TECHNICAL SPECIFICATION

B53 – UAT BUS BAR CONNECTIONS
BRANDY BRANCH GENERATING STATION (BBGS)

Scope of Work

NETA Accredited Contractor (Contractor) shall furnish all equipment, supervision, labor, transportation, tools and consumables to complete the scope of work that includes disassembling, cleaning, inspecting, electroplating, insulating the isolated phase bus (IPB) bushing box and internal bus bar for the BBGS B53 Unit Auxiliary Transformer (UAT). Contractor shall clean to remove all foreign matter, inspect and make repair recommendations for the vertical tap conductors, flex links, and bushings on the line side of the Unit Auxiliary Transformer and disassemble the bus bar below the bushings. The total linear feet of bus internal to the UAT is approximately twelve feet per phase – 36ft. The bus system shall be labeled such that each pice has a documented position in the re-assembly. This method shall be discussed with and approved by JEA. **The Contactor shall provide scaffolding and lumber needed to support the bus during disassembly**. The weight of the bus shall be supported during disassembly. After disassembly, the bus bar shall be cleaned and coated with an insulating coating powder for low and medium voltage aluminum or copper busbars, applied using the fluid bed process such as SolEpoxy DK19, rated at least 30kV up to the electrical face-to-face bus bar connections. The purpose of this work is to ensure that the existing bus and associated parts are ready to be installed when a replacement transformer arrives. Each piece of the bus system shall be measured and a sketch shall be created based on those measurements for each piece.

The electrical face-to-face connections shall be electroplated with silver to at least a 5mil thickness. The electorplating hall be completed offsite by an ISO 9001 Certified Metal Finsher that specializes in electroplating and specifically for electrical bus bar.

All of the insulators shall be wiped down with denatured alcohol to ensure that no dust, dirt, or any inperfections exist on the insulators after cleaning. JEA expects that the denatured alcohol is not sprayed directly onto the insulators due to the risk of over-spray onto insulated conductors etc. Instead, the cleaning shall be performed such that, the denatured alcohol will be applied to a rag and then the rag can be used to clean insualtors. This is to ensure that no denatured alcohol gets on any cables or plastic accessories that can become brittle when exposed to denatured alcohol.

It is assumed that the connections are copper but there may be aluminum connections and or silvered aluminum connections as well. It will be the JEA Project Manager or Engineer's decision to replace the bushings and or insulators if there are cracks, chips, or any other signs of age. The intent is to ensure that the iso-phase insulators and ducts are sufficiently clean, that the bus bar is properly sealed against moisture intrusion, and is refurbished to a like-new conductive performance and that issues due to inadequate grounding are resolved. If any equipment is found to be damaged, it will be up to the JEA Project Manager to decide if the equipment is to be left as-is, repaired or replaced. Any damaged insulators, gaskets, or other material will be supplied by the Contractor on a unit price basis as identified in the extra work section of this document. No electrical testing shall take place without JEA personnel present.

Bushings and insulators shall be cleaned with denatured alcohol and Megger Tested with 5kV, and Hi-Pot tested with their respective ratings. The test value for the insulators that isolate the bus bar at the cross over will also be 40kVdc. During each test, a 10kV wetting voltage shall be applied initially for one minute and then steps of 5kV shall be taken checking leakage current and voltage stability to ensure a safe test. All values shall be recorded and communicated to everyone involved with the test to ensure consensus on proceding to the next voltage level. The bushings shall be coated with mobil 28 after refurbishment and wrapped with clear saran wrap in order to preserve the finish as much as possible before replacing the transformer.

The Contractor shall build a wood crate to safely store the refurbed bus bar, insulators, hardware, and any other items that may accommodate the system until the next outage which is a year away. The wooden crate must be built so that a fork lift can move the load without damaging the crate or the items inside. The items

inside shall be situated so that there is no possibility of any part taking on damage from a different part. The silver shall be coated with Mobil 28 and wrapped with clear saran wrap so that there is no tarnishing or contamination.

The secondary (4160V) cables shall be tested with a VLF withstand test voltage according to IEEE Std. 400.2-2013. The testing will be performed to 2400Vac (nominal phase to ground) as the cables will be connected to a racked out power circuit breaker. The 12 AWG control cable for the CT's and for the temperature controller shall be lifted on both ends (JEA Relay Technicians will lift the DCS end) and each wire shall be megger tested with 500Vdc to ensure that there are no grounds.

It is expected that this work will require three mobilizations. During the first mob, the bus will be disassembled, the secondary cables and control wire will be electrically tested. The second mobilization will only require one person to receive the bus bar and pack it in the crate on site. The third mobilization will be to construct the bus bar and electrically test it.

During the first mobilization, the Contractor shall be responsible for:

- Visually inspecting bushing box, bus bar inside transformer and secondary cabels.
- Electrically testing bushings – hipot to 40kV.
- Electrically testing nine 750MCM secondary cables – VLF to 2400V.
- Electrically testing fifty 12AWG control cables with a 500VDC megger.
- Supporting bus bar with lumbar to ensure structural integrity as it is disassembled.
- Disassembling bus bar below bushings.
- Labeling each piece of bar as the bus is deconstructed.
- Measuring and photographing each piece to provide JEA dimensions.
- Grounding the transformer windings.
- Coiling up cables so that the transformer can be rigged off the pad.
- Building a crate that can safely store all parts, keeping them damage free and organized.

During the second mobilization, the Contractor shall be responsible for:

- Opening boxes and unpacking bus bar to verify quality of plating.
- Storing bus bar in wodden crate built on site or prefabricated and delivered.

During the third mobilization, the Contractor shall be responsible for:

- Visually verifying that the secondary cables do not get damaged as the transformer is lifted.
- Making any modifications to the existing bolting hardware on the concrete skid after the transformer is removed.
- Guiding power cables and control cables into new transformer as it is being rigged into place.
- Installing new ½ inch expansion anchor bolts in concrete for new transformer.
- Terminating the existing 12 AWG control cable to the terminal boards inside the new transformer.
- Assist with commissioning the temperature controller by communicating with OEM PM, Engineer, or technicians that will be involved with the commissioning process.
- Terminating the existing 750MCM to the new secondary bus bars.
- Providing scaffolding on primary side for construction of bus.
- Assembling existing refurbished bus bar on primary side.
- Removing existing bushing box from old transformer.
- Installing existing bushing box onto new transformer.
- Megging bushings and bus with a 5kV Megger.
- Hipot testing bushings and bus with 40kVdc.
- Providing new 316 SS hardware for flex links including Belleville washers.
- Installing existing flex links.
- Installing existing clamshell covers onto existing bushing box / IPB.
- Swapping cables on transformer taps if and only if there are phasing issues.

Existing clamshell covers on top of existing bushing box.

Profile of transformer pointing out existing bushing box.

Contractor shall update the JEA Project Manager daily, providing a complete summary of the day's activities. The Contractor shall immediately alert the JEA Project Manager to any changes in schedule and present a remedy for completing the work on or before the contract completion dates of TBD.

Project Schedule

The BBGS Combined Cycle outage is scheduled for March 3rd 2025, but work will not start until March 7th 2025. The disassembly **must complete by end of business on March 13th 2025.** No extensions will be granted. The reassembly is contingent on the delivery of the new transformer and is expected to be completed **in Spring of 2026 or Fall of 2026**. This will depend on when the transformer is delivered and when a combined cycle outage can be scheduled.

The Contractor shall not commence any work until a notice to proceed is received. A project schedule for this contract shall be prepared and maintained by the Contractor to provide coordination, to establish the basis for measuring and monitoring Contractor progress and to detect problems for the purpose of taking

corrective action(s). The Contractor shall provide JEA with daily updates. These updates shall include the following:

- Current status of the job progress
- One day Look-Ahead Schedule
- Report the planned and actual progress of the current day
- Report all planned work that is to be accomplished the following day
- Changes in the Work
- Safety and Quality Control issues
- Problem areas or concerns

The Contractor will not be responsible for any work beyond the bus connections above the UAT flex links or beyond end of bus bar inside of the UAT. The Contractor will be responsible for cleaning and inspecting the upper and lower insulators inside of the UAT.

****Prior to any work a daily JSB shall be performed with JEA PM and or Engineer****

The testing below will be completed after cleaning, inspection, and assembly. All information and data collected will be provided in a final report that includes photos and detailed descriptions of specific parts and work that is performed.

Testing to be performed:

Megger Testing

- Upon verifying complete system isolation and the bus system is reconstructed, a Megger test will be performed on the bottom of the bus with the flex links above the bushings, and transformer secondary cables removed from bus and the transformer windings shall be grounded.
- A one minute 5kV megger test will be completed for each of the three phases.
- Both the 30 second and 1 minute resistance values will be recorded.
- The megger test will insure complete isolation of the IPB and transformer prior to DC Hi-Pot testing.
- Receive approval from JEA Engineer prior to proceeding to DC Hi-Pot Testing.

Dielectric Testing - DC High Potential Procedure

- Determine proper DC Hi-Pot Test Voltage from Basic Insulation Rating (150 BIL) requirements of the UAT – 40kV DC (conservative test voltage).
    a. Reference IEEE Std. C37.23-2015
- Only DC Hi-Pot testing will be performed (AC testing <u>IS NOT</u> in the scope of work).
- A 10kV wetting voltage shall be used and then steps of 5kV shall be performed.
- At each step, leakage and voltage values shall be recorded.
- Each step shall be taken with consensus between JEA and Contractor.
- The DC Hi-Pot test will be performed at the predetermined test voltage for one minute.
- Record leakage current results and final one minute values for each phase.
- Verify JEA High Potential Procedure is followed with Engineer or Project Manager.
- Phases under test shall be performed with other two phases and enclosure grounded.

DLRO (digital low resistance ohm) Testing – Bolted Connections:

- The bolted connecitons shall be torqued to 45 ft-lbs for half inch hardware absent any other specification and torque wrench shall be calibrated (within 1 previous year). A DLRO test machine shall be used to ensure all bolted connecitons are within 2% of each other.

    a. When removing links, ensure braids are indexed so that they can be reinstalled in the exact location and orientation they are removed from by labeling before removal.

b. When reinstalling braids use new 316 SS conical washers with an oversized flat washer so that the conical does not overlap the flat on one side if there is any sort of movement or shifting. Dimensions shall be specified during disassembly and agreed upon inspection with both Contractor and JEA Engineer or PM present.

- Verify all bolted connections are within 2 % resistance of each other.
- All results will be recorded.
- If any DLRO test results are found to exceed the average by more than 2% then the connection must be resilvered prior to bringing the IPB back online.
- JEA Engineer and or PM shall be notified with any issues discovered ASAP.

VLF (Very Low Frequency) Testing – UAT Secondary Cables :

1. The secondary cables shall be tested according to NETA guidelines by a NETA certified electrical testing Contractor with a calibrated (within 1 year) VLF test machine. The test shall be conducted for 30 minutes. The load side of the cables are terminated in a switchgear bucket. The bus inside is energized and will need to be de-energized for the testing duration which will be coordinated with plant operations.

Inspection – Inspection is to be done both before and after cleaning. All three clamshell access covers shall be removed to allow for visual inspection of the iso-phase bus duct interior, gaskets, bushings, and float drains. All access covers, clamshells, and float drains shall be put back in place as soon as work is finished to prevent any wildlife from entering the transformer enclosure. The transformer is being sold by investment recovery, therefore, it shall not be treated as metal scrap during disassembly.

Equipment List – The equipment list is intended to be a partial list with special notes on what to look for. It is not intended to provide an exhaustive list.

1. Access hatches and gaskets - All access hatches are to be removed and re-installed by Contractor. It is expected that any gasket material shall be replaced as a part of the base scope.

2. Insulators and bushings – All insulators (26), bushings (3) and mounting hardware must be inspected for any damage. Visual inspection must be done 360 degrees around each insulator (including insulator hardware). Repairs/Replacements shall be discussed with Project Manager prior to moving forward. All issues must to be documented with pictures and included in the final report.

3. Iso-phase Bus Bushings – The current carrying conductor is connected to the bushings above the UAT transformer. Each bushing shall be HI-Pot tested to 40kV and visually inspected for any signed of corrosion, pitting, chips or cracks on the porcelain.

4. Flexible shunts braids - All of the flexible shunts (flex braids) internal to the iso-phase bus duct need to be disconnected and visually inspected for discoloration, broken strands, pits and hot spots. Replace any flex braids that are discolored deformed or expanded. <u>All 316 stainless steel conical washers to be replaced.</u> (Contractor supplied) A flat washer shall be specified in the field to be 1/8 inch larger in diameter than the Belleville washers to avoid the possibility of a Belleville over lapping the edge of a flat washer. The flex links shall be stored in plastic storage containers or five gallon buckets indoors, so that there is no exposure to rain, dust, dirt etc. For bidding purposes, the flex links are to be considered 21 inches long with a 6 inch seamless silver plated copper ferrule; 1.5 inches wide (electrical surface contact) and 5/8 inches thick. There shall be a small typical bubble in the middle for additional flex and 1.75 inch hole spacing assumed. The stranding shall be 30 awg tinned 750MCM,

5. Grounding connections – All bolted grounding connections external to the iso-phase bus duct are to be DLRO tested and inspected to insure good grounding of the Transformer. All bolts that are used for grounding connections shall be re-torqued to manufacturer recommendations.

6. 18 kV Connections – All 18 kV electrical bolted connections in the iso-phase bus duct are believed to be silver plated copper or copper clad silver plated aluminum. If damaged, it will be up the JEA Project Manager to decide if the stab/connector is to be repaired (re-silver plated) or replaced with a new silver plated connector. All stainless steel conical washers to be replaced with 316 stainless steel (Contractor supplied).

7. Enclosures and Seals – The UAT termination enclosures/seals at clamshells for bushings.

8. Torque all Bolts – After inspection and upon reassembly, all bolts that are used for the 18 kV electrical connections will be re-torqued to manufacturer recommendations. All oxidized bolts and conical washers will be replaced with 316 stainless bolts and conical washers. Manufacturer torque values shall be available and will be provided. In the absence of any manufacture torque recommendations the Contractor shall consult with JEA engineer.

9. Hand Cleaning - Any components with remaining FME (foreign material) following the cleaning shall be wiped down and cleaned by hand. The cleaning solvent/agent used must be approved prior to Contractor usage. A Safety Data Sheet (SDS) for the cleaning solvent being used by the Contractor must be sent to JEA with the Bid Package for JEA Approval. The SDS must also be kept on site during the project in case of spills or injury.

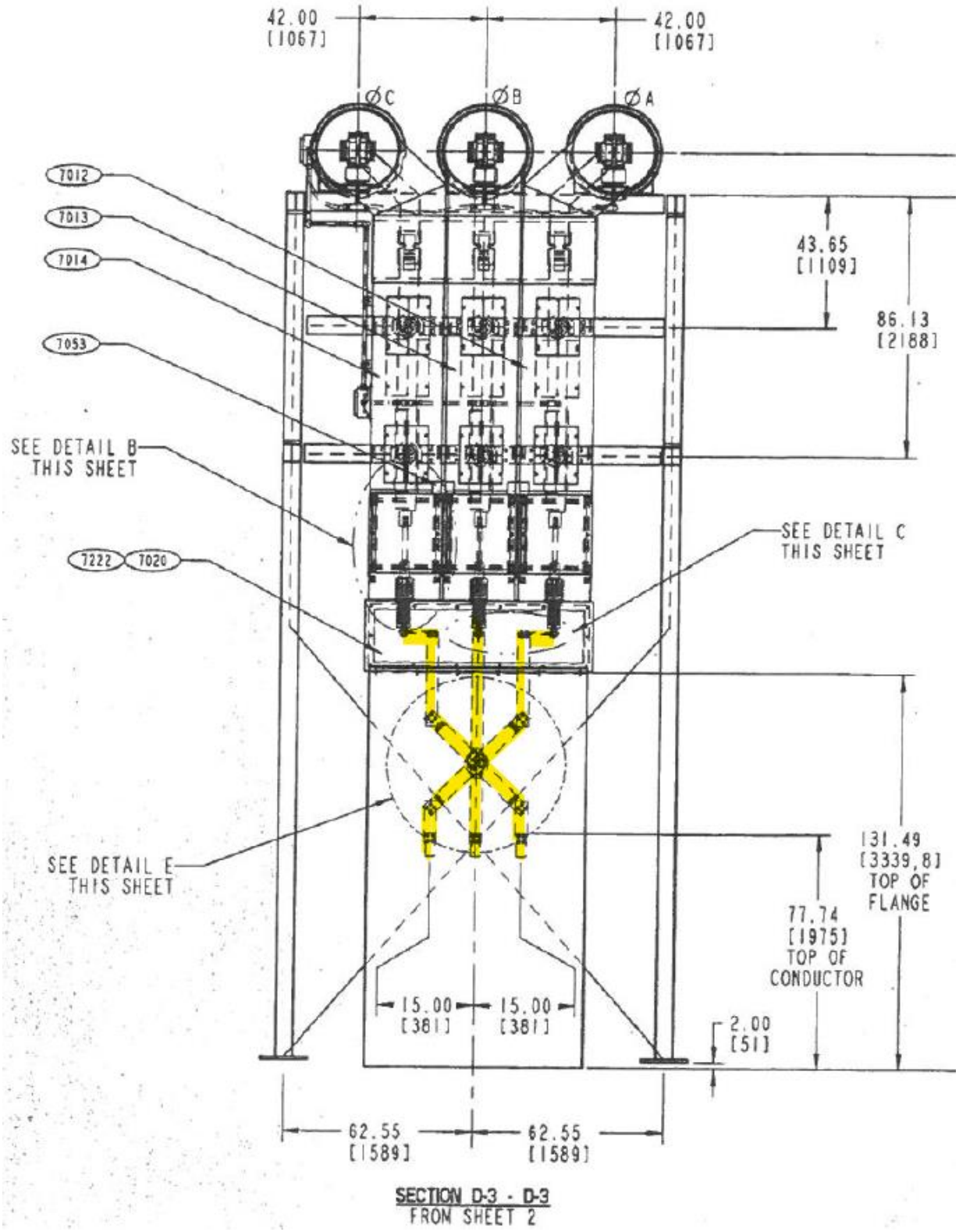
   If Contractor has an existing standard cleaning solvent standard, the Brand, Part #, and MSDS must be provided with the bid. Contractor recommended cleaning solvents must be approved by JEA Project Manager prior to use on JEA equipment.

Preliminary Reports- during the disassembly, cleaning and inspection, the Contractor shall keep JEA informed of any damaged equipment along with recommendations on their disposition, including how to repair or replace damaged equipment.

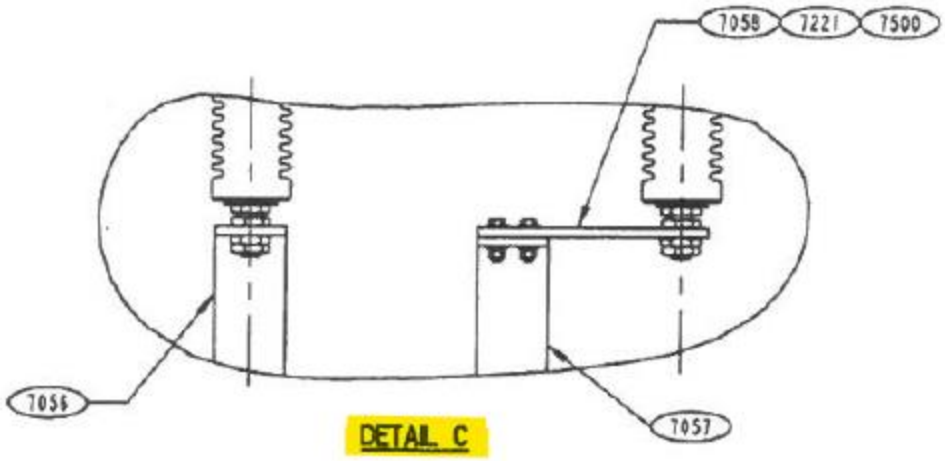
Final Report- The Contractor shall prepare a final written report that includes pictures of all parts that were disassembled and or repaired. The pictures shall include bushings, insulators and bus bar, as found, and all equipment identified as having flaws before and after repairs of all work done. Any parts replaced shall be listed with the respective manufacture(s), part number(s) and supplier(s). This report will also include any welding certifications for completed work.

Extra work- It is anticipated that repair work may be necessary. The Contractor shall provide unit costs for each of the following items based on the following estimated quantities. These quantities are no guarantees and may vary in magnitude.

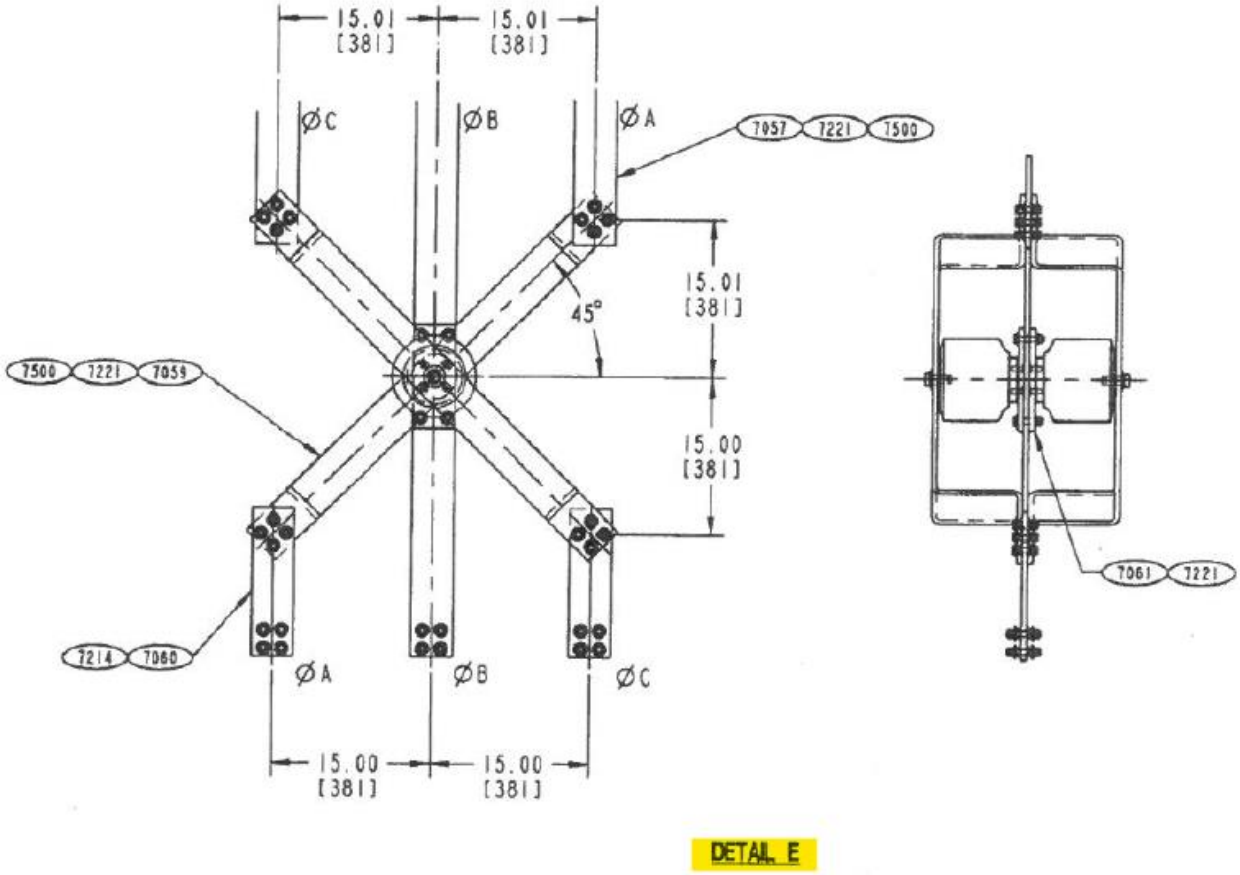
Item No.	Description	# Required		Total Lump Sum Price
1	**Lump Sum for Scope of Work described in this solicitation**	**1 Lot**		**$**
	Additional Materials, options for execution based on discovery during performance of the project: Pricing should include installation of <u>total</u> quantity listed below.			
		# Items	**Unit Cost**	**Total Cost**
2	Copper/Silver re-plating of electrical connections (assumes necessary cleaning is included)	12	20 sq in	$
3	Replace 18 kV connection bolts (1 Set = 4 Bolts, 4 Nut, 8 Flat Washers and 4 Conical washers) (Type: 316 SS, not 304)	1		$
4	Replace cracked/damaged 18kV bushings	1		$
5	Replace cracked/damaged/missing clamshell cover bolts (1 set = 9)	9		$
6	Replace cracked/damaged hatch gasket material (set = necessary material for clamshells)	3		$
7	Replace Flex Links	2		
				$
				$
Subtotal for Additional Materials During Discovery				$
Total Bid Price (total of Lines 1 through 6) Enter this Total on the Bid Form - Page 1 of 1.				$



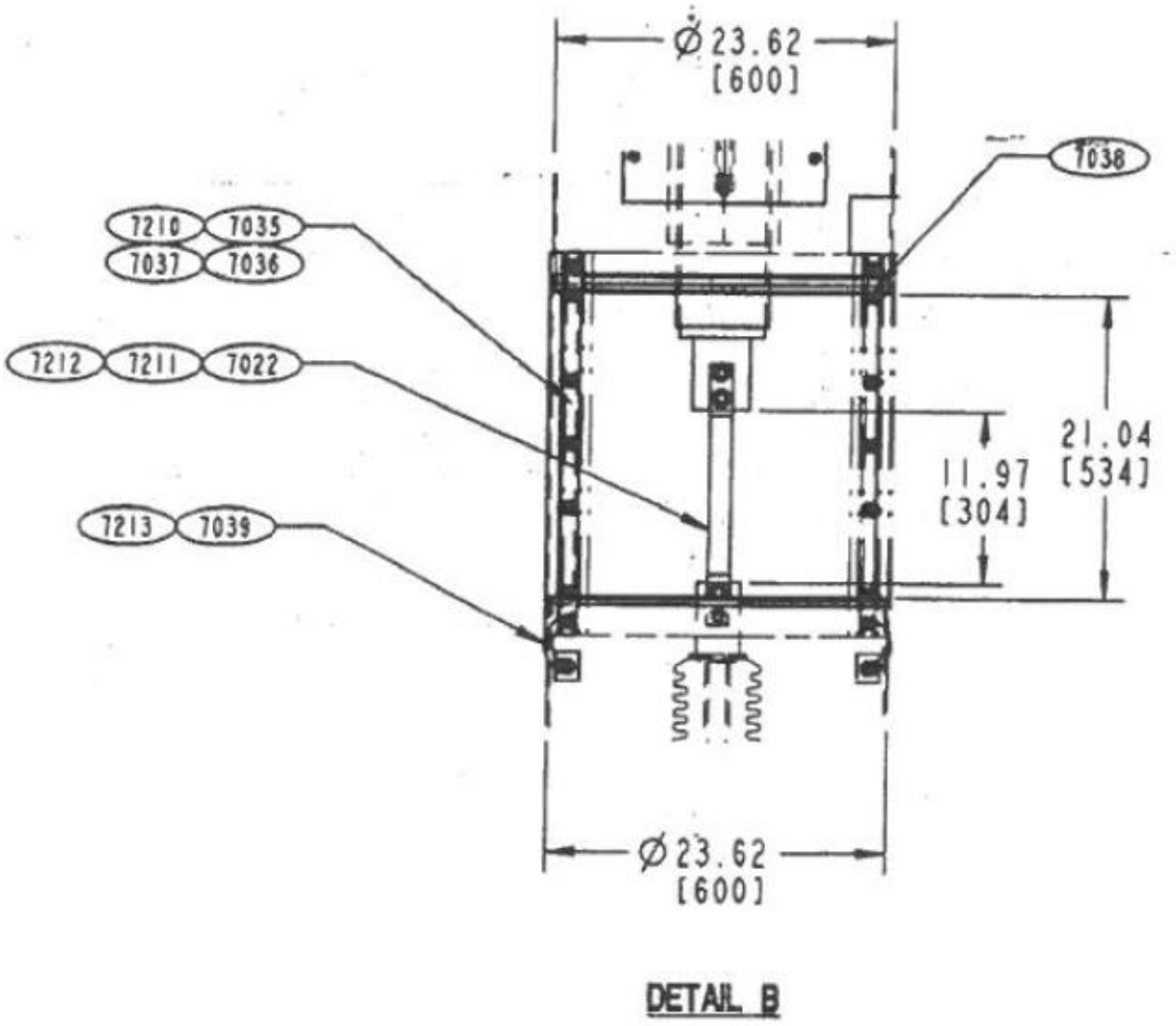
Bus Bar on Primary Side UAT.



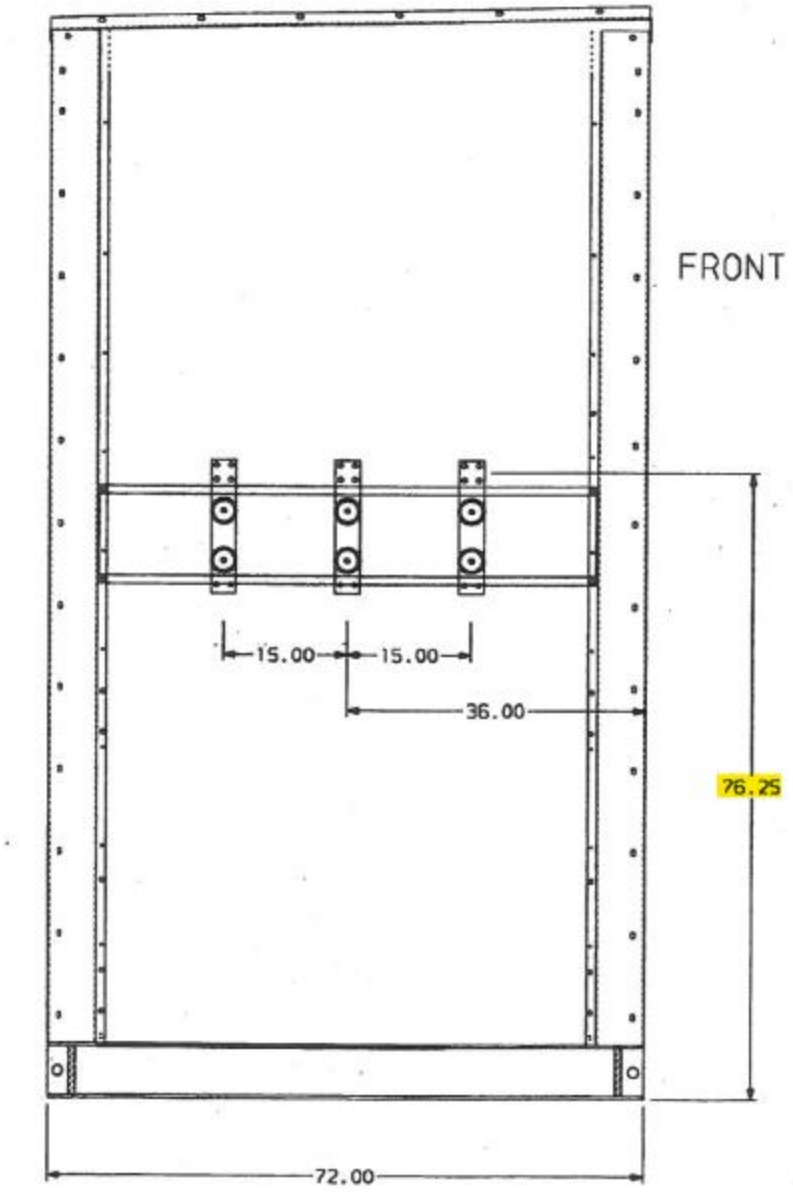
Bottom of Bushings Detail C.



Bus Bar Detail E.

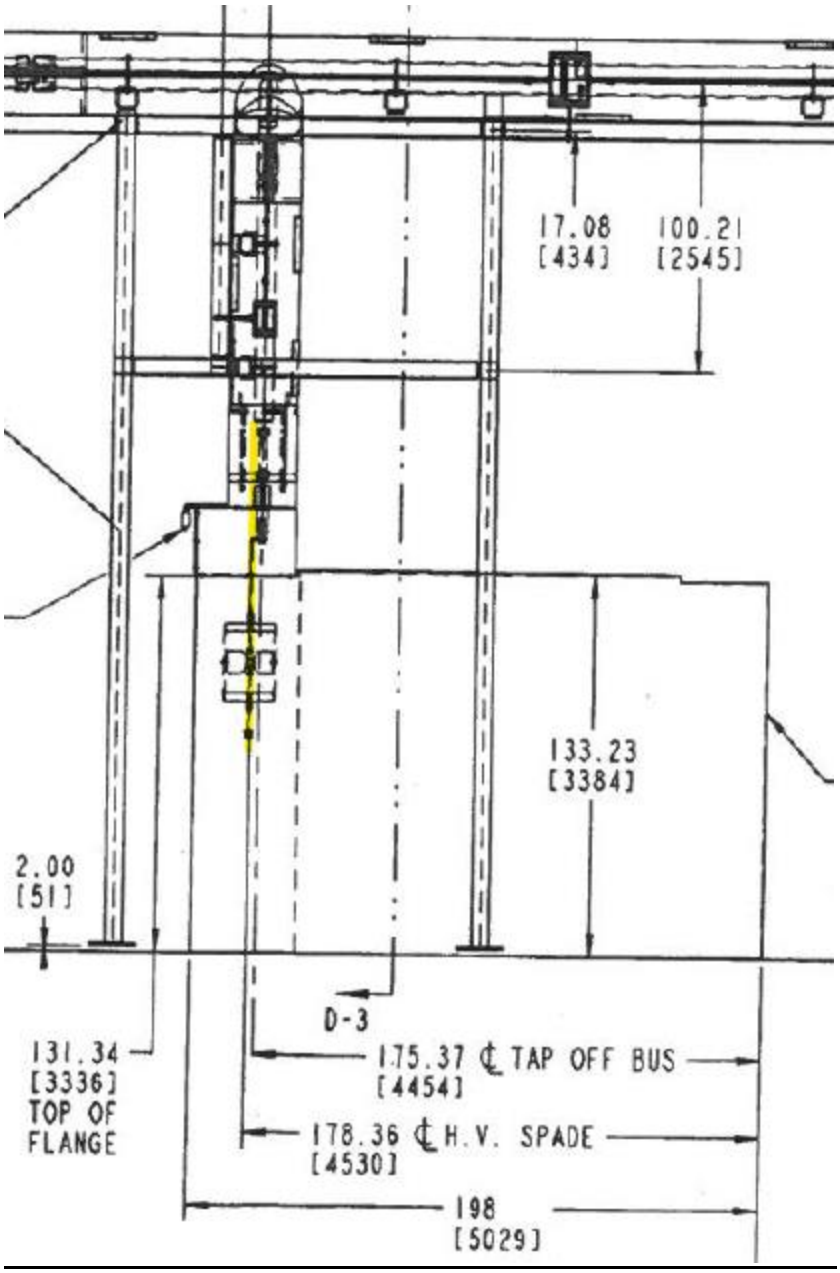


Clamshells Detail B.



TRANSFORMER LEFT END VIEW (ANSI SEG. #2)

UAT Bus Bar Supported by Three Stacked 4kV Insulators.



Profile Shows Height of Transfromer – 133 inches.

Secondary Medium Voltage 750MCM Cables.

Primary Bus Bar.