SUBSTATION STANDARDS REFERENCE MANUAL

2023

DEFINITIONS

CONTRACTOR - Construction contractors, unit price contractors or bulk bid contractors contracted by JEA to construct the specific project referred to by the project documents.

OWNER - JEA, Jacksonville, FL

PROJECT - The entire material to be supplied and/or work to be performed, as provided in the Contract Documents.

PROJECT DOCUMENTS - The project cost estimate, the bill of materials, the project drawings, any special details and any other associated project documents.

PROJECT ADMINISTRATOR - JEA authorized representative assigned to administer the project.

PROJECT INSPECTOR - JEA authorized representative assigned to coordinate and inspect the project.

PROJECT ENGINEER - JEA authorized representative(s) of the division or department of JEA preparing and overseeing the Design and Project documents.

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ABBREVIATIONS

" in	Inches
‘ ft	Feet
%	Percentage
°C	Degrees Celsius
°F	Degrees Fahrenheit
µs	Microseconds
A	Amperes
AAC	All Aluminum Cable
AC	Alternating Current
ACI	American Concrete Institute
ACR	Automatic Circuit Recloser
ACSR	Aluminum Conductor Steel Reinforced
AEIC	Association of Edison Illuminating Companies
AEP	American Electric Power
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
ANSI	American National Standard Institute
ASCE	American Society of Civil Engineers
ASNT	American Society of Nondestructive Testing
ASTM	American Society for Testing and Materials
ASYM	Asymmetrical
ATM	Asynchronous Transfer Mode
AWG	American Wire Gage
AWS	American Welding Society
BF	Breaker Failure
Bkr	Breaker
BIL	Basic Impulse Insulation Level
C	Capacitor
CADD	Computer Aided Design and Drafting
CC	Coupling Capacitor
CCVT	Coupling Capacitor Voltage Transformer
CF	Centerformed
Ckt	Circuit
CL	Center Line
cm	Centimeter
CT	Current Transformer; Center Tap
Cu	Copper
CVT	Capacitor Voltage Transformer
dB	Decibels
DC	Direct Current
DSA	Dead Soft Annealed

EEI	Edison Electric Institute
EHV	Extra High Voltage
EMF	Electromagnetic Force
EPR	Ethylene Propylene Rubber
f	Frequency
FA	Forced Air cooing (transformers)
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GFI	Ground Fault Interrupting
GHz	Gigahertz (1,000,000,000 hertz or cycles per second)
GIS	Geographic Information Systems or Gas Insulated Substation
GPR	Ground Potential Rise
GRD	Ground
hr	Hour
HV	High Voltage
Hz	Hertz (cycles per second)
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
ISO	International Organization for Standards
J	Joule
K	Rated Voltage Range Factor
kA	Kiloamperes (1,000 amperes)
kcmil	Kilocircular mils (1,000 circular mils)
kg	Kilogram (1,000 grams)
kHz	Kilohertz (1,000 hertz or cycles per second)
km	Kilometers (1,000 meters or 1,608 feet)
km/h	Kilometers per hour
kN	Kilonewtons
kNm	Kilonewton meters
kPa	Kilopascals (1,000 Pascals)
ksi	KIP (1000lbs) per square inch
kV	Kilovolt (1,000 volts)
kVA	Kilovolt-amperes (1,000 volt-amperes)
kVAR	Kilovolt-amperes reactive (1,000 volt-amperes reactive)
kW	Kilowatt (1,000 volts)
kWh	Kilowatt-hour
lb	Pound
lbs	Pounds
lbs/ft	Pounds per foot
L/C	Inductance / Capacitance
LCD	Liquid Crystal Display
LTC	Load Tap Changer
LV	Low Voltage

m	Meter(s)
m^2	Square meter
mA	Milliamperes (0.001 ampere)
Mbps	megabits per second (1,000,000 bits per second)
MCOV	Maximum Continuous Operating Voltage
MHD	Medium Hard Drawn
MHz	Megahertz (1,000,000 hertz or cycles/second)
mil	One Thousandth of an Inch
mm	Millimeter (0.001 meter)
MOV	Metal Oxide Varistor
mph	Miles per hour
ms	milliseconds
mV	Millivolt
MVA	Megavolt-Ampere (1,000,000 Volt-Amperes)
MVAR	Megavolt-Ampere Reactive
MW	Mega Watts (1,000,000 Watts)
N	Newton
N/m	Newtons per meter
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NERC	North American Electric Reliability Corporation
NESC	National Electric Safety Code
NI-CAD	Nickel Cadmium
NLTC	No Load Tap Change
OA/FA	Self-cooled and assisted by forced air for one stage (transformers)
OA/FA/FA	Self-cooled and assisted by forced air for two stages (transformers)
O & M	Operations and Maintenance
OEM	Original Equipment Manufacturer
OE	Overhead Electric
OH	Overhead
OHGW	Overhead Ground Wire
OSHA	Occupational Safety and Health Administration
PF	Power Factor
PO	Purchase Order
psf	Pounds per square foot
psi	Pounds per square inch
PT	Potential Transformer
R	Resistivity / Resistance
rms	Root Mean Square
RPM	Revolutions per minute

SCADA	Supervisory Control and Data Acquisition
SD	Soft Drawn
SF6	Sulfur Hexafluoride
UG	Underground
UGE	Underground Electric
USWG	USA Steel Wire Gage
UL	Underwriters' Laboratories
V	Volts
VA	Volt-amperes
VAC	Volts Alternating Current
VAR	Volt-amperes reactive
VDC	Volts Direct Current
VT	Voltage Transformer
XLPE	Cross-Linked Polyethylene
Z	Impedance

SUBSTATIONS – GENERAL ARRANGEMENTS

A substation is a combination of switching, controlling and voltage step-down equipment arranged to reduce transmission voltage (69kV and above) to distribution voltage (38kV and below).

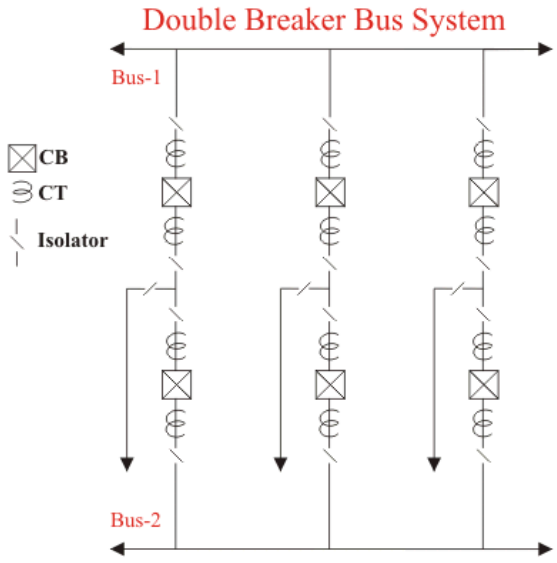
JEA typically utilizes four basic substation arrangements in the planning and design of the electric system. They are as follows:

Double Bus, Double Breaker
Breaker and a Half
Ring Bus
Double Bus, Single Breaker

The arrangement used for a particular substation is determined by the required reliability of the generators, transmission lines and transformers connected to its bus. The double breaker and the breaker-and-a-half arrangements are used in generating and transmission substations because of their high reliability in the event of single equipment outages or failures. The ring bus and single breaker arrangements are common where distribution loads are required.

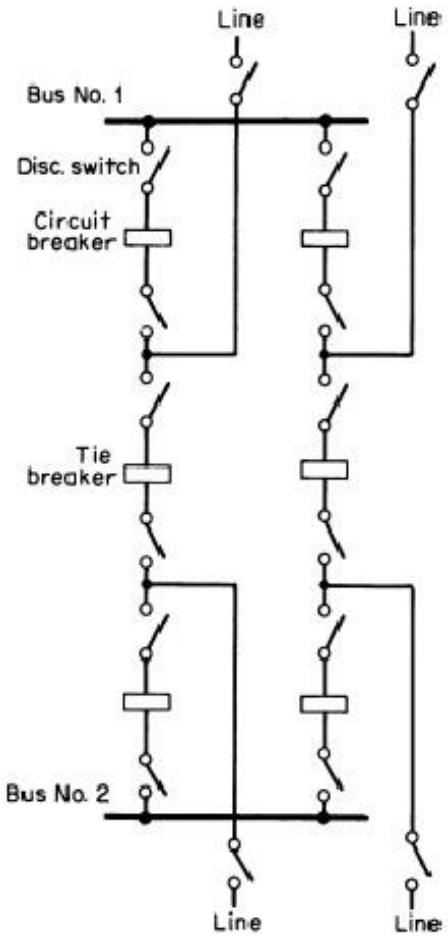
Double Bus, Double Breaker:

The double breaker arrangement is most common at generation plant substations where reliability is extremely important. The loss of equipment due to outage or failure can be tolerated without the loss of major capacity-carrying capabilities. This characteristic provides very high reliability for the generator step-up transformers and the transmission lines connected to that station. The outage of any single piece of equipment does not cause an outage for any lines. In the event of a failure of any breaker, the only line outage would be the line associated with the failed breaker. A failed breaker is one that does not properly respond to a required operation and therefore adjacent breakers must clear the disturbance. The cost of a double breaker substation arrangement is the most expensive of all the options, but with the high cost of reduced or lost generation capabilities, it is often easily justified.



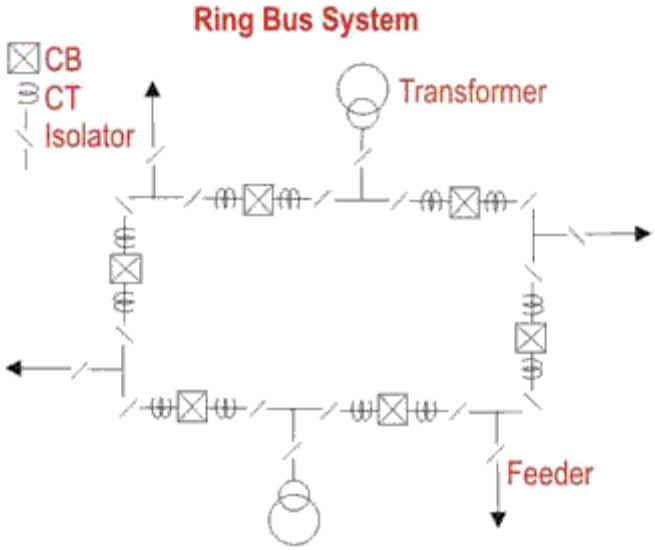
Breaker-and-a-Half:

The breaker-and-a-half arrangement is used in both generating plant substations and high load capacity transmission substations. This arrangement utilizes two main busses, one on either side of the connected transmission lines and transformers. The outage of a single piece of equipment in this arrangement does not cause an outage for any of the transmission lines or transformers associated with the substation. The failure of a bus breaker will only outage the line associated with that breaker. However, the failure of a common breaker (the breaker between two terminations) will result in the outage of both circuits connected to that breaker. This option has a high real estate requirement and is typically limited to substations with multiple transmission and autotransformer terminations. The breaker-and-a-half arrangement is the most widely used option for transmission type substations and has had increased use for generating plant substations in recent years.



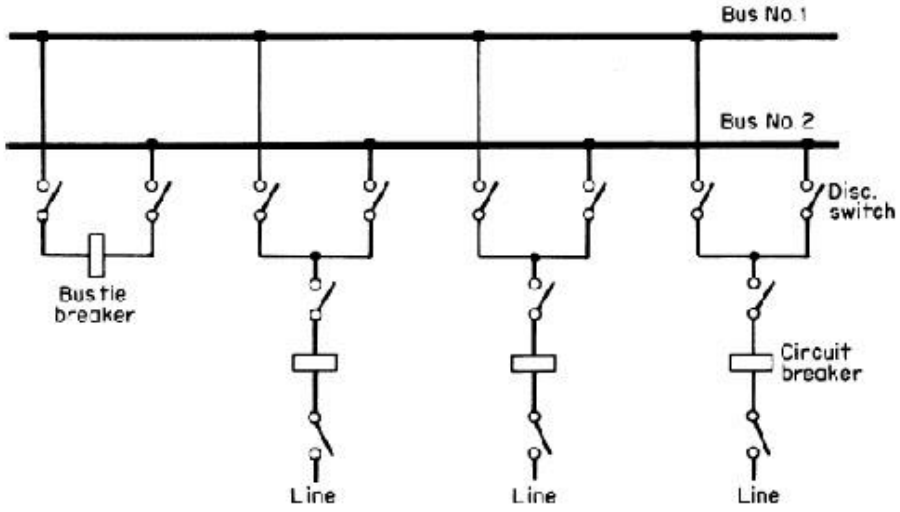
Ring Bus:

The ring bus is used where both transmission reliability and a distribution load are required. It provides a compact design with high transmission reliability and ease of distribution transformer connections. The ring bus design provides for single piece equipment outages without the disruption of any connected loads. It is more compact than the breaker-and-a-half and still provides the capability to outage single piece equipment without loss of service. The ring bus has obvious physical limitations that prohibit its use in transmission substations where multiple line and transformer terminations are required. A typical ring bus arrangement will have only 4 or 5 circuit positions in its design.



Double Bus, Single Breaker:

The single breaker arrangement is common where a distribution load is being served from a transmission line. The typical arrangement for a single breaker substation is to connect two transmission lines and two power transformers to a single transmission bus with single breakers or in the case of the power transformers - circuit switchers. The single breaker arrangement does not provide for any back-up in the case of single equipment outage or failure. When a piece of equipment is outaged, the transformer or transmission line connected to it is outaged also. In the case of a breaker failure, the entire substation will be outaged. The cost of single breaker substations is substantially less than all other arrangements. This arrangement is very common for distribution substations where the primary function is the distribution load and minimal outages are acceptable.



SUBSTATIONS - ONE-LINE DIAGRAM EXAMPLES

The one-line diagram serves as a major substation reference drawing as it is a summary of the substation. It shows all the transmission lines coming into the substation and the major equipment in the substation (transformers, breakers, switches, etc.) and the distribution lines leaving the substation.

One of the first steps in designing a substation is to create a one-line diagram. The Transmission, Substation and Distribution groups must coordinate to create the one-line. Feedback on the one-line must be received from the JEA SOCC (System Operations Control Center). Once the substation construction is complete, the one-line diagram must be updated to reflect as-built status. All JEA One-lines are stored online and are maintained by the Substation Protection and Controls group.

Below is a list of substation general arrangements and a JEA substation that represents that configuration as discussed in the previous section.

- Double Bus, Double Breaker - Dillon
- Breaker-and-a-Half - Center Park
- Ring Bus - Church Street
- Double Bus, Single Breaker - Baymeadows

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SUBSTATIONS – STRUCTURE TYPES

JEA utilizes three standard types of structures in the design and construction of its substations. Each design has a specific application in the JEA system. The three designs are as follows:

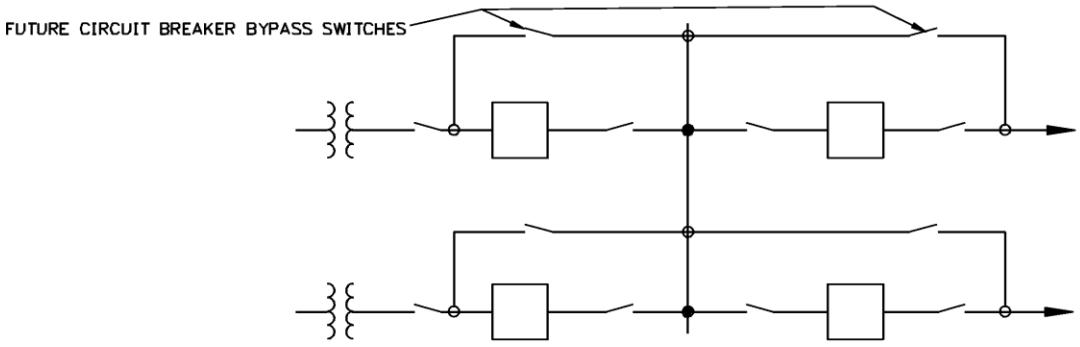
High Profile Lattice Steel
Low Profile Tapered Tubular Steel
Low Profile Square Tubed Steel

High Profile Lattice Steel:

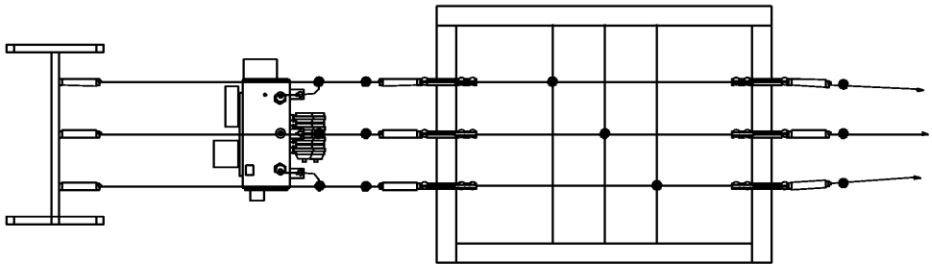
This design was very popular for the construction of substation during the 1950s and 1960s. This design utilizes angle steel members bolted together to form box trusses. The box trusses are then bolted together to form the substation bays. The box trusses within the bays support all bus, switches and other equipment to facilitate the interconnection of different circuits or transformer connections. Although this design may be less expensive for the purchase of the structures, the costs associated with the labor intensive construction required to erect this type of substation structure has led many utilities, including JEA, to the low construction cost of low profile steel designs. Aesthetics is also an important consideration in today's environment. Many new substations are being built in or near suburban neighborhoods and the low profile steel designs provide for a much more acceptable visual site than the lattice design. The high profile lattice design is not used by JEA for the design and construction of new substations except in special circumstances. The design of a double breaker substation may still require the use of high profile lattice due to the property requirements that would be necessary for other designs for the same arrangement. Additions and modifications to existing high profile lattice steel substations is still performed with the same lattice steel design as the existing substation bays for that substation.

High Profile Lattice Steel Design

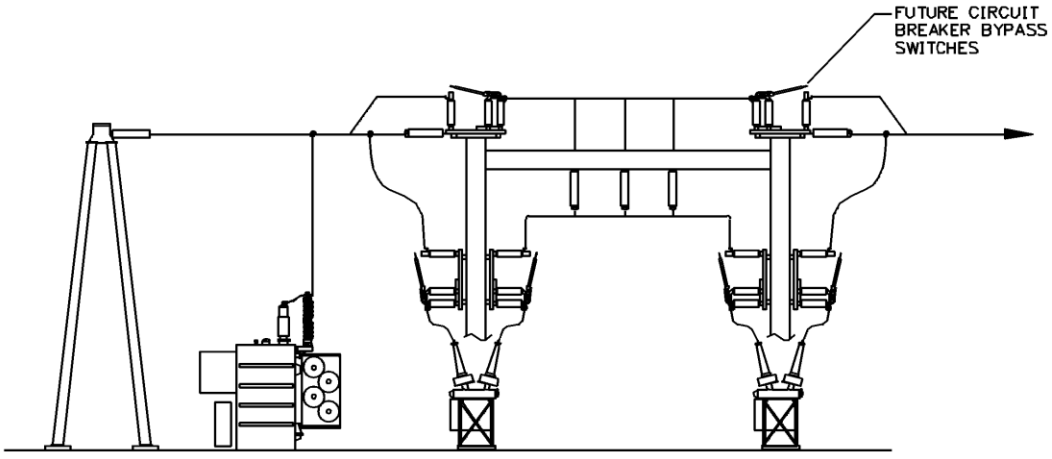
HIGH PROFILE – Single Breaker Layout



TYPICAL ONE–LINE DIAGRAM



PLAN VIEW–TYPICAL BAY



ELEVATON–TYPICAL BAY

(https://www.rd.usda.gov/files/UEP_Bulletin_1724E-300.pdf)

Low Profile Tapered Tubular Steel:

This design has become increasingly popular throughout the country for the design and construction of substations. JEA has standardized on this design for the construction of all new 69kV, 138kV and 230kV substations. The tapered tubular design provides for an aesthetically pleasing substation with little visual impact to the surrounding areas. The inherent design of the tapered tubular structures provide for a very simplistic installation. The ease of installation is where the cost benefits from low profile structures come from. Although the replication of structures is very easy to accomplish with the tapered tubular design, JEA has limited in-service applications of these structures and standard designs are still being developed. Many 138kV and 230kV structures have been standardized and are presently available for the design and purchase of this voltage class substation structure.

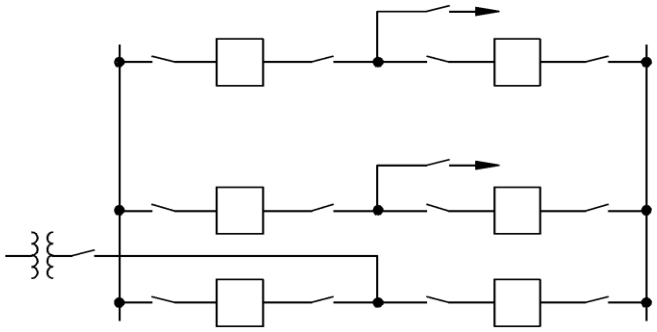
Low Profile Tapered Tube Design (High Side)

Low Profile Square Tubed Steel:

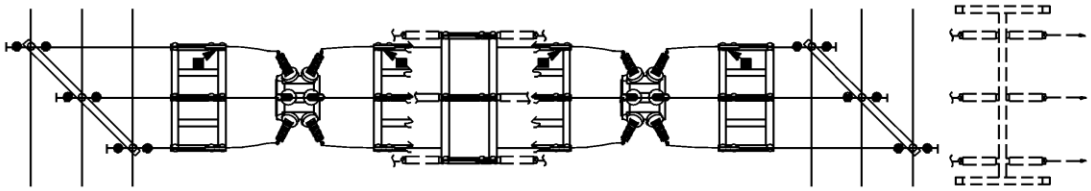
This design has been utilized in the construction of low profile 26kV substation structures since around 1970. During that time period both square tube steel and I-beam steel designs were used for the construction of low profile substations. The I-beam steel design is no longer accepted due to problems encountered with twisting and bending in of some structures used in these applications. JEA has standardized on the square tube design for all low profile 26kV substations and standard design drawings are presently utilized in the specification and purchase of these structures. The square tube design has also been used in some 69kV substations in the past, however, new 69kV applications will utilize the tapered tubular design. This will provide a more consistent standard for the transmission portion of JEA's substations.

Low Profile Square Tube Design (Low Side)

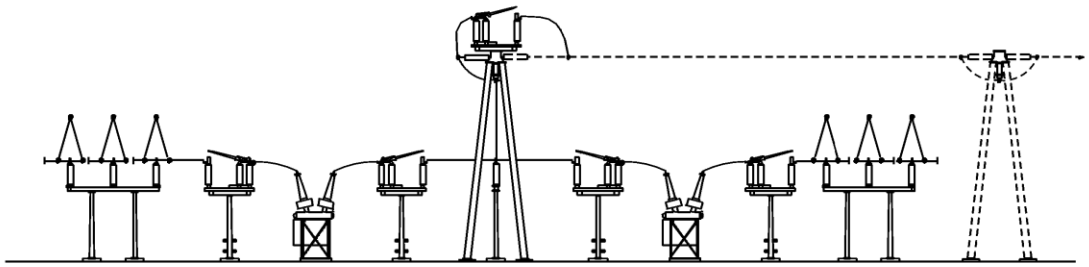
LOW PROFILE – Double Breaker – Double Bus Layout



TYPICAL ONE–LINE DIAGRAM



PLAN VIEW—TYPICAL BAY



ELEVATION—TYPICAL BAY

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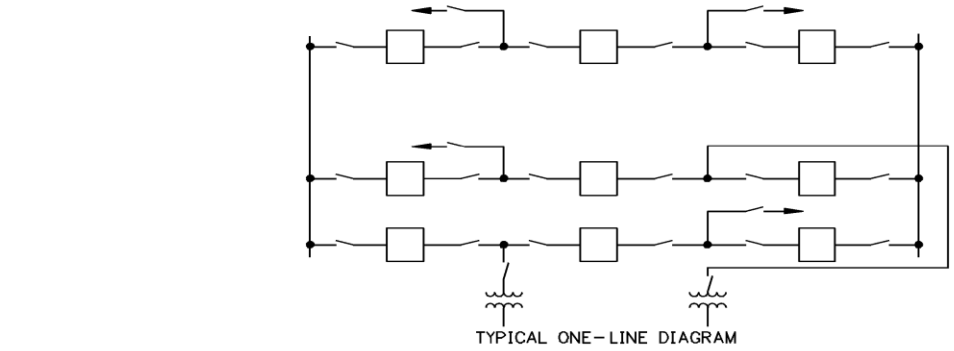
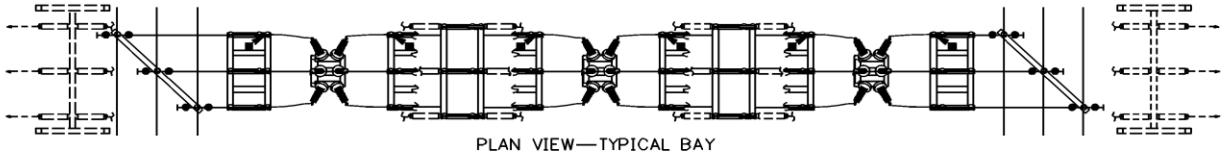
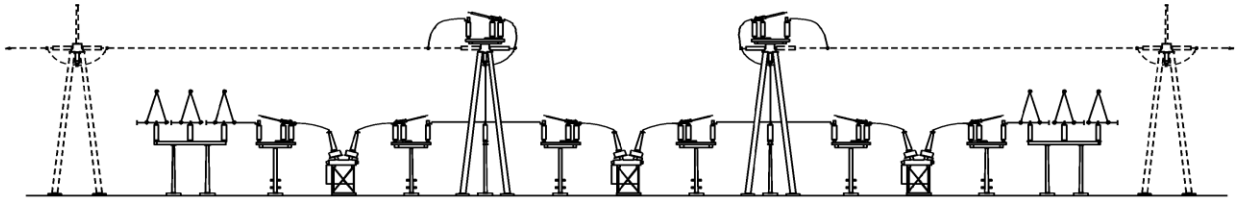
LOW PROFILE – Breaker and a Half Bus Layout



TYPICAL ONE-LINE DIAGRAM



PLAN VIEW—TYPICAL BAY



ELEVATION—TYPICAL BAY

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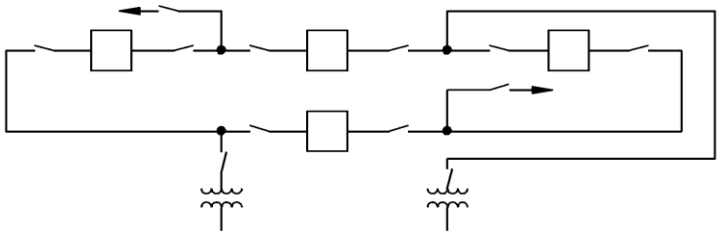
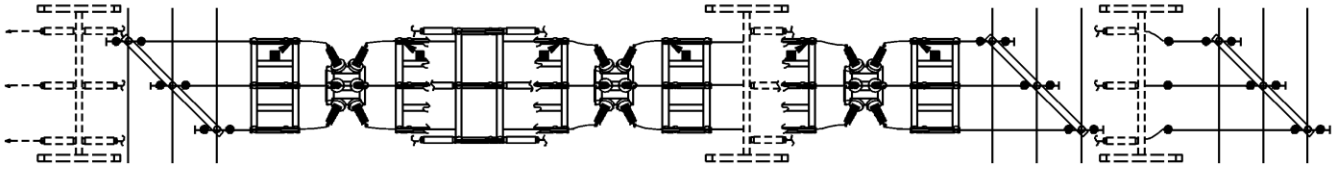
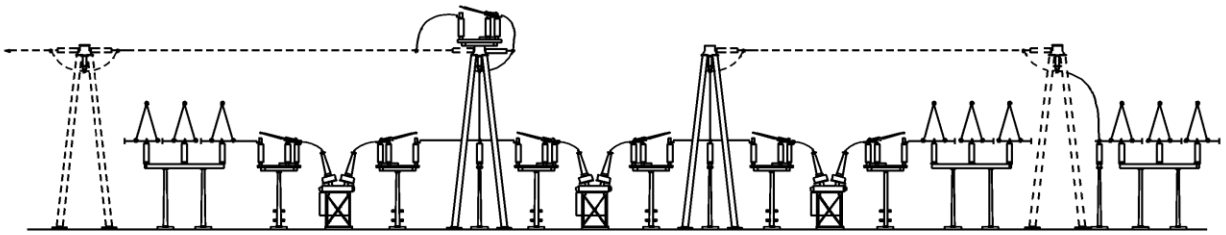
LOW PROFILE – Ring Bus Layout



TYPICAL ONE – LINE DIAGRAM



PLAN VIEW — TYPICAL BAY



ELEVATION — TYPICAL BAY

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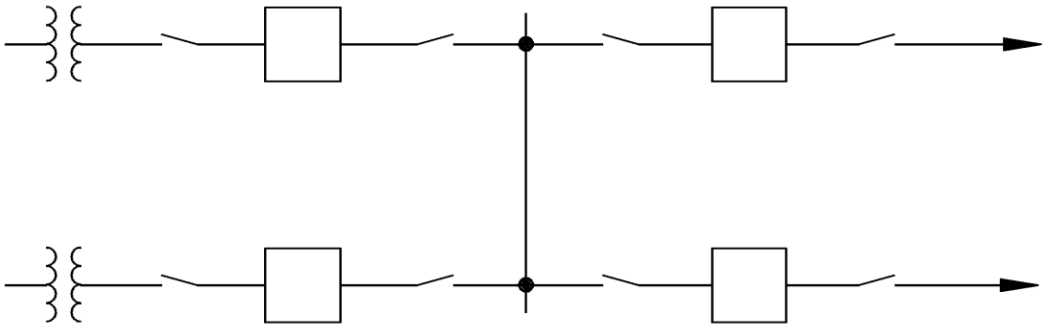
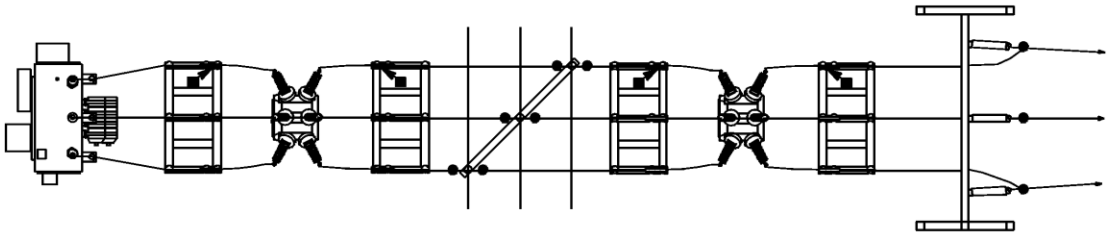
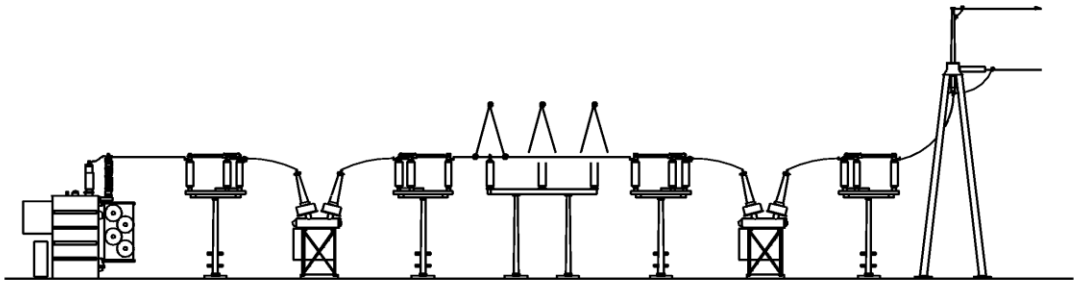
LOW PROFILE - Single Breaker Layout



TYPICAL ONE-LINE DIAGRAM



PLAN VIEW — TYPICAL BAY



ELEVATION — TYPICAL BAY

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SUBSTATIONS - PLAN LAYOUT EXAMPLES

New JEA substations are typically 230kV/26kV or 138kV/26kV low profile substations. The following pages contain examples of actual substations in the JEA system. These examples are for reference purposes only. Refer to Project Design drawings for specific project related details.

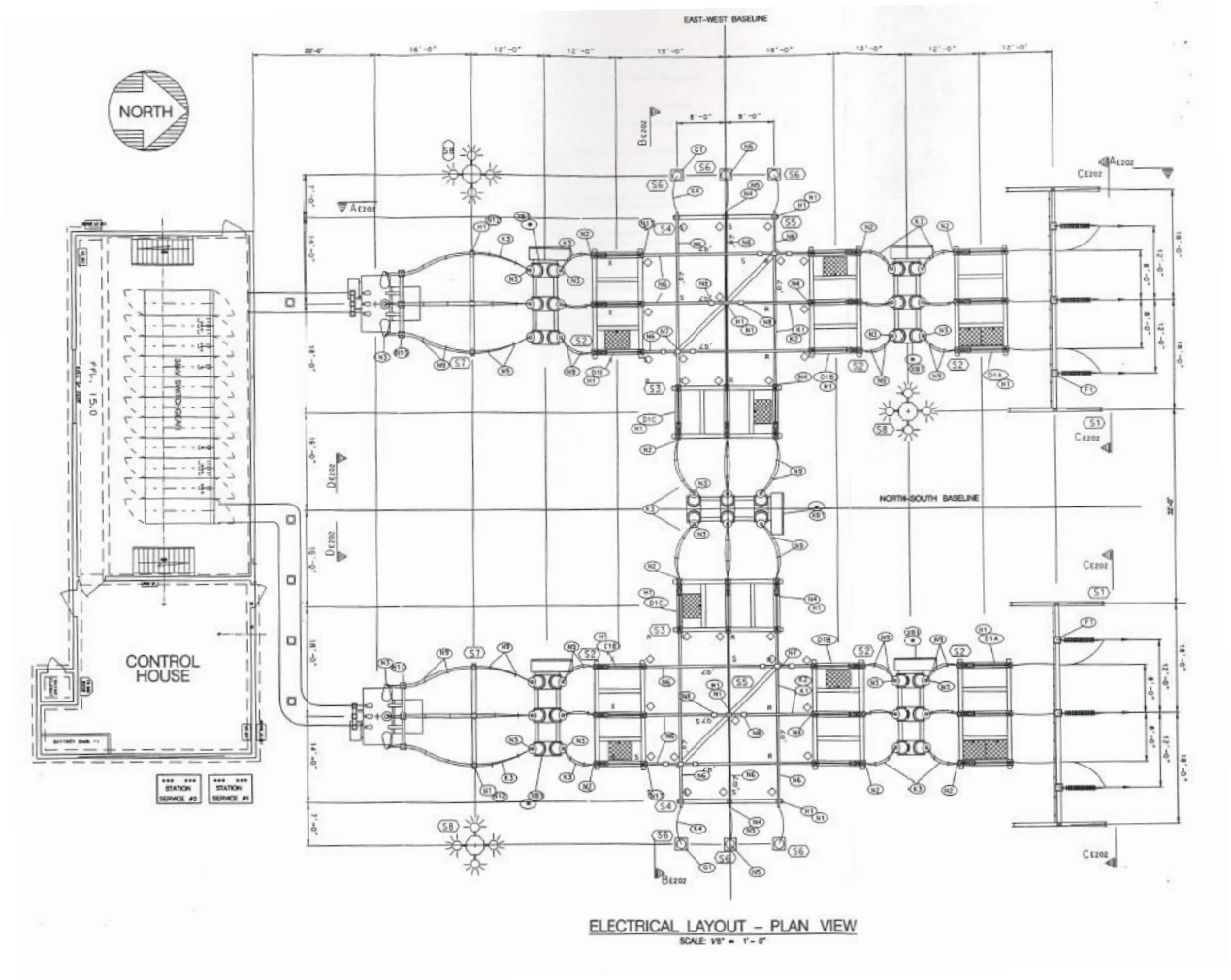
List of Drawings:

138kV/26kV Electrical Plan View
230kV/26kV Electrical Plan View
26kV Electrical Plan View
230kV Electrical Plan View
26kV Electrical Section Views
230kV Electrical Section Views

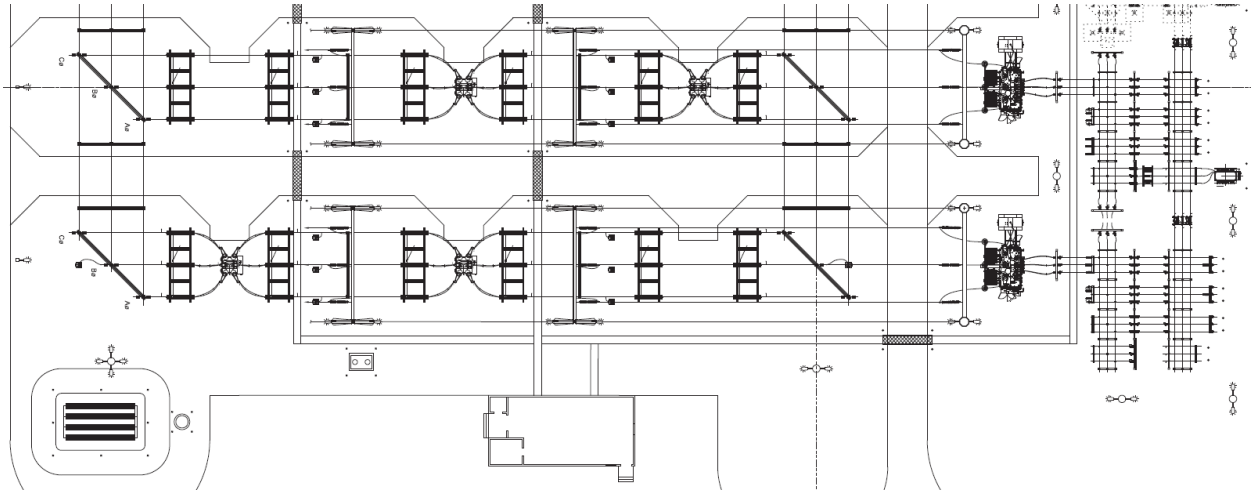
All substations must be designed to the following minimum electrical clearances.

Electrical Clearances

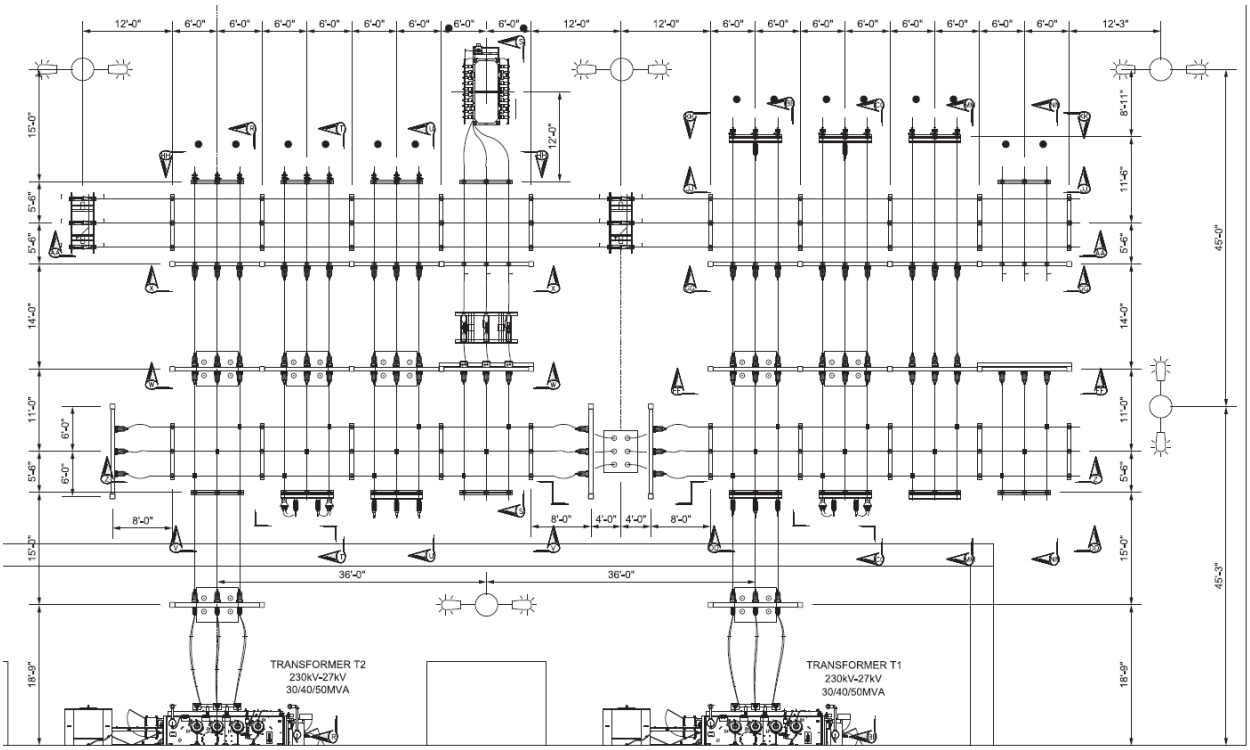
Nominal Phase-to-Phase Voltage (kV)	Maximum Phase-to-Phase Voltage (kV)	BIL (kV)	Minimum Metal-to-Metal for Rigid Conductors (inches)	Centerline-to-Centerline Phase Spacing for Rigid Buses (inches)	Minimum to Grounded Parts for Rigid Conductors (inches)	Minimum Between Bare Overhead Conductors and Ground for Personal Safety (feet)	Minimum Between Bare Overhead Conductors and Roadways Inside Substation Enclosure (feet)	Minimum to Fence Horizontal (feet)
13.2	15.5	110	12”	24”	7”	9’	21’	10’
34.5	38	200	18”	36”	13”	10’	22’	10’
69	72.5	350	31”	60”	25”	11’	23’	12’
138	145	650	63”	96”	50”	13’	25’	14’
230	242	900	89”	132”	71”	15’	27’	16’



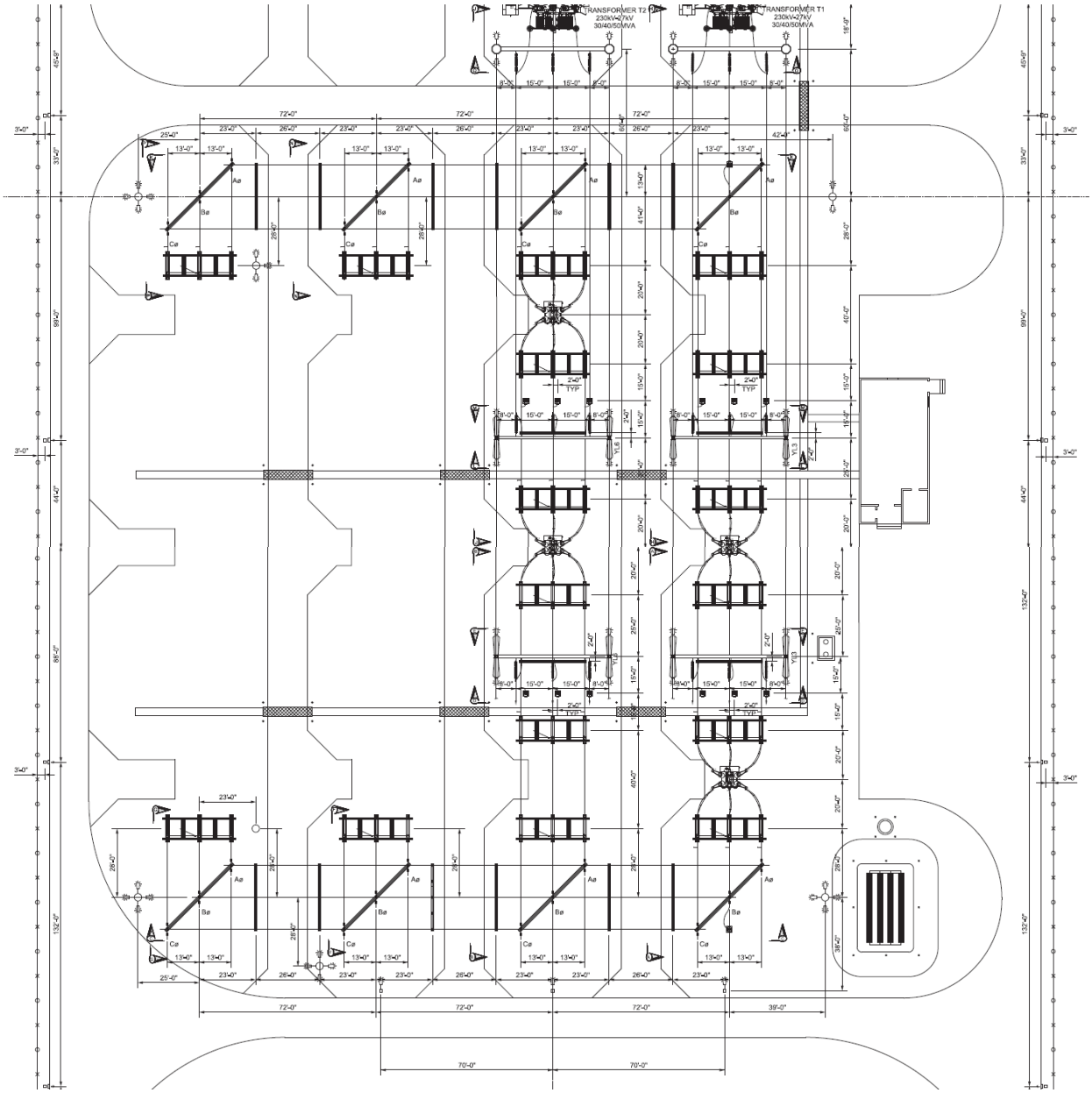
138kV/26kV Electrical Plan View (Switchgear for 26kV)



230kV/26kV Electrical Plan View

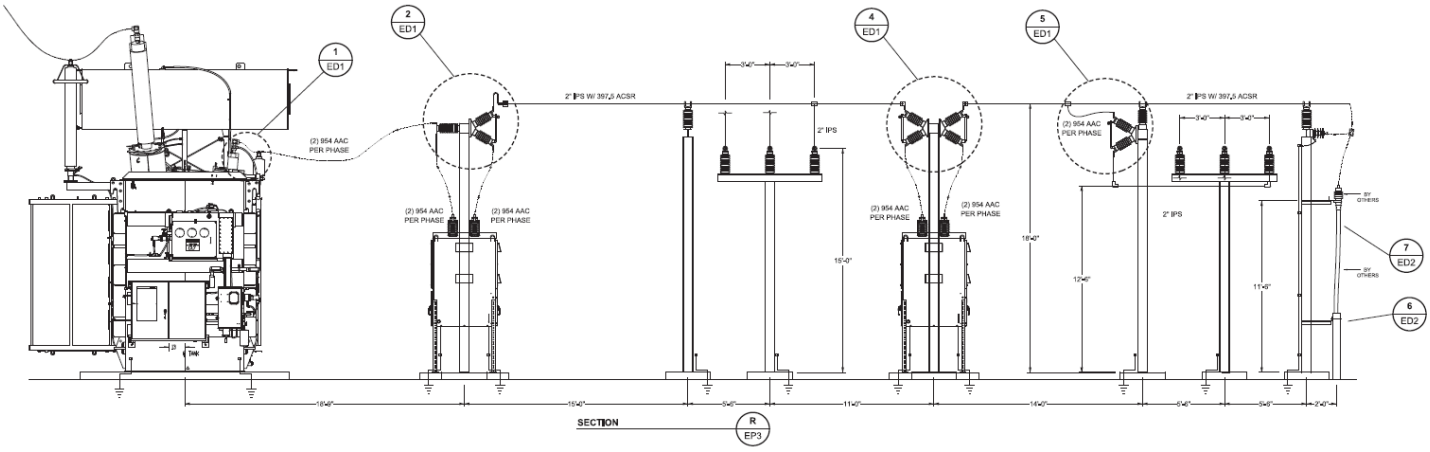


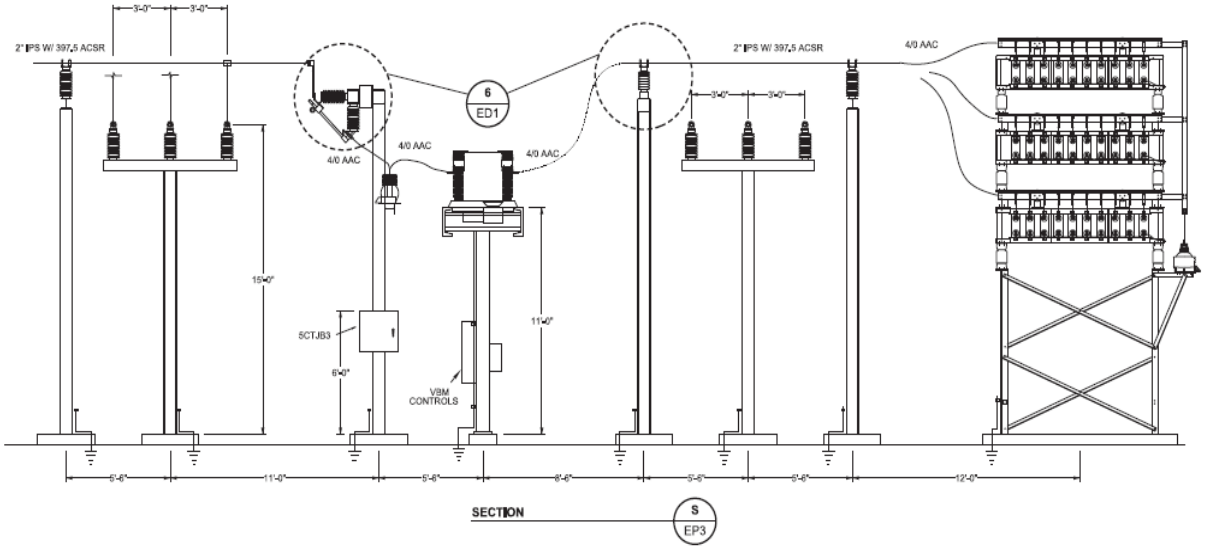
26kV Electrical Plan View

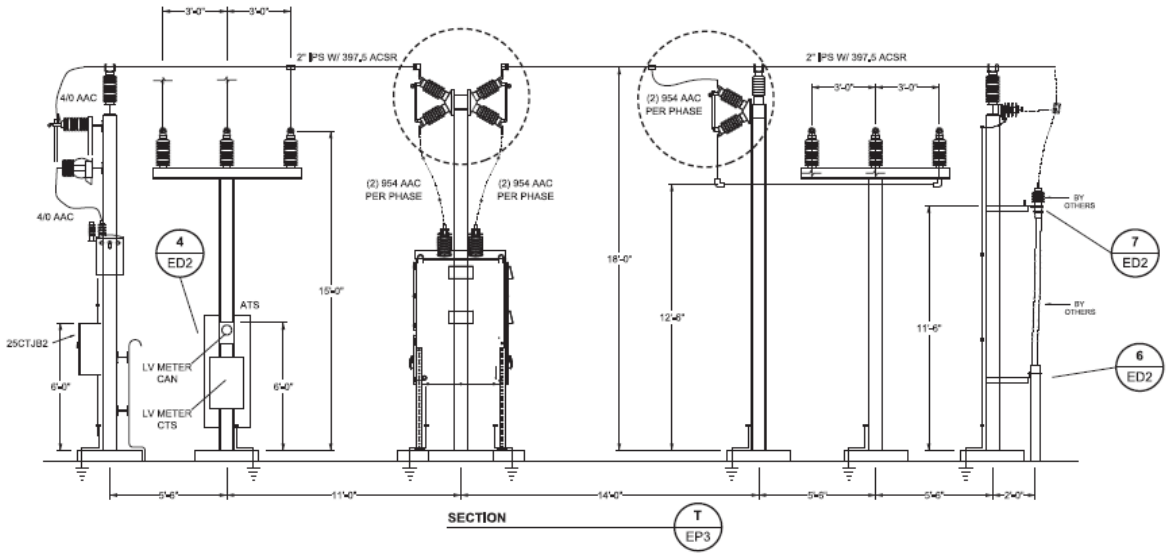


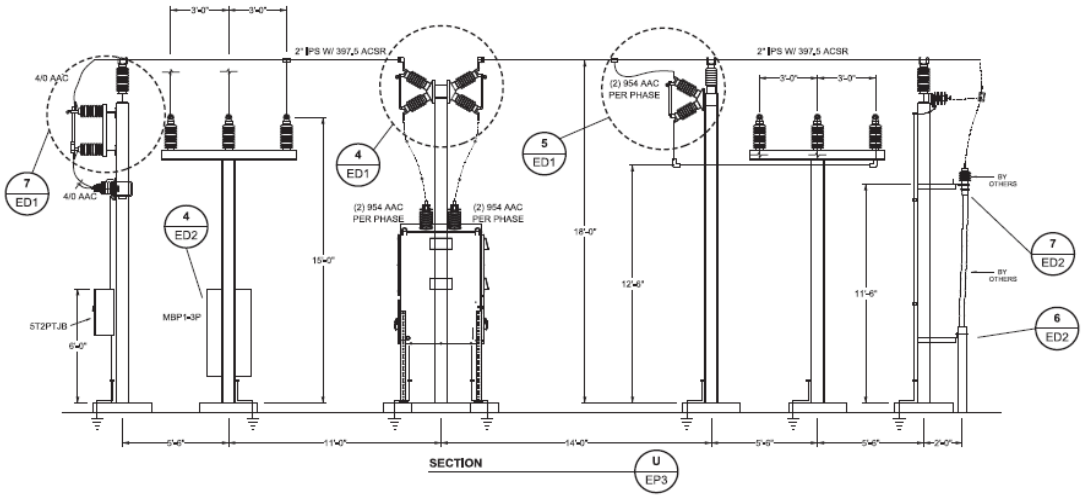
230kV Electrical Plan View

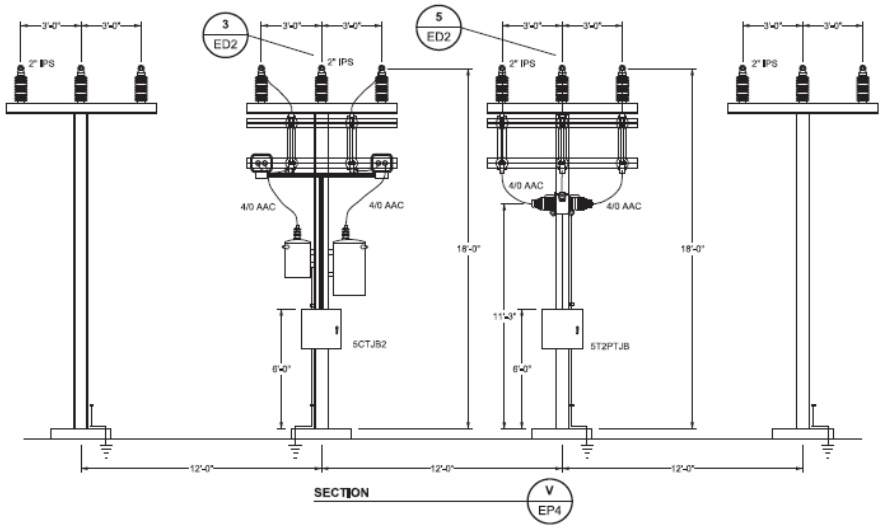
26kV Electrical Section Views








2" IPS W/ 397,5 ACSR
4/0 AAC
7 ED1
4/0 AAC
4 ED2
MBP1-3P
5T2PTJB
6'-0"
15'-0"
4 ED1
(2) 954 AAC PER PHASE
(2) 954 AAC PER PHASE
5 ED1
(2) 954 AAC PER PHASE
2" IPS W/ 397,5 ACSR
18'-0"
12'-6"
BY OTHERS
11'-6"
7 ED2
BY OTHERS
6 ED2
5'-6"
11'-0"
14'-0"
5'-6"
5'-6"
2'-0"
SECTION
U EP3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5 ED2
2" IPS
2" IPS
2" IPS
2" IPS
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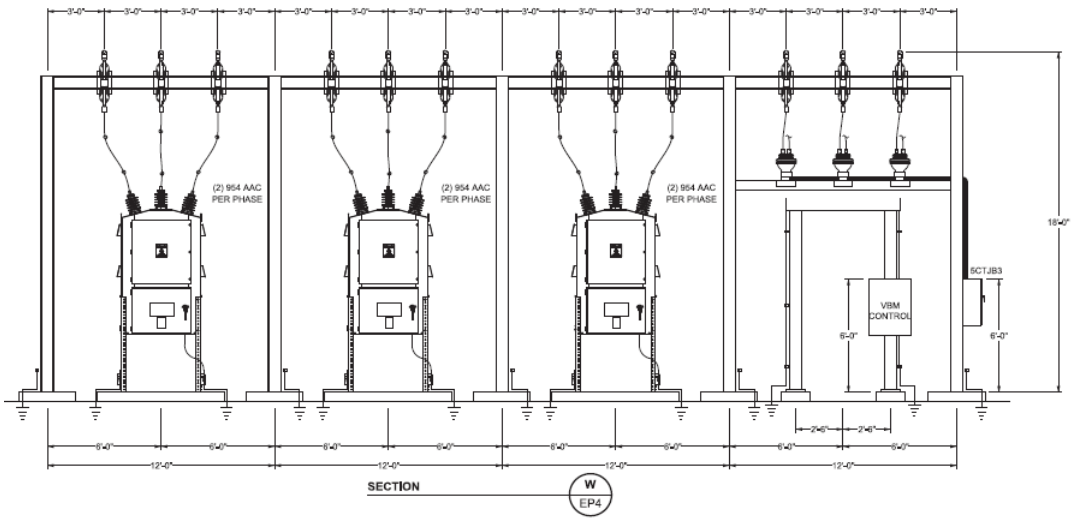
4/0 AAC
4/0 AAC
4/0 AAC
18'-0"
18'-0"
11'-3"
6'-0"
5CTJB2
6'-0"
5T2PTJB
12'-0"
12'-0"
12'-0"
SECTION
V EP4


(2) 954 AAC PER PHASE
(2) 954 AAC PER PHASE
(2) 954 AAC PER PHASE
18'-0"
5CTJB3
VBM CONTROL
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6'-0"
2'-6"
2'-6"
6'-0"
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12'-0"
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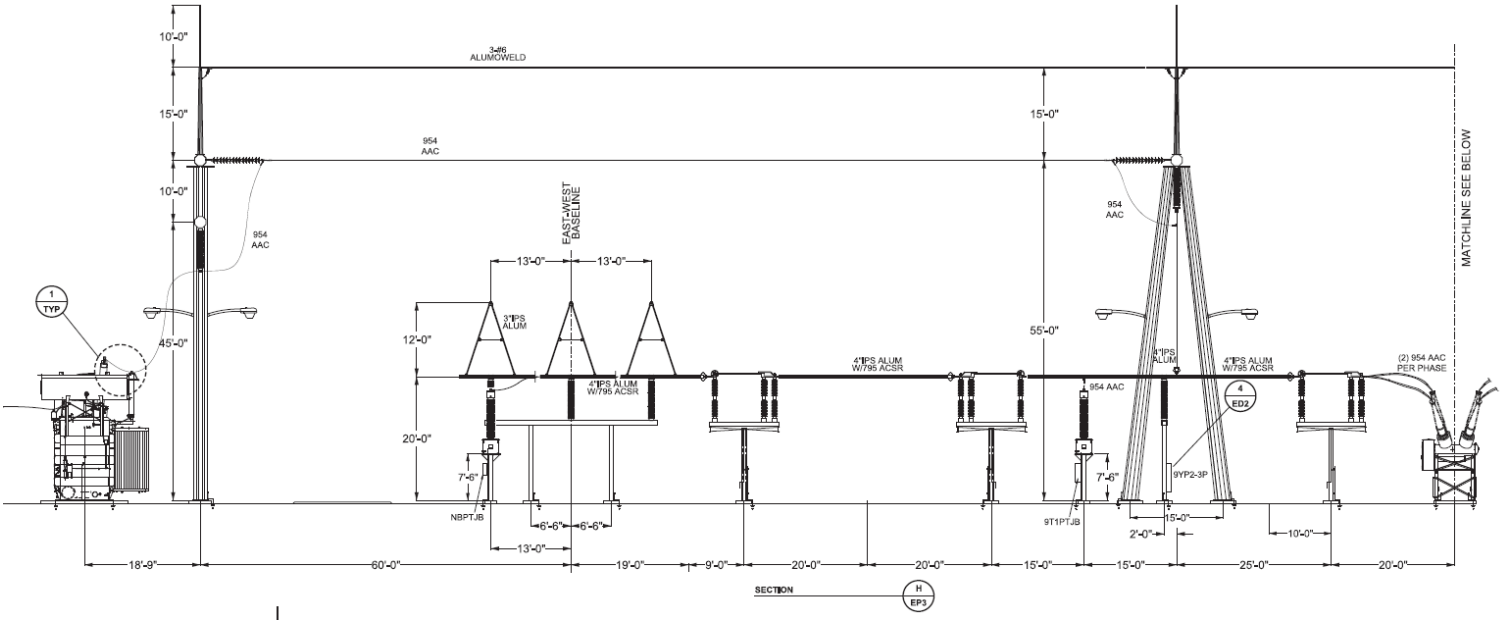
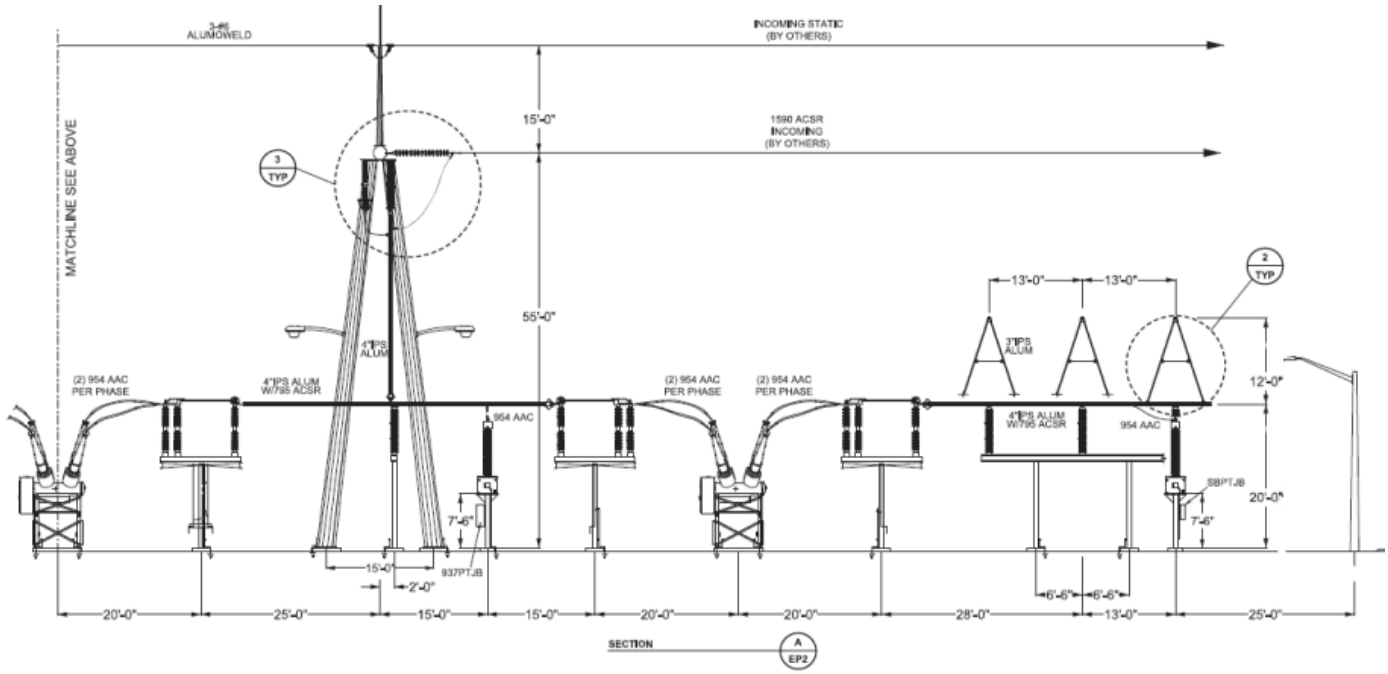
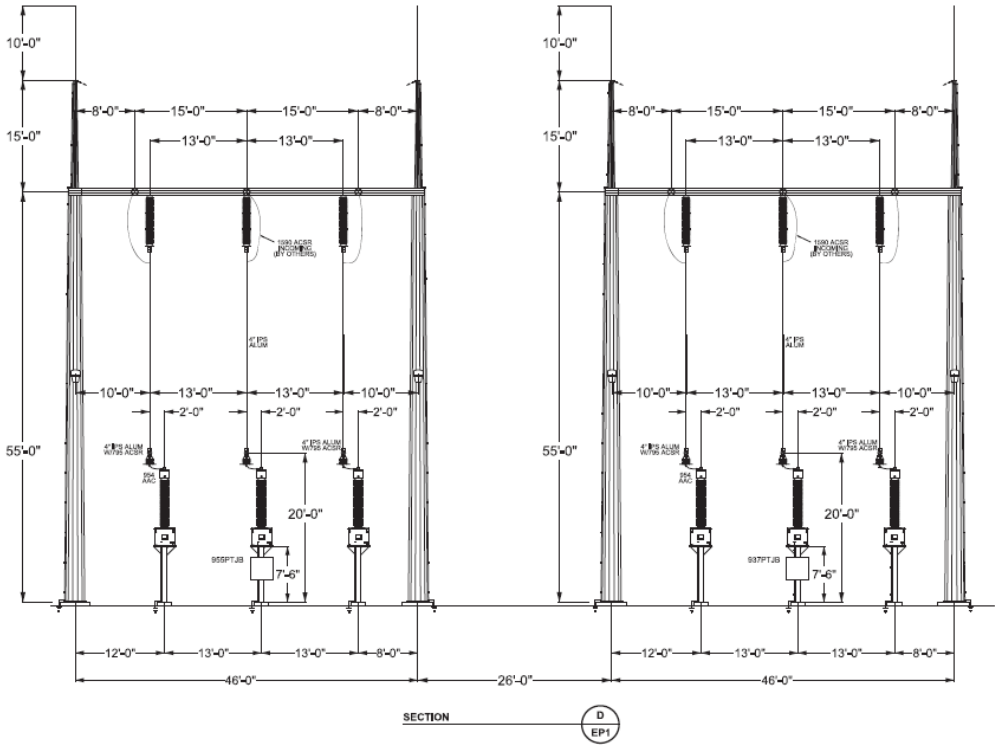
SECTION
W EP4

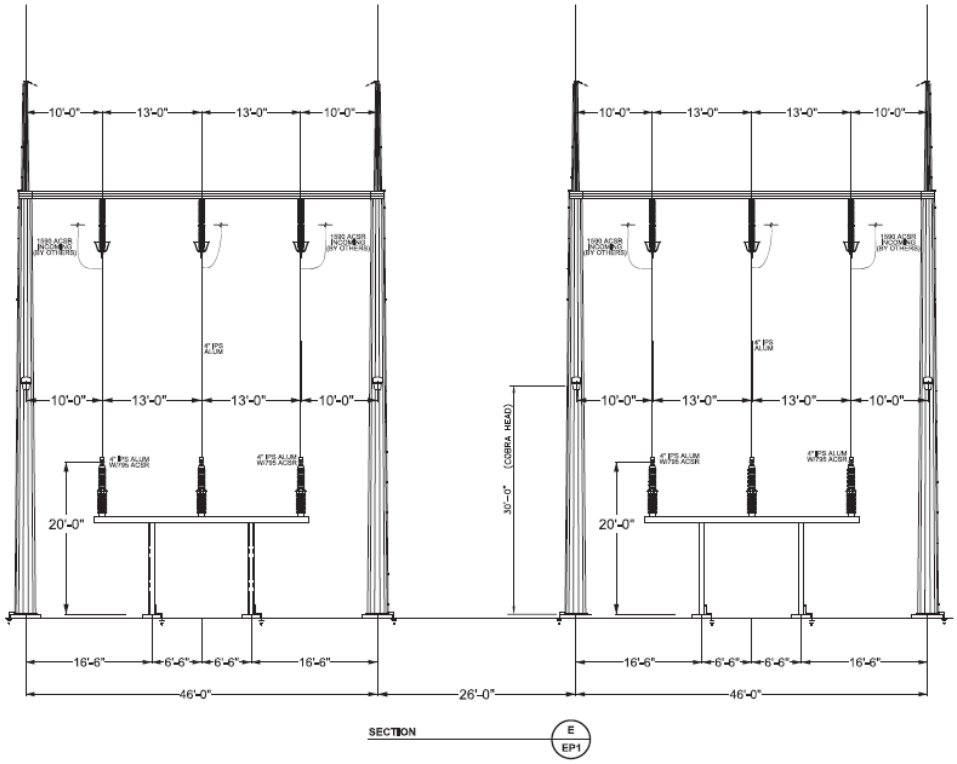
230kV Electrical Section Views







SECTION D EP1



SECTION E EP1

3.1 STANDARD LIGHT AND PROBE POLES

Standard Light and Probe Poles are purchased from the Substation Packager for each substation. Refer to the Structures and Materials Packager Specification for further details.

The design of the poles shall meet or exceed the latest editions of the NESC and the ASCE "Design of Steel Transmission Pole Structures". The design, fabrication, coating, and other provisions of this Subsection shall apply to the light and probe poles.

Fabrication

The poles shall be direct embedded tapered tubular steel poles complete with cap plate and accessories. The poles shall be hot dip galvanized. The length of the probe pole shall be as specified per drawings.

For any metallic pole that is directly embedded, mastic coating of 16 mils is required 2' AGL (two feet above ground line) to base of pole. Also, a 4' (four foot) ground sleeve is required from 2' AGL (two feet above ground line) to 2' BGL (two feet below ground line).

Lighting attachments shall be fabricated at a height of 30' from the ground line. The pole shall also include grounding attachments along the full height of the pole, that meet the requirements of the grounding Subsection in the Structures and Materials Packager Specification.

The poles shall be designed to eliminate the need for vibration dampening.

One (1), 4" X 6 1/2" hand hole shall be welded into each pole two (2) feet from the base. A weatherproof flat cover shall be provided for flush mounting to the hand hole.

One (1) single gang outlet frame shall be welded in each pole three (3) feet from the base as shown on the drawings. The outlet frame must have a flat surface for installation of a standard duplex outlet and cover plate.

Four (4), 2" pipe couplings shall be welded in each pole as shown on the drawings and shipped with removable caps.

Four (4), 2" pipe plugs shall be supplied with each pole.

A 2" diameter lightning probe five (5) feet in length, pointed on one (1) end, and threaded on the other, shall be supplied for installation in the top cap of the probe poles. The top cap on the pole shall be drilled and tapped to accept the lightning probe.

A grounding pad, drilled and tapped, as shown on the drawings will be provided. Ground connectors shall be, Anderson type VL4D-41-4-H.

Luminaire supports shall be fabricated as indicated in Section referencing the probe pole detail as shown on the drawings. The 2" diameter arms shall be threaded at the open end for luminaire mounting. The luminaires shall be provided by JEA.

After galvanizing, ensure that the threaded taps for the lightning probe and the luminaire supports are free of excess galvanizing. Ensure luminaire supports and lightning probe will thread into the pole.

Vangs for static wire pull-off shall be as shown on the drawings, designed for the pull-off tension(s) and direction(s) specified.

All structure openings shall be designed to be plugged or covered during final field installation.

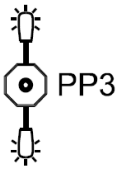
The Substation Construction Contractor shall install all lighting and probe poles as shown on the Substation Project Drawings. The Contractor shall install all perimeter lighting poles complete with anchor bases, arms, conduit, wiring, light fixtures and photocells in the locations shown on the Substation Project Drawings.

Lighting poles, anchor bases, arms and light fixtures are typically provided by JEA for new substation installations. Conduits, switches and wiring shall be furnished by the Substation Construction Contractor.

Refer to the Street Light Standards Reference Manual for any Poles, Street Lights and Photocells that are kept in inventory,

Refer to the Project Design drawings for specific project related details. These examples are for reference purposes only.

LED LIGHTS



Probe Pole Symbols from project drawings

LED Light – JEA Item ID # STLLE001 – 40W LED, Cobrahead, 120VAC, PE Receptacle – 7pin
JEA Item ID # STLLE002 – 115W LED, Cobrahead, 120VAC, PE Receptacle – 7pin

Photocell – JEA Item ID # STLPC010
Item description: Photocontrol, long life for LED Fixture, 1280 Joule MOV, Fail-Off

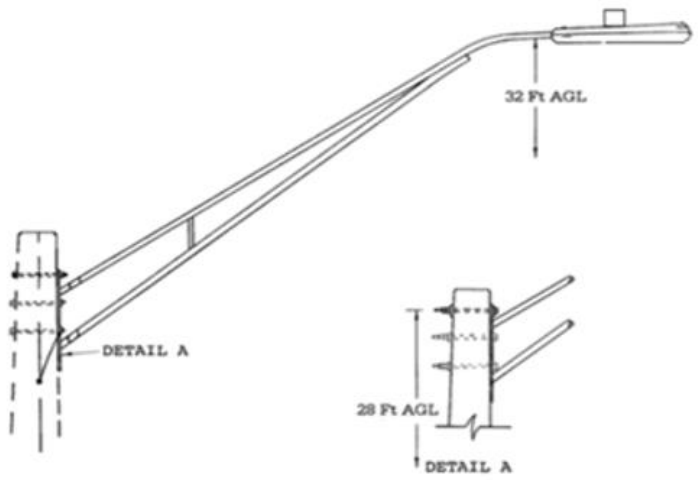
Light Pole - JEA Item ID # POLCO004 - 40' concrete pole used for lighting only
Other options: POLCO001 – 30' Type 1 w/ conduit
POLCO002 – 35' Type 1 w/conduit

Bracket - JEA Item ID # BKTSL002 – 8' Length, 3' Rise, Universal Base
JEA Item ID # BKTSL007 – 12' Length, 4' Rise, Universal Base

Example references from the Street Light Manual for use in Substations:

12 Ft Bracket on Street Light Pole

L201 - 115W LED COBRAHEAD (200/250W HPS EQUIVALENT)



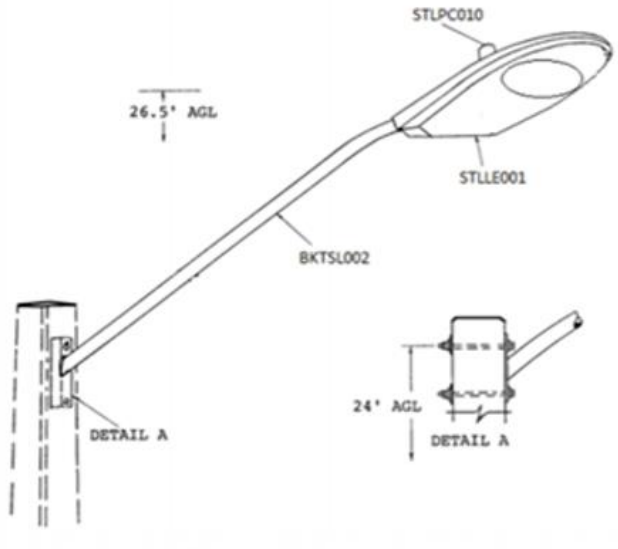
NOTE: 28' AGL = 28' ABOVE GROUND LEVEL

ITEM	QTY	DESCRIPTION
BKT SL 007	1	BRACKET, TRUSSARM 12FT. 4FT. RISE JEA #DMD-67
CAI UF 001	18	CABLE, STREET LIGHT 12/2 UF CU W/O GROUND
CNN CP 002	1	CONNECTOR, ALUM. COMP. SIDE BY 6-2 2-1/0
CNN CP 008	1	CONNECTOR, ALUM. COMP SIDE BY 6-2 3/0-4/0
CNN VG 003	2	CONNECTOR, VISE TYPE 6-2 SOL. 10-2 SOL.
COB CO 028	3	CONDUCTOR, BARE COPPER #4 SOL. SOFT DRAWN
COV IC 002	1	COVER COMP. CONNECTORS INSULATING
STL LE 002	1	LUMINARE, LED, IES TYPE M.N. III
STL PC 010	1	PHOTOCONTROL, LONG LIFE FOR LED, TWIST-LOCK

PLATE OPTIONS: (INCLUDES WIRE IF NECESSARY)
L201 (Mount to existing pole), L201R (LED Luminaire & Photocell Only), L201U (Includes 35/1C Pole – Pg. 8)

8 Ft Bracket on Street Light Pole

L101 - 40W LED COBRAHEAD (70W HPS EQUIVALENT)

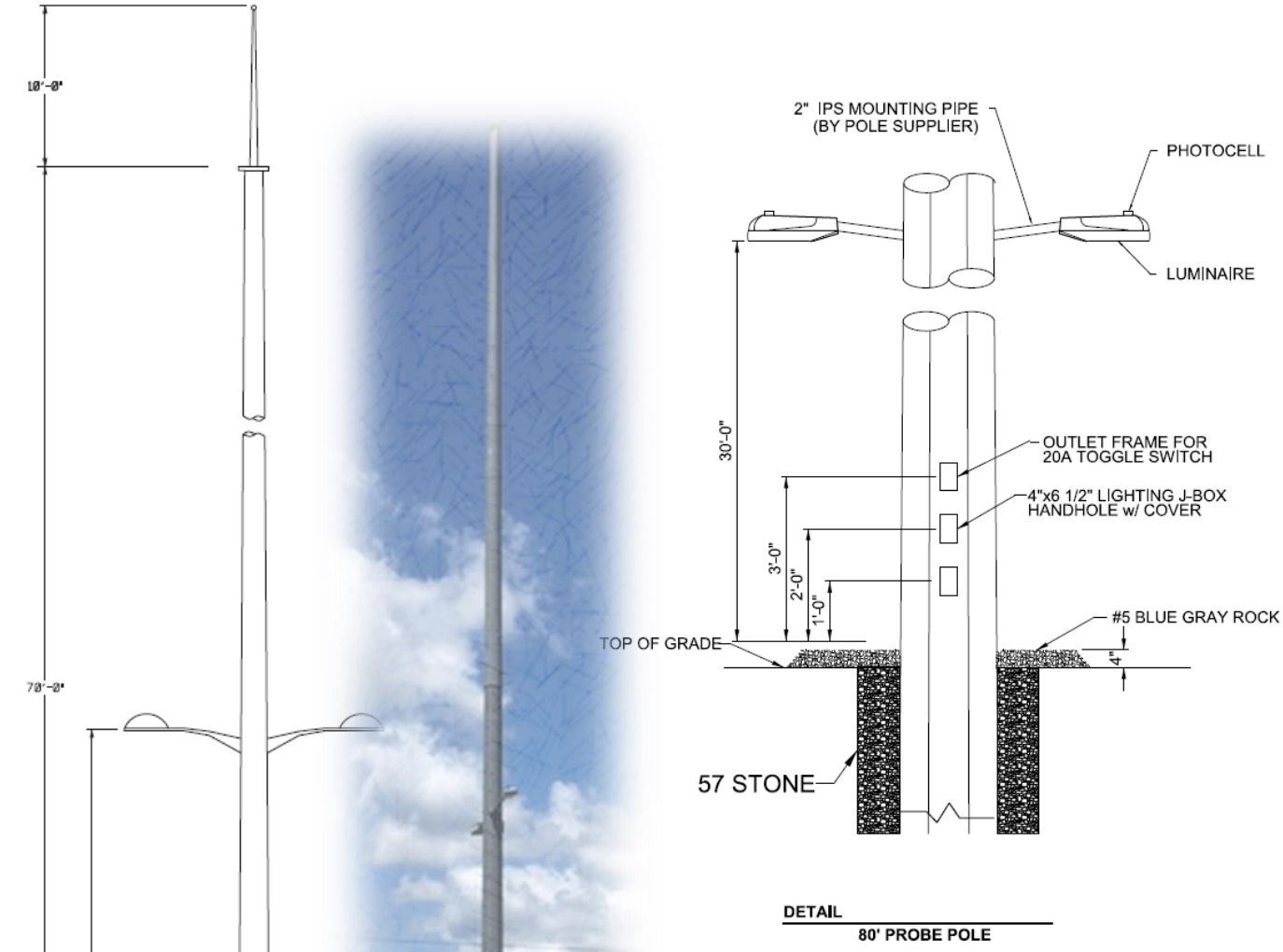


NOTE: 24' AGL = 24' ABOVE GROUND LEVEL

ITEM	QTY	DESCRIPTION
BKT SL 002	1	BRACKET 8FT. 3FT. RISE JEA #DMD-31
CAI UF 001	13	CABLE, STREET LIGHT 12/2 UF CU W/O GROUND
CNN CP 002	1	CONNECTOR ALUM. COMP. SIDE BY 6-2 2-1/0
CNN CP 008	1	CONNECTOR ALUM. COMP SIDE BY 6-2 3/0-4/0
CNN VG 003	2	CONNECTOR VISE TYPE 6-2 SOL. 10-2 SOL.
COB CO 028	3	CONDUCTOR BARE COPPER #4 SOL. SOFT DRAWN
COV IC 002	1	COVER COMP. CONNECTORS INSULATING
STL LE 001	1	LUMINAIRE LED 120 V 40 WATT HORIZONTAL
STL PC 010	1	PHOTOCONTROL, LONG LIFE FOR LED, TWIST-LOCK

PLATE OPTIONS: (INCLUDES WIRE IF NECESSARY)
L101 (Mount to existing pole), L101R (LED Luminaire & Photocell Only), L101U (Includes 30/1C Pole – Pg. 8)

PROBE POLE DETAILS



Probe Pole with Lighting (Bartram Substation)

3.2 SQUARE AND TAPERED TUBE STRUCTURES

The substation structures shall be one (1) of the following classes:

Class "A" structures are those intended for the support of high voltage equipment such as air switches, potential transformers, bus supports, and surge arresters. Class “A” structures and all their components shall comply with the latest revision of the AISC “Load and Resistance Factor Design Specification for Structural Steel Buildings”

Class "B" structures are those on which the deflections within the limits do not affect the performance of supported equipment such as dead end structures for terminating incoming overhead transmission circuits. Class “B” structures shall comply with the latest revision of the ASCE “Design of Steel Transmission Pole Structures” and “Guidelines for Electrical Transmission Line Structural Loading”. Overload Capacity Factors shall be in accordance with the latest revision of the NESC.

The type of steel required for the substation project shall be clearly identified on the Bill of Material.

The type of steel may be required to match an existing substation. In that case, steel drawings from the original project shall be supplied in order to match the design requirements.

All low profile 69kV, 138kV, and 230kV structures shall be either square tube or tapered tubular in design, unless otherwise specified. All dead end structures shall be tapered tubular in design. Tapered tubular structures shall be folded plate steel with a right, regular, polygonal cross section, having at least eight (8) sides.

The largest shape steel component shall be 12” square tube. When loading conditions require stronger structural components, the Company shall use a tapered tubular in design.

All square tube structures shall have a black-steel minimum wall thickness of ¼”.

All low profile 26kV structures shall be square tube in design.

All high profile structures shall be lattice steel in design with all components constructed of standard angle shape steel and/or bar with all column angles turned inward.

Knee braces shall not be permitted on any structure.

All required field assembly of structures shall be by bolted connection only. There shall be no field welding except for aluminum bus work. The structures shall be supplied with all fasteners, nuts, bolts, washers, and anchor bolts needed to erect and assemble the structures.

All anchor rods shall be furnished with each structure, ready for "cast-in-place" installation during the structure foundation’s construction. Post-installed anchors are not permitted. Anchor rod embedment sizing calculations shall be in accordance with ACI 318, Appendix D. Shop drawings shall show the minimum required foundation plan dimensions required to achieve the required anchor rod capacity. Anchor rods shall be straight, and provided with double nuts at the bottom for concrete embedment. Hooked bolts (i.e. J-bolts) are not permitted. Provide two (2) bottom nuts (embedded in foundation), one (1) leveling nut and two (2) top nuts for installation at top of anchor rod. Make allowances in anchor rod lengths so that anchor rod projections, above the foundation, accommodate a free air space between the foundation upper surface and the base plate lower

surface of up to 3" maximum. The structure base plate thickness, the washers, and the leveling nuts shall be capable of achieving such free air space with a minimum projection of at least 1" and a maximum of 3" of the anchor rod above the top of the upper nut. Tack welding or damaging threads to prevent top nut back-off shall not be permitted.

The nuts and the threaded portion of anchor rods plus a minimum of six (6) additional inches shall be galvanized in accordance with ASTM A153 or B695, Class 50, Type 1.

Anchor rods shall be shipped as preassembled clusters or shall have steel templates adequate to properly align the bolts for each individual base plate. For larger folded-plate structures (i.e. transmission pull-offs, lightning masts, etc.) the anchor rods shall be shipped as preassembled clusters only.

The 26kV pedestal structure which supports the station service transformers shall be capable of supporting three (3) pole-mounted transformers (1800lbs each) mounted 90 degrees to each other. The station service configuration is shown on the drawings. Provide symmetrically mounted steel channels for attaching either of the transformer sizes on either side of these structures, as is indicated in the attached reference drawings.

Structures shall be designed with consideration given to providing sufficient rigidity so that all equipment (e.g. air switches) will operate properly and so that deflections of members will not exceed the limits specified by the equipment manufacturer.

The structures shall be designed in order to accommodate the electrical and mechanical clearances indicated on the JEA Project Drawings, and to prevent interference with all structure mounted equipment. Panel mounting locations shall be determined by JEA's Conduit Plan. In addition, all structures shall be designed such that the final installation of the bus supports, switches, surge arresters, and voltage transformers meet or exceed NESC requirements for electric supply stations.

Structures shall be designed to withstand apparatus loads, dead loads, wind loads, and other specified loads. The structures shall comply with a design wind speed of 120 MPH as a minimum.

Additionally, minor structure attachment requirements, such as mounting bracket details (typically, a simple piece of channel or wide flange) for miscellaneous items shall be indicated on the Structure Detail Approval Drawings by the JEA Project Manager.

All members shall be clearly marked to provide easy identification in the field. Markings shall be durable in nature and agree with Erection Drawings for each substation or structure.

Dead end structures shall have provisions for attaching luminaries, hand holes, and outlet frames as indicated on the drawings included with this Specification.

All open ends of structures shall be provided with screens to prevent birds from nesting inside the structures. Similarly, all openings of greater than 1" shall be screened. The screening material shall be similar to 9 gauge galvanized grating, shall have no opening greater than 3/8" in any direction, and shall be welded in place prior to galvanization.

APPLICABLE STANDARDS

All substation structures shall be manufactured to conform to the latest applicable revisions of the standards from the following institutes:

ACI - American Concrete Institute

AISC - American Institute of Steel Construction

ASTM - American Society for Testing of Materials

AWS - American Welding Society

ASNT - American Society of Nondestructive Testing

ASCE - American Society of Civil Engineers

NESC - National Electrical Safety Code

NEMA - National Electrical Manufacturers Association

MATERIALS

All material shall be steel and shall conform to the requirements as stated herein.

Reports and Test Samples: A copy of the certified mill test report for all steels, including impact properties, shall be submitted to JEA, if/as requested. Charpy V-notch impact tests shall be in accordance with ASTM A370, and test reports shall include the test temperature and energy value (ft-lbs) for each test specimen broken. Sufficient procedures will be required to demonstrate to JEA complete satisfaction that all material shall be traceable to the mill heat number shown on the mill test report.

Structural Steel Shapes: ASTM A992

Structural Plates and Bars: ASTM A36 or ASTM A572

Structural Steel Tubes (Round, Square, Rectangular): ASTM A500 or ASTM A501 or ASTM A618

Structural Steel Tubes (Tapered Polygonal): ASTM A572 or ASTM A575

Base Plates: ASTM A36 or ASTM A572 or ASTM A588

Connection Bolts: ASTM A307 or ASTM A325 or ASTM A394

Anchor Rods: ASTM F1554

Nuts: ASTM A563

Washers: ASTM F436

LOADINGS & DEFLECTIONS

The design loading of attached conductors and shields for all dead end structures required by these Specifications shall be provided to the Company in the preliminary design package.

For the purpose of this Specification, deflection shall be defined as the deviation of a structural member from its intended theoretical design position to its actual position under maximum loading conditions.

Dead end structures shall be sufficiently rigid to meet the deflection requirements without being "raked".

In Class "A" structures, the horizontal deflection of vertical members shall be limited to 1/100 of the vertical height of the structure. The vertical deflection of horizontal members shall be limited to 1/200 of the span. The horizontal deflection of horizontal members shall be limited to 1/200 of the span.

In Class "B" structures, the horizontal deflection of vertical members shall be limited to 1/50 of the vertical height of the structure. The vertical deflection of horizontal members shall be limited to 1/200 of the span. The horizontal deflection of horizontal members shall be limited to 1/100 of the span.

Each Class "A" structure shall be designed to perform according to the following conditions:

Loading Case I, High Winds: Structure to be loaded with all apparatus loads and the weight of the structure. A wind load of 25 psf. (on flat surface) shall be applied to the structure and apparatus mounted thereon, with wind load being applied in the most severe direction. Under this condition, structure stresses shall remain below allowable stresses as outlined by AISC Specifications. Under this loading condition, vertical deflections shall be limited to a maximum of 1/300 of the span and horizontal deflection to 1/200 of the span.

Loading Case II, Short Circuit: A horizontal loading of 100% of the cantilever strength of the insulator stack shall be applied at the bus elevation to represent a short circuit force. Wind loads shall also be applied per Loading Case I, except wind load need not be applied to the bus or insulators. Under this condition, there shall be no permanent deformation of the structure resulting from the yielding of the material. Deflections for Loading Case II shall be limited as outlined in Loading Case I for switch stands and rigid bus support structures. Deflection need not be considered on equipment stands which are not connected to rigid bus.

Loading Case III, Storm Load: Structure to be loaded with all apparatus loads and the weight of the structure. A wind load of 120 MPH (sea level) wind shall be applied to the structure and apparatus mounted thereon, with wind load being applied in the most severe direction. Under this condition, the structures and associated fasteners will survive the simulation, with no significant, non-elastic shear, bending, or twisting. In this case, JEA only requires that the resulting deflections not result in catastrophic damage to the structures or attached electrical apparatus.

Loading conditions for Class "B" structures. Loads shown will include NESC overload capacity factors. These structures shall be designed to be self-supporting with tension in one (1) direction only and shall withstand the following conditions:

Loading Case I:
Normal Condition
Temperature: 60 °F
No wind

Conductor and shield tensions as shown on the drawings.

Deflection Limitations: Vertical and horizontal deflections of horizontal supporting members shall be limited to 1/100 of the span. Vertical supporting members shall be so designed that they will not deflect more than 1/50 of the height of the structure.

Loading Case II:
Temperature: 30 °F
Wind on wires: 16 psf (on round shape)
Wind on flat surface: 25 psf

Conductor and shield tensions calculated for above conditions with pre-loading tensions as shown on the drawings.

Loading Case III, Heavy Wind:
Temperature: 60 °F
Wind on wires: Equivalent of 120 MPH at sea level

Conductor and shield tensions calculated for above conditions with pre-loading tensions as shown on the drawings.

GROUNDING

A grounding attachment shall be welded near the base of each structure leg. The ground attachment shall normally be located one (1) foot from the bottom of the base plate, oriented to either the north or the east when practical.

Every ground attachment shall consist of a small piece of Channel (i.e. C 4 x 5.4, 3" in length) welded to the structure, with one (1) centered-hole suitable for bolting an Anderson grounding connector.

Provide a ground connector for each structure leg for below grade grounding. This connector shall be sized for 7#5 copperweld conductor.

Provide ground attachments and connectors for vertical runs up each structure, where required on drawings, at 4' intervals. The ground connector shall be sized for 7#5 copperweld conductor.

For high profile lattice steel structures, all connectors required to terminate the JEA supplied 3#6 alumoweld conductor between goatheads and vertical ground conductor shall be furnished by the Company.

For low profile tapered tubular dead end structures, all connectors required to terminate JEA supplied 3#6 alumoweld conductor between ground conductors shall be furnished by the Company.

For all structures, all connectors that support arrestors, switches, cable terminators, instrument transformers, or other components that require current carrying grounds, the Company shall include on the structure those grounding attachments as needed to assure that a continuous ground riser conductor may be attached to the structure at four (4) foot intervals and shall be continued to allow the continuous ground riser conductor to pass within two (2) feet of each device grounding pad. A connector shall also be provided to form the junction of the equipment grounding cable with the continuous ground riser conductor. For structures with two (2) or more legs, the ground connectors shall allow routing of a continuous ground riser conductor up one (1) leg, across the structure and down the other leg, without cutting the continuous ground riser conductor.

STRUCTURE NAMEPLATES: Additionally, JEA requires that a permanent nameplate is attached to each whole structure, one (1) per completed structure. The purpose of this nameplate is to allow JEA to readily identify any structure in the field, for the life of the structure.

Each structure shall contain at least one (1) such plate, attached to a piece of channel, similar to the means for attaching the ground connector to the structure, and similar in location (different face).

Each plate shall be fabricated of stainless steel, approximately 1/16" thick. Each corner shall be rounded to a radius of 1/4". All lettering shall 1/8" tall block text and shall be engraved. Each plate shall be rectangular, sized approximately 4" x 3" and shall include four (4) holes, approximately 3/16", in each corner, located to provide at least 1/8" of metal around the hole. Text shall be spaced at least 1/8" away from any edge or hole.

Each plate shall be fastened to the channel in an approved method after structure galvanization.

The location of the nameplate shall be identified on the Structure Detail Drawings including a complete nameplate detail sheet showing the nameplate, its dimensions, and text, excepting that text that changes from structure to structure.

The label shall include the following text, as a minimum with block printed text 1/8" in height: Company Name & Location, JEA Project Name and Number, Company JOB #, JEA PO #, Manufacturing Date, Manufacturer's Drawing Number, Structure Number, Piece Number, APPROX. WT. THIS PIECE in Pounds (LBF).

3.3 LIGHTNING PROTECTION

JEA utilizes both static line and static pole designs for the protection of its substation facilities from lightning strikes. The type of design used for an individual substation facility is dictated by the area to be protected. Only the bus and equipment are covered in the lightning protection design for the substation. Surrounding areas such as roadways and control houses are not considered in the design process.

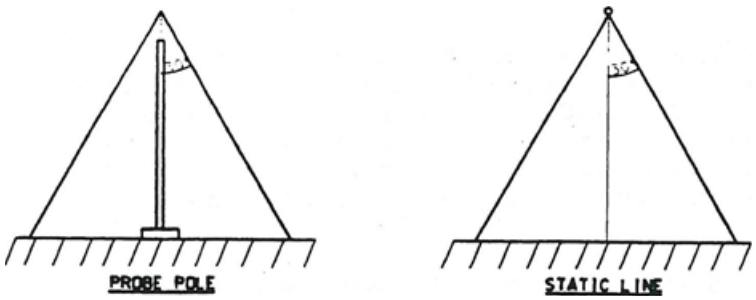
When the substation facility is very large, static line protection designs are utilized to provide maximum protection at a minimum cost. Most large facilities have several transmission lines terminating into them and the accompanying static lines are brought into the substation as part of the protection coverage scheme. Additional static lines or static poles are used to complete the coverage as the design dictates. Small distribution type substations use static pole designs. The coverage area is usually small enough that several static poles will provide the necessary protection without the use of static lines. However, the combination of static pole and static lines is very common in new distribution substation designs.

Static poles are purchased with the substation structures through the substation packager. There are two different heights used for the static pole designs for JEA substations. When a static line is to be used in conjunction with the static pole, the static pole design height is 55'. When static poles alone are used for the protection scheme, the design height is 65'. These poles are typically tapered tubular, hot dipped galvanized steel and directly embedded with 16 mils of corecoat from the Butt to two feet above the ground line.

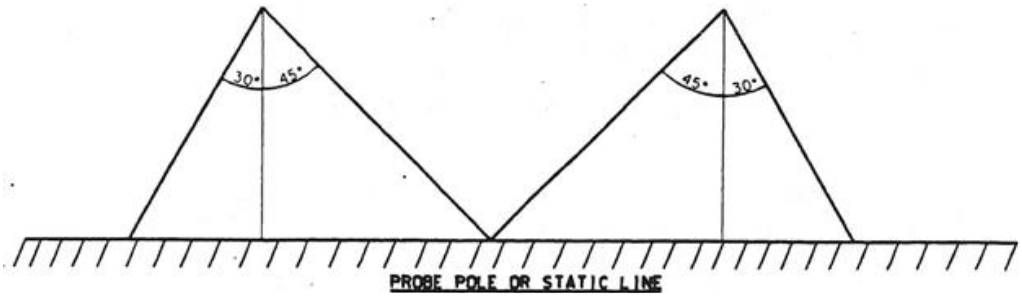
The lightning protection scheme for a particular substation is designed utilizing the substation structure plan view drawing. Static lines and/or static poles are positioned on the drawing to provide the required coverage utilizing pre-established coverage angles that have been accepted by the utility industry. Although no amount of coverage will guarantee total immunity from lightning strikes, the design angles used by JEA and the utility industry in general, have proven to be successful.

The diagram below illustrates the standard coverage design used for lightning protection within JEA substation facilities:

STANDARD LIGHTNING PROTECTION COVERAGE DESIGN



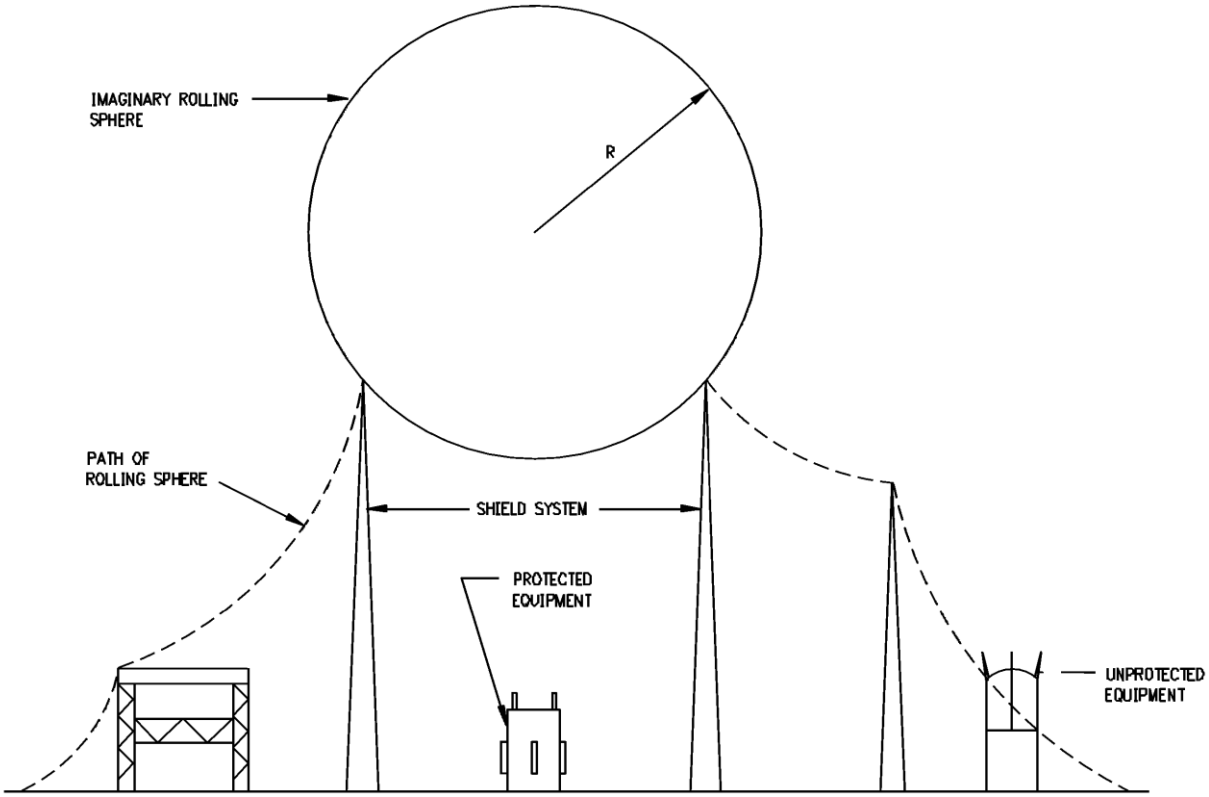
SINGLE POINT COVERAGE



DOUBLE POINT COVERAGE

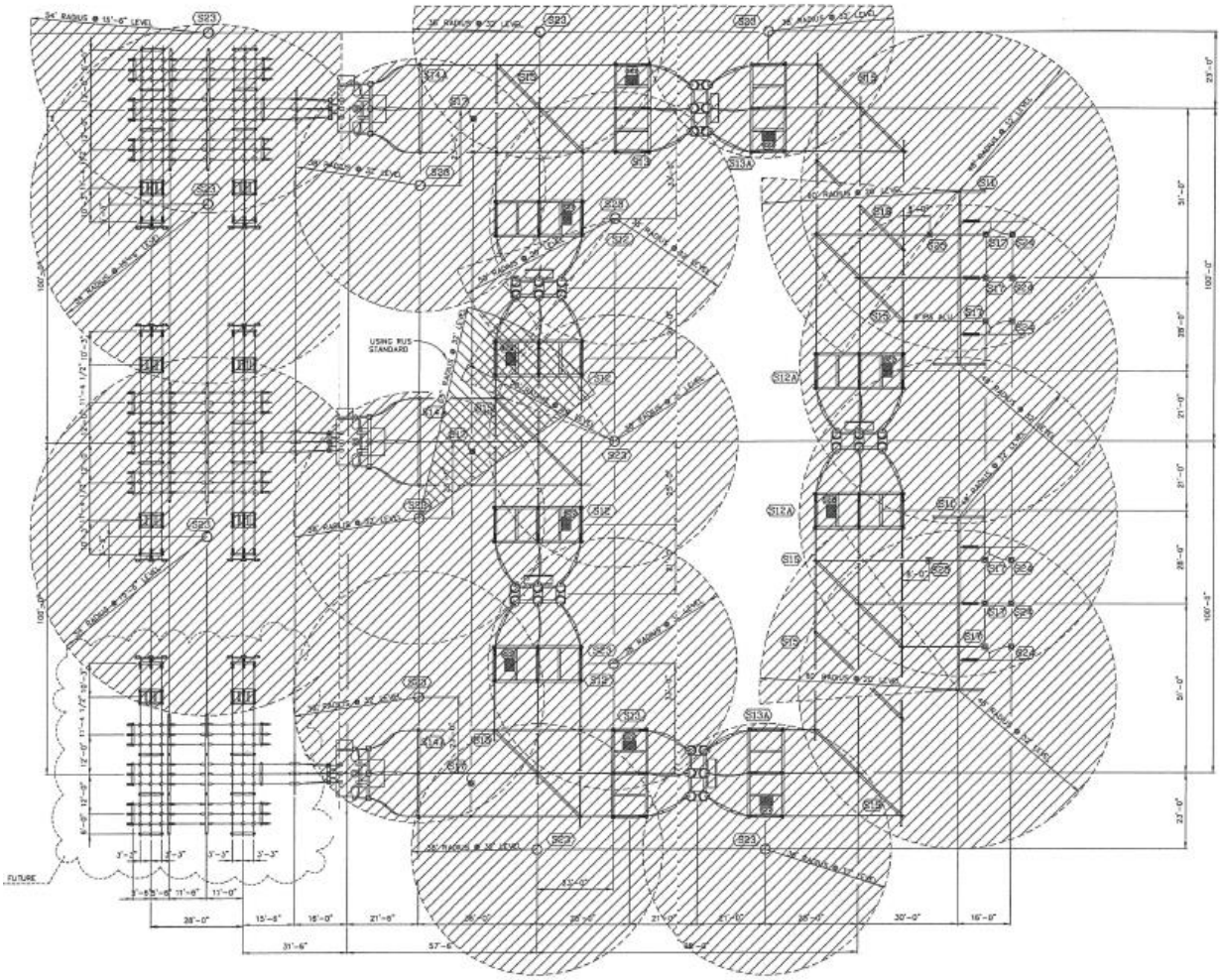
Rolling Sphere Method:

The Rolling Sphere Method is another lightning protection scheme. It involves rolling an imaginary sphere over the substation. As the sphere rolls up and over lightning masts, probe poles, static lines and other grounded metal objects, the equipment stays protected from a direct stroke if it is below the curved surface of the sphere. Refer to IEEE 998 "Guide for Direct Lightning Stroke Shielding of Substations" for further details.



ROLLING SPHERE COVERAGE
(IEEE Std. 998-1996, Fig. 7.3)

STANDARD LIGHTNING PROTECTION COVERAGE DESIGN (ENTIRE SUBSTATION)



BUSWORK

JEA substations are constructed using a combination of aluminum bus and aluminum and copper cables. The conductor sizes are standardized to the standard ampacity ratings of the associated substation equipment (circuit breakers and disconnect switches). All transmission voltage class substations (69kV and above) are designed for operating up to 2000A. All 26kV distribution substations are designed for operating up to 1200A. Most of the JEA's 13kV substations are 3000A switchgear type arrangements with metal enclosed copper bus sections. Conductors and Buswork used in the design and construction of additions to existing substation facilities will typically match the existing sizes for that substation. Buswork and cables are purchased from the substation packager for each substation project.

JEA uses Aluminum Bus for new substations. Copper Bus exists in older JEA substations. Aluminum Bus used is 2" and 4" with some 3" applications. Copper Bus is in multiple sizes including, but not limited to 1 ½", 2", 3" and 3 ½". Fence posts in JEA substations are 2 ½".

ALUMINUM BUS CONDUCTORS:

Unless otherwise specified, the standard bus for JEA substation design and construction is schedule 40, 6063-T6, seamless aluminum tubing. Below is a list of 20', schedule 40, 6063-T6 Aluminum bus sections kept in JEA Inventory.

BSUAP005 - 1 1/2" IPS	**BSUAP006** - 2" IPS (inactivated in 2014)
BSUAP008 - 3" IPS	**BSUAP010** - 4" IPS
BSUAP011 - 5" IPS	**BSUAP014** - 4" IPS, schedule 80, 6063-T6 Aluminum

The aluminum bus shall conform with the latest revisions of ASTM B-345. The alloy shall have the physical properties or superior to that of aluminum alloy 6063-T6. Copper bus shall meet the latest revision of ASTM B188.

Aeolian dampening cable is used to control vibration in all horizontal runs greater than 8' in length of 2" diameter or larger aluminum bus. The dampening cable is installed unsecured in the bus runs. The standard dampening cable sizes are 795 ACSR for 4" Aluminum Bus and 397.5 ACSR for 2" Aluminum Bus.

Corona-free and watertight welded end covers are required on all exposed ends. Only one (1) bus splice is permitted between any two adjacent supports. Pipe shall be supplied in the mill finish and shall be of uniform quality and temper, sound, and free from injurious defects. The ends of each length of pipe shall be ground smooth. Except for length, variations from the specified dimensions shall not exceed the permissible variations prescribed in ANSI H35.2

Rigid, slip and expansion fittings are required where necessary to permit expansion resulting from ambient temperature variation. Suitable expansion joints or flexible connections are required where necessary to relieve stress from equipment bushings and insulators due to expansion or differential foundation settlement of up to ¼". All 45° or 90° radius bends to 2" or larger copper or aluminum pipe shall be made with prefabricated short radius connectors.

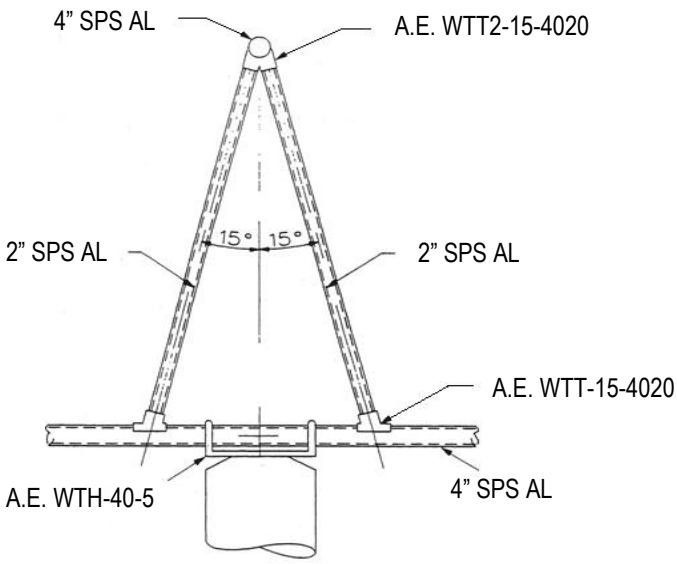
Aluminum bus connections are either field welded or bolted connections. Field welding includes all splice joints, transition points and wherever connectors are required to attach to electrical equipment. Instructions for proper field welding of aluminum bus is provided in this section and included in the JEA substation construction specifications.

Bus spacing and overhead clearances shall comply with JEA standards and the latest revision of ANSI C37.32 and NEMA SG6. All energized equipment and bus are required to be designed within minimum design tolerances as set forth in the NESC and all other applicable standards for phase-phase and phase-ground clearances.

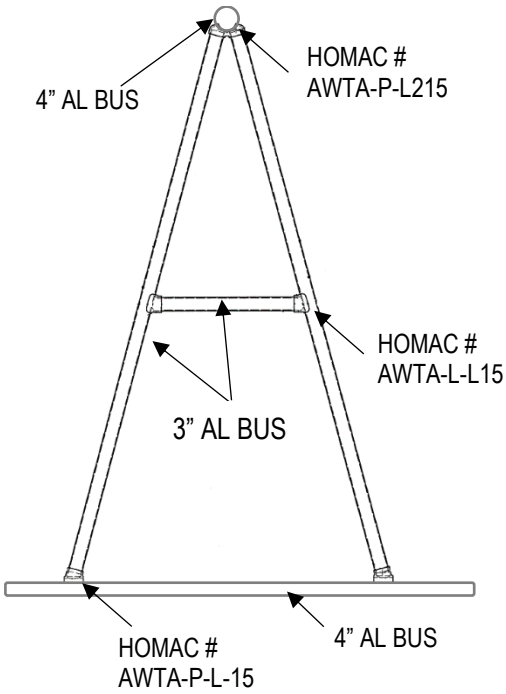
JEA STANDARD SUBSTATION DESIGN CRITERIA								
System Voltage (kV)	Maximum Phase-to-Phase Voltage (kV)	BIL (kV)	*Minimum Metal-to-Metal for Rigid Conductors (inches)	Centerline-to-Centerline Phase Spacing for Rigid Buses (inches)	*Minimum Phase to Grounded Parts for Rigid Conductors (inches)	**Minimum Clearance Above Grade [Between Bare Overhead Conductors and Ground for Personal Safety] (feet)	Minimum Between Bare Overhead Conductors and Roadways Inside Substation Enclosure (feet)	Minimum to Fence Horizontal (feet)
13.2kV	15.5kV	110kV	12”	24”	7”	9’	21’	10’
26.4kV	38kV	200kV	18”	36”	13”	10’	22’	10’
69kV	72.5kV	350kV	31”	60”	25”	11’	23’	12’
138kV	145kV	650kV	63”	96”	50”	13’	25’	14’
230kV	242kV	900kV	89”	132”	71”	15’	27’	16’
*ANSI C37.32; **NESC								

BUS TRANSITION DIAGRAMS

26KV A-FRAME



230KV A-FRAME



STRAIN BUS

A strain bus is defined as a system of conductors and supports which, but for the fact that they lie entirely within the substation boundary, would normally be considered a Transmission Line. Strain bus shall normally be single conductor per phase and shall be provided with all required connectors, including either bolted quad clamp type connectors for mechanical termination (route the current-carrying cable through the clamp to the substation pad termination) or compression type dead end body connectors.

JEA's standard design is to use 954 or 1590 ACSR conductor with a maximum final tension of 20%. Suspension insulators shall be non-ceramic (composite) design with integral corona ring. Jumpers on the Strain bus, if any, shall match the strain bus and overhead shield wires shall be a minimum 3 No. 6 Alumoweld.

All conductor, connectors, hardware and suspension insulators shall match JEA Transmission standard material. Refer to the Transmission Construction Standards Book for further information.

VARIOUS TRANSMISSION SIZE CONDUCTORS USED BY JEA						
JEA ITEM ID #	**CONDUCTOR**	**CODE WORD**	**SIZE**	**STRANDS**	**COMPLETE CABLE DIAMETER (INCHES)**	**USE**
COBSR 001	**ACSR**	Parakeet	556.5	24/7	.914	
COBSR 002		**Cardinal**	**954**	**54/7**	**1.196**	
COBSR 003		Falcon	1590	54/19	1.544	
COBSR 005	ACSS	Cardinal	954	54/7	1.196	
COBAA 020	AAAC	Ames	#2	7	.316	
COBAA 021		Azusa	1/0	7	.398	
COBAA 022		Amherst	3/0	7	.502	
COBAA 023		Alliance	4/0	7	.563	
COBAA 024		Elgin	652	19	.927	
-	**AAC**	**Iris**	**2**	**7**	**.292**	
-		**Oxlip**	**4/0**	**7**	**.522**	
COBAA 025		Tulip	336	19	.665	
COBAA 026		**Orchid**	**636**	**37**	**.918**	**Dampening Cable & Low Side Breaker Jumpers (double)**
COBAA 027		Goldenrod	954	61	1.125	
-		**Magnolia**	**954**	**37**	**1.124**	**High Side Breaker Jumpers (double) & Circuit Switcher Jumpers, Dampening Cable**
COBAA 028		Lupine	2500	91	1.823	
COBAS 005	AW	Shieldwire	3#6		.349	

Approved Manufacturers: Alcan, CME, General, Midal, Nehring, Nexans and Southwire

Refer to Oracle for a complete list of Approved Manufacturers and part numbers.

CONDUCTOR

COPPER BUS CONDUCTORS:

JEA does not use copper bus for any new substation construction. When additions to existing substation facilities that have existing copper bus are required, the design and construction of the addition will utilize Schedule 40 copper tubing.

COPPER CABLE CONDUCTORS:

JEA substation construction typically uses medium hard drawn, stranded copper conductor. In cases where tensile strength is not an issue, soft drawn copper conductor may be used. Refer to Oracle for a complete list of Approved Manufacturers and part numbers.

COPPER CABLE SIZES FOR NEW SUBSTATION CONSTRUCTION				
JEA ITEM ID #	**SIZE**	**TYPE**	**CONSTRUCTION**	**USE**
COBCO025	#6	Soft Drawn (SD)	solid	
COBCO026	#6	Hard Drawn (HD)	solid	
COBCO028	**#4 AWG**	**SD**	**solid**	Grounding Enclosure
COBCO029	#2	HD	solid	
COBCO031	1/0	Medium Hard Drawn (MHD)	7 strand	26kV Arrester Jumper
COBCO032	**4/0**	**MHD**	**7 strand**	PT Jumpers, 69kV Arrester Jumper
COBCO033	**4/0**	**SD**	**7 strand**	
COBCO034	250 KCM	MHD	37strand	
COBCO035	300 KCM	SD	37 strand	
COBCO036	**350 KCM**	**MHD**	**37 strand**	1200A Breaker Jumpers (use double jumpers)
COBCO039	**500 KCM**	**MHD**	**37 strand**	1200A Breaker Jumpers, Power/Auto Xfmr Grounding, 138kV Arrester (use double jumpers)
COBCO040	**750 KCM**	**MHD**	**61 strand**	Breaker and Power/Auto Xfmr Jumpers
COBCO042	1000 KCM	MHD	61 strand	230kV Arrester Jumper

Copper Cable Approved Manufacturers: CME, General, Nehring, Nexans, Phillips and Southwire.

COPPER WELD AND COPPER-COPPERWELD CONDUCTOR*				
JEA ITEM ID #	**SIZE**	**TYPE**	**DESCRIPTION**	**USE**
COBCW010	3#8	30EHS	Copperweld and Copperweld-Copper	
COBCW011	7#10	30EHS	Copperweld and Copperweld-Copper	
COBCW012	3#7	30EHS	Copperweld and Copperweld-Copper	
COBCW013 (Inactive)	3#6	30EHS	Copperweld and Copperweld-Copper	
COBCW014	**#4**	**40% Dead Soft Annealed (DSA)**	**Copperweld and Copperweld-Copper**	Fence Grounding
COBCW015	**19#8**	**40% Soft Annealed (SA)**	**Copperweld**	Ground Grid
COBCW016	**7#5**	**40% Soft Annealed (SA)**	**Copperweld**	Ground Grid

*Copperweld and Copperweld-Copper shall meet or exceed the latest ASTM, AEIC, EEI, NEMA and ICEA specifications and/or testing procedures.

Copperweld Approved Manufacturers: Copperweld (approved for all of the above conductors). AFL and Commscope are approved for only some of the above conductors.

SUBSTATION CONDUCTOR DESIGN CRITERIA

CURRENT CAPACITY DATA		BUS SUPPORT SPAN DATA	
Copper Bus Schedule 40	Amperes 50 Degrees C Rise	MAXIMUM SPAN LENGTHS	
		2-Support Span	3-Support Span
1”		12’	15’
1-1/2”	1600	16’	20’
2”	1980	19’	23’
2-1/2”	2525	21’	26’
3”	3225	24’	30’
3-1/2”	3860	27’	32’
4”	4305	29’	35’
5”	4500	39’	47’
Copper Conductor Size			
1/0	305		
250 MCM	535		
350 MCM	640		
500 MCM	830		
750 MCM	1075		
1000 MCM	1285		

CURRENT CAPACITY DATA		BUS SUPPORT SPAN DATA	
Aluminum Bus Schedule 40	Amperes 30 Degrees C Rise	MAXIMUM SPAN LENGTHS	
		2-Support Span	3-Support Span
2”	1150	22’	28’
2-1/2”	1525	26’	31’
3”	1850	30’	35’
3-1/2”	2100	32’	39’
4”	2450	34’	41’
5”	3150	39’	47’
6”		44’	53’

MINIMUM CORONA FREE CONDUCTOR SIZES	
System Voltage	Conductor Size
13.2kV	#2
26.4kV	#4
69kV	1/0
138kV	250 MCM
230kV	750 MCM

INSULATORS

Outdoor Apparatus Insulators are used in substations primarily to support rigid buswork and other electrical equipment. There are two types of these insulators: Cap and Pin-type and Post type. Cap and Pin are the original substation insulator type and can still be found in some substations. Post type are used in new substation construction. Post type insulators are made of porcelain, polymer or composite.

JEA uses standard strength, porcelain or polymer, solid core station post insulators that are ANSI 70 gray in color and comply with the latest revision of pertinent ANSI, IEEE, and NEMA standards for the majority of substation construction. Refer to ANSI C29.1 and C29.9.

JEA approved manufacturers for insulators are **Lapp, MacLean, Newell, NGK-Locke** and **Victor.**

LOW PROFILE SUBSTATION CONSTRUCTION

JEA uses standard strength, gray porcelain or polymer station post insulators for all new low profile substation construction. High strength insulators are used where unusual cantilever strength or other circumstances require their use in place of the standard strength insulator. The height dimension of the high strength insulator is the same as the standard strength insulator. This allows them to be mixed as necessary with other standard strength insulators.

HIGH PROFILE SUBSTATION CONSTRUCTION

Cap and pin insulators were used in most all high profile substation construction in the past. All new high profile construction and additions to existing facilities is performed with standard gray porcelain or polymer station post type insulators. Substation additions to existing facilities where a cap and pin height requirement must be maintained utilize station post type cap and pin "replacement insulators" for that construction.

POST TYPE INSULATORS

UP TO 69KV

STATION POST INSULATORS

UP TO 230KV

POST TYPE INSULATORS

Nominal System Voltage (kV)	BIL (kV)	Technical Reference (TR) No.	Cantilever Strength (lbs)	Height of stack (inches)	Bolt Circle (inches)	JEA ITEM ID #	Manufacturer #
7.5kV	95	202	4000	7.5”	3”	INSPG202	LAPP # 315202-70; NEWELL # 231001-7001 NGK # PS00910; VICTOR # 1750 MACLEAN # NPP20XG05S
14.4kV	**110**	**205**	**2000**	**10”**	**3”**	**INSPG205**	LAPP # 315205-70; NEWELL # 231002-7001 NGK # PS01110; VICTOR # 1751I MACLEAN # NPP20SG07S
23kV	150	208	2000	14”	3”	INSPG208	LAPP # 315208-70; NEWELL # 231003-7001 NGK # PS01510; VICTOR # 1752 MACLEAN # NPP20XG11S
34.5kV	**200**	**210**	**2000**	**18”**	**3”**	**INSPG210**	LAPP # 315210-70; NEWELL # 231004-7001 NGK-LOCKE # PS02010; VICTOR # 1753I PORCELAIN PRODUCTS # 200SU S & C # 5662-009; MACLEAN # NPP20XG15S
69kV	**350**	**216**	**1500**	**30”**	**3”**	**INSPG216**	LAPP # 315216-70; NEWELL # 231006-7001 NGK # PS03510; VICTOR # 1755 PORCELAIN PRODUCTS # 350SU MACLEAN # NPP20XG27S
138kV	**650**	**288**	**1400**	**54”**	**5”**	**INSPG288**	LAPP # 315288-70; NEWELL # 47802-7001 NGK # PS06510; VICTOR # 17PA21 PORCELAIN PRODUCTS # 650SU MACLEAN # NAA100XH29S0
161kV	750	291	1200	62”	5”	INSPG291	LAPP # 315291-70; NEWELL # 47803-7001 NGK # PS07510; VICTOR # 17PA22 MACLEAN # NAA100XH34S0
230kV	**900**	**304**	**950**	**80”**	**5”**	**INSPG304**	LAPP # 315304-70; NEWELL # 47805-7001 NGK # PS090201; VICTOR # 17PA23 PORCELAIN PRODUCTS # 900SU MACLEAN # P25353070BBSS033
15kV	110	225	4000	12”	5”	INSPG225 (INACTIVE)	LAPP # 315225-70; NEWELL # 41512-7001 NGK # PH01110; VICTOR # 1767 MACLEAN #
23kV	150	227	4000	15”	5”	INSPG227	LAPP # 315227-70; NEWELL # 41515-7001 NGK # PH01510; VICTOR # 1768 MACLEAN # NAA100XH06S
46kV	250	267	4000	24”	5”	INSPG267	LAPP # 315267-70; NEWELL # 41524-7001 NGK # PH02510; VICTOR # 1764 MACLEAN # NAA100XH12S
69kV	350	278	3000	30”	5”	INSPG278	LAPP # 315278-70; NEWELL # 41530-7001 NGK # PH03510; VICTOR # 1765 PORCELAIN PRODUCTS # 350HU MACLEAN # NAA100XH16S
138kV	650	289	2200	54”	5”	INSPG289	LAPP # 315289-70; NEWELL # 47822-7001 NGK # PH06510; VICTOR # 17PA26 PORCELAIN PRODUCTS # 650HU MACLEAN # NAA200XV28S0
230kV	**900**	**308**	**1450**	**80”**	**5”**	**INSPG308**	LAPP # 315308-70; NEWELL # 47825-7001 NGK # PH090201; VICTOR # 17PA28 MACLEAN # P45050068ABSS027 PORCELAIN PRODUCTS # 900HU
230kV	1050	316	1250	92”	5”	INSPG316	LAPP # J-315316-70; NEWELL # 47827-7001 NGK # PH105201; VICTOR # 17PA29; MACLEAN # PORCELAIN PRODUCTS# 117053; TR-316
230kV	900		3000	79”	7”	INSPG31X	LAPP # J-72181A-70
230kV	**900**	**N/A**	**2750**	**80”**	**7”**	(EXTRA HIGH STRENGTH)	LAPP # 314161-70; NEWELL # 47845-7001 NGK-LOCKE # PE90201; VICTOR # 16PA88; MACLEAN #

*Where bus length and design require the substitution of a high strength insulator, the same height as the associated standard strength insulator should be supplied.

CAP AND PIN TYPE REPLACEMENT INSULATORS

In certain substation additions, the matching cap and pin replacement insulator may be specified. The specific Technical Reference (TR) number of the applicable insulator will be given on the Bill of Materials.

CAP AND PIN TYPE REPLACEMENT INSULATORS *								
Nominal System Voltage (kV)	**BIL (kV)**	**Technical Reference (TR) No.**	**Cantilever Strength (lbs)**	**Height of stack (inches)**	**Bolt Circle (inches)**	**Material Type**	**JEA ITEM ID #**	**Manufacturer #**
13.2kV	110	44	4000	10”	5”	Porcelain	INSCG044 (INACTIVE) (HIGH STRENGTH)	LAPP# 315044-70 (CAP AND PIN TYPE)
23kV	150	7	2000	12”	3”	Porcelain	INSPG007	LAPP # 315007-70 NGK # SS01210LG VICTOR # 1748 MACLEAN # NPP20XG09S (SILICONE)
26.4kV	200	10	2000	15”	3”	Silicone	INSSC010	MACLEAN # NPP20XG13S
26.4kV	200	10	2000	15”	3”	Porcelain	INSPG010	LAPP # 315010-70 NEWELL # 47515-7001 NGK # SS02010LG VICTOR # 1746
69kV	350	16	1500	29”	3”	Silicone	INSSC016	LAPP # CP1-029-11-080-A MACLEAN # NPP20XG25S
69kV	350	16	1500	29”	3”	Porcelain	INSPG016	LAPP # 317016-70 NEWELL # 47517-7001 NGK # SB03510; PX0449-GRAY VICTOR # 1589
138kV	650	174	2000	58”	5”	Porcelain	INSPG026 (INACTIVE)	LAPP # J-317174-70 VICTOR # 15PA39
230kV	900	175	1450	72.5”	5”	Porcelain	INSPG175 (INACTIVE)	NGK # 315175-70 Cap Base & 317175-70 Pedestal Base
230kV	1050	176	1170	87”	5”	Porcelain	INSPG176 (INACTIVE)	NGK # 315176-70 Cap Base & 317176-70 Pedestal Base

* The characteristics listed are typical. Refer to manufacturers’ data for actual ratings and additional characteristics.

SUSPENSION INSULATORS

Suspension insulators are used in substations as insulation and support for strain buses. They are composed of porcelain, polymer or glass. Suspension insulators come in different forms to accommodate specific utility requirements:

- Distribution deadend-type suspension insulators can be used at distribution voltages for substation strain buses. They normally have clevis-type connections.
- Conventional suspension insulators are normally used for strain bus insulation at higher voltages and can be furnished with either clevis or ball and socket connections.

Suspension Insulators in a High Profile Substation

The quantity of suspension insulators chosen for a particular application should be large enough to prevent unnecessary flashovers, but not so large that overinsulation occurs which can result in flashovers occurring from phase to phase rather than from phase to ground. The number of insulators should be such that all flashovers occur to ground.

Minimum Quantity of Suspension Insulators		
Nominal System Phase-to-Phase Voltage (kV)	**BIL (kV)**	**Minimum Quantity of Suspension Insulators***
14.4kV	110	2
34.5kV	200	3
69kV	350	5
138kV	650	8
230kV	900	12
230kV	1050	14

*For standard 14.6- x 25.4-centimeter (5 ¾- x 10-inch) suspension insulators.

Additional insulators should be added if the substation site is above 3300 feet or in high contamination areas. An additional insulator is added when deadending on steel structures and one or two insulators are added when the angle from vertical approaches 45 and 90 degrees.

Suspension insulators are tested and categorized with simultaneous mechanical-electrical strength ratings which represent ultimate strengths. The maximum suspension insulator loading should not exceed 40 percent of the mechanical– electrical strength ratings.

The following pages list standard insulator design criteria and insulator cantilever strength requirement calculations used by JEA.

INSULATOR CANTILEVER STRENGTH REQUIREMENT CALCULATIONS

Substation insulators are available in several cantilever strength ratings: Standard Strength, High Strength and Extra High Strength. The standard strength insulators are sufficient for most substation applications. However, short circuit force calculations are performed for each bus design to ensure that the individual application meets or exceeds the strength ratings of the insulators being used.

Use the following equation to calculate the forces exerted on the bus support insulators due to short circuit forces:

$$F = \frac{2.3 \times 5.4 \times I^2}{S \times 10^7}$$

Where: F = Force in lbs. per linear foot of bus
I = 3-phase RMS asymmetrical short circuit current
(or 1.6 x RMS symmetrical current)
S = Bus phase spacing in inches

The above formula applies to both upright and inverted insulator mounting arrangements. It is a standard practice to try to limit the forces expected on insulators to 60% of the published cantilever strength ratings. For insulators mounted horizontally, the forces should be kept below 40% of the published ratings. If the short circuit current is not known, then the momentary rating of the switches or circuit breakers associated with the bus sections can be used.

Below is an example of a bus force calculation for insulators using specific bus design criteria:

INSULATOR CANTILEVER STRENGTH REQUIREMENT CALCULATIONS

EXAMPLE:

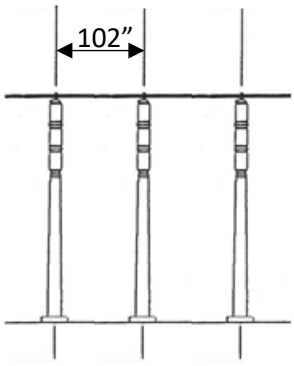
I = 20kA symmetrical
S = 102”
Insulators are 138kV, 650KV BIL, TR#288

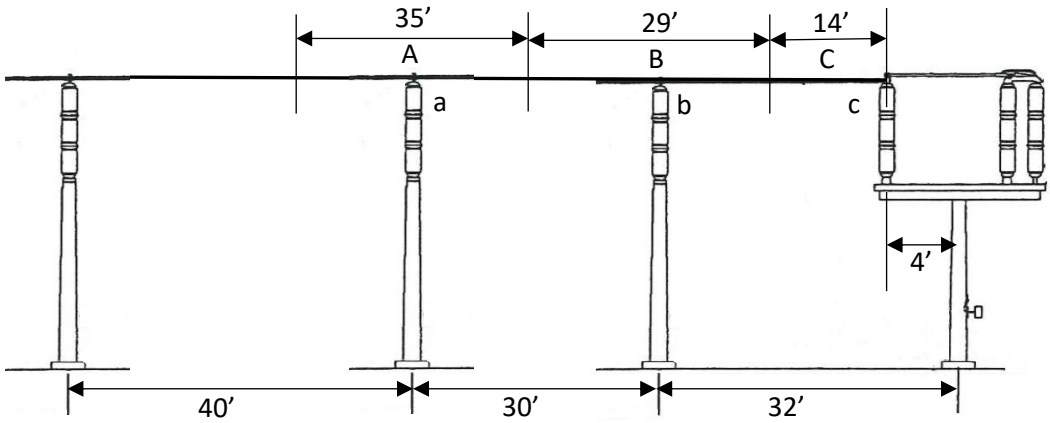
$$F = \frac{2.3 \times 5.4 \times I^2}{S \times 10^7}$$

$$F = \frac{2.3 \times 5.4 \times (1.6 \times 20{,}000)^2}{102 \times 10^7}$$

$$F = \frac{1.27 \times 10^{10}}{1.02 \times 10^9}$$

F = 12.47 lbs/linear foot





INSULATOR CANTILEVER STRENGTH CALCULATIONS

Force exerted on insulators for Bus Section “A” = 12.47 lbs/ft x 35 ft = 436.45 lbs
Force exerted on insulators for Bus Section “B” = 12.47 lbs/ft x 29 ft = 361.63 lbs
Force exerted on insulators for Bus Section “C” = 12.47 lbs/ft x 14 ft = 174.58 lbs

The above example illustrates that the forces exerted on the insulators are well below the standard strength cantilever withstand ability as shown in the “Post Type Insulator” table previously.

DISCONNECT SWITCHES

GENERAL:

Disconnect switches are used in the JEA substations to isolate equipment of sections of bus. There are three types of disconnect switches commonly used in the construction of JEA substations: Group Operated, Hook Stick Operated and Fused. All transmission voltage class disconnect switches are of the group operated type. The distribution bus in a JEA substation commonly utilizes all three types. When remote operation of a switch is required, a motor operator is provided with a group operated switch and remote control wiring is installed to provide the system operations center with full control of that switch.

The group operated switches purchased for substation construction are typically made of aluminum. There are existing group operated switches on the system that are copper. All hook stick operated switches are made of copper. JEA has standardized on transmission voltage class disconnect switches with current ratings of 2000A. The distribution voltage class disconnect switches are rated for 1200A. All switches are required to have silver-to-silver contact points.

GROUP OPERATED DISCONNECT SWITCHES:

The group operated disconnect switches used for substation construction are of the vertical break type and utilize worm gear operating mechanisms. The use of a swing handle for the operation of a group switch is not permitted. All transmission voltage class disconnect switches are group operated type. The only application for group operated disconnect switches in the construction of the 26kV distribution substation are for the separation of the main and transfer bus sections between power transformers.

The 26kV main bus tie switch utilizes two options not normally used on other group operated disconnect switches in JEA substation construction. The switch is provided with a motor operator for remote control by the system operations center. In addition to the motor operator, load break devices are also included on each phase of the switch. This allows the switch to be re-opened after service is restored to the bus section that was out without disruption of service to the customers. Although either device may have applications on transmission voltage class group operated disconnect switches on the JEA system, they are not considered standard equipment.

Ground switches are in use at some existing substations, but generally not installed in new substations. They are installed on the contact end of all transmission voltage class disconnect switches that are used for line terminations at the substation. These ground switches provide a convenient method of grounding the line during planned outages. The ground switches are provided with interlocks to prevent the possibility of both switches being closed at the same time.

SPECIFICATION:

This specification covers the technical requirements for the design and manufacturer of three pole, group operated vertical break or double end break air disconnect switches rated 14.4KV through 230KV, 600A through 3000A continuous current. The switches shall be supplied complete with mounting channels, post-type insulators and control mechanisms, including inter-phase operating pipes, vertical operating pipes, gear devices, outboard bearings and all other parts required to make up the operating mechanisms.

STANDARDS: All equipment and materials shall be designed, manufactured and tested in accordance with the latest edition of all applicable codes and standards (NEMA, ANSI, OSHA and EPA) including but not limited to those listed below. In the event of a conflict between referenced standards and this specification, requirements of this specification shall govern.

ANSI A58.1: Minimum Design Loads for Buildings and Other Structures

ANSI C29.1: Electrical Power Insulators, Test Methods

ANSI C29.9: Wet-Process Porcelain Insulators

ANSI C37.34: Test Code for High Voltage Air Switches

ANSI/ASQ A9000-2000: Quality Management Standards.

ANSI/NEMA MG1: Motors and Generators

STM A153: Zinc Coating (Hot Dip) on Iron or Steel Hardware

NEMA: The switches shall be designed and furnished in accordance with NEMA standards in effect prior to the 1971 revisions. All switches shall be designed for 30° C temperature rise rather than the 53° C currently allowed. For switches that have been tested at 53° C, JEA will consider those as meeting the 30° C as long as they are de-rated a minimum of 27%.

SERVICE CONDITIONS: The switches shall be suitable for use in an ambient temperature range of -30° C to +40° C. The switches, structure, material, fittings and hardware shall be suitable for use in a seacoast marine environment.

SWITCH CONSTRUCTION:

STRENGTH: The mechanical strength of the switch shall be designed to withstand all stresses to which they will be subjected.

DESIGN LIFE: The switch shall be designed for maintenance-free operation in severe environmental and operating conditions with a design life minimum of 40 years. Note that contact replacements shall not be considered defects as long as they last a minimum of 15 years.

CONTACTS: All contacts shall be silver to silver and designed to prevent damage or contact welding under normal and fault conditions. Make-break contacts shall be designed so that wiping action is accomplished with minimum wear and without galling of either contact surface.

MOUNTING: Detailed steel structural drawings will be supplied by purchaser with the request for quotation showing the required mounting position, mounting height and phase spacing of the switches on the request. Manufacturer shall custom engineer the operating mechanism arrangement for each switch to fit its specific structure.

DISSIMILIAR METALS: There shall be no stainless to aluminum connections in moving joints, pivot points or where long term preventive maintenance will be performed. Stainless steel helical inserts are acceptable where stainless steel screws will be used.

BLADE: Blades shall be hard drawn bus copper or aluminum tubing with silver current transfer surfaces having a minimum silver thickness of 0.001".

HINGE ASSEMBLY:

COUNTERBALANCE: All vertical break switch blades rated 69KV and above and 2000 amps and above shall be furnished with counterbalances to provide smooth, thoroughly controlled movements of the blades from the full closed to the full open position and vice versa. The required operating effort to open and close the switch shall not exceed 35 lbs. Counterbalance springs (and plunger where applicable) shall be insulated maintenance-free coated carbon steel or tectile coated steel (stainless steel is acceptable). The housing shall be galvanized steel, bronze, stainless steel, aluminum or UV resistant plastic to protect against dirt and corrosives.

JAW ASSEMBLY:

CONTACTS: The contacts shall be high pressure contacts backed by stainless steel springs located outside of the current path. The design will be a reverse loop or tulip design to provide superior contact during faults. Current transfer shall be via copper contact fingers having silver current transfer surfaces with a minimum of 4-5 mils silver. The contact fingers shall be field replaceable and where applicable, interchangeable with the hinge contact fingers. The jaw for double end break switches shall be designed to allow for substantial deflection without diminishing contact pressure of effectiveness of current transfer.

INTERRUPTING ATTACHMENTS:

ARCING HORNS: Movable and stationary arcing horns suitable for interruption of line charging and transformer magnetizing currents shall be supplied as standard equipment unless the request for quotation specifies that load break interrupters are required. The arcing horn shall be stainless steel or bronze.

INSULATORS:

TYPE: Insulators shall be wet process station post single porcelain units that have an ANSI/IEEE 70 light gray finish. Polymer/composite is also acceptable.

JEA approved manufacturers are Lapp, Maclean, Newell, NGK-Locke and Victor.

The following table lists required insulator ratings:

INSULATOR RATINGS			
VOLTAGE (kV)	MINIMUM BIL (kV)	LEAKAGE DISTANCE (INCHES)	BOLT CIRCLE DIAMETER (BCD)
13.8	110	15”	3”
34.5	200	37”	3”
34.5	200	37”	5”
69	350	72”	3”
69	350	72”	5”
138	650	116”	5”
230	900	165”	5”

At 69KV and below the selection of either 3 inch bolt circle insulators or 5 inch bolt circle insulators will be determined by the switch manufacturer based upon the switch’s requirements for the specific KV and amperage rating required.

JACKING BOLTS: For 69KV switches and above, galvanized steel jacking bolts and hardware shall be provided to level all insulator stacks. Shims are not acceptable for leveling.

BEARINGS: The rotating insulator stack bearing shall be a sealed maintenance free double bearing assembly. Acceptable types shall be stainless steel ball type, bronze ball type, Timken tapered roller type, or sealed automotive ball type as selected by the manufacturer for the KV rating and amperage rating of the switch. All bearing seals shall be rubber or felt – plastic (nylon) is not acceptable.

BASE: The base shall be welded structural steel channel (single or double channel as determined by the manufacturer based on the KV and amperage rating of the switch) and hot dipped galvanized after fabrication. The channel shall be webbed and rolled. Double channel bases may be bolted together after fabrication. The switch base shall be sufficiently rigid to operate properly under all loading conditions without dependence on the supporting structure. All switch bases shall have mounting holes custom punched to fit the support structure upon which they will be installed. Excessive holes for additional mounting options are not acceptable as they tend to decrease the strength of the base. Mounting brackets and other hardware as required for upright horizontal mounting or vertical mounting on substation switch structures shall be provided.

OPERATING MECHANISM: The operating mechanism for the switches shall be defined in the request for quotation and shall be either a manual worm gear operator or a motor operator. The operator shall come complete with all necessary operating rods, attachment hardware, etc. for a complete installation in accordance with the contract drawings. Except for vertically mounted switches, the operating mechanism shall be connected to the B phase with linkages to the A and C

phase. The mechanism shall provide smooth, continuous motion with minimal operating effort suitable for motor or manual operator.

INDICATOR AND LOCKING DEVICE: An all metal OPEN and CLOSED position indicating device shall be provided at or near the operating device. Provisions for padlocking the switch in the OPEN and CLOSED positions shall be provided. Holes shall be ½" minimum.

PIPE (INTER-PHASE, DRIVE and OPERATING): Linkages shall be designed such that they will not deteriorate or become hard to operate with the passage of time. No lubrication, adjustments or maintenance of any kind should be required. The vertical control pipe shall be 1 1/2". All other pipes shall be sized as required by the manufacturer to accommodate the specific installation requirements and to prevent excessive deflection and pipe sag. Where permitted by the structure design the drive pipe shall be connected to the center phase of the switch. All linkage pipe shall be threaded to allow easy adjustments – punched holes are not acceptable. Rod ends and other linkage shall be made from galvanized steel – Cast parts are not acceptable.

CLEVIS: Clevises shall be galvanized steel or high strength silicone bronze. Pin for clevis, flat washer and cotter key shall be stainless steel (303 or 316).

GROUNDING: A flexible tin-plated copper strap with clamp type connectors shall be furnished for connecting the lower end of the vertical operating shaft (rod) to the structure ground. The conductor's current carrying capability shall not be less than 4/0 AWG copper conductor.

OUTBOARD BEARING: The outboard bearing shall be a sealed maintenance free stainless steel bearing or high molecular weight polyethylene bushing. The housing shall be galvanized, bronze, or aluminum.

MANUAL OPERATOR: All switches shall come with a manual worm gear operator with a manufacturer recommended gear ratio and permanently lubricated gears. It shall be adjustable from 90 degrees rotation to 180 degrees rotation and pad-lockable in both the open and closed positions. The operator shall require a maximum operating effort to open or close the switch of 35 lbs. of force. There shall be a minimum of 6" from back of housing to the center-line of the vertical pipe for simplicity of mounting brackets. Coupling shall be as necessary for the manufacturer's designed vertical pipe.

MOTOR OPERATOR:

ENCLOSURE: The enclosure shall be weather tight, NEMA 4X aluminum housing (minimum thickness of 1/8") with stainless steel handle hardware. For ease of access to all components, a removable or hinged top and front access door are required. The handle shall have provisions for a padlock. The bottom shall have plate covered openings for three 2" conduits. The enclosure shall have provisions for grounding the cabinet with a #2 copper conductor. Painted motor operator cabinets are not acceptable. Powder coated aluminum is acceptable.

LIGHTING: Provide a 120V conventional light socket and bulb in the mechanism housing.

MOTOR: The motor shall be a single phase high torque electric motor rated for 125VDC.

HEATER CIRCUIT: Provide a 120V single phase heater with thermostat.

CONTROLS: The motor operator shall be solid state and shall include local/remote selector switch, open-close-stop pushbuttons, reversing contactor and an 8 stage auxiliary switch.

PROTECTION: Provide thermal overload protection for the motor and fused pullouts to protect the motor/ control circuit and the heater circuit.

WIRING: Provide a power terminal block for incoming source supply leads.

HAND CRANK: A manual hand crank (insertion of which shall automatically disconnect the motor circuit) shall be provided and stored on the inside of the cabinet door for security purposes. The unit shall include a de-coupler with manual swing handle - the ability to re-couple in the incorrect position shall be positively prevented.

ADJUSTMENTS: The motor operating mechanism shall be capable of rotational adjustments from 30 degrees to 220 degrees (but shall be factory set with the proper output rotation for the switch it is to operate).

DOCUMENTATION: The unit shall include an instruction book with applicable drawings. A pocket shall be provided on the inside of the front door to store drawings and instruction book.

INTERRUPTERS: Interrupters to provide full load-break capabilities are required on all switches used in buss-tie applications. One interrupter shall be provided per phase.

MISCELLANEOUS:

OPERATOR PLATFORM: All group operated switches shall be supplied with an operator platform as shown on the drawings as “Typical Operator Platform Detail”. The platform may be provided by a third party such as the substation packager. The manufacturer shall provide ground connectors for attaching the platform at one location to the structure and one location to the station ground grid. The platform shall be designed in accordance with recommendations of IEEE-80 pertaining to touch potentials.

MECHANICAL STOPS: Adjustable non-breakable stops shall be provided at both the operating mechanism and the rotating insulators.

TERMINAL PADS: All pads shall be finished on the top and bottom surface to provide a smooth connection point for terminal connectors to transfer current. The pads shall be tin plated 4-hole NEMA pad suitable for bolted aluminum or copper connectors with standard hole spacing of 1 ¾ inches x 1 ¾ inches. Cast pads are not acceptable.

GREASE: All grease shall be high temperature synthetic grease.

DOUBLE END BREAK SWITCHES: These switches may only be used when the completed assembly will require the same spacing as vertical break switches.

SPECIAL REQUIREMENTS FOR ALUMINUM SWITCHES:

CONTACTS: Silver contacts shall be applied to a base of copper and then electro-tin plated or hot dip tinned to prevent the wash of copper salts over aluminum parts. Silver applied directly to aluminum is not acceptable.

STAINLESS STEEL SCREWS: In order to prevent aluminum growth from seizing screws, there shall be no direct interconnection of stainless steel screws to aluminum.

SHIPPING: On switches rated 138KV and below the individual switch phases shall be shipped fully assembled and adjusted on insulators, thus minimizing field installation time required. At 230KV the individual switch phases shall be shipped with the live parts bolted to the switch bases (due to transportation height limitations) and the insulators shipped packaged separately for field installation on the switch phases.

MISCELLANEOUS: The structure/switch shall be provided with a stainless steel nameplate with Aluminum or Stainless steel rivets in a convenient location. The nameplate shall include: Manufacturer Name, Switch type and catalog number, rated voltage, rated continuous and short circuit current, BIL and manufacturer S.O. number or J.O. number.

SWITCH RATINGS: All ratings shall be based on the latest version of ANSI C37.30 and tested in accordance with ANSI C37.34. Minimum ratings are shown below but these ratings shall be exceeded when necessary to accommodate anticipated mechanical or electrical loads.

SWITCH RATINGS					
Operating Voltage (kV)	**Rated Maximum Voltage (rms kV)**	**Full Load Amps (A)**	**Short Circuit (kA)**	**Lightning Impulse - BIL (kV peak)**	**Part Numbers**
34.5	38	2000	61	200	C/P: C06A032G16
34.5	38	3000	100	200	C/P: C06A020G04
69	72.5	1200	61	350	C/P: C06A032G22
69	72.5	2000	70	350	C/P: C06A032G24
138	145	1600	70	650	C/P: C06B033G09
138	145	2000	100	650	C/P: C06B033G10
230	245	1600	70	900	C/P: C06B034G03
230	245	2000	100	900	C/P: C06B034G04

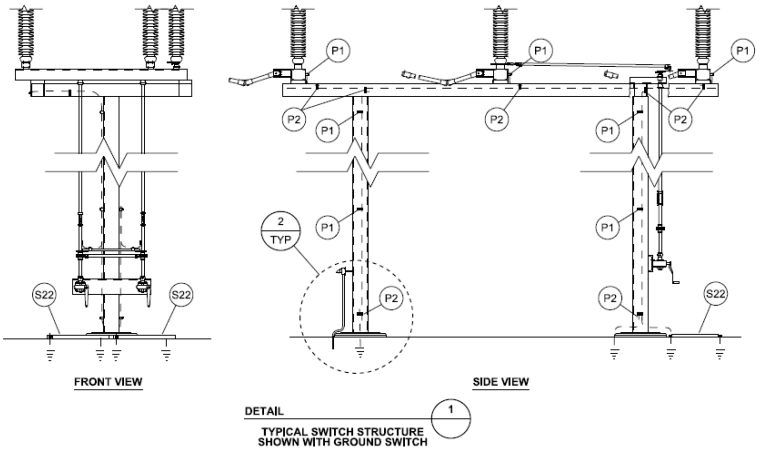
Any group operated switch replacement parts that are listed in Oracle's inventory listing will have SWEGO### as the JEA Item ID #.

APPROVED MANUFACTURERS: The following is a current list of the existing pre-qualified manufacturers and switches:

Cleaveland Price (C/P) –V2-CA

Southern States (SS) – EV-2 Series, (WAG – older version previously used)

TYPICAL SWITCH STRUCTURE AND SWITCH OPERATOR'S PLATFORM

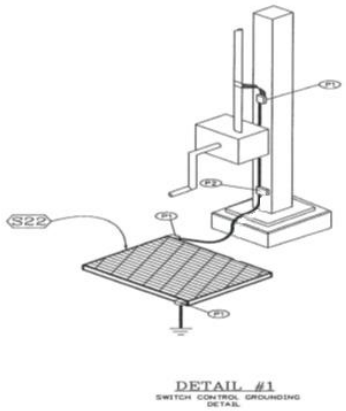


230KV GROUP OPERATED SWITCH

ITEM	DESCRIPTION
	GROUND CONNECTOR, BRONZE BOLTED, 7#5 COPPERWELD CONDUCTOR TO NEMA 2-HOLE PAD, FURNISHED BY THE OWNER.
P1	GROUND CONNECTOR, BRONZE BOLTED, 7#5 COPPERWELD TO FLAT, ANDERSON CATALOG NO. GC-141A-G2 OR EQUAL, FURNISHED BY THE OWNER.
P2	GROUND CONNECTOR, BRONZE BOLTED, TWO (2) 7#5 COPPERWELD TO FLAT, ANDERSON CATALOG NO. GC-143A-GS OR EQUAL, FURNISHED BY THE OWNER.
S22	SWITCH OPERATOR'S PLATFORM, 4' X 6' GALVANIZED STEEL GRATING, FURNISHED BY THE OWNER.

SWITCH NOTES:

1. THE CONTRACTOR SHALL GROUND THE SWITCH OPERATOR PIPE DIRECTLY TO THE SWITCH OPERATOR'S PLATFORM AS SHOWN ON THIS DETAIL,THE SWITCH OPERATOR'S PLATFORM SHALL THEN BE CONNECTED TO THE STATION GROUND GRID.
2. THE CONTRACTOR SHALL CONNECT EACH COLUMN OF THE SWITCH STRUCTURE TO THE STATION GROUND GRID. THE COLUMNS SHALL NOT BE CONNECTED TO THE SAME GRID CONDUCTOR, WHERE POSSIBLE.
3. FOR SWITCHES WITH GROUND BLADE, CONTRACTOR SHALL INSTALL GROUND WIRE UP COLUMN AND CONNECT TO GROUND PAD OF THE GROUND SWITCH AS REQUIRED.



SWITCH OPERATOR HANDLE AND PLATFORM

HOOK STICK OPERATED DISCONNECT SWITCHES

The principle application of hook stick operated disconnect switches for substation construction is in the 26kV distribution buswork. There are some applications for 69kV hook stick operated disconnect switches, but they are not considered a standard in JEA substation construction.

SPECIFICATION:

This Specification covers the electrical characteristics and mechanical features of 26kV and 69kV, hookstick-operated, air disconnect switches with continuous current ratings of 600, 1200 and 2000 amperes.

All hook-operated disconnect switches are to be furnished complete with bases, insulators and terminals. The switch shall be designed, manufactured and tested in accordance with current ANSI, IEEE and NEMA standards.

Current rating shall be based on a 30°C temperature rise. The continuous current (RMS) shall be based on a limit of observable temperature rise as specified in Clause 5 of IEEE standard 37.30, when tested in accordance with Clause 6 of IEEE standard C37.34.

The rated maximum voltage shall be based on dielectric tests in accordance with Clause 4 of IEEE standard C37.34.

The rated peak-withstand currents and rated short-time (symmetrical) withstand currents shall be based on Section 5.5 of IEEE standard C37.30.

Outdoor air switches in either the open or closed position shall withstand the dielectric test voltages between live parts and ground in accordance with ANSI, IEEE and NEMA standards.

Outdoor air switches when new and clean and when tested at the point of manufacture shall be capable of meeting the limits of radio-influenced voltage at the test voltage specified in IEEE standard C37.34, Clause 5, latest revision. The design of the switch including nuts, bolts, pins and other conducting parts shall prevent radio or telephone interference with the switch in either the open or closed position.

Terminal pad drilling for each switch shall consist of standard NEMA 4-hole pad, ground-smooth finished and tin-plated. Transition plates for copper to aluminum connections are not allowed.

Connection to each switch shall be clamp type or weld type connectors to fit the conductor to be attached to the switch. Each connector shall be attached to the switch with a minimum of four stainless steel bolts.

All switches are to be furnished with live parts made of high conductivity copper and the blade of hard drawn high conductivity copper.

Vertical mounted switches shall have blade stops so that the maximum travel of the blade is 90 degrees.

The hinge and blade contact shall be silver plated. The hinge contact shall maintain connection throughout the complete open and close cycle of operation.

Acceptable methods of silver applications with Commercial Purity of 99.90% and a minimum thickness of .010" are:

1) Brazed overlay of fine silver

2) Brazed inlay of fine silver

3) Approved silver flame-spray application (Metco or equivalent), coined.

*No solder shall be employed in the application of silver.

All silver-to-silver contacts shall be made of silver having differing hardness, preferably of two (2) different types of silver applications. Contacts shall be designed so that wiping action is accomplished with minimum wear and without galling of either contact surface. Wear of contacts shall be such that after 1000 operations, the connecting parts will still have adequate surface material to meet electrical nameplate requirements.

Hook stick operated switches shall be furnished with a latch for positive lock-in on closing. Latch position shall be easily seen from ground level. A large hook eye shall be furnished for ease of operation. The blade pry-out mechanism device that imparts an easy opening motion to the switch blade when the operating ring is pulled should be designed such that any downward lever action will apply pressure directly on top of and in line with the insulator stack and also spread the jaw blades.

Hook eye shall be made of stainless steel to prevent any possibility of breaking.

All bolts, pins, nuts, washers and lock washers used on conducting parts shall be stainless steel.

The switch shall be designed such that a reasonable buildup of industrial or salt contaminates shall not prohibit the successful operation of the switch.

The switch shall be designed such that no hinge or jaw spacers are used between the insulator and the blade and hinge assembly.

Each switch shall be equipped with a stainless steel nameplate permanently mounted on base and stamped with the following information: Manufacturer's Name, Manufacturer's Type and Catalog Number, Rated Voltage, Rated Maximum Voltage, Rated Continuous Current, Rated Short Circuit Current, Rated Impulse Withstand Voltage, Manufacturer's S.O. or J.O. Number and Serial Number

The manufacturer shall perform all tests and inspections necessary to show full compliance with this Specification and provide the following test data:

The continuous overload capability in amps of the switch at 0, 10, 20 and 40°C rise above ambient temperature in moving air at 2ft./sec. A maximum hot spot temperature of 90°C at the contacts (jaw or hinge end) shall not be exceeded.

The emergency (six hour) overload capability in amps of the switch at 0, 10, 20 and 40°C rise above ambient temperature in moving air at 2ft./sec. A maximum hot spot temperature of 90°C at the contacts (jaw or hinge end) shall not be exceeded.

Switches shall be shipped completely assembled with insulators unless specified otherwise. Insulators shall be supplied with the switch and shall be of the station post type. The station post insulators shall be porcelain, solid core, ANSI-70 gray in color. JEA Approved Insulator Manufacturers are: Lapp, Newell, NGK-Locke and Victor.

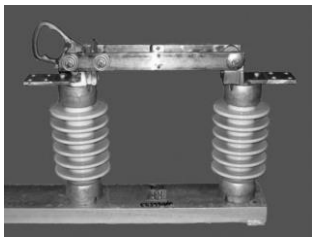
The following is a list of manufacturers and types of hook stick operated disconnect switches approved for use in substation construction:

JEA APPROVED MANUFACTURERS FOR HOOK STICK OPERATED DISCONNECT SWITCHES	
APPLICATION	**MANUFACTURER AND CATALOG #**
34.5kV V-Type (60 Degree Underhung), 1200 Amp, 200kV BIL, @ 30° C rise	USCO: HH6V-03820-SIP3210N
34.5kV V-Type (90 Degree Underhung), 1200 Amp, 200kV BIL, @ 30° C rise	Cleaveland Price: C108A030-G22
34.5kV Standard - 1200 Amp, 200kV BIL Standard, @ 30° C rise	USCO: HH6-03820-SIO3210N Southern States: PBO1-34 Cleaveland Price: C102A230-G16

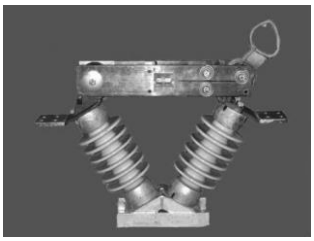
The following table lists frequently used inventory items for the Hook Stick Operated switches:

HOOK STICK OPERATED DISCONNECT SWITCH INVENTORY ITEMS		
JEA ITEM ID#	**APPLICATION**	**MANUFACTURER AND CATALOG #**
	34.5kV V-Type (90 Degree Underhung), 1600 Amp,	Cleaveland Price: C108A030-G22
	34.5kV V-Type (90 Degree Underhung), 1600 Amp, Live Parts Only	Cleaveland Price: C108A030-G22-LP
	34.5kV V-Type (60 Degree Underhung), 1200 Amp, (Complete with Insulators and Mounting Base)	USCO: HH6V-03812-SIP3210N
SWEHO019	34.5kV V-Type (60 Degree Underhung), 1200 Amp, Live Parts Only	USCO: HH6V-03812-LP
SWEHO020	34.5kV, Standard Type, 1200 Amps, Live Parts Only	USCO: HH6-03812-LP Cleaveland Price: C102A175G008-LP Siemens: HPO 860 Southern States: PBO-1341200-LP
SWEHO023	34.5kV, Standard Type, 1200 Amps, 200kV BIL (Complete with Insulators and Mounting Base)	USCO: HH6-03812-SIO3210N Southern States: PBO1-34-1200 Cleaveland Price: C102A230-G16

EXAMPLES ON JEA SYSTEM:



USCO TYPE HH6 SWITCH



USCO TYPE HH6V SWITCH

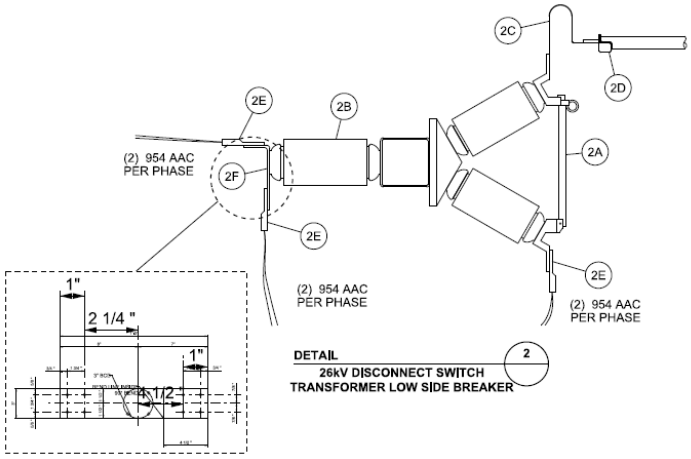
(*https://hubbellpowersystems.cld.bz/USCO-Power-Switches/45#45)*

Below are examples of hook disconnect switches in use on the JEA system. These examples are for reference purposes only. Refer to the Project Design drawings for specific project related details.

BILL OF MATERIAL
26KV DETAIL 2

ITEM NO.	UNIT QTY.	DESCRIPTION
2A	1	34.5KV H.S. DISCONNECT SWITCH
2B	1	34.5KV STATION POST INS.-TR210
2C	1	2" AL. EXPANSION 4-HOLE TERMINAL
2D	1	2" IPS AL. TO 4-HOLE PAD
2E	5*	(2) 954 AAC TO 4-HOLE PAD
2F	1	3/8" CU. FLAT BAR (AS DETAILED BELOW)

*QUANTITY INCLUDES BREAKER TERMINALS

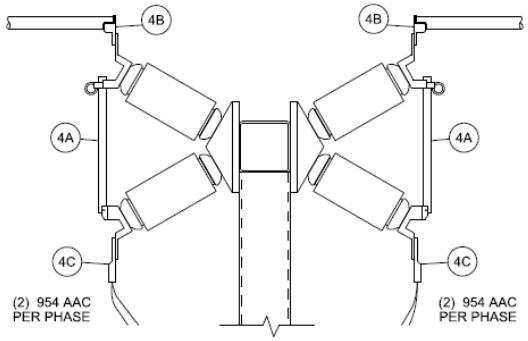


DETAIL 2
26kV DISCONNECT SWITCH
TRANSFORMER LOW SIDE BREAKER

BILL OF MATERIAL
26KV DETAIL 4

ITEM NO.	UNIT QTY.	DESCRIPTION
4A	2	34.5KV H.S. DISCONNECT SWITCH
4B	2	2" IPS AL. TO 4-HOLE PAD, 90°
4C	4*	(2) 954 AAC TO 4-HOLE PAD

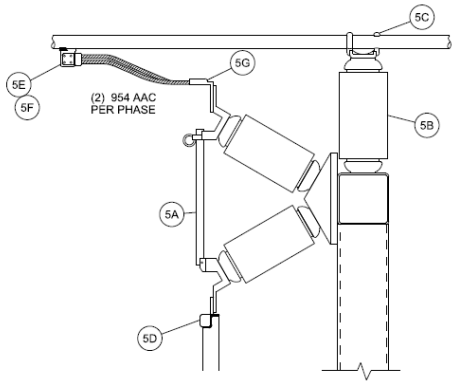
*QUANTITY INCLUDES BREAKER TERMINALS



DETAIL 4
26kV DISCONNECT SWITCH
FEEDER BREAKER

BILL OF MATERIAL
26KV DETAIL 5

ITEM NO.	UNIT QTY.	DESCRIPTION
5A	1	34.5KV H.S. DISCONNECT SWITCH
5B	1	34.5KV STATION POST INS.-TR210
5C	1	2" AL. BUS SUPPORT CLAMP
5D	1	2" IPS AL. TO 4-HOLE PAD, CENTER FORMED
5E	1	2" IPS AL. TEE TO 4-HOLE PAD
5F	1	(2) 954 AAC TO 4-HOLE PAD
5G	1	(2) 954 AAC TO 4-HOLE PAD, 90°



DETAIL 5
26kV DISCONNECT SWITCH
TRANSFER BUS TIE

FUSED DISCONNECT SWITCHES

The fused disconnect switches are used for the protection of station service transformers and potential transformers on the 26kV distribution bus within the substation. This is the only application of these type switches within the substation construction standards. As with the 69kV hook stick operated switches, there are limited applications of 69kV fused disconnect switches, but they are not considered a standard for JEA substation construction. The fused disconnect switch provides protection from faults and a means of isolation for repair or replacement of the equipment.

JEA has standardized on the S&C type SMD-40 fused disconnect switches. The SMD-40 is an expulsion type power fuse that is provided with a snuffler device to disperse fuse debris during operation. This provides the necessary safety requirements in the unlikely event that fuse operation occurs while personnel are standing near the device.

The fused disconnect switches used for station service and potential transformer application, shall be 26kV, 150kV BIL, S&C Electric Company, type SMD-40, catalog number 192323-SP-Z5 with 34.5-kV NEMA TR-210 Insulators.

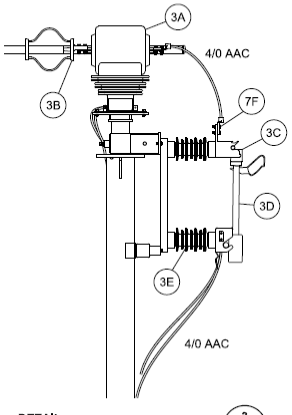
The associated S&C Electric Company type SMU-40 Power Fuse Units shall be as follows and provided with tin-plated copper terminals:

FUSED DISCONNECT SWITCH INVENTORY ITEMS		
JEA ITEM ID #	**APPLICATION**	**MANUFACTURER AND CATALOG #**
FUSHO026	26kV SMD-40 Switch Parts – Mounting less insulators including fuse-unit end fittings w/silencer, tinned terminal pads. **Used on 26kV PTs & Station Service & VBMs**	S&C # 192323-S103
FUSSU199	26kV PT Fuse, 1E amp, SMU-40, TCC115-2	S&C # 823001
FUSSU200	SS Transformer Fuse, 5E amp, SMU-40, TCC 153-2 (use: 25kVA and 50kVA Transformers operated at 26kV)	S&C # 823005
FUSSU201	SS Transformer Fuse, 10E amp, SMU-40, TCC 153-2 (use: 75kVA and 100kVA Transformers operated at 26kV)	S&C # 823010
	15E amp, SMU-40, TCC 153-2	S&C # 823015
FUSSU020	20E amp, SMU-40, TCC 153-2	S&C # 823020

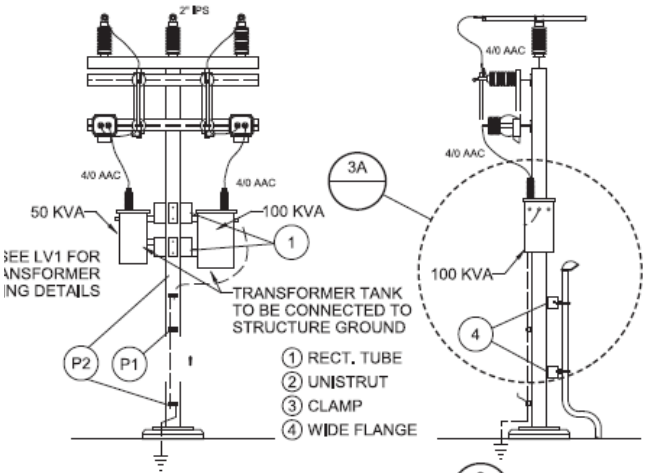
Below are examples of fused disconnect switches in use on the JEA system. These examples are for reference purposes only. Refer to the Project Design drawings for specific project related details.

BILL OF MATERIAL 26KV DETAIL 3		
ITEM NO.	UNIT QTY.	DESCRIPTION
3A	1	CT, 34.5KV, WINDOW TYPE WITH BAR INSTALLED, DRYE TYPE
3B	1	TERMINAL WELDED, AL 2" SPS AL. TUBE, 4 HOLE 3" PAD, EXPANSION
3C	1	26KV FUSED DISCONNECT SWITCH, 150KV BIL
3D	1	26KV FUSE UNIT (VARIOUS SPEEDS)
3E	2	34.5KV STATION POST INS.-TR210
3F	3	4/0 AAC TO 2-HOLE PAD

*STATION SERVICE ONLY REQUIRE Aø & Cø, BUT Bø BUSWORK TO BE INSTALLED.

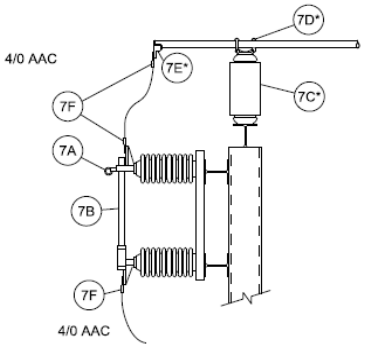


DETAIL 3
26kV FUSED DISCONNECT STATION SERVICE

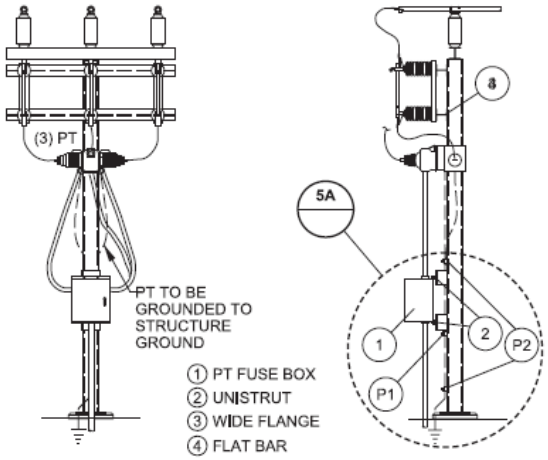


DETAIL 3
STATION SERVICE XFMRS MOUNTING & GROUNDING

BILL OF MATERIAL 26KV DETAIL 7		
ITEM NO.	UNIT QTY.	DESCRIPTION
7A	1	26KV FUSED DISCONNECT SWITCH, S&C SMD-40
7B	1	26KV FUSE UNIT (VARIOUS SPEEDS), S&C SMU-40
7C	1	34.5KV STATION POST INS.-TR210
7D	1	2" AL BUS SUPPORT CLAMP
7E	1	2" IPS AL. TO 4-HOLE PAD, 90°
7F	3	4/0 AAC TO 2-HOLE PAD

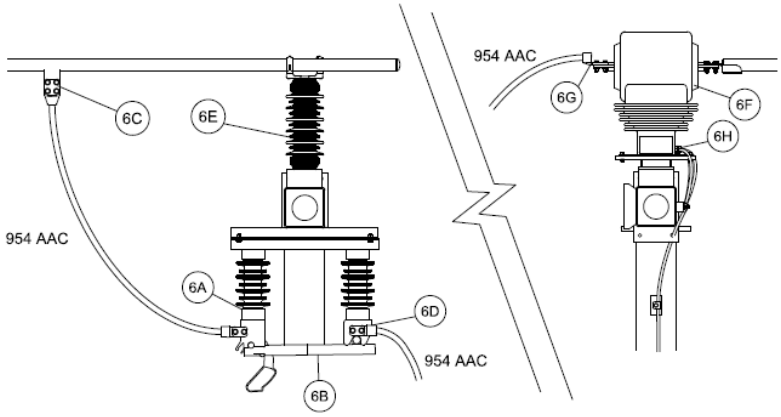


DETAIL 7
26kV FUSED DISCONNECT PTs

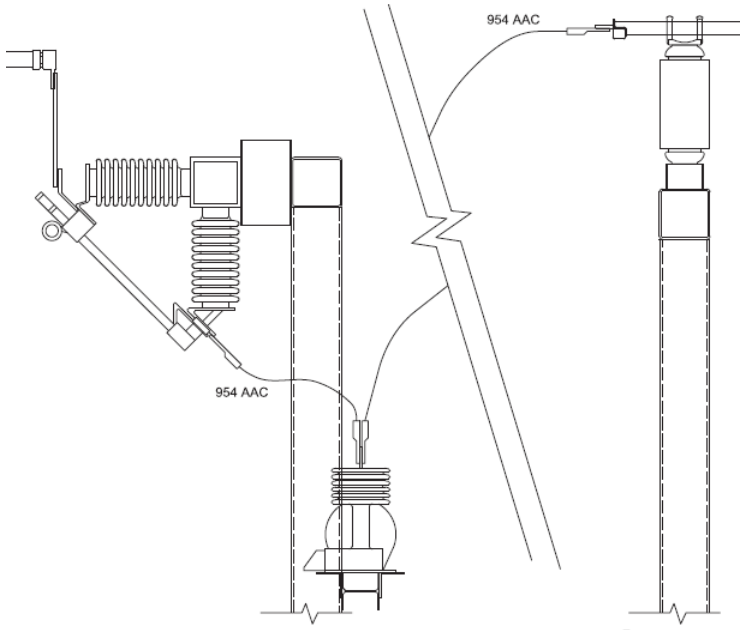


DETAIL 5
27 KV PT FUSE STAND PT MOUNTING DETAIL

BILL OF MATERIAL 26KV DETAIL 6		
ITEM NO.	UNIT QTY.	DESCRIPTION
6A	1	26KV FUSED DISCONNECT SWITCH
6B	1	MD-20 POWER FUSE, INVERTED
6C	2	2" IPS AL. TEE TO 4-HOLE PAD
6D		TERMINAL, 954 AAC TO 2HOLE PAD, WELDED
6E	1	34.5KV STATION POST INS.-TR210
6F	1	CT, 34.5KV, WINDOW TYPE WITH BAR INSTALLED, DRYE TYPE
6G	1	TERMINAL WELDED ALUMINUM,954 AAC ACSR TO 4-HOLE PAD
6H	1	BRONZE TAP LUG TERMINAL, CABLE TO FLAT

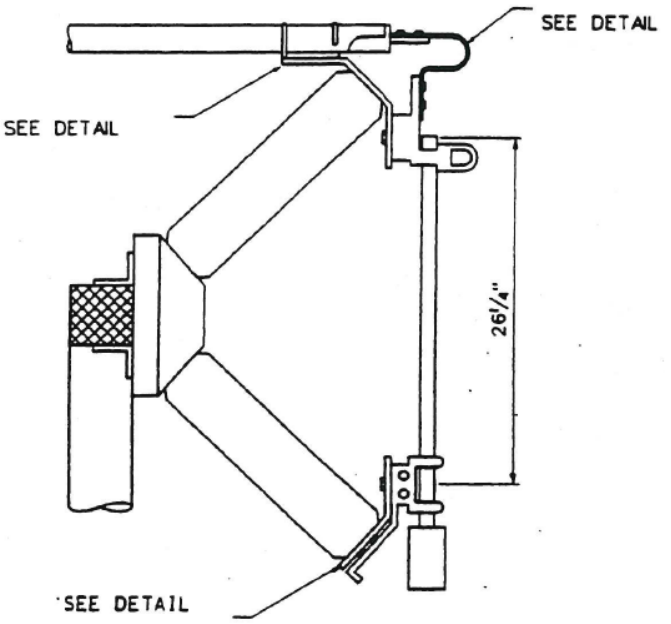


DETAIL 6
26kV DISCONNECT SWITCH
CAP BANK VBM CONTROLLER

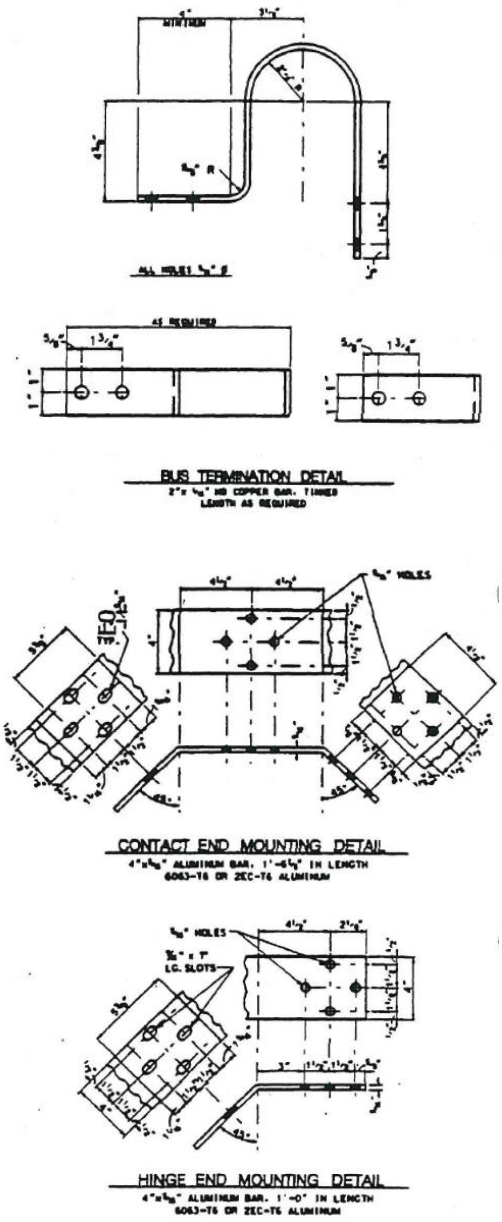


DETAIL 6
26kV DISCONNECT SWITCH
CAP BANK VBM CONTROLLER

FUSED DISCONNECT SWITCH DETAIL



ITEM	DESCRIPTION
1.	DISCONNECT SWITCH, FUSED, HOOK STICK OPERATED, S&C ELECTRIC COMPANY TYPE SMD-40, 25KV, 150KV BIL CATALOG NUMBER 192323-Z1
2.	INSULATOR, STATION POST, 34.5KV, 200KV BIL, ANSI GRAY 70, 3" BOLT CIRCLE, NEMA TR210
3.	POWER FUSE, S&C ELECTRIC COMPANY TYPE SMU-40



REVISED: DESIGNED BY: C.H.S. APPROVED BY: DATE: 8-15-95

CONSTRUCTION

CAPACITOR BANKS

The efficiency of power generation, transmission and distribution equipment is dependent on operating equipment at a unity (1.0) power factor. Because capacitors act as reactive current generators, they are used to improve power factor, reduce system losses, and increase voltage level at the load. Capacitor banks are typically switched on and off during load cycles as necessary.

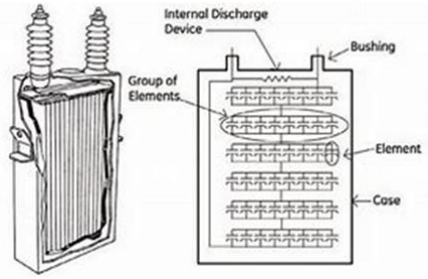
The capacitor bank shall be designed, manufactured, assembled, installed, and tested in accordance with the latest applicable ANSI/IEEE, NEMA, and ASTM standards, in addition to the ASME code for unfired pressure vessels. The materials used for the manufacturing of the capacitor bank shall be new and 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.

Grounded capacitor bank systems shall be equipped with phase imbalance detection utilizing a tap Potential Transformer. Ungrounded capacitor bank systems shall be equipped with neutral imbalance detection.

The Elevating Substructure shall be an Open Rack Assembly. The manufacturer shall furnish substructures that will elevate the capacitor racks a minimum of eight (8) feet above the ground. Grounded transmission (rated above 34.5kV) capacitor units shall be fuseless and ungrounded transmission capacitor units are fused. Base and stack insulators shall be high strength station post “sky gray” porcelain.

The manufacturer shall furnish all necessary racks, shelves, superstructures, bus work, insulators, connections, terminals and hardware. All external hardware such as nuts, bolts, washers, hinges, door handles, etc., shall be stainless steel type 316. Any tools required for installation and maintenance of the capacitor bank, as well as, a can of touch-up paint of the same color as the capacitors shall be furnished by the Manufacturer. Any necessary instrument transformers for proper operation of the controls shall be furnished and they shall be suitably protected by means of arresters, protector tubes, or gaps, as required.

Refer to the technical specifications and approval drawings for further technical and equipment information for specific substation capacitor banks.



Typical High Voltage Capacitor Unit

245KV CAPACITOR BANK

Capacitor Banks are typically ordered through the steel packager for new substations.

The current approved manufacturers are Cooper Eaton and GE.

All drawings shown are for reference only. Refer to the Substation Project drawings for specific details.

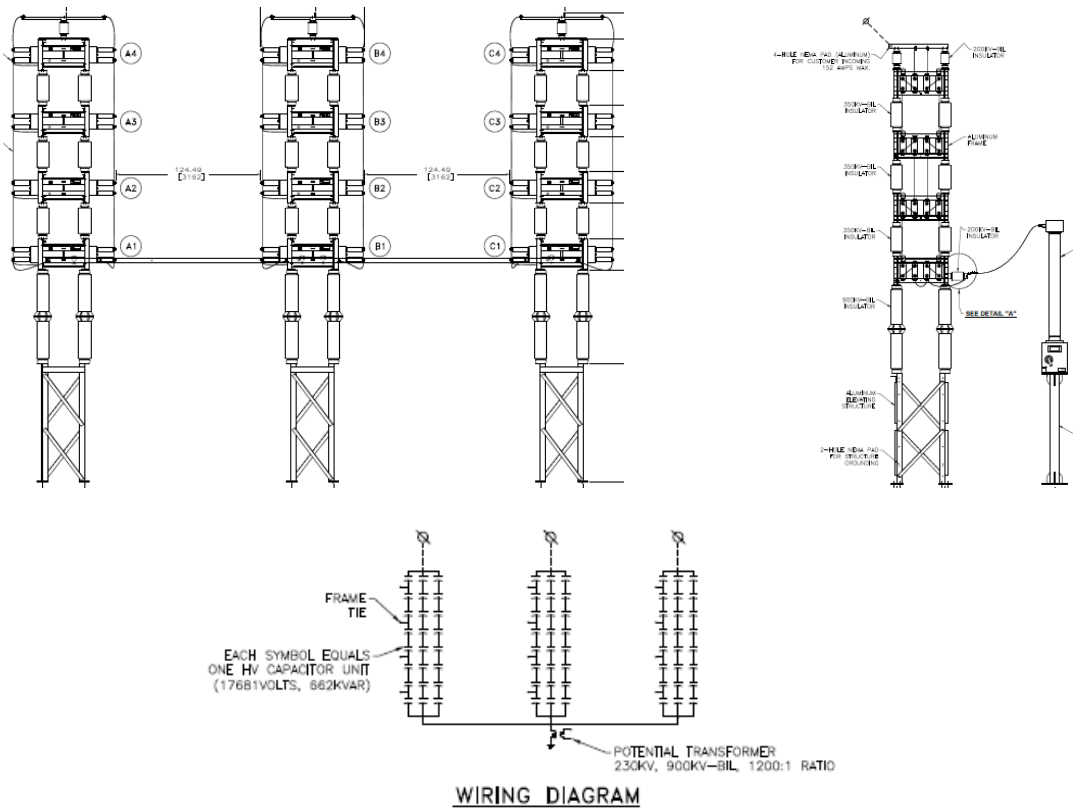
High Voltage UnGrounded Wye Capacitor Banks:

In recent discussions, JEA prefers Ungrounded banks for the High Voltage Capacitor Banks. JEA has had good operational history of ungrounded banks on the Transmission System.

Some substations that have ungrounded banks are Beeghly, Craven Rd, Dillon, Firestone, Greenland, Kennedy, Normandy, Phillips, Starratt and Southside GIS.

Item 1 - One (1) 42MVAR, 245KV, 60Hz, 900kV BIL, 3-phase outdoor shunt capacitor bank assembly. The capacitor bank shall be connected ungrounded single wye. Each capacitor bank shall comprise 84 individual 662kVAR, single-phase, 17.681kV, single bushing, 150kV BIL capacitors. Each phase shall consist of three (3) parallel connected strings with eight (8) series capacitor units per string. The capacitor bank shall be capable of 42MVAR at an operating voltage of 230kV.

Each capacitor bank assembly shall be equipped with neutral imbalance detection consisting of a 230kV potential transformer.

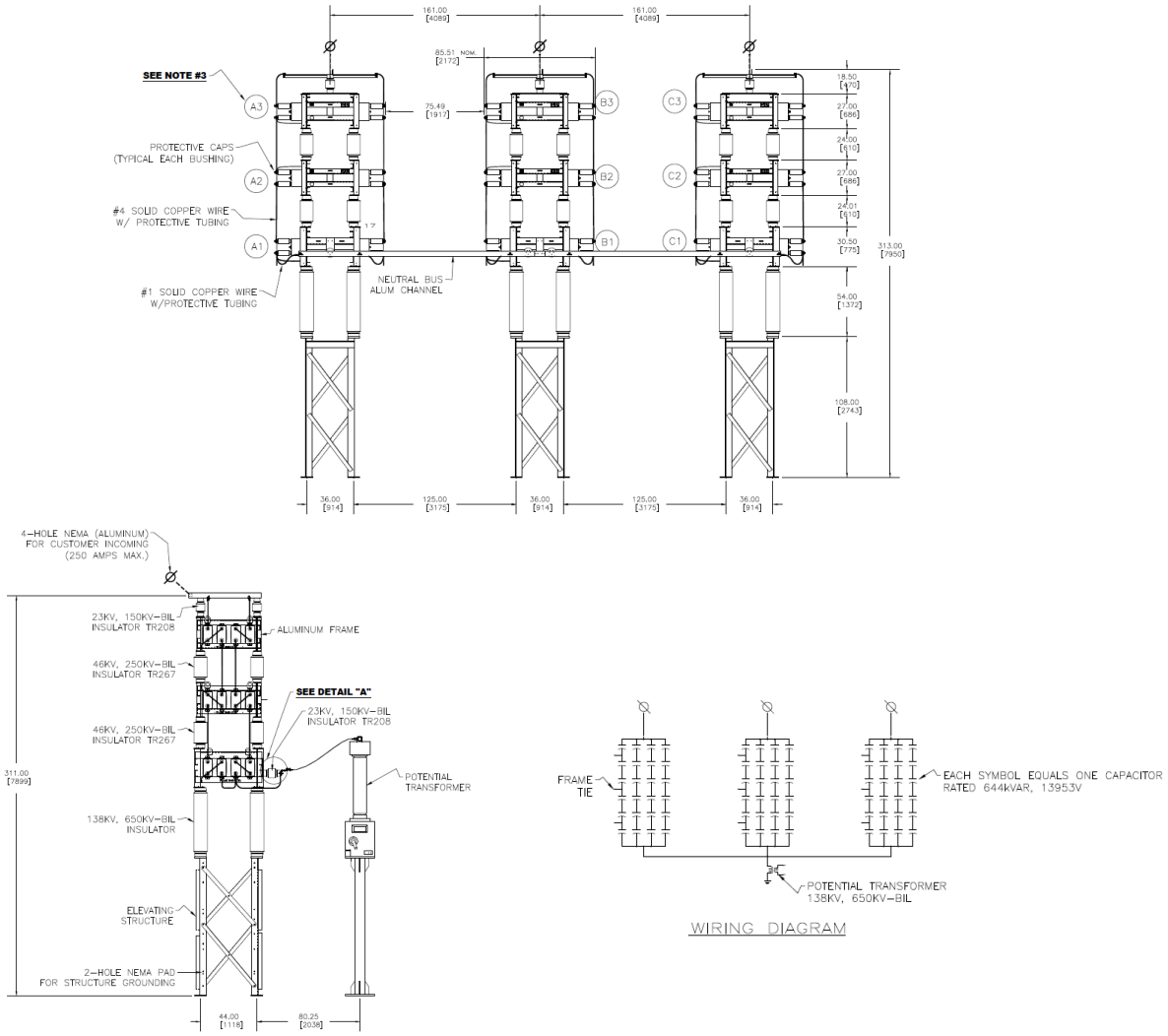


230KV UNGROUNDED CAPACITOR BANK DETAIL

*These drawings are for reference purposes only. Refer to Project Drawings for specific details.

Item 2 - One (1) 42MVAR, 145KV, 60Hz, 650kV BIL, 3-phase outdoor shunt capacitor bank assembly. The capacitor bank shall be connected ungrounded single wye. Each capacitor bank shall comprise 72 individual 644kVAR, single-phase, 13.953kV, single bushing, 150kV BIL capacitors. Each phase shall consist of four (4) parallel connected strings with six (6) series capacitor units per string. The capacitor bank shall be capable of 42MVAR at an operating voltage of 138kV.

Each capacitor bank assembly shall be equipped with neutral imbalance detection consisting of a 138kV potential transformer.

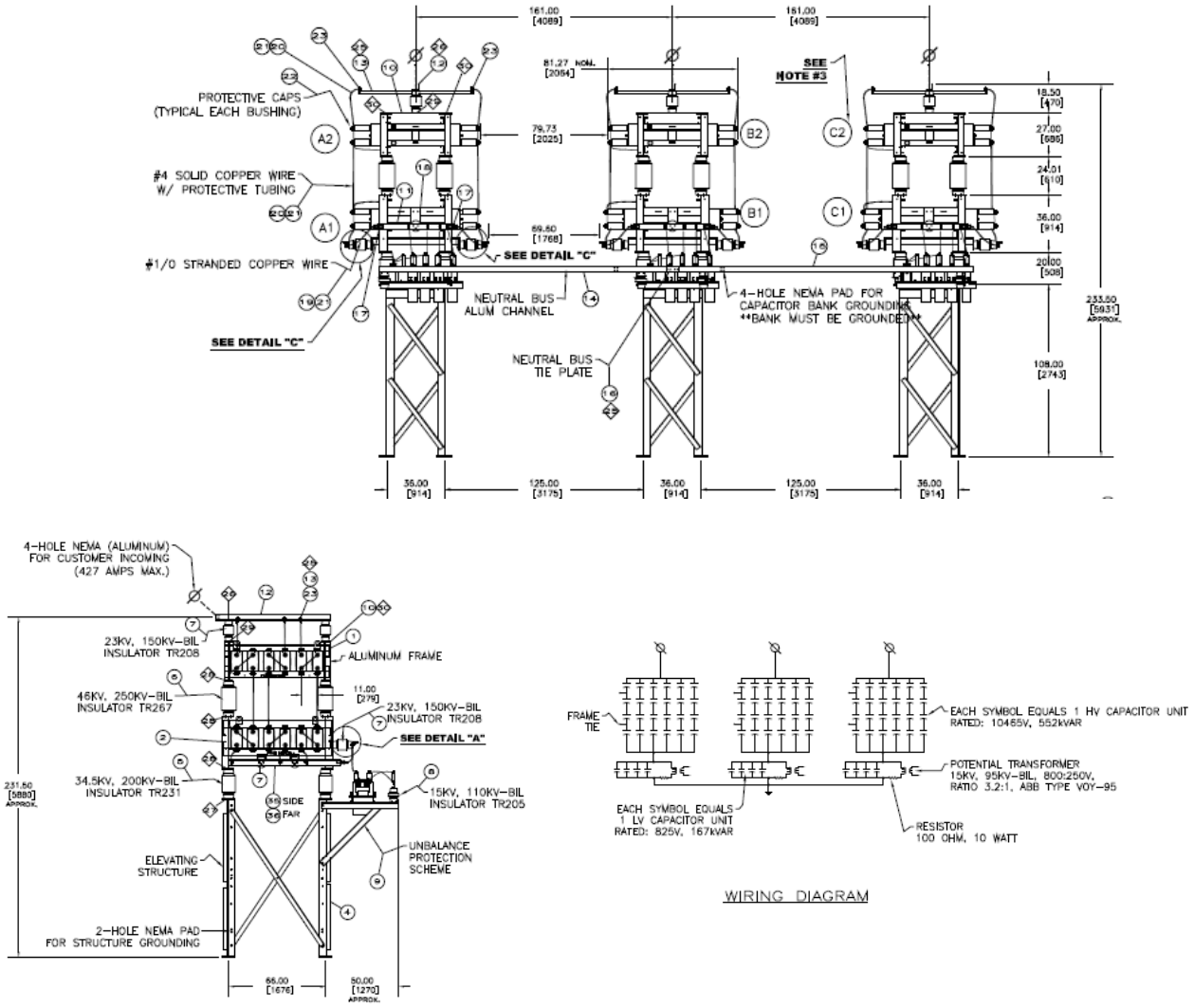


138KV UNGROUNDED CAPACITOR BANK DETAIL

*These drawings are for reference purposes only. Refer to Project Drawings for specific details.

Item 3 - One (1) 36MVAR, 72.5KV, 60Hz, 350kV BIL, 3-phase outdoor shunt capacitor bank assembly. The capacitor bank shall be connected ungrounded single wye. Each capacitor bank shall comprise 72 individual 552kVAR, single-phase, 10.465kV, single bushing, 150kV BIL capacitors. Each phase shall consist of four (4) parallel connected strings with six (6) series capacitor units per string. The capacitor bank shall be capable of 36MVAR at an operating voltage of 69kV.

Each capacitor bank assembly shall be equipped with neutral imbalance detection consisting of a 69kV potential transformer.



69KV UNGROUNDED CAPACITOR BANK DETAIL

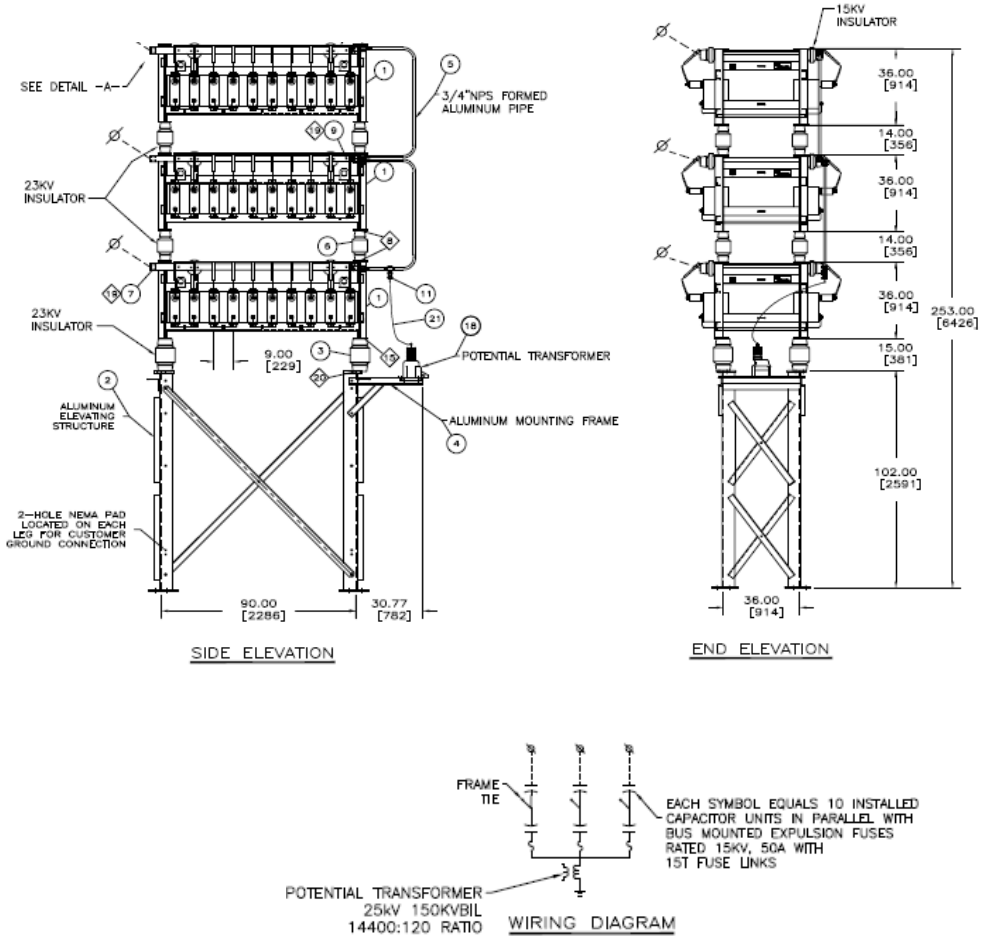
*These drawings are for reference purposes only. Refer to Project Drawings for specific details.

Medium Voltage Ungrounded Wye Capacitor Banks:

The general specification for the medium voltage ungrounded capacitor bank is as follows:

Outdoor, externally fused, shunt capacitor bank, rated 6MVAR @27.57KV-LL, 3 Phase, 60Hz, connected ungrounded Wye with the following:

A. 3 Racks, Welded Aluminum Fuse Bus and Station Post Fuse Bus Insulators
B. 60 Capacitor Units, 100KVAR, 7960 Volt, 1 Bushing (12" Creepage), 60HZ W/95KVBIL Insulation, Type EX-&L
C. 60 Copper Type Expulsion Fuse Assembly
D. 8 Stacking Insulators between Frames, 150KVBIL
E. 4 Base Insulators
F. 1 Marine Grade Cap Bank Elevating Structure, 96"
G. 1 Potential Transformer, Double Bushing, 25KV, 150KV BIL, 120:1



27.57 KV UNGROUNDED CAPACITOR BANK DETAIL

*These drawings are for reference purposes only. Refer to Project Drawings for specific details.

High Voltage Grounded Wye Capacitor Banks:

JEA has a number of substations with grounded banks. Some substations with grounded banks are Bartram, Ft. Caroline, Robinwood and SJRPP

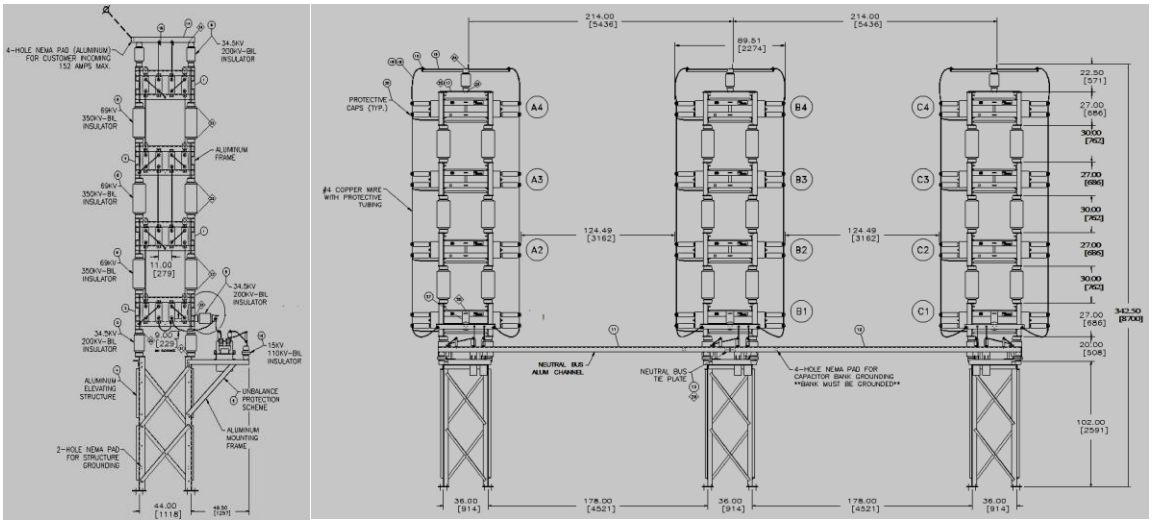
All banks are 3 phase outdoor shunt assembly and connected in a grounded single wye.

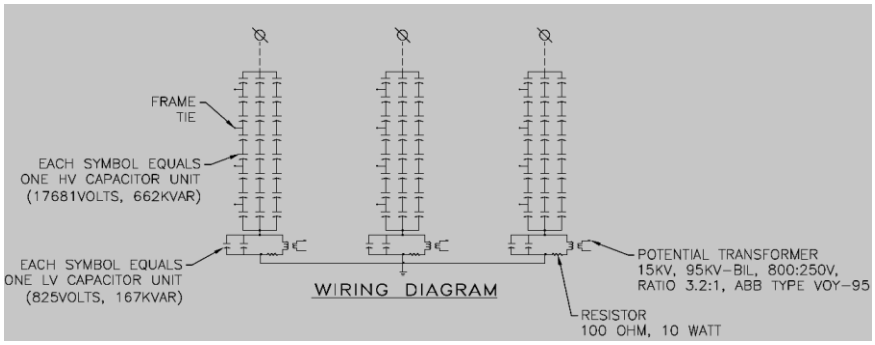
Item 1 - One 47.7MVAR, 245 KV, 60Hz, 900kV BIL, 3-phase outdoor shunt capacitor bank assembly.

Each capacitor bank shall comprise 72 individual 662kVAR, single-phase, 17.681kV, double bushing, 125kV BIL capacitors and 2 individual 167kVAR, single-phase, 825V, double bushing for each phase tap.

Each phase shall consist of three (3) parallel connected strings with eight (8) series capacitor units per string and 2 units in each phase tap.

The capacitor bank shall be capable of 42MVAR at an operating voltage of 230kV.





245KV GROUNDED CAPACITOR BANK DETAIL

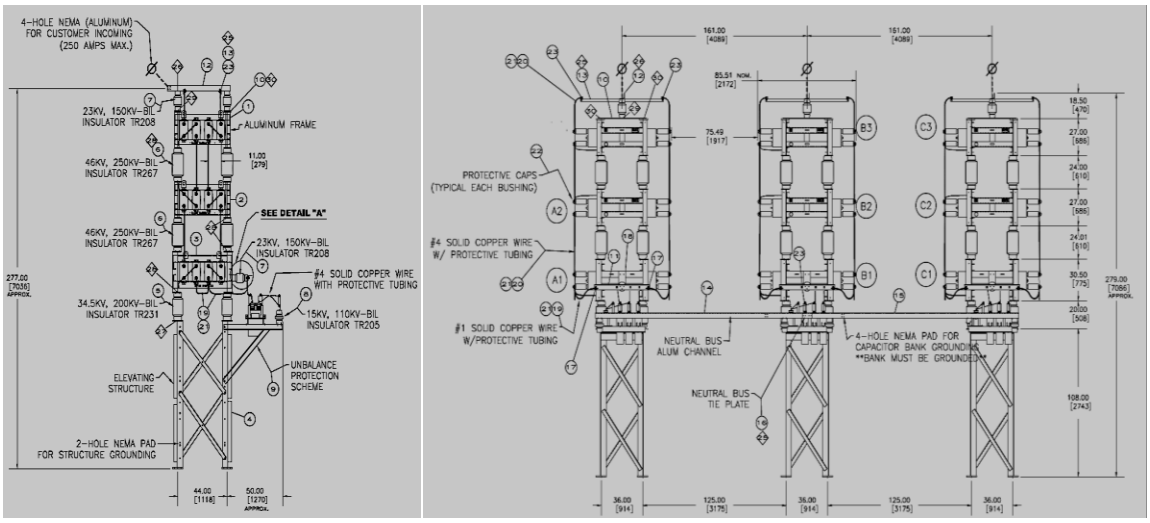
*These drawings are for reference purposes only. Refer to Project Drawings for specific details.

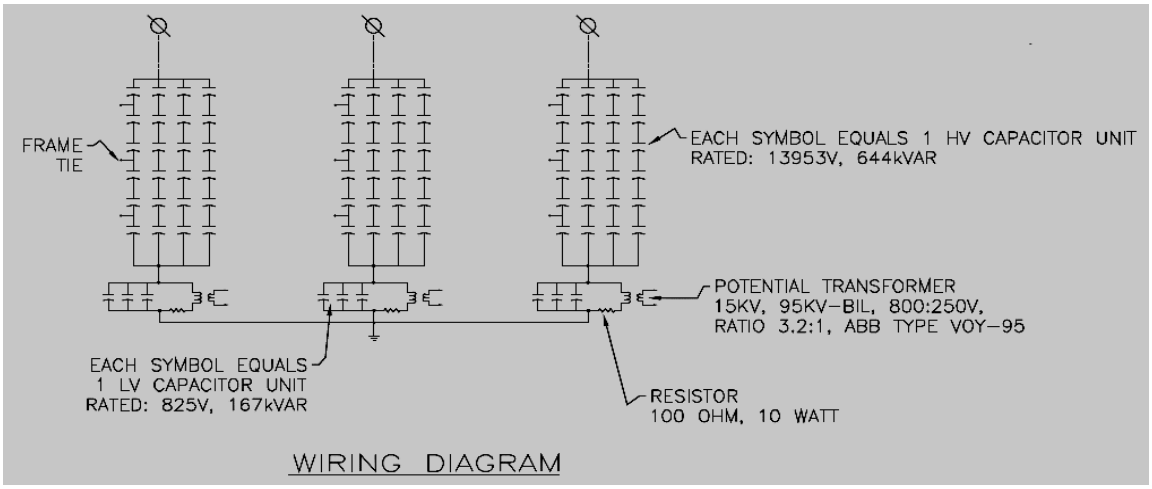
Item 2 - One 46.4MVAR, 145KV, 60Hz, 650kV BIL, 3-phase outdoor shunt capacitor bank assembly.

Each capacitor bank shall comprise 72 individual 644kVAR, single-phase, 13.953kV, double bushing, 125kV BIL capacitors and 3 individual 167kVAR, single-phase, 825V, double bushing for each phase tap.

Each phase shall consist of four (4) parallel connected strings with six (6) series capacitor units per string and 3 units in each phase tap.

The capacitor bank shall be capable of 42MVAR at an operating voltage of 138kV.





145KV GROUNDED CAPACITOR BANK DETAIL

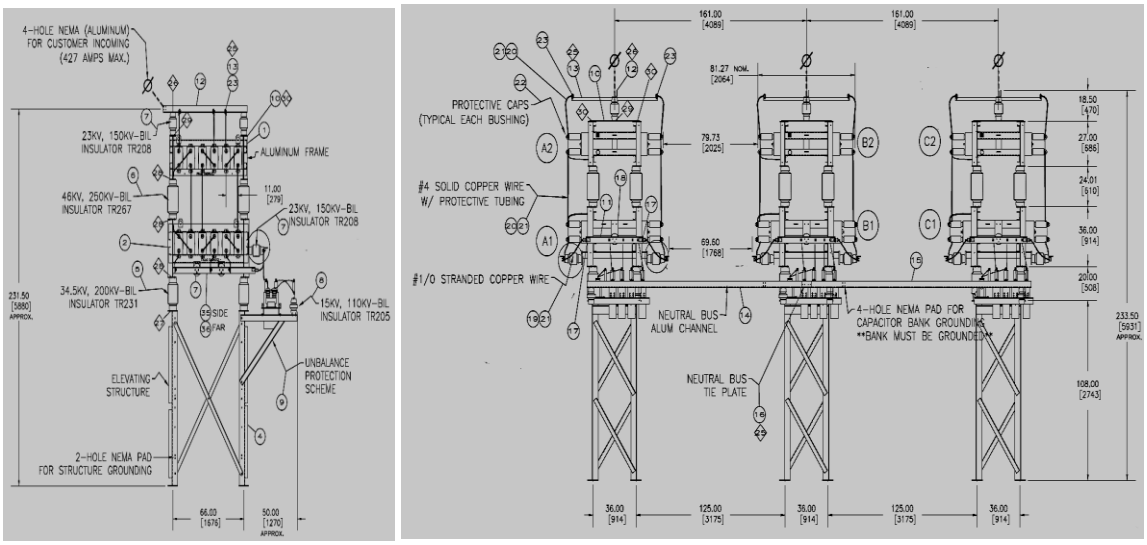
*These drawings are for reference purposes only. Refer to Project Drawings for specific details.

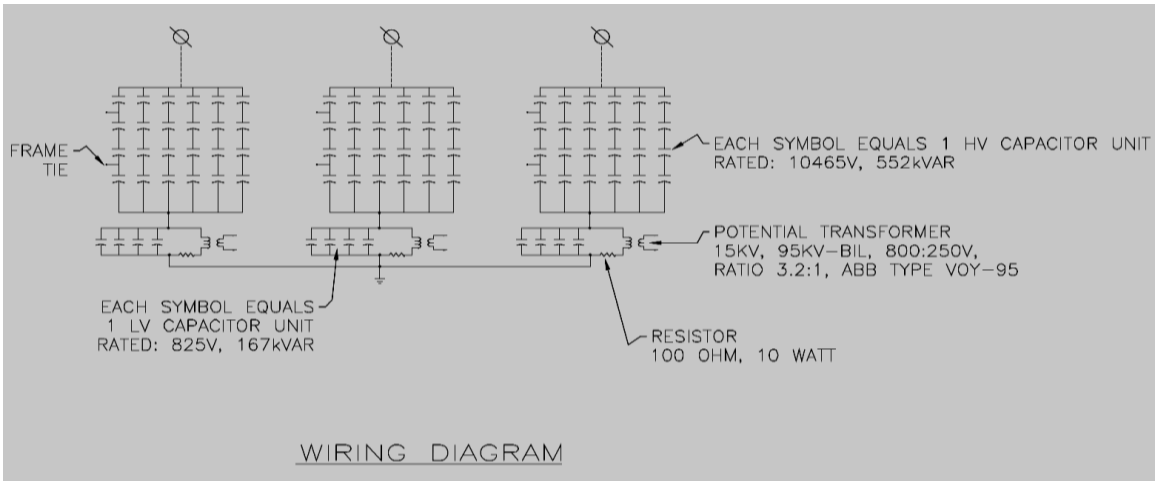
Item 3 - One 39.7MVAR, 72.5KV, 60Hz, 350kV BIL, 3-phase outdoor shunt capacitor bank assembly.

Each capacitor bank shall comprise 72 individual 552kVAR, single-phase, 10.465kV, double bushing, 125kV BIL capacitors and 4 individual 167kVAR, single-phase, 825V, double bushing for each phase tap.

Each phase shall consist of six (6) parallel connected strings with four (4) series capacitor units per string and 4 units in each phase tap.

The capacitor bank shall be capable of 36MVAR at an operating voltage of 69kV.





72.5KV GROUNDED CAPACITOR BANK DETAIL

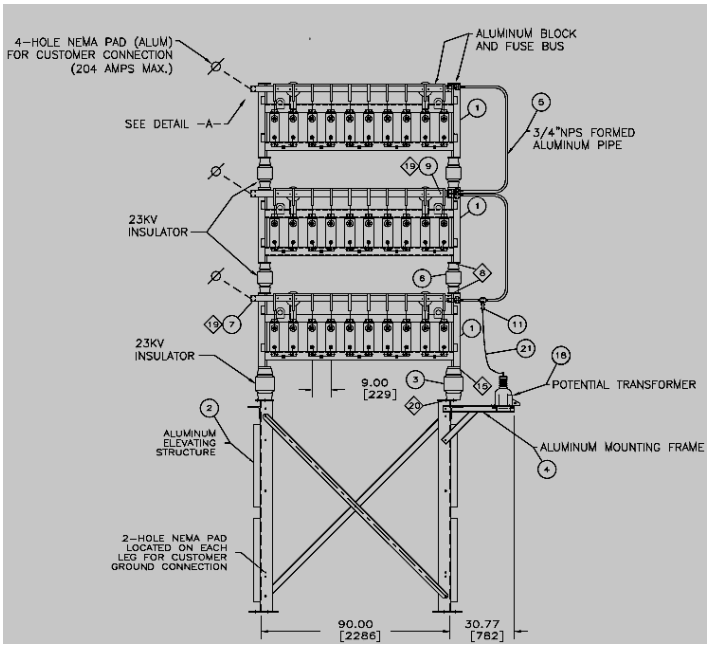
*These drawings are for reference purposes only. Refer to Project Drawings for specific details.

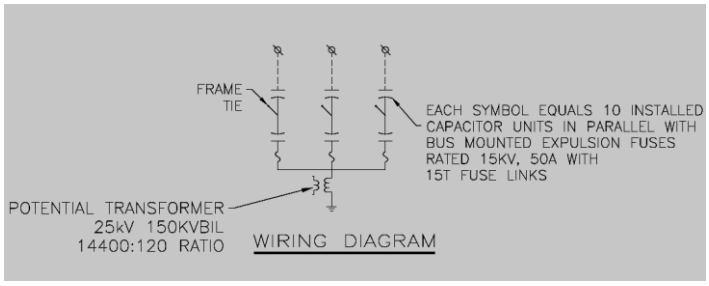
Medium Voltage Grounded Wye Capacitor Banks:

The general specification for the medium voltage grounded capacitor bank is as follows:

Outdoor, externally fused, shunt capacitor bank, rated 6MVAR @27.57KV-LL, 3 Phase, 60Hz, connected grounded Wye with the following:

H. 3 Racks, Welded Aluminum Fuse Bus and Station Post Fuse Bus Insulators
I. 60 Capacitor Units, 100KVAR, 7960 Volt, 1 Bushing (12" Creepage), 60HZ W/95KVBIL Insulation, Type EX-&L
J. 60 Copper Type Expulsion Fuse Assembly
K. 8 Stacking Insulators between Frames, 150KVBIL
L. 4 Base Insulators
M. 1 Marine Grade Cap Bank Elevating Structure, 96"



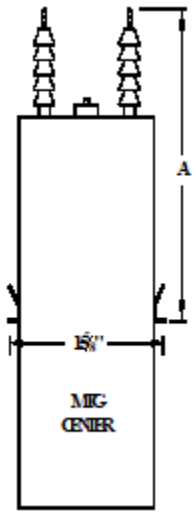


27.57 KV GROUNDED CAPACITOR BANK DETAIL

*These drawings are for reference purposes only. Refer to Project Drawings for specific details.

CAPACITOR BANK REPLACEMENT PARTS		
JEA ITEM ID #	**DESCRIPTION**	**MANUFACTURER**
CAPUN002 Y (15 / 20)	CAPACITOR, POWER, 100 KVAR, 95 KV BIL, 7960 VOLTS, 2 BUSHING, MOUNTING FLANGES 7.50" FROM CAN TOP FOR GE 25 KV CAP BANK.	ABB # 2GUA079100G2201 GE # 54L208WC60
CAPUN005 (INACTIVE)	CAPACITOR UNIT, REPLACEMENT, 200 KVAR, 125 KV BIL, 15240 VOLT, 2 BUSHING	-
CAPUN007 (INACTIVE)	CAPACITOR UNIT, REPLACEMENT, 100 KVAR, 95 KV BIL, 2400/4160 VOLT, 1 BUSHING	-
CAPUN008 (INACTIVE)	CAPACITOR UNIT, REPLACEMENT, 200 KVAR, 95 KV BIL, 2400/4160 VOLT, 1 BUSHING	-
CAPUN009 (INACTIVE)	CAPACITOR UNIT, REPLACEMENT, 50 KVAR, 95 KV BIL, 2400/4160 VOLT, 2 BUSHING	-
CAPUN010 N (0 / 0)	CAPACITOR UNIT, REPLACEMENT, 200 KVAR, 125 KV BIL, 15240 VOLT, 1 BUSHING, GE P/N 58L393RC,	GE # 58L393WC51
CAPUN012 Y (15 / 20)	CAPACITOR, POWER, 300 KVAR, 95 KV BIL, 9960 VOLTS, 1 BUSHING, MOUNTING FLANGES, 9.88" FROM CAN TOP FOR MCGRAW EDISON 69KV CAP BANKS.	ABB #2GUA099300D1301 COOPER # CEP160B9FB OR CEP160B9FD GE # 59L130WC60
CAPUN013 Y (15 / 20)	CAPACITOR, POWER, 300KVAR, 150KV BIL, 19920 VOLTS, 1 BUSHING, MOUNTING FLANGE 9.88" FROM CAN TOP FOR MCG-ED 138KV CAP BANK AT PHIL HWY & NORM SUB.	ABB # 2GUA199300G150 COOPER # CEP165B4FB GE # 59L155WC51
CAPUN014 Y (15 / 20)	CAPACITOR, POWER, 200 KVAR, 150 KV BIL, 19920 VOLTS, 1 BUSHING, MOUNTING FLANGE 9.88" FROM CAN TOP FOR MCG-ED 230KV CAP BANK AT GREENLAND & NORM SUBS.	ABB # 2GUA199200G1502 COOPER # CEP345B4
CAPUN025 (INACTIVE)	CAPACITOR, OIL FILLED, 4 MFD, 370 VAC	-
CAPUN026 (INACTIVE)	CAPACITOR, OIL FILLED, 3 MFD, 370 VAC	-
CAPUN027 (INACTIVE)	CAPACITOR, 400 MFD, 300 WVDC, ELECTROLYTIC, PLASTIC SLEEVED ALUMINUM CAN, HIGH TERMINAL POST FOR SIEMENS CAPACITOR TRIP DEVICES (MCB-SI-122)	-
CAPUN028 (INACTIVE)	CAPACITOR, MOTOR, 50UF, 300 VACX, FOR ASEA LOAD TAP CHANGER TYPE "UZD" S/N A4932, SHORTING WIRE & TAG INCLUDED	-
CAPUN030 N (12 / 18)	CAPACITOR UNIT REPLACEMENT FOR CAPBA001, 200 KVAR, 150 KV BIL, 26.4 KV/15240 VOLT, 1 BUSHING, SHORTING WIRE & TAG INCLUDED	ABB # 2GUA152200D1502 COOPER # CEP129M71FD
CAPUN032 Y (3 / 6)	CAPACITOR, POWER, 100 KVAR, 110 KV BIL, 7960 VOLTS, SINGLE BUSHING, FOR ABB 26KV CAP BANK	ABB # 2GUA079100D130
CAPUN033 Y (8 / 10)	CAPACITOR UNIT, REPLACEMENT, 230KV, 662 KVAR, 17681 VOLT, 125 KV BIL, 2 BUSHING, 60HZ, HEAVY DUTY TYPE.	COOPER # CEP17036A1
CAPUN034 (NEW) Y (2 / 2)	CAPACITOR UNIT, REPLACEMENT, 138KV, 644KVAR, 13953 VOLT, 125 KV BIL, 2 BUSHING, 60HZ, HEAVY DUTY TYPE.	COOPER # CEP17042A1
CAPUN035 (NEW) Y (2 / 2)	CAPACITOR UNIT, REPLACEMENT, 69KV, 552KVAR, 10465 VOLT, 125 KV BIL, 2 BUSHING, 60HZ, HEAVY DUTY TYPE.	COOPER # CEP17043A1

VOLTAGE AND SIZE OF UNITS					
ITEM ID	**KVAR SIZE**	**VOLTAGE RATING**	**# OF BUSHINGS**	**DIM. A* (IN.)**	**BIL (KV)**
CAP UN 002	**100**	**7,960 V**	**2**	**17.36**	**95**
CAP UN 010	200	15,240 V	1	22	125
CAP UN 012	**300**	**9,960 V**	**1**	**18**	**95**
CAP UN 013	**300**	**19,920 V**	**1**	**22**	**150**
CAP UN 014	**200**	**19,920 V**	**1**	**22**	**150**
CAP UN 030	200	15,240 V	1	17.4	150
CAP UN 032	**100**	**7,960 V**	**1**	**14.25 ± 1.0**	**110**
CAP UN 033	**662**	**17,681 V**	**2**	**26.75**	**125**
CAP UN 034	**644**	**13,953 V**	**2**	**24.75**	**125**
CAP UN 035	**552**	**10,465 V**	**2**	**22.63**	**125**



* Dimension Tolerance: A + 3"

CAPACITOR UNIT DIMENSIONS

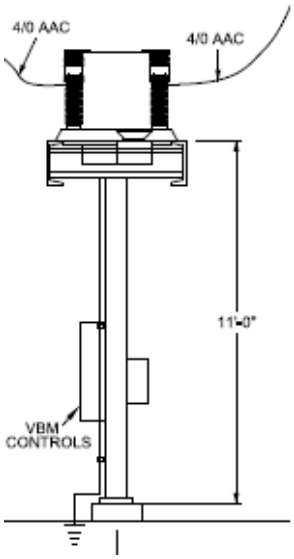
CAPACITOR SWITCHING DEVICES

The switching device utilized to energize/isolate the capacitor bank will be a SF6 power synch close circuit breaker (for 69kV and above – see Circuit Breaker section) or a VBM Capacitor Switch or Cap Switcher (below 69kV) with synchronous closing capability.

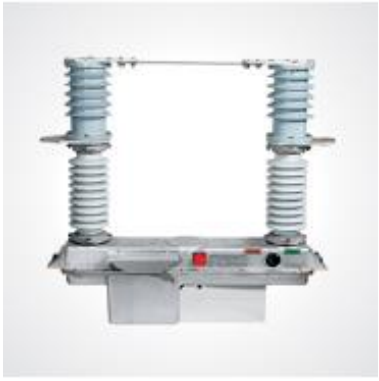
VBM CAPACITOR SWITCH manufactured by Joslyn

The specification for the Capacitor Switch is as follows: 34.5KV, 400A, 200KV BIL, 125DC Control, Zero Voltage Closing with Control Operator, 3KA Interrupting, 3 Phase

- 5 Minute Closing Delay after Opening
- Prewired Internal Wiring Scheme
- 17'-6" Shielded Control Cable Jumper
- Cabinet Heater



VBM CAPACITOR SWITCH DETAIL



VBM - 1 POLE, 38KV, 400A

CAPSWITCHER manufactured by Southern States

The CapSwitcher (38kV, 600A, 200KV BIL) is a newer device on the JEA system as of 2021.

JEA Item IDs: **CAPSW001** – CapSwitchers;

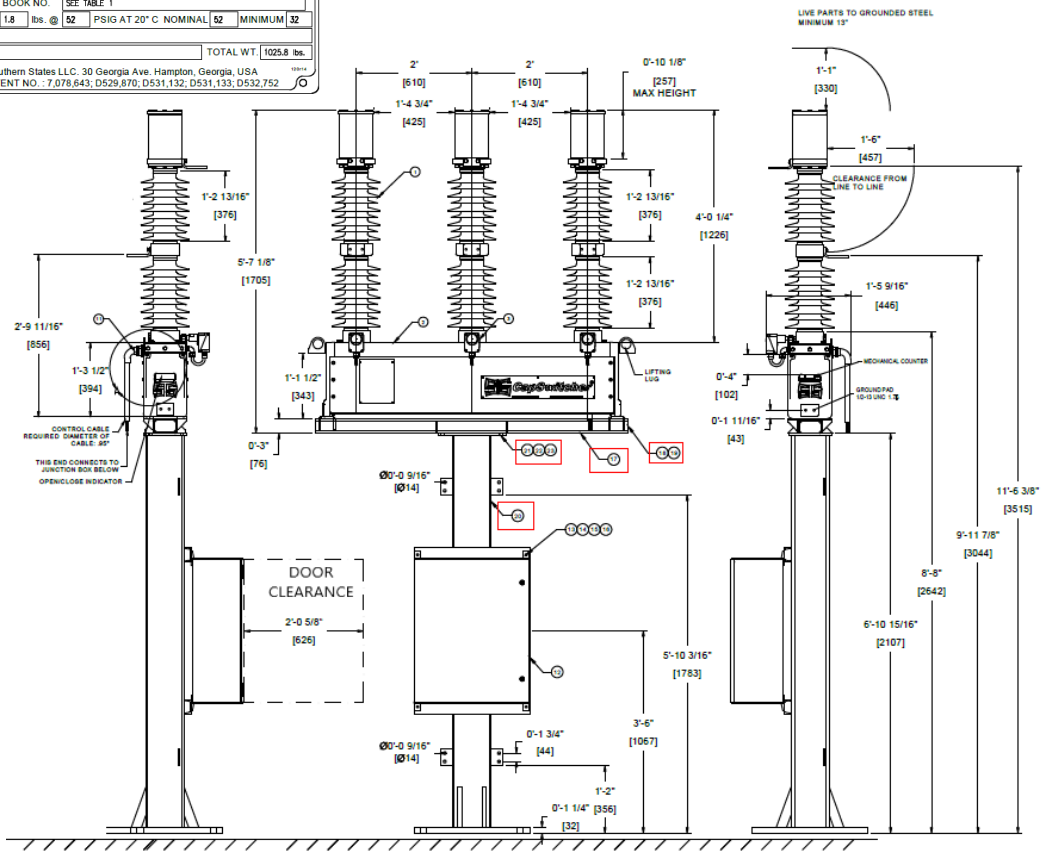
CAPSW002 – 38kV CapSwitcher Structure

CAPSW003 – CapSwitcher Adapter Plate for use on a VBM structure

Southern States
The Quality Name in High Voltage Switching
CapSwitcher®

TYPE DESIGNATION	CAP-38M	SERIAL NO.	SEE TABLE 1
JOB ORDER NO.	SEE TABLE 1	AMBIENT TEMP. RANGE	-50°C to +50°C
DRAWING NO.	SEE TABLE 1	REFERENCE DRAWING NO.	N/A
MFR DATE: MM/YY		WARRANTY EXP. MM/YY	
RATED MAX VOLT.	38 kV	POWER FREQUENCY	60 Hz.
CONTINUOUS CURRENT	600 A	INTERRUPTING TIME	6 CYCLES
RATED PRIMARY-BUS FAULT BREAKING CURRENT	N/A kA		
TRANSFORMER-LIMITED FAULT BREAKING CURRENT	N/A kA		
SHORT TIME WITHSTAND CURRENT (RMS)	40 kA, FOR 2 SEC.		
SHORT-CIRCUIT MAKING CURRENT (RMS)	40 kA		
PEAK WITHSTAND CURRENT	107 kA		
LIGHTNING IMPULSE WITHSTAND VOLTAGE INTERRRUPTER (BIL)	200 kV		
COIL VOLTAGE:CLOSING	125 VDC	TRIPPING	125 VDC
MOTOR VOLTAGE	125 VDC	AUX. CKT.	120 VAC
OPERATING SEQUENCE	CO – 5 MIN – CO	HEATER CKT.	120 VAC
SHUNT CAPACITOR BANK SWITCHING CURRENT	600 A		
BACK TO BACK CAPACITOR BANK BREAKING CURRENT	600 A		
PEAK CAPACITIVE INRUSH CURRENT	5400 Hz 23 kA		
CLOSING RESISTOR	SEE TABLE 1 Ω		
INSTRUCTION BOOK NO.	SEE TABLE 1		
GAS WEIGHT	1.8 lbs. @ 52	PSIG AT 20° C. NOMINAL 52	MINIMUM 32
SEE TABLE 1			
SEE TABLE 1		TOTAL WT	1025.8 lbs.

Southern States LLC. 30 Georgia Ave. Hampton, Georgia, USA
US PATENT NO. : 7,078,643; D529,670; D531,132; D531,133; D532,752



CIRCUIT BREAKERS

GENERAL:

A circuit breaker is a device that "breaks an electric circuit" under both load and fault conditions. Refer to ANSI C37 for the latest standards on Circuit Breakers. JEA has standardized on dead tank construction for all of its circuit breaker requirements. All transmission class circuit breakers (69kV and above) use SF6 gas as the interrupting medium. Distribution class circuit breakers (38kV and below) use vacuum as the interrupting medium.

Circuit breaker manufacturers are prequalified and placed on the approved manufacturers lists for the substation circuit breakers commonly used in the JEA system. Please refer to the latest specification (SF6 or Vacuum) and purchase agreement for further details and the approved breaker manufacturers list. Current approved manufacturers are ABB/Hitachi, GE Alstom and Mitsubishi.

TRANSMISSION CLASS:

The general specification for transmission class circuit breaker design is as follows:

Type:	Dead Tank
Insulation:	SF6 gas
Interrupting Rate:	50kA
Current Rating	3000A
Interrupting Time:	
69kV	3 cycles (JEA ITEM ID# GCBAR002)
138kV	2.5 cycles (2 cycles @ generating stations) (JEA ITEM ID# GCBAR003)
230kV	2 cycles (2 cycles @ generating stations) (JEA ITEM ID# GCBAR004)
Control Voltage:	125VDC

DISTRIBUTION CLASS:

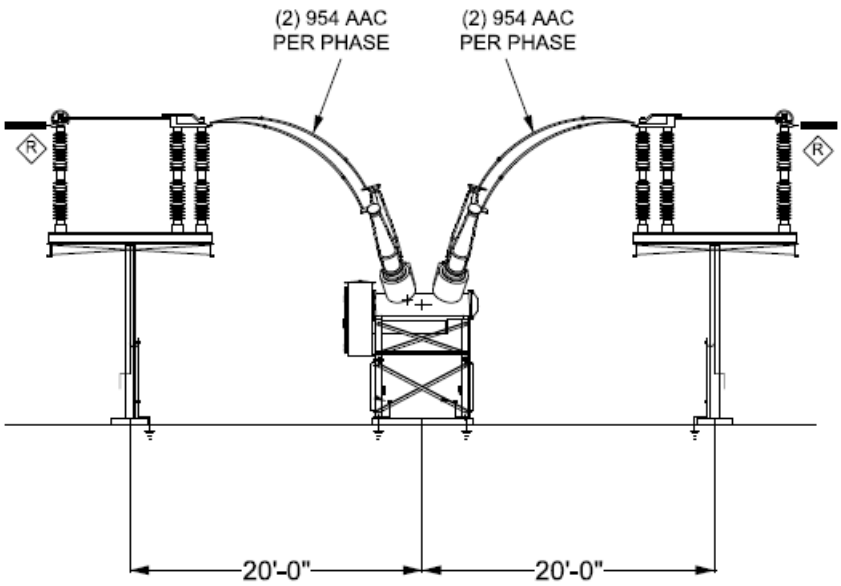
The general specification for distribution class circuit breaker design is as follows:

Type:	Dead Tank
Insulation:	Vacuum
Interrupting Rate:	25kA
Current Rating	1200A
Interrupting Time:	3 cycles
Control Voltage:	125VDC
JEA ITEM ID #:	VCBAR002 (28.4kV w/o relays), VCBAR003 (28.4kV with relays)

ZERO CROSSING:

Zero crossing breakers are used with capacitor bank installations for 69kV and above.

TRANSMISSION CLASS:



230KV CIRCUIT BREAKER DETAIL

DISTRIBUTION CLASS:

26KV CIRCUIT BREAKER DETAILS

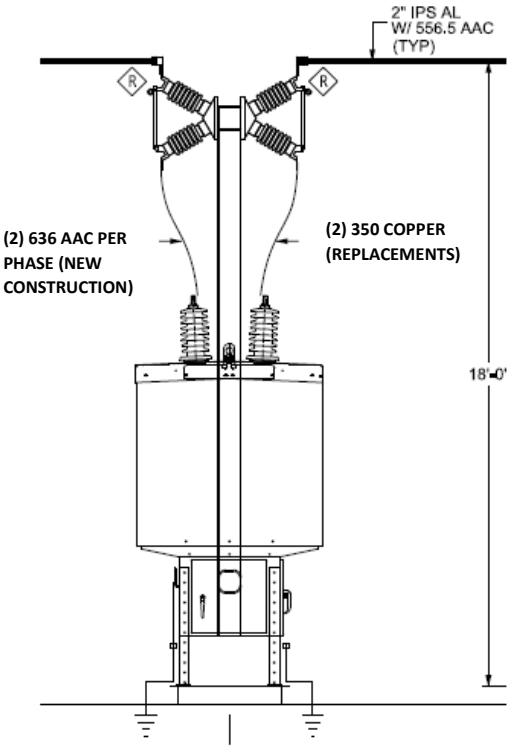


ABB TYPE V BREAKER

28.4kV Mitsubishi Breaker (standard since 2019)

ZERO CROSSING BREAKER FOR TRANSMISSION CLASS CAPACITOR BANKS:

ZERO CROSSING CIRCUIT BREAKER DETAIL

CIRCUIT SWITCHERS

GENERAL:

JEA commonly uses circuit switchers for the switching and fault protection of distribution power transformers in substation applications. Circuit Switchers are primarily used in locations where there are substation site constraints (Point Meadows Substation). This application requires a load break switching device and the interruption of minimal fault current. The application of a circuit switcher in this situation requires that the load interrupting requirement and the fault duty be below certain values as specified by the circuit switcher manufacturer. These criteria are determined prior to use of the circuit switcher in this application.

APPLICATION:

The following criteria must be met to provide for the application of a circuit switcher for power transformer switching requirements:

Load Break Current Rating:	1200A
Primary Fault Current Interrupting Rating	20kA
Inherent Secondary Fault Current Interrupting Medium	4kA

The primary fault current requirement is determined from the JEA system parameters for the particular substation location. It is calculated by adding the available fault current contributions from all incoming transmission lines to that substation. Consideration of future fault currents for the same lines should be given where the calculated primary fault current is close to the maximum allowed for circuit switcher applications. The inherent secondary fault current requirement (secondary fault as seen from the primary side) can be calculated from the following formula:

$I = 57.8\ P/E\ (\%Z)$

Where: I = inherent secondary fault current, amperes

P = transformer self-cooled three phase rating, kVA

E = system phase-to-phase voltage, kV

%Z = percent transformer impedance

Example:

P = 30MVA, E = 138kV, %Z = 8%

$I = 57.8(30{,}000) / 138(8)$

$I = 1{,}570.65A$

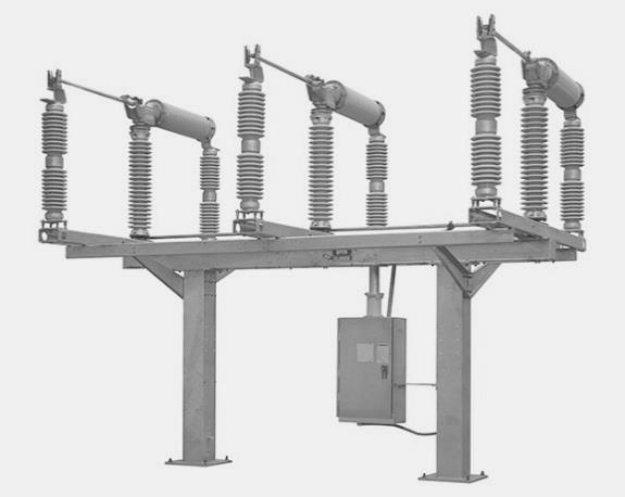
MANUFACTURERS:

JEA has standardized on the S&C Series 2000 circuit switcher. The 2010 model of the Series 2000 line is used for all JEA substation circuit switcher applications. This model provides a visible vertical disconnect device with an automatic switching feature that is in sequence with the interrupters. The 2010 circuit switcher is completely assembled and tested at the factory. The mounting pedestal and all operating controls and accessories are provided with the 2010 circuit switcher.

The applications and catalog numbers for circuit switchers used by JEA are as follows:

Application	Manufacturer	Catalog Number
69kV, 1200A	S&C Electric	197736-B-E10-H1-K-M-W1-Y
138kV, 1200A	S&C Electric	197839-B-E10-H1-K-M-W1-Y
230kV, 1200A	S&C Electric	197031-B-E10-H1-K-M-W1-Y

JEA ITEM ID # **SWECS###** for Circuit Switcher replacement parts that are in JEA Inventory.



CONNECTORS

JEA uses both aluminum and bronze connectors in substation construction. The aluminum connectors are either bolted or weldment type and are used for coupling aluminum bus or making transitions from the aluminum bus to other electrical equipment. The bronze connectors are bolted type and are used for copper cable terminations.

All bus-to-cable and cable-to-equipment connections are made with two flat connectors. The flat connectors are NEMA standard 2-hole or 4-hole arrangements. The use of one connector for this transition is not allowed. These connections are made with NEMA standard flat pads that are bolted together with stainless steel hardware. A bolt, two flat washers, one lock washer and nut are standard hardware requirements for all bolted flat connections.

All connections between dissimilar metals, i.e. bronze-to-aluminum, must either utilize tinned connectors or bi-metallic transition pads. The JEA standard for these connections is to utilize tinned bronze connectors. However, in the absence of tinned connectors, bi-metallic transition pads are allowed. JEA stocks both 2-hole and 4-hole bi-metallic transition pads.

Substation connectors for new substations are purchased with the substation structures through "Structures and Materials Packager" Agreement.

Refer to Substation Project Specification and Drawings for Substation specific connector details.

Refer to ORACLE for the approved manufacturers for each JEA Item ID and for those connectors that are kept in JEA inventory. ORACLE has the most up-to-date part numbers.

The following connector manufacturers are prequalified and approved to supply connectors to JEA for substation construction requirements:

- **AFL (Dossert)** – represented by Preferred Sales
- **Hubbell (Anderson, Burndy, Fargo)** – represented by Irby
- **Sefcor** – represented by Lekson Associates Inc.
- **Thomas & Betts (Gibbons, Homac)** – represented by Engineer Sales
- **Travis (Alcoa)** – represented by Superior Power Products
  *Travis can manufacture connectors as required as they have their own foundry

CONNECTOR SPECIFICATION:

Connectors are required for terminating or coupling bus and cable to substation equipment and switches. All connectors for aluminum bus and aluminum current carrying cable shall be bolted or weldment type connectors. All copper cable connectors shall be bronze bolted and tinned connectors unless otherwise specified. All connectors shall utilize center formed pads.

All NEMA 2-hole and 4-hole flat connectors shall have a ground-smooth surface for terminating. NEMA 3", 4-hole pads shall be used for buswork and cables operating at 26kV and below. NEMA 4", 4-hole pads shall be used for buswork and cables operating above 26kV. NEMA 4-hole pad-to-cable connectors are required to complete terminations to breakers and transformers.

NEMA 2-hole pad connectors may be used in 26kV applications that do not carry significant steady-state currents (i.e. potential transformers and arresters) or in specific applications involving multiple braided connections, etc.

Bolted pad-to-pad connector arrangements are required for all cable connectors to large equipment to allow the removal of the connector from the equipment it is terminated to without disturbing the connection between the connector and the cable.

All bronze connectors shall be tinned where connected to aluminum. Tin-plated bronze ground connectors are required for each structure. All grounding connectors in contact with galvanized structure shall be tinned bronze material.

Electrical joint compound is required for all aluminum-to-aluminum and aluminum-to-copper connections. Use "Alcoa Filler Compound" for application in conductor dead-end bodies and Alcoa No. 3 Electrical Joint Compound (Alnox), or approved equal for aluminum connections.

Ground studs are required for tubular bus which shall be weldment type and shall be installed horizontal.

Tubular aluminum welded splicing sleeves are required for necessary splices in aluminum tubing.

For connections between aluminum tubing and cable, a welded, tubing-to-terminal, non-transverse type pad connector and a weldment type cable-to-terminal pad connector on the end of the cable are required. All Aluminum Conductor is to function as the jumper cabling.

Bus support clamps for rigid bus shall be fixed or slip type as required to firmly support the bus but allow for temperature expansion and contraction. The static eliminator spring on bus support connectors shall be permanently fixed to the bus support.

Wire guides and bundle conductor spacers shall be provided as required to maintain adequate clearance and support on cable jumpers, connections and overhead lines.

All hardware shall be static-free type.

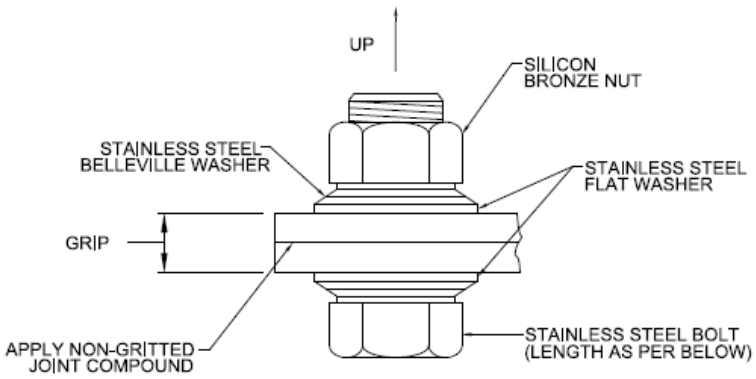
When buswork connects directly to switches, expansion terminals using expansion-type connectors with internal ball-type alignment guides are required.

The preferred method of establishing a current-carrying connection between buswork and major equipment is via a jumper constructed of cabling and connectors. The specific size jumpers used are determined by the Project Engineer. Refer to specific substation drawings for this information. All connectors for new substations are weldment.

For bolted electrical pad connections, the following are required per required bolt: one (1) stainless steel bolt, two (2) stainless steel flat washers, one (1) stainless steel Bellville washer, and one (1) silicon bronze nut. Belleville washers shall have a minimum compression rating of 4,000 pounds. Bolt lengths are sized to provide minimal projection beyond hexnut to prevent excessive noise due to corona, but entire hexnut must be engaged.

TABLE 1 - RECOMMENDED TORQUE VALUES FOR BOLTED CONNECTIONS*		
BOLT DIAMETER	**STEEL AND SILICON BRONZE**	**ALUMINUM**
5/16”	15 FT/LB	10 FT/LB
3/8”	20 FT/LB	14 FT/LB
1/2”	40 FT/LB	25 FT/LB
5/8”	55 FT/LB	40 FT/LB
3/4”	70 FT/LB	60 FT/LB

*These are guidelines only. Please refer to the specific manufacturer recommended torque values.



UP TO GRIP	BOLT LENGTH
1/2"	1.5"
1"	2"
1.5"	2.5"
2"	3"
2,5"	3,5"
3"	4"

NOTE: GRIP OF FW/FW/BW/BW/NUT IS APPROXIMATELY $1\frac{3}{16}$", AS SUCH, BOLT LENGTH SHALL BE AT LEAST 1" BEYOND REQUIRED GRIP LENGTH.

DETAIL
TYPICAL BOLTED CONNECTION

INSTALLATION PROCEDURES FOR CONNECTORS

ALUMINUM WELDED CONNECTIONS:

1. Remove all oil, grease and water in vicinity of surfaces to be welded.
2. Vigorously clean the bus and connector welding areas with a stainless steel brush.
3. Prior to welding the connection, a test bead should be made upon an aluminum casting to test the weld settings.
4. Align the bus and connector groove. Begin welding by "burning into" the casting and proceeding into the tube. Wire brush the original weld if more than one weld pass is required.
5. Due to the manufacturing tolerances on aluminum tubular bus, it is recommended that the tube be positioned in the weldment cavity and tack welded before starting final weld.

   The recommended welding methods for substation bus and aluminum connectors is either tungsten-arc welding (TIG) or metallic-arc inert gas shielded welding (MIG). All welding performed on JEA substation bus shall be done by qualified welders experienced with welding aluminum alloys.

ALUMINUM BOLTED CONNECTIONS:

1. Vigorously clean the contact surfaces with a stainless steel wire brush to remove oxides. A typically bright aluminum surface should be obtained.
2. Immediately apply contact sealant to both surfaces. Contact sealant shall be used for all aluminum to aluminum connections. Care should be taken to prevent sealant from being applied to the clamping hardware. Torque values will be effected if the hardware becomes lubricated with sealant.
3. Alternately and evenly tighten bolts until snug.
4. Alternately and evenly tighten bolts with torque wrench to the values shown in Table 1.

ALUMINUM TO COPPER CONNECTIONS:

1. Tin plated bronze connectors or bi-metallic transition pads shall be used for all aluminum to copper connections.
2. Vigorously clean all contact surfaces with a stainless steel wire brush to remove oxides. A typically bright aluminum surface should be obtained on the aluminum connector. DO NOT WIRE BRUSH PLATED CONTACT SURFACES.
3. Immediately apply contact sealant to the connector. Contact sealant shall be used for all aluminum to copper connections. Care should be taken to prevent sealant from being applied to the clamping hardware. Torque values will be effected if the hardware becomes lubricated with sealant.
4. Do not position the aluminum member in such a way that would allow water to drain from the bronze connector over onto the aluminum.
5. Alternately and evenly tighten bolts until snug.
6. Alternately and evenly tighten bolts with torque wrench to the values shown in Table 1.

BRONZE CONNECTORS:

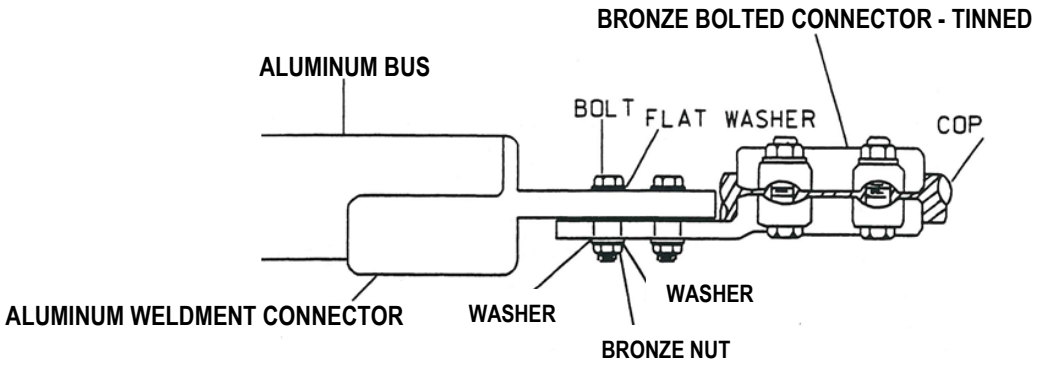
Bronze connectors are used for all substation copper cable terminations. All bronze cable connectors are standard NEMA 2-hole or 4-hole flat terminations. The bronze connectors are furnished with silicon bronze hardware. Stainless steel hardware is used for all flat bolted connections. The bolts for the connector-to-cable must be a separate bolting arrangement from the bolts for the flat terminal. The use of connectors that use one bolting arrangement for both the cable and flat connection are not allowed.

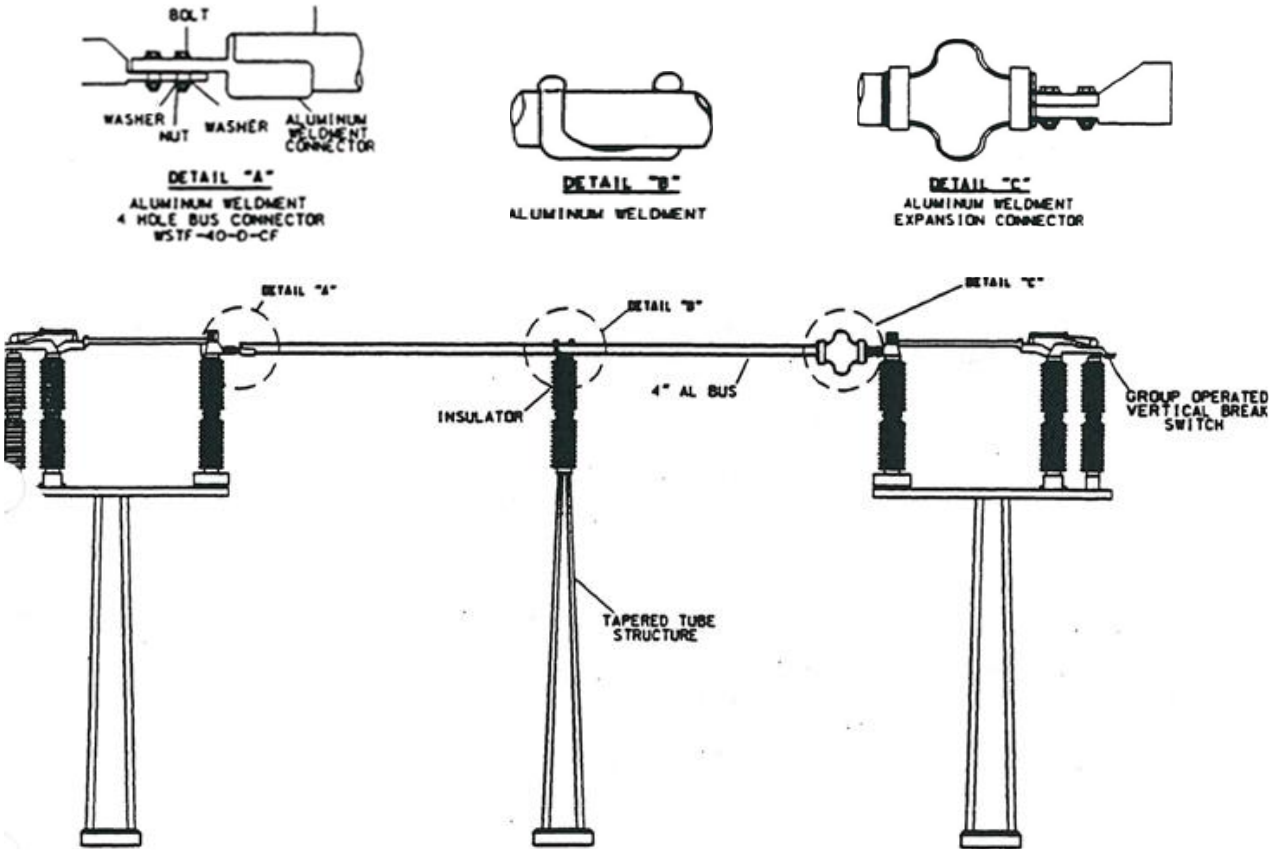
BRONZE BOLTED CONNECTOR INSTALLATION PROCEDURE:

BRONZE AND COPPER CONNECTIONS:

1. Contact sealants are not normally required in copper connections. However, the use of sealant is recommended in severe corrosive environments and direct burial applications such as ground grids.
2. Vigorously clean all contact surfaces of the conductor and connector with a stainless steel wire brush.
3. Alternately and evenly tighten bolts until snug.
4. Alternately and evenly tighten bolts with torque wrench to the values shown in Table 1.

TYPICAL NEMA FLAT CONNECTION





TYPICAL ALUMINUM BUS CONNECTIONS

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JEA Item ID# for all substation connectors that are kept in inventory start with CNN XX ###

CNN AJ ### - Aluminum Jumper Terminal
CNN BS ### - Bus Support Connector
CNN CB ### - Corona End Plug to Tube
CNN CO ### - Straight Coupler Connector
CNN CP ### - Compression Connector
CNN CT ### - Contact Connector
CNN GR ### - Ground Clamp Connector
CNN HS ### - Heat-Shrink Splice Connector
CNN JU ### - Jumper Connector
CNN LB ### - Loadbreak Connector
CNN ME ### - Liquid Tight Connector
CNN NL ### - Non-loadbreak Connector
CNN PA ### - Parallel Connector
CNN PL ### - Bi-Metallic Transition Plate
CNN PT ### - Preformed Tee Connector
CNN RP ### - Compression Repair Connector
CNN SB ### - Split-Bolt Connector
CNN SD ### - Stud to Flat Connector
CNN SH ### - Shear Bolt Connector
CNN SL ### - Street Light Connector
CNN SO ### - Solder Connector
CNN SP ### - Secondary Connector
CNN ST ### - Mechanical Stirrup Clamp
CNN TA ### - Tap Connector
CNN TB ### - Two Bolt Parallel Connector
CNN TE ### - Straight Tee Connector
CNN TL ### - Terminal Connector
(CNNTLR## - Ring CNNTLF## - Fork)
CNN TR ### - Terminator Connector
CNN TS ### - Transformer Secondary
CNN TY ### - Nylon Cable Tie
CNN VG ### - Vise Grip Connector
CNN WC ### - Wire Connector
CNN WE ### - Weldment Bus Supports, Coupler, Tees and Terminals

****NOTE: ORACLE has the most up-to-date part numbers****

BUS SUPPORTS (ALUMINUM)

		**ALUMINUM BUS SUPPORT, TUBE TO INSULATOR, HOOK-ON, SLIP OR RIGID, WELDED [356-T6 ALUMINUM ALLOY CASTING WITH STAINLESS STEEL STATIC SPRING AND GALVANIZED STEEL MOUNTING HARDWARE]**	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN WE 404 (INACTIVE)	1 1/4" IPS, 3" BCD	ANDERSON # WTH-12-3; HOMAC # AWBQ-G-3 SEFCOR # ASWH-49-3-SE; TRAVIS # 19-341
Y (6/6)	**CNN WE 408**	**2" IPS, 3" BCD**	**ANDERSON # WTH-20-3; HOMAC # AWBQ-J-3 SEFCOR # ASWH-58-3-SE; TRAVIS # 19-345**
N	CNN WE 409 (INACTIVE)	2" IPS, 5" BCD	ANDERSON # WTH-20-5; HOMAC # AWBQ-J-5 SEFCOR # ASWH-58-5-SE; TRAVIS # 19-346
N	CNN WE 410 (INACTIVE)	2 1/2" IPS, 3" BCD	ANDERSON # WTH-24-3; HOMAC # AWBQ-K-3 SEFCOR # ASWH-60-3-SE; TRAVIS # 19-347
N	CNN WE 411 (INACTIVE)	2 1/2" IPS, 5" BCD	ANDERSON # WTH -24-5; HOMAC # AWBQ-K-5 SEFCOR # ASWH-60-5-SE; TRAVIS # 19-348
N	CNN WE 412 (INACTIVE)	3" IPS, 3" BCD	ANDERSON # WTH-30-3; HOMAC # AWBQ-L-3 SEFCOR # ASWH-62-3-SE; TRAVIS # 19-349
N	CNN WE 413	3" IPS, 5" BCD	ANDERSON # WTH-30-5; HOMAC # AWBQ-L-5 SEFCOR # ASWH-62-5-SE; TRAVIS # 19-350
N	CNN WE 415 (INACTIVE)	3 1/2" IPS, 3" BCD	ANDERSON # WTH-34-3; HOMAC # AWBQ-M-3 SEFCOR # ASWH-63-3-SE; TRAVIS # 19-351
N	CNN WE 416	3 1/2" IPS, 5" BCD	ANDERSON # WTH-34-5; HOMAC # AWBQ-M-5 SEFCOR # ASWH-63-5-SE; TRAVIS # 19-3352
N	CNN WE 417 (NO LISTING)	4" IPS, 3" BCD	ANDERSON # WTH-40-3; HOMAC # AWBQ-P-3 SEFCOR # ASWH-64-3-SE; TRAVIS # 19-353
Y (6/6)	**CNN WE 418 (REACTIVATED)**	**4" IPS, 5" BCD**	**ANDERSON # WTH-40-5; HOMAC # AWBQ-P-5 SEFCOR # ASWH-64-5-SE; TRAVIS # 19-354**
Y (3/3)	**CNN WE 420 (NEW)**	**4" IPS, 7" BCD**	**ANDERSON # WTH-40-7; HOMAC # AWBQ-P-7 SEFCOR # ASWH-64-7-SE; TRAVIS #19-354-7BC**

N	CNN WE 419 (INACTIVE)	5" IPS, 5" BCD	ANDERSON # WTH-50-5; HOMAC # AWBQ-R-5 SEFCOR # ASWH-67-5-SE; TRAVIS # 19-358
		**CONNECTOR, WELDMENT BUS SUPPORT, VERTICAL TUBE TO INSULATOR [ALUMINUM 356-T6 WITH GALVANIZED STEEL HARDWARE]**	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN WE 520 (NO LISTING)	4" IPS TO 5" BCD	ANDERSON # WUDE-405; HOMAC # AWPX-P-5; SEFCOR # WVTI-64-5; TRAVIS # 19-1266

		**CONNECTOR, HORIZONTAL BUS SUPPORT, ALUMINUM, TUBE TO INSULATOR (356-T6 ALUMINUM ALLOY CASTING WITH ALUMINUM ALLOY CLAMPING HARDWARE. STAINLESS STEEL STATIC ELMININATOR SPRINGS AND GALVANIZED STEEL MOUNTING HARDWARE. CAPS ROTATE TO PROVIDE SLIP-FREE OR RIGID CLAMPING.)**	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN BS 215 (INACTIVE)	1 1/4" IPS TO 3" BCD	ANDERSON # AUR-12-3; HOMAC # ASBC-G-3; SEFCOR #ASTI-49-3; TRAVIS # 19-185
N	CNN BS 220 (INACTIVE)	1 1/2" IPS TO 3" BCD	ANDERSON # AUR-14-3; HOMAC # ASBC-H-3; SEFCOR #ASTI-53-3; TRAVIS # 19-187
N	CNN BS 225	2" IPS TO 3" BCD	ANDERSON # AUR-20-3; HOMAC # ASBC-J-3; SEFCOR # ASTI-58-3; TRAVIS # 19-189
N	CNN BS 230	3" IPS TO 3" BCD	ANDERSON # AUR-30-3; HOMAC # ASBC-L-3; SEFCOR #ASTI-62-3; TRAVIS # 19-193
N	CNN BS 325 (NO LISTING)	2" IPS TO 5" BCD	ANDERSON # AUR-20-5; HOMAC # ASBC-J-5; SEFCOR # ASTI-58-5; TRAVIS # 19-190
N	CNN BS 330	2 1/2" IPS TO 5" BCD	ANDERSON # AUR-24-5; HOMAC # ASBC-K-5; SEFCOR #ASTI-60-5; TRAVIS # 19-192
N	CNN BS 335 (INACTIVE)	3 1/2" IPS TO 5" BCD	ANDERSON # AUR-34-5; HOMAC # ASBC-M-5; SEFCOR #ASTI-63-5; TRAVIS # 19-196
N	CNN BS 340 (INACTIVE)	4" IPS TO 5" BCD	ANDERSON # AUR-40-5; HOMAC # ASBC-P-5; SEFCOR # ASTI-64-5; TRAVIS # 19-198

		**HORIZONTAL BOLTED BUS SUPPORT, ALUMINUM, SINGLE CABLE OR TUBE TO INSULATOR, ALLOY CASTING WITH GALVANIZED STEEL MOUNTING HARDWARE** [RANGE: 4/0-1750 AAC OR 4/0 –1590 ACSR]	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN BS 319	600-3000AAC, 556-2156 ACSR (½" - 1 ½" IPS) TO 3" BCD	ANDERSON # ASR-300-3; HOMAC # ASBD-175-3; SEFCOR # ASCRI-53-3
N	CNN BS 320 (INACTIVE)	600-3000AAC, 556-2165 ACSR (½" - 1 ½" IPS) TO 5" BCD	ANDERSON # ASR-300-5; HOMAC # ASBD-175-5; SEFCOR # ASCRI-53-5
N	Not Stocked	954 AAC TO 7" BCD	ANDERSON # ASR-2007; HOMAC # ASBD-175-7; SEFCOR # ASCRI-53-7

		**ALUMINUM BUS SUPPORT, EXPANSION, TUBE TO INSULATOR, WELDED**	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	Not Stocked	4" IPS TO 5" BCD	ANDERSON # WURF-40-5; TRAVIS # 18-1097 HOMAC # AWECC-P-5; SEFCOR # WXCTO-64-5

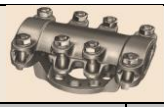
		HORIZONTAL BUS SUPPORT CLAMP, CABLE OR TUBE TO INSULATOR, BOLTED	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	**Not Stocked**	**954 AAC TO 5" BCD**	**SEFCOR # AVCA-34-5**

		HORIZONTAL BOLTED BUS SUPPORT, DOUBLE CABLE TO INSULATOR	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN BS 717 (INACTIVE)	1590 ACSR TO 5" BCD	ANDERSON # ADCS-200-3; HOMAC # ASBP-250-5; SEFCOR # AVCA2-51-3; TRAVIS # 19-403-2COND
N	CNNBS___	4/0 - 2000 AAC; 795-1590 ACSR TO 5" BCD	TRAVIS # 19-404-2COND

BUS SUPPORTS (BRONZE)

		HORIZONTAL BUS SUPPORT CLAMP, BRONZE, CABLE OR TUBE TO INSULATOR, BOLTED	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N		750 MCM CU TO 3" BCD	ANDERSON # CSSB-75-3; HOMAC # KSBD-100-3; SEFCOR # SCRI-20-3
N		750 MCM CU TO 5" BCD	ANDERSON # CSSB-75-5; HOMAC # KSBD-100-5; SEFCOR # SCRI-20-5
Y (0/0)	**CNN BS 710**	**4/0-1000 MCM TO 3" BCD, TIN PLATED**	**ANDERSON# ICA-100-3-TP; TRAVIS # 19-389-TPA HOMAC#KSBD-100-3-R; SEFCOR#SCRI-34-3-SND**
Y (0/0)	**CNN BS 810**	**250-1750 MCM TO 5" BCD**	**ANDERSON # *CSSB-200-5;* HOMAC # KSBD-175-5; SEFCOR # SCRI-48-5**

		HORIZONTAL BOLTED BUS SUPPORT, BRONZE, DOUBLE CABLE TO INSULATOR, TIN PLATED [BRONZE ALLOY CASTING WITH SILICON BRONZE CLAMPING HARDWARE AND GALVANIZED STEEL MOUNTING HARDWARE]	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN BS 711	1000 MCM TO 3" BCD	ANDERSON # CDSB-100-3-TP; HOMAC # KSBP-100-3R; SEFCOR # SCRI2-34-3-SND; TRAVIS # 19-389-2COND-TPA
Y (6/6)	**CNN BS 713**	**250 - 500 MCM TO 3" BCD**	**ANDERSON # CDSB-50-3-TP; HOMAC # KSBP-50-3R; SEFCOR # SCRI2-20-3-SND; TRAVIS # 19-387-2COND-TPA**
Y (6/6)	**CNN BS 715 (REACTIVATED)**	**800 - 1000 MCM TO 5" BCD**	**ANDERSON # CDSB-100-5-TP; HOMAC # KSBP-100-5R; SEFCOR # SCRI2-34-5-SND; TRAVIS # 19-390-2COND-TPA**
N	CNN BS 717 (INACTIVE)	1590 ACSR TO 5" BCD	ANDERSON # ADCS-200-3; HOMAC # ASBP-250-5; SEFCOR # AVCA2-51-3; TRAVIS # 19-403-2COND-TPA

		CONNECTOR, HORIZONTAL BUS SUPPORT, BRONZE, TUBE TO INSULATOR, COUPLER	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN BS 735	1 ¼" IPS TO 3" BCD	ANDERSON # UPH-12-3; HOMAC # ASBCC-G-3-BZ; SEFCOR # CCTI-49-5; TRAVIS # 19-519

		**HORIZONTAL BUS SUPPORT, BRONZE, TUBE TO INSULATOR.** [BRONZE ALLOY CASTING WITH SILICON BRONZE CLAMPING HARDWARE, STAINLESS STEEL STATIC ELIMINATOR SPRINGS AND GALVANIZED STEEL MOUNTING HARDWARE. CAPS ROTATE TO PROVIDE SLIP-FREE OR RIGID CLAMPING.]	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN BS 732 (INACTIVE)	1 ¼" IPS TO 3" BCD	ANDERSON # UP-12-3; HOMAC # KSBE-G-3 SEFCOR # SCTI-49-3; TRAVIS # 19-107
Y (3/6)	**CNN BS 740**	**1 ½" IPS TO 3" BCD**	**ANDERSON # UP-14-3; HOMAC # KSBE-H-3 SEFCOR # SCTI-53-3; TRAVIS # 19-109**
Y (6/6)	**CNN BS 745 (REACTIVATED)**	**2" IPS TO 3" BCD**	**ANDERSON # UP-20-3; HOMAC # KSBE-J-3 SEFCOR # SCTI-58-3; TRAVIS # 19-111**
N	CNN BS 755 (INACTIVE)	2 ½" IPS TO 3" BCD	ANDERSON # UP-24-3; HOMAC # KSBE-K-3 SEFCOR # SCTI-60-3; TRAVIS # 19-113
Y (3/6)	**CNN BS 760**	**3" IPS TO 3" BCD TIN PLATED**	**ANDERSON # UP-30-3-TP; HOMAC # KSBE-L-3R; SEFCOR # SCTI-62-3-SND; TRAVIS # 19-115-TPA**
N	CNN BS 820 (NO LISTING)	1 ¼" IPS TO 5" BCD	ANDERSON # UP-12-5; HOMAC # KSBE-G-5 SEFCOR # SCTI-49-5; TRAVIS # 19-108
N	CNN BS 825 (NO LISTING)	1 ½" IPS TO 5" BCD	ANDERSON # UP-14-5; HOMAC # KSBE-H-5 SEFCOR # SCTI-53-5; TRAVIS # 19-110
N	CNN BS 835	2 ½" IPS TO 5" BCD	ANDERSON # UP-24-5; HOMAC # KSBE-K-5 SEFCOR # SCTI-60-5; TRAVIS # 19-114
Y (3/6)	**CNN BS 840**	**3" IPS TO 5" BCD**	**ANDERSON # UP-30-5; HOMAC # KSBE-L-5 SEFCOR # SCTI-62-5; TRAVIS # 19-116**
N	CNN BS 845	3 ½" IPS TO 5" BCD	ANDERSON # UP-34-5; HOMAC # KSBE-M-5 SEFCOR # SCTI-63-5; TRAVIS # 19-118
N	CNN BS 850	4" IPS TO 5" BCD	ANDERSON # UP-40-5; HOMAC # KSBE-P-5 SEFCOR # SCTI-64-5; TRAVIS # 19-120

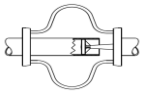
		**CONNECTOR, BOLTED, HORIZONTAL BUS SUPPORT, BRONZE, TUBE TO INSULATOR, EXPANSION COUPLER.** BRONZE ALLOY CASTING WITH SILICON BRONZE CLAMPING HARDWARE, GALVANIZED STEEL MOUNTING HARDWARE, TINNED COPPER BRAIDED SHUNT AND STAINLES STEEL ROLLERS.	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN BS 742 (INACTIVE)	1 ½" IPS TO 3" BCD	*ANDERSON # UPECF-14-3; HOMAC # GB-4301* SEFCOR # CXTI-53-3
N	CNN BS 749	2" IPS TO 3" BCD	*ANDERSON # UPECF-20-3; HOMAC # GB-4301* SEFCOR # CXTI-58-3
N	CNN BS 762	3" IPS TO 3" BCD	*ANDERSON # UPECF-30-3; HOMAC # GB-4304* SEFCOR # CXTI-62-3
N	CNN BS 770	4" IPS TO 3" BCD	*ANDERSON # UPECF-40-3; HOMAC # GB-* SEFCOR # CXTI-64-3

		**CONNECTOR, HORIZONTAL BUS SUPPORT, BRONZE, TUBE TO INSULATOR, SLIDING COUPLER,** BRONZE CLAMPING HARDWARE AND GALVANIZED STEEL MOUNTING HARDWARE BRONZE TUBE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN BS 747	2" IPS TO 3" BCD	ANDERSON # UPH-20-3: S. STATES # CAJ-27-3
N	CNN BS 772 (INACTIVE)	4" IPS TO 3" BCD	ANDERSON # UPH-40-3; S. STATES # CAJ-31-C

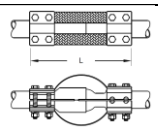
COUPLERS

		ALUMINUM COUPLER, 90 DEGREE ANGLE, TUBE TO TUBE, WELDED, ALUMINUM 356-T6, SCHEDULE (40/80)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	**CNN WE 087 (INACTIVE)**	**2" IPS, SCHEDULE 40**	**ANDERSON# WLI-90-2020; HOMAC# AWBE-J-90; SEFCOR # WLBI90-5858; TRAVIS # 18-654-90**
N	CNN WE 090 (INACTIVE)	3" IPS, SHEDULE 40	ANDERSON # WLI-90-3030; HOMAC # AWBE-L-90; SEFCOR # WLBI90-6262; TRAVIS # 18-656-90
N	CNN WE 091 (INACTIVE)	3" IPS, SCHEDULE 80	ANDERSON # WLIH-90-3030; HOMAC # AWBEH-L-90; SEFCOR # WLBI90-6262H; TRAVIS # 18-656H-90
N	**(NO LISTING)**	**4" IPS, SCHEDULE 40**	**SEFCOR # WLBI90-6464; AFL # WEP1400-AA**

		ALUMINUM COUPLER, TUBE TO TUBE, WELDMENT, STRAIGHT, ALUMINUM 6061-T6, SCHEDULE (40/80)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (3/6)	**CNN WE 100**	**2" IPS**	**ANDERSON # WCI-2020; HOMAC # AWCL-J SEFCOR # WSC-5858; TRAVIS # 18-538**
N	CNN WE 102 (INACTIVE)	2 ½" IPS	ANDERSON # WCI-2424; HOMAC # AWCL-K; SEFCOR # WSC-6060; TRAVIS # 18-546
N	CNN WE 104 (INACTIVE)	3" IPS	ANDERSON # WCI-3030; HOMAC # AWCL-L; SEFCOR # WSC-6262; TRAVIS # 18-554
N	CNN WE 106	3 ½" IPS	ANDERSON # WCI-3434; HOMAC # AWCL-M; SEFCOR # WSC-6363; TRAVIS # 18-562
Y (3/6)	**CNN WE 108**	**4" IPS**	**ANDERSON # WCI-4040; HOMAC # AWCL-P SEFCOR # WSC-6464; TRAVIS # 18-572**
N	CNN WE 110 (INACTIVE)	5" IPS	ANDERSON # WCI-5050; HOMAC # AWCL-R; SEFCOR # WSC-6767; TRAVIS # 18-596
N	CNN WE 112 (NO LISTING)	6" IPS	ANDERSON # WCI-6060; HOMAC # AWCL-S; SEFCOR # WSC-6969; TRAVIS # 18-608
N	CNN WE 144 (INACTIVE)	2 ½" IPS, SCHEDULE 80	ANDERSON # WCH-2424; HOMAC # WALBH-K; SEFCOR # WSC-6060H; TRAVIS # 18-547
N	CNN WE 156	3 ½" IPS, SCHEDULE 80	ANDERSON # WCH-3434; HOMAC # WALBH-M; SEFCOR # WSC-6363H; TRAVIS # 18-563

		COUPLER, WELDMENT, EXPANSION, TUBE TO TUBE, ALUMINUM 356-T6 CASTING WITH ALUMINUM 1100-0 STRAPS, SCHEDULE 40	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN WE 192 (INACTIVE)	3 ½" MAIN TO 3 ½" TAP	ANDERSON # WCL-3434-G; HOMAC # WAFG-M SEFCOR # WXCF-6363
N	CNN WE 194	4" MAIN TO 2 ½" TAP	ANDERSON # WCL-4024-G; HOMAC # WAFG-P-K SEFCOR # WXCF-6460

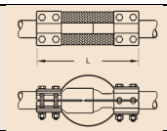
		SPLICE, COPPER COMPRESSION, LONG BARREL, 250MCM-600MCM, STRAIGHT	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN CP 501 (INACTIVE)	2.7" D, 5.5" L	ANDERSON # VHS-600

		**COUPLER, EXPANSION, TUBE TO TUBE, ALUMINUM**	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN CO 086 (INACTIVE)	3 ½" IPS ALUMINUM	ANDERSON # ATF-3434-G; HOMAC # AFG-M; SEFCOR # AXCF-6363; TRAVIS # 15-200

		**COUPLER, STRAIGHT, TUBE TO TUBE** **[ALUMINUM 356-T6 WITH ALUMINUM ALLOY HARDWARE]**	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN CO 305 (INACTIVE)	1 ¼" TO 1 ¼" AL	ANDERSON # ASTT-1212; HOMAC # ABC-G SEFCOR # ASCT-4949; TRAVIS # 13-175
N	CNN CO 308 (INACTIVE)	1 ½" TO 1 ¼" AL	ANDERSON # ASTT-1412; HOMAC # ABC-H-G; SEFCOR # ASCT-5349; TRAVIS # 13-179
N	CNN CO 309	1 ½" TO 1 ½" AL	ANDERSON # ASTT-1414; HOMAC # ABC-H SEFCOR # ASCT-5353; TRAVIS # 13-180
N	CNN CO 311 (INACTIVE)	2" TO 1 ¼" AL	ANDERSON # ASTT-2012; HOMAC # ABC-J-G SEFCOR # ASCT-5849; TRAVIS # 13-183
Y (3/9)	**CNN CO 313**	**2" TO 2" AL**	**ANDERSON # ASTT-2020; HOMAC # ABC-J SEFCOR # ASCT-5858; TRAVIS # 13-185**
N	CNN CO 315 (INACTIVE)	2 ½" TO 1 ¼" AL	ANDERSON # ASTT-2412; HOMAC # ABC-K-G SEFCOR # ASCT-6049;
N	CNN CO 318 (INACTIVE)	2 ½" TO 2 ½" AL	ANDERSON # ASTT-2424; HOMAC # ABC-K SEFCOR # ASCT-6060; TRAVIS # 13-191
N	CNN CO 324 (NO LISTING)	3" TO 3" AL	ANDERSON # ASTT- ; HOMAC # ABC-L SEFCOR # ASCT-6262; TRAVIS # 13-197
N	CNN CO 326	3 ½" TO 2" AL	ANDERSON # ASTT-3420; HOMAC # ABC-M-J SEFCOR # ASCT-6358; TRAVIS # 13-200
N	CNN CO 329 (NO LISTING)	3 ½" TO 3 ½" AL	ANDERSON # ASTT- ; HOMAC # ABC-M SEFCOR # ASCT-6363; TRAVIS # 13-203
Y (3/3)	**CNN CO 335**	**4" TO 4" AL**	**ANDERSON # ASTT-4040; HOMAC # ABC-P SEFCOR # ASCT-6464; TRAVIS # 13-209**
N	CNN CO 350 (NO LISTING)	6" TO 2" AL	ANDERSON # ASTT- ; HOMAC # ABC-S-J SEFCOR # ASCT-6958;

		**COUPLER, BOLTED, 90 DEGREE ANGLE, TUBE TO TUBE** **[ALUMINUM 356-T6]**	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN CO 406 (INACTIVE)	1 ¼" ALUMINUM	ANDERSON # AL-90-1212; HOMAC # ABCE-G-90 SEFCOR # ALB90-4949; TRAVIS # 13-407-90
N	CNN CO 409 (INACTIVE)	1 ½" ALUMINUM	ANDERSON # AL-90-1414; HOMAC # ABCE-H-90 SEFCOR # ALB90-5353; TRAVIS # 13-412-90
N	CNN CO 412 (INACTIVE)	2" ALUMINUM	ANDERSON # AL-90-2020; HOMAC # ABCE-J-90 SEFCOR # ALB90-5858; TRAVIS # 13-417-90
N	CNN CO 415 (INACTIVE)	2 ½" ALUMINUM	ANDERSON # AL-90-2424; HOMAC # ABCE-K-90 SEFCOR # ALB90-6060; TRAVIS # 13-423-90
N	CNN CO 418 (INACTIVE)	3" ALUMINUM	ANDERSON # AL-90-3030; HOMAC # ABCE-L-90 SEFCOR # ALB90-6262; TRAVIS # 13-429-90

		**COUPLER, STRAIGHT, TUBE TO TUBE** **[BRONZE WITH SILICON BRONZE HARDWARE]**	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN CO 700 (INACTIVE)	½" TO ½" BRONZE	ANDERSON # STTH-0404; HOMAC # KC-C SEFCOR # CCT-; TRAVIS # 13-101
N	CNN CO 702 (INACTIVE)	¾" TO ½" BRONZE	ANDERSON # STTH-0606; HOMAC # KC-E-C SEFCOR # CCT-30__;
N	CNN CO 704 (INACTIVE)	¾" TO ¾" BRONZE	ANDERSON # STTH-0606; HOMAC # KC-E; SEFCOR # CCT-3030; TRAVIS # 13-103
N	CNN CO 705 (INACTIVE)	1" TO ½" BRONZE	ANDERSON # STTH-1004; HOMAC # KC-F-C; SEFCOR # CCT-39__;
N	CNN CO 706	1" TO ¾" BRONZE	ANDERSON # STTH-1006; HOMAC # KC-F-E; SEFCOR # CCT-3930; TRAVIS # 13-105
N	CNN CO 708	1" TO 1" BRONZE	ANDERSON # STTH-1010; HOMAC # KC-F SEFCOR # CCT-3939; TRAVIS # 13-106
N	CNN CO 709 (INACTIVE)	1 ¼" TO ½" BRONZE	ANDERSON # STTH-1204; HOMAC # KC-G-C SEFCOR # CCT-49__;
N	CNN CO 712 (INACTIVE)	1 ¼" TO 1" BRONZE	ANDERSON # STTH-1210; HOMAC # KC-G-F SEFCOR # CCT-4939; TRAVIS # 13-109
N	CNN CO 714 (INACTIVE)	1 ¼" TO 1 ¼" BRONZE	ANDERSON # STTH-1212; HOMAC # KC-G SEFCOR # CCT-4949; TRAVIS # 13-110
N	CNN CO 718	1 ½" TO 1" BRONZE	ANDERSON # STTH-1410; HOMAC # KC-H-F SEFCOR # CCT-5339; TRAVIS # 13-113
N	CNN CO 722 (INACTIVE)	1 ½" TO 1 ½" BRONZE	ANDERSON # STTH-1414; HOMAC # KC-H SEFCOR # CCT-5353; TRAVIS # 13-115
N	CNN CO 726	2" TO 1" BRONZE	ANDERSON # STTH-2010; HOMAC # KC-J-F SEFCOR # CCT-5839; TRAVIS # 13-117
N	CNN CO 730 (INACTIVE)	2" TO 1 ½" BRONZE	ANDERSON # STTH-2014; HOMAC # KC-J-H SEFCOR # CCT-5853; TRAVIS # 13-119
N	CNN CO 732	2" TO 2" BRONZE	ANDERSON # STTH-2020; HOMAC # KC-J SEFCOR # CCT-5858; TRAVIS # 13-120
N	CNN CO 738 (INACTIVE)	2 ½" TO 1 ¼" BRONZE	ANDERSON # STTH-2412; HOMAC # KC-K-G SEFCOR # CCT-6049; TRAVIS # 13-123
N	CNN CO 740 (INACTIVE)	2 ½" TO 1 ½" BRONZE	ANDERSON # STTH-2414; HOMAC # KC-K-H SEFCOR # CCT-6053; TRAVIS # 13-124
N	CNN CO 742 (INACTIVE)	2 ½" TO 2" BRONZE	ANDERSON # STTH-2420-TP; HOMAC # KC-K-J SEFCOR # CCT-6058; TRAVIS # 13-125-TPA
N	CNN CO 744	2 ½" TO 2 ½" BRONZE	ANDERSON # STTH-2424; HOMAC # KC-K SEFCOR # CCT-6060; TRAVIS # 13-126
N	CNN CO 756	3" TO 3" BRONZE	ANDERSON # STTH-3030; HOMAC # KC-L SEFCOR # CCT-6262; TRAVIS # 13-132
N	CNN CO 778 (INACTIVE)	4" TO 4" BRONZE	ANDERSON # STTH-4040; HOMAC # KC-P SEFCOR # CCT-6464; TRAVIS # 13-144

		**COUPLER, EXPANSION, TUBE TO TUBE, BRONZE**	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN CO 788 (INACTIVE)	2" IPS BRONZE	HOMAC # VEX-J; SEFCOR # CXT-5858; TRAVIS # 15-119
N	CNN CO 790	2 ½" IPS TO 2" BRONZE	HOMAC # VEX-K-J; SEFCOR # CXT-6058

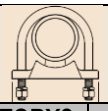
		COUPLER, BOLTED, ANGLE, TUBE TO TUBE WITH SILICON BRONZE HARDWARE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN CO 800 (INACTIVE)	½" IPS	ANDERSON # L-45-0404; HOMAC # KE-C-45 SEFCOR # LB45-; TRAVIS # 13-333-45
N	CNN CO 802 (INACTIVE)	¾" IPS	ANDERSON # L-45-0606; HOMAC # KE-E-45 SEFCOR # LB45-3030; TRAVIS # 13-335-45
N	CNN CO 804	1" IPS	ANDERSON # L-45-1010; HOMAC # KE-F-45 SEFCOR # LB45-3939; TRAVIS # 13-338-45
N	CNN CO 806 (INACTIVE)	1 ¼" IPS	ANDERSON # L-45-1212; HOMAC # KE-G-45 SEFCOR # LB45-4949; TRAVIS # 13-342-45
N	CNN CO 808 (INACTIVE)	1 ½" IPS	ANDERSON # L-45-1414; HOMAC # KE-H-45 SEFCOR # LB45-5353; TRAVIS # 13-347-45
N	CNN CO 810 (INACTIVE)	2" IPS	ANDERSON # L-45-2020; HOMAC # KE-J-45 SEFCOR # LB45-5858; TRAVIS # 13-352-45
N	CNN CO 812 (INACTIVE)	2 ½" IPS	ANDERSON # L-45-2424; HOMAC # KE-K-45 SEFCOR # LB45-6060; TRAVIS # 13-358-45
N	CNN CO 814 (INACTIVE)	3" IPS, TIN PLATED	ANDERSON # L-45-3030-TP; HOMAC # KE-L-45R SEFCOR # LB45-6262-SND; TRAVIS # 13-364-45-TPA
N	CNN CO 816 (INACTIVE)	3 ½" IPS	ANDERSON # L-45-3434; HOMAC # KE-M-45 SEFCOR # LB45-6363; TRAVIS # 13-370-45
N	CNN CO 818	4" IPS	ANDERSON # L-45-4040; HOMAC # KE-P-45 SEFCOR # LB45-6464; TRAVIS # 13-376-45

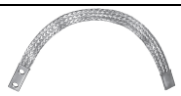
		COUPLER, BOLTED, 90 DEGREE ANGLE, TUBE TO TUBE [BRONZE WITH SILICON BRONZE HARDWARE]	
N	CNN CO 822 (NO LISTING)	½" BRONZE	ANDERSON # L-90-____; HOMAC # KE-C-90 SEFCOR # LB90-; TRAVIS # 13-333-90
N	CNN CO 824 (NO LISTING)	¾" BRONZE	ANDERSON # L-90-0606; HOMAC # KE-E-90 SEFCOR # LB90-3030; TRAVIS # 13-335-90
N	CNN CO 826 (INACTIVE)	1" BRONZE	ANDERSON # L-90-1010; HOMAC # KE-F-90 SEFCOR # LB90-3939; TRAVIS # 13-338-90
Y	**CNN CO 828**	**1 ¼" BRONZE**	**ANDERSON # L-90-1212; HOMAC # KE-G-90 SEFCOR # LB90-4949; TRAVIS # 13-342-90**
N	CNN CO 830 (INACTIVE)	1 ½" BRONZE	ANDERSON # L-90-1414; HOMAC # KE-H-90 SEFCOR # LB90-5353; TRAVIS # 13-347-90
Y	**CNN CO 832 (REACTIVATED)**	**2" BRONZE**	**ANDERSON # L-90-2020; HOMAC # KE-J-90R SEFCOR # LB90-5858; TRAVIS # 13-352-90**
Y	**CNN CO 834**	**2 ½" BRONZE**	**ANDERSON # L-90-2424; HOMAC # KE-K-90 SEFCOR # LB90-6060; TRAVIS # 13-358-90**
Y	**CNN CO 836**	**3" BRONZE**	**ANDERSON # L-90-3030; HOMAC # KE-L-90 SEFCOR # LB90-6262; TRAVIS # 13-364-90**
Y	**CNN CO 838**	**3 ½" BRONZE**	**ANDERSON # L-90-3434; HOMAC # KE-M-90 SEFCOR # LB90-6363; TRAVIS # 13-370-90**
N	CNN CO 840 (INACTIVE)	4" BRONZE	ANDERSON # L-90-4040; HOMAC # KE-P-40 SEFCOR # LB90-6464; TRAVIS # 13-376-90

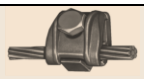
		COUPLER, BOLTED, ANGLE (45° / 90°), 4 HOLE PAD TO 4 HOLE PAD, ALUMINUM OR BRONZE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (6/6)	**CNN CO 476 (REACTIVATED)**	**AL, 4" PAD, 90°**	**HOMAC # AAP-4NN90; TRAVIS # AL-4X4X90 (1")**
N	CNN CO 477 (REACTIVATED)	AL, 4" PAD, 45°	TRAVIS # AL-4X4X45 (3/4" THICK)
N	CNN CO 478 (INACTIVE)	AL, 3" PAD, 90°	HOMAC # AAP-4N90; TRAVIS # 3X3X90 (3/4")
Y (6/6)	**CNN CO 875 (REACTIVATED)**	**BRONZE, 4" PAD, 90°**	**HOMAC # BY-4NN-4NN90R; TRAVIS # BR-4X4X90 (3/4")**
N	CNN CO 876	BRONZE, 4" PAD, 45°	HOMAC # BY-25-4NN-4NN45R

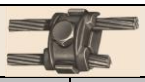
GROUNDING

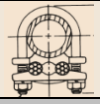
		ALUMINUM GROUNDING STUD, WELDMENT, ALUMINUM 356-T6	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	**CNN WE 280 (INACTIVE)**	**1" TO 2 ½" TUBING**	**ANDERSON # WTESR-10-24; HOMAC # AWGS-FK SEFCOR # WTS-3960; TRAVIS # 18-1280-WR**
N	**CNN WE 281 (INACTIVE)**	**3" TO 6" TUBING**	**ANDERSON # WTESR-30-60; HOMAC # AWGS-LS SEFCOR # WTS-6064; TRAVIS # 18-1280-WR**

		GROUND CLAMP, FLEXIBLE BRAID TO TUBE, BRONZE WITH SILICONE BRONZE HARDWARE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN GR 600 (INACTIVE)	¾" IPS TUBE	ANDERSON # GC-109-03; HOMAC # NTB-E; SEFCOR # GBR-30
N	CNN GR 602 (INACTIVE)	1" IPS TUBE	ANDERSON # GC-109-04; HOMAC # NTB-F; SEFCOR # GBR-39
N	CNN GR 604 (INACTIVE)	1 ¼" IPS TUBE	ANDERSON # GC-109-05; HOMAC # NTB-G; SEFCOR # GBR-49; TRAVIS # 17-177
Y (2/2)	**CNN GR 606 (REACTIVATED)**	**1 ½" IPS TUBE**	**ANDERSON # GC-109-06; HOMAC # NTB-H; SEFCOR # GBR-54; TRAVIS # 17-178**
Y (2/2)	**CNN GR 608 (RELISTED)**	**2" IPS TUBE**	**ANDERSON # GC-109-07; HOMAC # NTB-_; SEFCOR # GBR-58; TRAVIS # 17-179**
N	CNN GR 610 (NO LISTING)	2 ½" IPS TUBE	ANDERSON # GC-109-08; HOMAC # NTB-_ ; SEFCOR # GBR-61; TRAVIS # 17-180
N	CNN GR 612 (INACTIVE)	3" IPS TUBE	ANDERSON # GC-109-09; HOMAC # NTB-L; SEFCOR # GBR-62; TRAVIS # 17-181
N	CNN GR 614 (INACTIVE)	3 ½" IPS TUBE	ANDERSON # GC-109-10; HOMAC # NTB-M; SEFCOR # GBR-63; TRAVIS # 17-182
N	CNN GR 616 (INACTIVE)	4" IPS TUBE	ANDERSON # GC-109-11; HOMAC # NTB-P; SEFCOR # GBR-64; TRAVIS # 17-182

		GROUNDING BRAID, FLEXIBLE, TIN PLATED COPPER, 1 14/" WIDE X 24" LONG X 1/4" THICK, HOLES ON ONE END ONLY.	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (7/12)	**CNN GR 634**	**1 HOLE**	**ANDERSON # GB-200-5A; HOMAC # GA-397-W-24; TRAVIS # 111-182-24-HP**
Y (7/12)	**CNN GR 636**	**2 HOLES**	**ANDERSON # GB-200-5B; HOMAC # GA-397-O-24 SEFCOR # XBG146-D-24; TRAVIS # 111-182-24-2HP**

		GROUND CLAMP, SINGLE CABLE TO FLAT, TIN PLATED BRONZE, GALVANIZED STEEL HARDWARE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (15/25)	**CNN GR 652**	**#4 SOL. – 300 MCM OR 7#5 COPPERWELD**	**ANDERSON # GC-141A-G2-TP; TRAVIS # 17-159-TPA HOMAC # 2709-1-30REH ; SEFCOR # GTC-14-SND;**
Y (15/25)	**CNN GR 654**	**300-500 MCM OR 19#8 COPPERWELD**	**ANDERSON # GC-141-G3-TP; TRAVIS # 17-160-TPA HOMAC # 2709-1-50REH; SEFCOR # GTC-20-SND;**

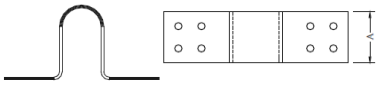
		DOUBLE GROUND CLAMP, TWO CABLES TO FLAT, TIN PLATED BRONZE, GALVANIZED STEEL HARDWARE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (12/48)	**CNN GR 662**	**#4 SOL – 300 MCM OR 7#5 COPPERWELD**	**ANDERSON # GC-143A-G2-TP; TRAVIS # 17-164-TPA; HOMAC # 2709-2-30REH; SEFCOR # GTC2-14-SND;**
N	CNN GR 666 (INACTIVE)	300-500 MCM OR 19#8 COPPERWELD	ANDERSON# GC-143-G3-TP; TRAVIS # 17-165-TPA HOMAC# 2709-2-50REH; SEFCOR # GTC2-0520-TP;

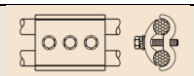
 		GROUND CLAMP, ONE, TWO OR THREE CABLES TO TUBE [BRONZE WITH SILICONE BRONZE HARDWARE] (JEA FENCE POSTS ARE 2 ½")	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (25/72)	**CNN GR 530**	**2 ½" IPS, #4 – 2/0 CABLE**	**ANDERSON # GC-110-101C; HOMAC # 2752-3-K-2/0; TRAVIS # 17-135**
N	CNN GR 706 (INACTIVE)	¾" IPS, 2/0 – 250 CABLE	ANDERSON # GC-110-32D; HOMAC # 2752-3-E-25; TRAVIS # 17-115
N	CNN GR 710 (INACTIVE)	1" IPS, 2/0 – 250 CABLE	ANDERSON # GC-110-42D; HOMAC # 2752-3-F-25; TRAVIS # 17-119
N	CNN GR 714 (INACTIVE)	1 ¼" IPS, 2/0 – 250 CABLE	ANDERSON # GC-110-52D; HOMAC # 2752-3-G-25; TRAVIS # 17-123
N	CNN GR 716 (INACTIVE)	1 ¼" IPS, 300 - 500 CABLE	ANDERSON # GC-110-53D; HOMAC # 2752-3-G-50
N	**CNN GR 720 (INACTIVE)**	**1 ½" IPS, 2/0 – 250 CABLE (7#5)**	**ANDERSON # GC-110-62C; HOMAC # 2752-3-H-25; SEFCOR # 1-OC-2651; TRAVIS # 17-127**
N	CNN GR 722 (NO LISTING)	1 ½" IPS, 300 - 500 CABLE	ANDERSON # GC-110-53D; HOMAC # 2752-3-H-50
N	CNN GR 726	2" IPS, 2/0 – 250 CABLE	ANDERSON # GC-110-82C; HOMAC # 2752-3-J-25; TRAVIS # 17-131
N	CNN GR 728 (NO LISTING)	2" IPS, 300 - 500 CABLE	ANDERSON # GC-110-63D ; HOMAC # 2752-3-J-50; TRAVIS # 17-132
Y (6/6)	**CNN GR 732**	**2 ½" IPS, 2/0 – 250 CABLE**	**ANDERSON # GC-110-102C; HOMAC # 2752-3-K-25; TRAVIS # 17-136**
N	CNN GR 734 (INACTIVE)	2 ½" IPS, 300 - 500 CABLE	ANDERSON # GC-110-103C;HOMAC # 2752-3-K-50; TRAVIS # 17-137
N	CNN GR 738 (INACTIVE)	3" IPS, 2/0 – 250 CABLE	ANDERSON # GC-110-122C; HOMAC # 2752-3-L-25; TRAVIS # 17-142
N	CNN GR 740 (INACTIVE)	3" IPS, 300 - 500 CABLE	ANDERSON # GC-110-123C; HOMAC # 2752-3-L-50; TRAVIS # 17-143
N	CNN GR 744 (INACTIVE)	3 ½" IPS, 2/0 – 250 CABLE	ANDERSON # GC-110-142C; HOMAC # 2752-3-M-25; TRAVIS # 17-148
N	CNN GR 746	3 ½" IPS, 300 - 500 CABLE	ANDERSON # GC-110-143C; HOMAC # 2752-3-M-50; TRAVIS # 17-149
N	CNN GR 750 (INACTIVE)	4" IPS, 2/0 – 250 CABLE	ANDERSON # GC-110-162C; HOMAC # 2752-3-P-25; TRAVIS # 17-154
N	CNN GR 752 (INACTIVE)	4" IPS, 300 - 500 CABLE	ANDERSON # GC-110-163C; HOMAC # 2752-3-P-50; TRAVIS # 17-155

MISCELLANEOUS (USED BY MULTIPLE DEPARTMENTS)

		CONNECTOR, CORONA END PLUG TO TUBE (ALUMINUM OR BRONZE)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (4/6)	**CNN CB 105 (REACTIVATED)**	**2" IPS**	**ANDERSON # ACBI-20; HOMAC # AKFI-J SEFCOR # DP-58-AL; TRAVIS # 111-137**
Y (4/6)	**CNN CB 109**	**4" IPS**	**ANDERSON # ACBI-40; HOMAC # AKFI-P SEFCOR # DP-64-AL; TRAVIS # 111-145**
N	CNN CB 104 (INACTIVE)	1 ½" IPS	ANDERSON # ACBI-14; HOMAC # AKFI-H SEFCOR # DP-53-AL; TRAVIS # 111-135
N	CNN CB106 (INACTIVE)	2 ½" IPS	ANDERSON # ACBI-24; HOMAC # AKFI-K SEFCOR # DP-60-AL; TRAVIS # 111-139
N	CNN CB 107 (INACTIVE)	3" IPS	ANDERSON # ACBI-30; HOMAC # AKFI-L SEFCOR # DP-62-AL; TRAVIS # 111-141
N	CNN CB 108 (INACTIVE)	3 ½" IPS	ANDERSON # ACBI-34; HOMAC # AKFI-M SEFCOR # DP-63-AL; TRAVIS # 111-143
N	CNN CB 110 (INACTIVE)	5" IPS	ANDERSON # ACBI-50; HOMAC # AKFI-R SEFCOR # DP-67-AL; TRAVIS # 111-149
N	CNN CB 114 (INACTIVE)	3" IPS, SCHEDULE 80	ANDERSON # ACBIH-30; HOMAC # AKFIH-L SEFCOR # DP-62H-AL; TRAVIS # 111-142
N	CNN CB 115 (INACTIVE)	3 ½" IPS, SCHEDULE 80	ANDERSON # ACBIH-34; HOMAC # AKFIH-M SEFCOR # DP-63H-AL; TRAVIS # 111-144
N	CNN CB116 (INACTIVE)	4" IPS, SCHEDULE 80	ANDERSON # ACBIH-40; HOMAC # AKFIH-P SEFCOR # DP-64H-AL; TRAVIS # 111-146

		CONNECTOR, CORONA END PLUG TO TUBE (BRONZE)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN CB 506 (INACTIVE)	2" IPS BRONZE	ANDERSON # CBI-20; HOMAC # KFI-J SEFCOR # DP-58-BR; TRAVIS # 111-111
N	CNN CB 507 (INACTIVE)	2 ½" IPS BRONZE	ANDERSON # CBI-24; HOMAC # KFI-K SEFCOR # DP-60-BR; TRAVIS # 111-113
Y (4/6)	**CNN CB 508 (REACTIVATED)**	**3" IPS BRONZE**	**ANDERSON # CBI-30; HOMAC # KFI-L SEFCOR # DP-62-BR; TRAVIS # 111-115**
N	CNN CB 509 (INACTIVE)	3 ½" IPS BRONZE	ANDERSON # CBI-34; HOMAC # KFI-M SEFCOR # DP-63-BR; TRAVIS # 111-117

		JUMPER, FLEXIBLE, 4" 4 HOLE PAD TO 4" 4 HOLE PAD, LAMINATED TIN PLATED COPPER, 2000 AMPS, STRAIGHT EXPANSION BEND	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN JU 550	4" 4 HOLE PAD	SEFCOR # CFX-4B-4 ; HOMAC # VLS1-2000-4NN

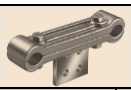
		CONNECTOR, BOLTED PARALLEL, TIN PLATED, BRONZE WITH SILICON BRONZE HARDWARE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (7/12)	CNN PA 553	4/0 – 500 CONDUCTOR RANGE	ANDERSON # LC-404-TP; HOMAC # PT3-50-50R; SEFCOR # PAU-56-SND
Y (3/3)	CNN PA 554	500-1000 CONDUCTOR RANGE	ANDERSON # LC-406-TP; HOMAC # PT3-100-100R; SEFCOR # PAU-66-SND

		CONNECTOR, PARALLEL, 2 – U BOLTS, BRONZE WITH SILICON BRONZE HARDWARE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y	CNN PA 590	#1 – 4/0 CONDUCTOR RANGE	ANDERSON# LC-1133; HOMAC # VWU2-4/0-1

		PARALLEL CABLE SPACER (TIN PLATED BRONZE)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (24/36)	CNN PA 603 (NEW)	4" CABLE SPACER, 250-500 MCM	AFL # CASV60-4-SN; SEFCOR # ASPC-20-4-BR-SND; TRAVIS # 110-103-CS-4-TPA
Y (6/12)	CNN PA 604	4" CABLE SPACER, 500-800 MCM	AFL # CASV90-4-SN; ANDERSON# BPCS-0804-TP; HOMAC # KACS2-80-4R; TRAVIS# 110-105-CS-4-TPA; SEFCOR# ASPC-20-4BR-SND;
Y (6/12)	CNN PA 612	2.5" CABLE SPACER, 750-1000 MCM, USE IN SETS OF 3.	AFL # CASV100-2-1/2-SN; ANDERSON# BPCS-100-2-1/2-TP; HOMAC # GA-582-TP; SEFCOR# CSPC-34-6-SND; TRAVIS # 110-105-CS-2.5-TPA

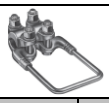
		PARALLEL CABLE SPACER (ALUMINUM)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (6/12)	CNN PA 636	636 AAC / 556 ACSR	AFL # CASV90-4-AA; ANDERSON # APCS-11-4; SEFCOR # ASPC-24-4; TRAVIS 3 110-117-CS-4
Y (6/12)	CNN PA 613	954 AAC/ACSR (4" SPACER)	AFL # CASV125-4-AA; ANDERSON # APCS-13-4; HOMAC # ACS2-125-4; SEFCOR # ASPC-36-4; TRAVIS # 110-119-CS-4
N	CNN PA 614 (INACTIVE)	1590 ACSR (8" SPACER)	AFL # CASV200-8-AA; ANDERSON # APCS-16-8; HOMAC # ACS2-200-8; SEFCOR # ASPC-46-8; TRAVIS # 110-123-CS-8

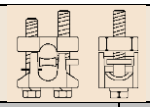
		PARALLEL CABLE SPACER TERMINAL (ALUMINUM)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN PA 615 (INACTIVE)	1590 ACSR WITH 4 HOLE 3" PAD	ANDERSON # APCSF-16C8; HOMAC # ACS2-200-6-4N90; SEFCOR# ASPC-46-8-4A; TRAVIS # 110-123-CSTC-8-90
N		954 MCM AAC TO 4-HOLE 4" PAD, 4" SPACING	ANDERSON # APCSF-13D8; HOMAC # ACS2-125-4-4NN90 SEFCOR # ASPC-34-4-4B; TRAVIS # 110-119-CSTD-4-90
		636 AAC TO 4 HOLE PAD, 4" SPACING	**SEFCOR # ASPC-24-4-4A**

		PARALLEL CABLE SPACER TERMINAL (TIN PLATED BRONZE)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN PA 616 (INACTIVE)	1000 MCM WITH 4 HOLE 3" PAD	ANDERSON# BPCS- -TP; HOMAC# CS2-125-4-4N90-TP; SEFCOR # ASPC-35-4-4A-BR-TP

		CONNECTOR, BI-METALLIC TRANSITION PLATE (EITHER 80% AL / 20% CU OR COPPER TIN PLATED)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (20/40)	**CNN PL 501**	**3 X 3, 4-HOLE**	**ANDERSON # TP-C; HOMAC # GB-9557-3; SEFCOR # ATP-C; TRAVIS # TP3**
Y (20/40)	**CNN PL 503**	**3 X 2, 2-HOLE**	**ANDERSON # TP-B2; HOMAC # GB-9557-2; SEFCOR # ATP-B2; TRAVIS # TP2**
Y (10/25)	**CNN PL 502**	**4 X 4, 4-HOLE**	**ANDERSON # TP-D; HOMAC # GB-9557-4; SEFCOR # ATP-D; TRAVIS # TP4**
Y (20/40)	**CNN PL 504**	**3 X 1 ½, 2-HOLE**	**ANDERSON # TP-B; HOMAC # GB-9557-1.5; SEFCOR # ATP-B; TRAVIS # TP2**

		CONNECTOR, SPLIT BOLT, BRONZE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (10/20)	CNN SB 001	#6 - #2, TIN PLATED	ANDERSON # CPS-1; HOMAC # E-2-GP
Y (15/30)	CNN SB 002	#10- #8 TIN PLATED	ANDERSON # CPS-6; HOMAC # E-8-GP
Y (22/51)	CNN SB 005	4-8 MAIN, 4-12 TAP	
Y (1/1)	CNN SB 532	500-1000 MCM	ANDERSON # C-1000; HOMAC # E-1000; BURNDY #KS44

		CONNECTOR, MECHANICAL STIRRUP CLAMP, ALUMINUM BODY WITH TIN PLATED COPPER LOOP	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN ST 001 (INACTIVE)	2/0 – 477 MCM / 1/0-397 ACSR	ANDERSON # AHLS-397022-E-1/2-TP

		CONNECTOR, TWO BOLT PARALLEL, HIGH STRENGTH BRONZE WITH SILICON BRONZE HARDWARE, ONE PIECE CONSTRUCTION	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (20/40)	CNN TB 001	1/0 – 4/0 MAIN, 8 – 4/0 TAP COPPER ALLOY	MCLEAN # FO41811BUC-4; ANDERSON # *K3;* HOMAC # TBC-350-S; SEFCOR # GFCS-5050
Y (20/50)	CNN TB 002	250 – 350 MAIN, 8-350 TAP	ANDERSON # *K4;* HOMAC # TBC-350-S SEFCOR # GFCS-5353
Y (75/150)	CNN TB 003	400-500 MAIN, 8-500 TAP	ANDERSON # *K5;* HOMAC # TBC-500-S SEFCOR # GFCS-5656
Y (20/50)	CNN TB 004	400- 800 MAIN, 3/0-800 TAP	ANDERSON # *K6;* HOMAC # TBC-800-S SEFCOR # GFCS-6262

		CONNECTOR, VISE-GRIP, PARALLEL, BRONZE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (300/500)	CNN VG 002	#8 - #4 MAIN, #12 - #4 TAP	HUBBELL # GC-5004
Y (3000/8000)	CNN VG 003	#6 - #2 MAIN, #10 - #2 TAP	HUBBELL # GC-5002
Y (700/1500)	CNN VG 004	#2 – 2/0 MAIN AND TAP	HUBBELL # GC-5020S
Y	CNN VG 006	1/0 – 4/0 MAIN AND TAP	HUBBELL # GC-5040

STUD CONNECTORS

		BRONZE ALLOY STUD CONNECTOR FOR CONNECTING COPPER FLAT PAD TO COPPER STUD, TIN PLATED, BOTH SIDES FINISHED.	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (7/12)	CNN SD 718	1" – 14 THREAD TO 4 HOLE FLAT 3" PAD	ANDERSON # HDSF-10133814-TP; HOMAC # KSLC-5-4NR; SEFCOR # SNFT-27-4A-SND; TRAVIS # 14-333-TP
Y (12/24)	CNN SD 720	1 1/8" – 12 THREAD TO 4 HOLE FLAT 3" PAD	ANDERSON # HDSF-11133812-TP; HOMAC # KSLC-6-4NR; SEFCOR # SNFT-44-4A-SND; TRAVIS # 14-337-TP
N	CNN SD 721 (INACTIVE)	1 1/8" - 0 THREAD TO 4 HOLE FLAT 3" PAD	ANDERSON # HDSF-1113380-TP; HOMAC # KSLC-6SM-4NR; SEFCOR # SNFT- -4A-SND; TRAVIS # 14-337-TP
N	CNN SD 722 (INACTIVE)	1 1/8" - 12 THREAD TO 4 HOLE FLAT 4" PAD	ANDERSON # HDSF-111D3812-TP; HOMAC # KSLC-6-4NNR; SEFCOR # SNFT-33-4B-SND; TRAVIS # 14-338-TP
Y (8/15)	CNN SD 724	1 ¼" - 12 THREAD TO 4 HOLE FLAT 3" PAD	ANDERSON # HDSF-12133812-TP; HOMAC # KSLC-8-4NR; SEFCOR # SNFT-36-4A-SND; TRAVIS # 14-342-TP
Y (1/1)	CNN SD 726	1 ¼" - 12 THREAD TO 4 HOLE FLAT 4" PAD	ANDERSON # HDSF-121D3812-TP; HOMAC # KSLC-8-4NNR; SEFCOR # SNFT-36-4A-SND; TRAVIS # 14-343-TP
Y (6/6)	**CNN SD 728**	**1-1/2" -12 THREAD TO 4 HOLE FLAT 3" PAD**	**ANDERSON # HDSF-14133812-TP; HOMAC # KSLC-10-4NR; SEFCOR # SNFT-44-4A-SND; TRAVIS # 14-347-TP**
Y (6/6)	**CNN SD 730**	**1-1/2" -12 THREAD TO 4 HOLE FLAT 4" PAD**	**ANDERSON # HDSF-141D1212-TP; HOMAC # KSLC-10-4NNR; SEFCOR # SNFT-44-4B-SND; TRAVIS # 14-348-TP**
Y	CNN SD 731	1-3/4" – 12 THREAD TO 4 HOLE FLAT 4" PAD	ANDERSON # HDSF-161D1212; HOMAC # KSLC-11B-4NNR; SEFCOR # SNFT-50-4B-SND; TRAVIS # 14-353-TP
N	CNN SD 732 (INACTIVE)	1 ¾" - 12 THREAD TO 4 HOLE FLAT 3" PAD	ANDERSON # HDSF-16131212-TP; HOMAC # KSLC-11B-4NR; SEFCOR # SNFT-50-4A-SND; TRAVIS # 14-352-TP
N	CNN SD 736 (INACTIVE)	2" - 12 THREAD TO 4 HOLE FLAT 3" PAD	ANDERSON # HDSF-20131212-TP; HOMAC # KSLC-13-4NR; SEFCOR # SNFT-50-4B-SND; TRAVIS # 14-357-TP
Y (3/6)	CNN SD 738	2" - 12 THREAD TO 4 HOLE FLAT 4" PAD	ANDERSON # HDSF-201D1212-TP; HOMAC # KSLC-13-4NNR; SEFCOR # SNFT-54-4B-SND; TRAVIS # 14-358-TP
Y (4/6)	CNN SD 743	2 ¼" - 12 THREAD TO 4 HOLE FLAT 3" PAD	ANDERSON # HDSF-22131212-TP; HOMAC # KSLC-13A-4NR; SEFCOR # SNFT-57-4A-SND; TRAVIS # 14-363-TP
Y	CNN SD 746	2 ½" - 12 THREAD TO 4 HOLE FLAT 4" PAD	ANDERSON # HDSF241D1212-TP; HOMAC # KSLC-13B-4NNR; SEFCOR # SNFT-57-4B-SND; TRAVIS # 14-370-TP

		STUD CONNECTOR, BOLTED, EXPANSION, STUD TO IPS TUBE, BRONZE WITH SILICON BRONZE HARDWARE.	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN SD 840 (NO LISTING)	1 ½" -12 TO 1 ¼" IPS	ANDERSON # DSTL-1412G-12; HOMAC # VIF-10-G; SEFCOR # SXT-4449; TRAVIS # 15-490
N	CNN SD 842 (NO LISTING)	1 ½" -12 TO 2" IPS	ANDERSON # DSTL-1420G-12; HOMAC # VIF-10-J; SEFCOR # SXT-4458; TRAVIS # 15-492
N	CNN SD 844 (INACTIVE)	1 ½" -12 TO 2 ½" IPS	ANDERSON # DSTL-1424G-12 HOMAC # VIF-10-K; SEFCOR # SXT-4460
N	CNN SD 845 (NO LISTING)	1 ½" -12 TO 3 ½" IPS	ANDERSON # DSTL-1434G-12 HOMAC # VIF-10-M; SEFCOR # SXT-4463
N	CNN SD 846 (INACTIVE)	1 ½" -12 TO 2 ½" IPS, 90°	ANDERSON # DSTL-1412G-90-12 HOMAC # VIF-10-K90; SEFCOR # SXT90-4460
N	CNN SD 847 (NO LISTING)	2" -12 TO 2 ½" IPS, 45°	ANDERSON # DSTL-2024G-45-12 HOMAC # VIF-13-K45; SEFCOR # SXT45-5460
N	CNN SD 848 (NO LISTING)	2" -12 TO 2 ½" IPS, 90°	ANDERSON # DSTL-2024G-90-12 HOMAC # VIF-13-K90; SEFCOR # SXT90-5460
N	CNN SD 849 (NO LISTING)	2" -12 TO 3 ½" IPS, 90°	ANDERSON # DSTL-2034G-90-12 HOMAC # VIF-13-M90; SEFCOR # SXT90-5463
N	CNN SD 850 (NO LISTING)	2" -12 TO 3 ½" IPS	ANDERSON # DSTL-2034G-12 HOMAC # VIF-13-M; SEFCOR # SXT-5463

TEES / TEE CONNECTORS

		ALUMINUM TEE CONNECTOR, TUBE TO FLAT, WELDED	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (12/12)	**CNN WE 300 (REACTIVATED)**	**1" - 2 ½ " IPS TO 4 HOLE 3" PAD**	**ANDERSON # WTTFR-10-24-C; HOMAC # AWBT-FK-4N; SEFCOR # WTF-3960-4A; TRAVIS # 18-623-WR**
Y (12/12)	**CNN WE 301**	**3" – 6" IPS TO 4 HOLE 4" PAD**	**ANDERSON # WTTFR-30-60-D; HOMAC # AWBT-LS-4NN; SEFCOR # WTF-6269-4B; TRAVIS # 18-642-WR**
N	CNN WE 302 (INACTIVE)	1" – 2 ½ " IPS TO 4 HOLE 3" PAD, 90°	ANDERSON # WTTFR-10-24-C-90; HOMAC # AWBT-FK-4N90; SEFCOR # WTFR-3960-4A; TRAVIS # 18-623-90-WR
N	CNN WE 303 (INACTIVE)	3" – 6" IPS TO 4 HOLE 3" PAD	ANDERSON # WTTFR-30-60-C; HOMAC # AWBT-LS-4N; SEFCOR # WTF-6269-4A; TRAVIS # 18-641-WR
N	CNN WE 304 (INACTIVE)	1" – 2 ½ " IPS TO 2 HOLE 2" PAD	ANDERSON # WTTFR-10-24-B2; HOMAC # AWBT-FK-2N; SEFCOR # WTF-3960-2B; TRAVIS # 18-622-WR
N		2" IPS AL TO 4 HOLE 3" PAD, 90°, TRANSVERSE	ANDERSON # WTTFR-10-24-D-90; HOMAC # AWBT-FK-4N90; SEFCOR # WTFR-3960-4A; TRAVIS # 18-624-90-WR
N		**2" IPS AL TO 4 HOLE 4" PAD**	**ANDERSON # WTTFR-10-24-D; HOMAC # AWBT-FK-4NN; SEFCOR # WTF-3960-4B; TRAVIS # 18-624-WR**

		ALUMINUM TEE CONNECTOR, TUBE TO TUBE, WELDED	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN WE 315 (INACTIVE)	2 ½" IPS	ANDERSON # WTT-2424; HOMAC # AWT-K-K; SEFCOR #WFTT-6060; TRAVIS # 18-167
N	**CNN WE 316 (INACTIVE)**	**2" IPS**	**ANDERSON # WTT-2020; HOMAC # AWT-J-J; SEFCOR #WFTT-5858; TRAVIS # 18-160**
N	CNN WE 318 (INACTIVE)	3" IPS	ANDERSON # WTT-3030; HOMAC # AWT-L-L; SEFCOR #WFTT-6262; TRAVIS # 18-175

		ALUMINUM TEE CONNECTOR, 15° ANGLE, TUBE TO TWO TUBES, WELDED	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN WE 320 (INACTIVE)	3 ½" IPS, MAIN & TAP	ANDERSON # WTT2-15-3434; HOMAC # AWTA-M-M2-15; SEFCOR # WFVT15-6363; TRAVIS # 18-366-15
N	CNN WE 322 (INACTIVE)	3" IPS MAIN & TAP	ANDERSON # WTT2-15-3030; HOMAC # AWTA-L-L2-15; SEFCOR # WFVT15-6262; TRAVIS # 18-357-15
N	**CNN WE 324 (INACTIVE)**	**4" IPS TO 3" TAP**	**ANDERSON # WTT2-15-4030; HOMAC # AWTA-P-L2-15; SEFCOR # WFVT15-6462; TRAVIS # 18-374-15**
N	CNN WE 326 (INACTIVE)	4" IPS MAIN & TAP	ANDERSON # WTT2-15-4040; HOMAC # AWTA-P-P2-15; SEFCOR # WFVT15-6464; TRAVIS # 18-376-15

		ALUMINUM TEE CONNECTOR, 15° ANGLE, TUBE TO TUBE, WELDED	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN WE 350 (INACTIVE)	4" IPS MAIN & TAP	ANDERSON # WTT15-4040; HOMAC # AWTA-P-P15; SEFCOR # WFTT15-6464; TRAVIS # 18-285-15
		4" IPS TO 3" IPS	**SEFCOR # WFTT15-6462**
		3" IPS MAIN & TAP	**SEFCOR # WFTT15-6262**

		BOLTED TEE CONNECTOR, DUAL FUNCTION TERMINAL FOR CABLE OR PIPE CONNECTIONS TO FLAT PAD TAP	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
		4/0 – 1500 (954) MCM TO 4 HOLE 3" PAD	**SEFCOR #ACF-34-4A**

		TEE, COMPRESSION, ALUMINUM, CABLE TO 4 HOLE FLAT PAD	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (3/3)	**CNN CP 100**	**1272-1590 ACSR CABLE TO 4" PAD**	**ANDERSON # ATCF-1640; HOMAC # AYTF-1545-4NN; SEFCOR # ATCF-1548-4B; TRAVIS # 16-169D-T**

		CONNECTOR, COMPRESSION TEE – TAP, ALUMINUM, CABLE TO PAD, OPEN RUN WITH 4 HOLE NEMA PAD	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
	CNN TE 200	556 ACSR MAIN	HUBBELL# ORT2110C
	CNN TE 201	954 ACSR MAIN	HUBBELL # ORT2113D
	CNN TE 202	1590 ASCR MAIN	HUBBELL # ORT2117

		CONNECTOR, STRAIGHT TEE, BOLTED, CABLE MAIN TO CABLE TAP, ALUMINUM (HEAT TREATED)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
		636 AAC TO 4/0 AAC	**SEFCOR # ACRCT-2420**
Y	**CNN TE 206**	**556-795 ACSR TO #4-4/0 CU TAP**	**ANDERSON # ATCC-116; HOMAC # A6MT-100-25; SEFCOR # ACRCT-3413; TRAVIS # 12-908**
N	CNN TE 207 (INACTIVE)	556-652 ACSR MAIN TO 3/0 TAP	ANDERSON # ATCC-___ ; HOMAC # A6MT-100-25; SEFCOR # ACRCT-3413; TRAVIS # 12-908
Y (3/6)	**CNN TE 208**	**556-795 ACSR TO #4-336.4 TAP**	**ANDERSON # ATCC-117; HOMAC # A6MT-100-40; SEFCOR # ACRCT-3420; TRAVIS # 12-908**
Y (6/12)	**CNN TE 209**	**556-795 ACSR MAIN & TAP**	**ANDERSON # ATCC-1111; HOMAC # A6MT-100-100; SEFCOR # ACRCT-343; TRAVIS # 12-908**
Y (3/6)	**CNN TE 210**	**715-1113 ACSR TO #4-4/0 TAP**	**ANDERSON # ATCC-136; HOMAC # A6MT-150-25; SEFCOR # ACRCT-3913; TRAVIS # 12-915**
Y	**CNN TE 211 (INACTIVE)**	**715-1113 ACSR TO 4/0-336 TAP**	**ANDERSON # ATCC-137; HOMAC # A6MT-150-40; SEFCOR # ACRCT-3920; TRAVIS # 12-915**
Y (3/6)	**CNN TE 213**	**715-1113 ACSR TO 556-795 TAP**	**ANDERSON # ATCC-1311; HOMAC # A6MT-150-100; SEFCOR # ACRCT-3934; TRAVIS # 12-915**
Y (1/3)	**CNN TE 214**	**715-1113 ACSR MAIN & TAP**	**ANDERSON # ATCC-1313; HOMAC # A6MT-150-150; SEFCOR # ACRCT-3939; TRAVIS # 12-917**
N	CNN TE 224 (INACTIVE)	1272-1590 ACSR TO 4/0-336 TAP	ANDERSON # ATCC-167; HOMAC # A6MT-250-40; SEFCOR # ACRCT-4620; TRAVIS # 12-926
Y (6/9)	**CNN TE 227**	**1272-1590 ACSR MAIN & TAP**	**ANDERSON # ATCC-1616; HOMAC # A6MT-250-250; SEFCOR # ACRCT-4646; TRAVIS # 12-929**

		CONNECTOR, STRAIGHT TEE, BOLTED, CABLE MAIN TO CABLE TAP, BRONZE (TIN PLATED)	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (6/11)	**CNN TE 518**	**1/0 - 500 MCM MAIN & TAP**	**ANDERSON # TCC-8050050-TP; HOMAC# 6MT-50-50R; SEFCOR # TCRCT-____-SND; TRAVIS # 12-890-TPA**
Y (6/6)	**CNN TE 560 (REACTIVATED)**	**4/0 - 1000 MCM MAIN & TAP**	**ANDERSON# TCC-8100100-TP; TRAVIS # 12-893-TPA HOMAC# 6MT-100-100R; SEFCOR # TCRCT-3434-SND;**
N	CNN TE 561 (NO LISTING)	4/0 - 1000 MCM TO #4 – 300 TAP	ANDERSON # TCC-81000253-TP; HOMAC # 6MT-___; SEFCOR # TCRCT- __ ; TRAVIS # 12-892-TPA

		CONNECTOR, STRAIGHT TEE, BRONZE, TUBE TO FLAT, CENTERFORMED (CF), TIN PLATED	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN TE 660 (NO LISTING)	1 ¼" TUBE TO 4 HOLE 3" PAD	ANDERSON # TTF-1230-1-TP; HOMAC # KBNT-G-4NR; SEFCOR # TFT-49-4A-SND; TRAVIS # 12-767-TPA
N	CNN TE 792 (INACTIVE)	1 ¼" IPS TO 4 HOLE 4" PAD	ANDERSON # TTF-1240-1-TP; HOMAC # KBNT-G-4NNR; SEFCOR # TFT-49-4B-SND; TRAVIS # 12-768-TPA
Y (6/6)	**CNN TE 793**	**1 ½" IPS TO 4 HOLE 4" PAD**	**ANDERSON # TTF-1440-1-TP; HOMAC # KBNT-H-4NNR; SEFCOR # TFT-53-4B-SND; TRAVIS # 12-773-TPA**
Y (3/3)	**CNN TE 794 (REACTIVATED)**	**2" IPS TO 4 HOLE 4" PAD**	**ANDERSON # TTF-2040-1-TP; HOMAC # KBNT-J-4NNR; SEFCOR # TFT-58-4B-SND; TRAVIS # 12-778-TPA**
N	CNN TE 795 (INACTIVE)	2 ½" IPS TO 4 HOLE 4" PAD	ANDERSON # TTF-2440-1-TP; HOMAC # KBNT-K-4NNR; SEFCOR # TFT-60-4B-SND; TRAVIS # 12-783-TPA
Y (7/12)	**CNN TE 798**	**3 ½" IPS TO 4 HOLE 4" PAD**	**ANDERSON # TTF-3440-1-TP; HOMAC # KBNT-M-4NNR; SEFCOR # TFT-63-4B-SND; TRAVIS # 12-794-TPA**
Y (1/1)	**CNN TE 799**	**4" IPS TO 4 HOLE 4" PAD**	**ANDERSON # TTF-4040-1-TP; HOMAC # KBNT-P-4NNR; SEFCOR # TFT-64-4B-SND; TRAVIS # 12-800-TPA**

		BRONZE BOLTED TEE CONNECTOR, DUAL FUNCTION TERMINAL FOR CABLE OR PIPE CONNECTIONS TO FLAT PAD TAP	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (3/3)	**CNN TE 904 (REACTIVATED)**	**4/0 – 1500 MCM TO 4 HOLE 3" PAD**	**ANDERSON # SF-2C; HOMAC # 7MK-200-4N; SEFCOR # TFC-34-4A; TRAVIS # 11-222**
Y (3/3)	**CNN TE 905 (NEW ITEM #)**	**4/0 – 1500 MCM TO 4 HOLE 4" PAD**	**ANDERSON # SF-3C; HOMAC # 7MK-200-4NN; SEFCOR # TFC-34-4B; TRAVIS # 11-225**

		CONNECTOR, STRAIGHT TEE, BRONZE, TUBE TO TUBE, BRONZE WITH SILICON BRONZE HARDWARE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN TE 802 (NO LISTING)	½" MAIN & TAP	ANDERSON # TTH-04043; HOMAC # KTH- SEFCOR # TTT-____ ; TRAVIS # 12-101
Y	CNN TE 804	¾" MAIN & ½" TAP	ANDERSON # TTH-06043; HOMAC # KTH-E-C SEFCOR # TTT-30__; TRAVIS # 12-102
Y	CNN TE 806	¾" MAIN & ¾" TAP	ANDERSON # TTH-0606; HOMAC # KTH-E-E SEFCOR # TTT-3030; TRAVIS # 12-103
N	CNN TE 810 (NO LISTNG)	1" MAIN & ¾" TAP	ANDERSON # TTH-1006; HOMAC # KTH- SEFCOR # TTT-3930; TRAVIS # 12-105
Y (3/3)	CNN TE 812	1" MAIN & TAP	ANDERSON # TTH-1010; HOMAC # KTH-F-F SEFCOR # TTT-3939; TRAVIS # 12-106
Y (0/0)	CNN TE 816	1 ¼" MAIN & ¾" TAP	ANDERSON # TTH-1206; HOMAC # KTH-G-E SEFCOR # TTT-4930; TRAVIS # 12-108
Y (3/3)	CNN TE 818	1 ¼" MAIN & 1" TAP	ANDERSON # TTH-1210; HOMAC # KTH-G-F SEFCOR # TTT-4939; TRAVIS # 12-109
Y (3/3)	CNN TE 820	1 ¼" MAIN & TAP	ANDERSON # TTH-1212; HOMAC # KTH-G-G SEFCOR # TTT-4949; TRAVIS # 12-110
Y (0/0)	CNN TE 824	1 ½" MAIN & ¾" TAP	ANDERSON # TTH-1406; HOMAC # KTH-H-E SEFCOR # TTT-5330; TRAVIS # 12-112
Y (0/0)	CNN TE 826	1 ½" MAIN & 1" TAP	ANDERSON # TTH-1410; HOMAC # KTH-H-F SEFCOR # TTT-5339; TRAVIS # 12-113
N	CNN TE 828 (NO LISTING)	1 ½" MAIN & 1 ¼" TAP	ANDERSON # TTH-1412; HOMAC # KTH- SEFCOR # TTT-5349; TRAVIS # 12-114
Y (0/0)	CNN TE 830	1 ½" MAIN & TAP	ANDERSON # TTH-1414; HOMAC # KTH-H-H SEFCOR # TTT-5353; TRAVIS # 12-115
Y (0/0)	CNN TE 836	2" MAIN & 1" TAP	ANDERSON # TTH-2010; HOMAC # KTH-J-F SEFCOR # TTHT-5839; TRAVIS # 12-118
N	CNN TE 838 (INACTIVE)	2" MAIN & 1 ¼" TAP	ANDERSON # TTH-2012; HOMAC # KTH-J-G SEFCOR # TTHT-5849; TRAVIS # 12-119
Y (0/0)	CNN TE 840	2" MAIN & 1 ½" TAP	ANDERSON # TTH-2014; HOMAC # KTH-J-H SEFCOR # TTHT-5853; TRAVIS # 12-120
Y (3/3)	CNN TE 842	2" MAIN & TAP	ANDERSON # TTH-2020; HOMAC # KTH-J-J SEFCOR # TTHT-5858; TRAVIS # 12-121
Y (0/0)	CNN TE 850	2 ½" MAIN & 1 ¼" TAP	ANDERSON # TTH-2412; HOMAC # KTH-K-G SEFCOR # TTHT-6049; TRAVIS # 12-125
Y (0/0)	CNN TE 852	2 ½" MAIN & 1 ½" TAP	ANDERSON # TTH-2414; HOMAC # KTH-K-H SEFCOR # TTHT-6053; TRAVIS # 12-126
Y (0/0)	CNN TE 854	2 ½" MAIN & 2" TAP	ANDERSON # TTH-2420; HOMAC # KTH-K-J SEFCOR # TTHT-6058; TRAVIS # 12-127
Y (3/3)	CNN TE 856	2 ½" MAIN & 2 ½" TAP	ANDERSON # TTH-2424; HOMAC # KTH-K-K SEFCOR # TTHT-6060; TRAVIS # 12-128
Y (0/0)	CNN TE 864	3" MAIN & 1 ½" TAP	ANDERSON # TTH-3014; HOMAC # KTH-L-H SEFCOR # TTHT-6253; TRAVIS # 12-133
Y (0/0)	CNN TE 866	3" MAIN & 2" TAP	ANDERSON # TTH-3020; HOMAC # KTH-L-J SEFCOR # TTHT-6258; TRAVIS # 12-134
Y (0/0)	CNN TE 870	3" MAIN & TAP, TIN PLATED	ANDERSON # TTH-3030-TP; HOMAC # KTH-L-LR; SEFCOR # TTHT-6262-TP; TRAVIS # 12-136-TPA
Y (3/3)	CNN TE 894	4" MAIN & 1 ½" TAP	ANDERSON # TTH-4014; HOMAC # KTH-P-H SEFCOR # TTHT-6453; TRAVIS # 12-150
Y (0/0)	CNN TE 896	4" MAIN & 2 ½" TAP	ANDERSON # TTH-4024; HOMAC # KTH-P-K SEFCOR # TTHT-6460; TRAVIS # 12-152
Y (0/0)	CNN TE 897	4" MAIN & 3" TAP, TIN PLATED	ANDERSON # TTH-4030-TP; HOMAC # KTH-P-LR; SEFCOR # TTHT-6462-TP; TRAVIS # 12-153-TPA

TERMINALS

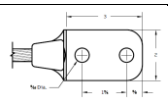
		ALUMINUM COMPRESSION TERMINAL, CABLE TO 4 HOLE PAD	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (9/18)	**CNN AJ 002**	**556 ACSR / 636 AAC, 15°, 3" PAD**	**ANDERSON # ACF-675B-15; TRAVIS # 16-148C-15 HOMAC# ALCC-*636*-4N15; SEFCOR # AL-918-4A-15;**
Y (12/24)	**CNN AJ 005**	**1590 ACSR, 15°, 3" PAD**	**ANDERSON # ACF-1545-N4-15; TRAVIS # 16-169D-15 HOMAC# ALCC-*1590*-4N15; SEFCOR # AL-1548-4B-15;**
Y (9/18)	**CNN AJ 006**	**954 AAC, 0°, 3" PAD**	**ANDERSON # ACF-1196-N4; TRAVIS # 16-161C HOMAC # ALCC-*954*-4N; SEFCOR # AL-1126-4A;**
Y (9/12)	**CNN AJ 007**	**954 ACSR, 0°, 3" PAD**	**ANDERSON # ACF-1196-N4; TRAVIS # 16-164C HOMAC # ALCC-*954*-4N; SEFCOR # AL-1196-4A;**
Y (10/20)	**CNN AJ 008**	**1590 ACSR, 0°, 4" PAD**	**ANDERSON # ACF-1545-N4; TRAVIS # 16-169D HOMAC # ALCC-*1590*-4NN; SEFCOR # AL-1548-4B;**
Y (0/0)	**CNN AJ 010**	**954 ACSR, 15°, 4" PAD**	**ANDERSON # ACF-1196-N4-15; TRAVIS # 16-164D-15 HOMAC# ALCC-*954*-4NN15; SEFCOR# AL-1196-4A-15;**
Y (6/6)	**CNN AJ 020**	**2500 AAC, 0°, 4" PAD**	**ANDERSON # ACF-1824-N4; TRAVIS # 16-172D HOMAC # ALCC-*2500*-4NN; SEFCOR # AL-1824-4B**

		ALUMINUM TERMINAL, TUBE TO FLAT, WELDMENT, (STRAIGHT/ANGLE OR CENTERFORMED (CF))	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN WE 204 (NO LISTING)	1" IPS TO 2 HOLE PAD	ANDERSON # WSTF-10B2; HOMAC # AWO-F-2N; SEFCOR # WFTO-39-2B; TRAVIS # 18-107E
N	**CNN WE 215 (INACTIVE)**	**2" IPS TO 2 HOLE PAD, CF**	**ANDERSON # WSTF-20B2-CF; HOMAC # AWO-J-2ND; SEFCOR # WFTOC-58-2B; TRAVIS # 18-116-CFE**
N	CNN WE 219 (INACTIVE)	2 ½" IPS TO 2 HOLE PAD	ANDERSON # WSTF-24B2; HOMAC # AWO-K-2N; SEFCOR # WFTO-60-2B; TRAVIS # 18-119E
N	CNN WE 232 (NO LISTING)	1" IPS TO 4 HOLE 3" PAD	ANDERSON # WSTF-10C; HOMAC # AWO-F-4N; SEFCOR # WFTO-39-4A; TRAVIS # 18-108E
Y (3/6)	**CNN WE 244 (REACTIVATED)**	**2" IPS TO 4 HOLE 3" PAD**	**ANDERSON # WSTF-20C; HOMAC # AWO-J-4N; SEFCOR # WFTO-58-4A; TRAVIS # 18-117E**
N	**CNN WE 245 (INACTIVE)**	**2" IPS TO 4 HOLE 3" PAD, 90°**	**ANDERSON # WSTF-20C-Y90; HOMAC # AWO-J-4N90; SEFCOR # WFTO90-58-4A; TRAVIS # 18-117-E-90**
N	**CNN WE 246 (INACTIVE)**	**2" IPS TO 4 HOLE 3"PAD, CF**	**ANDERSON # WSTF-20C-CF; HOMAC # AWO-J-4ND ; SEFCOR #WFTOC-58-4A; TRAVIS # 18-117-CFE**
N	CNN WE 253	2 ½" IPS TO 4 HOLE 3" PAD, CF	ANDERSON # WSTF-24C-CF; HOMAC # AWO-K-4ND; SEFCOR # WFTOC-60-4A; TRAVIS # 18-120-CFE
N	CNN WE 254 (INACTIVE)	2 ½" IPS TO 4 HOLE 3" PAD, 45°	ANDERSON # WSTF-24C-Y45; HOMAC # AWO-K-4ND; SEFCOR # WFTOC-60-4A; TRAVIS # 18-120-E-45
N	CNN WE 257 (INACTIVE)	2 ½" IPS TO 4 HOLE 4" PAD, CF	ANDERSON # WSTF-24D; HOMAC # AWO-K-4NND; SEFCOR # WFTOC-60-4B; TRAVIS # 18-121-CFE
N	CNN WE 258 (INACTIVE)	2 ½" IPS TO 4 HOLE 4" PAD, 90°	ANDERSON # WSTF-24D-Y90; HOMAC # AWO-K-4NN90; SEFCOR # WFTO90-60-4B; TRAVIS # 18-121-E-90
N	CNN WE 260	3" IPS TO 4 HOLE 3" PAD	ANDERSON # WSTF-30C; HOMAC # AWO-L-4N; SEFCOR # WFTO-62-4A; TRAVIS # 18-123E
N	CNN WE 268	3 ½" IPS TO 4 HOLE 3" PAD	ANDERSON # WSTF-34C; HOMAC # AWO-M-4N; SEFCOR # WFTO-63-4A; TRAVIS # 18-126E
N	CNN WE 269	3 ½" IPS TO 4 HOLE 3" PAD, CF	ANDERSON # WSTF-34C-CF; HOMAC # AWO-M-4ND; SEFCOR # WFTOC-63-4A; TRAVIS # 18-126-CFE
N	CNN WE 273	3 ½" IPS TO 4 HOLE 4 " PAD	ANDERSON # WSTF-34D; HOMAC # AWO-M-4NND; SEFCOR # WFTO-63-4B; TRAVIS # 18-127E
Y (4/6)	**CNN WE 277**	**4" IPS TO 4 HOLE 4" PAD, CF**	**ANDERSON # WSTF-40-D-CF; HOMAC # AWO-P-4NND; SEFCOR # WFTOC-64-4B; TRAVIS # 18-130-CFE**
N	CNN WE 278 (INACTIVE)	5" IPS TO 4 HOLE 4" PAD, CF	ANDERSON # WSTF-50D-CF; HOMAC # AWO-R-4NND; SEFCOR # WFTOC-67-4B; TRAVIS # 18-136-CFE

		ALUMINUM WELDMENT EXPANSION TERMINAL, TUBE TO 4 HOLE FLAT	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN WE 255 (INACTIVE)	2 ½" IPS TO 3" PAD	ANDERSON # WFTF-24-C; HOMAC # AWEPC-K-4N SEFCOR # WFXTC-60-4A; TRAVIS # 18-1136
N (0/0)	CNN WE 274	3 ½" IPS TO 4" PAD	ANDERSON # WFTF-34-D; HOMAC # AWEPC-M-4NN SEFCOR # WFXTC-63-4B; TRAVIS # 18-1143
N	CNN WE 275 (INACTIVE)	3" IPS TO 3" PAD	ANDERSON # WFTF-30-C; HOMAC # AWEPC-L-4N SEFCOR # WFXTC-62-4A; TRAVIS # 18-1139
N (0/0)	**CNN WE 276**	**4" IPS TO 4" PAD, CF**	**ANDERSON # WFTF-40-D; HOMAC # AWEPC-P-4NN SEFCOR # WFXTC-64-4B; TRAVIS # 18-1146**
		4" IPS TO 4" PAD	**SEFCOR # WFXTC-V-64-4B**
N	CNN WE 279 (INACTIVE)	5" IPS TO 4" PAD	ANDERSON # WFTF-50-D; HOMAC # AWEPC-R-4NN SEFCOR # WFXTC-67-4B; TRAVIS # 18-1152
N (0/0)	**CNN WE 282**	**2" IPS TO 3" PAD**	**ANDERSON # WFTF-20-C; HOMAC # AWEPC-J-4N SEFCOR # WFXTC-58-4A; TRAVIS # 18-1133**
N	CNN WE 283 (INACTIVE)	2" IPS TO 4" PAD, CF	ANDERSON # WFTF-20-D; HOMAC # AWEPC-J-4NN SEFCOR # WFXTC-58-4B; TRAVIS # 18-1134

		ALUMINUM STRAIGHT WELDED, SINGLE CABLE TO 4 HOLE FLAT	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y	**CNN WE 440**	**954 AAC TO 4 HOLE 4" PAD**	**ANDERSON # WCF-117D; HOMAC # AWM-95-4N; SEFCOR # WFC-34-4B; TRAVIS # 18-700**
Y (12/24)	**CNN WE 441**	**954 ACSR TO 4 HOLE 4" PAD**	**AFL # WPC103-4N4-AA; ANDERSON # WCF-129D; HOMAC # AWM-103-4NN; SEFCOR # WFC-36-4B; TRAVIS # 18-706**
N	CNN WE 451 (INACTIVE)	1590 ACSR TO 4 HOLE 4" PAD	AFL 3 WPC190-4N4-AA; ANDERSON # WCF-155D; HOMAC # AWM-180-4NN; SEFCOR # WFC-46-4B; TRAVIS # 18-724-SP
		1590 AAC TO 4 HOLE 4" PAD	ANDERSON # WCF-155D; HOMAC # AWM-180-4NN; SEFCOR # WFC-46-4B; TRAVIS # 18-724
		4/0 AAC TO 4 HOLE 3" PAD	**HOMAC # AWM-4/0-4N; TRAVIS # 18-672; SEFCOR # WFC-11-4A**
		954 AAC TO 4 HOLE 3" PAD	**HOMAC # AWM-95-4N; TRAVIS # 18-699 SEFCOR # WFC-34-4A**
N		954 AAC TO 4 HOLE PAD, 90°	HOMAC # AWM-95-4N90; TRAVIS # 18-699-90; SEFCOR # WFC-34-4B-90;
		636 AAC TO 4" PAD	**SEFCOR # WFC-24-4B; HOMAC # 70-4N**
		636 AAC TO 3" PAD	**SEFCOR # WFC-24-4A; HOMAC # 70-4N**

		ALUMINUM STRAIGHT WELDED, TWO CABLES TO 4 HOLE FLAT	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (12/24)	**CNN WE 442**	**(2) 954 ACSR TO 4" PAD**	**ANDERSON# W2CF-117C; HOMAC# AWMM-103-4NN; SEFCOR # WFC2-36-4B; TRAVIS # 18-769**
N (0/0)	CNN WE 452	(2) 1590 ACSR TO 4" PAD	ANDERSON # W2CF-155D; HOMAC # AWMM-180-4NN; SEFCOR # WFC2-46-4B; TRAVIS # 18-787-SP (1590ACSR)
Y (12/12)	**CNN WE 454 (NEW)**	**(2) 954 AAC TO 4" PAD, 90°**	**ANDERSON # W2CF-117CY90; TRAVIS # 18-763-90 HOMAC#AWMM-95-4NN90; SEFCOR# WFC2-90-34-4B;**
N		(2) 954 AAC TO 4" PAD, 45°	HOMAC # AWMM-95-4NN45; TRAVIS # 18-763-45 SEFCOR # WFC2-45-34-4B
		(2) 954 AAC TO 3" PAD	**HOMAC # AWMM-95-4N; TRAVIS # 18-762 SEFCOR # WFC2-34-4A**
N		(2) 954 AAC TO 3" PAD, 90°	HOMAC # AWMM-95-4N90; TRAVIS # 18-762-90 SEFCOR # WFC2-90-34-4A
		(2) 636 AAC TO 3" PAD	**SEFCOR # WFC2-24-4A**
		(2) 636 AAC TO 3" PAD, 90°	**SEFCOR # WFC2-90-24-4A**

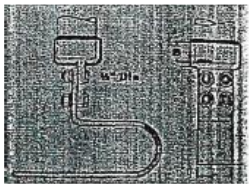


ALUMINUM STRAIGHT WELDED, SINGLE CABLE TO 2 HOLE FLAT

KEEP IN INVENTORY?	JEA ITEM ID #	PART DESCRIPTION	MANUFACTURER CATALOG #
N		954 AAC TO 2 HOLE PAD	HOMAC # AWM-95-2N; TRAVIS # 18-698
		#2 (7) AAC TO 2 HOLE PAD	**SEFCOR # WFC-06-2B**
		4/0 AAC TO 2 HOLE PAD	**SEFCOR # WFC-11-2B**
		636 AAC TO 2 HOLE PAD	**SEFCOR # WFC-24-2B**

STRAIGHT BOLTED TERMINAL, CABLE TO 4 HOLE FLAT, TINNED

KEEP IN INVENTORY?	JEA ITEM ID #	PART DESCRIPTION	MANUFACTURER CATALOG #
		636 AAC TO 3" PAD, 90°	**SEFCOR # AFNC90-24-4A-ETP**



CONNECTOR, WELDMENT FLEXIBLE TERMINAL, TUBE TO FLAT
[ALUMINUM 356-T6 CASTING WITH COPPER LAMINATED STRAPS AND STAINLESS STEEL HARDWARE]

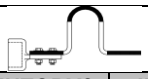
KEEP IN INVENTORY?	JEA ITEM ID #	PART DESCRIPTION	MANUFACTURER CATALOG #
N	CNN WE 500 (NO LISTING)	2" IPS TO 3" PAD	

TERMINAL, TEST ASSEMBLY, (STUD / PAD) TO 4 HOLE FLAT 4" PAD, GRAY PORCELAIN

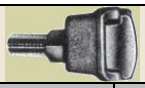
KEEP IN INVENTORY?	JEA ITEM ID #	PART DESCRIPTION	MANUFACTURER CATALOG #
Y	**CNN TLT 01**	**1 ½" - 12 STUD, 2000 AMPS**	***LAPP # 63056-70***
Y	**CNN TLT 02 (INACTIVE)**	**1 ¼" - 12 STUD, 1600 AMPS**	***LAPP # B-63040-70***
Y	**CNN TLT 03**	**2" - 12 STUD, 3000 AMPS**	***LAPP # B-63055-70***
Y	**CNN TLT 04**	**4 HOLE 4" PAD - 4 HOLE 4" PAD, 3000 AMPS**	***LAPP # 63037-70***

TERMINAL LUG CONNECTORS, 2 HOLE, LONG BARREL

KEEP IN INVENTORY?	JEA ITEM ID #	PART DESCRIPTION	MANUFACTURER CATALOG #
N	CNN TL 400 (INACTIVE)	#2 CU	BURNDY # YA2CRN; TRAVIS # 16-101B
Y (1/2)	CNN TL 402	1/0 CU	BURNDY # YA252N; TRAVIS # 16-102B
N	CNN TL 404 (INACTIVE)	2/0 CU	BURNDY # YA262N; TRAVIS # 16-103B
Y (9/16)	CNN TL 406	4/0 CU	BURNDY # YA282N; TRAVIS # 16-106B
Y (12/12)	CNN TL 407	500 CU	T&B #54876BE
Y (12/12)	CNN TL 408	750 CU	BURNDY # YA392N; TRAVIS # 16-115B; T&B # 54880BE
		1000 CU	

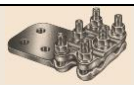
		ALUMINUM WELDMENT EXPANSION TERMINAL, TUBE TO 2 HOLE FLAT	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
		2" IPS	**SEFCOR # WSFFT-58-2B**

		JUMPER, 636AAC WITH BURNDY COMPRESSION CONNECTOR	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y	CNN JU 001	8 FT, 2 HOLE CONNECTOR	BURNDY # YNA39R
Y	CNN JU 002	15 FT, 4 HOLE CONNECTOR	BURNDY # YNA39R-4N

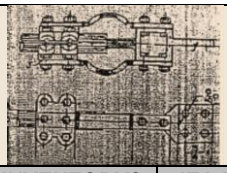
		TERMINAL, TAP LUG, CONDUCTOR TO FLAT, BRONZE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN TL 602 (INACTIVE)	#10- #1 CONDUCTOR; ½" MAX PAD; TIN PLATED	ANDERSON # TLS-22-L-TP
Y (20/50)	**CNN TL 606**	**#8 – 2/0 CONDUCTOR; ¾" MAX PAD; TIN PLATED**	**ANDERSON # TLS-32L-TP SEFCOR # UN-4048T-SND**
Y (16/32)	**CNN TL 616**	**#2 – 350 CONDUCTOR;¾" MAX PAD**	**ANDERSON # TLS-52-L SEFCOR # UN-4553-T**
Y (150/400)	**CNN TL 620**	**1/0 – 500 CONDUCTOR; ¾" MAX PAD**	**ANDERSON # TLS-62-L SEFCOR # UN-4656-T**
Y (7/12)	**CNN TL 621**	**2/0 – 1000 CONDUCTOR; ¾" MAX PAD; TIN PLATED**	**ANDERSON # TLS-89-L-TP**
Y (15/30)	**CNN TL 622**	**350 – 750 CONDUCTOR; ¾" MAX PAD**	**ANDERSON # TLS-89-L**

		BRONZE STRAIGHT BOLTED TERMINAL, CABLE TO 2 HOLE FLAT [TIN PLATED BRONZE WITH SILICON BRONZE CONNECTING HARDWARE]	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (15/40)	**CNN TE 046**	**#4 SOL – 250 MCM (7#5)**	**ANDERSON # SWH-025B-TP-ED; TRAVIS # 11-101-TPA HOMAC # 7M-60-2NR; SEFCOR # FNCT-12-2B-SND**
Y (30/80)	CNN TE 047	2/0 SOL – 800 MCM	ANDERSON # SWH-050B2-TP-ED; TRAVIS # 11-104-TPA HOMAC # 7M-80-2NR; SEFCOR # FNCT-34-2B-SND
Y (6/9)	**CNN TL 704**	**#4 - 250 MCM (7#5)**	**ANDERSON # SWH-025B-TP**; TRAVIS # 11-101-TPA **HOMAC # 7ME-60-2NR; SEFCOR # FNCT-12-2B-SND**
Y (6/12)	**CNN TL 708**	**1/0 – 500 MCM**	**ANDERSON # SWH-050B2-TP-ED**; TRAVIS # 11-104H-TPA **HOMAC # 7M-60-2NR; SEFCOR # FNCT-20H-2B-SND**
Y (3/5)	CNN TL 709	1/0 - 500 MCM, 90°	ANDERSON # SWH-050B2-Y-90-TP; TRAVIS # N/A HOMAC#7M-60-2N90R; SEFCOR#FNCT90-20H-2B-FF-SND
Y (6/6)	CNN TL 730	4/0 -1000 MCM	ANDERSON # SWH-100B2-TP-ED; TRAVIS # 11-104-TPA HOMAC # 7M-125-2NR; SEFCOR # FNCT-34-2B-SND

		BRONZE STRAIGHT BOLTED TERMINAL, CABLE TO 4 HOLE FLAT [TIN PLATED BRONZE WITH SILICON BRONZE CONNECTING HARDWARE]	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN TE 048	4/0 – 1000 MCM, 4" PAD	ANDERSON # SWH-100-D-TP;HOMAC # 7M-100-4NNR; SEFCOR # FNCT-34-4B-SND; TRAVIS # 11-112-TPA
N	CNN TL 705 (NO LISTING)	#6 - 250, 3" PAD	ANDERSON # SWH-025-C-TP; HOMAC # 7M- SEFCOR # FNCT-12-4A-SND; TRAVIS # 11-105H-TPA
N	CNN TL 758	1/0 - 500 MCM, 3" PAD	ANDERSON # SWH-050-C-TP; HOMAC # 7M-60-4NR SEFCOR # FNCT-20-4A-SND; TRAVIS # 11-105H-TPA
N	CNN TL 764	2/0 – 800 MCM, 3" PAD	ANDERSON # SWH-080-C-TP; HOMAC # 7M-80-4NR SEFCOR # FNCT-34-4A-SND ; TRAVIS # 11-111-TPA
N	CNN TL 765 (INACTIVE)	2/0 – 800 MCM, 4" PAD	ANDERSON # SWH-080-D-TP;HOMAC # 7M-80-4NNR SEFCOR # FNCT-34-4B-SND; TRAVIS # 11-112-TPA
N	**CNN TL 766 (INACTIVE)**	**2/0 – 800 MCM, 3" PAD, 90°**	**ANDERSON #SWH-080-C-Y90-TP-ED; HOMAC#7M-80-4N90R TRAVIS #11-111-90-TPA; SEFCOR #FNCT90-34-4A-SND;**
Y (24/36)	**CNN TL 770**	**4/0 – 1000 MCM, 3" PAD**	**ANDERSON # SWH-100-C-TP;HOMAC # 7M-125-4NR SEFCOR # FNCT-34-4A-SND; TRAVIS # 11-111-TPA**
N	CNN TL 773	4/0 – 1000 MCM, 4" PAD	ANDERSON # SWH-100-D-TP;HOMAC # 7M-100-4NNR SEFCOR # FNCT-34-4B-SND; TRAVIS # 11-112-TPA
Y (6/12)	**CNN TL 776 (NEW)**	**4/0 – 1000 MCM, 4" PAD, 90°**	**ANDERSON # SWH-100-D-Y90-TP; HOMAC #7M-100-4N90NR TRAVIS # 11-112-90-TPA; SEFCOR# FNCT90-34-4B-SND;**

		BRONZE STRAIGHT BOLT TERMINAL, TWO CABLES TO 4 HOLE FLAT [TIN PLATED BRONZE WITH BRONZE SILICON BRONZE HARDWARE]	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
Y (4/6)	CNN TL 759	1/0 - 500 MCM, 3" PAD	ANDERSON # SWHD-050-C-TP; TRAVIS # 11-231-TPA HOMAC # 7MM1-60-4NR; SEFCOR # FNCT2-20-4A-SND
Y (48/60)	**CNN TL 772**	**4/0 - 1000 MCM, 3" PAD**	**ANDERSON # SWHD-100-C-TP; TRAVIS # 11-234-TPA HOMAC # 7MM1-100-4NR; SEFCOR # FNCT2-34-4A-TP**
Y (12/18)	**CNN TL 774**	**4/0 - 1000 MCM, 4" PAD**	**ANDERSON # SWHD-100-D-TP; TRAVIS # 11-235-TPA HOMAC # 7MM1-100-4NNR; SEFCOR # FNCT2-34-4B-TP**
N	CNN TL 775	4/0 - 1000 MCM, 4" PAD, 90°	ANDERSON#SWHD-100D-Y90-TP; TRAVIS#11-235-90-TPA; HOMAC # 7MM-100-4NN90R; SEFCOR # FNCT290-34-4B

		TERMINAL, BRONZE, STRAIGHT, THREE CONDUCTORS TO 4 HOLE 3" PAD, SINGLE EYEBOLT CLAMPING	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN TL 761 (NO LISTING)	1/0 SOL - 500 MCM CU	ANDERSON # VL3D-61D-H; SEFCOR # FNCT3-20-4A
N	CNN TL 790 (INACTIVE)	350 MCM - 750 MCM CU	ANDERSON # VL3D-89D-H; SEFCOR # FNCT3-34-4A

		EXPANSION TERMINAL, BOLTED, BRONZE, TUBE TO FLAT	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN TL 919	½" IPS TO 2-HOLE FLAT PAD	DOSSERT # XL-200-4N; TRAVIS # 15-247

		CONNECTOR, STRAIGHT TERMINAL BRONZE, TUBE TO FLAT (2 OR 4 HOLE), TIN PLATED BRONZE WITH SILICON BRONZE HARDWARE	
KEEP IN INVENTORY?	**JEA ITEM ID #**	**PART DESCRIPTION**	**MANUFACTURER CATALOG #**
N	CNN TL 826 (NO LISTING)	½" IPS TO 2 HOLE PAD	ANDERSON # STF4-04B3-TP; HOMAC # KL-C3-2NR SEFCOR # FNTT-21-2B-SND; TRAVIS # 11-140-TPA
N	CNN TL 829 (INACTIVE)	¾" IPS TO 2 HOLE PAD	ANDERSON # STF4-06B2-TP; HOMAC # KL-E3-2NR SEFCOR # FNTT-30-2B-SND; TRAVIS # 11-143-TPA
N	CNN TL 832 (INACTIVE)	1" IPS TO 2 HOLE PAD	ANDERSON # STF4-10B2-TP; HOMAC # KL-F-2NR SEFCOR # FNTT-39-2B-SND; TRAVIS # 11-146-TPA
Y (2/2)	CNN TL 835	1 ¼" IPS TO 2 HOLE PAD	ANDERSON # STF4-12B2-TP; HOMAC # KL-G-2NR SEFCOR # FNNT-49-2B-SND; TRAVIS # 11-149-TPA
N	CNN TL 838 (INACTIVE)	1 ½" IPS TO 2 HOLE PAD	ANDERSON # STF4-14B2-TP; HOMAC # KL-H-2NR SEFCOR # FNTT-53-2B-SND; TRAVIS # 11-152-TPA
N	CNN TL 841 (INACTIVE)	2" IPS TO 2 HOLE PAD	ANDERSON # STF4-20B2-TP; HOMAC # KL-J-2NR SEFCOR # FNTT-58-2B-SND; TRAVIS # 11-155-TPA
N	CNN TL 844 (INACTIVE)	2 ½" IPS TO 2 HOLE PAD	ANDERSON # STF4-24B2-TP; HOMAC # KL-K-2NR SEFCOR # FNTT-60-2B-SND; TRAVIS # 11-158-TPA
N	CNN TL 847 (INACTIVE)	3" IPS TO 2 HOLE PAD	ANDERSON # STF4-30B2-TP; HOMAC # KL-L-2NR SEFCOR # FNTT-62-2B-SND; TRAVIS # 11-161-TPA
N	CNN TL 906	1" IPS TO 4 HOLE 3" PAD	ANDERSON # STF4-10C-TP; HOMAC # KL-F-4NR SEFCOR # FNTT-39-4A-SND; TRAVIS # 11-147-TPA
N	CNN TL 910	1 ¼" IPS TO 4 HOLE 3" PAD	ANDERSON # STF4-12C-TP; HOMAC # KL-G-4NR SEFCOR # FNTT-49-4A-SND; TRAVIS # 11-150-TPA
N	CNN TL 911	1 ¼" IPS TO 4 HOLE 3" PAD, 90°	ANDERSON# STF4-12C-90-TP; HOMAC# KL-G-4N90R; SEFCOR # FNTT90-49-4A-SND; TRAVIS # 11-150-90-TPA
N	CNN TL 912 (INACTIVE)	1 ¼" IPS TO 4 HOLE 4" PAD	ANDERSON # STF4-12D-TP; HOMAC # KL- SEFCOR # FNTT-49-4B-SND; TRAVIS # 11-151-TPA
N	CNN TL 914	1 ½" IPS TO 4 HOLE 3" PAD	ANDERSON # STF4-14C-TP; HOMAC # KL-H-4NR SEFCOR # FNTT-53-4A-SND; TRAVIS # 11-153-TPA
N	CNN TL 918 (INACTIVE)	2" IPS TO 4 HOLE 3" PAD	ANDERSON # STF4-20C-TP; HOMAC # KL-J-4NR SEFCOR # FNTT-58-4A-SND; TRAVIS # 11-156-TPA
Y (3/3)	**CNN TL 920**	**2" IPS TO 4 HOLE 4" PAD**	**ANDERSON # STF4-20D-TP; HOMAC # KL-J-4NNR SEFCOR # FNTT-58-4B-SND; TRAVIS # 11-157-TPA**
N	CNN TL 922	2 ½" IPS TO 4 HOLE 3" PAD	ANDERSON # STF4-24C-TP; HOMAC # KL-K-4NR SEFCOR # FNTT-60-4A-SND; TRAVIS # 11-159-TPA
N	CNN TL 924	2 ½" IPS TO 4 HOLE 4" PAD	ANDERSON # STF4-24D-TP; HOMAC # KL-K-4NNR SEFCOR # FNTT-60-4B-SND; TRAVIS # 11-160-TPA
N	CNN TL 926	3" IPS TO 4 HOLE 3" PAD	ANDERSON # STF4-30C-TP; HOMAC # KL-L-4NR SEFCOR # FNTT-62-4A-SND; TRAVIS # 11-162-TPA
N	CNN TL 927 (INACTIVE)	3" IPS TO 4 HOLE 4" PAD, 90°	ANDERSON # STF4-30D-90-TP; HOMAC # KL-L-4NN90R; SEFCOR # FNTT90-62-4B-SND; TRAVIS # 11-163-90-TPA
Y (3/3)	**CNN TL 928 (REACTIVATED)**	**3" IPS TO 4 HOLE 4" PAD**	**ANDERSON # STF4-30D-TP; HOMAC # KL-L-4NNR SEFCOR # FNNT-62-4B-SND; TRAVIS # 11-163-TPA**
N	CNN TL 929 (INACTIVE)	3" IPS TO 4 HOLE 4" PAD, CF	ANDERSON # STF4-30D-CF-TP; HOMAC # KLC-L-4NNR; SEFCOR # FNTTC-62-4B-SND; TRAVIS # 11-163-CF-TPA
N	CNN TL 930	3 ½" IPS TO 4 HOLE 3" PAD	ANDERSON # STF4-34C-TP; HOMAC # KL-M-4NR SEFCOR # FNTT-63-4A-SND; TRAVIS # N/A
N	CNN TL 934 (INACTIVE)	4" IPS TO 4 HOLE 3" PAD	ANDERSON # STF4-40C-TP; HOMAC # KL-P-4NR SEFCOR # FNTT-64-4A-SND; TRAVIS # N/A

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POTENTIAL TRANSFORMERS

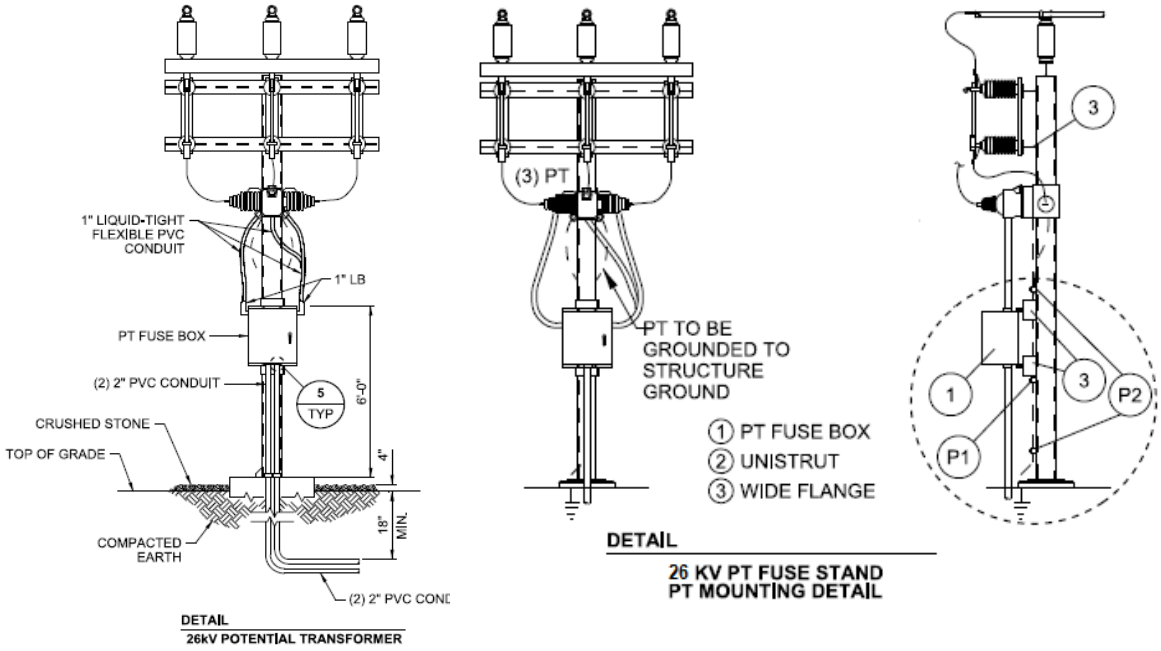
GENERAL:

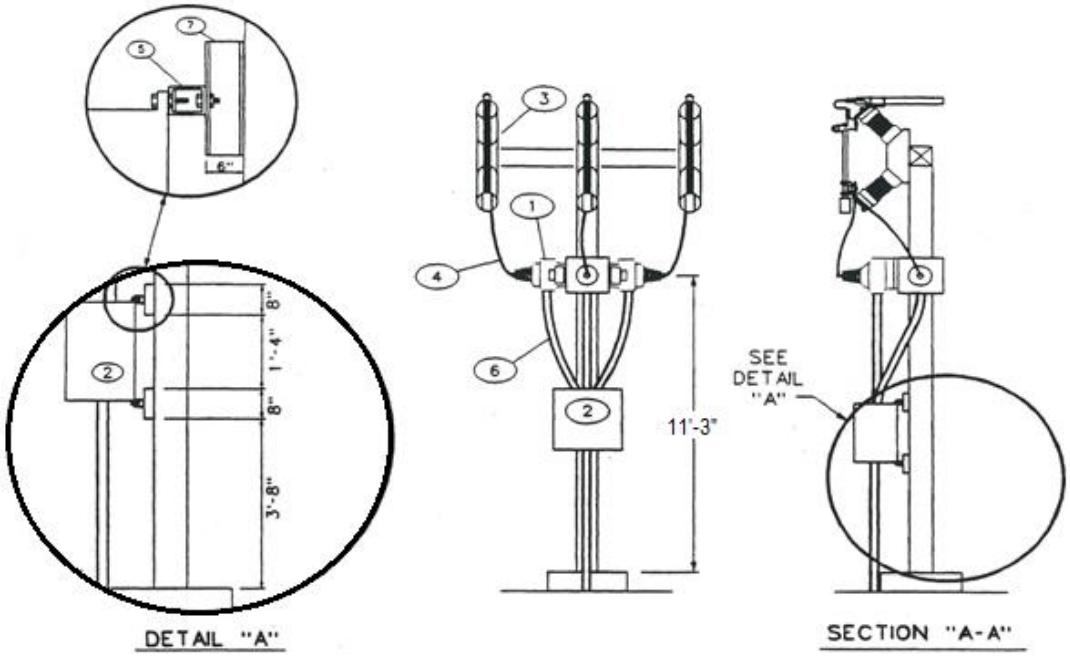
JEA uses only wound type potential transformers. Coupled capacitor type potential transformers are only allowed for communication coupling purposes, such as wave trap applications. All high voltage transmission class potential transformers are the oil filled type. The distribution class potential transformers are dry type.

INSTALLATION:

The potential transformers are connected directly to the substation bus with aluminum or copper cable sized for the particular application. All transmission voltage class PT's have 4-hole terminal pads at the top for connection to a 4-hole cable connector. The 26KV potential transformers have cable lugs for direct copper cable terminations. All potential transformers are solidly grounded with standard 7#5 Copperweld ground conductor which is connected to the substation ground grid system.

The secondary wiring for all potential transformers is brought to a common panel box (PT Fuse Box) mounted in the substation yard convenient to the PT's. Each secondary lead is fuse protected at that point and connections to other control equipment are made up in the PT Fuse Box. Detail installation drawings for reference only for the PT Fuse Boxes are on the following pages.



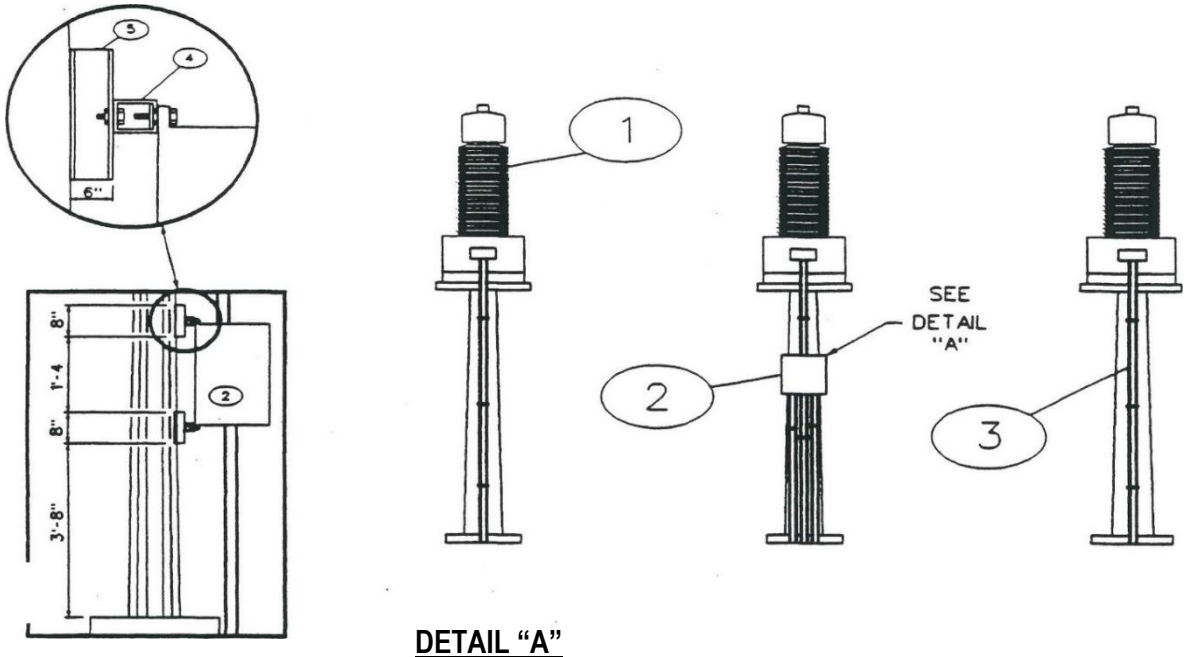


26KV P.T. BOX INSTALLATION DETAIL

ITEM	QUANTITY	DESCRIPTION
1	3	25KV POTENTIAL TRANSFORMER, SINGLE PRIMARY BUSHING, DRY TYPE, 150KV BIL, 14,000 PRIMARY VOLTAGE. VOLTAGE RATIO OF 120:1, ACCURACY OF 0.3% W, X, Y, Z AND ZZ. (JEA ITEM ID # XFRPT021 AND XFRPT023)
2	1	PT FUSE BOX, NEMA 4X WITH "L" LATCH HINGED COVER, 304 STAINLESS STEEL, 24 x 24 x 8 (ELUEB001) – NOTE: REFER TO POTENTIAL DEVICE ENCLOSURE DETAIL
3	3	FUSED DISCONNECT SWITCH, TYPE SMD-40, 25KV, S&C CAT # 19232B-Z1
4	15'	4/0 AAC (TYP), 7 STRAND, CODE NAME "OXLIP"
5	LOT	UNISTRUT, GALVANIZED, COMPLETE WITH HARDWARE, CUT TO REQUIRED LENGTH.
6	15'	1" LIQUID-TIGHT FLEXIBLE CONDUIT.
7	2	W6 X 15, 8" I-BEAM, FURNISHED WITH STRUCTURE.

NOTES:

1. THE CONTRACTOR SHALL FURNISH ALL CONDUIT, COMPLETE WITH NECESSARY HARDWARE AS SHOWN.
2. THE CONTRACTOR SHALL PROVIDE THE 25KV P.T. FUSE BOX.
3. THE CONTRACTOR SHALL FURNISH THE UNISTRUT AND ALL NECESSARY HARDWARE FOR MOUNTING THE P.T. FUSE BOX TO THE STRUCTURE. ALL AREAS CUT OR DRILLED SHALL BE COLD GALVANIZED.



DETAIL "A"

69KV, 138KV AND 230KV P.T. BOX INSTALLATION DETAIL

ITEM	QUANTITY	DESCRIPTION
1	3	POTENTIAL TRANSFORMER, ACCURACY OF 0.3% W, X, Y, Z AND ZZ. ~ 69KV P.T. WITH 350KV BIL - JEA ITEM ID# XFRPT025 ~ 138KV P.T. WITH 650KV BIL - JEA ITEM ID# XFRPT030 ~ 230KV P.T. WITH 900KV BIL - JEA ITEM ID# XFRPT035
2	1	PT FUSE BOX, NEMA 4X WITH "L" LATCH HINGED COVER, 304 STAINLESS STEEL, 24 x 24 x 8 (ELUEB001) NOTE: REFER TO POTENTIAL DEVICE ENCLOSURE DETAIL. ITEMS TO BE INCLUDED IN FUSE BOX: • ELUTB001 - TERMINAL BOARD, 6-CIRCUIT, WIRE SIZE 10-18 AWG, WITH WHITE MARKING STRIP • FUSHO013 – FUSEBLOCK, PHENOLIC, CARTRIDGE CLASS "H" FUSE, 3 POLE, MAXIMUM 30 AMP/250 VOLT, SCREW TERMINALS • TEMHE017 - HEATER, EDISON SCREW BASE, 120 V, 50 W CHROMALOX P/N SCB-50-253809 • LTGHR037 - HOLDER, LAMP, 660 WATT 250 V, PONY CLEAT PORCELAIN, MEDIUM BASE LEVITON 19062, WORK CTR 1-6
3	LOT	1 ½" PVC UV RATED, SCHEDULE 40 CONDUIT INCLUDING ATTACHMENT HARDWARE.
4	LOT	UNISTRUT, GALVANIZED, COMPLETE WITH HARDWARE, CUT TO REQUIRED LENGTH.
5	2	8" MOUNTING BEAM, FURNISHED WITH STRUCTURE.

NOTES:
1. THE CONTRACTOR SHALL FURNISH ALL CONDUIT, COMPLETE WITH NECESSARY HARDWARE, AS SHOWN.
2. THE CONTRACTOR SHALL PROVIDE THE P. T. FUSE BOX.
3. THE CONTRACTOR SHALL FURNISH THE UNISTRUT AND ALL NECESSARY HARDWARE FOR MOUNTING THE P. T. FUSE BOX TO THE STRUCTURE. ALL AREAS CUT OR DRILLED SHALL BE COLD GALVANIZED.
4. THE CONTRACTOR SHALL ATTACH THE CONDUIT TO THE STRUCTURE EVERY FOUR (4) FEET.

SPECIFICATION:

The potential transformers for metering and relaying applications are as follows:

- 26kV - ratio 120:1, 150kV BIL, 14.4kV primary
- 69kV - ratio 350/600:1:1, 350kV BIL, 40.25kV primary
- 138kV - ratio 700/1200:1:1, 650kV BIL, 80.5kV primary
- 230kV - ratio 1200/2000:1:1, 900kV BIL, 138kV primary (minimum leakage distance of 245")

All designs shall have 0.3% w, x, y, z, and zz burdens and comply with IEEE C57.13.

The potential transformer tanks/cabinets must be stainless steel, aluminum, powder coated steel, unpainted galvanized or approved equal with stainless steel hardware.

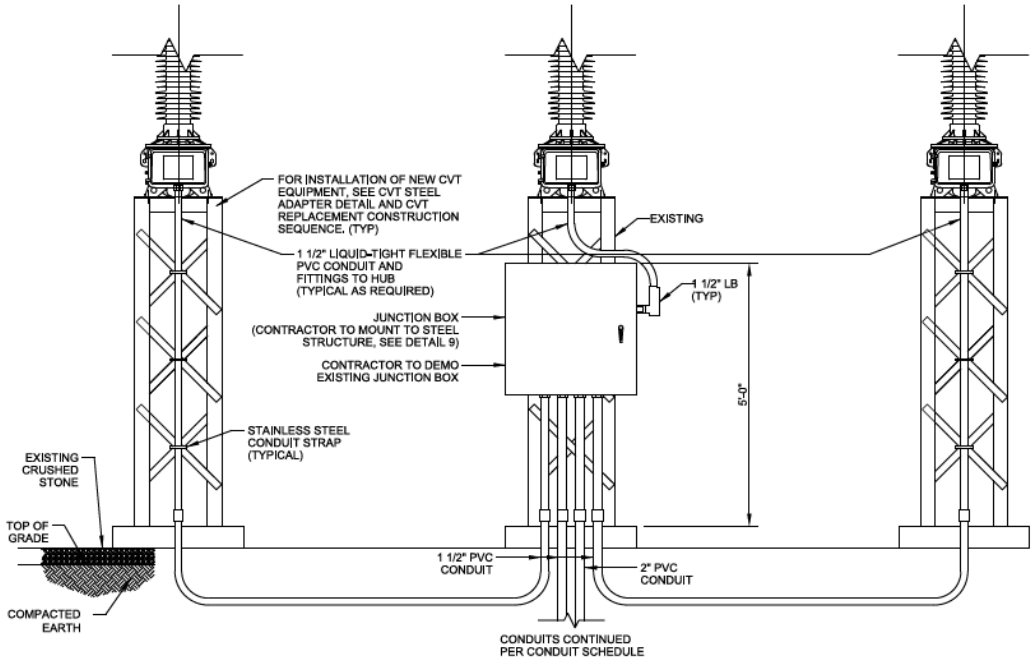
The following is a list of approved manufacturers for potential transformers for substation application:

JEA Approved Manufacturer List for Potential Transformers		
JEA ITEM ID #	**Nominal System Voltage**	**Manufacturer and Model Number**
XFRPT021	26kV, 150kV BIL, Ratio 120:1	Hitachi Energy # Type VOG-15B #E-923A680G03; OLD # E-7526A63G02; Ritz # 122031010.395685
XFRPT023	26kV, 200kV BIL Dual Ratio 120:1 / 200:1	Hitachi Energy # E-7526A55G09 Ritz # 123031010.72976
XFRPT025	69kV 350kV BIL	GE Grid Solutions # OTEF072 Hitachi Energy # J710600TE – Epoxy bushings Hitachi Energy # J710600TDAAAA – Porcelain bushings Ritz # VEF72-13 Trench # UT5-350-69
XFRPT030	138kV 650kV BIL	GE Grid Solutions # OTEF145 Hitachi Energy # L741200T0; UTE-145-OH Trench # UT5-650-138; VEOTA-145
XFRPT035	230kV 900kVBIL	GE Grid Solutions # OTEF245 Hitachi Energy # N742000T0; UTF245 Trench # UT5-900-230; VEOTA-245

Each potential transformer shall be equipped with a stainless steel nameplate permanently mounted on each unit and stamped with the following information: Manufacturer's Name, Rated Primary Voltage, Manufacturer's Type and Catalog Number, Ratios, Basic Impulse Insulation Level, Rated Frequency, Thermal Burden Ratings at Ambient Temperature, Accuracy Rating, Manufacturer's S.O. or J.O. Number, Serial Number

CAPACITIVE VOLTAGE TRANSFORMERS (CVT)

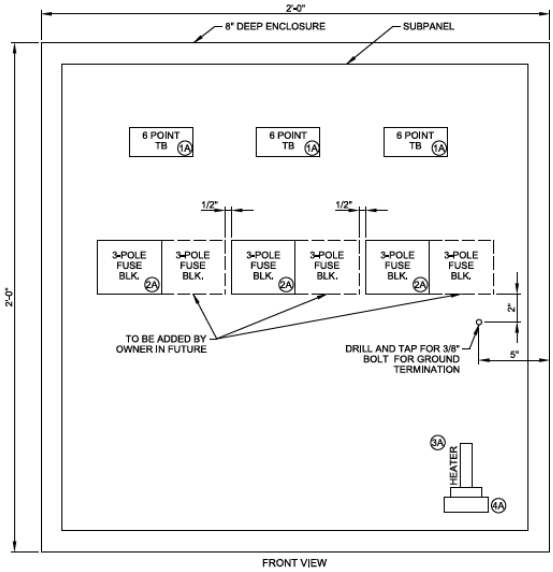
CVTs are used in place of PTs for certain applications in some of JEA substations.



3ø CVT CONDUIT RISER AND JUNCTION BOX 920CVTJB

3

TYPICAL 1 PLC
NOT TO SCALE



FRONT VIEW

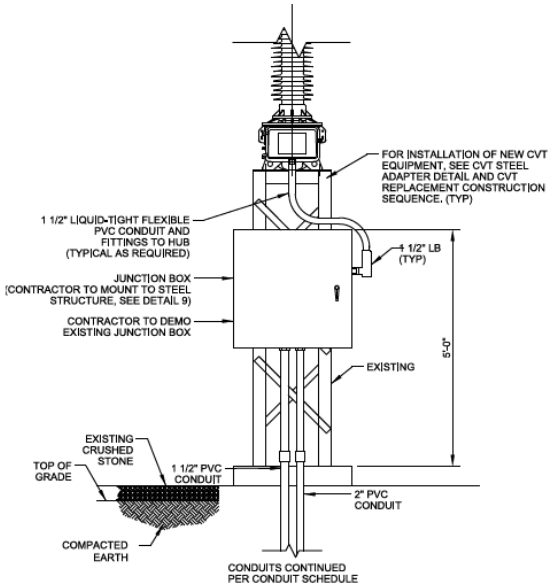
920CVTJB MATERIAL LIST

1	CVT ENCLOSURE, 24" X 24" X 8", NEMA 4X, STAINLESS STEEL 304, INCLUDING MOUNTING FASTENERS AND STEEL SUBPANEL, MID STATE - HOFFMAN A24H2408SSLP3PT W/ A24P24	
3	TERMINAL BLOCK, 6-POINT, 600V, 30A, W/ MARKING STRIP AND COVER, MID STATE SUPPLY CO. EB25B06C	1A
3	FUSE BLOCK, 3-POLE, 250V, 30A, H-CLASS, MID STATE - EATON HM25030-3SR	2A
1	HEATER, EDISON SCREW BASE, CHROMALOX. P/N SCB-100-253833 (100 WATTS AT 120VAC)	3A
1	SOCKET, SCREW BASE HEATER, CLEAT RECEPTACLE, PORCELAIN KEYLESS SCREW TERMINALS, 660 WATTS MAX, 250VAC LEVITON 19062 OR EQUAL	4A
PROVISIONS FOR BOTTOM ENTRY CONDUIT, AS REQUIRED		

FURNISHED AND INSTALLED BY CONTRACTOR

3ø CVT JUNCTION BOX

1



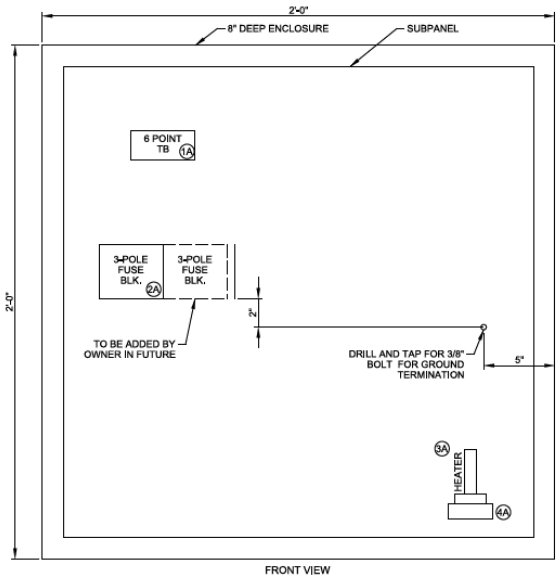
1ø CVT CONDUIT RISER AND JUNCTION BOXES
9G3CVTJB, 230SBCVTJB, 842CVTJB

4

TYPICAL 3 PLC
NOT TO SCALE

NOTES:

1. THE CONTRACTOR TO DRILL AND TAP FOR ⅜" BOLT FOR GROUND TERMINATION IN THE JUNCTION BOX AT LOCATION SHOWN. THE CONTRACTOR TO FURNISH AND INSTALL ALL GROUNDING PROVISIONS FOR THE JUNCTION BOX TO BE CONNECTED TO STATION GRID. CONNECT STRUCTURE GROUND RISER CONDUCTOR TO EXTERIOR OF JUNCTION BOX AND #8 COPPER OR LARGER FROM 3/8" INTERIOR BOLT TO GROUND CONDUCTOR SPLIT BOLT CONNECTION.
2. THE CONTRACTOR IS RESPONSIBLE FOR THE EQUIPMENT WIRING AS LISTED IN THE SPECIFICATIONS. THE CONTRACTOR SHALL NOTIFY THE JEA PROJECT REPRESENTATIVE OR PROJECT MANAGER TO REQUEST DETAILED INTERCONNECTION DRAWINGS.
3. ALL POTENTIAL TRANSFORMER (CVT) JUNCTION BOXES SHOULD BE PLACED SUCH THAT WHEN LOOKING INTO THE JUNCTION BOX, THE A-PHASE CVT WILL BE ON THE LEFT. IN ADDITION, WIRING INSIDE THE BOX SHOULD INDICATE CVT PHASE POSITION ON THE INDIVIDUAL TERMINAL BLOCKS IN THE SAME FASHION.
4. THE CONTRACTOR TO FURNISH, AND INSTALL IN A NON-PENETRATING FASHION TO STRUCTURAL STEEL, THE CVT JUNCTION BOX.
5. APPROPRIATE CONDUIT CLAMPS SHALL BE INSTALLED BY THE CONTRACTOR TO ATTACH CONDUIT TO STEEL STRUCTURES AS NEEDED. THIS SHALL INCLUDE A CLAMP AT EACH BEND WHERE THE CONDUIT RUN DEPARTS FROM THE STRUCTURE AND A MAXIMUM SPACING BETWEEN CLAMPS OF 4'.



FRONT VIEW

9G3CVTJB, 230SBCVTJB, 842CVTJB MATERIAL LIST

1	CVT ENCLOSURE, 24" X 24" X 8", NEMA 4X, STAINLESS STEEL 304, INCLUDING MOUNTING FASTENERS AND STEEL SUBPANEL, MID STATE - HOFFMAN A24H2408SSLP3PT W/ A24P24	
1	TERMINAL BLOCK, 6-POINT, 600V, 30A, W/ MARKING STRIP AND COVER, MID STATE SUPPLY CO. EB25B06C	1A
1	FUSE BLOCK, 3-POLE, 250V, 30A, H-CLASS, MID STATE - EATON HM25030-3SR	2A
1	HEATER, EDISON SCREW BASE, CHROMALOX. P/N SCB-100-253833 (100 WATTS AT 120VAC)	3A
1	SOCKET, SCREW BASE HEATER, CLEAT RECEPTACLE, PORCELAIN KEYLESS SCREW TERMINALS, 660 WATTS MAX, 250VAC LEVITON 19062 OR EQUAL	4A
PROVISIONS FOR BOTTOM ENTRY CONDUIT, AS REQUIRED		

FURNISHED AND INSTALLED BY CONTRACTOR

1ø CVT JUNCTION BOX

2

SPECIFICATION:

The capacitive voltage transformers for metering and relaying applications are as follows:

- 69kV - ratio 350/600:1:1, 350kV BIL, 40.25kV primary
- 138kV - ratio 700/1200:1:1, 650kV BIL, 80.5kV primary
- 230kV - ratio 1200/2000:1:1, 1050kV BIL, 138kV primary

All designs shall have 1.2% w, x, y, z burdens and comply with IEEE and ANSI Standards

The potential transformer tanks/cabinets must be stainless steel, aluminum, powder coated steel, unpainted galvanized or approved equal with stainless steel hardware.

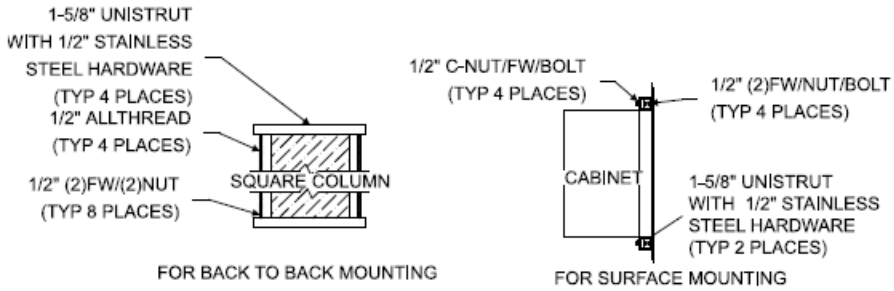
All CVTs should be Polymer. All cabinets and hardware should be Stainless Steel or Aluminum.

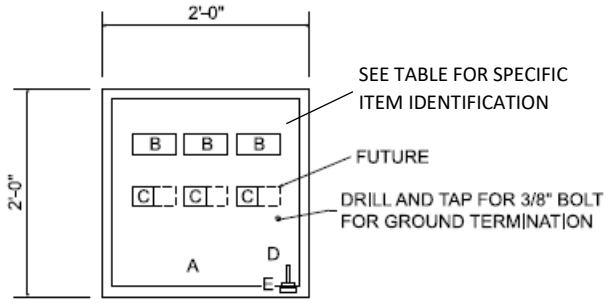
The following is a list of approved manufacturers for CVTs for substation applications:

JEA Approved Manufacturer List for Capacitive Voltage Transformers		
JEA ITEM ID #	**Nominal System Voltage**	**Manufacturer and Model Number**
XFRCC001	69 KV NOMINAL, 350 KV BIL, RATIO 350/600:1:1, SEC 115V/67.08V, 10,000 - 12,500 PF ACCURACY/BURDEN 1.2 WXYZ	GE Grid Solutions # OTCF 72SR Hitachi Energy # DDB-72 Trench # TEVF 72.5C
XFRCC002	138 KV NOMINAL, 650 KV BIL, RATIO 700/1200:1:1, SEC 115/67.08V, 5000 - 6250 PF, ACCURACY/BURDEN 1.2 WXYZ	GE Grid Solutions # OTCF 145SR Hitachi Energy # DDB-145 Trench # TEVF 145C
XFRCC003	230KV NOMINAL, 1050 KV BIL, RATIO 2000/1200:1:1, PRIMARY 138 KV-69/115V, 3000 PF	GE Grid Solutions # OTCF 245SR Hitachi Energy # DDB-245 Trench # TEVF-230
XFRCC005	230 KV NOMINAL, 1050 KV BIL, RATIO 1200/2000:1:1, SEC 115V/69V, 3,000 - 3,750 PF, ACCURACY/BURDEN 1.2 WXYZ	GE Grid Solutions # OTCF 245SR Hitachi Energy # DFK-245 Trench # TEVF 245C

Each CVT shall be equipped with a stainless steel nameplate permanently mounted on each unit and stamped with the following information: Manufacturer's Name, Rated Primary Voltage, Manufacturer's Type and Catalog Number, Ratios, Basic Impulse Insulation Level, Rated Frequency, Thermal Burden Ratings at Ambient Temperature, Accuracy Rating, Manufacturer's S.O. or J.O. Number, Serial Number

POTENTIAL DEVICE ENCLOSURE DETAIL





Each Enclosure for the Instrument Transformers must include the following:

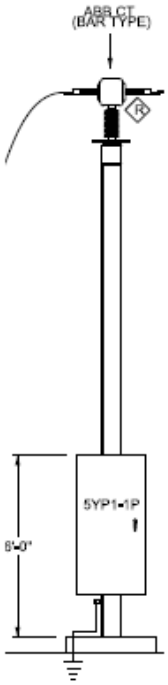
ITEM	QTY	JEA ITEM ID	DESCRIPTION
A	1	ELUEB001	ENCLOSURE, NEMA 4X WITH "L" LATCH HINGED COVER, 304 STAINLESS STEEL, 24" x 24" x 8"
B	3	ELUTB001	TERMINAL BOARD, 6-CIRCUIT, WIRE SIZE, 10-18 AWG WITH WHITE MARKING STRIP
C	3	FUSHO013	FUSEBLOCK, PHENOLIC, CARTRIDGE CLASS "H" FUSE, 3-POLE, MAXIMUM 30A, 250V
D	1	TEMHE017	HEATER, EDISON SCREW BASE, 120V, 50W (Chromalox # SCB-200-253833 or Equivalent)
E	1	LTGHR037	LAMP HOLDER, 660W, 250V, PONY CLEAT PORCELAIN, MEDIUM BASE (Leviton #19062 or Equal)
		CAICN016	CABLE/CONTROL SHIELDED #10 STRANDED, 4 CONDUCTOR, CLASS B
		CAICN017	CABLE/ CONTROL SHIELDED #10 STRANDED, 8 CONDUCTOR, CLASS B
		-	2/C, 12 AWG THWN, CU FOR CABLE TRAY (CONTRACTOR PROVIDED)

CURRENT TRANSFORMERS

Current Transformers are used in every JEA substation. Most CTs are located on the substation breakers. Standalone CTs are utilized in the JEA system in limited applications for the Substation Station Service, Capacitor Banks with the VBM Controller and at Solar sites.

For 26KV applications, JEA uses a 34.5KV rated Window Type with Bar Installed, Dry Type CT.

Refer to the substation engineer project drawings for specific project related details. These diagrams are for reference purposes only.



CT Structure Detail

SPECIFICATION:

The current transformers for metering and relaying applications are as follows:

- 4kV - ratio 2000:5, 75kV BIL
- 34.5kV – ratio 300/600:5, 200kV BIL
- 69kV - ratio 200:5, 350kV BIL
- 138kV - ratio 200/400:5, 650kV BIL
- 230kV – 1050kV BIL

All designs shall have 0.3% w, x, y, z, and zz burdens and comply with IEEE and ANSI Standards.

The current transformer tanks/cabinets must be stainless steel, aluminum, powder coated steel, unpainted galvanized or approved equal with stainless steel hardware.

GE Grid Solutions, Hitachi Energy, Ritz, Square D and Trench are all approved manufacturers for current transformers for substation application. CTs are ordered infrequently and therefore, all types used on the JEA system do not have JEA Item IDs in the current inventory system.

JEA Approved Manufacturer List for Current Transformers		
JEA ITEM ID #	**Nominal System Voltage**	**Manufacturer and Model Number**
-	4kV Ratio: 2000:5 75kV BIL	
-	26kV Ratio: 150kV BIL	
-	34.5kV Ratio: 300/600:5 200kV BIL	GE Grid Solutions # Hitachi Energy # (KOR-20) E-7524A21G10 Ritz# Square D # Trench#
-	72.5kV Ratio: 200:5 350kV BIL	GE Grid Solutions # Hitachi Energy # (COF-350) Ritz# Square D # Trench#
XFRCT025	138kV Ratio 200/400:5 650kV BIL	GE Grid Solutions # Hitachi Energy # COF-650 #L950400DD Ritz # OSKF-145; Square D # IK5-650-401S; Trench #
-	Transformer Ground CT Ratio 1500:5	
-	230kV Ratio: 1050kV BIL	

Each current transformer shall be equipped with a stainless steel nameplate permanently mounted on each unit and stamped with the following information: Manufacturer's Name, Rated Primary Voltage, Manufacturer's Type and Catalog Number, Ratios, Basic Impulse Insulation Level, Rated Frequency, Thermal Burden Ratings at Ambient Temperature, Accuracy Rating, Manufacturer's S.O. or J.O. Number, Serial Number.

SURGE ARRESTERS

GENERAL

The substation surge arrester requirements are specified and purchased with the substation structures for the substation bus applications and with the transformer purchases for the transformer applications. Metal oxide varistor (MOV) type surge arresters shall be used for all arrester applications. Station class arresters shall be used in all applications except feeder take-off points where intermediate type arresters shall be used.

JEA has standardized on polymer housing for surge arresters. Generally, there are no structural strength requirements from the surge arrester. There may be locations where porcelain surge arresters are still in use. In those cases, the Substation Engineering group shall be contacted to review the suitability of replacing with a polymer arrester.

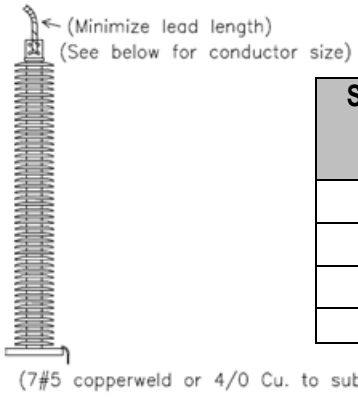
INSTALLATION

The surge arresters shall be connected directly to the substation bus with standardized cable used in that substation construction application. Standard 4-hole cable connectors shall be used to connect the cable to a 4-hole terminal pad at the top of the arrester. The arresters shall be solidly grounded with standard 7#5 copperweld ground conductor or 4/0 Cu. conductor which are connected to the substation ground grid system.

Arresters are typically placed at the entrance point of all transmission lines, exit points of all feeders and at the high voltage and low voltage sides of the substation transformers. The arresters are sized to provide the maximum voltage surge protection for the substation bus and equipment and still function below the MCOV (maximum continuous operating voltage) of the arrester. Station class arresters are chosen for their high energy discharge capability to provide more protection especially from switching surges within the substation environment.

Stands shall be provided as necessary to limit the tap length. Install as shown below.

For purposes of corona avoidance, unless otherwise noted, arresters shall be installed with conductor sizes as indicated below. Note that when there are other uses of conductors on the project that are near to these sizes (Outside Diameter +/- 10%), the Company may substitute the available size:



SYSTEM VOLTAGE	MINIMUM CONDUCTOR SIZE TO MEET CORONA REQUIREMENTS
26KV	1/0 AWG
69KV	4/0 AWG
138KV	400 KCM
230KV	795 KCM

SPECIFICATION:

All arresters covered by this Specification shall be standard duty, MOV (gapless metal oxide varistor) with ANSI-70 gray polymer housing and shall be designed, manufactured, and tested according to the latest edition of ANSI/IEEE Standard C62.11 for Metal-Oxide Surge Arresters and IEEE 62.22 application guide.

All arresters shall be of a single column design. Grading rings shall be provided as recommended by the manufacturer.

The arrester housing shall be a flame resistant gray polymer preferably silicone rubber formulated to provide long term UV and anti-tracking performance required for extreme coastal applications.

The arresters shall also be mechanically strong enough to withstand wind loads of 120 MPH.

All arresters shall be designed to operate in an average ambient temperature of up to 104 ˚F and a daily maximum temperature of 140 ˚F. They shall have a minimum rated ultimate cantilever moment of 20,000 in-lbs and unless otherwise noted shall be suitable for vertical mounting.

All arresters shall be station class with a minimum withstand fault current capability as specified in the latest IEEE standard. They shall have a minimum single shot energy rating of 4.6Kj/KV MCOV.

Arresters shall be station class and equipped with a tin-plated NEMA 4-hole pad line terminal on the high side that will accommodate aluminum or copper conductor diameter sizes from 1/4" inches to 1.15". The base of each arrester shall be equipped with a factory installed casting which provides a 10" diameter bolt circle and allows for 1/2" diameter bolts. Note that all arresters to be used on systems with voltage 69kV or greater shall accept a connector that terminates a 4", NEMA 4-hole pad onto the arrester pad.

Each arrester shall be equipped with a stainless steel nameplate permanently mounted on a base and shall be stamped with the following information: Manufacturer's Name, Manufacturer's Type and Catalog Number, Arrester Classification, Duty Cycle Voltage of the Arrester, MCOV Rating of the Arrester, Pressure Relief Current Rating (for intermediate and station arresters), Year of Manufacture and Serial Number.

CHARACTERISTICS

All arresters must conform to the minimum requirements outlined in the following table:

JEA ITEM ID #	APPROX. HEIGHT IN INCHES (WITH TOP SPADE CONNECTOR)	VOLTAGE RATING (KV)	MCOV (KV)	MINIMUM CREEPAGE DISTANCE (INCHES)	MAXIMUM 0.5 µsec VOLTAGE (KV CREST)*	MAXIMUM SWITCHING SURGE (@500amps) (KV CREST)	MAX. DISCHARGE VOLTAGE (KV CREST) USING A 8X20 µsec CURRENT WAVE 10kA	20 kA
ARRST003	13	3	2.55	30.7	8.2	6.1	7.8	8.4
ARRST011	14	10	8.4	38.4	26.9	19.9	25.6	27.7
ARRST017	17	21	17	53.7	54.4	40.2	51.7	56
ARRST018	21 +/- 2	21	17	33	56.3	41.3	51.8	57
ARRST042	27	54	42	99.8	135	99.3	128	139
ARRST043 (INACTIVE)	31 +/- 2	54	42	64	144.4	104	131.3	145.3
ARRST089	47	108	84	199.6	269	199	256	277
ARRST145	78	180	144	330.1	436	332	417	445

*Must use a 10kA impulse current wave which produces a voltage wave cresting in 0.5µSEC.

APPLICATION

Polymer arresters are the standard and silicone is preferred over EPDM. (1/22/04)

On applications where we use double conductors to connect to the transformer, manufacturers were in agreement that there is no significant change in protection if you use a connector that only connects one conductor to the arrester. (4/19/04)

For transformer applications, it is best to run a flyover and then tap down to the arresters. This will prevent large mechanical loads while only slightly decreasing protection. (4/24/04)

For incoming transmission lines and outgoing feeder lines it is acceptable to change out a single arrester at a time when one unit fails as long as the technology is the same. For example, if an arrester on one phase of a feeder fails and it was MOV then you can replace it with another MOV arrester. Verify with specific surge arrester manufacturer prior to proceeding. For transformers we take a more conservative approach and whenever any unit fails all three should be replaced with three of the same model number and manufacturer of the unit that failed. If this cannot be done, then all three arresters should be replaced in order to ensure identical protection characteristics.

APPROVED MANUFACTURERS FOR LISTED STATION CLASS SURGE ARRESTERS

JEA ITEM ID #	Nominal System Voltage	Manufacturer and Model Number
ARRST003	4.16KV CLASS 3KV DUTY CYCLE 2.55KV MCOV POLYMER	HITACHI ENERGY: Q003SA002A COOPER: UHAA003002A0845A11 GE GRID SOLUTIONS: 9L11XPA003AS HUBBELL: EVP0003003001
ARRST011	13.2KV CLASS 10KV DUTY CYCLE 8.4KV MCOV POLYMER	HITACHI ENERGY: Q010SA008B COOPER: UHAA010008A1045A11 GE GRID SOLUTIONS: 9L11XPA010AS HUBBELL: EVP0009003001
ARRST017	26.4KV CLASS 21KV DUTY CYCLE 17KV MCOV POLYMER	HITACHI ENERGY: Q021SA017B COOPER: UHAA021017A1445A11 GE GRID SOLUTIONS: 9L11XPA021AS HUBBELL: EVP0017003001
ARRST018	UNDERHUNG 26.4KV CLASS 21KV DUTY CYCLE 17KV MCOV POLYMER	HITACHI ENERGY: Q021SA017BUH COOPER: UHAA021017A1845C11 GE GRID SOLUTIONS: 9L11XPE021AS HUBBELL: EVP2017003001
ARRST042	69KV CLASS 54KV DUTY CYCLE 42KV MCOV POLYMER	HITACHI ENERGY: Q054SA042A COOPER: UHAA054042A2645A11 GE GRID SOLUTIONS: 9L11XPA054AS HUBBELL: EVP0042103001
ARRST043 (INACTIVE)	UNDERHUNG 69KV CLASS 54KV DUTY CYCLE 42KV MCOV POLYMER	HITACHI ENERGY: Q054SA042AUH COOPER: UHAA054042A3045C11 GE GRID SOLUTIONS: 9L11XPE054AS HUBBELL: EVP2042003001
ARRST089	138KV CLASS 108KV DUTY CYCLE 84KV MCOV	HITACHI ENERGY: Q108SA084D COOPER: UHAA108084A5245A11 GE GRID SOLUTIONS: 9L11XPA108AS HUBBELL: EVP0084003001
ARRST145	230KV CLASS 180KV DUTY CYCLE 144KV MCOV	HITACHI ENERGY: Q180SA144B COOPER: USAA180144A8645A11 GE GRID SOLUTIONS: 9L11XPA180AS HUBBELL: EVP014403001

*REFER TO ORACLE FOR THE MOST UP-TO-DATE MANUFACTURER PART NUMBERS

TRANSFORMERS

GENERAL:

All substation transformers utilize copper windings with high density paper insulation and are oil filled. The substation transformer requirements for JEA fall into one of three ANSI categories used for the classification of transformers. The JEA standard transformer ratings and their respective ANSI Categories are as follows:

6.88/8.6MVA, Category II, (Typical 4kV distribution power transformer)
30/40/50MVA, Category III, (Typical distribution substation power transformer)
120/160/200MVA, Category IV, (Typical transmission substation autotransformer)

Transformer manufacturers are prequalified in order to bid on the JEA transformer specifications. There are three approved manufacturers lists for substation transformers. The lists are separated into the three ANSI Categories as stated above. These lists are reviewed and updated as necessary prior to the advertisement of each specification for the purchase of new transformers. The substation transformer requirements for JEA are typically advertised and purchased through a multi-year contract.

Please refer to the Transformer Specifications for more details.

POWER TRANSFORMERS:

Power transformers are used on the JEA system to step down transmission voltage to distribution voltage levels or to lower one distribution voltage level down to another distribution voltage level. The general specification for power transformer design is as follows:

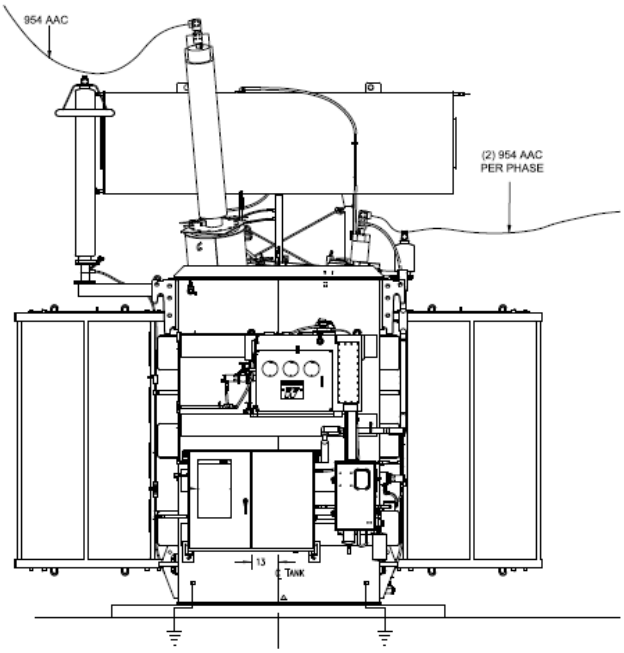
HV Winding:	Delta; +/- 5% manual no-load tap changing equipment
LV Winding:	Grounded Wye, +/- 10% automatic load tap changing equipment
Winding Material:	Copper
Type:	Core Form
Oil Preservation:	Conservator Type
Cooling Ratings:	OA, FA, FA or OA, FA (OA – oil air, no forced cooling; FA - forced air cooling)
Typical Impedance:	8% - 9%

AUTOTRANSFORMERS:

Autotransformers are used on the JEA system to step down a transmission voltage to a lower transmission voltage level. The general specification for autotransformer design is as follows:

HV Winding:	Grounded Wye; +/- 5% manual no-load tap changing equipment
LV Winding:	Grounded Wye, +/- 10% automatic load tap changing equipment
Type:	Core Form
Oil Preservation:	Conservator Type
Cooling Ratings:	OA, FA, FA (OA – oil air, no forced cooling; FA - forced air cooling)
Typical Impedance:	6% - 8%

TRANSFORMER DETAILS



230kV/26kV Transformer

230kV/69kV Transformer Detail

Approved Transformer Manufacturers

Large Power Transformers (100+ MVA) Approved Manufacturers:

Hitachi Energy – Varennes, Canada

Hyundai – Montgomery, AL

PTI – Winnipeg, Canada

Prolec GE Waukesha (PGEW) – Waukesha, WI and Goldsboro, NC

Medium Power Transformers (<100 MVA) Approved Manufacturers:

Delta Star – Lynchburg, VA and Saint-Jean-sur-Richelieu near Montreal, Quebec, Canada

Hitachi Energy – South Boston, VA and Crystal Springs, MS

PTI – Winnipeg, Canada

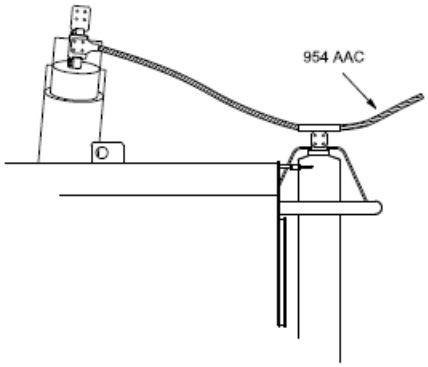
Prolec GE Waukesha (PGEW) – Waukesha, WI and Goldsborough, NC

4kV Power Transformers Approved Manufacturers:

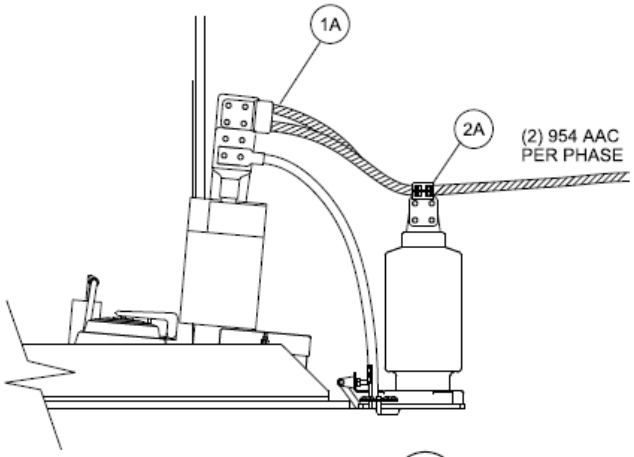
Delta Star – Lynchburg, VA and Saint-Jean-sur-Richelieu near Montreal, Quebec, Canada

Prolec GE Waukesha (PGEW) – Waukesha, WI and Goldsborough, NC

BILL OF MATERIAL 26KV DETAIL 1		
ITEM NO.	UNIT QTY.	DESCRIPTION
1A	1	(2) 954 AAC TO 4-HOLE PAD
2A	1	(2) 954 AAC 6" SPACER TO 4-HOLE PAD, 90°



DETAIL 1
TYPICAL CONNECTIONS
TRANSFORMER HIGH SIDE



DETAIL 1
TYPICAL CONNECTIONS
TRANSFORMER LOW SIDE

*The above examples are for reference purposes only. Refer to the Project Design drawings for specific project related details.

AUTOMATIC TRANSFER SWITCH (ATS)

GENERAL:

JEA utilizes an automatic transfer switch to maintain a constant source of low voltage AC supply for its substations. The low voltage AC is used in the substations for lighting, motors, fans, heaters, compressors, battery chargers, etc. The only outage the low voltage AC source should experience would be a complete substation outage that disables both AC sources. Two separate AC sources are brought into the automatic transfer switch and the switch feeds all AC panels in the substation facility. The automatic transfer switch remains in one position until the voltage of that source falls below 85%, at that time the switch operates to change sources and maintain the voltage source to the panels. The switch purchased and used by JEA has a utility function option that does not recognize either incoming source as the normal or emergency source. Once the switch operates to change sources, it will remain in that position until that source falls below 85% and a switching operation is required to maintain the AC supply.

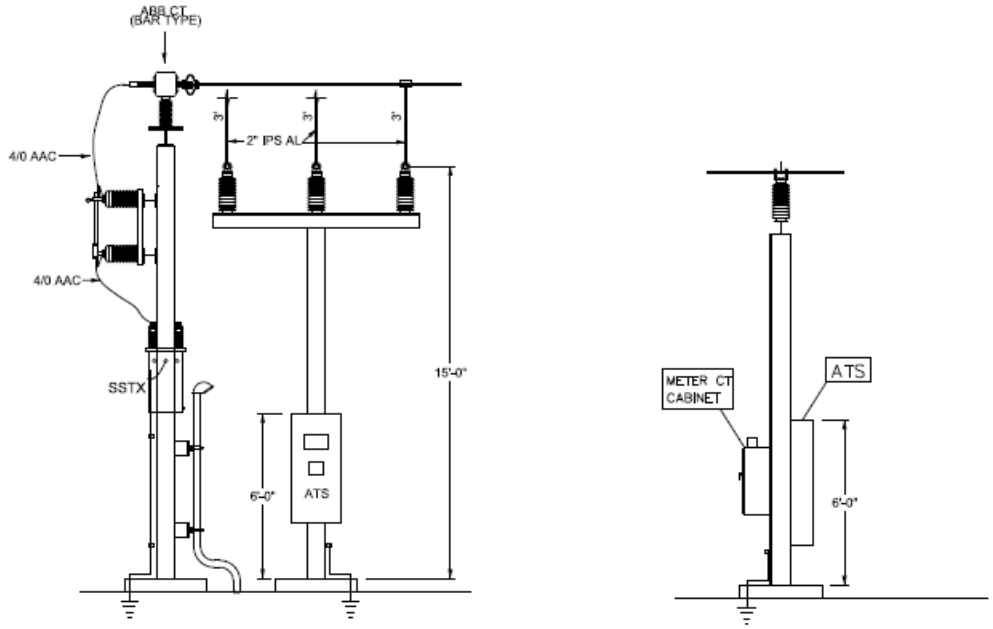
JEA has two suppliers for the automatic transfer switches. ASCO and Lakeshore Electric. The automatic transfer switch is maintained in the JEA inventory and available for use as a replacement for existing switches or new installations as necessary. The specification on the automatic transfer switch is as follows:

Type:	ASCO 7000 or Lakeshore Electric FPL230400GK
Voltage Options:	120/240 VAC
Special Features:	3 Phase, 60 HZ, 400 Amps
	Fully rated solid neutral
	NEMA 3R enclosure, 316 stainless
	Utility function
	Heater and humidistat
	Quick make/break operation

AUTOMATIC TRANSFER SWITCH (ATS) INVENTORY INFORMATION		
JEA ITEM ID#	**Manufacturer**	**Catalog Number**
SWETR002	ASCO	J07ATSA30400F5XF
SWETR015	LAKESHORE ELECTRIC	FPL230400GK

Automatic Transfer Switch Recent History:

- JEA started using the Lakeshore Electric ATS in 2023.
- The ASCO ATS used in JEA substations starting in 2018: SWITCH, AUTO TRANSFER, ASCO 7000 SERIES, J-FRAME, 120/240 VAC, 3 PH, 60 HZ, 400 A, W/OPT 6C 29A 73AD1, 44A, SPACE HEATR & HUMIDSTAT INSTALLED, 3R ENCLOSURE.
- The ASCO ATS used in JEA substations prior to 2018 and is no longer offered by the Manufacturer: SWITCH, AUTO TRANSFER, ASCO 7000 SERIES, E-FRAME, 120/240 VAC, 3 PH, 60 HZ, 400 A, W/OPT 6C 29A 35 36 73AC 44A, SPACE HEATR & HUMIDSTAT INSTALLED, 3R ENCLOSURE.
- In the past, JEA has also used an ASCO series 940 Automatic Transfer Switch with 120/208 VAC or 120/240 VAC which is no longer offered by the manufacturer.

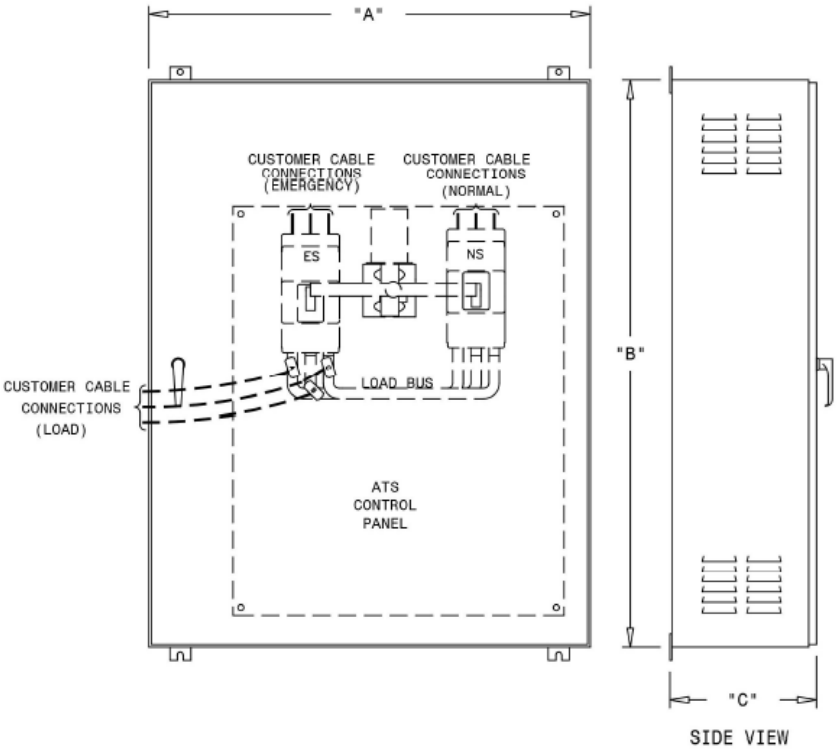


AUTOMATIC TRANSFER SWITCH YARD DETAIL*

* The drawing and picture are for the E-FRAME ATS. The J-Frame ATS has a larger footprint than the E-Frame and no external side handle. When installing the J-Frame, the project engineer needs to adjust for the increased height.

Lakeshore Electric ATS FPL230400GK:

Transfer: FP&L Series

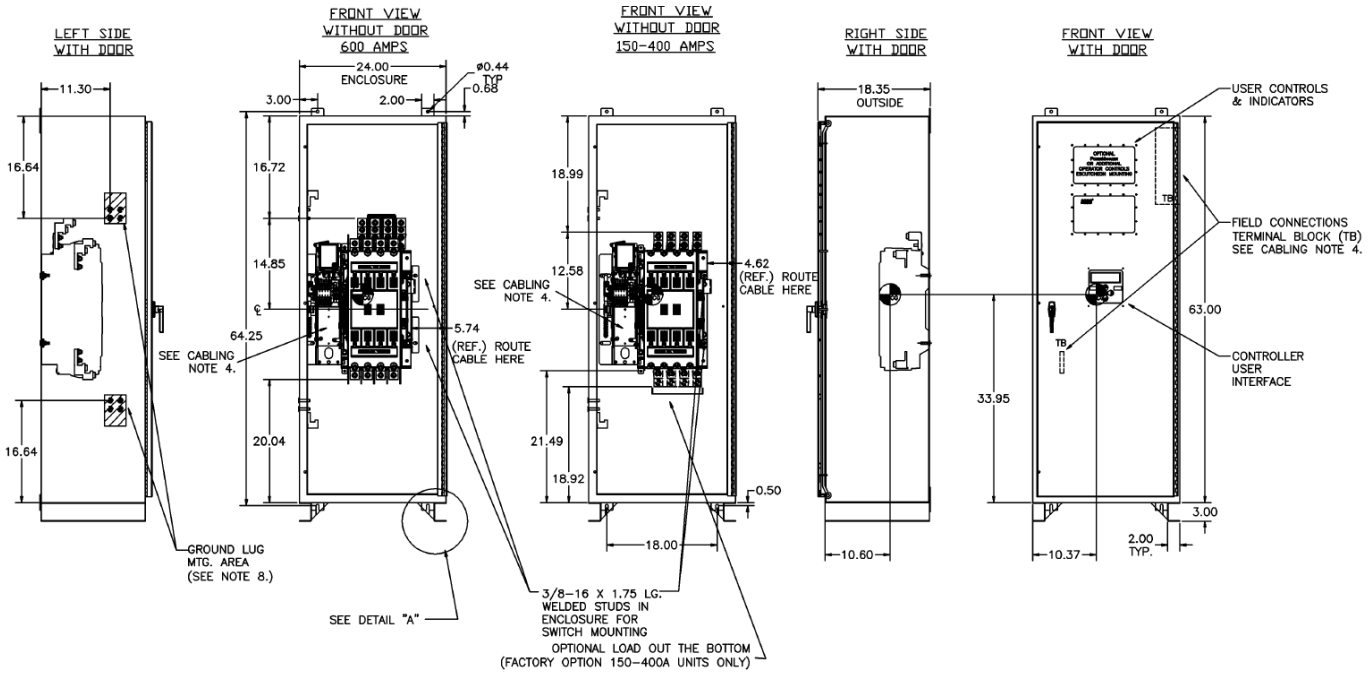


Dimensions

Amp	Style	DIMENSIONS A	B	C	CABLE ENTRY Depth	Width	Appox. Weight
100	Open	26	23	7.5	N/A	N/A	150
225	W/M	36	48	19.5	9	27	360
225	S/P	33.5	33.5	12.5	N/A	N/A	320
400	W/M	42	54	15	13	41	360
400	Open	31	39	12.5	N/A	N/A	320
600	W/M	42	54	15	13	41	425

Rating	Power Cable Terminals	
Amp	# Lugs Per Phase	Lug Range
100	1	#4-4/0
225	1	3/0-340 MCM
400	1	3/0-340 MCM
600	2	400-500 MCM

ASCO ATS Details:



AUTOMATIC TRANSFER SWITCH "J" FRAME DETAIL DRAWING

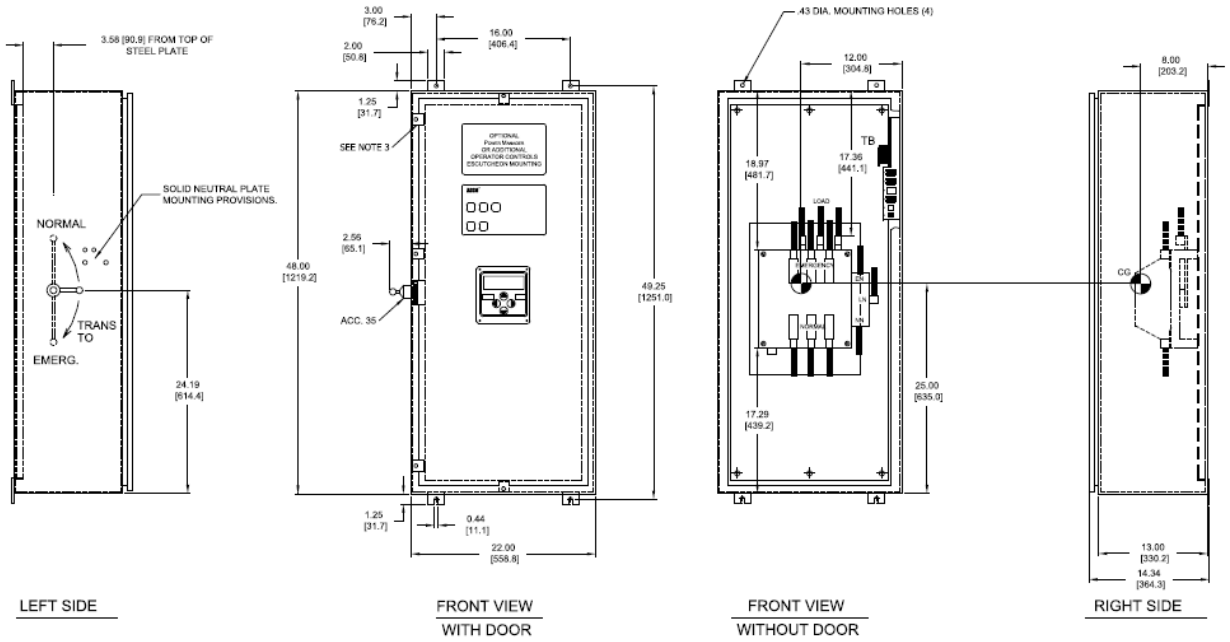
GENERAL NOTES

1. TYPE 3R/12 ENCLOSURE. FREE STANDING. FLOOR OR WALL MOUNTABLE. 14 GAUGE CONSTRUCTION.
2. THREE POINT LATCHING DOOR WITH LOCKABLE HANDLE.
3. FINISH: ANSI 61 GRAY, POLYESTER POWDER STANDARD. OTHER ANSI COLORS AVAILABLE CONSULT FACTORY UL RECOGNIZED.
4. RECOMMENDED CLEARANCES:
   FRONT: 24 INCHES
5. A 20% RATED GROUND BUS IS PROVIDED.
6. UNIT IS DESIGNED FOR COMBINATION TOP AND BOTTOM CABLE ENTRY. THE STANDARD SWITCH CONFIGURATION IS FOR TOP LUGS EMERGENCY AND LOAD AND BOTTOM LUGS NORMAL. OPTIONALLY, THE SWITCH MAY BE SUPPLIED WITH REVERSE NORMAL & EMERGENCY LUGS. (REFER TO THE WIRING DIAGRAM FURNISHED WITH EACH TRANSFER SWITCH TO DETERMINE TERMINATION POSITIONS).
7. A FULL RATED NEUTRAL CONNECTION FOR EACH SOURCE AND THE LOAD IS OPTIONAL. WHEN PROVIDED IT IS IN ONE OF THE FOLLOWING FORMATS AS SPECIFIED BY THE CATALOG NO. NEUTRAL TYPE;
   A. SOLID (COPPER BUS) NEUTRAL
   B. SWITCHED NEUTRAL POLE
   C. OVERLAPPING NEUTRAL POLE (NOT AVAILABLE ON 7ACTS/ADTS UNITS)
8. CG CENTER OF GRAVITY.

ASCO Series 7000																			
7 + A + TS + A + 3 + 400 + F + 5X + F																			
Product			**Type**		**Neutral Code**		**Phase Poles**[1]		**Amperes**	**Voltage Code**		**Optional Accessories**	**Cabinet**						
7	**A**		**TS**		**A**		**3**		**400**	**F**		**5X**	**F**						
7000 Series	**A**	Automatic	**TS**	Conventional 2 Position	Blank	No Neutral	2	2 poles, 1 Ø 1 phase	**TS Type** 30, 70, 100, 150, 200[2], 230[2], 260, **400**, 600, 800, 1000, 1200, 1600, 2000, 2600, 3000, 4000	Code	Voltage	5 No Accessories	O or Blank	No Cabinet					
										A	115								
										B	120		C	Type 1 Standard Enclosure					
			TB	Open Transition Bypass						C	208								
					A	Solid Neutral				D	220		E	Type 2 Enclosure					
			CTS	Closed Transition			**3**	3 poles, 3 Ø 3 phase		E	230		**F**	Type 3R Enclosure					
	N	Non-Automatic								**F**	240	**5X** Optional Accessories	G	Type 4 Enclosure					
			CTB	Closed Transition Bypass	B	Switched Neutral				H	380								
										J	400		H	Type 12 Enclosure					
			DTS	Delayed Transition					**All Other Types** 150, 200[2], 230[2], 260, 400, 600, 800, 1000, 1200, 1600, 2000, 2600, 3000, 4000	K	415								
					C	Overlapping Neutral				L	440		K	Type 7 Enclosure					
	M	Manually Operated	DTB	Delayed Transition Bypass						M	460								
										N	480		L	Type 12					
													M	Type 3R Secure Double Door					
										P	550		N	Type 4 Secure Double Door					
										Q	575		P	Type 4X Secure Double Door					
										R	600		Q	Type 12 Secure Double Door					

Notes: [1] For 4 pole applications on switches rated 260 to 400 amps (Bypass configurations only) and 4000 amps ,specify overlapping switched neutral (optional). Conventional switch neutral is provided on delayed transition transfer products when specified. [2] 200 and 230 amp switch limited to 480 volts maximum.

#	ACCESSORY DESCRIPTIONS	
	Accessory Code	**Description**
1	6C	Reset switch to manually retransfer the automatic transfer switch to the normal source after the feature 3A retransfer time delay expires. In the event of emergency source failure the switch will automatically retransfer to the normal source. When accessory 6C is enabled the 6B feature retransfer time delay bypass is not available. Note: factory CP setting of feature 6B.6C must be changed to 6C.
2	29A	Manual selection between two utilities as to which utility will be designated as the preferred source. Note: feature 5 is removed and feature 6B becomes pushbutton.
3	44A	120VAC Accessory 44 Strip heater is designed to keep humidity and or temperature within the ATS enclosure at acceptable levels. This accessory consists of a mounting bracket with strip heater, thermostat and terminal block.
4	73AD1	65kA - 3phase 240V High Leg delta



AUTOMATIC TRANSFER SWITCH "E" FRAME DETAIL DRAWING (FOR REFERENCE ONLY)

GENERAL NOTES

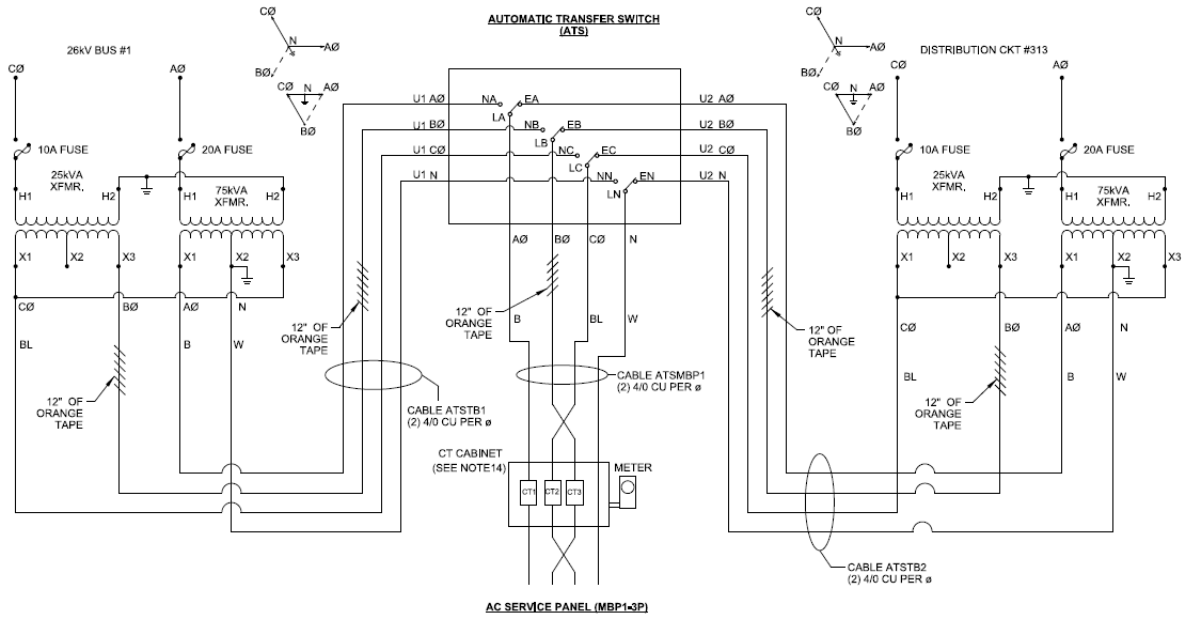
1. TYPE 3R/4/12 WALL MOUNTED ENCLOSURE CONSTRUCTED IN ACCORDANCE WITH UL STANDARDS 50 & 508
2. STANDARD FINISH – LIGHT GREY, ANSI 61.
3. DOOR HINGED ON RIGHT SIDE, PADLOCK HASP LEFT SIDE PLATED DOOR CLAMPS (LEFT SIDE FOR TYPES 3R & 12; LEFT, TOP & BOTTOM FOR TYPE 4).
4. FULL WIRING GUTTERS AT TOP & BOTTOM. NO KNOCKOUTS PROVIDED.
5. TERMINALS – SCREW TYPE LUGS FOR EXTERNAL POWER CONNECTIONS. RANGE: (2) #1/0 AWG TO 250 MCM OR (1) #4 AWG TO 600 MCM
6. OVERALL DIMENSIONS ARE OUTSIDE MEASUREMENTS.
7. REFER TO THE OPERATOR'S MANUAL PROVIDED WITH EACH UNIT BEFORE INSTALLING AND OPERATING THE SWITCH.
8. ⊕ CG – CENTER OF GRAVITY
9. NEUTRAL CONFIGURATIONS:
10. AN OPTIONAL FULL RATED NEUTRAL CONFIGURATION FOR EACH SOURCE AND THE LOAD MAY BE PROVIDED. WHEN EQUIPPED IT IS IN ONE OF THE FOLLOWING FORMATS AS SPECIFIED BY THE CATALOG NUMBER NO. NEUTRAL TYPE:
    - (A) SOLID NEUTRAL
    - (B) SWITCHED NEUTRAL POLE (AVAILABLE ON TWO POLE UNITS ONLY)
    - (C) OVERLAPPING NEUTRAL POLE

Automatic Transfer Switch (ASCO E-Frame)

External view of ATS (E-Frame)

Internal wiring for ATS (E-Frame)

Internal wiring for CTs (E-frame)



AUTOMATIC TRANSFER SWITCH WIRING DETAIL

*These examples are for reference purposes only. Refer to the Project Design drawings for specific project related details.

SWITCHYARD ELECTRICAL PANELS

All Switchyard Electrical Panels are furnished and installed in the substation yard by the Substation Construction Contractor for new substation installations. Refer to the substation engineer project drawings for specific project related details. The diagrams included in this section are for reference purposes only.

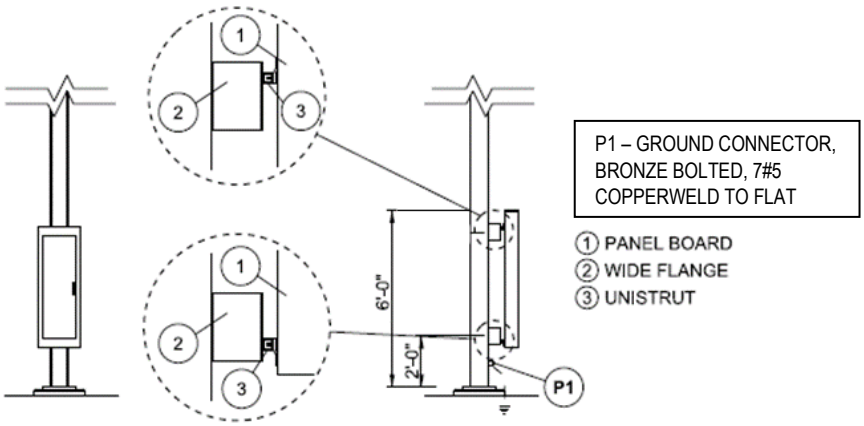
All switchyard AC panels are required to be enclosed in lockable stainless steel enclosures (NEMA 4X or higher) due to them being exposed to the weather. All panels shall have aluminum or powder coated steel backing.

Each panel shall be securely mounted to the substation structures provided and as shown on the Substation Project Drawings. The Substation Construction Contractor shall furnish and install galvanized unistrut channels and stainless steel mounting hardware as required to mount the electrical panels, cabinets and junction boxes to the structure mounting brackets.

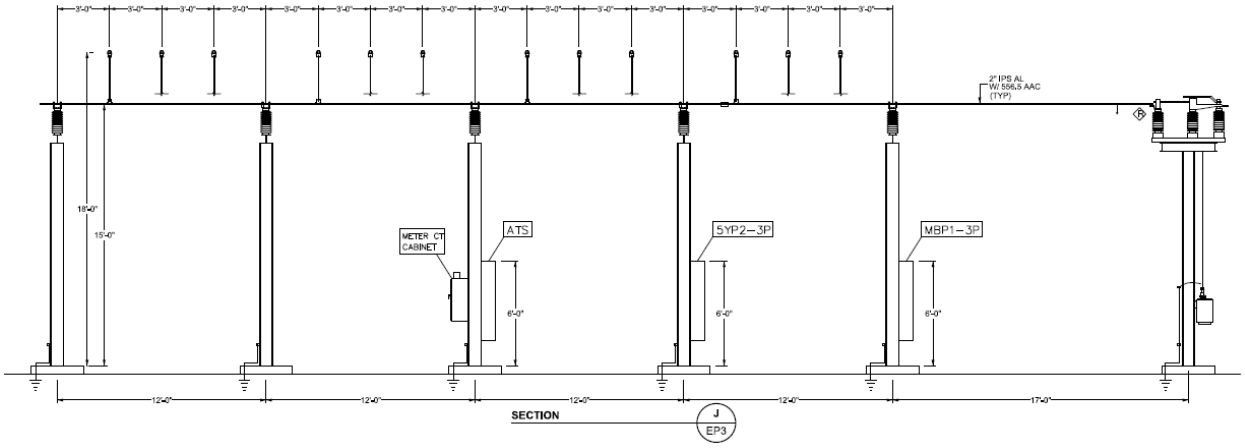
AC Yard Panels:

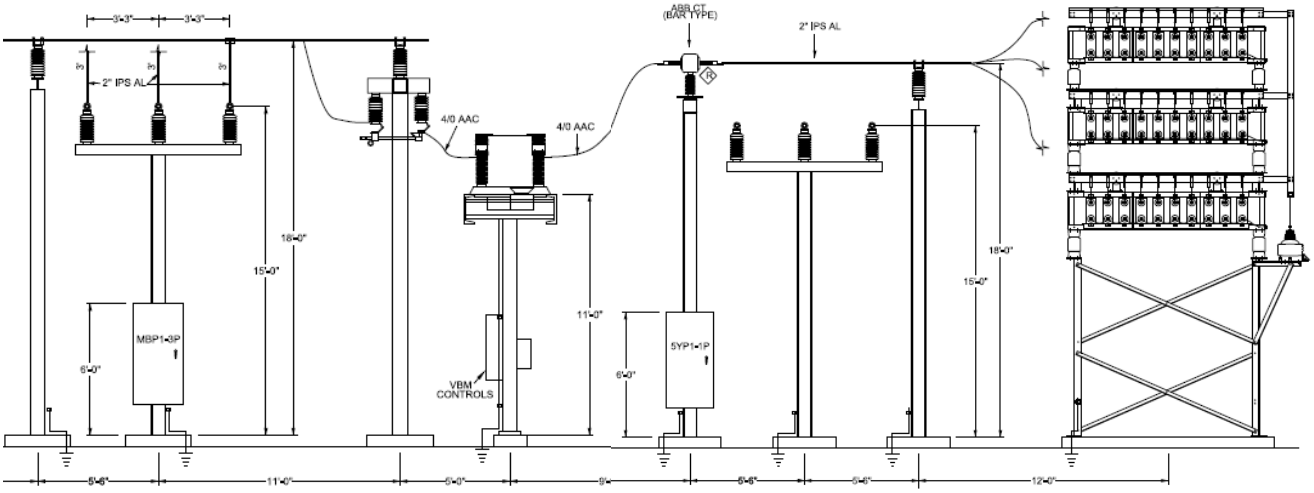
- AC Main Breaker Panel Three Phase (connected to the Automatic Transfer Switch and feeds all other AC panels in the yard and control house): 3 phase, 4 wire, 240/120V, 450A, Solid Neutral Surface Mounted, Panelboard with 24 single pole branches equipped with Breakers as shown on the drawings and NEMA 4X stainless steel enclosure with lockable cover and/or door.
- AC Yard Panel Three Phase (feeds the gas cart and transformers): 3 phase, 4 wire, 240/120V, 225A, Solid Neutral Surface Mounted, Panelboard with 42 single pole breakers equipped with Breakers as shown on the drawings and NEMA 4X stainless steel enclosure with lockable piano hinged door. There is typically one of these type panels installed in the substation yard.
- AC Yard Panel Single Phase (feeds the breakers, receptacles, heaters, yard lights, and VBM): 1 phase, 3 wire, 240/120V, 225A, Solid Neutral Surface Mounted, Panelboard with 42 single pole breakers equipped with Breakers as shown on the drawings and NEMA 4X stainless steel enclosure with lockable piano hinged door. There are typically three of these type panels installed in the substation yard with one of the panels being for the low voltage side and two of the panels being for the high voltage side (one of which is a spare panel installed with spare breakers for future expansion).

AC YARD PANEL DETAILS



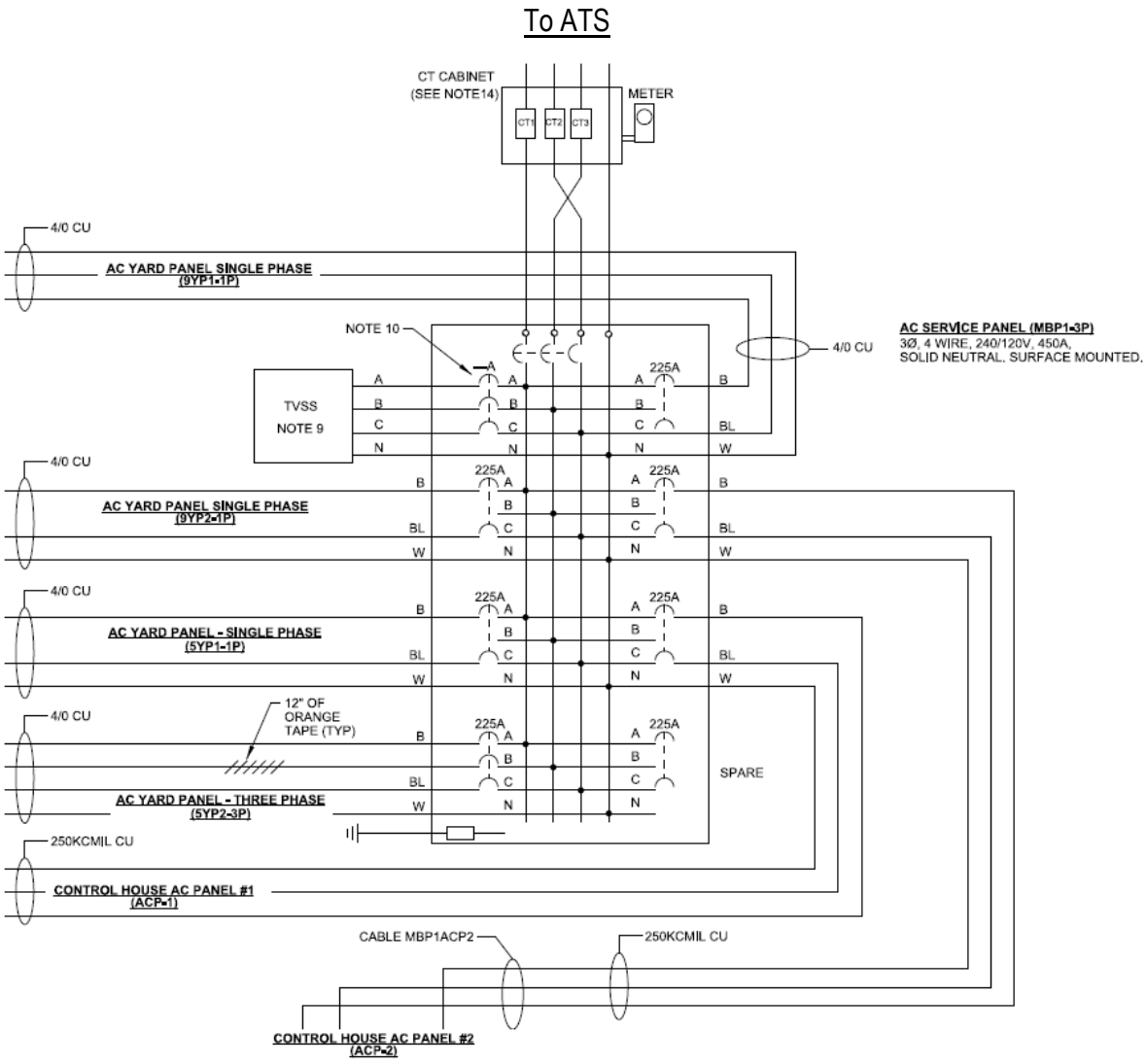
DETAIL
POWER DISTRIBUTION PANEL
TYPICAL MOUNTING





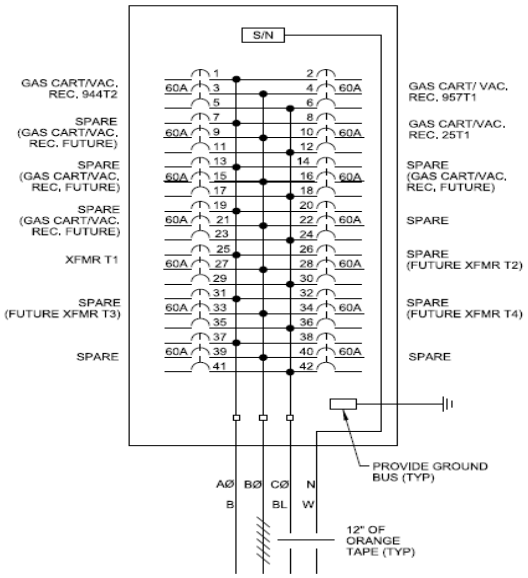
AC AUXILIARY SYSTEM

The AC Auxiliary System includes the Switchyard Electrical Panels, the CT Cabinet, Metering Devices and TVSS (Surge Suppressor).



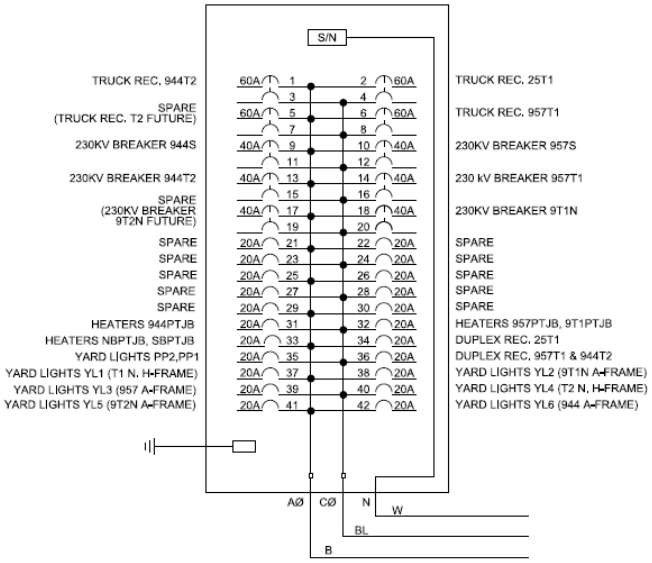
AC THREE PHASE MAIN BREAKER PANEL CONNECTION DETAIL

AC YARD PANEL THREE PHASE (5YP2-3P)
3 PHASE, 4 WIRE, 240/120V, 225A, SOLID NEUTRAL
SURFACE MOUNTED PANELBOARD WITH 42 SINGLE
POLE BREAKERS AND NEMA 3R STAINLESS STEEL
ENCLOSURE WITH LOCKABLE PIANO HINGED DOOR.



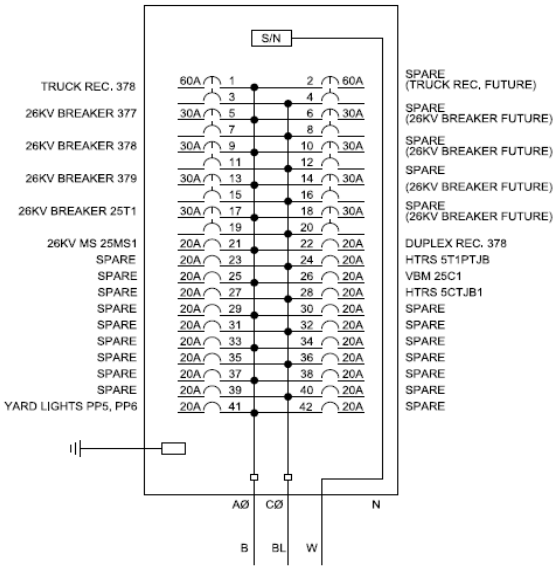
AC THREE PHASE (26KV) YARD PANEL

AC YARD PANEL SINGLE PHASE (9YP1-1P)
1 PHASE, 3 WIRE, 120/240V, 225A, SOLID NEUTRAL
SURFACE MOUNTED PANELBOARD WITH 42 SINGLE
POLE BREAKERS AND NEMA 3R STAINLESS STEEL
ENCLOSURE WITH LOCKABLE PIANO HINGED DOOR.



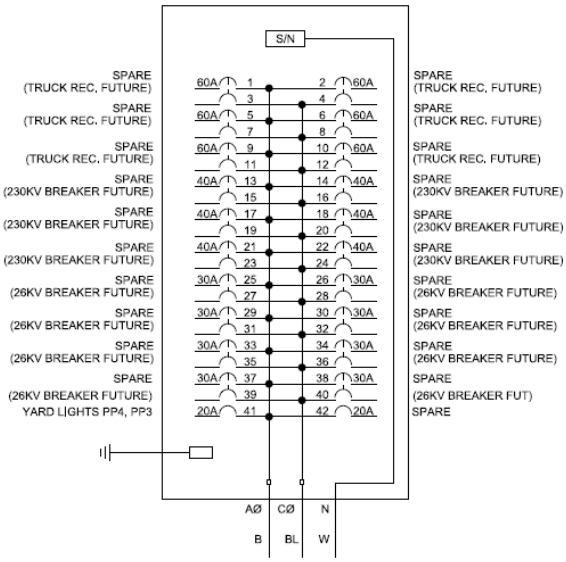
AC SINGLE PHASE (230KV) YARD PANEL

AC YARD PANEL SINGLE PHASE (5YP1-1P)
1 PHASE, 3 WIRE, 120/240V, 225A, SOLID NEUTRAL
SURFACE MOUNTED PANELBOARD WITH 42 SINGLE
POLE BREAKERS AND NEMA 3R STAINLESS STEEL
ENCLOSURE WITH LOCKABLE PIANO HINGED DOOR.



AC SINGLE PHASE (26KV) YARD PANEL

AC YARD PANEL SINGLE PHASE (9YP2-1P)
1 PHASE, 3 WIRE, 120/240V, 225A, SOLID NEUTRAL
SURFACE MOUNTED PANELBOARD WITH 42 SINGLE
POLE BREAKERS AND NEMA 3R STAINLESS STEEL
ENCLOSURE WITH LOCKABLE PIANO HINGED DOOR.

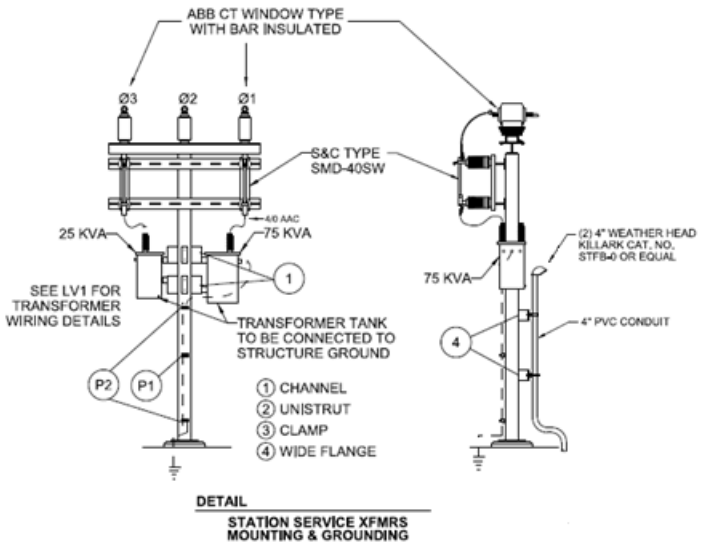


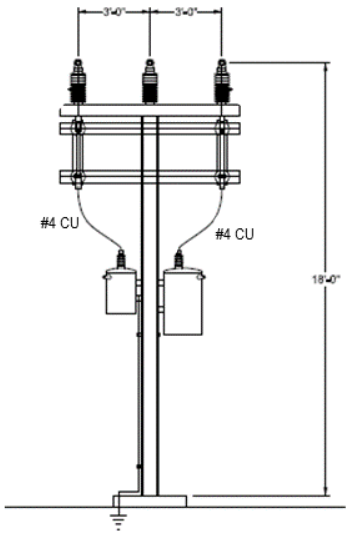
AC SINGLE PHASE (230KV) YARD PANEL

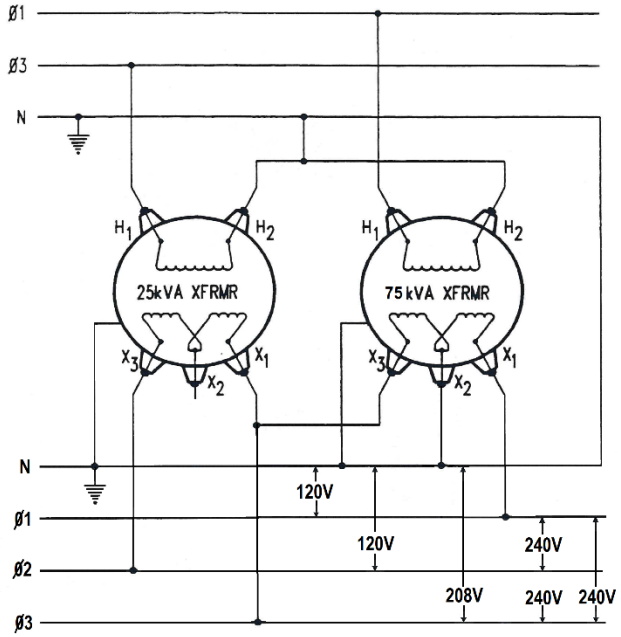
These examples are for reference purposes only. Refer to Project Design Drawings and Specifications for specific project related details.

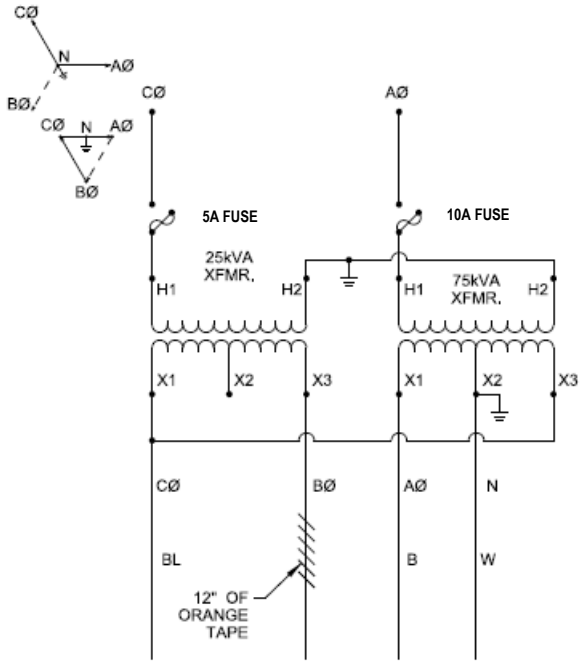
STATION SERVICE TRANSFORMERS

Station service transformers are JEA stock items and provided by JEA for new substation installations. These examples are for reference purposes only. Refer to the Project Design drawings for specific project related details.

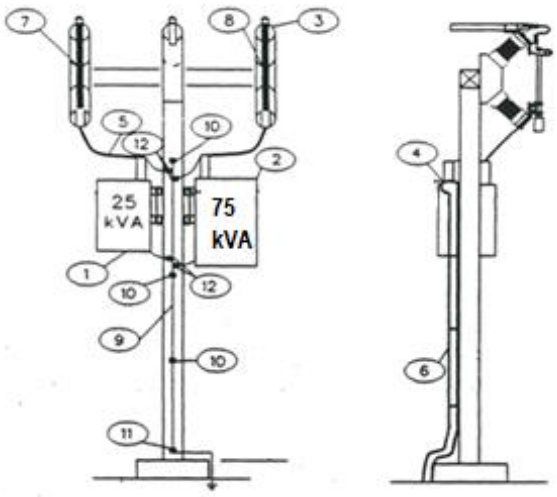








STATION SERVICE TRANSFORMER WIRING DIAGRAM



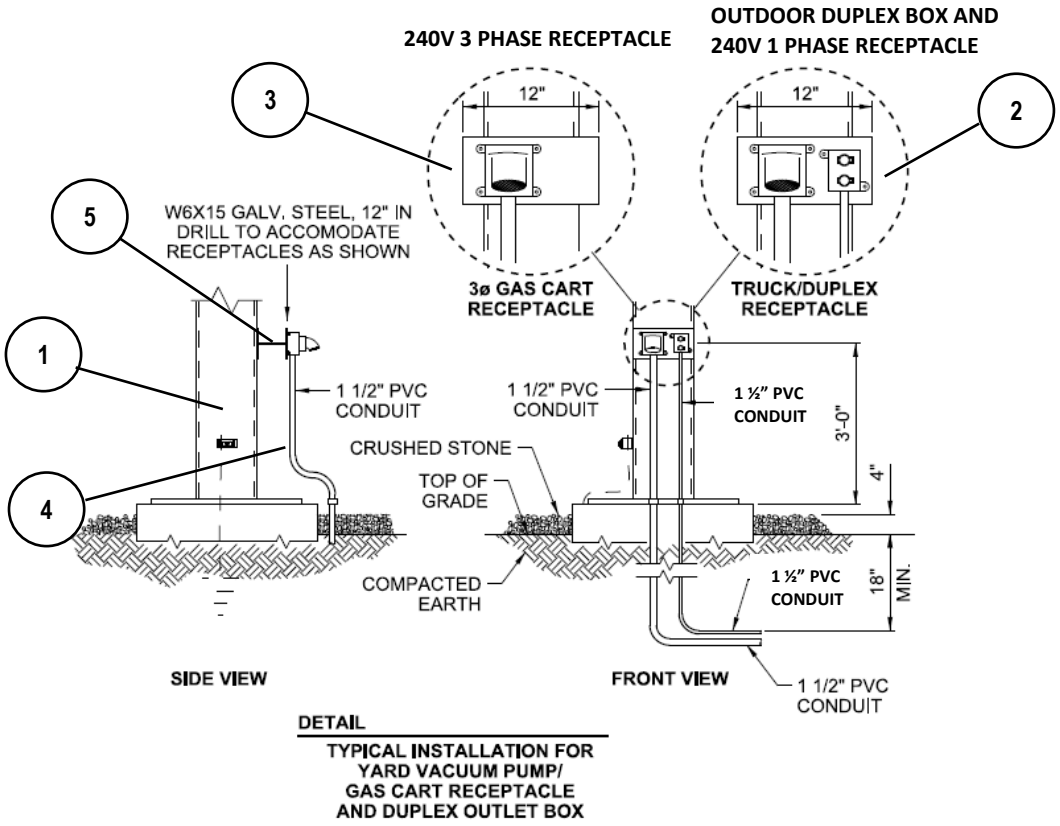
STATION SERVICE TRANSFORMER INSTALLATION DETAIL

ITEM	QUANTITY	DESCRIPTION
1	1	25 KVA STATION SERVICE TRANSFORMER, JEA ITEM ID # TRACG003
		50 KVA STATION SERVICE TRANSFORMER, JEA ITEM ID # TRACG004
2	1	75 KVA STATION SERVICE TRANSFORMER, JEA ITEM ID # TRACG005
		100 KVA STATION SERVICE TRANSFORMER, JEA ITEM ID # TRACG006
3	2	FUSE DISCONNECT SWITCH, TYPE SMD-40SW, 25KV
4	1	(2) 4" WEATHERHEAD, KILLARK CAT. # STFB-0 OR EQUAL, FURNISHED BY CONTRACTOR.
5	LOT	#4 COPPER CONDUCTOR.
6	LOT	4" PVC UV RATED, SCHEDULE 40 CONDUIT, INCLUDING ATTACHMENT HARDWARE.
7	1	FUSE UNITS TYPE SMU-40, 25KV, 5 E AMP, S&C CAT. #823005, JEA ITEM ID# FUSSU200 ~ FOR 25KVA OR 50KVA STATION SERVICE TRANSFORMER
8	1	FUSE UNITS TYPE SMU-40, 25KV, 10 E AMP, S&C CAT. #823010, JEA ITEM ID# FUSSU201 ~ FOR 75KVA OR 100KVA STATION SERVICE TRANSFORMER
		FUSE UNITS TYPE SMU-40, 25KV, 20 E AMP, S&C CAT. #823020, JEA ITEM ID# FUSSU020 ~ FOR 100KVA STATION SERVICE TRANSFORMER
9	LOT	7 #5 COPPERWELD CONDUCTOR.
10 (P1)	3	GROUND CONNECTOR, BRONZE BOLTED, 7 #5 COPPERWELD TO FLAT (1-GROOVE), ANDERSON CAT. #GC-141A-G2 OR EQUAL, FURNISHED BY THE OWNER.
11 (P2)	1	GROUND CONNECTOR, BRONZE BOLTED TWO (2) 7 #5 COPPERWELD TO FLAT (2-GROOVE), ANDERSON CAT. #GC-143A-GS OR EQUAL, FURNISHED BY THE OWNER.
12	4	PARALLEL CONNECTOR. 7 #5 COPPERWELD RUN AND 1/0 TAP, ANDERSON CAT. #ST-4.

NOTES:

1. THE CONTRACTOR SHALL FURNISH ALL CONDUIT, HARDWARE, AND WEATHERHEAD. ALL OTHER ITEMS SHOWN ON THIS DRAWING SHALL BE FURNISHED BY THE OWNER. THE CONTRACTOR SHALL ATTACH THE CONDUIT EVERY FOUR (4) FEET.

SWITCHYARD RECEPTACLES



DETAIL

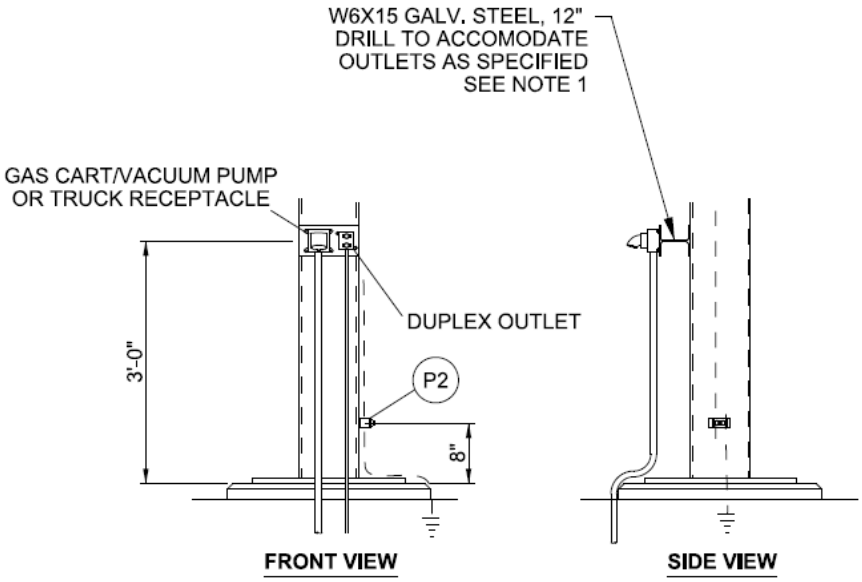
TYPICAL INSTALLATION FOR YARD VACUUM PUMP/ GAS CART RECEPTACLE AND DUPLEX OUTLET BOX

ITEM	DESCRIPTION
1	TAPERED TUBE GALVANIZED STEEL STRUCTURE COMPLETE WITH WIDE FLANGE MOUNTING BRACKET WELDED IN PLACE OR SQUARE TUBE GALVANIZED STRUCTURE.
2	○ 120 VOLT (SINGLE PHASE) YARD RECEPTACLE, 20A, DUPLEX, GROUNDING TYPE (GFCI) WITH **JEA ITEM ID # ELCBC200** - WEATHERPROOF COVER, CROUSE-HINDS # WLRD-1 ○ **JEA ITEM ID # ELUPL006** - 240 VOLT (SINGLE PHASE) TRUCK RECEPTACLE, 60A, WATERPROOF, THOMAS & BETTS / RUSSELLSTOLL TYPE SCA # 3323-78 (OLD #), DF6204FRAB0 (NEW #) ~ PROVIDE ITEM LISTED ABOVE OR APPROVED EQUAL.
3	**JEA ITEM ID # ELUPL005** - 240 VOLT (THREE PHASE) VACUUM PUMP RECEPTACLE, 60A, WATERPROOF, THOMAS & BETTS/ RUSSELLSTOLL TYPE SCA CAT # 3324-78 (OLD #) DF6404FRA (NEW #) OR APPROVED EQUAL.
4	ABOVE GRADE CONDUIT TO THE RECEPTACLES - 1 ½" UV RATED PVC, SCHEDULE 40 OR RIGID GALVANIZED STEEL
5	GALVANIZED MOUNTING HARDWARE PROVIDED OR CONTRACTOR MAY USE NON-COMPRESSION UNISTRUT. THE STRUCTURE SHOULD NOT BE PENETRATED.

NOTES:

1. THE CONTRACTOR SHALL FURNISH INSTALL 1 ½" PVC CONDUIT, COMPLETE WITH NECESSARY HARDWARE IN THE LOCATION AS SHOWN.
2. THE CONTRACTOR SHALL ATTACH THE CONDUIT TO THE STRUCTURE AT 2' INTERVALS.
3. THE CONTRACTOR SHALL FURNISH ALL MOUNTING HARDWARE REQUIRED TO ATTACH THE RECEPTACLE TO THE STRUCTURE. ALL AREAS CUT OR DRILLED SHALL BE COLD GALVANIZED.

Switchyard receptacles are provided and installed by the Substation Construction Contractor for new substation installations. These examples are for reference purposes only. Refer to the Project Design drawings for specific project related details.



DETAIL
RECEPTACLE
MOUNTING BRACKET

(P2) – Ground Connector, Bronze bolted, Two (2) 7#5 Copperweld to Flat, Anderson Catalog No. GC-143A-GS or equal. Furnished by the owner.

YARD RECEPTACLES

METAL-CLAD SWITCHGEAR

Metal-clad switchgear is utilized where aesthetics, compactness of the site, land use, ease of installation, exiting low-voltage circuits, weather or safety require consideration. It serves the same system function as comparable elements in a conventional substation, but typically takes up less area.

Switchgear can be indoor or outdoor and designed as one of the following:

- Single cubicle lineup without enclosed aisle (JEA preferred)
- Single cubicle lineup with enclosed aisle
- Double cubicle lineup with common enclosed center aisle

Switchgear can also be made to any substation switching configuration such as straight bus/radial, network, sectionalized bus, main and transfer bus, breaker-and-a-half, ring bus and double bus-double breaker. Each switchgear section is made to accommodate auxiliary equipment including, but not limited to current transformers, potential transformers, fuses, switches and surge arresters.

Rated Insulation Levels of Metal-Clad Switchgear		
Rated Nominal Voltage (rms)	60 Hz, 1 Min Withstand	BIL
4.16 kV	19 kV	60 kV
7.2 kV	36 kV	95 kV
13.8 kV	36 kV	95 kV
25.0 kV	60 kV	125 kV
34.5 kV	80 kV	150 kV

See IEEE Std. C37.20.2, Table 1, for further clarification.

JEA has a number of substations that have switchgear as part of the substation footprint. The substations utilizing switchgear are Kennedy, Northside, Northside Auxiliary and Southside GIS (13kV and 26kV), Water, College, Main, Church, Kings, McDuff, Ortega, Roselle, Georgia, Herschel, St. Johns and Park & King.

At the Northside Auxiliary substation, the switchgear is housed in the substation control house with all the other electrical equipment typically found in a control house. Whereas, for Kennedy, the switchgear is housed in its own dedicated building. Southside GIS Substation is an example of a substation where appearance and minimal land use were the key determining factors on utilizing switchgear and GIS elements as the entire substation is housed inside the Southside GIS Building at the Southside Substation location.

<u>Basic Specifications for 38kV Switchgear (operated at 26kV):</u>

Main Breaker (2) - 38kV, 2000A, 3 phase (on each end)

Feeder Breakers (4) – 38kV, 1200A, 3 phase (2 adjacent to each main breaker)

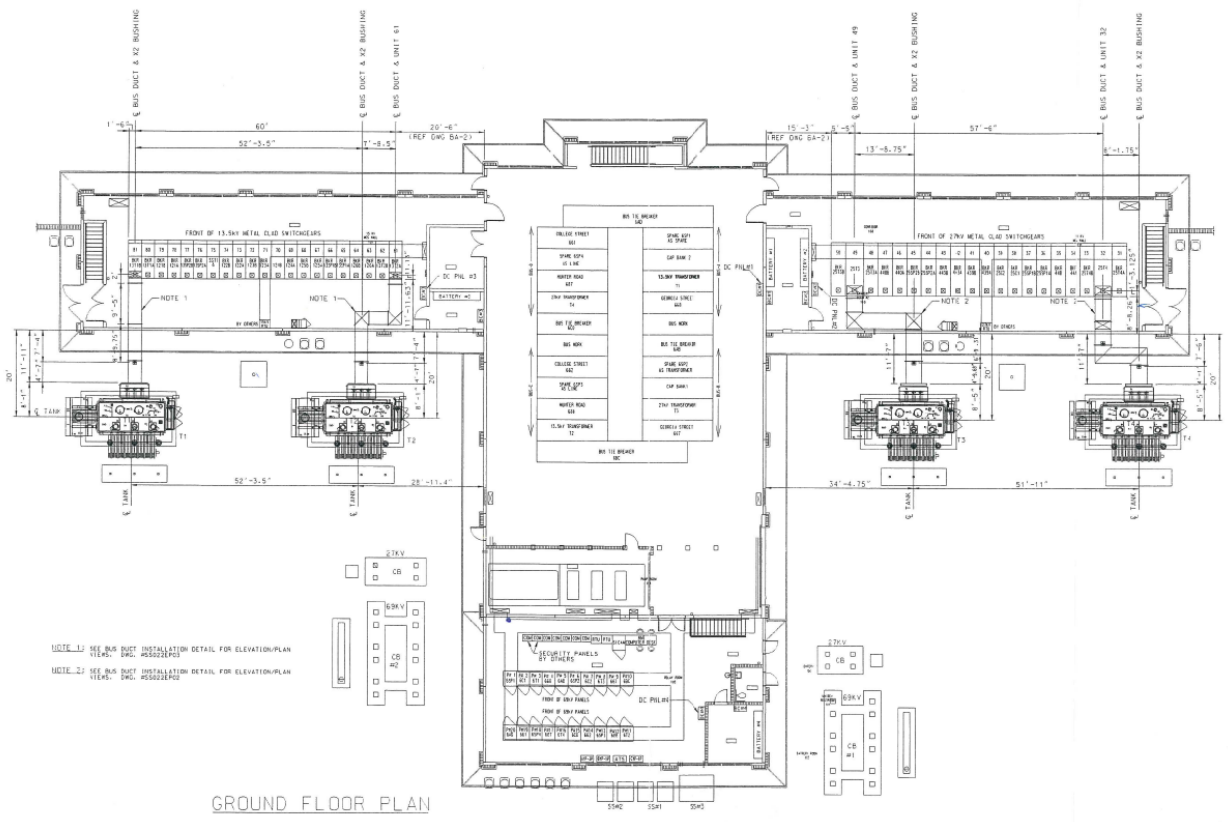
Tie Breaker (1) – 38kV, 2000A, 3 phase (middle section)

PT's (2) – 14400V – 120/72V (on either side of tie breaker)

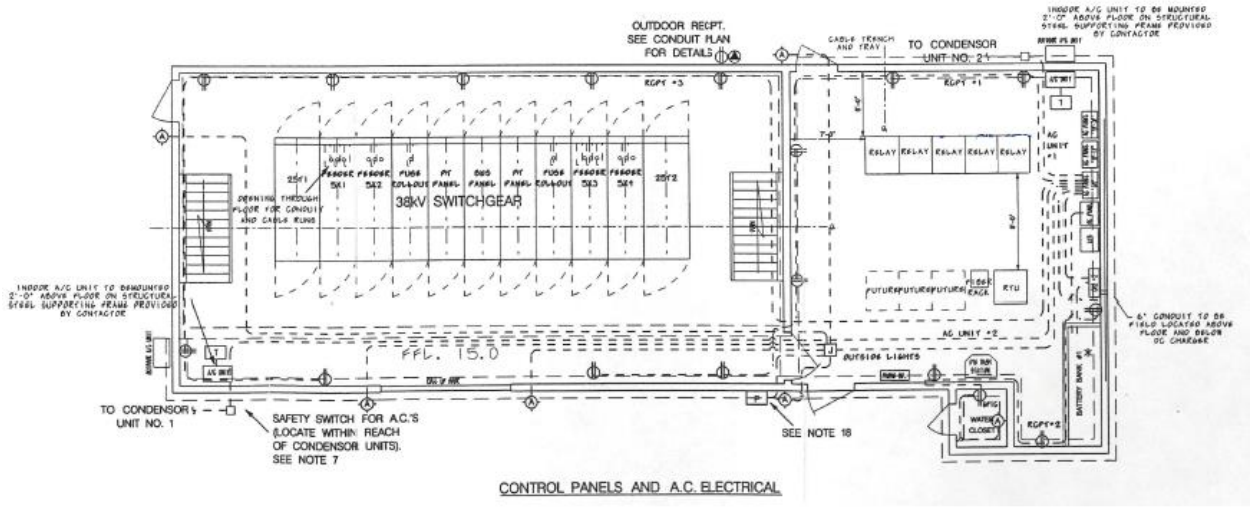
Fuse (2) to Station Service Transformers – (adjacent to PT sections)

JEA prefers Arc-Resistant switchgear for 13kV and 26kV applications. Arc-Quenching technology will be considered in 4kV applications and where space considerations justify its use.

Substation with Switchgear for 13kV and 26kV



Substation Control House with Switchgear



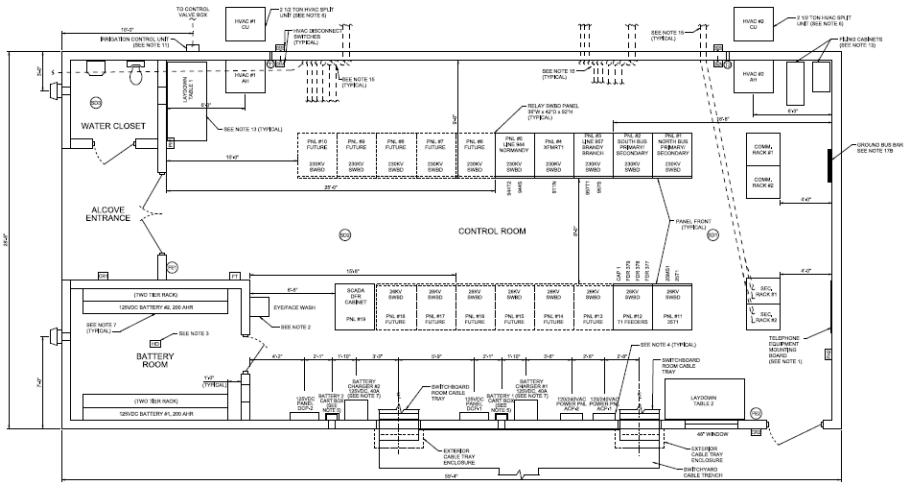
CONTROL HOUSE

All JEA substations have a control house building in which all the SCADA, electrical and communication panels and the battery banks are located. The majority of the JEA control houses are constructed of concrete block although there are a few prefabricated control houses in the JEA system.

General Control House Layout Drawings are included in this section. These examples are for reference purposes only. Refer to JEA Project Design drawings, the project technical specifications and facilities specifications for specific project related details.

The SCADA RTU, Communications Panels, Network Panels, Relay Panels, Switchboard Panels, Batteries, Battery Racks, Battery Chargers, Communication Racks and Security Racks are housed in the control house and are typically furnished by JEA.

CONTROL HOUSE (OUTSIDE VIEW)



CONTROL HOUSE (TYPICAL INSIDE LAYOUT)

5.1 CABLE RISER / CABLE TRAY

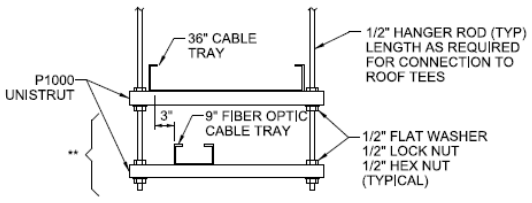
All control houses have a cable tray system that is furnished and installed by the Substation Construction Contractor. Indoor cable trays are fabricated from extrusions of aluminum alloy 6063-T5 or 6063-T6 and shall be of the aluminum ladder type with cross rungs spaced six (6") inches maximum center to center. The cable trays shall be designed to be in compliance with the latest ASCE Specifications and AWS Standards.

The trays shall be furnished with a six (6") inch depth or four (4") inch depth as indicated on the Substation Construction Drawings and in nominal twelve (12') foot lengths. Any splices shall be of the high pressure bolted type. The design load for the tray installation shall be a minimum 200 lbs. per linear foot for the maximum tray width of thirty-six (36") inches for control cable use or nine (9") inches for fiber optic use as described on the Substation Construction Drawings.

Cable tray supports shall be provided at intervals not to exceed the Manufacturer's recommendations for maximum span for the design load and type of tray being supported. In no case shall the spans exceed that shown on the Substation Construction Drawings. All necessary splice plates, bolts, nuts, lock washers, etc. shall be furnished to be compatible for use with the type of metal tray provided. All rungs, dropouts and other metal surfaces in contact with the cable shall have smooth, rounded edges. The rungs shall be joined to the sides by a homogeneous union method, weld on swage.

The cable tray shall not be used as a ground path. Connection of the ground conductor to the cable tray shall be made utilizing Burndy Type GC2929CT connection or approved equal. The ground conductor shall be secured to the cable tray at each cable tray fitting or at intervals not exceeding four (4') feet throughout the length of the tray. Ground wire lugs and hardware shall be provided by the Substation Construction Contractor as required.

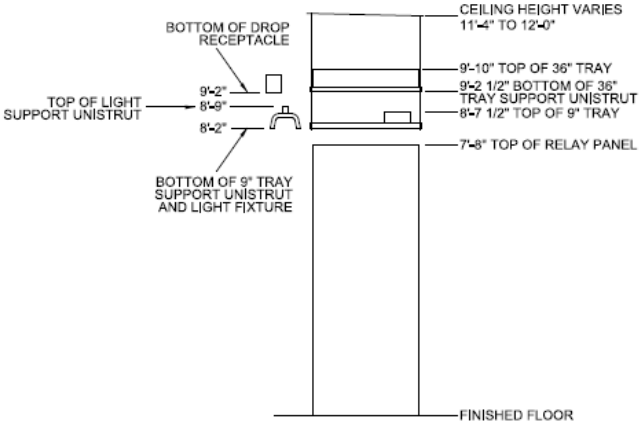
Refer to the Substation Construction Specifications and Drawings for project specific requirements. Refer to the Facilities specifications for Building construction specific requirements.



**NOTE:
DOUBLE TRAY SUPPORTS ONLY REQUIRED WHEN BOTH CABLE TRAYS ARE PRESENT, FOR LOCATION OF CABLE TRAYS REFER TO DRAWING CE3,

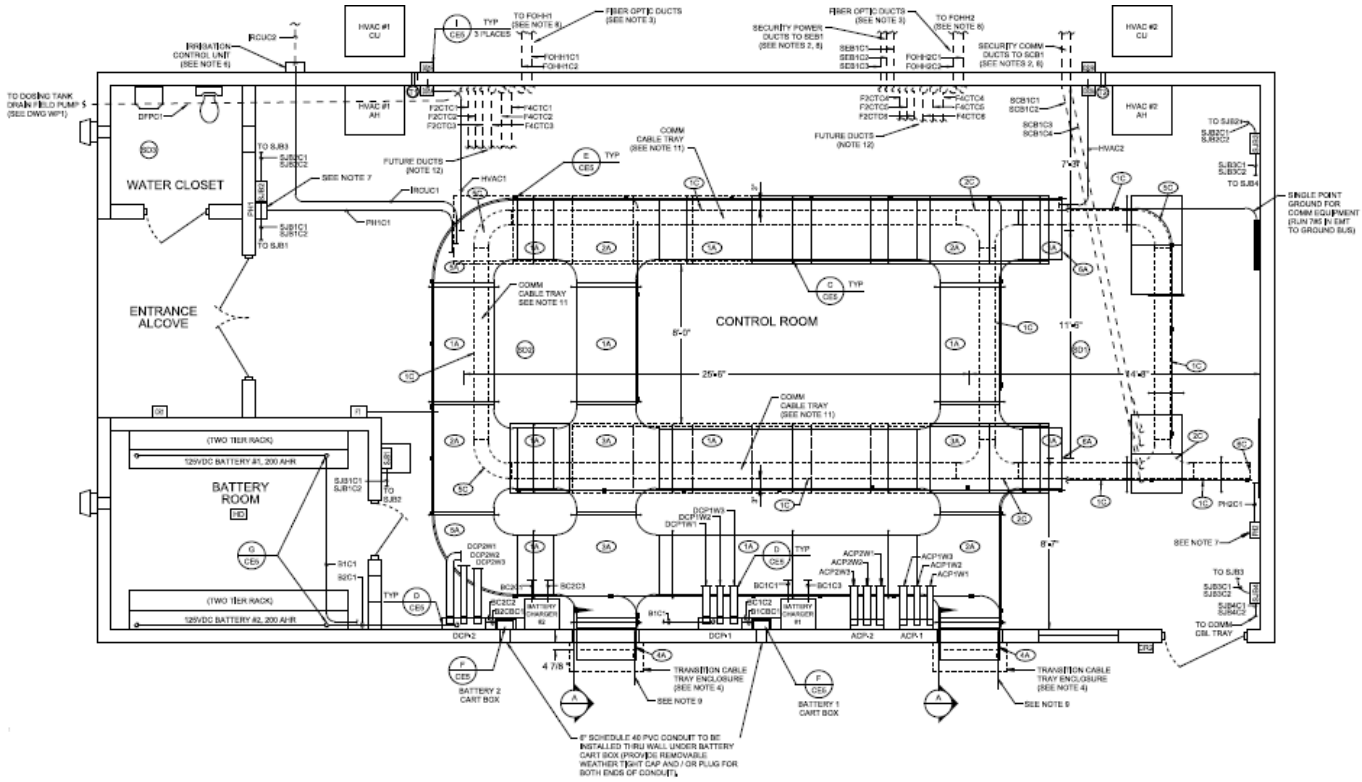
DETAIL

CABLE TRAY HANGER
(NOT TO SCALE)

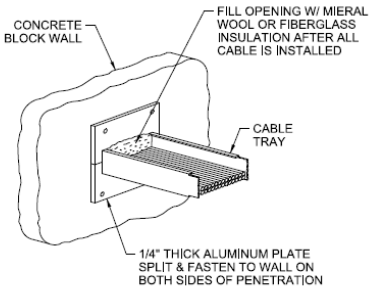


CONTROL ROOM
ELEVATION DETAIL
N.T.S.

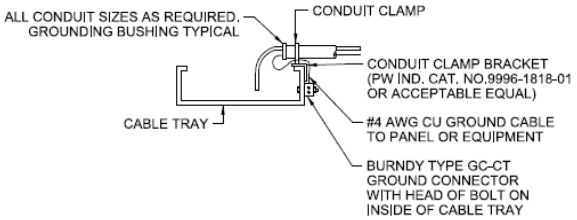
CONTROL HOUSE WITH CABLE RISER / CABLE TRAY



CONTROL HOUSE CABLE RISER / CABLE TRAY DETAILS



DETAIL
CABLE TRAY WALL PENETRATION
(NOT TO SCALE)



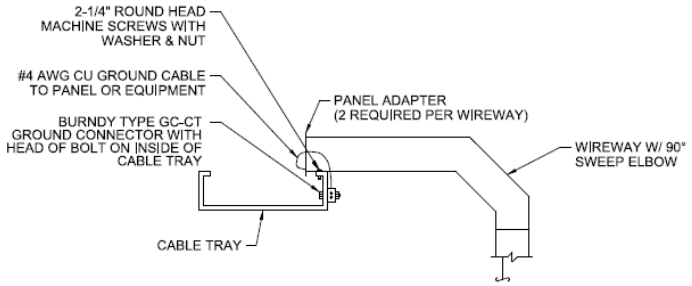
DETAIL
CONDUIT/GROUNDING TO CABLE TRAY
(NOT TO SCALE)

WIREWAY

All control houses have a wireway system that is furnished and installed by the Substation Construction Contractor. The Contractor shall furnish and install the wireway as specified in the Project Design Package "Conduit Schedule" and as shown on the Control House Drawings. The wireway shall be NEMA 1 square wireway, smooth, seam free, without knockouts, and shall have removable covers. The wireway and associated fittings shall be finished with baked satin ANSI 61 gray enamel over phosphatized surface. The wireway shall be manufactured from steel not less than 16 gauge and shall conform to NEMA standards.

The Contractor shall install the wireway in accordance with the Manufacturer instructions and as indicated on the drawings. All field cuts shall be made with a hacksaw and grounded smooth. Terminations of the wireway run into the cable tray, electrical panels, or electrical equipment shall utilize a panel adapter. Wireway sweeps consisting of two (2) 45 degree bends shall be used in lieu of one (1) 90 degree bend.

Refer to the Substation Construction Specifications and Drawings for project specific requirements. Refer to the Facilities specifications for Building construction specific requirements.



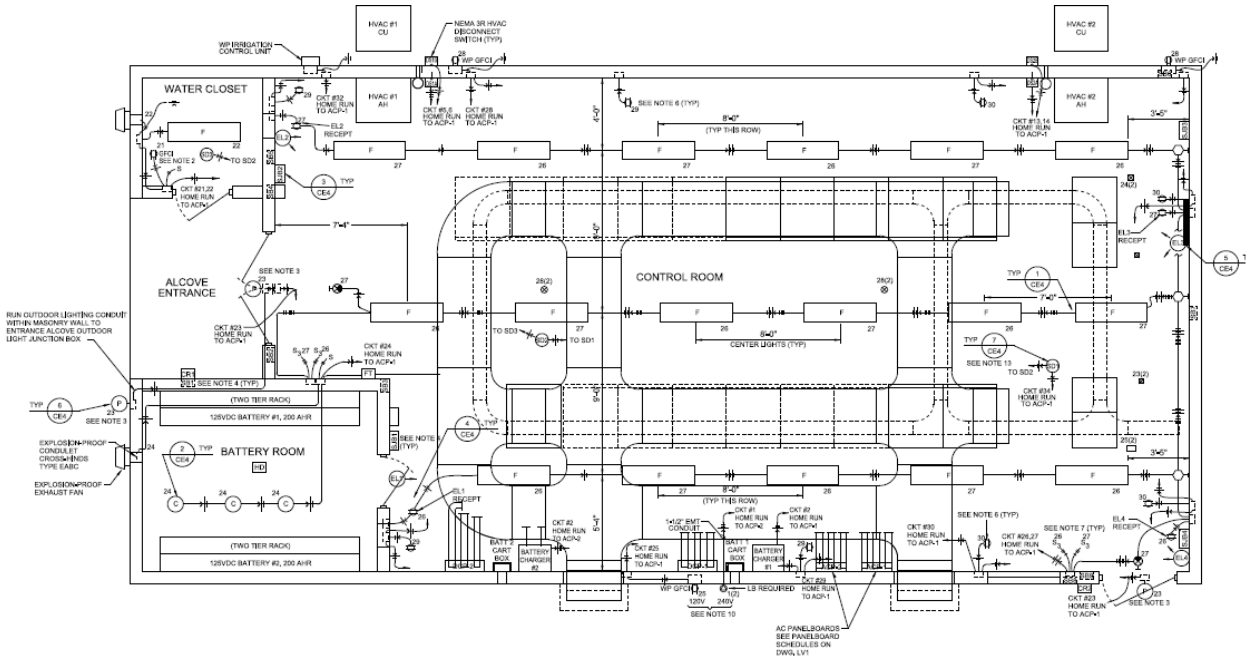
DETAIL
WIREWAY/GROUNDING TO CABLE TRAY
(NOT TO SCALE)

5.2 CONTROL HOUSE LIGHTING, OUTLETS AND SWITCHES

All JEA substations have a control house building in which all the SCADA, electrical and communication panels and the battery banks are located. The majority of the JEA control houses are constructed of concrete block although there are a few prefabricated control houses in the JEA system.

General Control House Layout Drawings are included in this section. Refer to JEA project drawings and the project technical specifications for more specific details. Refer to Facilities specifications for Lighting and other facility specific details.

The SCADA RTU, Communications Panels, Network Panels, Relay Panels, Switchboard Panels, Batteries, Battery Racks, Battery Chargers, Communication Racks and Security Racks are housed in the control house and are typically furnished by JEA.



LEGEND:

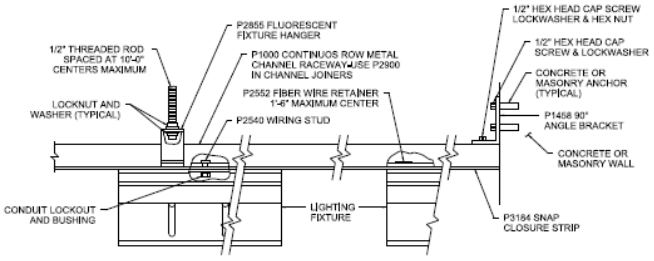
- DENOTES CONCEALED #12 AWG CONDUCTORS UNLESS OTHERWISE NOTED. CONDUCTOR CODE: SHORT DASH INDICATES PHASE OR SWITCHED CONDUCTOR; LONG DASH INDICATES NEUTRAL CONDUCTOR; ARC INDICATES GROUND CONDUCTOR
- CIRCUIT CONTINUATION
- JUNCTION BOX, 4" x 4" x 2-1/8" (TYP), SURFACE MOUNTED
- JUNCTION BOX, 4" x 4" x 2-1/8" (TYP), FLUSH MOUNTED
- SECURITY OUTLET BOX, 4" x 4" x 2-1/8" (TYP), FLUSH MOUNTED
- CR — CARD READER, TO BE FURNISHED AND INSTALLED BY OWNER
- SC — SECURITY CAMERA, TO BE FURNISHED AND INSTALLED BY OWNER
- SJB — SECURITY JUNCTION BOX, 12" x 12" x 6", SURFACE MOUNTED, HOFFMAN A-1212CH
- SD — SMOKE DETECTOR
- JUNCTION BOX IN-LINE UNISTRUT RACEWAY SYSTEM (P2813/P2814)
- S — SINGLE POLE SWITCH
- S_3 — THREE WAY SWITCH
- S_4 — FOUR WAY SWITCH
- GROUNDING - TYPE DUPLEX RECEPTACLE
- 240V, 60A, YARD RECEPTACALE. RUSSELLSTOLL TYPE SCA, CAT. NO. 3323-78
- GFCI — GROUND FAULT CIRCUIT - INTERRUPTER, DUPLEX RECEPTACLE
- WP — GFCI PROTECTED WEATHER-PROOF GROUNDING-TYPE RECAPTACLE
- THRU-WALL EXHAUST FAN
- C — EXPLOSION PROOF LIGHT, 200W, TYPE EVCX CEILING MOUNT CROUSE-HINDS
- HD — EXPLOSION PROOF HEAT DETECTOR, CHEMETRONICS EPB 501 OR EQUAL
- EL — DIE-FORMED STEEL EMERGENCY LIGHT UNIT, 12 VOLT, 2 LAMP HEADS, 120VAC INPUT WITH SELF DIAGONOSTIC OPTION AND CORD SET OPTION, McPHILBEN CAT. ES12N 100W PAWG SD CS CONNECT ALL EMERGENCY LIGHTS AHEAD OF CIRCUIT SWITCHES, ARROWS INDICATE AIMING ANGLE.
- P — OUTDOOR WALL MOUNTED LED WALLPACK BRONZE LUMINAIRE, E-LITE STAR CAT. NO. EWP-C02H035NB (120V, 35W, 4300K)
- F — LIGHTING FIXTURE, FLUORESCENT, DAY-BRITE CAT. NO. IA-232-120-EB (4', 32Wx2, 120V, ELECTRONIC BALLAST)
- 120 VAC 50' CABLE REEL W /5-15R HUBBELL HBL45123C #12AWG, NEMA 5-15R CONNECTOR
- 4X4 DUPLEX
- FT — INTERMATIC FAN TIMER MODEL T1975
- DS — DISCONNECT SWITCH - SEE NOTE 14
- WALL MOUNTED, ILLUMINATED EXIT SIGN WITH RED LEDs AND INTEGRAL BATTERY PACK. INSTALL ABOVE DOOR LEVEL. NUMBER OF SHADED QUADRANTS = NUMBER OF FACES

LIGHTING

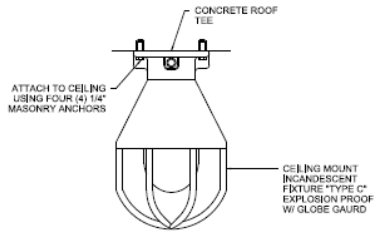
The Substation Construction Contractor shall furnish and install all lighting fixtures for the control house. All lighting shall operate at a line voltage of 120 volts. All exterior lighting circuit shall be dawn-dusk controlled by a single photocell mounted on the exterior of the control house.

For example: a combination of lighting is used in the substation control house as follows (please refer to the JEA Facilities Reference Manual for the most up-to-date lighting fixtures):

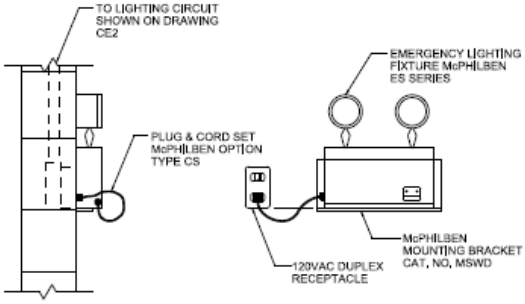
- Lighting in Main areas and the Water Closet: Lighting fixture, Fluorescent, 4', 32Wx2, 120V Electronic Ballast (ex. Day-Brite Catalog # IA-232-120-EB)
- Battery Room lights: Explosion proof light 200W Ceiling Mount (ex.Type EVCX by Crouse-Hinds)
- Outdoor Lighting: Outdoor wall mounted LED Wallpack Bronze Luminaire, 120V, 35W, 4300K (ex. E-Lite Star Catalog # EWP-C02H035NB)
- Emergency Lighting: Die-formed steel emergency light unit, 12V, 2 Lampheads, 120VAC Input with self diagnostic option and cord set option (ex. McPhilben Catalog # ES12N 100W PAWG SD CS). Connect all emergency lights ahead of circuit switches. Arrows indicate aiming angle.



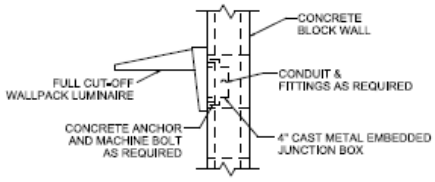
DETAIL 1
FIXTURE TYPE F
(PART NUMBERS REFER TO UNISTRUT CATALOG NUMBERS)
(NOT TO SCALE)



DETAIL 2
EXPLOSION PROOF
FIXTURE TYPE C
(NOT TO SCALE)



DETAIL 5
FIXTURE TYPE S
EMERGENCY LIGHTING FIXTURE
(NOT TO SCALE)



DETAIL 6
FIXTURE TYPE P
OUTDOOR WALL MOUNTED LIGHTING FIXTURE
(NOT TO SCALE)

OUTLETS AND SWITCHES

All outlets and switches shall be furnished and installed by the Substation Construction Contractor. The types of outlets and switches used in the substation are as follows:

- Receptacle, ground–type duplex, surface mounted.
- Receptacle, ground fault circuit-interrupter, duplex, surface mounted.
- Receptacle, GFCI protected weather-proof grounding-type, surface mounted.
- 240V, 60A Yard Receptacle, Russellstoll Type SCA, Cat. No. 3323-78
- Three way switch, surface mounted.
- Four way switch, surface mounted.
- Single pole switch, surface mounted.
- Weather proof covers for all outdoor switches and receptacles

5.3 CONTROL PANELS AND LOW VOLTAGE ELECTRICAL EQUIPMENT

The control panels are located in the control house and are typically furnished by JEA.

The D.C. Panels are typically housed in a NEMA 1 enclosure with Main breaker and Sub-feed lugs with a lockable piano hinge door. They are 2 Wire, 125VDC, 200A, Surface Mounted with Breakers as shown on the project drawings.

The A.C. Panels are typically housed in a NEMA 1 enclosure and Lightning arrestor with a lockable piano hinge door. They are 1 phase, 3 wire, 120/240V, 225A, Solid neutral surface mounted, panelboards with 42 single pole branches equipped with Breakers as shown on the project drawings.

5.4 BATTERY BANKS AND BATTERY CHARGERS

BATTERY BANKS

JEA utilizes a 125 volt DC system for the control and operation of its transmission and distribution substations. JEA has standardized on lead acid type battery banks to supply this 125 volt DC requirement for its substations. There are two major types of battery banks used for substation application: lead acid and nickel cadmium. The nickel cadmium battery banks are about twice the cost of lead acid for the same size bank. The major advantage that nickel cadmium batteries have over lead acid is their performance in poor climatic conditions. Since all JEA substation battery banks are installed in climate controlled control houses, the additional cost is not justified. The lead acid battery banks have proven to be a very reliable and maintenance free battery for JEA for many years. The following is the standard design of substation battery banks being purchased:

Type:	Lead Calcium
Voltage Rating	125 volt nominal, (129 volt, fully charged)
Bank Size:	60 cell
Cell Size:	2.15 volt (fully charged), 1.75 volt (discharged)
Typical Bank Sizes:	150Ah and 200Ah
Physical Design:	Two tier, stepped rack system

The substation battery banks are sized and purchased by the substation engineering activity. Battery banks are purchased directly from pre-approved battery bank manufacturers. Battery banks are purchased for individual substation projects and for replacement of deteriorated existing banks throughout the system as needed. Lead acid battery banks are purchased as close to their required need date as possible. It is not recommended to store a lead acid battery bank more than 6 months without charging. Battery banks purchased for new substation projects are typically delivered as soon as the control house is complete and ready for the bank to be installed.

The following page illustrates the method of sizing battery banks for the JEA substation applications. Criteria, formulas and an example are provided to demonstrate the method used for sizing battery banks on an individual application basis.

SUBSTATION BATTERY BANK – SIZING

JEA utilizes the "approximation method" for sizing substation battery banks. This method follows the guidelines set forth in IEEE 485, "Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations."

There are three types of loads that occur during a power outage; continuous load, emergency load and momentary load. These loads are all taken into account in the sizing formula and are represented by their respective suffix. Since the emergency load and the momentary load may occur at any time, a worst-case condition is assumed; i.e. momentary load occurring at the end of the load cycle. The momentary load is the worst case scenario of breaker operations within the substation during a fault condition. The formula used by JEA to size substation battery banks is as follows: $S(size) = Kc\ Ic + Ke\ Ie + Km\ Im$

The K's in this formula represent the ratio of the nominal ampere-hour rating of a battery to the available discharge current rate for the time period being considered. The I's represent the load currents expected throughout that respective time period. For lead acid batteries, the individual K values are practically the same for all manufacturers. Graphs and tables are available from manufacturers to determine K values for use in the sizing equation.

A typical K value for one eight hour discharge (Kc) is 8. A typical K value for a three hour discharge (Ke) is 4. Since the highest discharge rate for lead acid batteries is a one minute rate, although the momentary load is considerably less, the one minute K value (Km) of 0.75 must be used for the momentary discharge. When sizing a battery bank, the worst case load condition, including future loading of the substation, is considered. These values are determined from the substation equipment that will be used at the particular substation that the battery bank is being sized for. The following is a battery bank sizing example that was used to size the battery bank for the Craven Road Substation.

Craven Road Substation Example:

Kc = 8 hours
Ic = 5 amps 3 amps for solid state relay functions; 2 amps for panel indicating lamps

Ke = 4 hours
Ie = 10.5 amps 8 amps for emergency lights; 2.5 amps for communications

Km = 0.75 hours
Im = 108 amps 60amps: 20 amps each to operate three (3) 138kV Circuit Breakers
40amps: 20amps each to operate two (2) 138kV Circuit Switchers
8 amps: 4 amps each to operate two (2) 25kV Circuit Breakers

Substituting into the formula $S(size) = Kc\ Ic + Ke\ Ie + Km\ Im$ gives:

$S = 8(5) + 4(10.5) + 0.75(108)$
$S = 163$ ampere-hours

Since the closest lead acid battery bank sizes are 150 and 200 ampere-hours capacity, a 200 ampere-hour battery bank is chosen in this example. It is also recommended that the required load be approximately 80% of the battery bank size.

BATTERY CHARGERS

JEA has standardized on the battery charger used for all substation battery banks. The battery charger is maintained in the JEA inventory and available for use as a replacement for existing chargers or new installations as necessary. The specification on the battery charger is as follows:

Voltage Requirements: 208/240 VAC
Voltage Output: 130VDC
Current Output: 35 amps DC
Type: Wall mounted

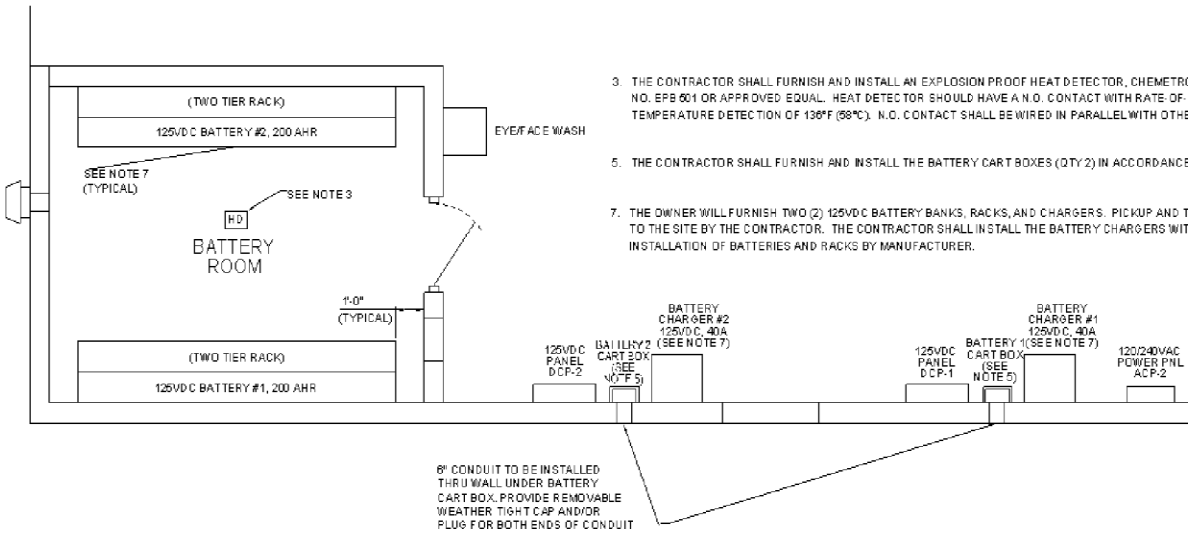
The inventory information for the Batteries are as follows:

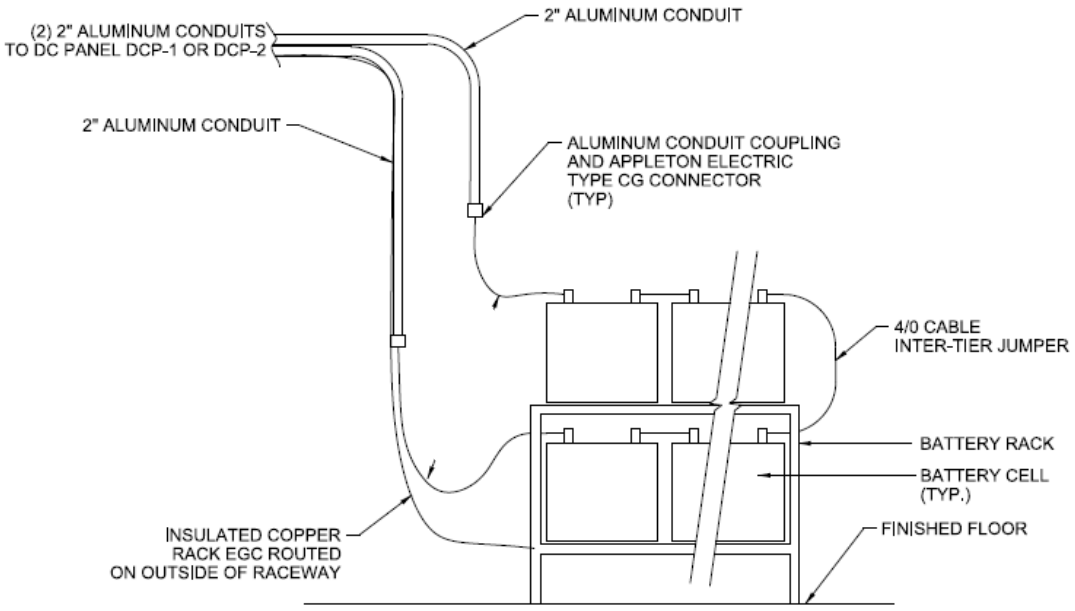
Manufacturer	Catalog Number	JEA ITEM ID #
Battery - Alpine Power System	Enersys Model 3CC-9M GP; 200Ah	BATBA001
Rack – Alpine Power System	Utility Rack 2 tier Model UC002T132A	BATRA001
Charger – See latest Oracle listing	Alpha – ACS16035208416107	BATCG001
Charger – See latest Oracle listing	Hindle – AT 10 Charger AT130040F240SXSXXXLFXXAPS	BATCG003

The mounting and connection requirements for the battery charger are shown on the following pages:

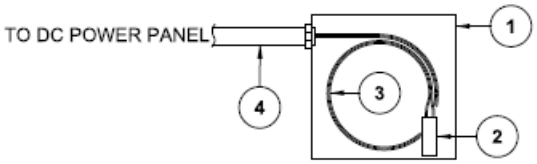
INSTALLATION

TYPICAL LAYOUT





DETAIL G
TWO TIER BATTERY RACK
(NOT TO SCALE)



ITEM	DESCRIPTION
1	NEMA 1 STEEL ENCLOSURE, 12"X12"X6", ASA-61 GRAY FINISH, HOFFMAN A-1212CH (BY CONTRACTOR)
2	DC DISCONNECT HOUSING, 600V, 350A, COMPLETE WITH HARDWARE AND CRIMP
	CONNECTORS, JEA STOCK NO. BAT EL 001 (BY OWNER)
3	(2) #2 FINE STRANDED COPPER CONDUCTOR CABLE INSULATION RATED FOR 600V (BY CONTRACTOR)
4	CONDUIT, 2" IMC (BY CONTRACTOR)

NOTES:

1. THE CONTRACTOR SHALL FURNISH ALL NECESSARY HARDWARE FOR MOUNTING THE BATTERY CART CONNECTION BOX TO THE CONTROL BUILDING WALL.
2. IN THE LOCATION AS SHOWN, THE CONTRACTOR SHALL FURNISH AND INSTALL 2" IMC CONDUIT, COMPLETE WITH NECESSARY HARDWARE.
3. THE CONTRACTOR SHALL FURNISH AND INSTALL (2) #2 STRANDED COPPER CONDUCTOR FLEXIBLE CABLES, AS REQUIRED, THE CONDUCTOR SHALL BE OF SUFFICIENT LENGTH TO PROVIDE ONE COIL TO BE STORED TO BE STORED IN THE BATTERY CART CONNECTION BOX.
4. THE CONTRACTOR SHALL INSTALL THE DC DISCONNECT HOUSING, USING THE CRIMP CONNECTORS PROVIDED.

DETAIL F
BATTERY CART CONNECTION BOX
(NOT TO SCALE)

SUBSTATION CABLES AND RACEWAY

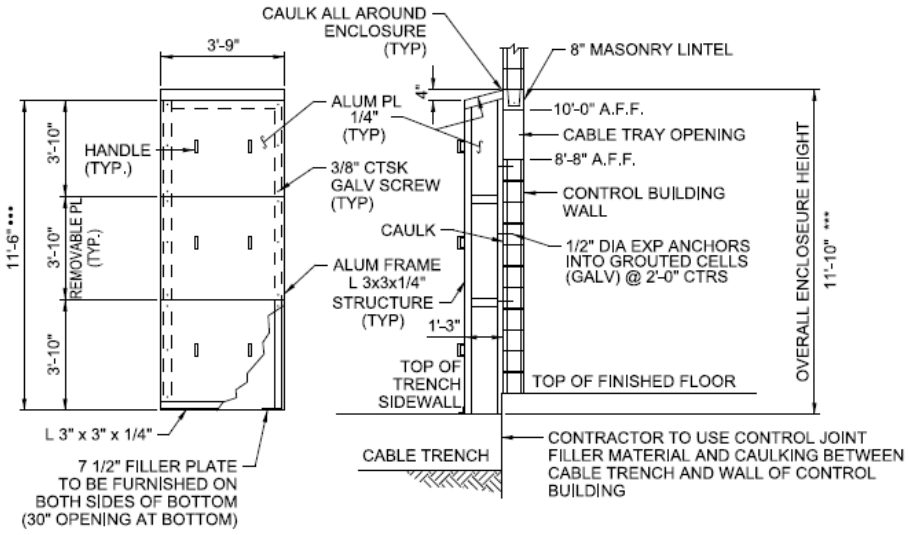
Raceways are comprised of conduits, trays and trenches and are used in substations to provide protection and electrical separation of cables. JEA uses a combination of conduits and trenches in the Substation Yard and cables in trays in the Substation Control House. Refer to the Project Design drawings and specifications for specific project related details.

6.1 CABLE TRENCH AND TRANSITION COMPARTMENT

The Substation Construction Contractor furnishes and installs the cable trench system which consists of precast polymer composite framing members, side sections and removable cover sections assembled to form a completely enclosed trench, except with an open earth bottom having a 4" bedding of sand. JEA cable trenches have a thirty (30") nominal width and sixteen (16") inch nominal depth and are furnished in ten (10') foot standard lengths unless indicated otherwise on the Substation Project Drawings. The trench systems are designed to support at least 200# per square foot live load with the road crossing sections being precast and designed for H-20 loading. **TRENWA** is the approved manufacturer of the JEA cable trench systems.

ITEM	MANUFACTURER	PART #
PEDESTRIAN		
1-Piece Multi-Duty Trench Base 10' Length, 30" Internal Width, 15" Deep	TRENWA	BM3015-120
Pedestrian Rated Fibrelite Lid & Section For 30" Wide Multi-Duty Trench (60"L x 30"W x 2.25"D)	TRENWA	LPF36-60
Ground Clips for BM Trench	TRENWA	GC5
ROAD CROSSING		
1-Piece Multi-Duty Trench Base 10' Length, 30" Internal Width, 16" Deep, HS20 Rated	TRENWA	BHF3016-120
HS20 Rated Fibrelite Lid & Section for 30" Wide Multi-Duty Trench (60"L x 30"W x 4"D)	TRENWA	LHF36-60
Ground Clips for HS20 Trench	TRENWA	GC3
CABLE RISER		
	TRENWA	
MISCELLANEOUS		
Guard Posts (Bollards)	TRENWA	GP-78

The cables in the cable trench in the Substation Yard go through the cable transition ladder compartment to enter into the Substation Control House.

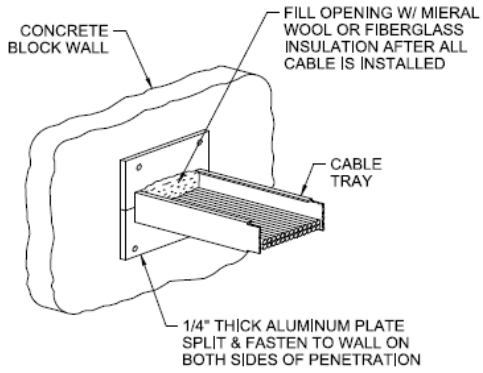


NORTH ELEVATION **EAST ELEVATION**

*** CONTRACTOR TO VERIFY WITH OWNER LENGTH OF CABLE TRAY ENCLOSURE BEFORE FABRICATING ENCLOSURE.

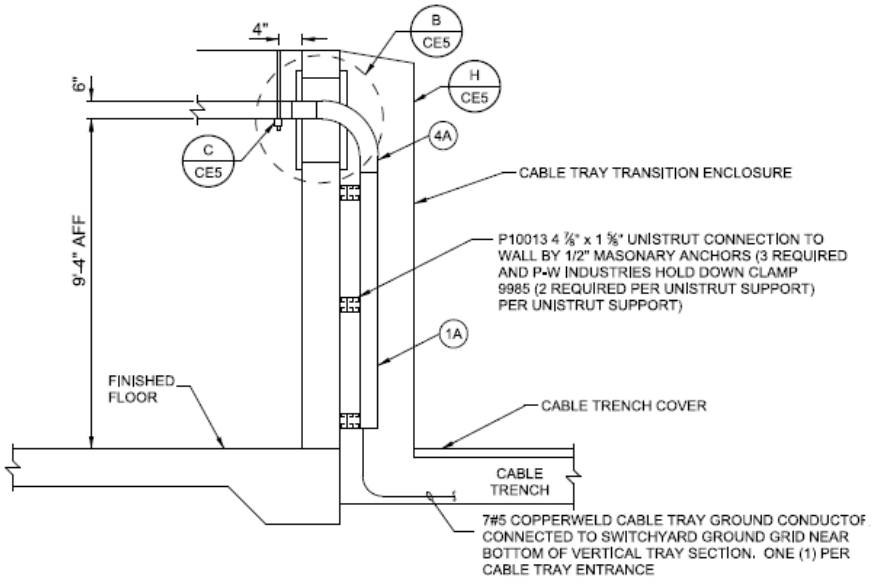
DETAIL

CABLE TRAY TRANSITION ENCLOSURE
(NOT TO SCALE)



DETAIL

CABLE TRAY WALL PENETRATION
(NOT TO SCALE)

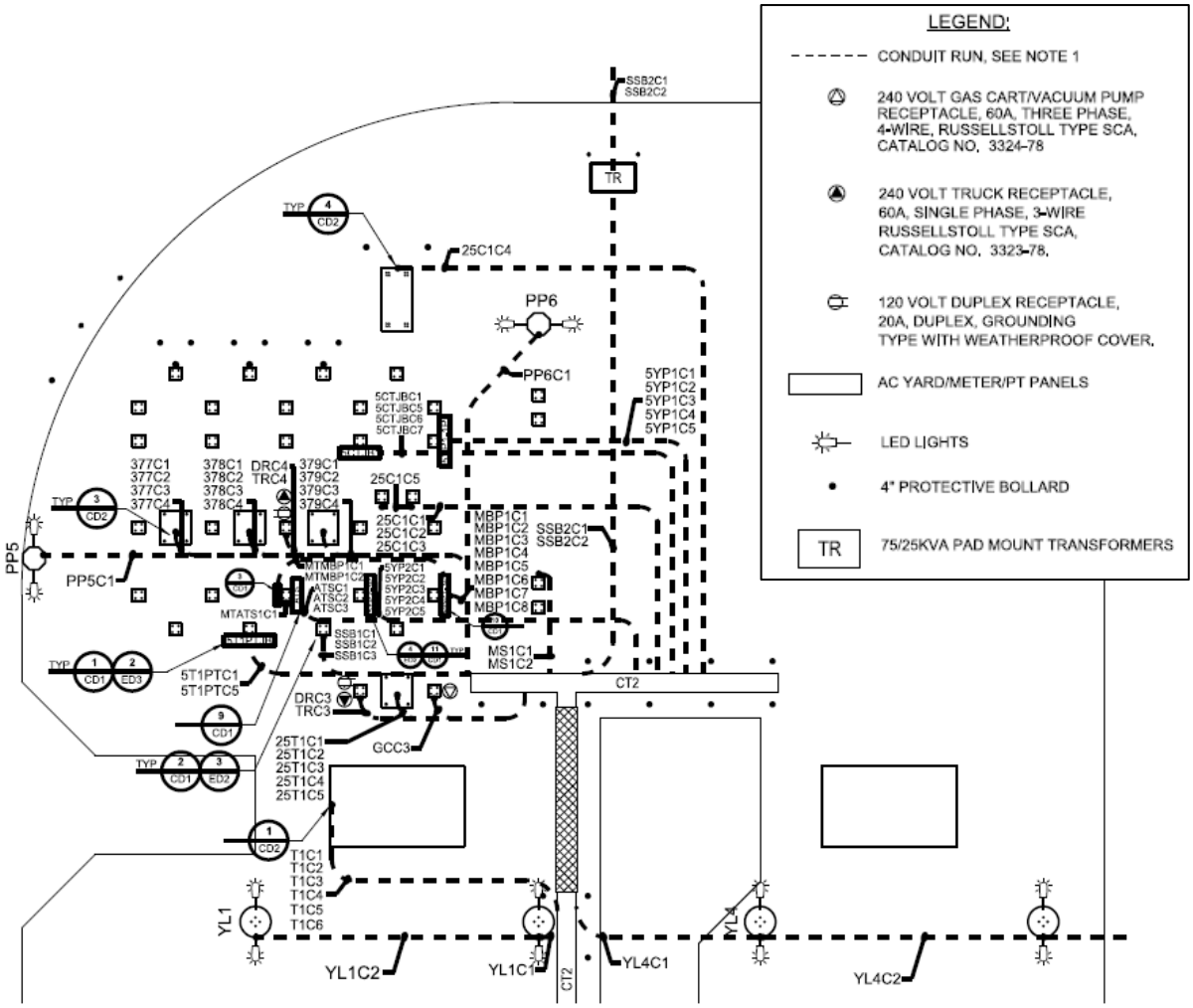


SECTION

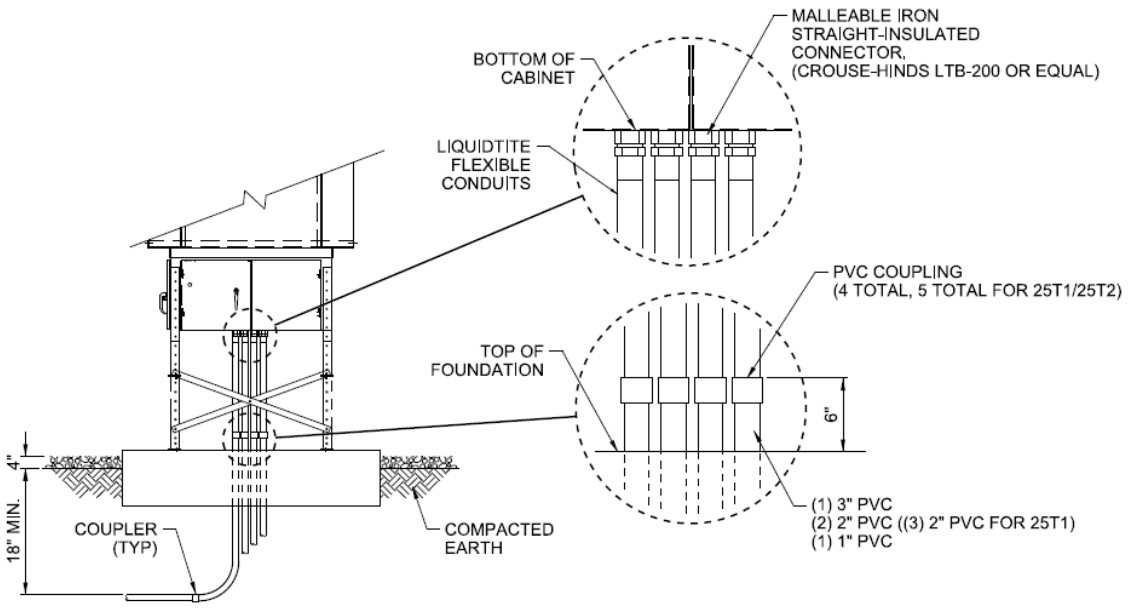
EXTERIOR TRAY ENCLOSURE

6.2 CONDUIT / DUCT BANKS / RACEWAY

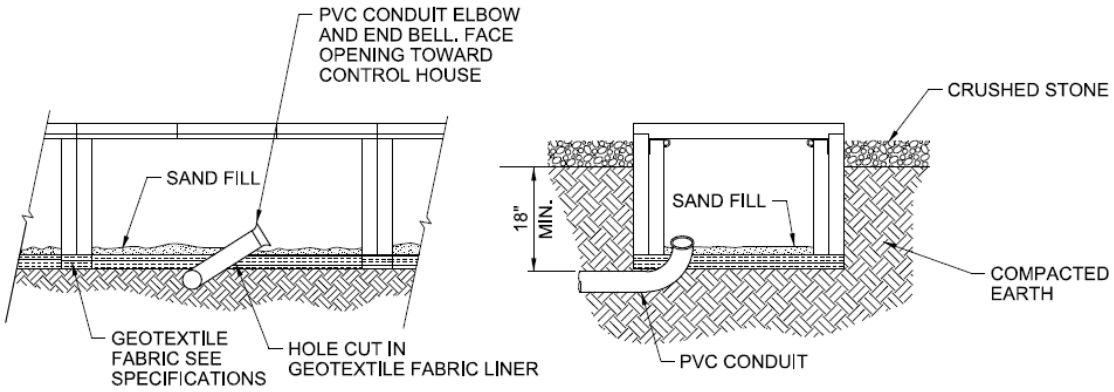
The Substation Construction Contractor furnishes and installs all the conduits and hardware necessary to complete the conduit installation in the JEA Substation. All conduit runs shall be labeled at both ends and at all entrance and exit points to the cable trench. The conduit details are listed in the Project Conduit Schedule and Project drawings. Refer to Project Design drawings and specifications for specific details.



SUBSTATION 26KV CONDUIT PLAN EXAMPLE



DETAIL 3
CONDUIT STUB UP @ 38kV BREAKERS



SIDE ELEVATION **END ELEVATION**

DETAIL 5
CONDUIT RISER IN CABLE TRENCH

*Refer to "UCL9*_ Installation of Conduit ELL" for conduit depth and radius bends
(see following page)

Jacksonville Electric Authority

Underground Distribution Standards

UCL9*

INSTALLATION OF CONDUIT ELL

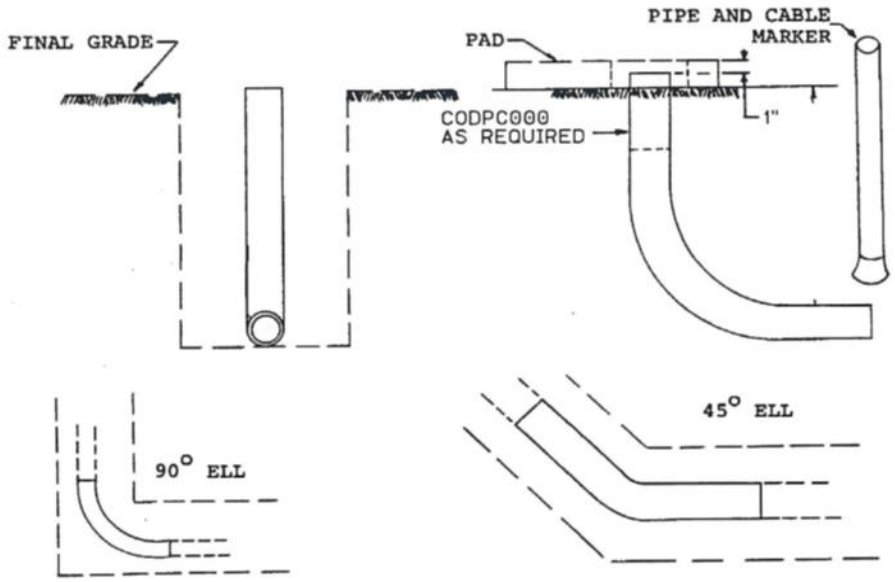


PLATE	ITEM	DESCRIPTION	QTY	RADIUS
		SCH 40 CONDUIT		
UCL9*1	CODEP024	1"– 90°	1	18"
UCL9*2	CODEP002	2"– 90°	1	48"
UCL9*3	CODEP004	3"– 90°	1	36"
UCL9*4	CODEP006	4"– 90°	1	36"
UCL9*6	CODEP009	6"– 90°	1	48"
UCL4*2	CODEP001	2"– 45°	1	36"
UCL4*3	CODEP003	3"– 45°	1	36"
UCL4*4	CODEP005	4"– 45°	1	36"
UCL4*6	CODEP010	6"– 45°	1	48"
UCL4*1	CODEP025	1"– 45°	1	18"
		GALVANIZED STEEL		
UCL9*2S	CODEP002	2"– 90°	1	9 3/4"
UCL9*3S	CODEP004	3"– 90°	1	13"
UCL9*4S	CODEP006	4"– 90°	1	36"
UCL9*6S	CODEP007	6"– 90°	1	48"
		SPECIAL SCH–40 PVC		
UCL9*1	CODEP008	6"– 90°	1	150"

REVISED: 10/01/94 REVIEWED BY: DS APPROVED BY: Charles J. Jones DATE: 9/29/94

DIRECT BURIED CONDUIT

DB-4

6.3 CONTROL CABLE / INSTRUMENT CABLE

The Substation Construction Contractor shall pull, terminate and label all cables as listed in the Substation Project Cable Schedule. All cables shall be clearly labeled at both ends and at all entrance and exit points to the cable trench. All control cable, shielded control cable and instrument cable is provided by JEA unless indicated otherwise on the cable schedule. All runs of control cable shall be continuous. Splices in control cable is not permitted. Splices in low-voltage electrical cable should be avoided, but if necessary, they shall adhere to NEC and NESC standards.

SPECIFICATION:

This Specification covers single and multiple conductor control cable to be used in control houses, generating stations, and substations where a multiple conductor cable of maximum service reliability is required for remote control of motors, circuit breakers and miscellaneous power equipment, relays, switches, light systems, and similar types of automatic or control circuits. Cable shall be suitable for 0-600 Volt A-C or D-C operations, for installation in wet or dry locations, in conduits or ducts, direct buried and as open wiring indoors, and for continuous operation at conductor temperature up to 75ºC.

Cable shall meet or exceed all applicable requirements of the latest edition of ICEA - NEMA Standards for thermoplastic insulated wire and cable.

CONDUCTOR

The conductors shall consist of soft or annealed, stranded, uncoated copper, unless otherwise specified, meeting the requirements of ASTM B-3, ASTM B-8, and ICEA - NEMA Standard S-61-402. If coating is required it shall conform to ASTM B-33 or ASTM B-189, for tin or lead-tin alloy. The stranding shall be Class B meeting the requirements of ASTM B-8.

INSULATION

Each individual conductor shall be insulated with a free stripping, 20 mil thick of clear or natural high molecular weight polyethylene, meeting the requirements of ICEA S-61-402, NEMA WC-5, Part 3.

A nominal 10 mil jacket of color coded polyvinyl chloride shall be extruded tightly over the insulation.

ASSEMBLY

The required number of conductors shall be assembled into a round cable with a suitable length of lay, the direction of lay alternating for each layer with the outer layer in a left hand direction. Fillers shall be used only when necessary to assure a round cross section. The assembly shall comply with the requirements of ICEA S-61-402, NEMA WC-5, Part 5, Paragraph 5.2. A suitable binder tape shall be helically applied over the assembly.

SHIELDING

Whenever shielded cable is supplied, the shielding shall be a corrugated 5 mil nominal copper tape longitudinally applied with a minimum overlap of fifteen (15) percent of its width. The overlap seam shall be sealed with a sealant type adhesive. At least one (1) #16 AWG or larger copper drain wire shall be included in each cable on the inside of the copper shielding tape and remain in electrical contact with the copper shield tape.

COLOR CODING

The jacket over the individual conductors shall be permanently color coded according to NEMA Publication WC 30, Method 1, Table K-1. The jacket over the individual conductors shall be permanently color coded according to the following table. Tracer stripes shall be continuous and spirally wound.

Conductor Number	Background or Base Color	Tracer Color
1	Black	-
2	White	-
3	Red	-
4	Green	-
5	Orange	-
6	Blue	-
7	White	Black
8	Red	Black
9	Green	Black
10	Orange	Black
11	Blue	Black
12	Black	White
13	Red	White
14	Green	White
15	Blue	White
16	Black	Red
17	White	Red
18	Orange	Red
19	Blue	Red
20	Red	Green
21	Orange	Green

OUTER COVERING

A jacket of polyvinyl chloride shall be extruded over the taped assembly to protect the insulation. The jacket shall meet the requirements of ICEA S-61-402, Part 4, and be sufficiently flexible for installation in cold weather.

Cable identification shall be surface printing applied to the outer jacket at a maximum of 24" intervals and shall include the manufacturer's name or trademark, type of cable, number and size of conductors, and rated voltage.

Cable sheathing shall also include a length marking which can be readily used to determine the length of the cable to within two (2) foot increments which remains on a spool or is installed in a specific run. In the event that the marking is a serial marking on the sheath which does not start from zero, the manufacturer shall note the starting and ending numbers on both the reel tag and on the reel itself.

REELS

Cable shall be shipped on non-returnable wooden reels marked with the cable identification, the JEA P.O #, the total footages, and the starting and ending numbers of the cable, as discussed above. The cable shall be shipped with lengths of 5000', except in the case of the 21 conductor cable, which shall be shipped on reels of 2,500'. Reels shall be allowed with these lengths +/- 10%. Reels shall be built in accordance with NEMA WC-26. Minimum arbor diameter shall be 3".

QUALIFICATIONS

CONTROL CABLE					
JEA ITEM ID #	**CONDUCTOR SIZE**	**# CONDUCTORS**	**SHIELDED/ UNSHIELDED**	**REEL SIZE**	**OUTER DIAMETER**
CAI CN 016	#10 STR/B	4	SHIELDED	NRC32.24	
CAI CN 017	#10 STR/B	8	SHIELDED	NRC40.24	
CAI CN 018	#10 STR/B	21	SHIELDED	NRC58.32	
CAI CN 020	#18	3		500FT/SPOOL	

INSTRUMENT CABLE (CLASS B, 600 VOLT, #18 STR. SHIELDED, #20 STR. DRAIN WIRE SIZE)			
JEA ITEM ID #	**CONDUCTOR NUMBER**	**# CONDUCTORS**	**# PAIRS**
CAIIN001	2	2	1 TWISTED
CAIIN002	8	8	4 TWISTED
CAIIN003	3	3	1 TWISTED
CAIIN004 - INACTIVATED	4	4	2 TWISTED

The insulation over the individual conductors shall be permanently color coded according to ICEA S-61-402. The jackets over the individual conductors in each twisted pair shall be permanently color coded according to the following table:

INSTRUMENT CABLE		
PAIR #	**BASE COLOR 1st CONDUCTOR**	**BASE COLOR 2nd CONDUCTOR**
1	Black	White
2	Green	White
3	Orange	White
4	Red	White

NOTE: Color coding for JEA ITEM ID # CAIIN003 shall be black, white and red.

Current Approved* Cable Manufacturers for:

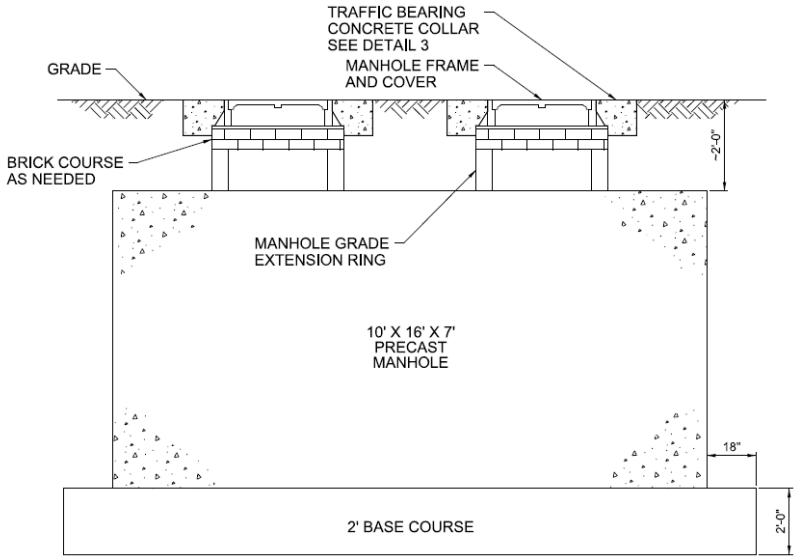
Shielded Control Cable: Lake Cable, Nexans, Okonite, Prysmian and Southwire

Instrument Cable: Nexans and Okonite

*Please refer to ORACLE for the most up-to-date approved manufacturers.

6.4 MANHOLES

Manholes are furnished by JEA and installed by the Substation Construction Contractor. The contractor shall install the manholes per Project Design drawings and specifications. Manholes are manufactured by Lindsey Precast.

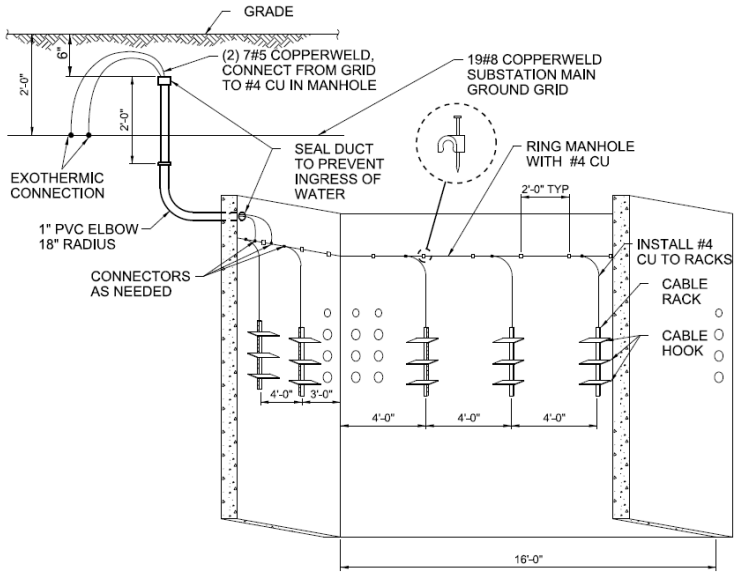


DETAIL 1
MANHOLE INSTALLATION OVERVIEW

NOTES

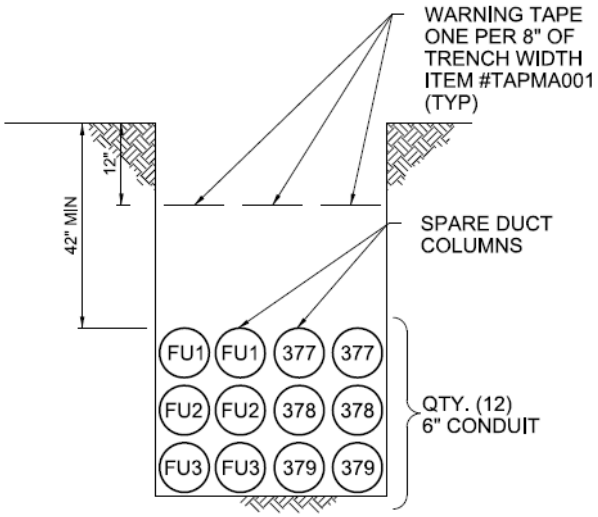
1. OWNER TO FURNISH AND CONTRACTOR TO INSTALL MATERIAL AS LISTED IN THE TABLE BELOW. ALL OTHER ITEMS NOT LISTED, CONTRACTOR SHALL FURNISH AND INSTALL, INCLUDING MANHOLE, CONDUCTOR, CLIPS, CONNECTORS, CONDUIT, CONCRETE, BRICK, MORTAR, ETC. TO PROVIDE A COMPLETE INSTALLATION OF THE MANHOLE AS SHOWN.

OWNER SUPPLIED MATERIAL		
JEA ITEM ID	**QUANTITY**	**DESCRIPTION**
COVMA001	10	MANHOLE COVERS
FRAMC001	10	MANHOLE COVER FRAME
MANER003	10	MANHOLE GRADE EXTENSION RING (INCLUDES NECK)
HOKCA003	150	DOUBLE CABLE HOOK, 8-1/4" EXTENSION, LOCK TYPE
RACUC002	50	CABLE RACK, 42 INCHES
TAPMA001	11	ELECTRIC WARNING TAPE, 6"x1000' ROLL
MANHO009	5	MANHOLE, 10'x16'x7' VAULT PRECAST CONCRETE
MAREL002	1	ELECTRONIC BALL MARKER, 5' RANGE, 3M 1402-XR



DETAIL 2

TYPICAL MANHOLE CABLE ARM HOOK, RACK & GROUNDING
(NOT TO SCALE)

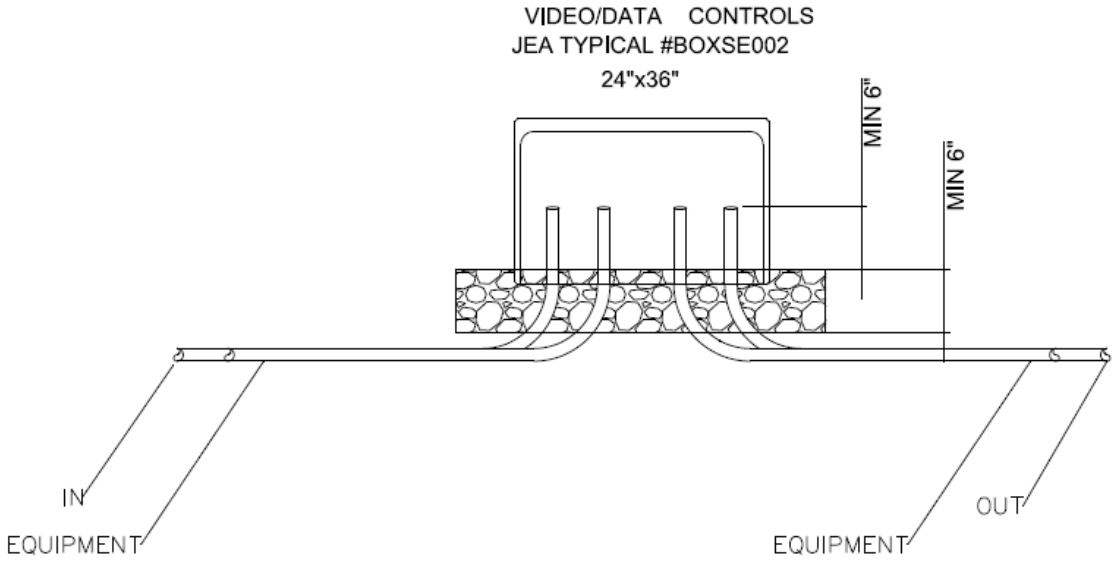


DETAIL

MH-1 TRENCH SECTION
(NOT TO SCALE)

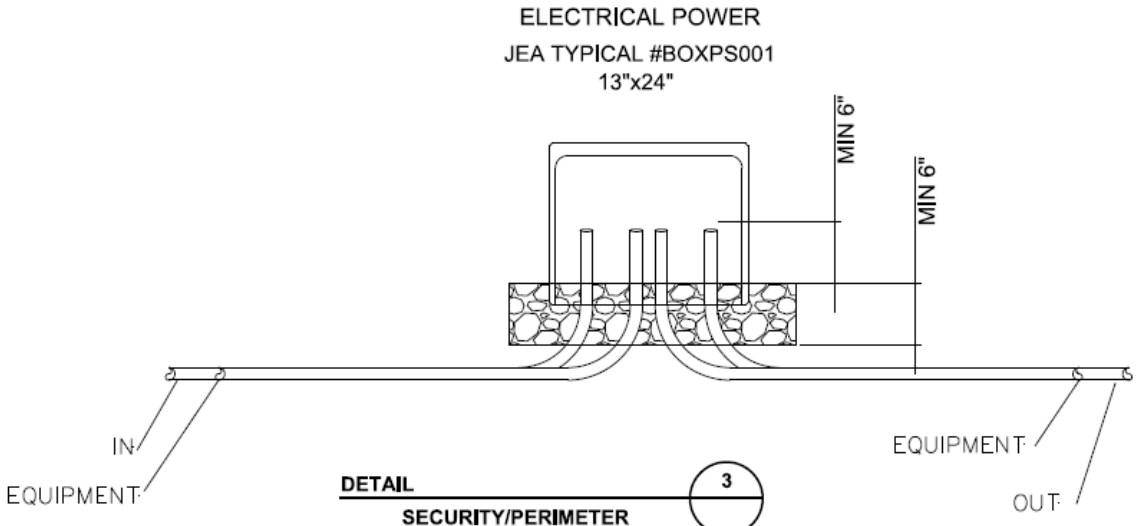
6.5 HANDHOLES

The Substation Construction Contractor shall install handholes furnished by JEA (Item ID# BOXPS001, BOXSE002). The contractor is to install pull strings and seal both ends of unused conduits within handholes.



IN-GROUND JUNCTION BOX NOTES:

1. BOXES WILL BE SET IN GRAVEL, MIN. 6", FOR DRAINAGE AND TO PREVENT MUD FROM ENTERING CONDUITS
2. CONDUITS WILL BE 6" ABOVE GRAVEL



SUBSTATION GROUNDING

JEA has standardized to exclusively use nVent ERICO Cadweld Exothermic Connections for all below-grade connections to the main ground grid. The connections shall be made with the Cadweld Plus System with the corresponding molds and electronic control unit for weld metal ignition. This includes cable to ground rod connections. All materials, including molds, shall be new and free of defects. A single mold shall not be used more than 50 times or past the manufacturer's recommendation.

All details and descriptions shown are examples of what has been used in JEA substations. Refer to Project Drawings and Specifications for what is required for specific projects.

7.1 GROUND GRID SYSTEM

JEA has developed and standardized the method for which substation ground grids are calculated and designed. The formulas used in the design calculations follow the guidelines set forth in IEEE 80, "Guide for Safety in AC Substation Grounding". The ground grid design is performed for each specific substation project.

The formulas used in the ground grid design process require field data that relates to the specific site where the substation is to be constructed. Field measurements of the ground resistance for each site is gathered along with soil core boring information. During the process of ordering core borings, the substation engineer will request soil resistivity measurements to be taken at specific site locations where borings are to be placed. The soil resistivity measurements are taken at 2' and 50' depths in several locations to coincide with the standard grid and rod depths, respectively. These values are then averaged and placed into the formulas for the grid calculations. Utilizing site resistivity information provides for a more accurate ground grid design for each substation construction project.

The substation grounding system used by JEA consists of a main mat made up of perpendicular runs of 19#8 copperweld conductor evenly spaced and distributed throughout the substation yard area. This main grid mat is placed at a depth of 2' below the surface, which is why the resistance measurement is taken at a 2' depth. The main grid mat is supplemented by standard 5/8" x 8' copper ground rods coupled together and driven to a depth of 50' and placed around the perimeter of the ground grid system.

In order to design a substation ground grid design most programs require the input of eight (8) variables that are specific to the individual substation project. The variables used are defined as follows:

Area of Grid: The area of the ground grid. Typically the area within the substation fence.
Soil Resistivity at 2' depth: The average 2' soil resistivity measurement taken in the field.
Soil Resistivity at 50' depth: The average 50' soil resistivity measurement taken in the field.
Available Fault Current: The phase-to-ground fault current as provided by System Planning for that specific substation.
Distribution Neutrals: The # of distribution neutrals that are tied to the substation grounding.
Transmission OHG's: The # of transmission neutrals that are tied to the substation grounding.

Size of Grid Mesh: The ground grid consists of copper conductor placed in the ground running in two directions perpendicular to each other throughout the substation area. The placement of the conductor in this arrangement creates approximately equal squares throughout the grid area. The "size of grid mesh" is the approximate size of these squares. A number is "plugged" into the program for this variable for the first run and typically changed to obtain the proper ground grid design as necessary.

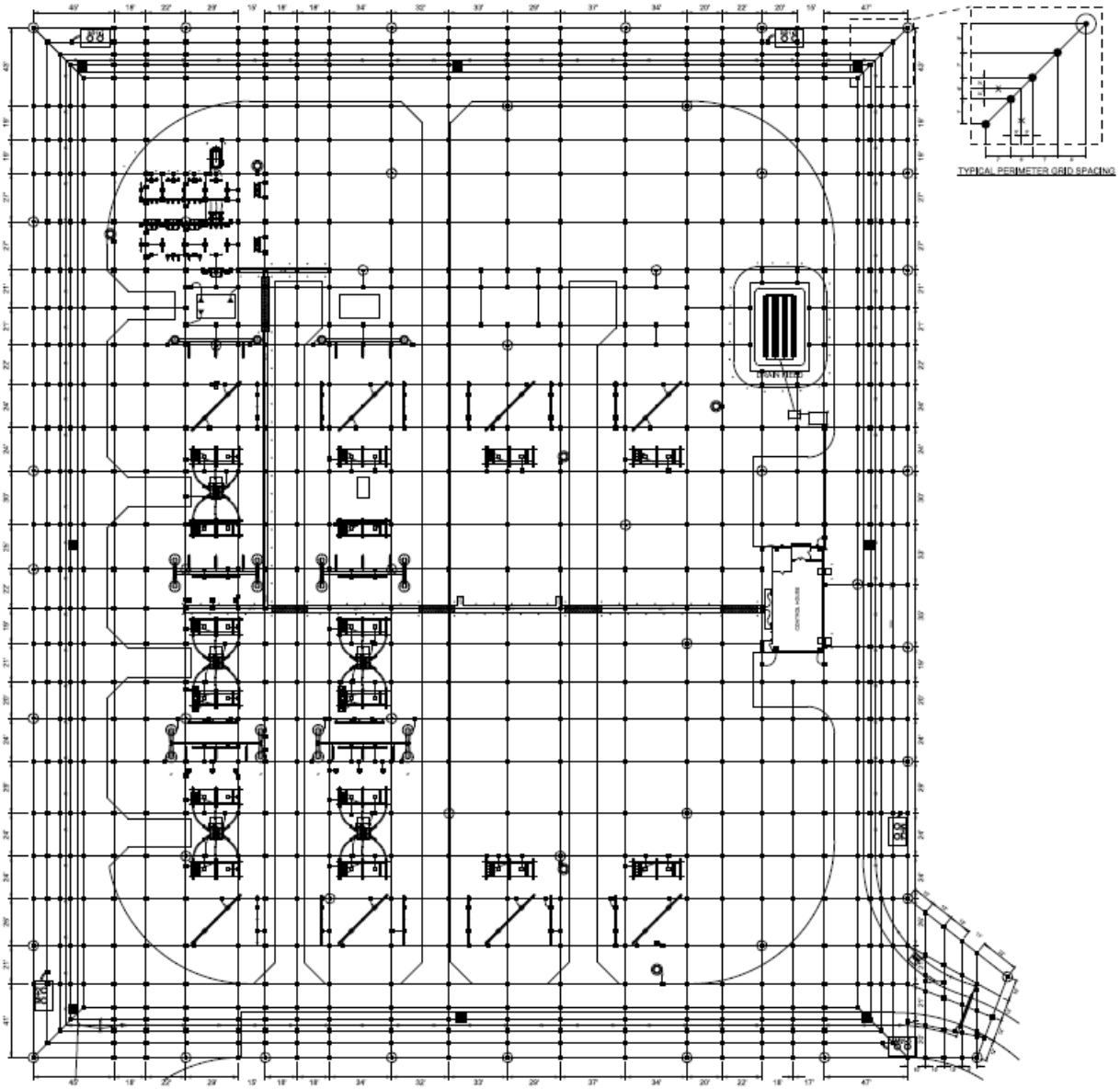
Ground Rods: Ground rods are used in the ground grid design to maximize the efficiency of the ground grid. The number of rods used for a particular substation will depend on the soil resistivity for that location. Without the use of ground rods, the grid mesh would typically be very small thereby requiring large amounts of copper grid conductor and connectors. Therefore, ground rods are placed around the perimeter of the grid design and the number of rods to be used is "plugged" into the program. The number of rods can be changed as necessary to obtain an acceptable grid mesh dimension for the ground grid design.

The first six (6) variables are determined for the specific substation application and do not change during the ground grid design process. The "size of mesh" and "ground rods" variables are changed in an iterative process to obtain the necessary grid design. Engineering estimates are used for the "size of mesh" and "ground rods" variables for the first run of the program. These estimates are taken from past experience in the grid design process. The program is designed to provide a ground grid design that will experience a mesh potential below the IEEE acceptable "Maximum Tolerable Mesh Potential" during fault conditions. The "size of mesh" and "ground rods" variables are changed as necessary to achieve a mesh potential below this value. Once an acceptable mesh potential is achieved, the ground grid design is placed on the substation site layout plan and modified as necessary to avoid foundations and other obstructions. The required ground rods are placed around the perimeter of the grid with concentration at the corners of the grid due to the flow of the fault current being higher in these areas.

During construction, the contractor is required to measure the resistance of each ground rod installation and report these readings to the Project Engineer. The Project Engineer then takes these readings and calculates the total resistance of all rods connected in parallel. This value is checked against the "resistance of rods" value in the ground grid design program. If the resistance value in the program is less than the actual field value, the Project Engineer should request that additional rods be installed. If the field value is equal to or less than the program value, the Project Engineer will approve the ground rod installation and allow connection of the rods to the grid.

7.2 MAIN GROUND GRID

This is an example of a complete JEA Substation Ground Grid. Refer to JEA project specific drawings and specifications for further details.



LEGEND:

———	GROUND CONDUCTOR - 19#8 COPPERWELD FOR MAIN GROUND GRID, 7#5 COPPERWELD FOR STRUCTURE, GROUND ROD, EQUIPMENT, CABLE TRENCH, CABLE TRAY, AND TRANSFORMER TANK GROUNDING. 500KCMIL COPPER CONDUCTOR FOR THE POWER TRANSFORMER NEUTRAL BUSHING (CONTRACTOR FURNISHED AND INSTALLED).
⊕	GROUND CONNECTION - CADWELD PLUS EXOTHERMIC MOLD CONNECTION, SIZED, AND CONFIGURED AS REQUIRED (CONTRACTOR FURNISHED AND INSTALLED)
▦	SWITCH OPERATOR GROUND PLATFORM (FURNISHED BY OWNER, INSTALLED BY CONTRACTOR).
⊙	GROUND ROD - COPPERWELD RODS 5/8" DIAMETER, 8' IN LENGTH, COUPLED AND DRIVEN TO A DEPTH OF FORTY-EIGHT (48') FEET (CONTRACTOR FURNISHED AND INSTALLED).
—×—×—	CHAIN LINK SECURITY FENCE. CONTRACTOR FURNISHED AND INSTALLED.
·	4" CAST IRON PIPE, CEMENT-FILLED BOLLARD. THE CONTRACTOR SHALL CONNECT TO STATION GRID (NOT SHOWN) PER THE GROUNDING DETAIL DRAWINGS OF THIS SET (CONTRACTOR FURNISHED AND INSTALLED).
◀	BOLTED GROUNDING CONNECTOR TO TRANSFORMER TANK AND NEUTRAL GROUNDS.

MAIN GROUND GRID DESIGN NOTES:

JEA ITEM ID # COBCW015 - 19#8 COPPERWELD FOR MAIN GROUND GRID

JEA ITEM ID # COBCW016 - 7#5 COPPERWELD FOR CONNECTIONS OF STRUCTURES, EQUIPMENT, ETC. TO THE GROUND GRID

500KCMIL COPPER CONDUCTOR FOR THE POWER TRANSFORMER NEUTRAL BUSHING.

GRID DESIGNED FOR 4" SUBSTATION ROCK ONLY IN SUBSTATION STRUCTURE AREA.

GROUND GRID DEPTH: TWENTY FOUR (24") INCHES BELOW COMPACTED EARTH

GROUND ROD DEPTH: 48 FEET

SPLIT FACTOR: .32146 (4 LINES, 12 FEEDERS, 100% REMOTE)

UPPER LAYER THICKNESS: 8.5 FEET

UPPER LAYER RESISTIVITY: 1250 OHM-M

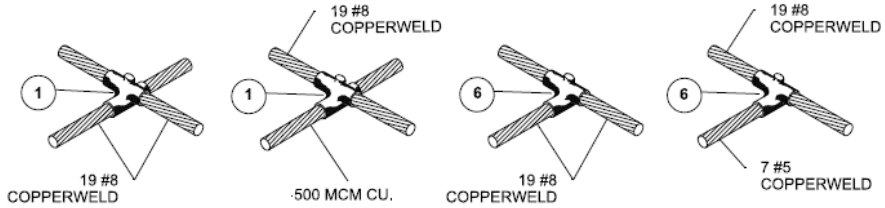
LOWER LAYER RESISTIVITY: 80 OHM-M

SURFACE LAYER THICKNESS: 4 INCHES

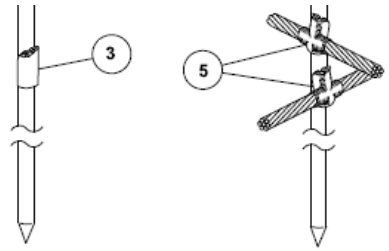
SURFACE LAYER RESISTIVITY: 2500 OHM-M

PARALLEL Z: 10 OHMS

7.3 GROUND GRID CONNECTIONS



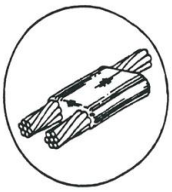
DETAIL
TYPICAL GROUND CONNECTIONS



DETAIL
TYPICAL GROUND ROD CONNECTIONS

EQUIPMENT	SIZE	WIRE DESCRIPTION
• **Main Ground Grid** • **Cable Trench**	19#8 AWG	Copperweld, Soft Drawn w/ 40% Conductivity
• **Power/Auto Transformer (Neutral Only)**	500 kcmil	37 Stranding, Concentric, Soft or Medium-Hard Drawn
• **Power/Auto Transformer (Tank Only)** • **Steel Structures** • **Instrument Transformers** • **Station Service Tranformers** • **Switch Operating Platforms** • **Lightning Masts** • **Surge Arresters** • **Capacitor Bank Stands**	7#5 AWG	Copperweld, Soft Drawn w/ 40% Conductivity
• **Metal Enclosures** • **Junction Box Chassis** • **Yard Panel Chassis**	#4 AWG	Copperweld or bare stranded copper
• **Static Wire**	3#6 AWG	Alumoweld
• **Fence**	#4 AWG	Copperweld
Note: Control House Equipment grounding will be addressed in the Control House Section.		

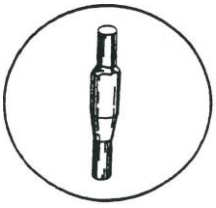
ITEM 1



ITEM 2

GROUND GRID CONNECTIONS

ITEM	DESCRIPTION
1	WELDED ELECTRICAL GROUND CONNECTION, CABLE TO CABLE, 19#8 CABLE THROUGH CROSS, CADWELD PLUS MOLD AND (2) #200 OR 500KCM CABLE TO 19#8 CABLE THROUGH CROSS CADWELD PLUS MOLD AND (3) #200. WELD METAL AS REQUIRED.
2	WELDED ELECTRICAL GROUND CONNECTION, PARALLEL, ABLE RUN AND TAP, CADWELD MOLD. WELD METAL AS REQUIRED. (TWO CONNECTIONS PER INTERSECTION REQUIRED)



ITEM 3

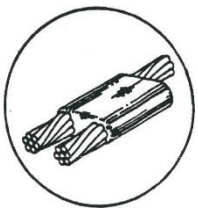
ITEM 4

ITEM 5

GROUND ROD CONNECTIONS

ITEM	DESCRIPTION
3	WELDED ELECTRICAL- GROUND CONNECTION, GROUND ROD TO GROUND ROD. CADWELD PLUS MOLD AND #2-150. WELD METAL AS REQUIRED.
4	WELDED ELECTRICAL GROUND CONNECTION, GROUND ROD TO CABLE TAP, CADWELD PLUS MOLD. WELD METAL AS REQUIRED
5	WELDED ELECTRICAL GROUND CONNECTION. GROUND ROD TO CABLE CROSS,CADWELD PLUS MOLD AND #250. WELD MATERIAL AS REQUIRED

ITEM 6



ITEM 7

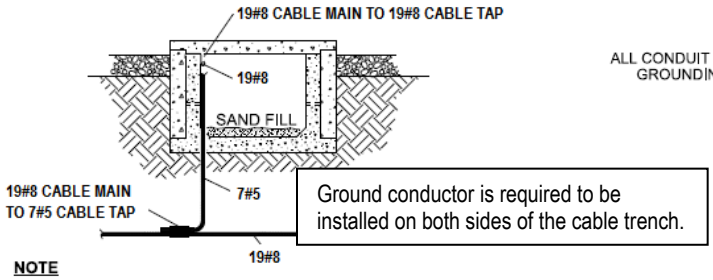
TAP CONNECTIONS TO GROUND GRID

ITEM	DESCRIPTION
6	WELDED ELECTRICAL GROUND CONNECTION, EITHER 19#8 CABLE MAIN TO 19#8 CABLE TAP, CADWELD PLUS MOLD AND (1) #200 OR 19#8 CABLE MAIN TO 7#5 CABLE TAP, CADWELD PLUS MOLD AND (1) #200. WELD METAL AS REQUIRED.
7	WELDED ELECTRICAL GROUND CONNECTION, PARALLEL, CABLE RUN AND TAP, CADWELD MOLD. WELD METAL AS REQUIRED.

GROUND GRID CONNECTION NOTES:

1. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL 19#8 AND 7#5 COPPERWELD CONDUCTORS USED TO CONSTRUCT THE STATION MAIN GROUND GRID AS SPECIFIED ON THE SUBSTATION PROJECT "GROUNDING PLAN" AND "GROUNDING DETAILS" DRAWINGS.
2. ALL GROUND GRID CONDUCTORS AND TAPS SHALL BE CONNECTED USING CADWELD EXOTHERMIC CONNECTIONS AND SHALL BE INSTALLED 24" BELOW GRADE (28" BELOW ROCK SURFACE) EXCEPT WHERE CONNECTION TO STRUCTURES AND EQUIPMENT IS ABOVE GRADE.
3. THE GRID CONDUCTORS SHALL BE INSTALLED IN MAXIMUM LENGTH CONTINUOUS RUNS AND CONNECTED AT ALL INTERSECTIONS USING CADWELD PLUS CROSS CONNECTION OR OTHER CADWELD PLUS PARALLEL CONNECTIONS TO AVOID CUTTING THE GRID CONDUCTOR. THE CONTRACTOR SHALL VERIFY THE FINAL LOCATION OF THE 7#5 COPPERWELD CONDUCTOR GROUND TAP CONNECTIONS TO THE STRUCTURES AND EQUIPMENT USING THE MANUFACTURER'S SHOP DRAWINGS.
4. ALL EQUIPMENT AND STRUCTURES ERECTED IN THE SUBSTATION SHALL BE GROUNDED TO THE MAIN GRID WITHIN THE SAME WORKING DAY.
5. THE CONTRACTOR SHALL FURNISH AND INSTALL GROUND RODS AS SPECIFIED AND IN THE LOCATION SHOWN ON THE SUBSTATION PROJECT "GROUNDING PLAN" DRAWING. GROUND RODS ARE TO BE INSTALLED TO A DEPTH OF FORTY-EIGHT (48') FEET. GROUND RODS ARE TO BE COUPLED USING CADWELD SPLICE CONNECTIONS.
6. GROUND RODS SHALL BE INSTALLED PRIOR TO ITS CONNECTION TO THE GRID. THE CONNECTION OF THE ROD TO THE STATION GROUND GRID SHALL BE MADE ONLY AFTER OWNER APPROVAL USING CADWELD PLUS CABLE-TO-ROD CONNECTIONS.
7. THE CONTRACTOR IS REQUIRED TO MEASURE AND REPORT THE RESISTANCE OF EACH GROUND ROD INSTALLED PRIOR TO ITS CONNECTION TO THE GRID. CONNECTION OF THE ROD TO THE STATION GROUND GRID SHALL BE MADE ONLY AFTER OWNER APPROVAL.
8. THE CONTRACTOR SHALL STRICTLY FOLLOW THE MANUFACTURER'S INSTALLATION PROCEDURES. ALL WELDED CONNECTIONS MADE BY THE EXOTHERMIC PROCESS SHALL BE VISUALLY INSPECTED BY THE PROJECT- FIELD INSPECTOR AND MAY BE SUBJECTED TO TESTING. TESTING SHALL BE IN THE FORM OF MODERATE HAMMER BLOWS FROM WHICH A PROPERLY FORMED CONNECTION WILL EASILY RESIST ANY VISUAL DAMAGE.
9. ANY CONNECTION WHICH FAILS VISUAL INSPECTION OR TESTING SHALL BE REMADE AT THE CONTRACTOR'S EXPENSE. SHOULD ADDITIONAL OR DIFFERENT MOLDS OR MATERIALS BE REQUIRED TO FACILITATE THE CORRECTED CONNECTION OF A FAILED WELD, SUCH MATERIAL SHALL BE FURNISHED AND INSTALLED AT THE CONTRACTOR'S EXPENSE.
10. THE USE OF MOLDS AND MATERIALS OTHER THAN THOSE SPECIFIED MUST BE APPROVED FOR USE BY THE PROJECT ENGINEER.

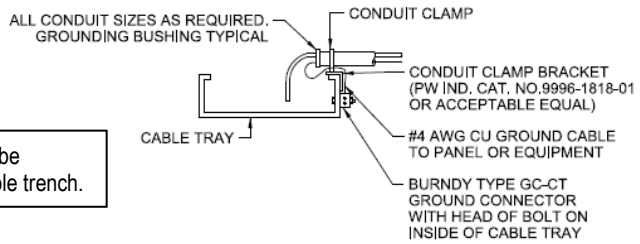
7.4 CABLE TRENCH AND CONTROL HOUSE GROUNDING



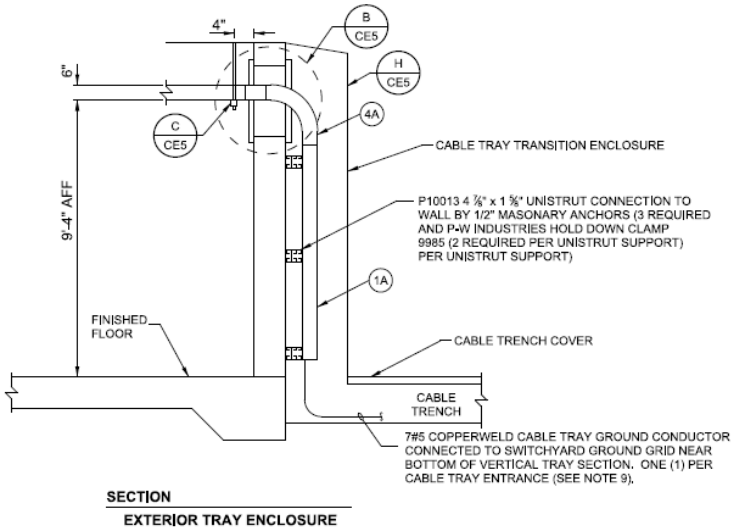
NOTE

19#8 COPPERWELD GROUND CONDUCTOR SHALL BE INSTALLED AT TOP OF THE CABLE TRENCH AND SUPPORTED BY CABLE CLIPS APPROXIMATELY EVERY FIVE FEET (TRENWA TYPE GC-1 OR EQUAL). CONTRACTOR TO INSTALL A CONTINUOUS RUN FROM THE TRENCH, LOOP THROUGH CONTROL BUILDING CABLE TRAY, THEN ROUTE OUTSIDE TO CONNECT TO A SECOND POINT OF THE STATION GRID. THE GROUND CONDUCTOR SHALL RUN THE ENTIRE LENGTH OF THE CABLE TRENCH AND CONNECT TO THE STATION GROUND GRID AT ALL POINTS OF INTERSECTION.

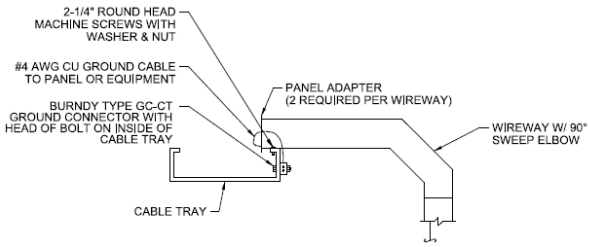
DETAIL
TYPICAL GROUND CONNECTIONS
(NOT TO SCALE)



DETAIL
CONDUIT/GROUNDING TO CABLE TRAY
(NOT TO SCALE)



SECTION
EXTERIOR TRAY ENCLOSURE

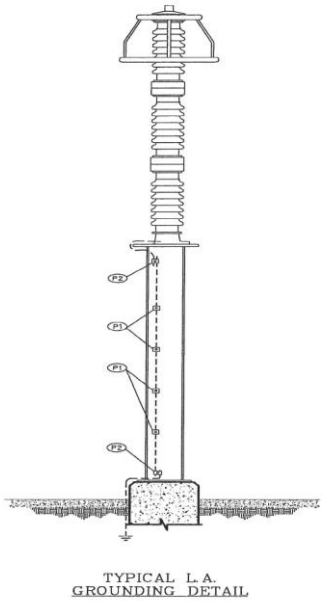


DETAIL
WIREWAY/GROUNDING TO CABLE TRAY
(NOT TO SCALE)

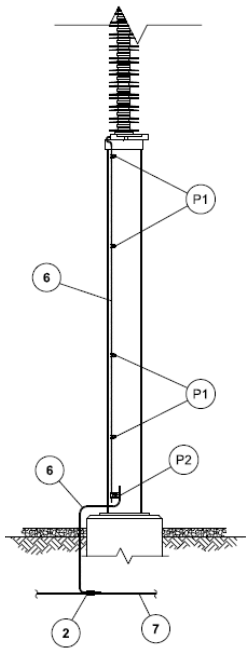
CABLE TRENCH AND CONTROL HOUSE GROUNDING NOTES:

1. THE CONTRACTOR SHALL BRING TWO (2) 7#5 COPPERWELD GROUND CONDUCTORS INTO THE CONTROL HOUSE AND SHALL BE CONNECTED WITHIN THREE (3') FEET OF EACH OTHER TO THE SWITCHYARD GROUND GRID BY EXOTHERMIC WELDS. THE 7#5 COPPERWELD GROUND CONDUCTOR SHALL BE ATTACHED TO THE OUTSIDE OF EACH CABLE TRAY SECTION AND AT INTERVALS NOT EXCEEDING FOUR (4') FEET USING BURNDY GB AND GC CONNECTORS (WITH THE HEAD OF THE BOLT ON THE INTERIOR OF THE CABLE TRAY).
2. THE CONTRACTOR SHALL BOND ALL AC EQUIPMENT (PANELBOARDS, BATTERY CHARGERS, DISCONNECTS, LIGHTS, RECEPTACLES, ETC.) BY INSTALLING EQUIPMENT GROUND CONDUCTORS (EGC) AS PER NEC REQUIREMENTS. FOR THOSE DEVICES THAT DO NOT HAVE NEC EGCs, THE CONTRACTOR SHALL FURNISH AND INSTALL AN INSULATED (600V) #4 AWG CU EGC FROM THE 7#5 CABLE TRAY GROUND TO EACH DEVICE (BATTERY RACKS, DC PANELBOARDS, BATTERY CART BOX, ETC.) USING BURNDY GC-CT CONNECTORS. RELAY PANEL GROUNDING SHALL BE IN ACCORDANCE WITH THE SUBSTATION PROJECT SPECIFICATIONS.
3. THE 7#5 COPPERWELD GROUND CONDUCTOR, WHICH IS TIED INTO THE 36" CABLE TRAY GROUNDING SYSTEM, SHALL BE ATTACHED TO THE OUTSIDE OF EACH COMM CABLE TRAY SECTION AND AT INTERVALS NOT EXCEEDING FOUR (4') FEET USING BURNDY GB AND GC CONNECTORS (WITH THE HEAD OF THE BOLT ON THE INTERIOR OF THE FIBER OPTIC CABLE TRAY).

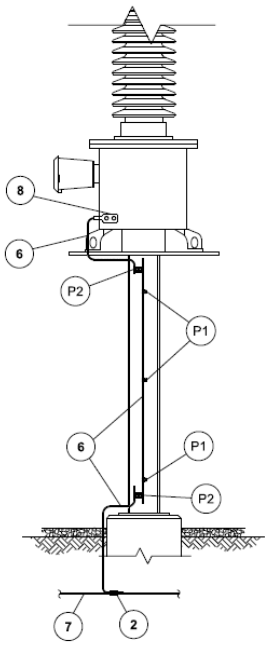
7.5 EQUIPMENT AND STRUCTURE GROUNDING



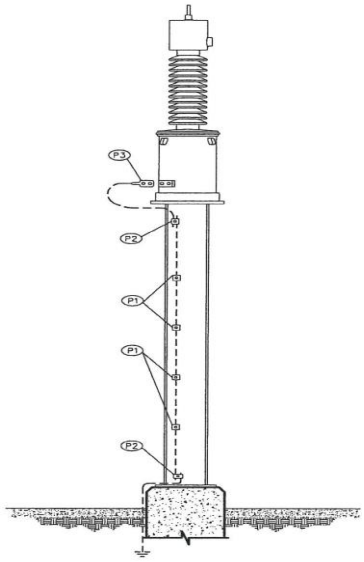
TYPICAL L.A.
GROUNDING DETAIL



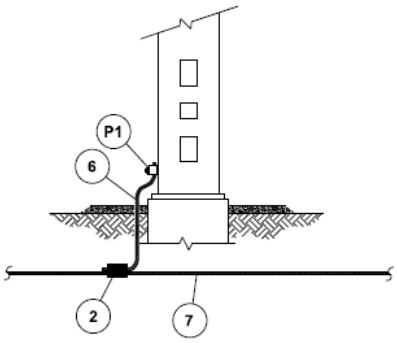
DETAIL 2
LIGHTNING ARRESTER



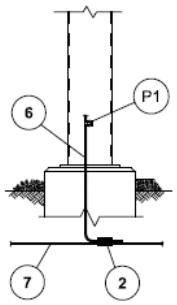
DETAIL 3
POTENTIAL TRANSFORMER



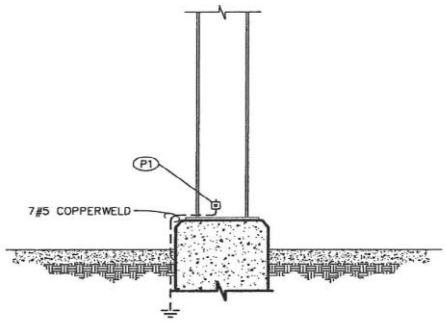
TYPICAL P.T.
GROUNDING DETAIL



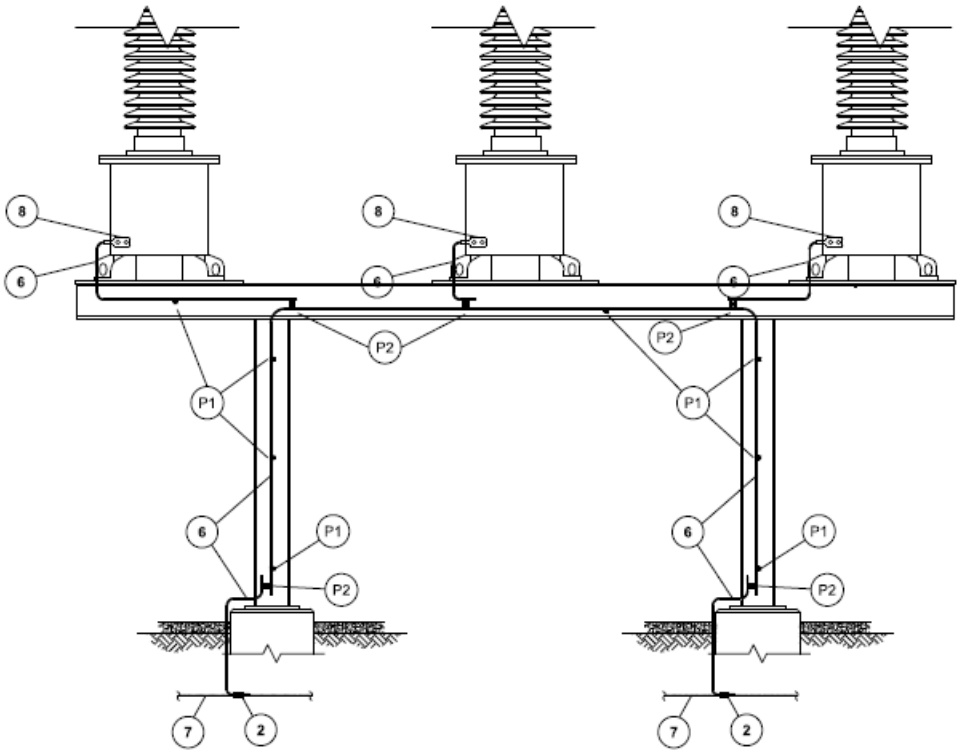
DETAIL 4
PROBE LIGHT/80' YARD POLE GROUNDING



DETAIL 5
TYPICAL STRUCTURE GROUNDING



TYPICAL STRUCTURE
GROUNDING DETAIL



DETAIL 6

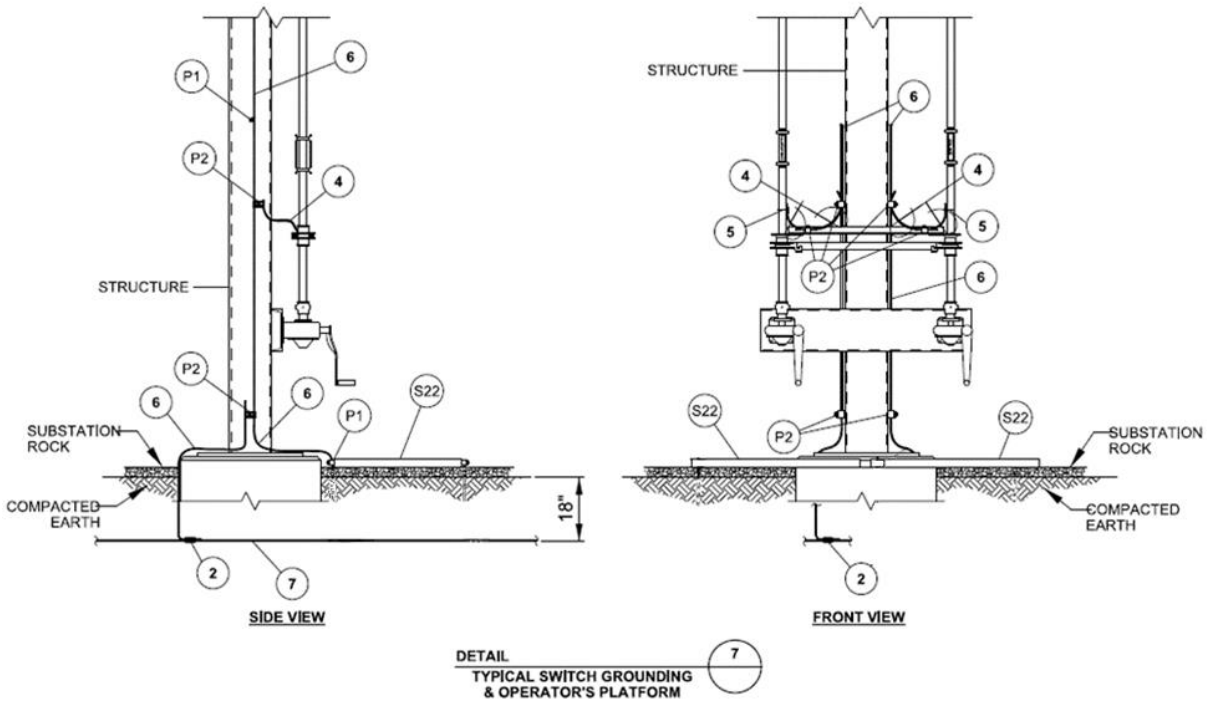
TYPICAL 3ø EQUIPMENT AND STRUCTURE GROUNDING

ITEM	DESCRIPTION
1	WELDED GROUND CONNECTION, CABLE TO CABLE, 19#8 CABLE THROUGH CROSS, CADWELD PLUS MOLD TYPE XBZ9G9G AND (2) #200 WELD METAL AS REQUIRED.
2	WELDED GROUND CONNECTION, 19#8 CABLE MAIN TO 7#5 CABLE TAP, CADWELD PLUS MOLD TYPE TAC3D2V AND (1) #200 WELD METAL AS REQUIRED.
3	WELDED GROUND CONNECTION, 500KCM CABLE TO 19#8 CABLE THROUGH CROSS, CADWELD PLUS MOLD TYPE XBV3Q3D AND (3) #200 WELD METAL AS REQUIRED.
4	FLEXIBLE COPPER BRAID, FURNISHED BY THE SWITCH MFG.
5	GROUND CONNECTOR, BRONZE BOLTED, OPERATOR PIPE TO FLAT, FURNISHED BY THE SWITCH MFG.
6	7 #5 COPPERWELD CONDUCTOR, FURNISHED BY THE CONTRACTOR.
7	19 #8 COPPERWELD CONDUCTOR, STATION GRID 18" BELOW GRADE FURNISHED BY CONTRACTOR.
8	GROUND CONNECTOR, BRONZE BOLTED, 7#5 COPPERWELD CONDUCTOR TO NEMA 2-HOLE PAD, FURNISHED BY THE OWNER.
P1	GROUND CONNECTOR, BRONZE BOLTED, 7#5 COPPERWELD TO FLAT, ANDERSON CATALOG NO. GC-141A-G2 OR EQUAL, FURNISHED BY THE OWNER.
P2	GROUND CONNECTOR, BRONZE BOLTED, TWO (2) 7#5 COPPERWELD TO FLAT, ANDERSON CATALOG NO. GC-143A-GS OR EQUAL, FURNISHED BY THE OWNER.
S22	SWITCH OPERATOR'S PLATFORM, 4' X 6' GALVANIZED STEEL GRATING, FURNISHED BY THE OWNER.

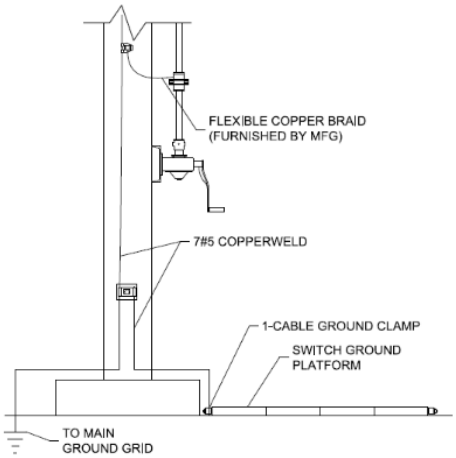
*Mold types listed above are for example only. Contractor shall use appropriate approved mold type as listed on specific project drawings or as approved by the Project Representative.

7.6 SWITCH GROUNDING

Switch Grounding shall adhere to IEEE Standard 80 and shall be one continuous ground.



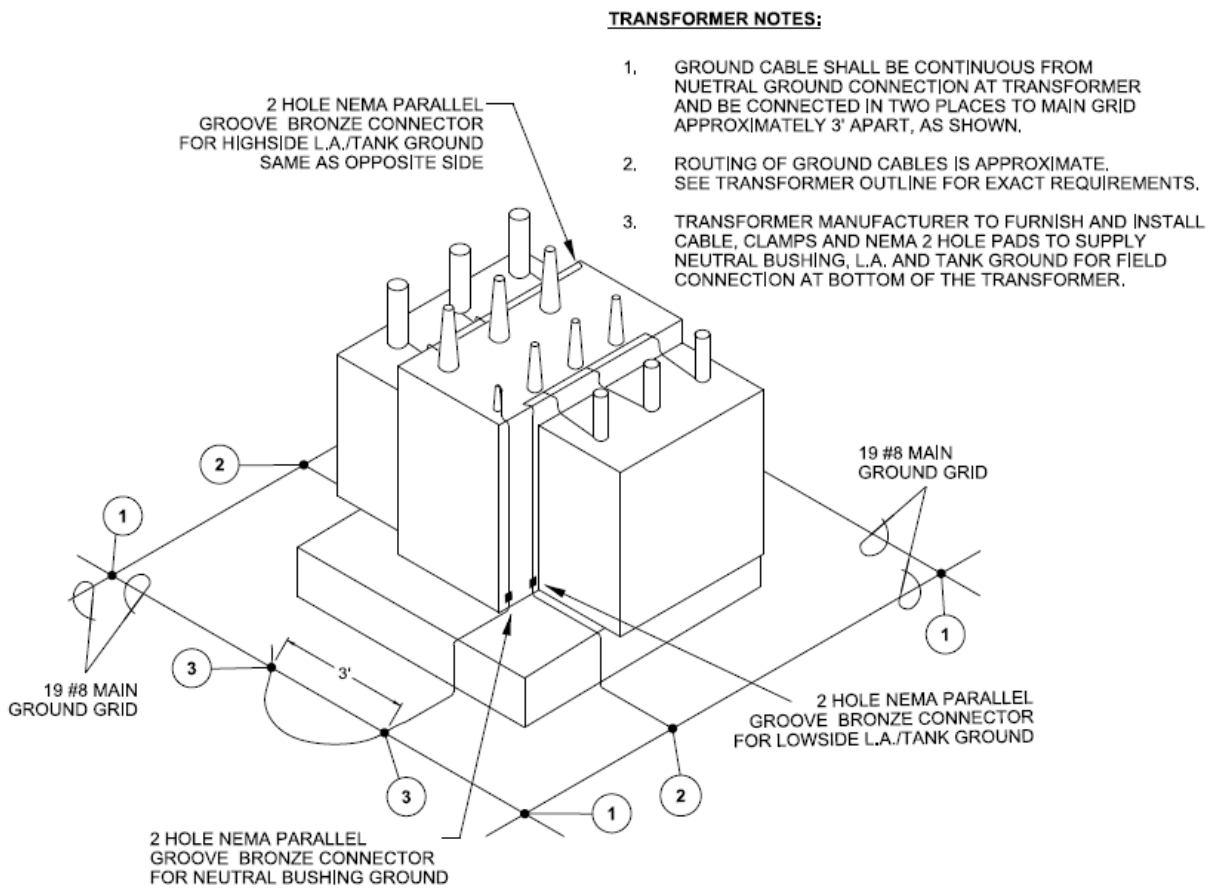
ITEM	DESCRIPTION
1	WELDED GROUND CONNECTION, CABLE TO CABLE, 19#8 CABLE THROUGH CROSS, CADWELD PLUS MOLD TYPE XBZ9G9G AND (2) #200 WELD METAL AS REQUIRED.
2	WELDED GROUND CONNECTION, 19#8 CABLE MAIN TO 7#5 CABLE TAP, CADWELD PLUS MOLD TYPE TAC3D2V AND (1) #200 WELD METAL AS REQUIRED.
3	WELDED GROUND CONNECTION, 500KCM CABLE TO 19#8 CABLE THROUGH CROSS, CADWELD PLUS MOLD TYPE XBV3Q3D AND (3) #200 WELD METAL AS REQUIRED.
4	FLEXIBLE COPPER BRAID, FURNISHED BY THE SWITCH MFG.
5	GROUND CONNECTOR, BRONZE BOLTED, OPERATOR PIPE TO FLAT, FURNISHED BY THE SWITCH MFG.
6	7 #5 COPPERWELD CONDUCTOR, FURNISHED BY THE CONTRACTOR.
7	19 #8 COPPERWELD CONDUCTOR, STATION GRID 18" BELOW GRADE FURNISHED BY CONTRACTOR.
8	GROUND CONNECTOR, BRONZE BOLTED, 7#5 COPPERWELD CONDUCTOR TO NEMA 2-HOLE PAD, FURNISHED BY THE OWNER.
P1	GROUND CONNECTOR, BRONZE BOLTED, 7#5 COPPERWELD TO FLAT, ANDERSON CATALOG NO. GC-141A-G2 OR EQUAL, FURNISHED BY THE OWNER.
P2	GROUND CONNECTOR, BRONZE BOLTED, TWO (2) 7#5 COPPERWELD TO FLAT, ANDERSON CATALOG NO. GC-143A-GS OR EQUAL, FURNISHED BY THE OWNER.
S22	SWITCH OPERATOR'S PLATFORM, 4' X 6' GALVANIZED STEEL GRATING, FURNISHED BY THE OWNER.



SWITCH NOTES:

1. THE CONTRACTOR SHALL GROUND THE SWITCH OPERATOR PIPE DIRECTLY TO THE SWITCH OPERATOR'S PLATFORM AS SHOWN ON THIS DETAIL.
2. THE CONTRACTOR SHALL CONNECT EACH COLUMN OF THE SWITCH STRUCTURE TO THE STATION GROUND GRID. THE COLUMNS SHALL NOT BE CONNECTED TO THE GRID CONDUCTOR, WHERE POSSIBLE.
3. FOR SWITCHES WITH GROUND BLADE, CONTRACTOR SHALL INSTALL GROUND WIRE UP COLUMN AND CONNECT TO GROUND PAD OF THE GROUND SWITCH AS REQUIRED.

7.7 TRANSFORMER GROUNDING



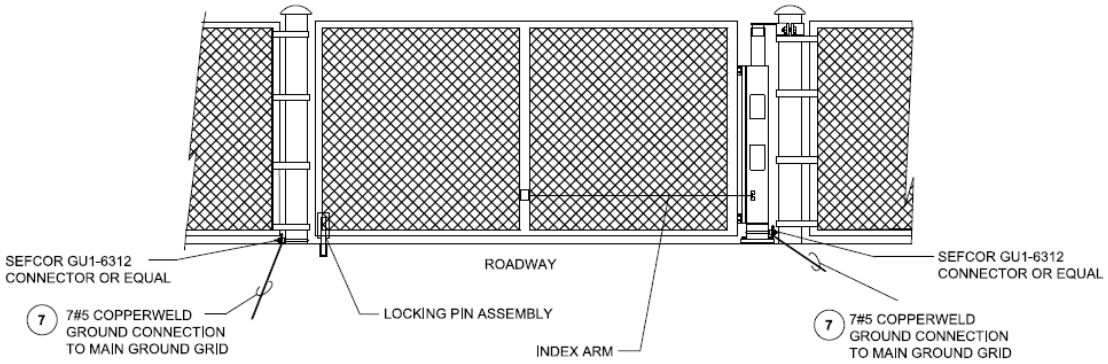
DETAIL 1
POWER TRANSFORMER

ITEM	DESCRIPTION
1	WELDED GROUND CONNECTION, CABLE TO CABLE, 19#8 CABLE THROUGH CROSS, CADWELD PLUS MOLD TYPE XBZ9G9G AND (2) #200 WELD METAL AS REQUIRED.
2	WELDED GROUND CONNECTION, 19#8 CABLE MAIN TO 7#5 CABLE TAP, CADWELD PLUS MOLD TYPE TAC3D2V AND (1) #200 WELD METAL AS REQUIRED.
3	WELDED GROUND CONNECTION, 500KCM CABLE TO 19#8 CABLE THROUGH CROSS, CADWELD PLUS MOLD TYPE XBV3Q3D AND (3) #200 WELD METAL AS REQUIRED.

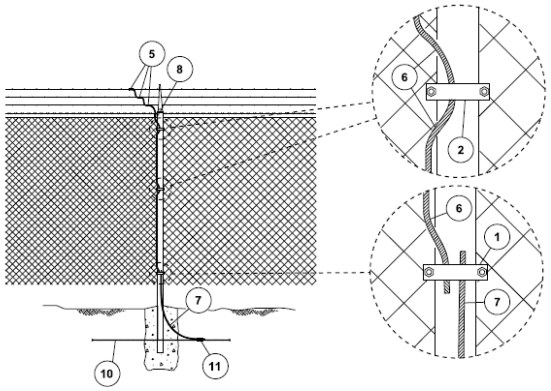
NOTE: THE CONTRACTOR SHALL CONNECT THE NEUTRAL BUSHING OF THE POWER TRANSFORMER DIRECTLY TO THE STATION GROUND GRID USING 500KCMIL COPPER CONDUCTOR. THE NEUTRAL GROUND CONDUCTOR SHALL EXTEND CONTINUOUSLY AND CONNECT TO THE STATION GRID IN TWO (2) PLACES USING THE CONNECTION PROCESS PREVIOUSLY MENTIONED.

*Mold types listed above are for reference purposes only. Contractor shall use appropriate approved mold type as listed on specific Project Design drawings or as approved by the Project Representative.

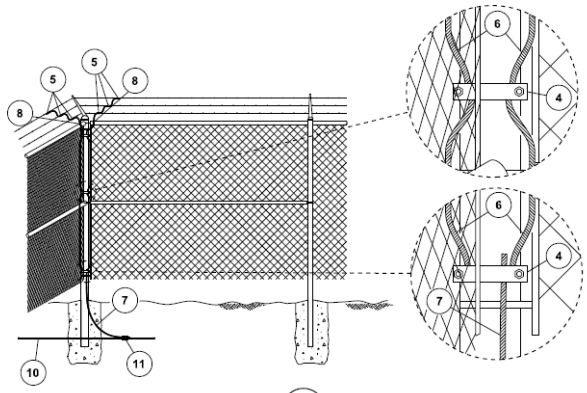
7.8 FENCE AND GATE GROUNDING



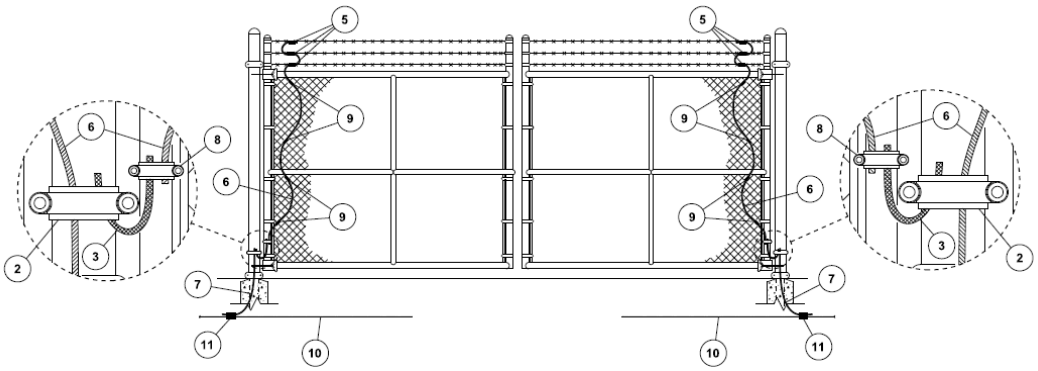
DETAIL 1
SWING RISER GATE
MAIN ENTRANCE
(NOT TO SCALE)



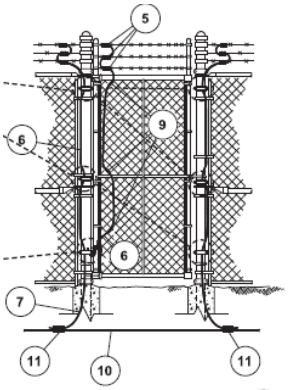
DETAIL 2
FENCE GROUNDING
INTERMEDIATE POST
(NOT TO SCALE)



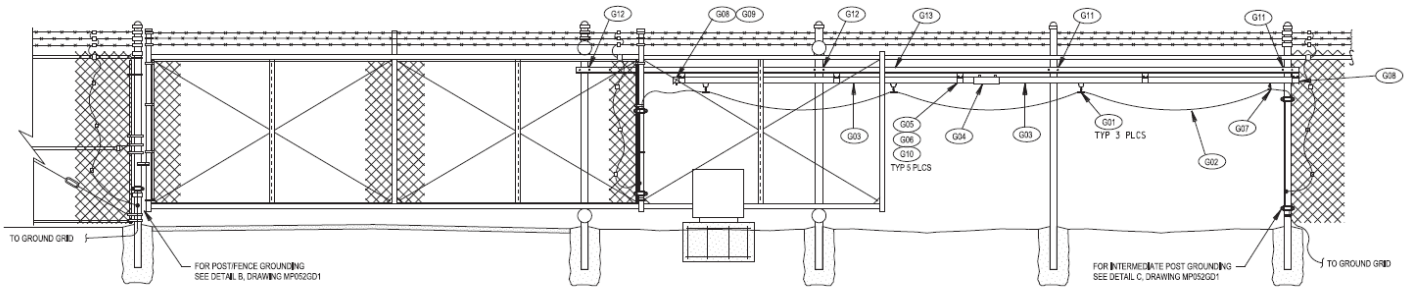
DETAIL 3
FENCE GROUNDING
CORNER POST
(NOT TO SCALE)



DETAIL 5
20' CHAIN LINK
DOUBLE SWING GATE
GROUNDING
(NOT TO SCALE)



DETAIL 4
CHAIN LINK
PERSONNEL ACCESS GATE
GROUNDING
(NOT TO SCALE)



DETAIL 6

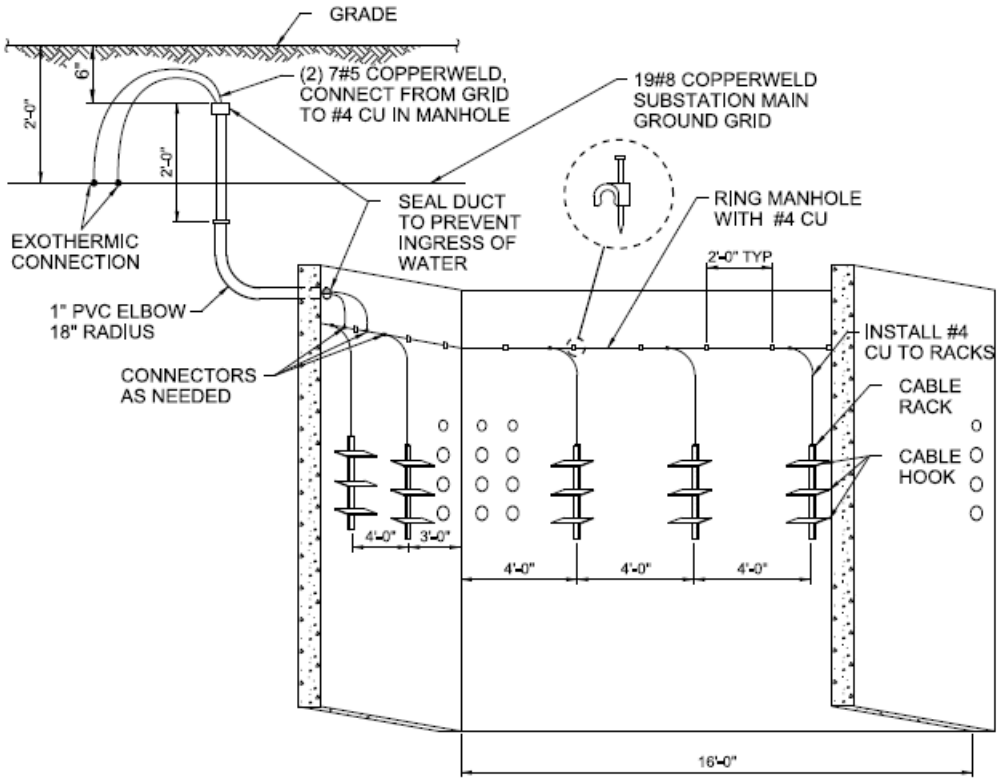
20' CHAIN LINK MOTORIZED SLIDING GATE GROUNDING
(NOT TO SCALE)

ITEM	DESCRIPTION
1	GROUND CONNECTOR, BRONZE BOLTED, TWO (2) CABLES TO 2 1/2" O.D. PIPE. CONDUCTOR RANGE SHALL BE FOR 2/0 SOLID – 250 KCM CU. SEFCOR GU1-5812 OR BURNDY CATALOG NO. GD1929.
2	GROUND CONNECTOR, BRONZE BOLTED, TWO (2) CABLES TO 2 1/2" O.D. PIPE. CONDUCTOR RANGE SHALL BE FOR #4 SOLID - 2/0 STRANDED SEFCOR GU1-5809 OR BURNDY CATALOG NO, GD1926,
3	FLEXIBLE COPPER BRAID, FURNISHED BY CONTRACTOR
4	GROUND CONNECTOR, BRONZE BOLTED, TWO (2) CABLES TO 3" O.D. PIPE. CONDUCTOR RANGE SHALL BE FOR #4 SOLID - 2/0 STRANDED SEFCOR GU1-6009 OR BURNDY CATALOG NO. GD2026.
5	GROUND CONNECTOR, BRONZE, SERVIT POST TYPE FOR TWO (2) #10-#2 SOLID AWG CONDUCTORS. SEFCOR BN-N-3SP OR BURNDY CATALOG NO. K2C22.
6	#2 SOLID COPPER CONDUCTOR, FURNISHED BY THE CONTRACTOR
7	7#5 COPPERWELD CONDUCTOR, FURNISHED BY THE CONTRACTOR.
8	GROUND CONNECTOR, BRONZE BOLTED, FOR ONE CONDUCTOR TO 1 1/4" O.D, PIPE, TOP RAIL, CONDUCTOR RANGE SHALL BE #4 SOL, TO 2/0 STR, SEFCOR 1-OC-2448
9	SPLIT BOLT CONNECTOR, BURNDY TYPE BN-N-3SP (TINNED)
10	19#8 COPPERWELD CONDUCTOR, STATION GRID 18" BELOW GRADE FURNISHED BY CONTRACTOR.
11	WELDED GROUND CONNECTION, 19#8 CABLE MAIN TO 7#5 CABLE TAP, CADWELD PLUS MOLD TYPE TAC3D2V AND (1) #200 WELD METAL AS REQUIRED.

NOTES

1. GROUND INSTALLATION SHALL BE PROVIDED AT INTERMEDIATE POSTS, SPACED NO MORE THAN FORTY (40') FEET APART. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL ABOVE GRADE GROUND CONNECTORS AND GROUND CONDUCTOR.
2. GROUND INSTALLATION SHALL BE PROVIDED AT ALL CORNER POSTS. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL ABOVE GRADE GROUND CONNECTORS AND GROUND CONDUCTOR.
3. THE CONTRACTOR SHALL PROVIDE AT LEAST THREE (3) BOND POINTS TO THE FENCE POST.
4. THE CONTRACTOR SHALL FURNISH AND INSTALL A CONTINUOUS #2 SOLID COPPER CONDUCTOR THROUGH THE BOND POINTS. THE CONDUCTOR SHALL BE WOVEN INTO THE FENCE FABRIC AND POSITIVELY BONDED TO EACH STRAND OF BARBED WIRE.
5. THE CONTRACTOR SHALL REMOVE ANY THREAD PROJECTION IN EXCESS OF 1/4" BEYOND THE NUT,
6. THE CONTRACTOR TO FURNISH AND INSTALL THE ABOVE GROUNDING MATERIALS FOR THE SUBSTATION ENTRANCE GATE,

7.9 MANHOLE GROUNDING



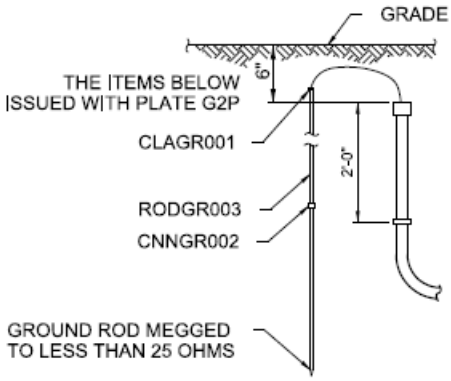
DETAIL

TYPICAL MANHOLE GROUNDING (NOT TO SCALE)

NOTE

CONTRACTOR TO FURNISH AND INSTALL 1" PVC, CONDUCTOR, EXOTHERMIC WELDS, CONNECTORS, AND MOUNTING CLIPS TO ESTABLISH A GROUND RING AT THE TOP OF EACH MANHOLES INTERIOR. CONTRACTOR TO CONNECT MANHOLES TO SUBSTATION GROUND GRID.

OWNER TO FURNISH AND CONTRACTOR TO INSTALL CABLE RACKS AND HOOKS,



DETAIL

SUBSTATION INDEPENDENT MANHOLE GROUNDING

*****ONLY USE WHEN SUBSTATION GROUND GRID IS NOT PRESENT**

7.10 CAPACITOR BANK GROUNDING

Where two or more grounded-wye capacitors are located in the same substation, the neutrals of these capacitor banks shall be grounded using “single-point” or “peninsula” grounding methods. These methods are intended to protect control cables and down-stream equipment from damage by capacitor back-to-back switching transients. See the Project Design Drawings for which method is to be used.

Single- Point Grounding Method: the neutrals of all capacitor banks shall be connected together with insulated cable and then connected to ground grid at a single point. Doing so prevents high-frequency currents that flow between capacitor banks during back-to-back switching from flowing into the ground grid. The insulated cable’s shield wires shall be connected to the local ground at both ends. See the Project Drawings for the specified cables to be used.

Peninsula Grounding Method: One or more ground grid conductor(s) are carried underneath the capacitor rack of each phase of each group and tied to the main station ground grid at one point at the edge of the capacitor area. All capacitor bank neutral connections are made to the isolated peninsula ground grid conductor(s) only. This method will allow the rise of potential at the capacitor bank neutrals and associated current and voltage transformers, but will reduce these transients in the rest of the substation.

SUBSTATION SIGNAGE AND LABELING

8.1 SUBSTATION SIGNAGE

The following signage shall be provided by JEA and installed by the Contractor on the substation fence, wall or partitions and control house entry points as designated and approved by the Project Engineer:

- Perimeter Fence Signage: "Warning Hazardous Voltage Keep Out" placed at forty (40') foot spacing around the substation perimeter boundary placed approximately six (6') feet high. JEA Item ID # SIGDA010
- Substation Entry Points Signage: All substation entry points shall have these four signs displayed: "Warning Hazardous Voltage Keep Out", "Safety Instructions / PPE", "Notice Contact Systems Dispatch Before Entering/After Securing", "Notice Private Property No Trespassing". JEA Item ID # SIGDA003, SIGDA004, SIGDA005, SIGDA012
- Control House Entry Point Signage: Each entry point into the control house or other building located on the substation property shall display the following signage: "Notice Contact Systems Dispatch Before Entering/After Securing" JEA Item ID # SIGDA005
- Interior Substation Signage: The following signage, "Danger Hazardous Voltage Keep Out", shall be displayed on a fiberglass post (JEA Item ID # SIGPO014) provided by JEA at the inner perimeter road, by the side of the switchgear and near the transformers, breakers, capacitor banks, bus and feeders. JEA Item ID # SIGDA011

8.2 STRUCTURE AND EQUIPMENT LABELING

All Substation Structures and Equipment shall be labeled in the specific locations at approximately eye level as designated by the Project Engineer according to the specific project's Substation Technical Specifications and Drawings.

- Substation Structure Nameplates – All substation steel structures shall have a permanent nameplate attached to each whole structure. The nameplates shall be attached to the structure using a piece of channel and shall include the Company Name, Substation Name and Location, Project Name and Number, Manufacturing Date, Manufacturer's Drawing Number, Structure Number, Piece Number and Weight of the piece. Further details in regard to these structure nameplates can be found in the Structure and Materials Packager specifications.

- Transformers and Breakers – shall be labeled as designated on the "Single Line Diagram" Drawing with six (6") inch high block stencil letters using flat black paint as designated by the Project Engineer.
- High-Voltage Switches – the switch support structures shall be labeled as designated on the "Single Line Diagram" Drawing with reflective labels as provided by JEA. Switches included are high-voltage hook switches, group-operated switches, circuit switchers and fused disconnect switches which interconnect to the substation buswork.
- Low-Voltage Panels – the panel covers shall be labeled as designated on the "Station Service and Yard Panels" Drawings with three (3") inch high block stencil letters using flat black paint as designated by the Project Engineer. The labeling shall also be handwritten inside the panel cover using a permanent fine-tip black marker as designated by the Project Engineer.
- Low-Voltage AC/DC Supply Branches –all supply branches shall be labeled as designated on the "Station Service and Yard Panels" Drawings in a minimum of two (2) locations: the panel front surface adjacent to the protection device (breaker) and the branch index sheet provided with the cover of the cabinet. Two (2) neatly typed or printed copies shall be provided to the Project Engineer or Representative at the final inspection.
- Switchyard Receptacles – shall be labeled as designated on the "Conduit Plan" drawing with three (3") inch block stencil lettering using flat black paint as designated by the Project Engineer. The labeling shall also be handwritten inside of the receptacle faceplate or cover using a permanent fine-tip black marker as designated by the Project Engineer.
- Conduits – shall be labeled as designated on the "Conduit Plan" drawing in two (2) locations. The conduit shall be labeled circumferentially, about two (2") inches outside of the box and on the interior of the box near the conduit entry points using a permanent fine-tip black marker. Where conduits enter a cable trench, the conduit shall be labeled along the axis of the conduit about two (2") inches below the conduit opening or termination. All labeling shall require using a permanent fine-tip black marker.
- Cable – shall be labeled at both ends where entering and leaving the cable trench and where exiting station electrical equipment to include all AC/DC power panels, power circuit breakers, power transformers, junction boxes, fiber optic, video, station control panels, etc. All cable identification tags will have the appropriate cable number clearly stamped in no less than ¼" high characters as designated in the Project's Cable Schedule. The cable identification tags will be attached to the cable in a manner approved by the Project Engineer. Outdoor cable identification and indoor cable identification tags shall be ½" flexible nylon labels – black on white and shall be secured with no less than two plastic cable ties.

SUBSTATION MOBILE UNITS

JEA utilizes mobile units when necessary. JEA currently has both a Mobile Battery Cart and Mobile Transformer. Refer to the Equipment Technical Specifications for further details.

9.1 MOBILE BATTERY CART

The Mobile Battery Trailer must be compatible with JEA's current approved Battery Banks and Battery Charger. The Mobile Battery Trailer requires a two-tier rack system to form a 200AH/125VDC battery bank. The battery system should be supplied fully charged complete with intercell connectors and covers.

In addition to the batteries, additional equipment provided should include:

- Eyewash station
- Fire extinguisher,
- Smoke Detector
- First Aid Kit
- Battery disconnect switch (fused) with (2) 100A Fuses
- Hydrogen gas monitor

The battery trailers also come equipped with 1-100A AC Distribution Panel-Equipped with:

- 1 x 2P, 60A Circuit Breaker, Main
- 1 x 2P, 50A, Circuit Breaker, ACSWM-125-070-0-4
- 1 x 1P, 10A, Fluorescent Lights
- 1 x 1P, 15A, Hydrogen Detector
- 1 x 1P, 15A, Outside Receptacle
- 1 x 1P, 15A, Inside Receptacle

Refer to the Battery Bank and Battery Charger specification for further details.

9.2 MOBILE TRANSFORMER

1. APPLICATION

1.1. One (1) Mobile Power Transformer is to be used in an existing substation. The Mobile Power Transformer will be 140/70 KV Delta - 27/13.5 KV Wye.

2. RATINGS

2.1. Transformer will operate on the JEA System with nominal voltages of 138KV and 69KV on the high side, and 26.4KV and 13.2KV on the low side.

2.2. Cooling Type - OA/FOA 30/35 MVA at 75 degrees C/ 95 degrees C with overloading capacity up to 115 degrees C, without exceeding the hot spot temperature of 130 degrees C.

2.3. 3-Phase, Dual wound primary, Dual wound secondary, 60 HZ, ANSI Standard Polarity.

2.4. Voltage and Arithmetical Loading

	Winding Volts	MVA @ 75 C	MVA @ 95 C
H	138 KV	30	35
H	69 KV	30	35
X	26.4 KV	30 W/A LTC	35 (with automatic LTC)
X	13.2 KV	30 W/A LTC	35 (with automatic LTC)

3. IMPEDANCE

138kV to 27kV 12% - 18.0% 30MVA Base

138KV to 13.2KV 12% - 18.0% 30MVA Base

69KV to 27KV 12% - 18.0% 30MVA Base

69 KV to 13.2KV 12% - 18.0% 30MVA Base

Supplier to provide accurate information for each unit proposed.

4. TAP VOLTAGES

(140KV)H +/- 5% in 2 - 2-1/2% steps Full Capacity De-energized Taps

(70KV)H +/- 5% in 2 - 2-1/2% steps Full Capacity De-energized Taps

(28KV) +/- 10% in 16 - 5/8% steps. With Automatic LTC

(14KV) X +/- 10% in 8 - 1.25% steps With Automatic LTC

5. STATION SERVICE

120/240 volt, open delta

SUBSTATION SPECIFICATIONS

Priority shall be given in the following order to Substation Standards:

1) The Substation Design Engineer's Project Plans and Specifications
2) Material and Equipment Specifications
3) Technical Specifications
4) Substation Standards Reference Manual

10.1 MATERIAL AND EQUIPMENT SPECIFICATIONS

Includes all major equipment not provided through the Steel Structures and Materials Packager Contract that is procured directly from the manufacturer and/or their designated distributor.

BATTERY BANK AND CHARGER

CABLES

CAPACITOR BANKS (provided by Steel Structures & Materials packager for new substations)

CIRCUIT BREAKERS (VACUUM & SF6)

METAL-CLAD SWITCHGEAR (4KV, 13KV & 26KV)

SWITCHES (provided by Steel Structures & Materials packager for new substations)

TRANSFORMERS (POWER, AUTO & MOBILE)

10.2 TECHNICAL SPECIFICATIONS

STEEL STRUCTURES AND MATERIALS PACKAGER - Includes, but is not limited to Specifications for Steel Structures, Potential Transformers, Surge Arresters, Disconnect Switches, Insulators, Buses (Tubular), Substation Connectors and Hardware, Strain Bus and Instrument Cable & Control Cables.

SUBSTATION CONSTRUCTION SPECIFICATIONS - Includes all Civil and Electrical Construction Details.

DISTRIBUTION UNDERGROUND DUCT SYSTEM

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SUBSTATION MONITORS

At JEA's Robinwood Substation a number of monitoring devices are under the evaluation process. Below is a list of equipment and the monitoring devices that are currently in testing or were tested.

11.1 TRANSFORMER MONITORS

- Robinwood T1
  1. APT Eclipse monitor (completed testing)
  2. Dynamic Ratings B100 Moisture and Temperature monitor with hydrogen monitor add-on (completed testing)
  3. Camlin Totus 5 gas DGA Monitor with Bushing Monitor (currently testing)
- Robinwood T2
  1. APT Total Eclipse with Bushing Monitor (to be installed in 2023)
  2. Dynamic Ratings B100 Moisture and Temperature monitor with hydrogen monitor add-on (completed testing)
  3. Qualitrol Severon TM1 1 gas DGA Monitor (completed testing)
  4. Vaisala MHT410 with Vaisala Indigo 520 Temperature, Moisture and Hydrogen monitor (completed testing)
  5. Weidmann 2 Gas DGA Monitor (completed testing)
  6. Severon ITM 509 (completed testing) - Moisture and Temperature monitor
- Robinwood T4
  1. Vaisala OPT100 9 Gas DGA Monitor (currently installed)
  2. Dynamic Ratings Bushing Monitor (currently installed)
- Robinwood T5
  1. Qualitrol Severon TM8 8 Gas DGA Monitor (currently installed)

- Dynamic Ratings B100 monitors installed on the following JEA transformers:
  1. Park and King T1
  2. St Johns T1 and T2
  3. Dillon
  4. Hartley Rd. T1 & T2
  5. MillCove
  6. Powers
  7. Paxon T1
  8. San Pablo
  9. Switzerland

11.2 BREAKER MONITORS

- Robinwood 6C6
    1. Dynamic Ratings Breaker Performance Monitor (currently installed)
    2. Vaisala DPT145 Breaker Monitor (currently installed)
- Robinwood 138kV SF6 Breakers
    1. Vaisala MI70 Handheld Monitor
    2. Vaisala DPT145 SF6 Gas Monitor (currently installed)
- Robinwood 69KV Oil Breakers
    1. Rugged Monitoring Breaker Monitors – measures compressor pressure and motor current
    2. AWC Breaker Monitors – measures compressor pressure and motor current

11.3 BATTERY MONITORS

1. Albers Battery Monitor (currently installed)
2. BTech Battery Monitor (currently installed)

11.4 OTHER MONITORS

1. Systems With Intelligence (SWI) Infrared Camera (mounted on the 69kV lattice structure) set to scan T1 and T2 (currently testing)