

SECTION V - TECHNICAL SPECIFICATIONS

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SECTION V - TECHNICAL SPECIFICATIONS

1. SCOPE

- 1.1. The purpose of this specification is to provide outdoor, dead tank, SF6, power circuit breakers, 245 kV, 145 kV, and 72.5kV voltage classes, as well as 34.5kV vacuum circuit breakers, including all accessory equipment and material.
- 1.2. The quantities of units to be purchased, for each voltage class rating, during the award period of the agreement are only estimated. Actual orders may vary, more or less, from the estimated quantity, depending on future project identification and approved funding.

2. PROJECT ENGINEER

The project engineer and contact person for technical questions and clarifications concerning this specification is:

Michael Sasan
JEA Standards
21 West Church Street
Jacksonville, FL 32202
Tel. (904) 665-7306
E-mail: sasamo@jea.com

3. STANDARDS

The breakers shall be designed, manufactured, assembled, insulated and tested in accordance with the latest applicable ANSI/IEEE, NEMA, and ASTM standards, in addition to the ASME code for unfired pressure vessels.

4. RATINGS

As defined in **ANSI/IEEE C37.04-1999** and as specified in **ANSI/IEEE C37.06-2000**, the following shall be the minimum ratings for each voltage class:

NOTE: External capacitors are not acceptable.

4.1. ITEM 1: 245 kV, 50 kA CIRCUIT BREAKER

- 4.1.1 Maximum kV RMS 245
- 4.1.2 Rated Voltage Range Factor K 1.0
- 4.1.3 Frequency 60 HZ
- 4.1.4 Continuous Current at 60 HZ 2,000 Amps RMS
- 4.1.5 Low-Frequency 1 Minute Dry RMS kV 425
- 4.1.6 Impulse Full Wave Withstand kV Crest 900
- 4.1.7 Rated Interrupting Time Maximum 2.5 Cycles
- 4.1.8 Rated Permissible Tripping Delay Y 1 Second
- 4.1.9 Short Circuit Current at Rated Max. kV 50 KA RMS
- 4.1.10 Maximum Symmetrical Interrupting Capability 50 KA RMS
- 4.1.11 Closing and Latching Capability 130 KA RMS
- 4.1.12 3-Second Short Time Current Carrying Capability 50 KA RMS
- 4.1.13 Power Requirements:
 - 4.1.13.1 Control Voltage Close and Trip 125 VDC

- 4.1.13.2 Motors and Heaters Voltage 120/240 VAC
 - 4.1.14 Current Transformers:
 - 4.1.14.1 Accuracy Class C800
 - 4.1.14.2 Ratio 2000/5, MRBCT
- 4.2 **ITEM 2:** 245 kV, 50 kA CIRCUIT BREAKER, 2.0 CYCLE
 - 4.2.1 Provide as per **Item 1**, except rated interrupting time shall be 2.0 cycles and with one (1) additional metering accuracy (0.3 B 0.9) MRBCT 2000:5 current transformer per phase on bushings 1-3-5 and one (1) additional relay accuracy MRBCT 2000:5 current transformer per phase on bushings 2-4-6.
- 4.3 **ITEM 3:** 145 kV, 50 kA CIRCUIT BREAKER
 - 4.3.1 Maximum kV RMS 145
 - 4.3.2 Rated Voltage Range Factor K 1.0
 - 4.3.3 Frequency 60 HZ
 - 4.3.4 Continuous Current at 60 HZ 2,000 Amps RMS
 - 4.3.5 Low-Frequency 1 Minute Dry RMS kV 310
 - 4.3.6 Impulse Full Wave Withstand kV Crest 650
 - 4.3.7 Rated Interrupting Time Maximum 2.5 Cycles
 - 4.3.8 Rated Permissible Tripping Delay Y 1 Second
 - 4.3.9 Short Circuit Current at Rated Max. kV 50 kA RMS
 - 4.3.10 Maximum Symmetrical Interrupting Capability 50 kA RMS
 - 4.3.11 Closing and Latching Capability 130 kA RMS
 - 4.3.12 3-Second Short Time Current Carrying Capability 50 kA RMS
 - 4.3.13 Power Requirements
 - 4.3.13.1 Control Voltage Close and Trip 125 VDC
 - 4.3.13.2 Motors and Heaters Voltage 120/240 VAC
 - 4.3.14 Current Transformers:
 - 4.3.14.1 Accuracy Class C800
 - 4.3.14.2 Ratio 2000/5, MRBCT
- 4.4 **ITEM 4:** 145 kV, 63 kA CIRCUIT BREAKER
 - 4.4.1 Maximum kV RMS 145
 - 4.4.2 Rated Voltage Range Factor K 1.0
 - 4.4.3 Frequency 60 HZ
 - 4.4.4 Continuous Current at 60 HZ 2,000 Amps RMS
 - 4.4.5 Low-Frequency 1 Minute Dry RMS kV 310
 - 4.4.6 Impulse Full Wave Withstand kV Crest 650
 - 4.4.7 Rated Interrupting Time Maximum 3 Cycles
 - 4.4.8 Rated Permissible Tripping Delay Y 1 Second
 - 4.4.9 Short Circuit Current at Rated Max. kV 63 kA RMS

- 4.4.10 Maximum Symmetrical Interrupting Capability 63 kA RMS
- 4.4.11 Closing and Latching Capability 164 kA RMS
- 4.4.12 3-Second Short Time Current Carrying Capability 63 kA RMS
- 4.4.13 Power Requirements:
 - 4.4.13.1 Control Voltage Close and Trip 125 VDC
 - 4.4.13.2 Motors and Heaters Voltage 120/240 VAC
- 4.4.14 Current Transformers:
 - 4.4.14.1 Accuracy Class C800
 - 4.4.14.2 Ratio 2000/5, MRBCT

- 4.5 **ITEM 5:** 72.5 kV, 50 kA CIRCUIT BREAKER
 - 4.5.1 Maximum kV RMS 72.5
 - 4.5.2 Rated Voltage Range Factor K 1.0
 - 4.5.3 Frequency 60 HZ
 - 4.5.4 Continuous Current at 60 HZ 2,000 Amps RMS
 - 4.5.5 Low-Frequency 1 Minute Dry RMS kV 150
 - 4.5.6 Impulse Full Wave Withstand kV Crest 350
 - 4.5.7 Rated Interrupting Time Maximum 5 Cycles
 - 4.5.8 Rated Permissible Tripping Delay Y 1 Second
 - 4.5.9 Short Circuit Current at Rated Max. kV 50 KA RMS
 - 4.5.10 Maximum Symmetrical Interrupting Capability 50 KA RMS
 - 4.5.11 Closing and Latching Capability 64 KA RMS
 - 4.5.12 3-Second Short Time Current Carrying Capability 50 KA RMS
 - 4.5.13 Power Requirements:
 - 4.5.13.1 Control Voltage Close and Trip 125 VDC
 - 4.5.13.2 Motors and Heaters Voltage 120/208/240 VAC
 - 4.5.14 Current Transformers:
 - 4.5.14.1 Accuracy Class C800
 - 4.5.14.2 Ratio 2000/5, MRBCT

- 4.6 **ITEM 6:** 72.5 kV, 50 kA CIRCUIT BREAKER, 2.0 CYCLE
 - 4.6.1 Provide as per **Item 5**, except rated interrupting time shall be 2.0 cycles and with one (1) additional metering accuracy (0.3 B 0.9) MRBCT 2000:5 current transformer per phase on bushings 1-3-5 and one (1) additional relay accuracy MRBCT 2000:5 current transformer per phase on bushings 2-4-6.

- 4.7 **ITEM 7:** 34.5kV, 200kV BIL TRANSFORMER VACUUM CIRCUIT BREAKER (WITHOUT RELAYS)
 - 4.7.1 Maximum kV RMS 38
 - 4.7.2 Range Factor K 1.0
 - 4.7.3 Low-Frequency Withstand kV
 - 4.7.3.1 Dry 60Hz for 1 Minute 80 kV RMS
 - 4.7.3.2 Wet 60Hz for 1 Minute 75 kV RMS

- 4.7.4 Impulse kV, Crest 150 kV
- 4.7.5 Continuous current at 60 Hz 1200 Amps
- 4.7.6 Short Circuit Current at Rated Max. kV 20 kA RMS
- 4.7.7 Rated Interrupting Time Maximum 3.5 Cycles
- 4.7.8 Rated Permissible Tripping Delay Y 2 seconds
- 4.7.9 Maximum Symmetrical Interrupting Capability 20 kA RMS Sym.
- 4.7.10 Closing and Latching Capability 32 kA RMS Asym.
- 4.7.11 3 Second Short Time Current Carrying Capability 20 kA RMS Sym.
- 4.7.12 Power Requirements:
 - 4.7.12.1 Control Voltage Close and Trip 125 VDC.
 - 4.7.12.2 Motors and Heaters Voltage 230 V.
- 4.7.13 Current Transformers:
 - 4.7.13.1 Accuracy Class C400
 - 4.7.13.2 1200/5 MRBCT
- 4.7.14 Relays shall be mounted in control panel.

4.8 **ITEM 8:** 34.5kV, 200kV BIL FEEDER VACUUM CIRCUIT BREAKER (WITHOUT RELAYS)

- 4.8.1 Maximum kV RMS 38
- 4.8.2 Range Factor K 1.0
- 4.8.3 Low-Frequency Withstand kV
 - 4.8.3.1 Dry 60Hz for 1 Minute 80 kV RMS
 - 4.8.3.2 Wet 60Hz for 1 Minute 75 kV RMS
- 4.8.4 Impulse kV, Crest 150 kV
- 4.8.5 Continuous current at 60 Hz 1200 Amps
- 4.8.6 Short Circuit Current at Rated Max. kV 20 kA RMS
- 4.8.7 Rated Interrupting Time Maximum 3.5 Cycles
- 4.8.8 Rated Permissible Tripping Delay Y 2 seconds
- 4.8.9 Maximum Symmetrical Interrupting Capability 20 kA RMS Sym.
- 4.8.10 Closing and Latching Capability 32 kA RMS Asym.
- 4.8.11 3 Second Short Time Current Carrying Capability 20 kA RMS Sym.
- 4.8.12 Power Requirements:
 - 4.8.12.1 Control Voltage Close and Trip 125 VDC.
 - 4.8.12.2 Motors and Heaters Voltage 230 V.
- 4.8.13 Current Transformers:
 - 4.8.13.1 Accuracy Class C400
 - 4.8.13.2 1200/5 MRBCT
- 4.8.14 Relays shall be mounted in control panel.

4.9 **ITEM 9:** 34.5kV, 200kV BIL TRANSFORMER VACUUM CIRCUIT BREAKER (WITH RELAYS)

- 4.9.1 Maximum kV RMS 38

- 4.9.2 Range Factor K 1.0
 - 4.9.3 Low-Frequency Withstand kV
 - 4.9.3.1 Dry 60Hz for 1 Minute 80 kV RMS
 - 4.9.3.2 Wet 60Hz for 1 Minute 75 kV RMS
 - 4.9.4 Impulse kV, Crest 150 kV
 - 4.9.5 Continuous current at 60 Hz 1200 Amps
 - 4.9.6 Short Circuit Current at Rated Max. kV 20 kA RMS
 - 4.9.7 Rated Interrupting Time Maximum 3.5 Cycles
 - 4.9.8 Rated Permissible Tripping Delay Y 2 seconds
 - 4.9.9 Maximum Symmetrical Interrupting Capability 20 kA RMS Sym.
 - 4.9.10 Closing and Latching Capability 32 kA RMS Asym.
 - 4.9.11 3 Second Short Time Current Carrying Capability 20 kA RMS Sym.
 - 4.9.12 Power Requirements:
 - 4.9.12.1 Control Voltage Close and Trip 125 VDC.
 - 4.9.12.2 Motors and Heaters Voltage 230 V.
 - 4.9.13 Current Transformers:
 - 4.9.13.1 Accuracy Class C400
 - 4.9.13.2 1200/5 MRBCT
 - 4.9.14 Relays shall be mounted in breaker control cabinet.
- 4.10 **ITEM 10: 34.5kV, 200kV BIL FEEDER VACUUM CIRCUIT BREAKER (WITH RELAYS)**
- 4.10.1 Maximum kV RMS 38
 - 4.10.2 Range Factor K 1.0
 - 4.10.3 Low-Frequency Withstand kV
 - 4.10.3.1 Dry 60Hz for 1 Minute 80 kV RMS
 - 4.10.3.2 Wet 60Hz for 1 Minute 75 kV RMS
 - 4.10.4 Impulse kV, Crest 150 kV
 - 4.10.5 Continuous current at 60 Hz 1200 Amps
 - 4.10.6 Short Circuit Current at Rated Max. kV 20 kA RMS
 - 4.10.7 Rated Interrupting Time Maximum 3.5 Cycles
 - 4.10.8 Rated Permissible Tripping Delay Y 2 seconds
 - 4.10.9 Maximum Symmetrical Interrupting Capability 20 kA RMS Sym.
 - 4.10.10 Closing and Latching Capability 32 kA RMS Asym.
 - 4.10.11 3 Second Short Time Current Carrying Capability 20 kA RMS Sym.
 - 4.10.12 Power Requirements:
 - 4.10.12.1 Control Voltage Close and Trip 125 VDC.
 - 4.10.12.2 Motors and Heaters Voltage 230 V.
 - 4.10.13 Current Transformers:
 - 4.10.13.1 Accuracy Class C400
 - 4.10.13.2 1200/5 MRBCT

4.10.14 Relays shall be mounted in breaker control cabinet.

5. MATERIALS & WORKMANSHIP

- 5.1 The materials used for the manufacturing of the circuit breakers shall be new and of standard, commercial, first-grade quality as to materials, workmanship, and design. The workmanship and design shall be most suitable for the application. The equipment shall be manufactured to conform to the best engineering practices.
- 5.2 All external hardware such as nuts, bolts, washers, hinges, door handles, etc., shall be **stainless steel type 316**.
- 5.3 The breakers shall be of outdoor type construction, floor mounted on a welded hot-dip galvanized steel base structure with removable legs.
- 5.4 All enclosures shall be sufficiently rigid to prevent warping of doors and latches. Doors shall be hinged and have heavy duty handle type latches.
- 5.5 All special tools required for installation and maintenance of the circuit breaker shall be furnished by the Manufacturer. Metric size wrenches or sockets are not considered as special.

6. BUSHINGS

- 6.1 Bushings shall conform to the latest NEMA and ANSI/IEEE standards.
- 6.2 All bushings shall be made of porcelain. The porcelain's color shall be "sky gray". The internal surface of the bushing shall be glazed.
 - 6.2.1 Bushings made of other materials may be approved upon request.
- 6.3 The bushings shall be equipped with a 4-hole NEMA pad terminal. If aluminum terminal pads are provided, bi-metallic transition pads shall be provided for each terminal.
- 6.4 The bushings' BIL shall be as follows:
 - 6.4.1 245 kV Circuit Breakers – 900 kV
 - 6.4.2 145 kV Circuit Breakers – 650 kV
 - 6.4.3 72.5 kV Circuit Breakers – 350 kV
 - 6.4.4 34.5 kV Circuit Breakers – 200 kV
- 6.5 Each bushing shall be furnished with a nameplate permanently mounted on the flange such that it can be easily read with the bushing installed. The nameplate shall be made of stainless steel and the following information should be stamped:
 - 6.5.1 Manufacturer
 - 6.5.2 Type
 - 6.5.3 Serial Number
 - 6.5.4 Catalog and/or Drawing Number
 - 6.5.5 Year
 - 6.5.6 Rated Voltage
 - 6.5.7 Rated Current
 - 6.5.8 Basic Impulse Level (BIL)
 - 6.5.9 Weight
- 6.6 The Manufacturer shall ship the breaker with the bushings installed when possible.

7. CURRENT TRANSFORMERS

The current transformers shall be designed, built and shall be expected to perform as per **ANSI/IEEE C57.13-1993**.

- 7.1 Multi-ratio bushing current transformers shall be provided in the power circuit breaker bushings. Each CT shall have a single turn primary with separate core. The accuracy class and primary current rating shall be C800 and 2000/5 MRBCT.
- 7.2 Each bushing shall have two (2) CTs. On each bushing the "Y" designation shall be the farthest from the interrupter and the "X" designation shall be the closest to the interrupter. See **Appendix I**.
- 7.3 The secondary tap leads of the current transformer shall be copper wire, No. 12 AWG minimum, 600 V insulation class and shall be brought out to a shorting type terminal blocks complete with engraved phenolic type marking strips (tape type labels are not acceptable) white having the wire identities in black.
- 7.4 There shall be no cable splices in the current transformer wiring circuits.
- 7.5 Proper protection shall be provided between current transformers and mounting plates. Bolts and hardware shall be made to prevent rubbing or chafing of the current transformer insulation.
- 7.6 Current transformer terminal block maximum height shall be no greater than 6'-0" from the top of the breaker foundation.
- 7.7 Current transformer terminal blocks shall have a minimum of 6" working room around the customer termination side with a minimum of 3" working room around the factory connection side.
- 7.8 Current transformer terminal blocks shall have engraved phenolic type labels identifying bushing CT and CT lead numbers.
- 7.9 If current transformer terminations are made within a separate enclosure, access to CT terminal blocks shall not require removal of a bolted panel. A hinge door shall be provided as per **Paragraphs 5.4 & 9.2.1**.
- 7.10 All secondary leads shall be connected to the terminal blocks using ring type compression connectors.
- 7.11 All taps from the multi-ratio current transformers brought to the shorting type terminal blocks shall retain a logical physical orientation. Individual sets of current transformer terminations shall not be mixed with other sets of terminations (e.g. 1X-3X-5X and 2X-4X-6X CTs are grouped together).
- 7.12 Current transformers shall have a stainless steel nameplate affixed to the outside of the circuit breaker or the inside of the cabinet door and shall contain the following information, as per **ANSI/IEEE C57.13-1993, Clause 6, Paragraph 6.8**:
 - 7.12.1 Manufacturer
 - 7.12.2 Type
 - 7.12.3 Serial Number
 - 7.12.4 Date
 - 7.12.5 Rated Frequency
 - 7.12.6 Rated Primary Current
 - 7.12.7 Rated Secondary Current
 - 7.12.8 Rated Continuous Thermal Current Factor
 - 7.12.9 Accuracy Rating
 - 7.12.10 Weight of Complete CT
 - 7.12.11 Instruction Book Number

8. SF6 GAS SYSTEM

- 8.1 The Manufacturer shall furnish a complete SF6 gas system for each circuit breaker.
 - 8.1.1 The gas system shall include pressure alarms, valves, dryers, filters and all accessories for filling, removal, operation and maintenance of the circuit breakers.
 - 8.1.2 The gas system shall be designed to automatically maintain the moisture content of the SF6 at an adequate level for proper operation.
 - 8.1.3 The monitoring system shall be temperature compensated.
- 8.2 In addition to a gasket or "O" ring seal between the bushing and the dead tank, an RTV (silicon based) sealant shall be required to be put along and between bushing flanges to minimize SF6 leaks.
 - 8.2.1 Materials other than RTV may be considered upon request.
- 8.3 The Manufacturer shall furnish temperature compensated gas pressure gauges and gas density monitors.
- 8.4 The Manufacturer shall provide and install ¼" tube fitting - a 37 degree AN male 7/16-20 flare type - for each circuit breaker. A valve shall be located directly behind this fitting. See **Appendix II**.
- 8.5 The Manufacturer shall provide and install a 1" Dilo fitting for SF6 filling for each circuit breaker.
- 8.6 The Manufacturer shall provide for filling the breaker, with the SF6 pressure gauge/density monitor in place and for testing the setting of the alarm contacts of the gauge/density monitor.
- 8.7 The SF6 normal operating pressure as well as the minimum SF6 pressure to interrupt full rated load and full rated fault current shall be stamped in the nameplate of each breaker. See **Paragraphs 12.23, 12.24 & 12.25**.
- 8.8 The SF6 gas system shall be designed such that there is one gas circuit per circuit breaker. The gas system for all phases shall be tied together such that gas pressure is shared by all phases. See **Appendix II**.
- 8.9 **SF6/Nitrogen mixtures are not acceptable.**
- 8.10 Each breaker shall be furnished with sufficient SF6 gas to maintain positive pressure and to provide for safe transport under pressure.
- 8.11 SF6 gas shall be new and shall conform to **ASTM D 2472-00, Standard Specification for Sulfur Hexafluoride**.
- 8.12 The JEA will furnish the necessary insulating SF6 gas to fill the breaker to operating pressure.
- 8.13 All the SF6 gas lines, as well as all the valves used in the SF6 gas system shall be **stainless steel type 316** and should be manufactured specifically for SF6 handling.
 - 8.12.1 All fittings shall be manufactured by Swagelok.
 - 8.12.2 All valves shall be manufactured by Cajon.
- 8.14 Where gas pipelines are exposed to possible damage, conduit, enclosed tray, or other mechanical protective means shall be furnished to adequately protect them from damage.
- 8.15 Moisture tests shall be performed in the SF6 gas of each circuit breaker before they leave the Manufacturer's facility. The results of these tests shall be included in the test report of each breaker. See **Subsection 16**.
- 8.16 The Manufacturer shall provide gas-sampling valves in places that will be safe to take samples while the breaker is energized. Furthermore, the location and operation of these sampling valves should be in a way that will not cause false trips to occur.

- 8.17 Isolating valves for the SF6 pressure switches, gauges, density monitor, etc., shall be provided to be able to replace any one of the subject components without having to remove the SF6 gas from the breaker.
- 8.18 The circuit breakers shall be designed to operate on decreasing SF6 pressure as follows:
 - 8.18.1 1st Stage - Alarm (Annunciator)
 - 18.18.1.1 The pressure setting of this 1st stage alarm shall be the pressure where the Manufacturer believes the drop in pressure is caused by a SF6 leak.
 - 8.18.2 2nd Stage - Block Close and Trip
 - 8.18.2.1 The pressure setting of this 2nd stage shall be the pressure where the Manufacturer believes that is not safe to operate the breaker (open and close).
- 8.19 Two pressure switches shall be provided for redundancy.
 - 8.19.1 The pressure switches can be installed in the same SF6 gas line or on separated lines.
 - 8.19.2 The contacts of these pressure switches shall be wired such as either one of the contacts intended for a specific function shall trigger the event without depending on the other contact.

9. OPERATING MECHANISM & CONTROL CABINET

- 9.1 The operating mechanism shall be spring open-spring close type.
 - 9.1.1 The breaker shall be electrically operated by a mechanically and electrically trip free mechanism which shall provide for positive opening of all three poles and circuit interruption, whether the tripping impulse is received in the fully closed or partially closed position.
 - 9.1.2 The circuit breakers shall be capable of an opening-closing-opening operation at rated short circuit or at related required capabilities after loss of ac station service power to the operating mechanism.
 - 9.1.3 The manufacturer shall provide electrical isolation between seal-in contact of the closing circuit at the breaker and the closing circuit of customer's control circuit. The input impedance at the trip input shall be low enough to draw a minimum of two (2) amps from the customer's 125VDC supply to assure target relay operation.
 - 9.1.4 The manufacturer shall state how long this mechanism has been in production.
- 9.2 The manufacturer shall provide a weatherproof stainless steel or aluminum (NEMA 4X or equivalent) control cabinet, which needs no paint, mounted on the side of the supporting framework. It shall have a removable bottom plate for conduit entrances.
 - 9.2.1 The control cabinet doors and swing panels shall have a minimum of two (2) latch points. A latching device shall be provided on the hinge end to hold the door/swing panel in the open position while work is being performed in the cabinet. The cabinet doors shall be capable of being latched open at least 120 degrees from the closed position.
 - 9.2.2 The door latch shall be lockable in the latched position with a pad lock having a 3/8" shackle.
- 9.3 The control cabinet, besides the operating mechanism, shall include all connections, wiring and linkages for a complete installation along with at least the following conditions and/or items:
 - 9.3.1 The circuit breaker, when located 1000 feet from a 125VDC source with #10 control cable, shall not experience a voltage drop which will cause unsatisfactory operation of the breaker.

- 9.3.2 A reliable and easily read mechanical position indicator shall be furnished to indicate the opened and closed positions of the circuit breaker.
- 9.3.2.1 The word "**OPENED**" or "**O**" in white letters shall be displayed on a green background.
- 9.3.2.2 The word "**CLOSED**" or "**C**" in white letters shall be displayed on a red background.
- 9.3.2.3 The open-close indicators shall be made of a material, which will stand up to UV deterioration.
- 9.3.3 The spring-charged mechanism indicator shall display:
- 9.3.3.1 The word "**CHARGED**" in black letters on a yellow background.
- 9.3.3.2 The word "**DISCHARGED**" in black letters on a white background.
- 9.3.4 One (1) auxiliary switch with twenty (20) spare mechanically adjustable contacts in 15-degree increments for owner's use, in addition to what the Manufacturer uses for circuit breaker control. The auxiliary switches shall be wired out to terminal blocks, which shall be grouped together. See **Appendix III**.
- 9.3.5 One (1) 120/240 and 120/208 (dual rated) VAC for the operating mechanism. A universal type spring-charging motor (125 VAC/VDC) will be acceptable.
- 9.3.6 Dual 125 VDC trip coils (magnetically and electrically independent) with separately fused disconnecting knife switches.
- 9.3.7 One (1) 125 VDC close coil, separately fused.
- 9.3.8 One (1) 120 VAC GFI convenience receptacle to be mounted in an accessible location, separately protected by a circuit breaker. See **Appendix IV**.
- 9.3.9 SF6 gas pressure gauge calibrated in pounds per square inch.
- 9.3.10 An operation counter that shall be located in the mechanism housing and conveniently read from ground level.
- 9.3.11 An external mechanical pull, electrically operated emergency trip device shall be provided. This device **shall not bypass** the circuit breaker safety and block features.
- 9.3.12 In addition to the alarm points specified in **Paragraph 8.17**, a "**Loss of AC Power**" alarm point shall also be provided.
- 9.3.13 In a separately fused circuit, indicating lights at the breaker shall be provided for each separate alarm function. The Manufacturer shall supply push button switches to test the indicating lamps.
- 9.3.14 The Manufacturer shall provide one (1) spare contact for remote indication of each of the alarmed points.
- 9.3.15 The Manufacturer shall provide a minimum of 6" working room for hands and hand tools around and between terminal board areas used for customer wiring connections in addition to the room for fully installed wires.
- 9.3.16 The mechanism housing shall be physically mounted such that it is accessible from ground level. Minimum height of the cabinet shall be 1'-6" above the top of the breaker foundation. The maximum height of the mechanism cabinet door handle shall be 5'-6" above the top of the breaker foundation. In addition, all items used for normal monthly maintenance (power disconnect switches, terminal boards, etc.) shall be below the 5'-6" level. See **Appendix V**.

- 9.3.17 Space heaters shall be provided in the control cabinet to prevent condensation within the enclosure. Space heater capacity shall be as required to maintain the enclosure internal temperature above the dew point. The heaters shall be spaced away and thermally insulated from any devices.
 - 9.3.17.1 The space heater shall have guards or shields, which are thermally isolated and non-conducting to prevent accidental contact with hot element or heater parts.
 - 9.3.17.2 JEA will provide an auxiliary power supply of 120/240 or 120/208 volts. Space heaters are to be sized and rated for both voltages.
 - 9.3.17.3 The space heaters shall be shipped from the factory connected at 240V with the capability of being reconnected at 120V by the customer.
 - 9.3.17.4 The heater circuits shall be separately protected by a circuit breaker. See **Appendix IV**.
- 9.3.18 All three phases shall be mechanically connected (no independent pole operation).
- 9.3.19 A control switch with red and green flags shall be used for local close and trip. A set of push buttons will be acceptable.
- 9.3.20 One (1) hand closing lever for manually closing the circuit breaker per breaker.
- 9.4 The Manufacturer shall provide knife blade fuses for the close and trip circuits only.
 - 9.4.1 These fuses shall be labeled with circuit name and amp rating.
 - 9.4.2 **Tape type labels are not acceptable.**
 - 9.4.3 The Manufacturer shall supply a spare fuse block, which shall be modular type with Bakelite frame and reinforced retaining clips to prevent accidental removal or dropping out due to vibration.
 - 9.4.4 The spare fuse block shall contain two (2) spare fuses for the close circuit and two (2) spare fuses for the trip circuit.
- 9.5 All other circuits shall be protected by circuit breakers.
- 9.6 The wiring of the closing circuit shall be such that the closing motor is separately protected by a circuit breaker from the closing control circuits. See **Appendix IV**.
- 9.7 The Manufacturer shall install double-pole single throw switches for the trip and close circuit isolation.
- 9.8 All surge protection devices shall be accessible and provide visual indication upon failure.
- 9.9 Two (2) bolted bronze type grounding terminals for 7#5 Copperweld conductor shall be provided on diagonally opposite corners of the structural frame of the high voltage compartment to provide convenient connection of ground grid lead with routing adjacent to breaker leg. See **Appendix V** for the ground pad detail.

10. TERMINAL BLOCKS & CONTROL WIRING

- 10.1 The breakers shall be designed and furnished with JEA DC typical schematic provided in **Appendix VI** at the end of this specification.
- 10.2 Wires to be terminated and individual termination points on terminal blocks shall be clearly marked for circuit identification and shall be terminated on terminal blocks, which are also to be marked for circuit identification (device codes etc.). Labels to be engraved plastic, or phenolic type labels; **tape, paper, composition, etc. will not be acceptable.**
- 10.3 The terminal block arrangement and location shall be such that incoming and outgoing cables can be supported. Adjacent rows of terminal blocks shall be separated at least 6" edge to edge, and at least 6" from sides, top or

bottom of the cabinet for all wiring that will be done in the field by the JEA. Wiring done at the factory may be made in a space, which is less than 3".

- 10.4 If terminal blocks are located within 6" of corners, top or bottom, the Manufacturer shall offset them at a 45-degree angle to facilitate easy termination.
- 10.5 Terminal blocks shall have an engraved phenolic type white marker strip having the wire identities in black as shown on the Manufacturer's certified drawings and shall be supplied for the following:
 - 10.5.1 Control circuits
 - 10.5.2 Current transformer leads
 - 10.5.3 Motor leads
 - 10.5.4 Heater leads
 - 10.5.5 Any other equipment controls, instruments, meters, and relays requiring external connections.
- 10.6 Penn Union, G.E. or Westinghouse heavy duty shorting blocks shall be used for terminating the CT secondary.
- 10.7 For easy removal by the JEA, terminal blocks shall be secured to permanently mounted brackets with tapped holes or to a welded nut with which block mounting screws are threaded into.
- 10.8 The Manufacturer shall provide a 24-pole terminal strip. This terminal strip shall be for JEA's use to interconnect for remote breaker control. One side shall be left open for customer use; the other side will be for Manufacturer's connections. The terminal blocks for remote breaker control shall be grouped together. See **Appendix VII**.
- 10.9 All control wiring shall be terminated in the operating mechanism housing with the terminal strip designation in accordance with the coding shown on the wiring diagrams.
- 10.10 All terminal and device codes shall be shown and properly labeled on the schematic drawings. The device codes shall be permanently labeled on the panel inside of the breaker control cabinet.
- 10.11 All wiring diagrams shall be drawn with all the devices indicated in their relative physical locations and shall represent the equipment and terminals arranged, as they would appear to the person wiring the equipment.
- 10.12 All control wiring shall be identified at both ends with wrap around markers carrying the same wire marks as shown on the Manufacturer's certified drawings and shall be supported in such a manner as to permit visual tracing of all the wires. Wiring marking shall be performed by the use of T & B "E-Z Code" self laminating adhesive material or equal.
- 10.13 Circuit code labels are not to be installed over crimped connections, as a visual inspection of the crimp is required.
- 10.14 Wiring ductwork shall be of such design to provide access to all wiring. Otherwise, grouping of wires to be exposed and tie-wrapped for neatness.
- 10.15 All Manufacturer's connections to the interconnecting terminal blocks shall be made on one side only, leaving space on the other side for the JEA's connections.
- 10.16 The Manufacturer shall mount two (2) twelve-point terminal blocks as spares for customer's use.
- 10.17 All cabinet wiring other than AC and or DC buses shall be AWG #12, tinned copper, 65 strand, G.E. type Vulkene switchboard wire SI-57275, 600 V, gray insulation.
- 10.18 The Manufacturer shall have no more than three (3) conductor terminations per terminal strip pole nor more than two (2) conductor terminations per relay or component terminal point.
- 10.19 Non-insulating ring-type compression terminal connectors shall be used on all terminals.

- 10.20 Ring type, solderless, barrel type compression connectors such as Burndy Hylug or approved equivalent shall be used for all terminations and connections within the breaker.
- 10.21 All terminal block individual termination point studs shall utilize 3/32" thick nuts.
- 10.22 The Manufacturer shall furnish all conduits necessary for inter-connecting all electrical control systems within the breaker.
 - 10.22.1 Conduit joints and fittings shall be dust tight and watertight.
 - 10.22.2 Conduits shall not be filled to more than 50% capacity.

11. SPARE PARTS & PM RECOMMENDATIONS

- 11.1 A list of recommended spare parts shall be included with the bid package. This list shall include a complete description of the part, including Manufacturer, catalog number or part number and prices for each item.
- 11.2 The Owner reserves the right to purchase any or all of the spare parts on the spare parts list. Only those parts required meeting inventory requirements will be purchased.
- 11.3 Prices for the following spare parts shall be included in the bid form as an attachment. These prices **will not** be used to determine the bid award.
 - 11.3.1 Bushing – Complete assembly
 - 11.3.2 Bushing gasket set, shipped in vacuum sealed bag
 - 11.3.3 Interrupter – Complete assembly
 - 11.3.4 Interrupter rebuild kit
 - 11.3.5 Closing coil
 - 11.3.6 Trip coil
 - 11.3.7 Motor
 - 11.3.8 Desiccant, shipped in vacuum sealed bag or bottle
- 11.4 A preventive maintenance schedule shall be included in each manufacturer's proposal. This schedule shall include from minor inspections to major overhauls.
- 11.5 The manufacturer shall state if bushings or any major part will have to be removed to inspect and replace contacts and interrupters.
- 11.6 The manufacturer shall state the man-hours required to perform the following procedures independently from one another when the circuit breaker is fully assembled and filled with SF6 gas.
 - 11.6.1 Replacement of the bushing CTs
 - 11.6.2 Replacement of the interrupter

12. NAMEPLATE

A stainless steel nameplate shall be provided for each circuit breaker. The nameplate shall be located on the outside of the circuit breaker control cabinet and the following information should be stamped on it, as per **ANSI/IEEE C37.04-1999, Section 7, Paragraphs 7.1 & 7.3:**

- 12.1 Manufacturer
- 12.2 Breaker Type
- 12.3 Manufacturing Date

- 12.4 JEA Purchase Order
- 12.5 Mechanism Type
- 12.6 Serial Number
- 12.7 Rated Maximum Operating Voltage
- 12.8 Rated Continuous Current
- 12.9 Rated Full Wave Impulse Withstand Voltage
- 12.10 Rated Short Circuit Current (kA)
- 12.11 Frequency
- 12.12 Motor Rating
- 12.13 Closing Control Voltage Range
- 12.14 Tripping Control Voltage Range
- 12.15 Closing Current
- 12.16 Tripping Current
- 12.17 K Factor
- 12.18 Rated Interrupting Time
- 12.19 Total Pounds of SF6 Gas
- 12.20 Weight, Complete
- 12.21 Instruction Book Number
- 12.22 Parts List Number
- 12.23 SF6 Normal Operating Pressure
- 12.24 SF6 Minimum Pressure for Interrupting Full Rated Load
- 12.25 SF6 Minimum Pressure for Interrupting Full Rated Fault Current

13. DELIVERY

- 13.1 The Manufacturer shall ship the circuit breakers F.O.B. substation site, Jacksonville, Florida.
- 13.2 The Manufacturer shall assume responsibility for safe arrival of the circuit breakers and shall handle all claims, if damaged in transit.
- 13.3 All equipment furnished which requires packaging shall be labeled with the following information:
 - 13.3.1 JEA P.O. Number
 - 13.3.2 Substation Name
 - 13.3.3 Item Number per Manufacturer's Bill of Material
 - 13.3.4 Content Description
- 13.4 All packages shall be shipped either on pallets or bundled in an acceptable manner for off-loading.
- 13.5 Packing shall be such as to adequately protect the contents from any damage that might be reasonably encountered during transportation and handling.
- 13.6 If the breaker is shipped with the bushings already installed in the dead tank, they shall be covered with plastic wrap, to prevent damage and contamination during transportation.
- 13.7 Packing crates shall be sturdy enough to withstand up to one (1) year of outdoor storage without deterioration of crates or damage to the contents.

- 13.8 Any packages that require indoor storage shall be clearly marked.
- 13.9 Prior to shipment, the Project Engineer shall receive a complete packing list of all the items to be shipped in order for the customer to verify complete shipment.
- 13.10 Spare parts shall be packed separately and clearly marked "**SPARE PARTS**". In addition, they shall be marked with their respective part numbers, descriptive information and JEA P.O. number.
- 13.11 Spare parts shall be shipped F.O.B. to:

JEA
6674 Commonwealth Avenue
Jacksonville, Florida 32254

14. FIELD ENGINEER SERVICES

- 14.1 The Manufacturer shall provide a quote for the services of a Field Engineer at the job site for two (2), eight (8) - hour days per bid item.
- 14.2 The cost of the Field Engineer shall be quoted separately and shall be included in the Bid Form. This price **will not be used** in the evaluation of the contract price.
- 14.3 The Field Engineer shall inspect the equipment to verify that it has been installed properly and shall supervise and assist in placing the breaker in operation.
- 14.4 The Field Engineer shall be thoroughly knowledgeable and experienced in the installation, operation and maintenance of the specific breaker.
- 14.5 The Field Engineer may be made available for a period of two (2), eight (8) - hour days for each type of circuit breaker to instruct JEA's personnel in the proper operation, adjustment, testing, and maintenance of the equipment.

15. DRAWINGS

- 15.1 The Manufacturer shall submit to the JEA, reproducible drawings (24" x 36"), including outline, wiring, and schematic diagrams of the control equipment and interconnection diagrams.
- 15.2 The drawings shall be submitted to the Project Engineer for approval prior to manufacture of the equipment. **Manufacturing shall not be started, under any circumstance, until the Project Engineer has approved the drawings.** Approval drawings shall be received within 60 days ARO.
- 15.3 A preliminary outline drawing showing dimensions, weights, and center of gravity shall be submitted within 30 days ARO.
- 15.4 The drawings and data necessary shall include, but not limited to, the following:
 - 15.4.1 Front view, side view, plan view and assembly drawings including center of gravity, shear and moment information (loading)
 - 15.4.2 Elementary Control Diagrams
 - 15.4.3 Interconnection diagrams illustrating terminal blocks of all equipment
 - 15.4.4 Eight (8) sets of final drawings
 - 15.4.5 Control cabinet arrangement drawings
 - 15.4.6 Bill of Material

- 15.4.7 AC, DC and interconnection drawings shall be provided on separate sheets
- 15.5 Interconnection diagrams referred to in **Paragraph 15.4.3** above shall show the actual physical arrangement of terminals on terminal blocks for all equipment furnished. The drawings shall also show the drawings in schematic form.
 - 15.5.1 Reproducible drawings shall be the same size as the original (24" x 36").
 - 15.5.2 **Tabular connection drawings will not be accepted.**
 - 15.5.3 Reduced drawings will not be accepted.
- 15.6 Each drawing shall include the JEA purchase order number and the name of the JEA substation.
- 15.7 All final drawings shall be submitted in 24" x 36" hard copies and an electronic copy provided on a compact disc (CD) Intergraph CAD system (MicroStation V8i, SELECT Series 3). DXF or DWG (up to AutoCad Version 2015) type conversion file is acceptable. PDF versions of drawings shall also be included on the compact disc.

16. TEST DATA

- 16.1 The Manufacturer shall supply the results in PDF format of all production tests made on each individual breaker before it is shipped from the factory.
- 16.2 The Manufacturer shall supply typical excitation, ratio correction factor and phase angle curves for current transformers.

17. INSTRUCTION BOOKS

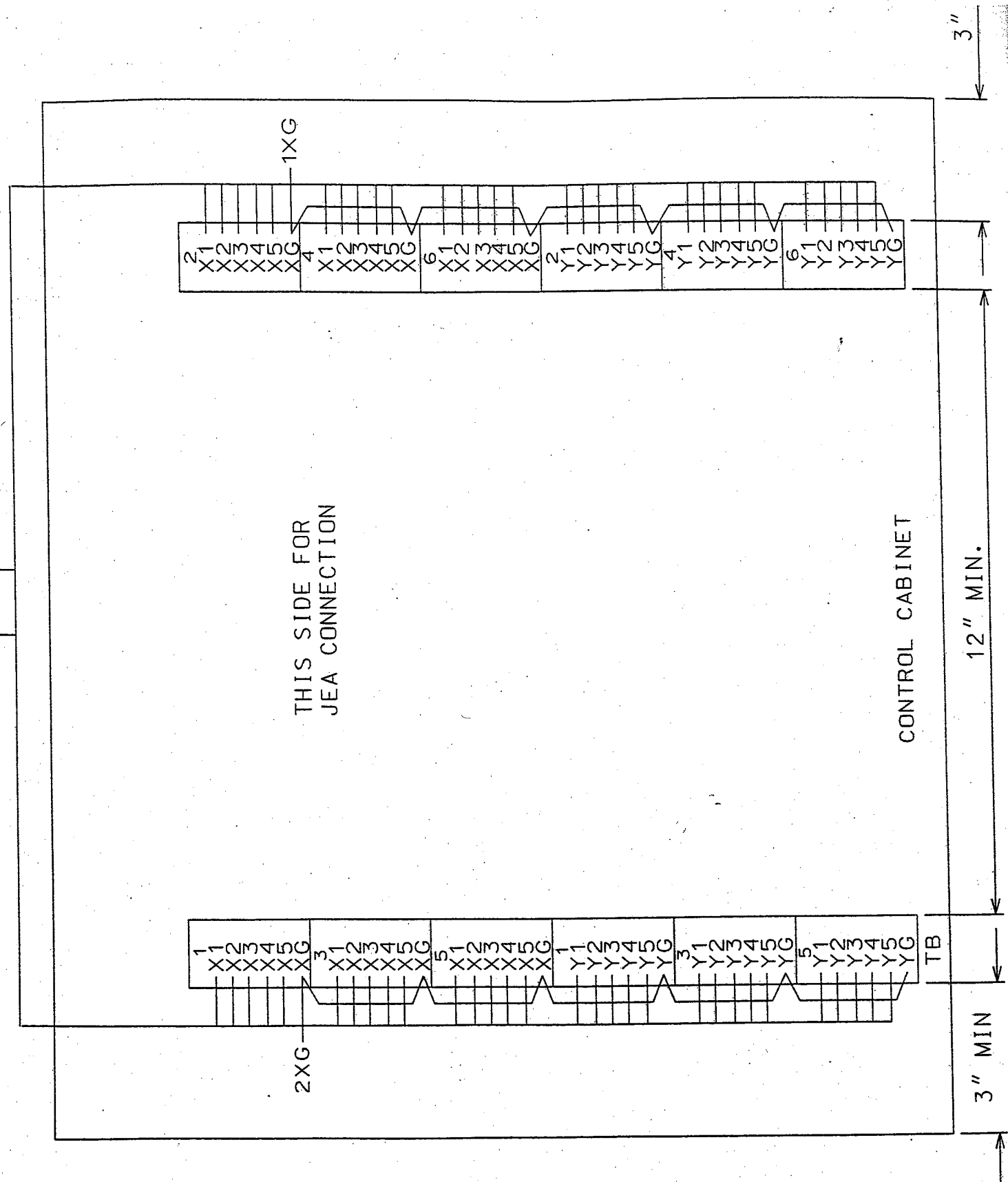
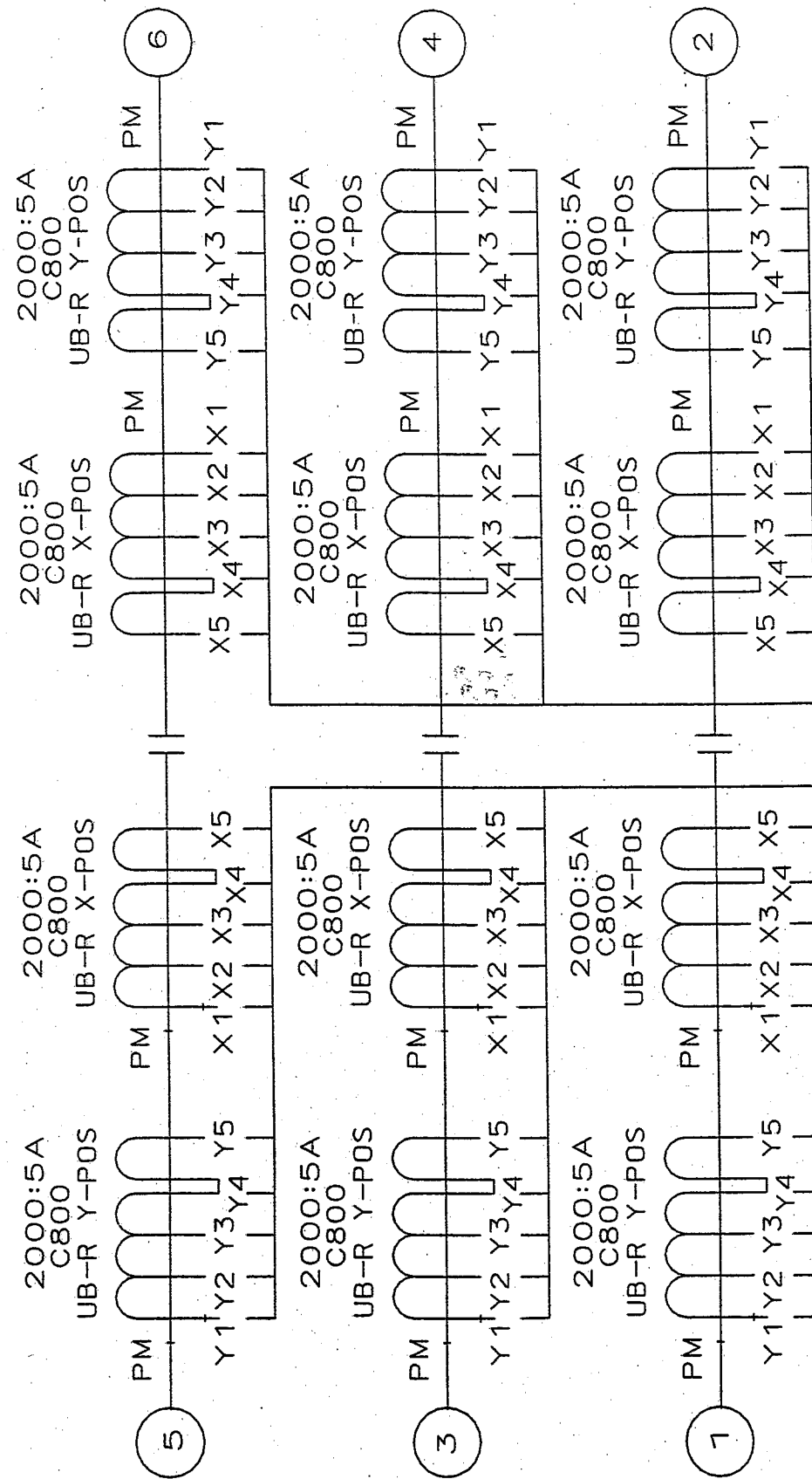
- 17.1 The Manufacturer shall supply three (3) instruction books per substation location, in addition to the requirements of **Paragraph 17.6** below.
- 17.2 The instruction book shall be assembled and bound in a three-ring binder with removable cover and edge sheets.
- 17.3 The instruction book shall contain information on receiving, storing, assembly, and maintenance of the breaker.
- 17.4 The Manufacturer shall include a complete set of final drawings in a pocket-type page in the back of the instruction books.
- 17.5 The OEM drawings shall be 11" x 17" drawings and included in the instruction books.
- 17.6 The Manufacturer shall supply an instruction book conveniently mounted in the pocket on the door inside of the breaker control panel for each circuit breaker shipped to the customer.
- 17.7 The instruction books shall include but not be limited to the following:
 - 17.7.1 Table of contents and index tabs
 - 17.7.2 Specifications, test data and curves
 - 17.7.3 Description of the equipment
 - 17.7.4 Operating Instructions (including but not limited to safety precautions and operating limits)
 - 17.7.5 Instructions in the methods of receiving, inspection, storage, and handling
 - 17.7.6 Complete installation, start-up, initial test, and maintenance instructions
 - 17.7.7 Assembly drawings
 - 17.7.8 Wiring and schematic diagrams
 - 17.7.9 Parts lists
 - 17.7.10 Schedule of required lubricants
 - 17.7.11 Nameplate information and shop order numbers for each item of equipment and component part

- 17.7.12 Instructions of accessories
- 17.7.13 Separate sheet defining measurements to be performed by customer on installation of the breaker
- 17.7.14 Separate sheet providing a summary of all breaker and mechanism adjustment values with allowable limits
- 17.7.15 List of maintenance tools furnished with the equipment, if applicable
- 17.7.16 A compact disc containing a PDF format version of the entire instruction book
- 17.8 The face sheet of each instruction book is to be identified with the JEA project name, JEA purchase order number, the product serial number, and product name. The manufacturer's job order number **is not** an acceptable substitute for the serial number.

18. APPENDICES

- 18.1 Typical drawings are for illustration purposes only. Project Specific drawings will be provided at the time of submittal of the PO.
- 18.2 Breaker specific drawings depicting relays installed within the breaker application will be provided at the time of submittal of the PO.

ATTACHED



1. CREATED FOR SPECIFICATIONS



DRAFTING
NJS

DESIGNED:
MI

REVISED:
MI

REVISED DATE:
11/00

TYPICAL CT TERMINAL BLOCK
TERMINAL BLOCK CONNECTIONS

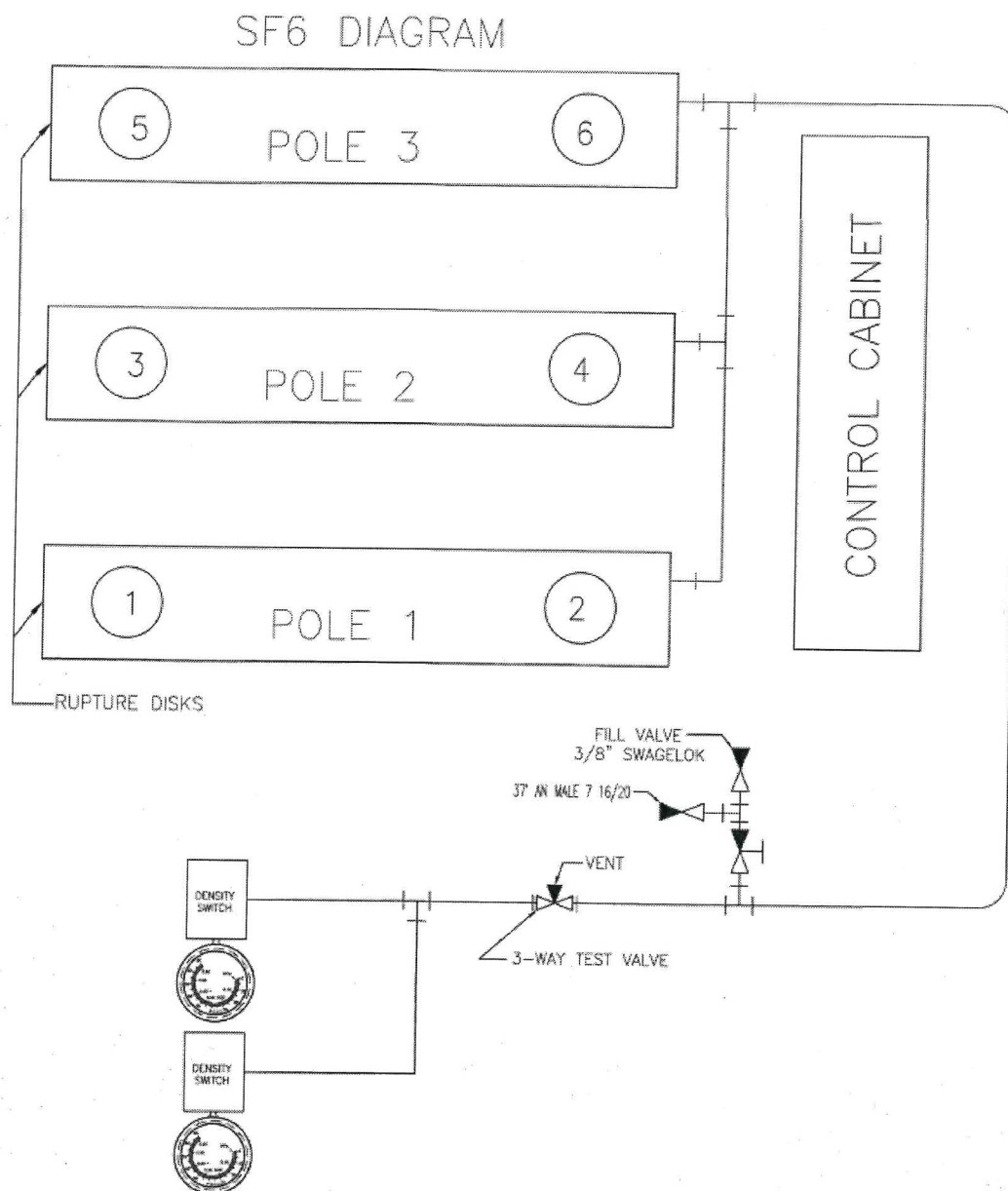
JEA TRANSMISSION GROUP
JACKSONVILLE, FLORIDA

DRAWING NUMBER

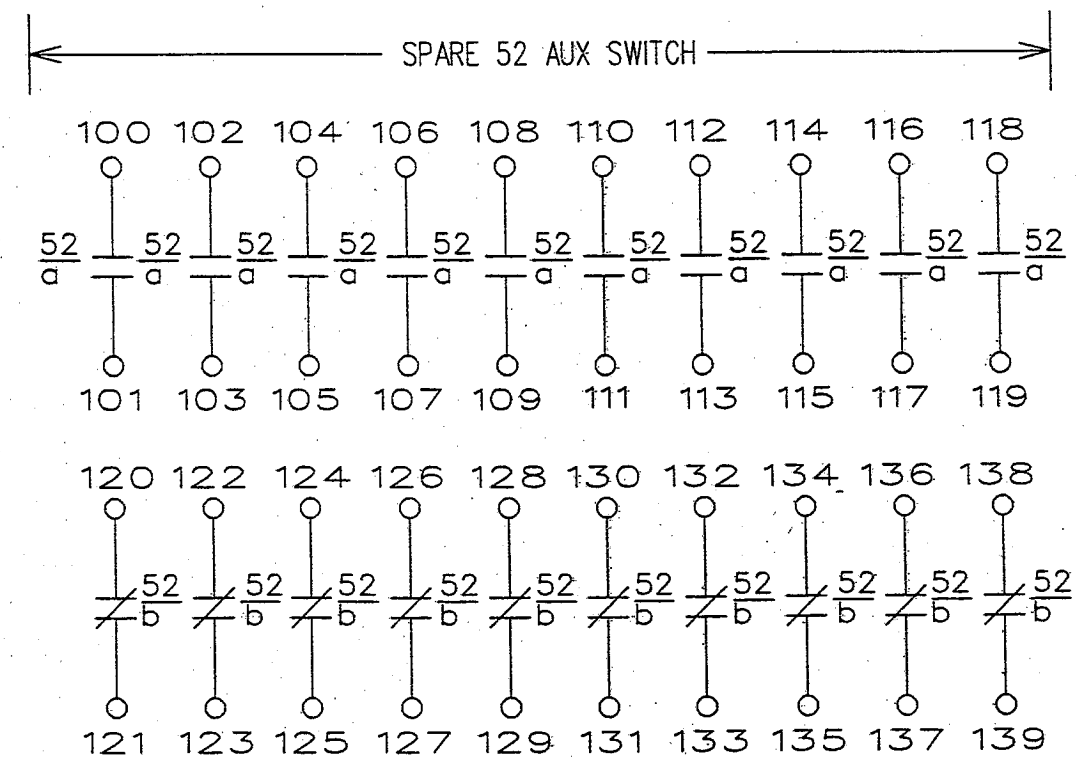
APPENDIX I

DESIGN FILENAME:
APPL.DGN

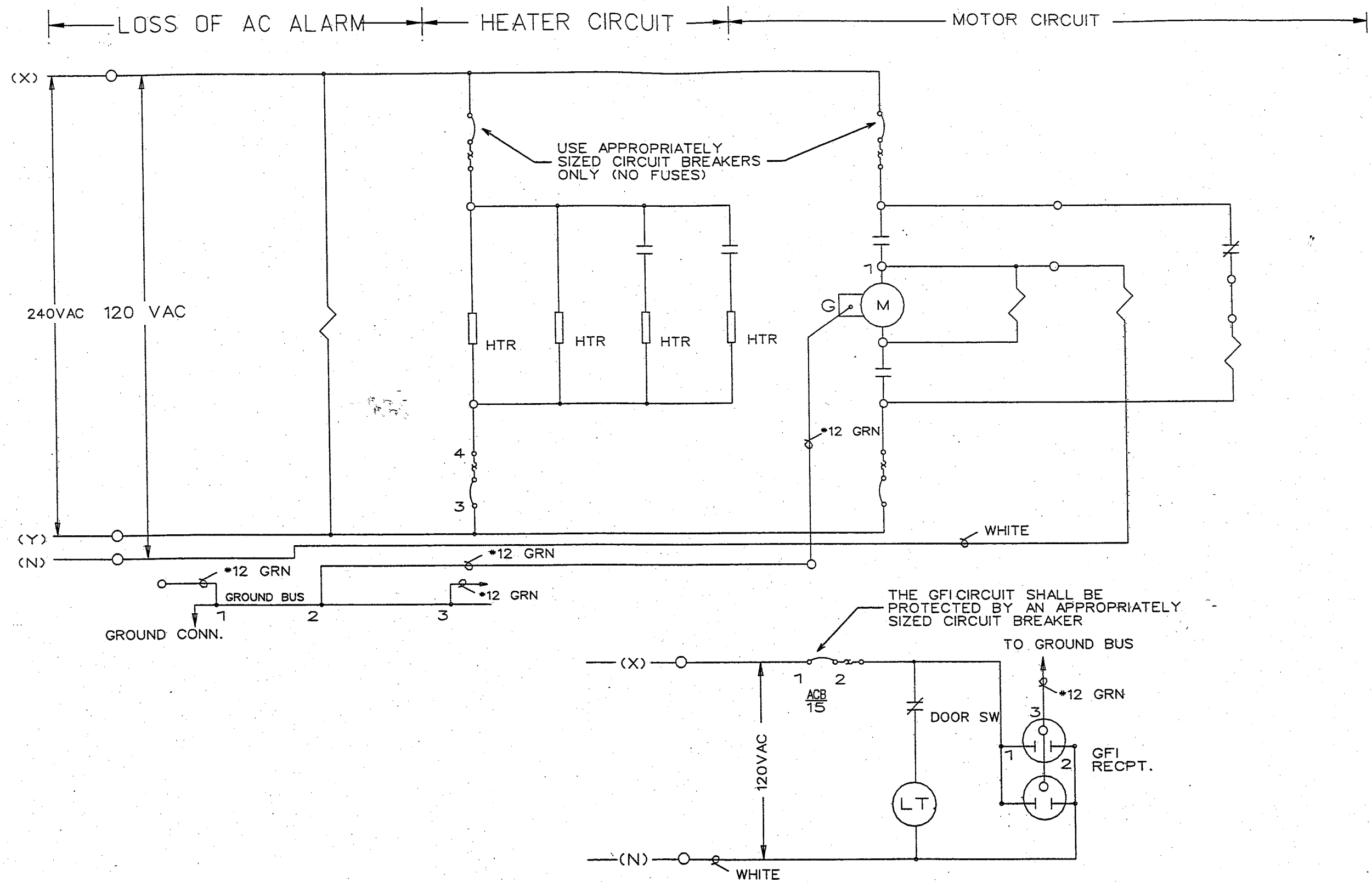
SHEET NO:
1 OF 1



Appendix II: SF6 Gas System Example



DRAFTING NJS	DESIGNED: MI	<div>CONNECTION DIAGRAM</div> <div>TYPICAL AUXILIARY SPARE SWITCHES</div> <div>JEA TRANSMISSION GROUP JACKSONVILLE, FLORIDA</div>	DRAWING NUMBER APPENDIX III	
	REVISED: MI		DESIGN FILENAME: APPIII.DGN	SHEET NO: 1 OF 1
	REVISED DATE: 11/00			



DRAFTING
NJS

DESIGNED:
MI

REVISED:
MI

REVISED DATE:
11/00

TYPICAL AC SCHEMATIC

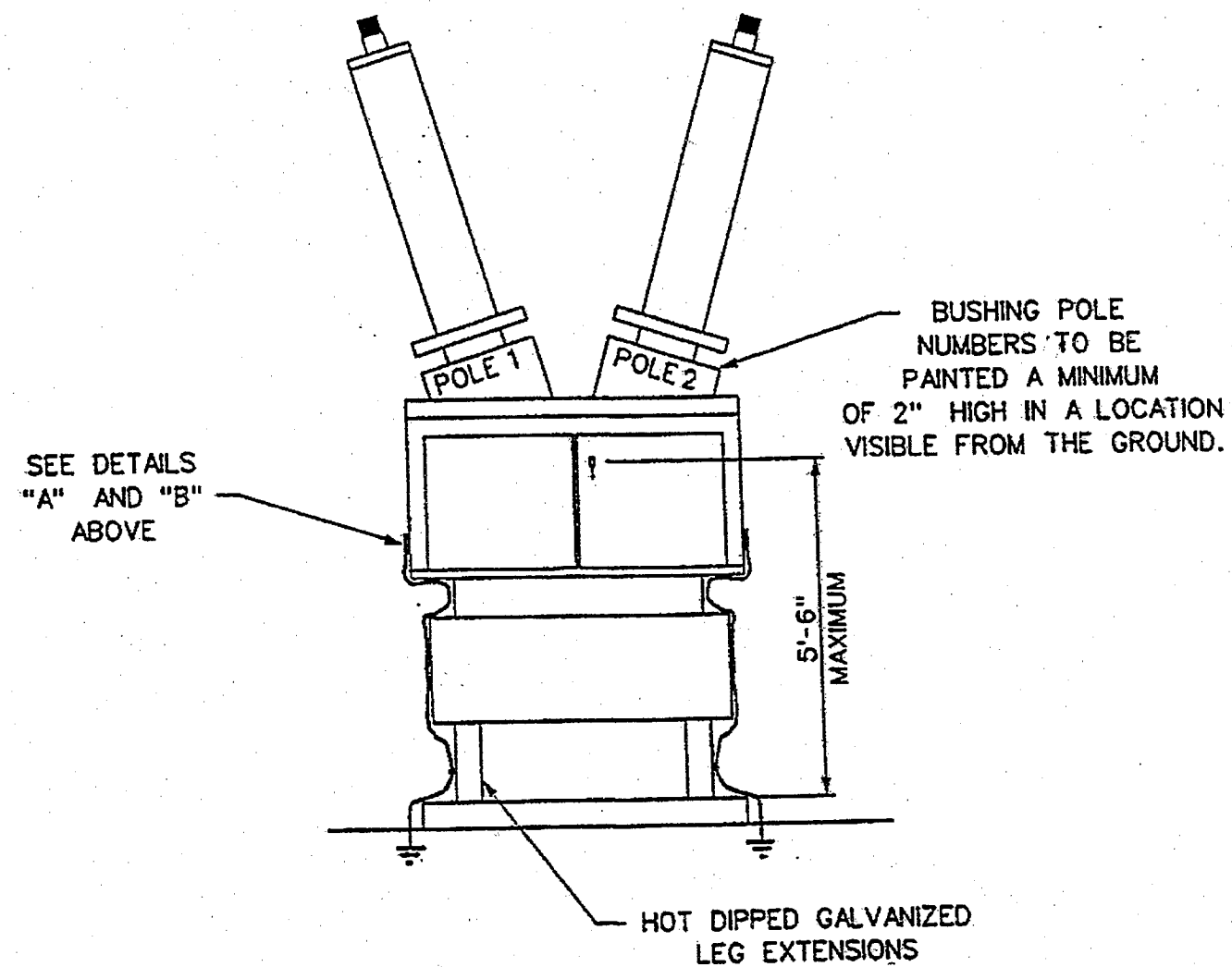
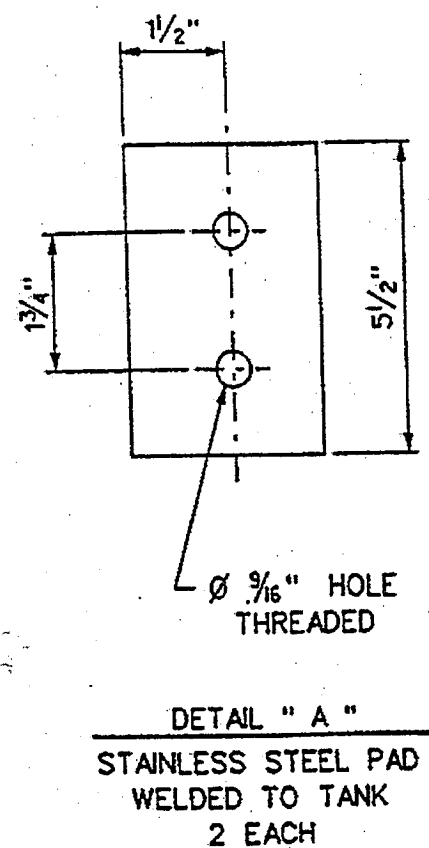
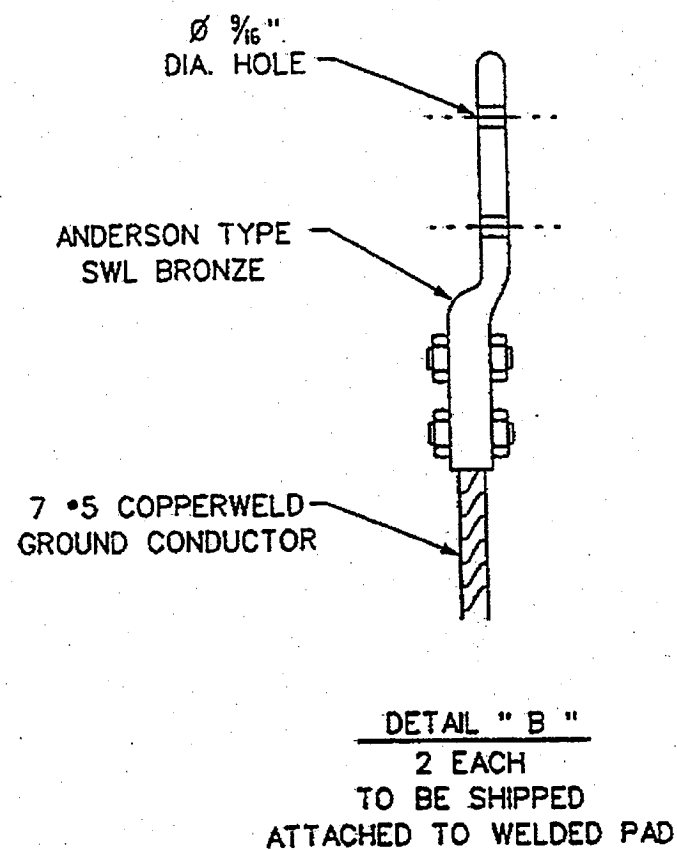
JEA TRANSMISSION GROUP
JACKSONVILLE, FLORIDA

DRAWING NUMBER

APPENDIX IV

DESIGN FILENAME:
APPV.DGN

SHEET NO:
1 OF 1



DRAFTING
NJS

DESIGNED:
MI

REVISED:
MI

REVISED DATE:
11/00

GROUND CONNECTION DETAIL AND BUSHING POLE NUMBERS (TYPICAL)

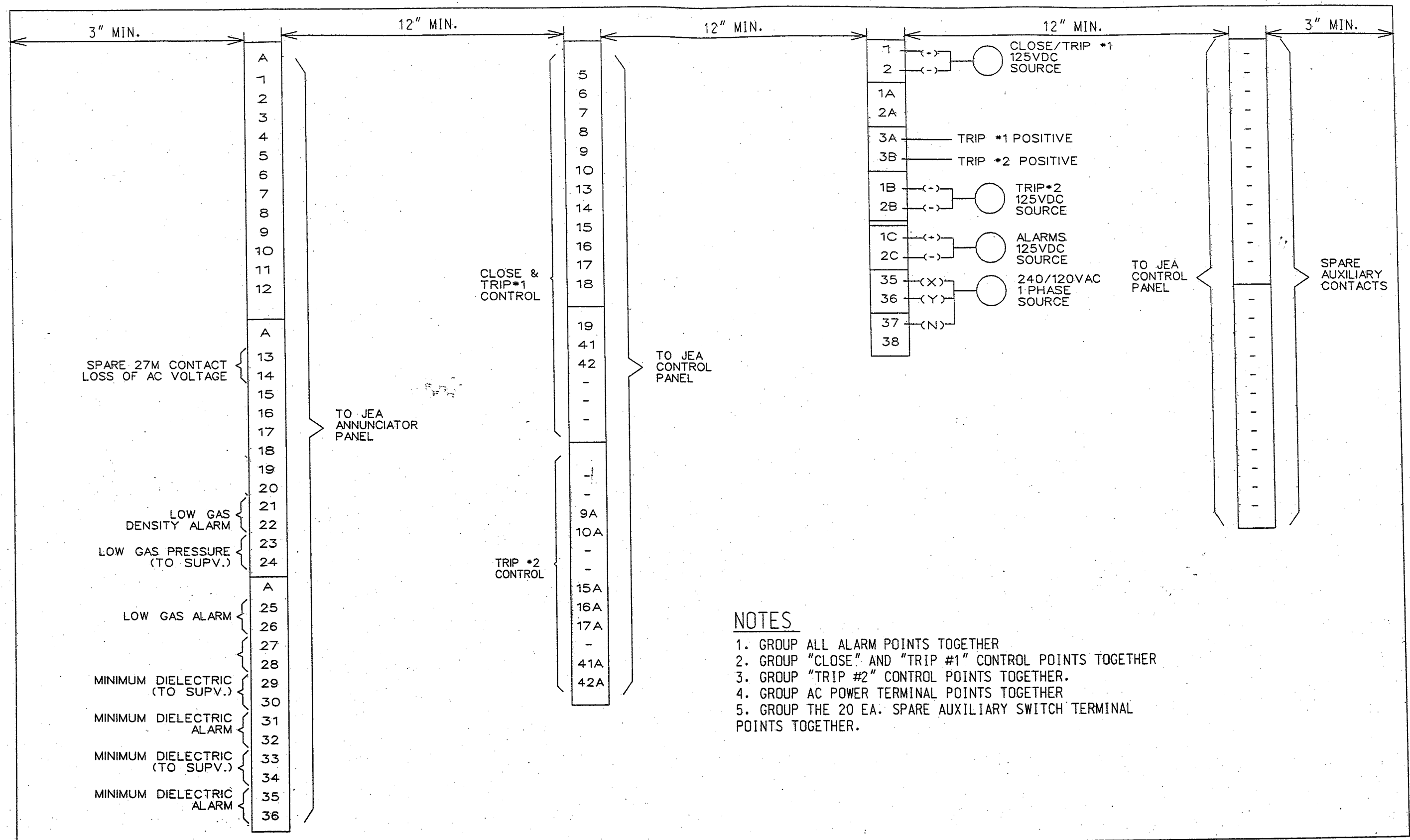
JEA TRANSMISSION GROUP
JACKSONVILLE, FLORIDA

DRAWING NUMBER

APPENDIX V

DESIGN FILENAME:
APPV.DGN

SHEET NO:
1 OF 1



NOTES

1. GROUP ALL ALARM POINTS TOGETHER
2. GROUP "CLOSE" AND "TRIP #1" CONTROL POINTS TOGETHER
3. GROUP "TRIP #2" CONTROL POINTS TOGETHER.
4. GROUP AC POWER TERMINAL POINTS TOGETHER
5. GROUP THE 20 EA. SPARE AUXILIARY SWITCH TERMINAL POINTS TOGETHER.



DRAFTING
NJS

DESIGNED:
MI

REVISED:
MI

REVISED DATE:
11/00

INTERCONNECTION DIAGRAM TYPICAL CONTROL CABINET LAYOUT

TRANSMISSION GROUP
JACKSONVILLE, FLORIDA

DRAWING NUMBER

APPENDIX VII

DESIGN FILENAME:
APPVII.DGN

SHEET NO:
1 OF 1

APPENDIX B – FORMS

140-17 Appendix B Medium Voltage Circuit Breaker Supply to JEA

MINIMUM QUALIFICATION INFORMATION

The minimum qualifications shall be submitted in the format attached. The report shall be presented in the order described below. In order to be considered a qualified supplier by JEA you must meet all the criteria listed and be able to provide all the services listed in this specification.

RESPONDENT INFORMATION

COMPANY NAME:_____

BUSINESS ADDRESS:_____

CITY, STATE, ZIP CODE:_____

TELEPHONE:_____

FAX:_____

E-MAIL:_____

- The Respondent shall submit a reference listing of customers for a minimum of one hundred (100) circuit breakers in the last three (3) years, date ending the Bid Due Date (provide this reference listing free form).
- The Respondent shall provide a minimum of three (3) contracts or purchase orders where a minimum of twenty (20) circuit breakers were supplied in the last three years, date ending the Bid Due Date (use the minimum qualification form attached to the bid).

2. Equipment Provided_____

Geographic Location_____

Customer_____

Reference Name_____

Reference Phone Number_____

Amount_____

Number of Circuit Breakers_____

Description of Project _____

3. Equipment Provided_____

Geographic Location_____

Customer_____

Reference Name_____

Reference Phone Number_____

Amount_____

Number of Circuit Breakers_____

Description of Project _____

**APPENDIX B
RESPONSE FORM**

140-17 Appendix B - Medium Voltage Circuit Breaker Supply to JEA

COMPANY INFORMATION:

COMPANY NAME: _____

BUSINESS ADDRESS: _____

CITY, STATE, ZIP CODE: _____

TELEPHONE: _____

FAX: _____

EMAIL OF CONTACT: _____

Description	Total Price
Total Bid Workbook	\$

☐ **I have read and understood the Sunshine Law/Public Records clauses contained within this solicitation. I understand that in the absence of a redacted copy my Response will be disclosed to the public “as-is”.**

Company's Certification

By submitting this Response, the Proposer certifies that it has read and reviewed all of the documents pertaining to this ITN and agrees to abide by the terms and conditions set forth therein, that the person signing below is an authorized representative of the company, that the company is legally authorized to do business in the State of Florida, and that the company maintains in active status an appropriate license for the work. The company certifies that its recent, current, and projected workload will not interfere with the company's ability to Work in a professional, diligent and timely manner.

The Respondent certifies, under penalty of perjury, that it holds all licenses, permits, certifications, insurances, bonds, and other credentials required by law, contract or practice to perform the Work. The Respondent also certifies that, upon the prospect of any change in the status of applicable licenses, permits, certifications, insurances, bonds or other credentials, the Company shall immediately notify JEA of status change.

We have received addenda _____ through _____

Signature of Authorize Officer of Company or Agent

Date

Printed Name & Title

Phone Number