(h) Gaskets shall be made of synthetic rubber such as Nitrile, Hycar, Neoprene, etc. Cork-neoprene is not acceptable. Any departure from these standard gasket arrangements shall be clearly stated with the proposal and shall require specific approval of the Purchaser prior to acceptance. All mating steel surfaces where gaskets are to be applied shall have two coats of gulped or other suitable paint applied and dried prior to gasket installation to prevent rusting.

(i) When required, transformer tanks shall be equipped with steel clips suitable for attaching an insulator bracket on the low voltage side of the tank for the purpose of supporting low voltage leads.

(j) All bolts, studs, nuts and washers used on the transformer cover for mounting manhole covers, pressure relief devices, bushings, and bushing adapters shall be stainless steel to facilitate ease of maintenance.

(k) Manholes may be of round, oval or rectangular shape with a minimum opening of nineteen inches.

(l) Transformer tanks shall be equipped with bushing type current transformers as follows:

(1) Two 600 to 5 ampere multiratio, C800 accuracy on each 110 KV bushing. One 600 to 5 ampere multiratio, C800 accuracy on 110 KV neutral bushing.

(2) Two 1200 to 5 ampere multiratio, C800 accuracy on each 44 KV bushing. One 1200 to 5 ampere multiratio, C800 accuracy on 44 KV neutral bushing.

All CT's shall be standard 5-tap with 2.0 Thermal Rating Factor.

(m) All tank welds shall be of highest quality and shall be pressure tested free of leaks, prior to painting. All tank seams shall be welded both internally and externally. No seams should be located at the tank corners. Steel should be bent at the corners and seams formed on the sides of the tank at a location not closer than 10 inches from the tank corner.

(n) Inside of transformer tank shall be painted white. Paint shall be compatible with transformer oil.

(o) Transformer tank shall be designed with a slightly domed cover to shed water. A non-skid surface shall be applied to the cover prior to shipment.

7. Tap Changer

De-energized ratio adjusters shall be provided in the high-voltage winding to permit changing of taps when the transformer is de-energized. These ratio adjusters shall be suitable for the maximum forced cooled rating of the transformer regardless of whether the equipment is purchased with cooling equipment or provisions for future cooling equipment.

The tap changer operating mechanism gearing shall be designed to easily overcome extra friction load which may develop over the life of the equipment due to age and lack of use. If sector type contacts are used, the turning ratio shall be adequate to insure good contact alignment even with the increased backlash or deflection due to aging of the equipment. The contacts shall be designed to provide for indexing approximately on the center of the sectors when approached from either direction.

The tap changer shall be provided with means for bolting and locking in any tap position.

8. Surge Protection

Complete surge protection (Type MOV) shall be provided. All arresters shall be metal cap type and mounted on the transformer. The H. V. arresters shall be station type with a maximum duty cycle rating of 96 KV. The L. V. arresters shall be station type with a maximum duty cycle rating of 39 KV. Copper faced pads, or stainless steel welded to the tank, shall be provided to solidly connect each arrester base to the transformer tank. Arrester porcelain glaze shall be light gray (ANSI No. 70).

9. Service Conditions

The transformer shall be designed from terminal to terminal including ancillary components as follows:

(a) Loading per ANSI C57.91. Current capacity of ancillary components shall not limit the current carrying capability of the transformer from terminal to terminal.

(b) Short circuit withstand per ANSI C57.00 with fault currents limited by the transformer impedance only.

(c) Audible sound levels shall be no higher than 6 dB below current NEMA Standard.

D. Accessory Equipment

1. Nameplates

A nameplate shall be furnished with each transformer. It shall be mounted at a height for easy reading from the ground and shall be located near the no-load tap changer. The following information shall be given thereon:

(a) Connection diagram which shall include the various voltage and current ratings.

(b) Gallons of oil, type and percent of inhibitor, and variation of oil level with temperature.

(c) Percent impedance between windings and KVA base.

(d) Vector diagram.

(e) Average copper temperature rise and maximum hot spot temperature rise.

(f) KVA rating of windings for both self-cooled and forced-cooled. These ratings shall include both the 55 and 65 degree Centigrade ratings.

(g) Serial number of transformer.

(h) Total new weight.

(i) Weight to be lifted when untanking.

(j) Maximum pressure and fuel vacuum permissible in tank.

2. Oil Connections

Oil connections terminated with 1 ½ inch IPS threaded inlet and outlet globe type valves shall be provided as follows:

(a) At bottom of tank. This connection shall be located so that the tank can be completely drained of oil by gravity. This valve shall be equipped with a sampler device suitable for removal of oil without opening the main valve. O. B. Series 1813, or equal, is acceptable.

(b) At top of tank above the maximum oil level. O. B. Series 1814, or equal, is acceptable.

3. Instruments

(a) A dial type thermometer with a maximum temperature indicating hand suitable for convenient manual reset and equipped with alarm contacts suitable for use with 48 volt ungrounded DC shall be provided. The thermometer shall be mounted not more than five (5) feet above the transformer base and shall indicate the hottest oil temperature. The controlling element for this thermometer shall be mounted in a well in the transformer tank so as to permit removal of the element without loss of oil. The well shall be welded to the tank where interference with tanking and untanking is prevented. Otherwise, it shall be attached to the tank wall with a suitable flange and "O" ring gasket.

(b) One (1) single-element, three-stage, thermal relay, activated by both top oil temperature and current proportional to the current in the transformer windings, shall be furnished. The stages of this relay shall be suitable for the following operations:

(1) First stage shall have contacts suitable for control of air blast equipment and shall operate at a temperature of 65 degrees Centigrade simulated hot spot.

(2) Second stage contacts shall operate an alarm circuit when load and ambient conditions specified in ASA standards C-57.92 (1959), tables 92-01.250A, 92-01.250B, 92-01.250C and 92-01.150D are exceeded by five (5) percent, assuming a 30 degree Centigrade ambient. No signal will be given for load and ambient conditions below the values given in the above tables.

(3) Third stage contacts shall operate a breaker tripping scheme at such temperature and time as will permit a loss of life of transformer insulation not to exceed one-half of one percent (1/2%) as indicated in tables 92-92.200A through 92-92.200P of ASA standard C57.92 (1959).

The controlling element for this relay shall be mounted in a well in the transformer tank so as to permit removal of the element without loss of oil. The well shall be welded to the tank where interference with tanking and untanking is avoided. Otherwise, it shall be attached to the tank wall with a suitable flange and "O" ring gasket.

Thermal relay operating curves shall be supplied for each relay.

Contacts for stages two and three shall be suitable for use with 48 volt ungrounded DC.

(c) The transformer shall be supplied complete with a large diameter magnetic type oil level gauge with contacts for a 48 volt ungrounded DC with maximum, minimum and 25 degrees Centigrade oil levels marked thereon.

(d) Sudden pressure relay with auxiliary relay (48 volt ungrounded DC).

(e) Automatic reseal pressure relief device with 48 volt ungrounded DC alarm contact.

(f) All controls, alarm and current transformer secondary circuits shall be brought out through the tank wall and terminated in the transformer control cabinet. All secondary leads within the tank shall be properly supported. Heavy terminal lugs shall be used. These lugs shall be sufficiently strong to prevent their bending during flexing of the control wire. All unfinished wiring which is to be completed in the field shall be equipped with captive connectors to prevent small parts from dropping into the windings during shipment and field assembly. Make provisions for padlocking cabinet door.

Inside of control cabinets shall be lighted by led lighting, controlled by cabinet door-actuated switches. Interior of cabinet shall be painted white.

A drawing pocket shall be provided on inside of control cabinet door. Pocket shall have a hinged lid to prevent rainwater from dripping into the pocket when the door is in the open position.

Short circuiting bars shall be supplied in the control cabinet for all current transformer secondaries.

E. Painting

Surfaces requiring painting shall be rendered clean and smooth and shall be finished with three (3) properly related coats of paint. Tank finish shall be a light gray color conforming to ANSI No. 70. Furnish touch-up paint identical to final coat. Paint shall be guaranteed for five (5) years. The transformer Paint System shall meet or exceed the requirements of ANSI/IEEE C57.12.28.

F. Oil

The necessary quantity of Type 1 inhibited oil with maximum 0.08% inhibitor shall be furnished for filling each transformer to the proper level for the temperature at the time of filling. Oil dielectric breakdown voltage shall be a minimum of 35 KV (D877); oil acid number shall not exceed 0.05 mg KOH/gal. oil; and oil interfacial tension shall test a minimum of 35 dynes/cm.

Oil must confirm or exceed the specifications given in ANSI/ASTM #D3487. PCB content in the oil to be in accordance with EPA regulation #40CFR761 or latest revision of regulation and with manufacturer's certification. Test results showing PPM.

All of the above plus full DGA and moisture content tests must be performed on all transformers.

G. Factory Tests

All tests shall be conducted according to ANSI/IEEE Standards, and three (3) copies of a certified report of tests shall be sent to the Owner. One copy shall be sent to Stewart Engineering, Inc. Also provide an electronic version of the certified test report in pdf format to the customer and Stewart Engineering. Purchaser reserves the right to witness test. Purchaser reserves the right to witness test. Purchaser shall be notified at least 10 days prior to factory testing.

Loss measuring equipment shall be calibrated in accordance with NIST (National Institute of Standards and Technology), Technical Note 1204.

Transformer shall be fully assembled prior to testing. Unit shall be tested with the radiators that ship with the unit.

The report shall include all routine tests specified in ASA standard 57.12-06.11 (1958) and the latest revision of ANSI Standard Test Code for Transformers C57.12.90. In addition, the following test information shall be required and documented in the certified test report:

1. Resistance measurements of all windings on the rated voltage connection and all tap positions. All resistance measurements shall be given in ohms at 75 degrees Centigrade.

2. No-load loss and exciting current data covered in the above routine tests at rated excitation voltage shall also be supplied for 110 percent of rated voltage.

3. Regulation at 70, 80 and 100 percent power factor.

4. Temperature test data may be supplied on one unit of any group and shall include the following additional information:

   (a) A statement that the test was run on the highest loss tap. Such statement shall include the value of losses.

   (b) Calculated average oil temperature from data taken during the total loss heat run. Provide measured bottom oil temperature for all temperature tests.

   (c) Calculated hottest spot temperature at rated load from total loss heat run data. Hottest spot temperature must be calculated using localized stray and eddy losses. Applying a factor or adding 15 degrees K to the average winding temperature rise is not acceptable.

   (d) Temperature tests when required shall be made before dielectric tests.

5. Insulation power factor data on each unit.

6. A Quality Control Impulse Test shall be made on each unit unless otherwise specified. A Statement that the transformer has successfully withstood this test shall appear on the test report.

7. The positive sequence impedance and load loss and the zero sequence impedance and load loss shall be measured at the self cooled rating (55 K ONAN) in all high voltage tap positions.

8. Turns ratio on all high voltage tap positions.

9. Factory test reports and results will be supplied to the customer prior to delivery of transformers.

H. Special Test Requirements

1. Temperature Rise Tests

Temperature rise tests will be required on the first transformer. Measure the bottom oil temperature for all temperature tests. Report all values on final certified test report. Temperature rise data can be derived from results of the first transformer. Show the test results on the duplicate with its serial number and test date. Temperature rise tests will be made at the highest loss tap position and with an equivalent no load loss at 105% voltage. The tests will be made at the following ratings:

(a) Self cooled, ONAN @ 55 K rise

(b) Self cooled, ONAN @ 65 K rise

(c) Maximum, ONAN/ONAF/ONAF @ 55 K rise

(d) Maximum, ONAN/ONAF/ONAF @ 65 K rise

(e) 125% of maximum ONAN/ONAF/ONAF @ 65 K rise
Top oil rise shall not exceed 80° C, and Hotspot rise shall not exceed 110° C, maximum (based on maximum temperatures of 110° C and 140° C, with a 30° C ambient).

Obtain samples in syringes for dissolved gas in oil and moisture in oil tests as follows:

(a) Before the start of temperature tests.

(b) After each temperature test at the different ratings given above.

(c) A minimum of 3 hours after the completion of the last temperature test.

(d) Following is the maximum allowed increase in the concentration of gasses:

Gas	Increase After Max 65 K Rating	Increase After 125% Max 65 K Rating
Acetylene C2H2	ND	ND
Methane CH4	2 ppm	15 ppm
Ethane C2H6	5 ppm	10 ppm
Ethylene C2H4	5 ppm	10 ppm
Hydrogen H2	15 ppm	15 ppm
CO	30 ppm	50 ppm
CO2	200 ppm	500 ppm

The purchaser shall be notified before draining oil from tank if any of the gas limits are exceeded. Test results that differ from these limits must be resolved between the purchaser and manufacturer before the oil is drained from the transformer. No further tests shall be performed before the matter is resolved.

2. Insulation Power Factor

Maximum allowable insulation power factor is 0.50% @ 20 C and shall be performed with Doble or purchaser approved equivalent.

3. Dielectric Tests

ANSI impulse test shall include the neutrals.

Measure the core to ground resistance after tanking and just prior to shipment. Minimum allowable resistance shall be 1,000 Megohms corrected to 20 C. These measurements shall be included in the final certified test report.

PD (Partial Discharge) and RIV (Radio Influence Voltage) testing shall be performed after all other electrical tests except the core ground test just prior to shipment. Maximum allowable value for PD is 300 picocoulombs during the one (1) hour test. Maximum allowable value for RIV is 200 microvolts during the enhancement test and 75 microvolts during the one (1) hour test.

Obtain oil samples in syringes for dissolved gas analysis before the beginning of dielectric tests and at least 3 hours after the completion of PDE and RIV tests. Following is the maximum allowable increase in the concentration of dissolved gasses:

Gas	Increase After Dielectrics
Acetylene C2H2	ND
Methane CH4	2 ppm
Ethane C2H6	2 ppm
Ethylene C2H4	1 ppm
Hydrogen H2	10 ppm
CO	20 ppm
CO2	200 ppm

The purchaser shall be notified before draining oil from tank if any of the gas limits are exceeded. Test results that differ from these limits must be resolved between the purchaser and manufacturer before the oil is drained from the transformer. No further tests shall be performed before the matter is resolved.

4. FRA (Frequency Response Analysis)

   Perform FRA testing with customer approved equipment (i.e. Doble SFRA) prior to shipment. The transformer shall be tested in its shipping configuration. For bushings removed for shipment, the bushing cover plate shall have a spark plug type bushing installed in each plate for FRA testing before shipment and upon delivery. All leads shall be secured so there is no movement during shipment in order to obtain valid results for comparison between the before shipment and after delivery tests. Any other method of making provisions for these two (2) tests must be approved by the customer.

5. Factory test reports and results will be supplied to the customer prior to delivery of transformers.

I. Inspection

The Owner is to visit the Seller's factory to inspect the transformer. This inspection is to occur after the transformer has been finally assembled and before it has been placed in tank. The tank shall be ready for inspection also. The Purchaser will be notified where the inspection can be made at least 14 days in advance. Owner shall pay all expenses of representative.

J. Spare Equipment

As an adder please quote:

1. One spare bushing for each voltage class.

2. Manufacturer's suggested spare parts listing.

K. Transportation

1. All transformers are to be shipped F.O.B. destination with freight prepaid and allowed. Transformers to be quoted set on customer's pad, tested and outfitted ready for connection to existing substation.

2. Impact recorder shall accompany the transformers during transit. The Seller shall be responsible for inspecting the transformers and impact recorder in the presence of the Purchaser upon arrival at the shipping destination to determine if any damage has occurred.

3. Owner shall be notified by the Seller at least 96 hours prior to shipment and by the Carrier 48 hours prior to arrival of each transformer at its destination.

L. Service Engineer

1. Inspect equipment that arrives with visible damage or signs of hidden damage; forward a written report to Owner and Engineer itemizing damage incurred.

2. Be responsible for assembly of the equipment. Also be responsible for disposal of any and all crates, packing materials, etc. at a remote approved location.

3. Instruct Owner's personnel in proper operation and maintenance of the equipment.

4. Perform following services in addition to those normally provided:

   (a) Record shipping gas pressure prior to assembly.

   (b) Thoroughly inspect all visible assembled parts and connections.

   (c) Check all gauges and relays to assure proper working conditions.

   (d) Check and operate all cooling equipment.

   (e) Thoroughly search for leaks.

   (f) Test oil prior to energizing to determine that dielectric strength meets requirements of ANSI and for filtering oil as required.

   (g) Oil Type.

   (h) Perform complete set of meggar and ratio tests.

   (i) Doble insulation tests.

   (j) Thoroughly check and operate high voltage no load tap changing equipment as recommended by manufacturer.

   (k) Core ground test.

   (l) Submit a written report to Owner and Engineer tabulating the checks and tests performed by each Service Engineer.

NOTE: THE COST OF THE SERVICE ENGINEER (2 DAYS MINIMUM PER TRANSFORMER) AND ASSEMBLING TRANSFORMERS TO BE INCLUDED WITH THE COST OF TRANSFORMER. WHEN ENGINEER LEAVES, TRANSFORMERS SHOULD BE READY FOR ENERGIZATION.

M. Information to be Furnished with Quotation

1. Type and rating of transformer.

2. Percent reactance and resistance; and high voltage to low voltage percent impedance, both positive and zero sequence. State the KVA basis on which these are calculated.

3. Load loss at normal frequency and voltage at full load.

4. No-load losses at 100 percent and 110 percent of rated voltage.

5. Exciting current at 100, 105 and 110 percent of rated voltage.

6. Auxiliary power requirements for all stages of cooling, including an estimate of requirements for future cooling.

7. The complete ratings, including catalog, drawings or style numbers of all bushings.

8. Dimensions, giving projected floor space, height to top of tank cover, overall height to top of high voltage bushings, vertical clearance above top of tank required for removal of high voltage bushings, and height required for untanking unit.

9. Quantity of oil; weight of oil.

10. Weight of core, coils, and other material to be lifted from tank.

11. Total weight of transformer with oil.

12. Total shipping weight of transformer.

13. General sketches, or descriptions of winding schemes including grouping of shell form groups, etc.

14. Preliminary temperature gradient diagrams showing estimated top oil, average winding and hot spot winding temperatures.

15. Drawings showing automatic inert gas equipment, relief device, temperature equipment, no-load tap changer, pressure relay, etc.

16. A statement is required that the transformer to be furnished will be in accordance with these specifications. Any exception to them must be listed in detail.

17. Length of warranty and associated cost must be stated.

N. Drawings to be Furnished

1. Electronic copy (pdf and dwg) of each of the following drawings for approval shall be sent to Stewart Engineering, Inc.:

   (a) Outline

   (b) Detail of base

   (c) Nameplate

   (d) Detail of bushings, gaskets and flanges

   (e) Detail of all bushing type current transformers

   (f) Detail of wiring diagrams (connection, alarm, control, and auxiliary)

   (g) Assembly and instruction books (final copies only)

   (h) Internal connection diagram (showing actual coil connections and turns diagram)

   (i) Thermal relay operating curves

   (j) Bushing type current transformer curves

   (k) Terminal board physical arrangement in control cabinet

   (l) After final issue and prior to shipment, mail the following as indicated:

      1) Electronic copy (ACAD and pdf formats) of all drawings showing all changes and revisions; one copy to Stewart Engineering, Inc., Engineer, and one to Owner.

      2) Hard copy print of all final drawings showing all changes and revisions; three sets to Owner, one set to Stewart Engineering, Inc., Engineer.

      3) One hard copy print of all final drawings shall accompany the transformer when shipped.

2. Instruction Books:

   (a) Each to include descriptive bulletins, spare parts lists, installation/ operation/maintenance manuals for all applicable equipment, and all final test results.

   (b) At time of shipment mail three (3) sets to Owner and one (1) set to Stewart Engineering, Inc., Engineer. Also provide electronic version of the full instruction book contents in pdf format to both Owner and Engineer.

O. Consideration of Bids

Power transformers which meet the above specifications can be supplied by ABB, Waukesha, Delta Star, Pennsylvania Transformer (Canonburgh Plant only), and Virginia Transformer.

Until final award of the contract is made, the user reserves the right to reject any and all bids and all bids, waive any informalities or accept any bid or bids which, in the opinion of the engineers, will serve the best interest of the user. The user also reserves the right to accept or reject any alternates that may serve his best interest.

Consideration will be given to the manufacturer's experience in the design and manufacture of power transformers, to the company's participation in transformer research, and to their other activities which aid the progress of the industry.

P. Guidelines that will be Followed while Evaluating each Bid

1. To enable easy comparison of bid prices, the base price quoted must be the firm price at delivery date.

2. The transformer price quoted must include the transformer oil cost on the delivery date.

3. $1000 will be deducted from the Purchase Order by Owner if the transformer and all its accessories are not shipped complete at the same time. This is the expected cost of excess handling of components that arrive at different times than the transformer.

4. The quoted price will be for the transformer to be shipped F.O.B. destination.

5. The seller's quote is to include offloading onto existing transformer pad, assembly, and testing of the unit in the field.

6. Transformer losses shall be evaluated. Furnish loss values in KW for the following:

   (1) No Load Losses _____KW @ $6,000/KW

   (2) Load Losses _____KW @ $2,000/KW

   (3) Auxiliary Losses _____KW @ $1,500/KW

   If losses, as determined by factory tests, exceed the proposed losses, the evaluated loss price will be deducted from the contract, or deducted from the amount to be paid the Vendor. If losses as determined by factory tests are less than proposed losses, no credit will be given.

Q. Guarantee

The transformer five year guarantee will begin the day the transformer is energized within 12 months from the date the transformer is delivered and placed on the existing transformer pad at the site:

7471 Twin Beach Road – Fairhope, Alabama 36532

R. Exceptions

Note any exceptions taken to these specifications should be stated and clarified and will be subject to Owner approval before awarding of bids.

II. ITEM 2 – GENERAL SPECIFICATIONS FOR POWER TRANSFORMERS

A. General

These specifications are intended to cover the design and construction of three (3) three-phase power transformers. Two (2) will be installed at the new Fairhope Substation (location yet to be determined). One (1) will be installed at the Fairhope Avenue Substation (location yet to be determined).

The transformer shall be designed and built in accordance with the latest rating, manufacturing, and testing standards of I.E.E.E., NEMA, ANSI, ASA, ASTM, AWS (American Welding Society), CGA (Compressed Gas Association), NESC, NFPA, SSPC, and USEPA, and shall be complete with bushings, oil, cooling equipment, ratio adjusters, filtering connections, and other accessories.

Bushings, leads, and ratio adjusters shall be designed or sized to carry full transformer rated load.

Transformer shall be designed to withstand a short circuit at the transformer terminals, with an infinite bus source.

B. Material, Workmanship and Warranty

All workmanship and material shall be of high quality and all material shall be free from defects affecting appearance or serviceability of equipment.

The vendor shall furnish a warranty that the transformer and its equipment will be in accordance with these specifications and with the latest I.E.E.E., NEMA, ANSI, ASA, ASTM, AWS (American Welding Society), CGA (Compressed Gas Association), NESC, NFPA, SSPC, and USEPA standards insofar as shall be consistent with the Purchaser's specifications.

Warranty period shall be for Five Years. In the event of a failure of the transformer or any component in the first year of service, in/out costs, (transportation and rigging) shall be covered.

C. Design Requirements and Equipment

1. Impedance

Unless otherwise specified, the transformer shall have minimum standard Positive Sequence Impedance @ 55 K ONAN base rating.

2. Insulation Levels

(a) The insulation on the line and neutral ends of the winding shall meet all dielectric requirements for their voltage class, both low frequency and impulse, as outlined in the latest edition of ANSI Standard C57.12.

(b) The following table lists the required BIL ratings for the corresponding rated line to line terminal voltage:

(1) RATED LINE-TO LINE TERMINAL VOLTAGE, KV	(2) BIL KV RATING
44 KV line end	250
15 KV line end	110
15 KV neutral end	110

The winding line and neutral terminals, with line-to-line terminal voltage ratings as given in column (1) shall be insulated at the BIL ratings as specified on the corresponding line in column (2).

3. Windings and Leads

(a) Make all bolted connections with a minimum of two (2) bolts. Lock washers are acceptable if fully retained.

(b) All leads to bushings shall be of flexible conductors. Proper tolerances shall be supplied in the bushing leads to prevent undue strain on the bushings and winding anchorage during installation and to prevent excess lead lengths which may constitute insulation hazards when not properly installed. Where leads run directly into the windings they shall be properly supported at the winding end within plain view to facilitate field inspection. Winding magnet wire shall not be extended past the anchorage point.

(c) All internal structural members shall be metal, except where insulating functions are required. Use of lebonite is not permissible.

(d) In the interest of oil preservation, the use of varnish or other materials not compatible with oil shall be prohibited.

(e) Core grounding strap shall be brought out to a convenient position on the side of the tank to facilitate field testing. The core ground shall be brought out through an adequately insulated bushing and bolted to the transformer tank. This core ground shall be shrouded with a bolted cover and the cover shall be clearly marked "CORE GROUND".

(f) Where bolted connections are made through panels, an insulating sleeve or spacer shall be used on both sides of the panel to reduce the electric field concentration and mitigate the precipitation of suspended solids at this point.

(g) Internal arresters are not permissible.

(h) All conductors shall be copper.

(i) All coils shall include full circumference clamping rings. Clamping rings shall be manufactured of non-conductive material.

(j) High and low voltage windings shall be of circular construction and windings shall be of Helical or Disc design. Tapped layer windings are not permissible.

(k) Autotransformer design shall not be permitted.

(l) Maximum current density in all windings shall be 1,340 Amps per square inch at the base 55 K ONAN rating.

(m) Maximum designed induction rate shall be 1.73 Tesla at 100% excitation in all HV taps.

4. <u>Cooling Equipment</u>

(a) The transformer shall be equipped with detachable coolers with provisions to permit drainage of oil and removal of self coolers without loss of oil from the main tank.

(b) The transformer cooling class shall be as specified and shall consist of one of the following types:

(1) Class ONAN-Self-Cooled: Self-cooled transformers shall be supplied with detachable coolers, and shall be equipped with provisions to permit drainage of oil and removal of coolers without loss of oil from the main transformer tank.

Unless otherwise stated, all self-cooled transformers shall be equipped with the necessary provisions for future addition of forced cooling equipment. All radiators required for forced cooled ratings shall be provided initially with the power transformer.

(2) Class ONAN/ONAF - Self-Cooled, Forced-Air Cooled: Transformers of this cooling class shall be equipped as described in item 4(b) (1) and shall include a sufficient number of fans equipped with 240 volt, 60 Hertz, single-phase motors.

(3) Class ONAN/ONAF/ONAF - Self-Cooled, Forced-Air Cooled, Forced-Air Cooled: Transformers of this cooling class shall be equipped as described in item 4(b) (1) and 4(b) 2. Where multi-stage cooling is supplied, a throwover switch shall be provided to alternate duty of each stage of cooling equipment. Air blast equipment shall be controlled from winding temperature equipment specified in Section D.

(c) Transformer cooling fans employed on ONAN/ONAF and ONAN/ONAF/ONAF rated transformers shall satisfy the following criteria:

(1) The interior of fan motors shall have no unprotected steel surfaces. Unpainted steel surfaces shall have thin coat of baked varnish or other suitable material applied to prevent rusting. All fan motor housings shall have drainage holes for draining of condensate or other liquid.

(2) Fans shall be free of excessive vibration. Headers or radiator tubes used for mounting fans shall be sufficiently rigid or adequately braced to prevent excessive vibration.

(3) Fans required for each stage of cooling shall be divided among the radiator banks.

(4) Single voltage motors are preferred.

(5) Fans mounted on top of radiators are not acceptable.

(6) Purchaser will supply a 240 Volt, single phase, 60 Hertz power source.

5. Bushings

(a) Full line voltage outdoor terminal bushings shall be furnished for all windings. Standard ASA bushings shall be furnished where applicable. The type of bushings furnished shall be subject to approval by purchaser. Bushing porcelain glaze shall be light gray (ANSI No. 70).

All bushings shall be equipped with standard threaded stud type terminals and with stud connectors to 4 hole flat pad, Anderson Electric type HDSF or Penn-Union type SLB.

(b) All bushings shall project into the oil at its lowest level, distance being sufficient as to positively prevent flashover from the inside end of the bushing to the tank or cover.

(c) Minimum external clearances metal to metal between adjacent phases shall be as follows, or as recommended in the latest National Standards, whichever is more stringent:

Phase to Phase Voltage (KV)	BIL (KV)	Clearance (in.)	Quantity
44	250	22	3
15	110	12	4

(d) All transformer bushings above 25KV (150KV BIL) shall be shipped detached from the transformer for on-site insertion into the tank.

(e) Provide bushings manufactured by Hubbell (PCORE) (or purchaser approved equivalent).

6. Tanks

(a) Transformer tanks shall be equipped with welded-on covers, and braced for a full vacuum. Split tank construction is not desirable, but may be used when required by shipping limitations. Unless specifically requested, there is no restriction on the assembled height, width, or depth of transformers.

(b) The tank shall be equipped with a base capable of being skidded in any direction. It shall be equipped with rounded pulling eyes not less than 2.5 inches in diameter and suitable for pulling in any direction. Pulling eyes shall be located approximately 6 inches above the bottom of the transformer for maximum pulling efficiency.

(c) Lugs shall be provided on the transformer for lifting the entire unit filled with oil and for the removal of cover and tank sections.

(d) Jack bosses shall be provided at not less than four locations for using hydraulic jacks. Jack lugs shall be mounted at a minimum height of 12 inches above base.

(e) Grounding pads shall be provided at two points on the tank and shall be complete with clamp type grounding terminal fittings for 2/0 AWG to 250 MCM copper cable (Anderson Electric #SWH-025B, or equal).

The two ground pads shall be located on opposite sides of the transformer. Flat steel lugs shall be provided on the tank to provide for attaching one-bolt clamps for the purpose of supporting copper cable neutral and lightning arrester grounds to be installed by the Purchaser. These lugs shall be installed down all four (4) corners of the transformer.

(f) Constant pressure type tank construction shall be used, unless otherwise specified or approved, and equipment shall be provided for automatically maintaining a cushion of inert gas over the oil. This equipment shall include pressure gauge(s), three-stage gas regulator, gas cylinder and other necessary equipment mounted in a suitable cabinet attached to the transformer tank and located such that the bottom of the cabinet is a maximum of twelve inches above the transformer base. Nitrogen inert-gas pressure system shall be in accordance with ANSI C57.12.00-2000 per Section 6.6.3 or latest revision. The nitrogen for use in the system shall be in accordance with ASTM D1933-1997, Type III. Nitrogen control equipment shall be mounted in an easily accessible, weatherproof, lockable enclosure with adequate space for the nitrogen bottles mounted on transformer tank. Nitrogen tank shall be provided with a certificate of ownership. Pressure switches indicating high/low tank pressure, and low cylinder pressure are to be provided.

(g) A mechanical pressure relief device without frangible diaphragm and equipment with resealing device, indicator visible from the ground and alarm contacts suitable for 48 volt ungrounded DC shall be installed on top of the tank. This device may be mounted in manhole covers if the design so dictates.

(h) Gaskets shall be made of synthetic rubber such as Nitrile, Hycar, Neoprene, etc. Cork-neoprene is not acceptable. Any departure from these standard gasket arrangements shall be clearly stated with the proposal and shall require specific approval of the Purchaser prior to acceptance. All mating steel surfaces where gaskets are to be applied shall have two coats of gulped or other suitable paint applied and dried prior to gasket installation to prevent rusting.

(i) When required, transformer tanks shall be equipped with steel clips suitable for attaching an insulator bracket on the low voltage side of the tank for the purpose of supporting low voltage leads.

(j) All bolts, studs, nuts and washers used on the transformer cover for mounting manhole covers, pressure relief devices, bushings, and bushing adapters shall be stainless steel to facilitate ease of maintenance.

(k) Manholes may be of round, oval or rectangular shape with a minimum opening of nineteen inches.

(l) Transformer tanks shall be equipped with bushing type current transformers as follows:

(1) Two 600 to 5 ampere multiratio, C800 accuracy on each 44 KV bushing.

(2) Two 1200 to 5 ampere multiratio, C800 accuracy on each 15 KV bushing. One 600 to 5 ampere multiratio, C800 accuracy on 15 KV neutral bushing.

All CT's shall be standard 5-tap with 2.0 Thermal Rating Factor.

(m) All tank welds shall be of highest quality and shall be pressure tested free of leaks, prior to painting. All tank seams shall be welded both internally and externally. No seams should be located at the tank corners. Steel should be bent at the corners and seams formed on the sides of the tank at a location not closer than 10 inches from the tank corner.

(n) Inside of transformer tank shall be painted white. Paint shall be compatible with transformer oil.

(o) Transformer tank shall be designed with a slightly domed cover to shed water. A non-skid surface shall be applied to the cover prior to shipment.

7. Tap Changer

De-energized ratio adjusters shall be provided in the high-voltage winding to permit changing of taps when the transformer is de-energized. These ratio adjusters shall be suitable for the maximum forced cooled rating of the transformer regardless of whether the equipment is purchased with cooling equipment or provisions for future cooling equipment.

The tap changer operating mechanism gearing shall be designed to easily overcome extra friction load which may develop over the life of the equipment due to age and lack of use. If sector type contacts are used, the turning ratio shall be adequate to insure good contact alignment even with the increased backlash or deflection due to aging of the equipment. The contacts shall be designed to provide for indexing approximately on the center of the sectors when approached from either direction.

The tap changer shall be provided with means for bolting and locking in any tap position.

8. Surge Protection

Complete surge protection (Type MOV) shall be provided. All arresters shall be metal cap type and mounted on the transformer. The H. V. arresters shall be station type with a maximum duty cycle rating of 39 KV. The L. V. arresters shall be station type with a maximum duty cycle rating of 10 KV. Copper faced pads, or stainless steel welded to the tank, shall be provided to solidly connect each arrester base to the transformer tank. Arrester porcelain glaze shall be light gray (ANSI No. 70).

9. Service Conditions

The transformer shall be designed from terminal to terminal including ancillary components as follows:

(a) Loading per ANSI C57.91. Current capacity of ancillary components shall not limit the current carrying capability of the transformer from terminal to terminal.

(b) Short circuit withstand per ANSI C57.00 with fault currents limited by the transformer impedance only.

(c) Audible sound levels shall be no higher than 6 dB below current NEMA Standard.

D. Accessory Equipment

1. Nameplates

A nameplate shall be furnished with each transformer. It shall be mounted at a height for easy reading from the ground and shall be located near the no-load tap changer. The following information shall be given thereon:

(a) Connection diagram which shall include the various voltage and current ratings.

(b) Gallons of oil, type and percent of inhibitor, and variation of oil level with temperature.

(c) Percent impedance between windings and KVA base.

(d) Vector diagram.

(e) Average copper temperature rise and maximum hot spot temperature rise.

(f) KVA rating of windings for both self-cooled and forced-cooled. These ratings shall include both the 55 and 65 degree Centigrade ratings.

(g) Serial number of transformer.

(h) Total new weight.

(i) Weight to be lifted when untanking.

(j) Maximum pressure and fuel vacuum permissible in tank.

2. Oil Connections

Oil connections terminated with 1 ½ inch IPS threaded inlet and outlet globe type valves shall be provided as follows:

(a) At bottom of tank. This connection shall be located so that the tank can be completely drained of oil by gravity. This valve shall be equipped with a sampler device suitable for removal of oil without opening the main valve. O. B. Series 1813, or equal, is acceptable.

(b) At top of tank above the maximum oil level. O. B. Series 1814, or equal, is acceptable.

3. Instruments

(a) A dial type thermometer with a maximum temperature indicating hand suitable for convenient manual reset and equipped with alarm contacts suitable for use with 48 volt ungrounded DC shall be provided. The thermometer shall be mounted not more than five (5) feet above the transformer base and shall indicate the hottest oil temperature. The controlling element for this thermometer shall be mounted in a well in the transformer tank so as to permit removal of the element without loss of oil. The well shall be welded to the tank where interference with tanking and untanking is prevented. Otherwise, it shall be attached to the tank wall with a suitable flange and "O" ring gasket.

(b) One (1) single-element, three-stage, thermal relay, activated by both top oil temperature and current proportional to the current in the transformer windings, shall be furnished. The stages of this relay shall be suitable for the following operations:

(1) First stage shall have contacts suitable for control of air blast equipment and shall operate at a temperature of 65 degrees Centigrade simulated hot spot.

(2) Second stage contacts shall operate an alarm circuit when load and ambient conditions specified in ASA standards C-57.92 (1959), tables 92-01.250A, 92-01.250B, 92-01.250C and 92-01.150D are exceeded by five (5) percent, assuming a 30 degree Centigrade ambient. No signal will be given for load and ambient conditions below the values given in the above tables.

(3) Third stage contacts shall operate a breaker tripping scheme at such temperature and time as will permit a loss of life of transformer insulation not to exceed one-half of one percent (1/2%) as indicated in tables 92-92.200A through 92-92.200P of ASA standard C57.92 (1959).

The controlling element for this relay shall be mounted in a well in the transformer tank so as to permit removal of the element without loss of oil. The well shall be welded to the tank where interference with tanking and untanking is avoided. Otherwise, it shall be attached to the tank wall with a suitable flange and "O" ring gasket.

Thermal relay operating curves shall be supplied for each relay.

Contacts for stages two and three shall be suitable for use with 48 volt ungrounded DC.

(c) The transformer shall be supplied complete with a large diameter magnetic type oil level gauge with contacts for a 48 volt ungrounded DC with maximum, minimum and 25 degrees Centigrade oil levels marked thereon.

(d) Sudden pressure relay with auxiliary relay (48 volt ungrounded DC).

(e) Automatic reseal pressure relief device with 48 volt ungrounded DC alarm contact.

(f) All controls, alarm and current transformer secondary circuits shall be brought out through the tank wall and terminated in the transformer control cabinet. All secondary leads within the tank shall be properly supported. Heavy terminal lugs shall be used. These lugs shall be sufficiently strong to prevent their bending during flexing of the control wire. All unfinished wiring which is to be completed in the field shall be equipped with captive connectors to prevent small parts from dropping into the windings during shipment and field assembly. Make provisions for padlocking cabinet door.

Inside of control cabinets shall be lighted by led lighting, controlled by cabinet door-actuated switches. Interior of cabinet shall be painted white.

A drawing pocket shall be provided on inside of control cabinet door. Pocket shall have a hinged lid to prevent rainwater from dripping into the pocket when the door is in the open position.

Short circuiting bars shall be supplied in the control cabinet for all current transformer secondaries.

E. Painting

Surfaces requiring painting shall be rendered clean and smooth and shall be finished with three (3) properly related coats of paint. Tank finish shall be a light gray color conforming to ANSI No. 70. Furnish touch-up paint identical to final coat. Paint shall be guaranteed for five (5) years. The transformer Paint System shall meet or exceed the requirements of ANSI/IEEE C57.12.28.

F. Oil

The necessary quantity of Type 1 inhibited oil with maximum 0.08% inhibitor shall be furnished for filling each transformer to the proper level for the temperature at the time of filling. Oil dielectric breakdown voltage shall be a minimum of 35 KV (D877); oil acid number shall not exceed 0.05 mg KOH/gal. oil; and oil interfacial tension shall test a minimum of 35 dynes/cm.

Oil must confirm or exceed the specifications given in ANSI/ASTM #D3487. PCB content in the oil to be in accordance with EPA regulation #40CFR761 or latest revision of regulation and with manufacturer's certification. Test results showing PPM.

All of the above plus full DGA and moisture content tests must be performed on all transformers.

G. Factory Tests

All tests shall be conducted according to ANSI/IEEE Standards, and three (3) copies of a certified report of tests shall be sent to the Owner. One copy shall be sent to Stewart Engineering, Inc. Also provide an electronic version of the certified test report in pdf format to the customer and Stewart Engineering. Purchaser reserves the right to witness test. Purchaser reserves the right to witness test. Purchaser shall be notified at least 10 days prior to factory testing.

Loss measuring equipment shall be calibrated in accordance with NIST (National Institute of Standards and Technology), Technical Note 1204.

Transformer shall be fully assembled prior to testing. Unit shall be tested with the radiators that ship with the unit.

The report shall include all routine tests specified in ASA standard 57.12-06.11 (1958) and the latest revision of ANSI Standard Test Code for Transformers C57.12.90. In addition, the following test information shall be required and documented in the certified test report:

1. Resistance measurements of all windings on the rated voltage connection and all tap positions. All resistance measurements shall be given in ohms at 75 degrees Centigrade.

2. No-load loss and exciting current data covered in the above routine tests at rated excitation voltage shall also be supplied for 110 percent of rated voltage.

3. Regulation at 70, 80 and 100 percent power factor.

4. Temperature test data may be supplied on one unit of any group and shall include the following additional information:

   (a) A statement that the test was run on the highest loss tap. Such statement shall include the value of losses.

   (b) Calculated average oil temperature from data taken during the total loss heat run. Provide measured bottom oil temperature for all temperature tests.

   (c) Calculated hottest spot temperature at rated load from total loss heat run data. Hottest spot temperature must be calculated using localized stray and eddy losses. Applying a factor or adding 15 degrees K to the average winding temperature rise is not acceptable.

   (d) Temperature tests when required shall be made before dielectric tests.

5. Insulation power factor data on each unit.

6. A Quality Control Impulse Test shall be made on each unit unless otherwise specified. A Statement that the transformer has successfully withstood this test shall appear on the test report.

7. The positive sequence impedance and load loss and the zero sequence impedance and load loss shall be measured at the self cooled rating (55 K ONAN) in all high voltage tap positions.

8. Turns ratio on all high voltage tap positions.

9. Factory test reports and results will be supplied to the customer prior to delivery of transformers.

H. <u>Special Test Requirements</u>

1. Temperature Rise Tests

   Temperature rise tests will be required on the first transformer. Measure the bottom oil temperature for all temperature tests. Report all values on final certified test report. Temperature rise data can be derived from results of the first transformer. Show the test results on the duplicate with its serial number and test date. Temperature rise tests will be made at the highest loss tap position and with an equivalent no load loss at 105% voltage. The tests will be made at the following ratings:

(a) Self cooled, ONAN @ 55 K rise

(b) Self cooled, ONAN @ 65 K rise

(c) Maximum, ONAN/ONAF/ONAF @ 55 K rise

(d) Maximum, ONAN/ONAF/ONAF @ 65 K rise

(e) 125% of maximum ONAN/ONAF/ONAF @ 65 K rise
Top oil rise shall not exceed 80° C, and Hotspot rise shall not exceed 110° C, maximum (based on maximum temperatures of 110° C and 140° C, with a 30° C ambient).

Obtain samples in syringes for dissolved gas in oil and moisture in oil tests as follows:

(a) Before the start of temperature tests.

(b) After each temperature test at the different ratings given above.

(c) A minimum of 3 hours after the completion of the last temperature test.

(d) Following is the maximum allowed increase in the concentration of gasses:

Gas	Increase After Max 65 K Rating	Increase After 125% Max 65 K Rating
Acetylene C2H2	ND	ND
Methane CH4	2 ppm	15 ppm
Ethane C2H6	5 ppm	10 ppm
Ethylene C2H4	5 ppm	10 ppm
Hydrogen H2	15 ppm	15 ppm
CO	30 ppm	50 ppm
CO2	200 ppm	500 ppm

The purchaser shall be notified before draining oil from tank if any of the gas limits are exceeded. Test results that differ from these limits must be resolved between the purchaser and manufacturer before the oil is drained from the transformer. No further tests shall be performed before the matter is resolved.

2. Insulation Power Factor

Maximum allowable insulation power factor is 0.50% @ 20 C and shall be performed with Doble or purchaser approved equivalent.

3. Dielectric Tests

ANSI impulse test shall include the neutrals.

Measure the core to ground resistance after tanking and just prior to shipment. Minimum allowable resistance shall be 1,000 Megohms corrected to 20 C. These measurements shall be included in the final certified test report.

PD (Partial Discharge) and RIV (Radio Influence Voltage) testing shall be performed after all other electrical tests except the core ground test just prior to shipment. Maximum allowable value for PD is 300 picocoulombs during the one (1) hour test. Maximum allowable value for RIV is 200 microvolts during the enhancement test and 75 microvolts during the one (1) hour test.

Obtain oil samples in syringes for dissolved gas analysis before the beginning of dielectric tests and at least 3 hours after the completion of PDE and RIV tests. Following is the maximum allowable increase in the concentration of dissolved gasses:

Gas	Increase After Dielectrics
Acetylene C2H2	ND
Methane CH4	2 ppm
Ethane C2H6	2 ppm
Ethylene C2H4	1 ppm
Hydrogen H2	10 ppm
CO	20 ppm
CO2	200 ppm

The purchaser shall be notified before draining oil from tank if any of the gas limits are exceeded. Test results that differ from these limits must be resolved between the purchaser and manufacturer before the oil is drained from the transformer. No further tests shall be performed before the matter is resolved.

4. FRA (Frequency Response Analysis)

Perform FRA testing with customer approved equipment (i.e. Doble SFRA) prior to shipment. The transformer shall be tested in its shipping configuration. For bushings removed for shipment, the bushing cover plate shall have a spark plug type bushing installed in each plate for FRA

testing before shipment and upon delivery. All leads shall be secured so there is no movement during shipment in order to obtain valid results for comparison between the before shipment and after delivery tests. Any other method of making provisions for these two (2) tests must be approved by the customer.

5. Factory test reports and results will be supplied to the customer prior to delivery of transformers.

I. Inspection

The Owner is to visit the Seller's factory to inspect the transformer. This inspection is to occur after the transformer has been finally assembled and before it has been placed in tank. The tank shall be ready for inspection also. The Purchaser will be notified where the inspection can be made at least 14 days in advance. Owner shall pay all expenses of representative.

J. Spare Equipment

As an adder please quote:

1. One spare bushing for each voltage class.

2. Manufacturer's suggested spare parts listing.

K. Transportation

1. All transformers are to be shipped F.O.B. destination with freight prepaid and allowed. Transformers to be quoted set on customer's pad, tested and outfitted ready for connection to existing substation.

2. Impact recorder shall accompany the transformers during transit. The Seller shall be responsible for inspecting the transformers and impact recorder in the presence of the Purchaser upon arrival at the shipping destination to determine if any damage has occurred.

3. Owner shall be notified by the Seller at least 96 hours prior to shipment and by the Carrier 48 hours prior to arrival of each transformer at its destination.

L. Service Engineer

1. Inspect equipment that arrives with visible damage or signs of hidden damage; forward a written report to Owner and Engineer itemizing damage incurred.

2. Be responsible for assembly of the equipment. Also be responsible for disposal of any and all crates, packing materials, etc. at a remote approved location.

3. Instruct Owner's personnel in proper operation and maintenance of the equipment.

4. Perform following services in addition to those normally provided:

   (a) Record shipping gas pressure prior to assembly.

   (b) Thoroughly inspect all visible assembled parts and connections.

   (c) Check all gauges and relays to assure proper working conditions.

   (d) Check and operate all cooling equipment.

   (e) Thoroughly search for leaks.

   (f) Test oil prior to energizing to determine that dielectric strength meets requirements of ANSI and for filtering oil as required.

   (g) Oil Type.

   (h) Perform complete set of meggar and ratio tests.

   (i) Doble insulation tests.

   (j) Thoroughly check and operate high voltage no load tap changing equipment as recommended by manufacturer.

   (k) Core ground test.

   (l) Submit a written report to Owner and Engineer tabulating the checks and tests performed by each Service Engineer.

   NOTE: THE COST OF THE SERVICE ENGINEER (2 DAYS MINIMUM PER TRANSFORMER) AND ASSEMBLING TRANSFORMERS TO BE INCLUDED WITH THE COST OF TRANSFORMERS. WHEN ENGINEER LEAVES, TRANSFORMERS SHOULD BE READY FOR ENERGIZATION.

M. Information to be Furnished with Quotation

1. Type and rating of transformer.

2. Percent reactance and resistance; and high voltage to low voltage percent impedance, both positive and zero sequence. State the KVA basis on which these are calculated.

3. Load loss at normal frequency and voltage at full load.

4. No-load losses at 100 percent and 110 percent of rated voltage.

5. Exciting current at 100, 105 and 110 percent of rated voltage.

6. Auxiliary power requirements for all stages of cooling, including an estimate of requirements for future cooling.

7. The complete ratings, including catalog, drawings or style numbers of all bushings.

8. Dimensions, giving projected floor space, height to top of tank cover, overall height to top of high voltage bushings, vertical clearance above top of tank required for removal of high voltage bushings, and height required for untanking unit.

9. Quantity of oil; weight of oil.

10. Weight of core, coils, and other material to be lifted from tank.

11. Total weight of transformer with oil.

12. Total shipping weight of transformer.

13. General sketches, or descriptions of winding schemes including grouping of shell form groups, etc.

14. Preliminary temperature gradient diagrams showing estimated top oil, average winding and hot spot winding temperatures.

15. Drawings showing automatic inert gas equipment, relief device, temperature equipment, no-load tap changer, pressure relay, etc.

16. A statement is required that the transformer to be furnished will be in accordance with these specifications. Any exception to them must be listed in detail.

17. Length of warranty and associated cost must be stated.

N. Drawings to be Furnished

1. Electronic copy (pdf and dwg) of each of the following drawings for approval shall be sent to Stewart Engineering, Inc.:

   (a) Outline

   (b) Detail of base

   (c) Nameplate

   (d) Detail of bushings, gaskets and flanges

   (e) Detail of all bushing type current transformers

   (f) Detail of wiring diagrams (connection, alarm, control, and auxiliary)

   (g) Assembly and instruction books (final copies only)

   (h) Internal connection diagram (showing actual coil connections and turns diagram)

   (i) Thermal relay operating curves

   (j) Bushing type current transformer curves

   (k) Terminal board physical arrangement in control cabinet

   (l) After final issue and prior to shipment, mail the following as indicated:

      1) Electronic copy (ACAD and pdf formats) of all drawings showing all changes and revisions; one copy to Stewart Engineering, Inc., Engineer, and one to Owner.

      2) Hard copy print of all final drawings showing all changes and revisions; three sets to Owner, one set to Stewart Engineering, Inc., Engineer.

      3) One hard copy print of all final drawings shall accompany the transformer when shipped.

2. Instruction Books:

   (a) Each to include descriptive bulletins, spare parts lists, installation/ operation/maintenance manuals for all applicable equipment, and all final test results.

   (b) At time of shipment mail three (3) sets to Owner and one (1) set to Stewart Engineering, Inc., Engineer. Also provide electronic version of the full instruction book contents in pdf format to both Owner and Engineer.

O. Consideration of Bids

Power transformers which meet the above specifications can be supplied by ABB, Waukesha, Delta Star, Pennsylvania Transformer (Canonburgh Plant only), and Virginia Transformer.

Until final award of the contract is made, the user reserves the right to reject any and all bids and all bids, waive any informalities or accept any bid or bids which, in the opinion of the engineers, will serve the best interest of the user. The user also reserves the right to accept or reject any alternates that may serve his best interest.

Consideration will be given to the manufacturer's experience in the design and manufacture of power transformers, to the company's participation in transformer research, and to their other activities which aid the progress of the industry.

P. Guidelines that will be Followed while Evaluating each Bid

1. To enable easy comparison of bid prices, the base price quoted must be the firm price at delivery date.

2. The transformer price quoted must include the transformer oil cost on the delivery date.

3. $1000 will be deducted from the Purchase Order by Owner if the transformer and all its accessories are not shipped complete at the same time. This is the expected cost of excess handling of components that arrive at different times than the transformer.

4. The quoted price will be for the transformer to be shipped F.O.B. destination.

5. The seller's quote is to include offloading onto existing transformer pad, assembly, and testing of the unit in the field.

6. Transformer losses shall be evaluated. Furnish loss values in KW for the following:

   (1) No Load Losses _____KW @ $6,000/KW

   (2) Load Losses _____KW @ $2,000/KW

   (3) Auxiliary Losses _____KW @ $1,500/KW

If losses, as determined by factory tests, exceed the proposed losses, the evaluated loss price will be deducted from the contract, or deducted from the amount to be paid the Vendor. If losses as determined by factory tests are less than proposed losses, no credit will be given.

Q. Guarantee

The transformer five year guarantee will begin the day the transformer is energized within 12 months from the date the transformer is delivered and placed on the existing transformer pad at these sites:

One (1) Transformer – New Fairhope Avenue Substation (Location yet to be determined)

Two (2) Transformers – New Substation (Location yet to be determined)

R. Exceptions

Note any exceptions taken to these specifications should be stated and clarified and will be subject to Owner approval before awarding of bids.

III. ITEM 3 – GENERAL SPECIFICATIONS FOR POWER TRANSFORMER

A. General

These specifications are intended to cover the design and construction of one (1) three-phase power transformer to be installed at Fairhope Volanta Avenue Substation.

The transformer shall be designed and built in accordance with the latest rating, manufacturing, and testing standards of I.E.E.E., NEMA, ANSI, ASA, ASTM, AWS (American Welding Society), CGA (Compressed Gas Association), NESC, NFPA, SSPC, and USEPA, and shall be complete with bushings, oil, cooling equipment, ratio adjusters, filtering connections, and other accessories.

Bushings, leads, and ratio adjusters shall be designed or sized to carry full transformer rated load.

Transformer shall be designed to withstand a short circuit at the transformer terminals, with an infinite bus source.

B. Material, Workmanship and Warranty

All workmanship and material shall be of high quality and all material shall be free from defects affecting appearance or serviceability of equipment.

The vendor shall furnish a warranty that the transformer and its equipment will be in accordance with these specifications and with the latest I.E.E.E., NEMA, ANSI, ASA, ASTM, AWS (American Welding Society), CGA (Compressed Gas Association), NESC, NFPA, SSPC, and USEPA standards insofar as shall be consistent with the Purchaser's specifications.

Warranty period shall be for Five Years. In the event of a failure of the transformer or any component in the first year of service, in/out costs, (transportation and rigging) shall be covered.

C. Design Requirements and Equipment

1. Impedance

Unless otherwise specified, the transformer shall have minimum standard Positive Sequence Impedance @ 55 K ONAN base rating.

2. Insulation Levels

(a) The insulation on the line and neutral ends of the winding shall meet all dielectric requirements for their voltage class, both low frequency and impulse, as outlined in the latest edition of ANSI Standard C57.12.

(b) The following table lists the required BIL ratings for the corresponding rated line to line terminal voltage:

(1) RATED LINE-TO LINE TERMINAL VOLTAGE, KV	(2) BIL KV RATING
44 KV line end	250
15 KV line end	110
15 KV neutral end	110

The winding line and neutral terminals, with line-to-line terminal voltage ratings as given in column (1) shall be insulated at the BIL ratings as specified on the corresponding line in column (2).

3. Windings and Leads

(a) Make all bolted connections with a minimum of two (2) bolts. Lock washers are acceptable if fully retained.

(b) All leads to bushings shall be of flexible conductors. Proper tolerances shall be supplied in the bushing leads to prevent undue strain on the bushings and winding anchorage during installation and to prevent excess lead lengths which may constitute insulation hazards when not properly installed. Where leads run directly into the windings they shall be properly supported at the winding end within plain view to facilitate field inspection. Winding magnet wire shall not be extended past the anchorage point.

(c) All internal structural members shall be metal, except where insulating functions are required. Use of lebonite is not permissible.

(d) In the interest of oil preservation, the use of varnish or other materials not compatible with oil shall be prohibited.

(e) Core grounding strap shall be brought out to a convenient position on the side of the tank to facilitate field testing. The core ground shall be brought out through an adequately insulated bushing and bolted to the transformer tank. This core ground shall be shrouded with a bolted cover and the cover shall be clearly marked "CORE GROUND".

(f) Where bolted connections are made through panels, an insulating sleeve or spacer shall be used on both sides of the panel to reduce the electric field concentration and mitigate the precipitation of suspended solids at this point.

(g) Internal arresters are not permissible.

(h) All conductors shall be copper.

(i) All coils shall include full circumference clamping rings. Clamping rings shall be manufactured of non-conductive material.

(j) High and low voltage windings shall be of circular construction and windings shall be of Helical or Disc design. Tapped layer windings are not permissible.

(k) Autotransformer design shall not be permitted.

(l) Maximum current density in all windings shall be 1,340 Amps per square inch at the base 55 K ONAN rating.

(m) Maximum designed induction rate shall be 1.73 Tesla at 100% excitation in all HV taps.

4. Cooling Equipment

(a) The transformer shall be equipped with detachable coolers with provisions to permit drainage of oil and removal of self coolers without loss of oil from the main tank.

(b) The transformer cooling class shall be as specified and shall consist of one of the following types:

(1) Class ONAN-Self-Cooled: Self-cooled transformers shall be supplied with detachable coolers, and shall be equipped with provisions to permit drainage of oil and removal of coolers without loss of oil from the main transformer tank.

Unless otherwise stated, all self-cooled transformers shall be equipped with the necessary provisions for future addition of forced cooling equipment. All radiators required for forced cooled ratings shall be provided initially with the power transformer.

(2) Class ONAN/ONAF - Self-Cooled, Forced-Air Cooled: Transformers of this cooling class shall be equipped as described in item 4(b) (1) and shall include a sufficient number of fans equipped with 240 volt, 60 Hertz, single-phase motors.

(c) Transformer cooling fans employed on ONAN/ONAF and ONAN/ONAF/ONAF rated transformers shall satisfy the following criteria:

(1) The interior of fan motors shall have no unprotected steel surfaces. Unpainted steel surfaces shall have thin coat of baked varnish or other suitable material applied to prevent rusting. All fan motor housings shall have drainage holes for draining of condensate or other liquid.

(2) Fans shall be free of excessive vibration. Headers or radiator tubes used for mounting fans shall be sufficiently rigid or adequately braced to prevent excessive vibration.

(3) Fans required for each stage of cooling shall be divided among the radiator banks.

(4) Single voltage motors are preferred.

(5) Fans mounted on top of radiators are not acceptable.

(6) Purchaser will supply a 240 Volt, single phase, 60 Hertz power source.

5. Bushings

(a) Full line voltage outdoor terminal bushings shall be furnished for all windings. Standard ASA bushings shall be furnished where applicable. The type of bushings furnished shall be subject to approval by purchaser. Bushing porcelain glaze shall be light gray (ANSI No. 70).

All bushings shall be equipped with standard threaded stud type terminals and with stud connectors to 4 hole flat pad, Anderson Electric type HDSF or Penn-Union type SLB.

(b) All bushings shall project into the oil at its lowest level, distance being sufficient as to positively prevent flashover from the inside end of the bushing to the tank or cover.

(c) Minimum external clearances metal to metal between adjacent phases shall be as follows, or as recommended in the latest National Standards, whichever is more stringent:

Phase to Phase Voltage (KV)	BIL (KV)	Clearance (in.)	Quantity
44	250	22	3
15	110	12	4

(d) All transformer bushings above 25KV (150KV BIL) shall be shipped detached from the transformer for on-site insertion into the tank.

(e) Provide bushings manufactured by Hubbell (PCORE) (or purchaser approved equivalent).

6. Tanks

(a) Transformer tanks shall be equipped with welded-on covers, and braced for a full vacuum. Split tank construction is not desirable, but may be used when required by shipping limitations. Unless specifically requested, there is no restriction on the assembled height, width, or depth of transformers.

(b) The tank shall be equipped with a base capable of being skidded in any direction. It shall be equipped with rounded pulling eyes not less than 2.5 inches in diameter and suitable for pulling in any direction. Pulling eyes shall be located approximately 6 inches above the bottom of the transformer for maximum pulling efficiency.

(c) Lugs shall be provided on the transformer for lifting the entire unit filled with oil and for the removal of cover and tank sections.

(d) Jack bosses shall be provided at not less than four locations for using hydraulic jacks. Jack lugs shall be mounted at a minimum height of 12 inches above base.

(e) Grounding pads shall be provided at two points on the tank and shall be complete with clamp type grounding terminal fittings for 2/0 AWG to 250 MCM copper cable (Anderson Electric #SWH-025B, or equal).

The two ground pads shall be located on opposite sides of the transformer. Flat steel lugs shall be provided on the tank to provide for attaching one-bolt clamps for the purpose of supporting copper cable neutral and lightning arrester grounds to be installed by the Purchaser. These lugs shall be installed down all four (4) corners of the transformer.

(f) Constant pressure type tank construction shall be used, unless otherwise specified or approved, and equipment shall be provided for automatically maintaining a cushion of inert gas over the oil. This equipment shall include pressure gauge(s), three-stage gas regulator, gas cylinder and other necessary equipment mounted in a suitable cabinet attached to the transformer tank and located such that the bottom of the cabinet is a maximum of twelve inches above the transformer base. Nitrogen inert-gas pressure system shall be in accordance with ANSI C57.12.00-2000 per Section 6.6.3 or latest revision. The nitrogen for use in the system shall be in accordance with ASTM D1933-1997, Type III. Nitrogen control equipment shall be mounted in an easily accessible, weatherproof, lockable enclosure with adequate space for the nitrogen bottles mounted on transformer tank. Nitrogen tank shall be provided with a certificate of ownership. Pressure switches indicating high/low tank pressure, and low cylinder pressure are to be provided.

(g) A mechanical pressure relief device without frangible diaphragm and equipment with resealing device, indicator visible from the ground and alarm contacts suitable for 48 volt ungrounded DC shall be installed on top of the tank. This device may be mounted in manhole covers if the design so dictates.

(h) Gaskets shall be made of synthetic rubber such as Nitrile, Hycar, Neoprene, etc. Cork-neoprene is not acceptable. Any departure from these standard gasket arrangements shall be clearly stated with the proposal and shall require specific approval of the Purchaser prior to acceptance. All mating steel surfaces where gaskets are to be applied shall have two coats of gulped or other suitable paint applied and dried prior to gasket installation to prevent rusting.

(i) When required, transformer tanks shall be equipped with steel clips suitable for attaching an insulator bracket on the low voltage side of the tank for the purpose of supporting low voltage leads.

(j) All bolts, studs, nuts and washers used on the transformer cover for mounting manhole covers, pressure relief devices, bushings, and bushing adapters shall be stainless steel to facilitate ease of maintenance.

(k) Manholes may be of round, oval or rectangular shape with a minimum opening of nineteen inches.

(l) Transformer tanks shall be equipped with bushing type current transformers as follows:

(1) One 600 to 5 ampere multiratio, C800 accuracy on each 44 KV bushing.

(2) One 600 to 5 ampere multiratio, C800 accuracy on each 15 KV bushing. One 600 to 5 ampere multiratio, C800 accuracy on 15 KV neutral bushing.

All CT's shall be standard 5-tap with 2.0 Thermal Rating Factor.

(m) All tank welds shall be of highest quality and shall be pressure tested free of leaks, prior to painting. All tank seams shall be welded both internally and externally. No seams should be located at the tank corners. Steel should be bent at the corners and seams formed on the sides of the tank at a location not closer than 10 inches from the tank corner.

(n) Inside of transformer tank shall be painted white. Paint shall be compatible with transformer oil.

(o) Transformer tank shall be designed with a slightly domed cover to shed water. A non-skid surface shall be applied to the cover prior to shipment.

7. Tap Changer

De-energized ratio adjusters shall be provided in the high-voltage winding to permit changing of taps when the transformer is de-energized. These ratio adjusters shall be suitable for the maximum forced cooled rating of the transformer regardless of whether the equipment is purchased with cooling equipment or provisions for future cooling equipment.

The tap changer operating mechanism gearing shall be designed to easily overcome extra friction load which may develop over the life of the equipment due to age and lack of use. If sector type contacts are used, the turning ratio shall be adequate to insure good contact alignment even with the increased backlash or deflection due to aging of the equipment. The contacts shall be designed to provide for indexing approximately on the center of the sectors when approached from either direction.

The tap changer shall be provided with means for bolting and locking in any tap position.

8. Surge Protection

Complete surge protection (Type MOV) shall be provided. All arresters shall be metal cap type and mounted on the transformer. The H. V. arresters shall be station type with a maximum duty cycle rating of 39 KV. The L. V. arresters shall be station type with a maximum duty cycle rating of 10 KV. Copper faced pads, or stainless steel welded to the tank, shall be provided to solidly connect each arrester base to the transformer tank. Arrester porcelain glaze shall be light gray (ANSI No. 70).

9. Service Conditions

The transformer shall be designed from terminal to terminal including ancillary components as follows:

(a) Loading per ANSI C57.91. Current capacity of ancillary components shall not limit the current carrying capability of the transformer from terminal to terminal.

(b) Short circuit withstand per ANSI C57.00 with fault currents limited by the transformer impedance only.

(c) Audible sound levels shall be no higher than 6 dB below current NEMA Standard.

D. Accessory Equipment

1. Nameplates

A nameplate shall be furnished with each transformer. It shall be mounted at a height for easy reading from the ground and shall be located near the no-load tap changer. The following information shall be given thereon:

(a) Connection diagram which shall include the various voltage and current ratings.

(b) Gallons of oil, type and percent of inhibitor, and variation of oil level with temperature.

(c) Percent impedance between windings and KVA base.

(d) Vector diagram.

(e) Average copper temperature rise and maximum hot spot temperature rise.

(f) KVA rating of windings for both self-cooled and forced-cooled. These ratings shall include both the 55 and 65 degree Centigrade ratings.

(g) Serial number of transformer.

(h) Total new weight.

(i) Weight to be lifted when untanking.

(j) Maximum pressure and fuel vacuum permissible in tank.

2. Oil Connections

Oil connections terminated with 1 ½ inch IPS threaded inlet and outlet globe type valves shall be provided as follows:

(a) At bottom of tank. This connection shall be located so that the tank can be completely drained of oil by gravity. This valve shall be equipped with a sampler device suitable for removal of oil without opening the main valve. O. B. Series 1813, or equal, is acceptable.

(b) At top of tank above the maximum oil level. O. B. Series 1814, or equal, is acceptable.

3. Instruments

(a) A dial type thermometer with a maximum temperature indicating hand suitable for convenient manual reset and equipped with alarm contacts suitable for use with 48 volt ungrounded DC shall be provided. The thermometer shall be mounted not more than five (5) feet above the transformer base and shall indicate the hottest oil temperature. The controlling element for this thermometer shall be mounted in a well in the transformer tank so

as to permit removal of the element without loss of oil. The well shall be welded to the tank where interference with tanking and untanking is prevented. Otherwise, it shall be attached to the tank wall with a suitable flange and "O" ring gasket.

(b) One (1) single-element, three-stage, thermal relay, activated by both top oil temperature and current proportional to the current in the transformer windings, shall be furnished. The stages of this relay shall be suitable for the following operations:

(1) First stage shall have contacts suitable for control of air blast equipment and shall operate at a temperature of 65 degrees Centigrade simulated hot spot.

(2) Second stage contacts shall operate an alarm circuit when load and ambient conditions specified in ASA standards C-57.92 (1959), tables 92-01.250A, 92-01.250B, 92-01.250C and 92-01.150D are exceeded by five (5) percent, assuming a 30 degree Centigrade ambient. No signal will be given for load and ambient conditions below the values given in the above tables.

(3) Third stage contacts shall operate a breaker tripping scheme at such temperature and time as will permit a loss of life of transformer insulation not to exceed one-half of one percent (1/2%) as indicated in tables 92-92.200A through 92-92.200P of ASA standard C57.92 (1959).

The controlling element for this relay shall be mounted in a well in the transformer tank so as to permit removal of the element without loss of oil. The well shall be welded to the tank where interference with tanking and untanking is avoided. Otherwise, it shall be attached to the tank wall with a suitable flange and "O" ring gasket.

Thermal relay operating curves shall be supplied for each relay.

Contacts for stages two and three shall be suitable for use with 48 volt ungrounded DC.

(c) The transformer shall be supplied complete with a large diameter magnetic type oil level gauge with contacts for a 48 volt ungrounded DC with maximum, minimum and 25 degrees Centigrade oil levels marked thereon.

(d) Sudden pressure relay with auxiliary relay (48 volt ungrounded DC).

(e) Automatic reseal pressure relief device with 48 volt ungrounded DC alarm contact.

(f) All controls, alarm and current transformer secondary circuits shall be brought out through the tank wall and terminated in the transformer control cabinet. All secondary leads within the tank shall be properly supported. Heavy terminal lugs shall be used. These lugs shall be sufficiently strong to prevent their bending during flexing of the control wire. All unfinished wiring which is to be completed in the field shall be equipped with captive connectors to prevent small parts from dropping into the windings during shipment and field assembly. Make provisions for padlocking cabinet door.

Inside of control cabinets shall be lighted by led lighting, controlled by cabinet door-actuated switches. Interior of cabinet shall be painted white.

A drawing pocket shall be provided on inside of control cabinet door. Pocket shall have a hinged lid to prevent rainwater from dripping into the pocket when the door is in the open position.

Short circuiting bars shall be supplied in the control cabinet for all current transformer secondaries.

E. Painting

Surfaces requiring painting shall be rendered clean and smooth and shall be finished with three (3) properly related coats of paint. Tank finish shall be a light gray color conforming to ANSI No. 70. Furnish touch-up paint identical to final coat. Paint shall be guaranteed for five (5) years. The transformer Paint System shall meet or exceed the requirements of ANSI/IEEE C57.12.28.

F. Oil

The necessary quantity of Type 1 inhibited oil with maximum 0.08% inhibitor shall be furnished for filling each transformer to the proper level for the temperature at the time of filling. Oil dielectric breakdown voltage shall be a minimum of 35 KV (D877); oil acid number shall not exceed 0.05 mg KOH/gal. oil; and oil interfacial tension shall test a minimum of 35 dynes/cm.

Oil must confirm or exceed the specifications given in ANSI/ASTM #D3487. PCB content in the oil to be in accordance with EPA regulation #40CFR761 or latest revision of regulation and with manufacturer's certification. Test results showing PPM.

All of the above plus full DGA and moisture content tests must be performed on all transformers.

G. Factory Tests

All tests shall be conducted according to ANSI/IEEE Standards, and three (3) copies of a certified report of tests shall be sent to the Owner. One copy shall be sent to Stewart Engineering, Inc. Also provide an electronic version of the certified test report in pdf format to the customer and Stewart Engineering. Purchaser reserves the right to witness test. Purchaser reserves the right to witness test. Purchaser shall be notified at least 10 days prior to factory testing.

Loss measuring equipment shall be calibrated in accordance with NIST (National Institute of Standards and Technology), Technical Note 1204.

Transformer shall be fully assembled prior to testing. Unit shall be tested with the radiators that ship with the unit.

The report shall include all routine tests specified in ASA standard 57.12-06.11 (1958) and the latest revision of ANSI Standard Test Code for Transformers C57.12.90. In addition, the following test information shall be required and documented in the certified test report:

1. Resistance measurements of all windings on the rated voltage connection and all tap positions. All resistance measurements shall be given in ohms at 75 degrees Centigrade.

2. No-load loss and exciting current data covered in the above routine tests at rated excitation voltage shall also be supplied for 110 percent of rated voltage.

3. Regulation at 70, 80 and 100 percent power factor.

4. Temperature test data may be supplied on one unit of any group and shall include the following additional information:

   (a) A statement that the test was run on the highest loss tap. Such statement shall include the value of losses.

(b) Calculated average oil temperature from data taken during the total loss heat run. Provide measured bottom oil temperature for all temperature tests.

(c) Calculated hottest spot temperature at rated load from total loss heat run data. Hottest spot temperature must be calculated using localized stray and eddy losses. Applying a factor or adding 15 degrees K to the average winding temperature rise is not acceptable.

(d) Temperature tests when required shall be made before dielectric tests.

5. Insulation power factor data on each unit.

6. A Quality Control Impulse Test shall be made on each unit unless otherwise specified. A Statement that the transformer has successfully withstood this test shall appear on the test report.

7. The positive sequence impedance and load loss and the zero sequence impedance and load loss shall be measured at the self cooled rating (55 K ONAN) in all high voltage tap positions.

8. Turns ratio on all high voltage tap positions.

9. Factory test reports and results will be supplied to the customer prior to delivery of transformers.

H. Special Test Requirements

1. Temperature Rise Tests

Temperature rise tests will be required on the first transformer. Measure the bottom oil temperature for all temperature tests. Report all values on final certified test report. Temperature rise data can be derived from results of the first transformer. Show the test results on the duplicate with its serial number and test date. Temperature rise tests will be made at the highest loss tap position and with an equivalent no load loss at 105% voltage. The tests will be made at the following ratings:

(a) Self cooled, ONAN @ 55 K rise

(b) Self cooled, ONAN @ 65 K rise

(c) Maximum, ONAN/ONAF/ONAF @ 55 K rise

(d) Maximum, ONAN/ONAF/ONAF @ 65 K rise

(e) 125% of maximum ONAN/ONAF/ONAF @ 65 K rise
Top oil rise shall not exceed 80° C, and Hotspot rise shall not exceed 110° C, maximum (based on maximum temperatures of 110° C and 140° C, with a 30° C ambient).

Obtain samples in syringes for dissolved gas in oil and moisture in oil tests as follows:

(a) Before the start of temperature tests.

(b) After each temperature test at the different ratings given above.

(c) A minimum of 3 hours after the completion of the last temperature test.

(d) Following is the maximum allowed increase in the concentration of gasses:

Gas	Increase After Max 65 K Rating	Increase After 125% Max 65 K Rating
Acetylene C2H2	ND	ND
Methane CH4	2 ppm	15 ppm
Ethane C2H6	5 ppm	10 ppm
Ethylene C2H4	5 ppm	10 ppm
Hydrogen H2	15 ppm	15 ppm
CO	30 ppm	50 ppm
CO2	200 ppm	500 ppm

The purchaser shall be notified before draining oil from tank if any of the gas limits are exceeded. Test results that differ from these limits must be resolved between the purchaser and manufacturer before the oil is drained from the transformer. No further tests shall be performed before the matter is resolved.

2. Insulation Power Factor

Maximum allowable insulation power factor is 0.50% @ 20 C and shall be performed with Doble or purchaser approved equivalent.

3. Dielectric Tests

ANSI impulse test shall include the neutrals.

Measure the core to ground resistance after tanking and just prior to shipment. Minimum allowable resistance shall be 1,000 Megohms corrected to 20 C. These measurements shall be included in the final certified test report.

PD (Partial Discharge) and RIV (Radio Influence Voltage) testing shall be performed after all other electrical tests except the core ground test just prior to shipment. Maximum allowable value for PD is 300 picocoulombs during the one (1) hour test. Maximum allowable value for RIV is 200 microvolts during the enhancement test and 75 microvolts during the one (1) hour test.

Obtain oil samples in syringes for dissolved gas analysis before the beginning of dielectric tests and at least 3 hours after the completion of PDE and RIV tests. Following is the maximum allowable increase in the concentration of dissolved gasses:

Gas	Increase After Dielectrics
Acetylene C2H2	ND
Methane CH4	2 ppm
Ethane C2H6	2 ppm
Ethylene C2H4	1 ppm
Hydrogen H2	10 ppm
CO	20 ppm
CO2	200 ppm

The purchaser shall be notified before draining oil from tank if any of the gas limits are exceeded. Test results that differ from these limits must be resolved between the purchaser and manufacturer before the oil is drained from the transformer. No further tests shall be performed before the matter is resolved.

4. FRA (Frequency Response Analysis)

Perform FRA testing with customer approved equipment (i.e. Doble SFRA) prior to shipment. The transformer shall be tested in its shipping configuration. For bushings removed for shipment, the bushing cover plate shall have a spark plug type bushing installed in each plate for FRA testing before shipment and upon delivery. All leads shall be secured so there is no movement during shipment in order to obtain valid results for comparison between the before shipment and after delivery tests. Any other method of making provisions for these two (2) tests must be approved by the customer.

5. Factory test reports and results will be supplied to the customer prior to delivery of transformers.

I. Inspection

The Owner is to visit the Seller's factory to inspect the transformer. This inspection is to occur after the transformer has been finally assembled and before it has been placed in tank. The tank shall be ready for inspection also. The Purchaser will be notified where the inspection can be made at least 14 days in advance. Owner shall pay all expenses of representative.

J. Spare Equipment

As an adder please quote:

1. One spare bushing for each voltage class.

2. Manufacturer's suggested spare parts listing.

K. Transportation

1. All transformers are to be shipped F.O.B. destination with freight prepaid and allowed. Transformers to be quoted set on customer's pad, tested and outfitted ready for connection to existing substation.

2. Impact recorder shall accompany the transformers during transit. The Seller shall be responsible for inspecting the transformers and impact recorder in the presence of the Purchaser upon arrival at the shipping destination to determine if any damage has occurred.

3. Owner shall be notified by the Seller at least 96 hours prior to shipment and by the Carrier 48 hours prior to arrival of each transformer at its destination.

L. Service Engineer

1. Inspect equipment that arrives with visible damage or signs of hidden damage; forward a written report to Owner and Engineer itemizing damage incurred.

2. Be responsible for assembly of the equipment. Also be responsible for disposal of any and all crates, packing materials, etc. at a remote approved location.

3. Instruct Owner's personnel in proper operation and maintenance of the equipment.

4. Perform following services in addition to those normally provided:

   (a) Record shipping gas pressure prior to assembly.

   (b) Thoroughly inspect all visible assembled parts and connections.

   (c) Check all gauges and relays to assure proper working conditions.

   (d) Check and operate all cooling equipment.

   (e) Thoroughly search for leaks.

   (f) Test oil prior to energizing to determine that dielectric strength meets requirements of ANSI and for filtering oil as required.

   (g) Oil Type.

   (h) Perform complete set of meggar and ratio tests.

   (i) Doble insulation tests.

   (j) Thoroughly check and operate high voltage no load tap changing equipment as recommended by manufacturer.

   (k) Core ground test.

   (l) Submit a written report to Owner and Engineer tabulating the checks and tests performed by each Service Engineer.

   NOTE: THE COST OF THE SERVICE ENGINEER (2 DAYS MINIMUM) AND ASSEMBLING TRANSFORMER IS TO BE INCLUDED WITH THE COST OF TRANSFORMER. WHEN ENGINEER LEAVES, TRANSFORMER SHOULD BE READY FOR ENERGIZATION.

M. <u>Information to be Furnished with Quotation</u>

1. Type and rating of transformer.

2. Percent reactance and resistance; and high voltage to low voltage percent impedance, both positive and zero sequence. State the KVA basis on which these are calculated.

3. Load loss at normal frequency and voltage at full load.

4. No-load losses at 100 percent and 110 percent of rated voltage.

5. Exciting current at 100, 105 and 110 percent of rated voltage.

6. Auxiliary power requirements for all stages of cooling, including an estimate of requirements for future cooling.

7. The complete ratings, including catalog, drawings or style numbers of all bushings.

8. Dimensions, giving projected floor space, height to top of tank cover, overall height to top of high voltage bushings, vertical clearance above top of tank required for removal of high voltage bushings, and height required for untanking unit.

9. Quantity of oil; weight of oil.

10. Weight of core, coils, and other material to be lifted from tank.

11. Total weight of transformer with oil.

12. Total shipping weight of transformer.

13. General sketches, or descriptions of winding schemes including grouping of shell form groups, etc.

14. Preliminary temperature gradient diagrams showing estimated top oil, average winding and hot spot winding temperatures.

15. Drawings showing automatic inert gas equipment, relief device, temperature equipment, no-load tap changer, pressure relay, etc.

16. A statement is required that the transformer to be furnished will be in accordance with these specifications. Any exception to them must be listed in detail.

17. Length of warranty and associated cost must be stated.

N. Drawings to be Furnished

1. Electronic copy (pdf and dwg) of each of the following drawings for approval shall be sent to Stewart Engineering, Inc.:

   (a) Outline

   (b) Detail of base

   (c) Nameplate

   (d) Detail of bushings, gaskets and flanges

   (e) Detail of all bushing type current transformers

   (f) Detail of wiring diagrams (connection, alarm, control, and auxiliary)

   (g) Assembly and instruction books (final copies only)

(h) Internal connection diagram (showing actual coil connections and turns diagram)

(i) Thermal relay operating curves

(j) Bushing type current transformer curves

(k) Terminal board physical arrangement in control cabinet

(l) After final issue and prior to shipment, mail the following as indicated:

1) Electronic copy (ACAD and pdf formats) of all drawings showing all changes and revisions; one copy to Stewart Engineering, Inc., Engineer, and one to Owner.

2) Hard copy print of all final drawings showing all changes and revisions; three sets to Owner, one set to Stewart Engineering, Inc., Engineer.

3) One hard copy print of all final drawings shall accompany the transformer when shipped.

2. Instruction Books:

(a) Each to include descriptive bulletins, spare parts lists, installation/ operation/maintenance manuals for all applicable equipment, and all final test results.

(b) At time of shipment mail three (3) sets to Owner and one (1) set to Stewart Engineering, Inc., Engineer. Also provide electronic version of the full instruction book contents in pdf format to both Owner and Engineer.

O. Consideration of Bids

Power transformers which meet the above specifications can be supplied by ABB, Waukesha, Delta Star, Pennsylvania Transformer (Canonburgh Plant only), and Virginia Transformer.

Until final award of the contract is made, the user reserves the right to reject any and all bids and all bids, waive any informalities or accept any bid or bids which, in the opinion of the engineers, will serve the best interest of the user. The user also reserves the right to accept or reject any alternates that may serve his best interest.

Consideration will be given to the manufacturer's experience in the design and manufacture of power transformers, to the company's participation in transformer research, and to their other activities which aid the progress of the industry.

P. Guidelines that will be Followed while Evaluating each Bid

1. To enable easy comparison of bid prices, the base price quoted must be the firm price at delivery date.

2. The transformer price quoted must include the transformer oil cost on the delivery date.

3. $1000 will be deducted from the Purchase Order by Owner if the transformer and all its accessories are not shipped complete at the same time. This is the expected cost of excess handling of components that arrive at different times than the transformer.

4. The quoted price will be for the transformer to be shipped F.O.B. destination.

5. The seller's quote is to include offloading onto existing transformer pad, assembly, and testing of the unit in the field.

6. Transformer losses shall be evaluated. Furnish loss values in KW for the following:

   (1) No Load Losses _____KW @ $6,000/KW

   (2) Load Losses _____KW @ $2,000/KW

   (3) Auxiliary Losses _____KW @ $1,500/KW

   If losses, as determined by factory tests, exceed the proposed losses, the evaluated loss price will be deducted from the contract, or deducted from the amount to be paid the Vendor. If losses as determined by factory tests are less than proposed losses, no credit will be given.

Q. Guarantee

The transformer five year guarantee will begin the day the transformer is energized within 12 months from the date the transformer is delivered and placed on the existing transformer pad at this site:

630 Volanta Avenue – Fairhope, Alabama 36532

R. Exceptions

Note any exceptions taken to these specifications should be stated and clarified and will be subject to Owner approval before awarding of bids.

EXHIBIT A

AFFIDAVIT FOR BUSINESS ENTITY/EMPLOYER/CONTRACTOR
(To be completed as a condition for the award of any contract, grant, or incentive by the State of Alabama, any political subdivision thereof, or any state-funded entity to a business entity or employer that employs one or more employees)

State of _____

County _____

Before me, a notary public, personally appeared _____ *(print name)* who, being duly sworn, says as follows:

As a condition for the award of any contract, grant, or incentive by the State of Alabama, any political subdivision thereof, or any state-funded entity to a business entity or employer that employs one or more employees, I hereby attest that in my capacity as _____ *(state position)* for _____ *(state business entity/employer/contractor name)* that said business entity/employer/contractor shall not knowingly employ, hire for employment, or continue to employ an unauthorized alien.

I further attest that said business entity/employer/contractor is enrolled in the E-Verify program. *(ATTACH DOCUMENTATION ESTABLISHING THAT BUSINESS ENTITY/EMPLOYER/CONTRACTOR IS ENROLLED IN THE E-VERIFY PROGRAM)*

_____
Signature of Affiant

Sworn to and subscribed before me this _____day of _____, 2____.

I certify that the affiant is known (or made known) to me to be the identical party he or she claims to be.

_____
Signature and Seal of Notary Public

EXHIBIT B

NOTE: PROPOSAL WILL NOT BE ACCEPTED AND BIDS WILL NOT BE CONSIDERED UNLESS THIS FORM FOR BID BOND IS USED AND SIGNED BY PRINCIPAL AND SURETY, OR UNLESS A CASHIER'S CHECK (DRAWN FROM AN ALABAMA BANK) IN THE PROPER AMOUNT IS FURNISHED.

BID BOND FORM

KNOW ALL MEN BY THESE PRESENTS:

That we, the undersigned,_____ as **PRINCIPAL,** and _____ as **SURETY**, are held and firmly bound unto the **FAIRHOPE PUBLIC UTILITIES** as **OBLIGEE** in the full and just sum of 5% of total bid amount (Maximum amount - $10,000), lawful money of the United States, for the payment of which sum, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed, this _____ day of_____ ,2018.

Whereas the said Principal is herewith submitting to the City of Fairhope a certain Bid, attached hereto and hereby made a part hereof to enter into a contract in writing, for the Power Transformers for Electrical Substations.

NOW, THEREFORE,

a. If said Bid shall be rejected, or in the alternate.

b. If said Bid shall be awarded by the Obligee and the Principal shall deliver the subject material as described in said bid, and shall in all other respects perform the agreement created by the acceptance of said Bid.

then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

EXHIBIT B

PRINCIPAL _____
Name of Corporation, Partnership, etc.

By: _____

Its: _____

SURETY _____

By (agent): _____
Attorney-in-Fact

Agent's Address: _____

_____

NOTICE: Valid Power of Attorney MUST be attached

EXHIBIT C

LIQUIDATED DAMAGES

A. The Bid Form provides required delivery dates (month / years) for each Item. Application of Liquidated Damages shall begin the day after the last day of the respective month / year shown on the Bid Form.

B. Any delay in the Transformer delivery / assembly / testing as provided for in the Specifications and Bid Form will cause inconvenience to the public and loss and damage to Fairhope Public Utilities (City) in interest, and in additional administrative, engineering, and Contractor charges. Therefore, a time charge equal to 2% of the total Purchase Price, per week (or any portion thereof), not to exceed 10% of the Purchase Price will be made against the Manufacturer for the entire period that any Item is not manufactured, delivered, and assembled/tested after the time specified on the Bid Form, the amount of which shall be deducted by the City from the Final Estimate, and shall be retained by the City out of the money's otherwise due the Manufacturer in the Final Payment, not as a penalty, but as liquidated damages sustained, it being mutually understood and agreed between the parties hereto that such amount is reasonable as liquidated damages.

C. The time for delivery / assembly / testing of Transformer(s) shall be extended for the period of any reasonable delay which is due exclusively to causes beyond the control and without the fault of the Manufacturer, including Acts of God, fires, floods, and acts or omissions of the City with respect to matters for which the City is solely responsible. Provided, however, that no such extension of time for completion shall be granted the Manufacturer unless within ten (10) days after the happening of any event relied upon by the Manufacturer for such an extension of time the Manufacturer shall have made a request therefor in writing to the City, and provided further that no delay in such time of completion or in the progress of the transformer delivery / assembly / testing which results from any of the above causes except acts of omissions of the City, shall result in any liability on the part of the City.

EXHIBIT D

PERFORMANCE BOND

1. Know all men that we, _____,

as Principal, and_____,

as Surety, are held and firmly bound unto Fairhope Public Utilities, City of

Fairhope, Alabama

(hereinafter called the "Owner) and unto all persons, firms and corporations who or

which may furnish materials for or perform labor on

Project known as Manufacture and delivery of Power Transformers for Fairhope

Public Utilities

and to their successors and assigns, in the penal sum of_____dollars

($_____), as hereinafter set forth and for the payment of which sum well and truly to be made we bind ourselves, our executors, administrators, successors and assigns jointly and severally by these presents. Said Project is described in the Power Transformer Specifications, and associated Bid Form (hereinafter called the "Purchase Contract") between the Owner and the Principal,

dated _____, 20_____.

2. The condition of this obligation is such if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of the Purchase Contract and any amendments thereto, whether such amendments are for additions, decreases, or changes in materials, their quantity, kind or price, labor costs, mileage, routing or any other purpose whatsoever, and whether such amendments are made with or without notice to the Surety, and shall fully indemnify and save harmless the Owner from all costs and damages which they, or either of them, shall suffer or incur by reason of any failure to do so, and shall fully reimburse and repay the Owner for all outlay and expense which they, or either of them shall incur in making good any such failure or performance on the part of the Principal, and shall promptly make payment to all persons working on or supplying labor or materials for use in the construction of the Project contemplated in the Purchase Contract and any amendments thereto, in respect of such labor or materials furnished

and used therein, to the full extent thereof, and in respect of such labor or materials furnished but not so used, to the extent of the quantities estimated in the Purchase Contract and any amendments thereto to be required for the construction of the Project, and shall well and truly reimburse the Owner and the Government, as their respective interests may appear, for any excess in cost of construction of said Project over the cost of such construction as provided in the Purchase Contract and any amendments thereto, occasioned by any default of the Principal under the Purchase Contract and any amendments thereto, then this obligation shall be null and void, but otherwise shall remain in full force and effect.

3. It is expressly agreed that this bond shall be deemed amended automatically and immediately, without formal and separate amendment to the Purchase Contract, so as to bind the Principal and the Surety to the full and faithful performance of the Purchase Contract as so amended, provided only that the total amount of all increases in the cost of construction shall not exceed 20 percent of the amount of the maximum price set forth in the Purchase Contract. The term "Amendment" wherever used in this bond, and whether referring to this bond, the Purchase Contract shall include any alteration, addition, extension, modification, amendment, rescission waiver, release or annulment, of any character whatsoever.

4. It is expressly agreed that any amendment which may be made by agreement or otherwise between the Principal and the Owner in the terms, provisions, covenants and conditions of the Purchase Contract, or the Owner to the Principal of any extension of time for the performance of the obligations of the Principal under the Purchase Contract, or the failure or refusal of the Owner to take any action, proceeding or step to enforce any remedy or exercise any right under either the Purchase Contract or the good faith upon the belief that the same is permitted by the provisions of the Purchase Contract shall not in any way release the Principal and the Surety, or either of them or their respective executors, administrators, successors or assigns, from liability hereunder. The Surety hereby acknowledges receipt of notice of any amendment, indulgence or forbearance made, granted or permitted.

5. This bond is made for the benefit of all persons, firms and corporations who or which may furnish any materials or perform any labor for or on account of the construction to be performed under the Purchase Contract and any amendments thereto, and they, and each of them, are hereby made obliges hereunder with the same force and effect as if their names were written herein as such, and they and each of them may sue hereon.

EXHIBIT D

WITNESS WHEREOF, the undersigned have caused this instrument to be executed and

their respective corporate seals to be affixed and attested by their duly authorized

representatives this _____ day of _____, 20___.

_____(Seal)
(Principal)

BY_____

ATTEST:

_____
(Secretary)

_____(Seal)
(Surety)

BY_____

ATTEST:

_____ _____
(Secretary) (Address of Surety's Home Office)

BY_____
(Resident Agent of Surety)

Signatures: The Performance Bond must be signed with the full name of the Manufacturer. If the Manufacturer is a partnership the Performance Bond must be signed in the partnership name by a partner. If the Manufacturer is a corporation the Performance Bond must be signed in the corporate name by a duly authorized officer and the corporate seal affixed and attested by the Secretary of the corporation. A typewritten copy of all such names and signatures shall be appended.

Power of Attorney: The Performance Bond must be accompanied by a Power of Attorney authorizing execution on behalf of the Surety and, in jurisdictions so requiring should be countersigned by a duly authorized resident agent of the Surety.