V. DESIGN STANDARDS

i. Medium Voltage Cables

ii. Separable Connectors
Splices & Fault Indicators

iii. Manholes & Ductbanks

iv. Primary Switches & Medium Voltage Transformers

v. Metering, Monitoring, & Data Logging

vi. SUCF Program Directives

MEDIUM VOLTAGE CABLES

This standard is not meant to exclude manufacturers who can meet or exceed the minimum requirements set herein. See approved manufacturers section.

CABLE MAIN CHARACTERISTICS:

COMPACT STRAND CONSTRUCTION

Okonite Cable Modified by Greenwich Engineering

Okoguard®-Okoseal® Type MV-105

15kV Shielded Power Cable

One Okopact® (Compact Stranded) Copper Conductor/105°C Rating
133% Insulation Level

A Uncoated, Okopact (Compact Stranded) Copper Conductor

B Strand Screen-Extruded Semiconducting EPR

C Insulation-Okoguard EPR

D Insulation Screen-Extruded semiconducting EPR

E Shield-Copper Tape

F Jacket Okoseal

Critical Specifications

Conductor: Annealed uncoated copper compact stranded per ASTM B-496.

Strand Screen: Extruded semiconducting EPR strand screen. Meets or exceeds electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8 and UL 1072.

Insulation: Meets or exceeds electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8 and UL 1072.

Insulation Screen: Extruded semiconducting EPR insulation screen . Meets or exceeds electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682, AEIC CS8 and UL 1072.

Shield: 5 mil bare copper tape helically applied.

Jacket: Meets or exceeds electrical and physical requirements of ICEA S-93-639/NEMA WC74 & S-97-682 and UL 1072 for polyvinyl chloride jackets. UL Listed as Type MV-105 and sunlight resistant in accordance with UL 1072

Product Features

Triple tandem extruded, all EPR system. Okoguard cables meet or exceed all recognized industry standards (UL, AEIC, NEMA/ICEA, IEEE). 105°C continuous operating temperature. 140°C emergency rating. 250°C short circuit rating. Excellent corona resistance. Screens are clean stripping. Exceptional resistance to "treeing". Moisture resistant. Resistant to most oils, acids, and alkalies. Sunlight resistant. Improved Temperature Rating.

1-Okonite Catalog Number **2-Conductor Size - AWG or kcmil** **3-Conductor Size - mm2** **4-Approx. Dia. over Insulation(in.)** **5-Approx. Dia. over Screen(in.)** **6-Jacket Thickness - mils** **7-Jacket Thickness - mm** **8-Approx. O.D. - Inches**	**09-Approx. O.D. - mm** **10-Approx. Net Weight lbs./1000'** **11-Approx. Ship Weight lbs./1000'** **12-Ampacities Conduit in Air** **13-Ampacities Underground Duct*** **14-Conduit Size-Inches**** **15-Bending radius (in)**

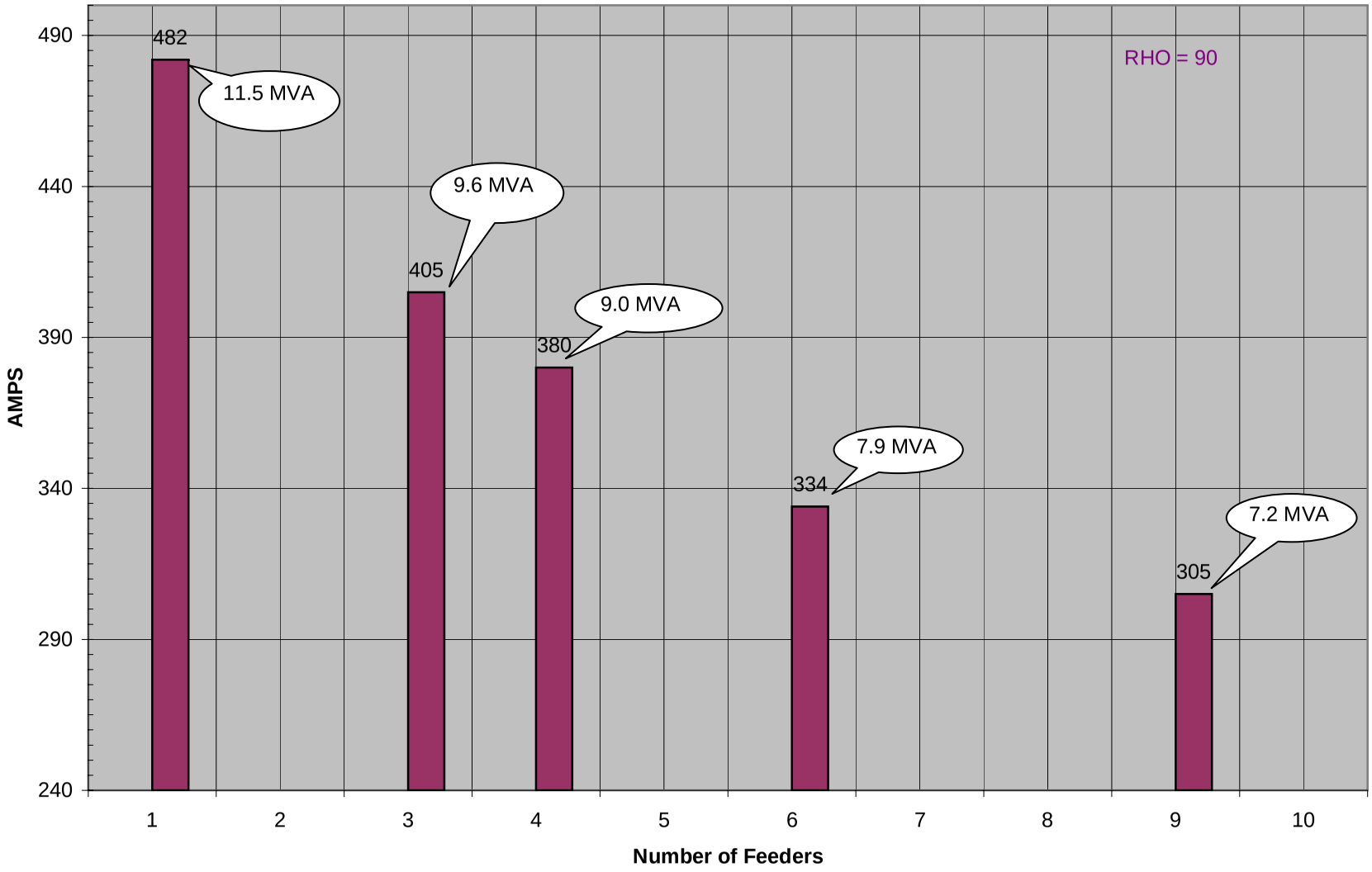
Okoguard Insulation:220 mils(5.59mm), 133% Insulation Level

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
▲115-23-3127	350	177.0	1.11	1.18	80	2.03	1.37	34.7	1810	1950	440	415	4	18
▲115-23-3131	500	253.0	1.22	1.30	80	2.03	**1.49**	37.7	2355	2555	535	500	5	20
▲115-23-3135	750	380.0	1.40	1.48	80	2.03	1.66	42.2	3246	3511	655	610	5	22

* Derate this figure to account for the external thermal contribution due to other cables and the specific installation configuration. ***See Greenwich Engineering Ampacity Chart***

** 3 x 1/c 500 Kcmil are approved in 4" existing conduits at SYNY-A

500kCMIL Cable Ampacities in UG Ductbank



Installation Notes and Requirements:

1. Contractors, accompanying their bid proposals, shall submit written evidence documenting that they have satisfactorily completed a minimum of three (3) similar medium-voltage projects, of equal or greater dollar value, within the previous five (5) years, and shall also submit the resumes of proposed electricians expected to perform the contract's cable pulling and splicing work."

2. Ensure all pulling procedures and compounds are as approved and certified by the cable manufacturer.

3. All single core cables shall be triplexed on reels prior to shipment at the factory

4. No cable over 6 months old, when delivered to site, shall be used.

5. A separate grounding conductor of #4/0 shall be run all along, and bonded to the cable sheath and manhole grounding system at every splice or termination.

6. Submit the following, certified by the manufacturer, for the full cable run and obtain campus facilities engineering approval prior to start of work:

    i. Side wall pressure profile
    ii. Cable tension profile
    iii. Cable pulling implementation plan, including ways and means of execution.

7. Submit high voltage cable Splicer/Terminator certification of competency and experience 30 days before splices or terminations are made in high voltage cables. Splicer/Terminator experience during the immediate past 5 years shall include regular and ongoing performance in splicing and terminating cables of the type and classification being provided under this Contract.

8. Company Field Advisor: Secure the services of the cable manufacturer's field advisor for minimum of (40) hours for the following:

    i. Render advice regarding method of installing cable.

    ii. Inspection of equipment for installing cable.

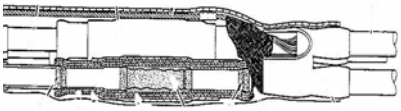
    iii. Witness representative amount of cable pulling and testing.

    iv. Certify with a sworn affidavit that the aforementioned particulars are satisfactory and the cable installed in accordance with cable manufacturer's recommendations.

APPROVED VENDORS:

1. **Kerite**
2. **Pirelli**
3. **Okonite**

SEPERABLE CONNECTORS
SPLICES &
FAULT INDICATORS



This standard is not meant to exclude other manufacturers who can meet or exceed the minimum requirements set here in. See approved manufacturers section.

SEPARABLE CONNECTORS:

1. **Junctions**

Critical Characteristics:

a. **Compliance with IEEE 386**
b. **All Copper current carrying and mating components**

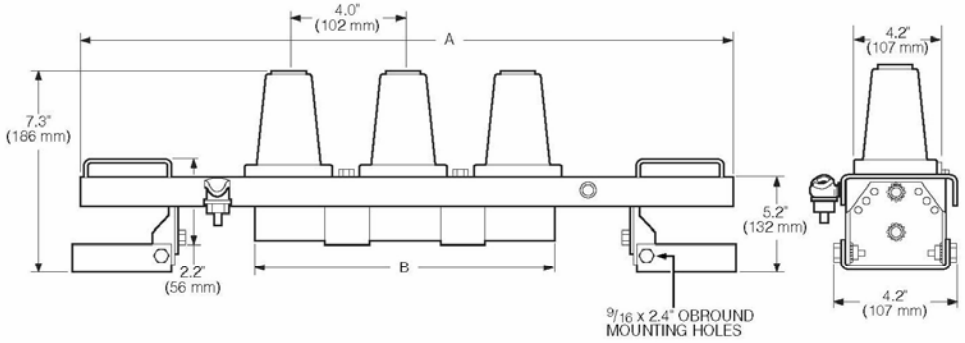


Figure 3.
Dimensional drawing shows mounting configuration.

Note: Dimensions given are for reference only.

TABLE 6
Dimensional Information

Number of Interfaces	Physical Dimensions in./mm		Mounting Dimensions in./mm					
			Configuration 1		Configuration 2		Configuration 3	
	A	B	Min.	Max.	Min.	Max.	Min.	Max.
2	19.0 (483)	7.0 (178)	14.1 (358)	16.9 (429)	9.7 (248)	12.5 (318)	5.6 (142)	8.4 (213)
3	23.0 (584)	11.0 (279)	18.6 (472)	21.4 (544)	14.2 (361)	17.0 (432)	10.1 (257)	12.9 (328)
4	27.1 (686)	15.0 (381)	24.1 (612)	26.9 (686)	19.7 (500)	22.5 (572)	15.6 (396)	18.4 (467)

Configuration 1. Both feet turned out.
Configuration 2. One foot turned out, the other in.
Configuration 3. Both feet turned in.

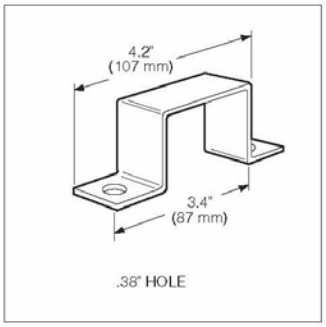


Figure 4.
Stainless Steel U-strap for direct wall mount.

Note: Dimensions given are for reference only.

SEPARABLE CONNECTORS:

2. No Load Breaks (NLB)

Critical Characteristics:

a. Compliance with IEEE 386

b. All Copper current carrying and mating components

c. Connectors shall be rated for 900A (Copper)

Deadbreak Apparatus Connectors

MODIFIED BY GREENWICH ENGINEERING

600 A 15/25 kV Class Bol-T™ Deadbreak Connector

GENERAL

The Cooper Power Systems 600 A, 15/25 kV Class Bol-T™ Deadbreak Connector is used to terminate high-voltage underground cable on deadfront apparatus such as transformers, switches and switchgear. It is fully shielded, submersible and meets the requirements of **IEEE Standard 386™** – "Separable Insulated Connector Systems".

The capacitive test point on the insulating plug provides a means of testing the circuit without disturbing the bolted connection.

In addition to the capacitive test point feature on the insulating plug, Cooper Power Systems offers an optional capacitive test point similar to the test points on Cooper 200 A Elbows. This allows the use of the Type "TPR" Series Fault Indicators, and provides a hotstick operable means of determining circuit condition when used with high impedance voltage sensing devices designed for test points.

Bol-T Connectors are designed for use on solid dielectric cable (XLPE or EPR) with extruded semi-conductive shields and concentric neutral, with or without a jacket.

Installation on jacketed concentric neutral cable may require additional sealing material. Cold shrinkable adapters are available for tape shield, linear corrugated and drain wire cable adaptation for use with deadbreak connectors.

900 AMP RATING

The Bol-T is rated for 900 A continuous when used with a coppertop compression connector, copper insulating plug, copper stud and copper bushing or junction.

INTERCHANGEABILITY

All Cooper Power Systems 600 A Deadbreak Connectors conform to the electrical, mechanical and dimensional requirements of **IEEE Standard 386™**. The connectors can be used on any comparably rated bushing interface that also meets the requirements of this standard. In addition, all cable adapters, insulating plugs, compression connectors and other component parts are designed to be interchangeable with those currently available from all other manufacturers that also comply with **IEEE Standard 386™**.

600 A Deadbreak Connector without test point; with test point.

INSTALLATION

A torque wrench and one-inch socket are used to tighten the insulating plug through the compression connector within the T-body onto a de-energized 600 A bushing interface. Refer to Installation Instruction Sheet 600-10-2 for details.

PRODUCTION TESTS

Tests conducted in accordance with **IEEE Standard 386™**:

- AC 60 Hz 1 Minute Withstand – 40 kV
- Minimum Corona Voltage Level – 19 kV

Tests conducted in accordance with Cooper Power Systems requirem

- Physical Inspection
- Periodic Dissection
- Periodic X-ray Analysis

Voltage Ratings and Characteristics

Description	kV
Standard Voltage Class	25
Maximum Rating Phase-to-Ground	15.2
AC 60 Hz 1 Minute Withstand	40
DC 15 Minute Withstand	78
BIL and Full Wave Crest	125
Minimum Corona Voltage Level	19

Voltage ratings and characteristics are in accordance with **IEEE Standard 386™**.

TABLE 2
Current Ratings and Characteristics

Description	Amperes
Continuous	600 A rms
24 Hour Overload	1,000 A rms
Short Time	40,000 A rms symmetrical for 0.17 s 27,000 A rms symmetrical for 4.0 s

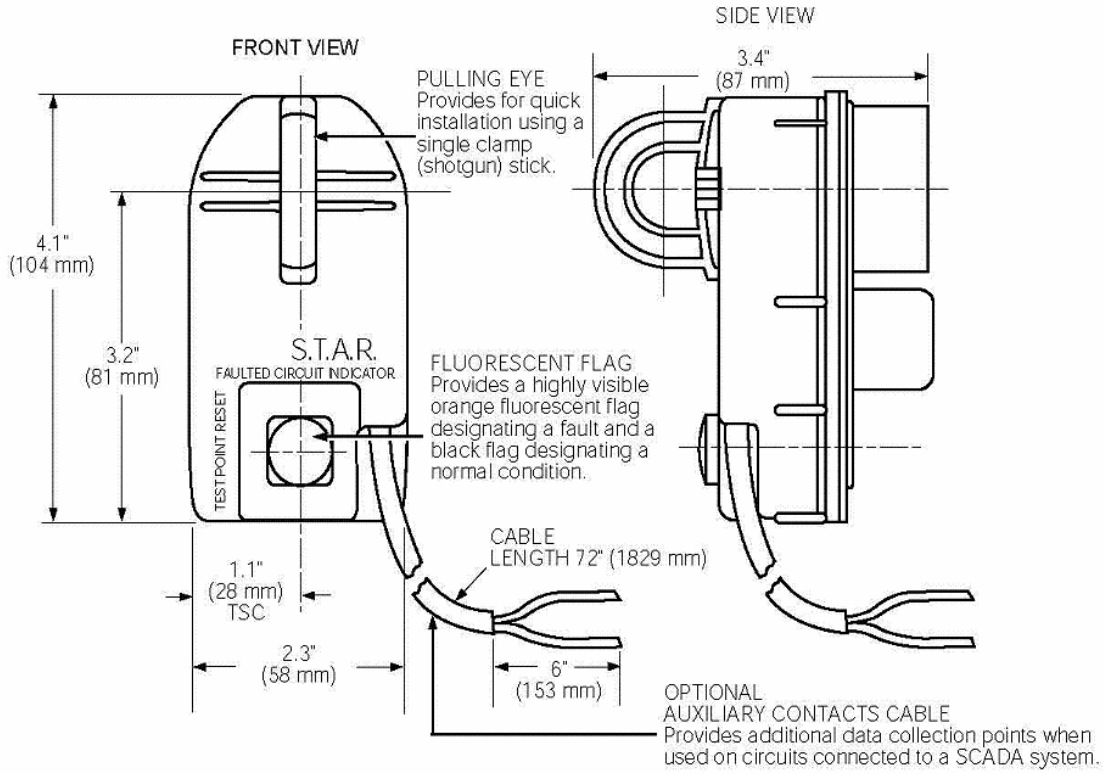
Current ratings and characteristics are in accordance with **IEEE Standard 386™**.

COOPER Power Systems

SEPARABLE CONNECTORS:

3. Fault Indicators with SCADA contacts

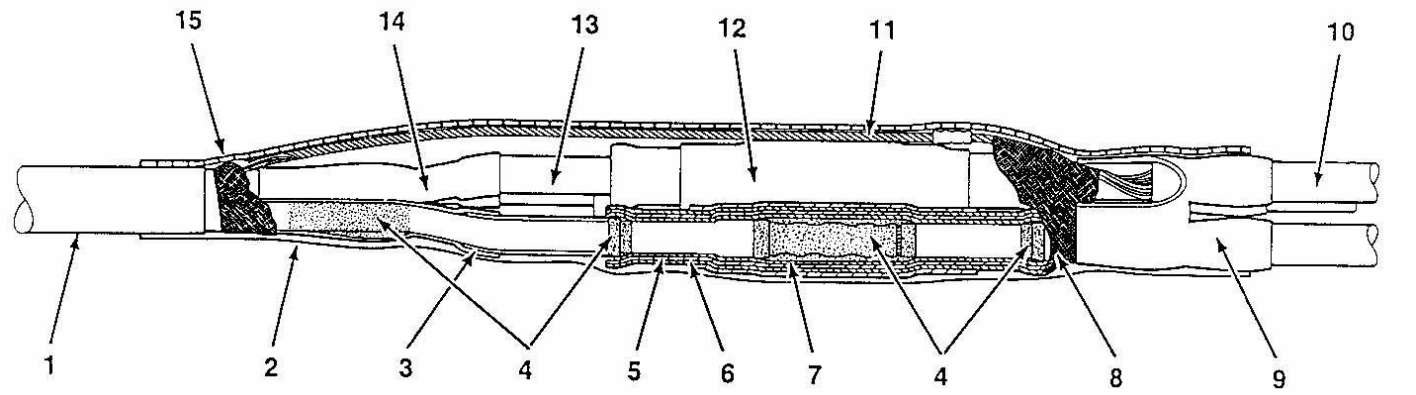
S.T.A.R.™ Faulted Circuit Indicators Test Point Reset Type



Features and dimensions of a TPR faulted circuit indicator with optional auxiliary contacts cable.

4. EPR / PILC CABLES

The basic kit approved for this particular case, is based on Raychem product HVS / HVSR product.
Below is the basic components of the splice in a Y configuration.



Key:

1. PILC Cable
2. Wraparound Sealing Sleeve
3. Oil Barrier Tubes
4. SRM (Stress Relief Mastic) Oil Block
5. Insulating Tube
6. Shielding/Insulating Tube
7. Stress Relief Tube
8. Copper Mesh
9. Sealing Breakout
10. Polymeric Cables
11. Ground Braid
12. Reinforcing Tube
13. Conductive Tubes
14. Conductive Breakout
15. Sealing Sleeve Joining Rail

APPROVED MANUFACTURERS:

I. SEPERABLE CONNECTORS
   i. ELASTIMOLD
   ii. COOPER INDUSTRIES

II. FAULT INDICATORS
   i. COOPER INDUSTRIES
   ii. FISHER PIERCE

III. INLINE SPLICES
   i. Raychem
   ii. 3M

Installation Notes and Requirements:

1. Ensure all termination procedures and ancillaries are as approved and certified by the cable and splice and termination manufacturer.

2. "Contractors, accompanying their bid proposals, shall submit written evidence documenting that they have satisfactorily completed a minimum of three (3) similar medium-voltage projects, of equal or greater dollar value, within the previous five (5) years, and shall also submit the resumes of proposed electricians expected to perform the contract's cable pulling and splicing work."

3. Submit high voltage cable Splicer/Terminator certification of competency and experience 30 days before splices or terminations are made in medium voltage cables. Splicer/Terminator experience during the immediate past 5 years shall include regular and ongoing performance in splicing and terminating cables of the type and classification being provided under this Contract.

4. Each worker and/or team shall provide a non-energized mockup of each type of splice required for the work, demonstrating methods and workmanship, which shall be retained throughout the period of work as the standard for judging the completed work.

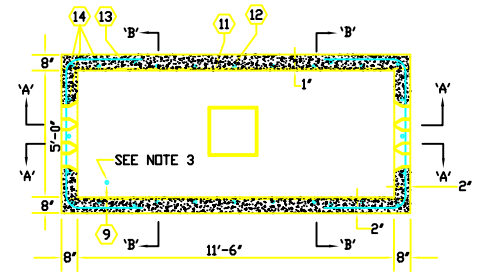
5. Contractor shall provide a witnessed test report of a satisfactory high potential test in conjunction with the splice manufacturer's destructive test report on all mockups prepared for this work.

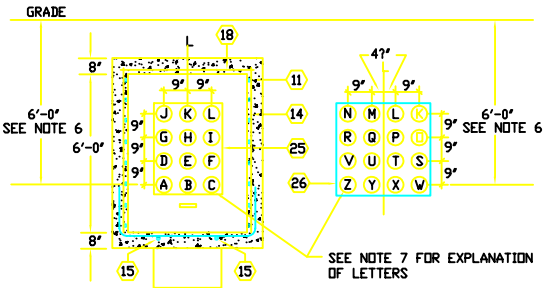
6. The contractor shall secure the services of the splice / termination manufacturer's field advisor for a minimum of (40) hours for the following:

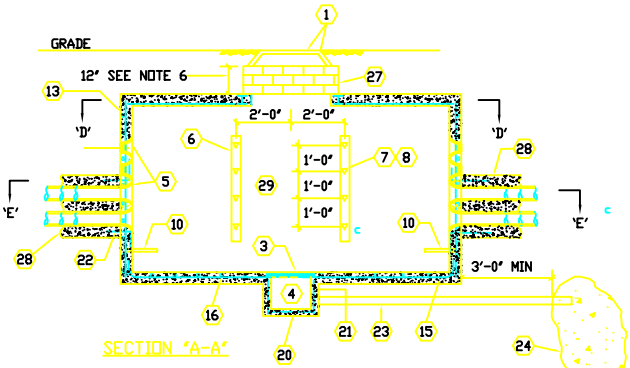
    i. Witness construction of at least 20 % of the splices and terminations by each cable splicer who will be doing the actual splicing.

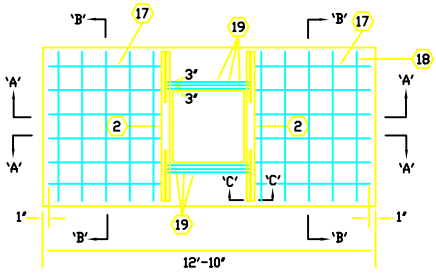
    ii. Certify with a sworn affidavit that the aforementioned particulars are satisfactory and the splice / terminations are installed in accordance with the splice / termination and cable manufacturer's recommendations.

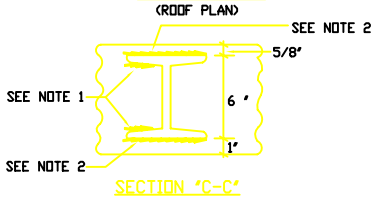
MANHOLES & DUCTBANKS











LEGEND

1. CAST IRON MANHOLE FRAME AND COVER -- 36" DIAMETER ROUND OPENING -- OF STANDARD DESIGN FOR VEHICULAR TRAFFIC LOADS -- COVER TO HAVE CAST INSCRIPTION "HIGH VOLTAGE".
2. EACH -- 6" WF 25#, STEEL BEAM 5'-6" LONG -- WITH 6" WIDE AND 3" WIDE STRIP OF #13 GAGE EXPANDED METAL REPRODUCING, TACK WELDED TO BEAM FOR ITS FULL LENGTH, AS SHOWN IN SECTION "C-C".
3. CAST IRON GRATING.
4. SUMP PIT, 18" X 18" X 18".
5. END BELLS - FLUSH- TYPICAL.
6. EACH -- CABLE RACK.
7. 2 - POSITION BACK ARM -- TYPICAL.
8. PORCELAIN INSULATOR -- TYPICAL -- (2) INSULATORS REQUIRED FOR EACH CABLE ENTERING MANHOLE.
9. 3/4" X 10'-0" COPPERWELD GROUND ROD WITH CABLE CONNECTOR.
10. EACH -- PULLING-IN EYE.
11. HORIZONTAL SIDEWALL REINFORCING -- TYPICAL #5 RODS SPACED 8" ON CENTERS.
12. EACH -- VERTICAL SIDEWALL REINFORCED ROD. SAME AS ITEM #14
13. HORIZONTAL ENDWALL REINFORCING -- TYPICAL #5 RODS SPACED 8" ON CENTERS.
14. VERTICAL REINFORCING -- TYPICAL #5 RODS SPACED 8" ON CENTERS.
15. EACH -- FLOOR REINFORCING ROD #5 @ 12" ON CENTERS
16. FLOOR REINFORCING -- TYPICAL #5-- RODS SPACED 8" ON CENTER.
17. ROOF REINFORCING -- TYPICAL #5-- RODS SPACED 6" ON CENTER.
18. ROOF REINFORCING -- TYPICAL #5 RODS SPACED 6" ON CENTER.
19. EACH 2-#5 ROOF REINFORCING ROD.
20. SUMP HORIZONTAL REINFORCING -- TYPICAL #5 RODS SPACED 6" ON CENTER.
21. SUMP VERTICAL REINFORCING -- TYPICAL #5 RODS SPACED 9" ON CENTER ALL AROUND.
22. REINFORCING KEYING CONDUIT BANK TO MANHOLE -- TYPICAL #5 TWO RODS TOP AND BOTTOM AT EACH BANK.
23. 4" CAST IRON DRAIN PIPE (OMIT WHERE BOTTOM OF MANHOLE FALLS WITHIN WATER TABLE).
24. CRUSHED ROCK DRY WELL -- 1 CUBIC YARD MINIMUM -- (OMIT WHERE BOTTOM OF MANHOLE FALLS WITHIN WATER TABLE).
25. CONDUIT ENTRY POSITIONS FOR 2 OR 3 WIDE CONDUIT BANK.
26. CONDUIT ENTRY POSITIONS FOR FOUR WIDE CONDUIT BANK.
27. BRICK CHIMNEY -- WATERPROOF OF ALL (4) SIDES.
28. EACH -- CONDUIT BANK -- REFER TO PLANS FOR QUANTITY AND ARRANGEMENT OF CONDUITS.
29. INSTALL POLYPROPPYLINE LADDER RUNGS AT 1'-0" INTERVAL

NOTES

1) 3" WIDE REINFORCING STRIPS AT SIDE TOWARDS MANHOLE OPENING.
2) 6" WIDE REINFORCING STRIP.
3) GROUND ROD TO BE SET WITH TOP 6" ABOVE FLOOR -- SEAL OPENING IN FLOOR SLAB AROUND GROUND ROD.
4) ALL REINFORCING RODS SHALL BE 5/8" BILLET STEEL DEFORMED INTERMEDIATE GRADE.
5) IN PAVED AREAS, MANHOLE COVER TO BE SET FLUSH WITH FINISHED GRADE -- IN UNPAVED AREAS, MANHOLE COVER TO BE SET 2" ABOVE FINISHED GRADE, WITH SURROUNDING SOIL REGRADED TO A SMOOTH SLOPE EXTENDING AT LEAST 3 FEET TO MEET UPSET COVER.
6) THESE DIMENSIONS RELATE TO A BASIC 30 INCH COVER OVER TOP CONDUITS -- THEY ARE TO BE INCREASED AS REQUIRED WHERE COVER IS GREATER.
7) CONDUITS IN ENTERING CONDUIT BANKS SHALL OCCUPY CONDUIT ENTRY POSITIONS IDENTIFIED BY LETTERS IN ACCORDANCE WITH THE FOLLOWING:-

CONDUIT BANK		
WIDE	HIGH	POSITIONS OCCUPIED
2	1	A,C
2	2	A,C,D,F
3	2	A,B,C,D,E,F
2	3	A,C,D,F,G,I
3	3	A,B,C,D,E,F,G,H,I
2	4	A,C,D,F,G,I,J,L
3	4	A,B,C,D,E,F,G,H,I,J,K,L
4	1	Z,Y,X,W
4	2	Z,Y,X,W,V,U,T,S
4	3	Z,Y,X,W,V,U,T,S,R,Q,P,O
4	4	Z,Y,X,W,V,U,T,S,R,Q,P,O,K,L,M,N

8) ALL INDICATED CONDUIT ENTRY POSITIONS WHICH ARE NOT OCCUPIED BY CONDUITS IN AN ENTERING DUCT BANK SHALL BE PROVIDED WITH PLUGGED OPENINGS.

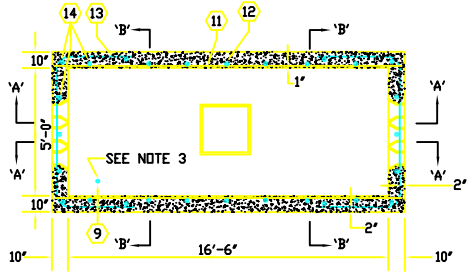
PRIMARY DISTRIBUTION MANHOLE- MH

GREENWICH ENGINEERING, LLC
Consulting & Engineering Services
124 WEST PUTNAM AVENUE
GREENWICH, CT 06830 USA

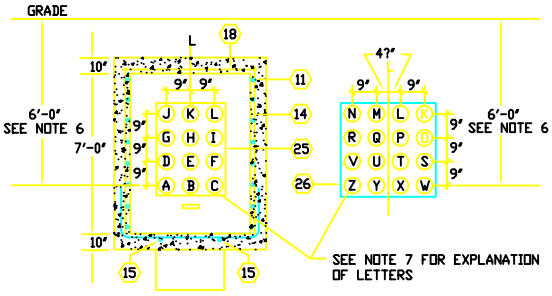
DESIGNED BY:	DATE:	SCALE:
N.Y.	05/05/2005	NTS

PROJECT:
ELECTRICAL MASTER PLAN DESIGN STANDARD

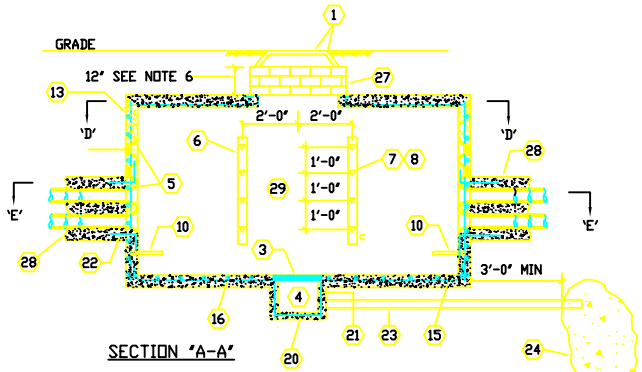
REFERENCE
GE-SKE-SUNYA-DS-001



PLAN AT "E-E"
(FLOOR PLAN)



SECTION "B-B"



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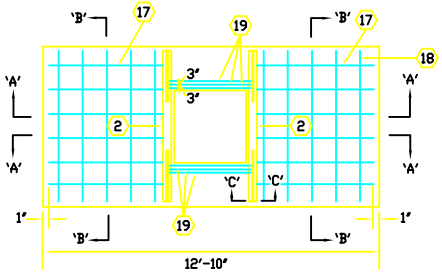
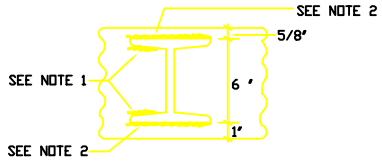


PLAN AT "D-D"
(ROOF PLAN)



SECTION "C-C"

LEGEND

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3. CAST IRON GRATING.
4. SUMP PIT, 18" X 18" X 18".
5. END BELLS - FLUSH-TYPICAL.
6. EACH -- CABLE RACK.
7. 2 - POSITION BACK ARM -- TYPICAL.
8. PORCELAIN INSULATOR -- TYPICAL -- (2) INSULATORS REQUIRED FOR EACH CABLE ENTERING MANHOLE.
9. 3/4" X 10'-0" COPPERWELD GROUND ROD WITH CABLE CONNECTOR.
10. EACH -- PULLING-IN EYE.
11. HORIZONTAL SIDEWALL REINFORCING -- TYPICAL #6 RODS SPACED 8" ON CENTERS.
12. EACH -- VERTICAL SIDEWALL REINFORCED ROD. SAME AS ITEM #14
13. HORIZONTAL ENDWALL REINFORCING -- TYPICAL #5 RODS SPACED 8" ON CENTERS.
14. VERTICAL REINFORCING -- TYPICAL #6 RODS SPACED 8" ON CENTERS.
15. EACH -- FLOOR REINFORCING ROD #6 @ 12" ON CENTERS
16. FLOOR REINFORCING -- TYPICAL #6 RODS SPACED 8" ON CENTER.
17. ROOF REINFORCING -- TYPICAL #6 RODS SPACED 6" ON CENTER.
18. ROOF REINFORCING -- TYPICAL #6 RODS SPACED 6" ON CENTER.
19. EACH 2-#6 ROOF REINFORCING ROD.
20. SUMP HORIZONTAL REINFORCING -- TYPICAL #6 RODS SPACED 6" ON CENTER.
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26. CONDUIT ENTRY POSITIONS FOR FOUR WIDE CONDUIT BANK.
27. BRICK CHIMNEY -- WATERPROOF OF ALL (4) SIDES.
28. EACH -- CONDUIT BANK -- REFER TO PLANS FOR QUANTITY AND ARRANGEMENT OF CONDUITS.
29. INSTALL POLYPRPYLENE LADDER RUNGS AT 1'-0" INTERVAL

NOTES

1) 3" WIDE REINFORCING STRIPS AT SIDE TOWARDS MANHOLE OPENING.
2) 6" WIDE REINFORCING STRIP.
3) GROUND ROD TO BE SET WITH TOP 6" ABOVE FLOOR -- SEAL OPENING IN FLOOR SLAB AROUND GROUND ROD.
4) ALL REINFORCING RODS SHALL BE 5/8" BILLET STEEL DEFORMED INTERMEDIATE GRADE.
5) IN PAVED AREAS, MANHOLE COVER TO BE SET FLUSH WITH FINISHED GRADE -- IN UNPAVED AREAS, MANHOLE COVER TO BE SET 2" ABOVE FINISHED GRADE, WITH SURROUNDING SOIL REGRADED TO A SMOOTH SLOPE EXTENDING AT LEAST 3 FEET TO MEET UPSET COVER.
6) THESE DIMENSIONS RELATE TO A BASIC 30 INCH COVER OVER TOP CONDUITS -- THEY ARE TO BE INCREASED AS REQUIRED WHERE COVER IS GREATER.
7) CONDUITS IN ENTERING CONDUIT BANKS SHALL OCCUPY CONDUIT ENTRY POSITIONS IDENTIFIED BY LETTERS IN ACCORDANCE WITH THE FOLLOWING:-

CONDUIT BANK		
WIDE	HIGH	POSITIONS OCCUPIED
2	1	A,C
2	2	A,C,D,F
3	2	A,B,C,D,E,F
2	3	A,C,D,F,G,I
3	3	A,B,C,D,E,F,G,H,I
2	4	A,C,D,F,G,I,J,L
3	4	A,B,C,D,E,F,G,H,I,J,K,L
4	1	Z,Y,X,W
4	2	Z,Y,X,W,V,U,T,S
4	3	Z,Y,X,W,V,U,T,S,R,Q,P,O
4	4	Z,Y,X,W,V,U,T,S,R,Q,P,O,K,L,M,N

8) ALL INDICATED CONDUIT ENTRY POSITIONS WHICH ARE NOT OCCUPIED BY CONDUITS IN AN ENTERING DUCT BANK SHALL BE PROVIDED WITH PLUGGED OPENINGS.

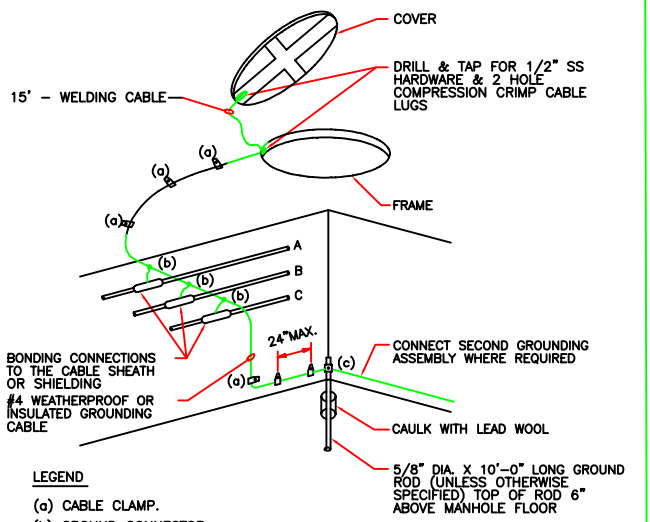
PRIMARY DISTRIBUTION MANHOLE-MEGA MH

GREENWICH ENGINEERING, LLC
Consulting & Engineering Services
124 WEST PUTNAM AVENUE
GREENWICH, CT 06830 USA

DESIGNED BY:	DATE:	SCALE:
N.Y.	05/05/2005	NTS

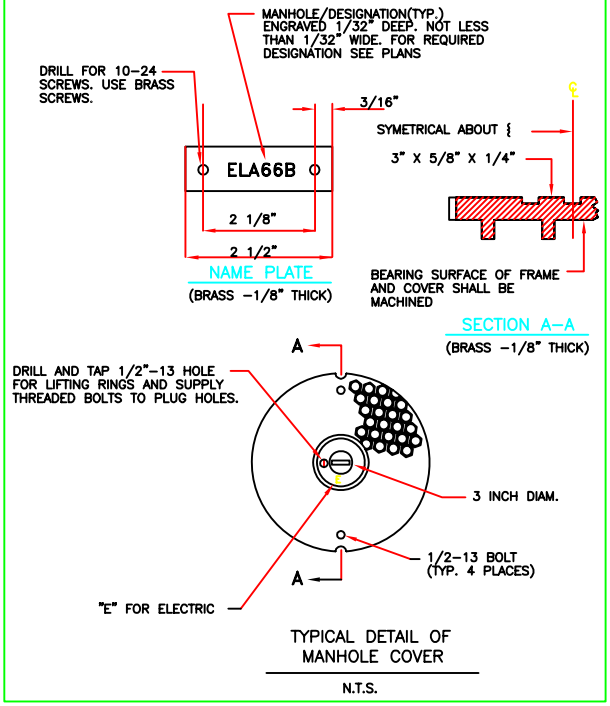
PROJECT:
ELECTRICAL MASTER PLAN DESIGN STANDARD

REFERENCE
GE-SKE-SUNYA-DS-001



GROUNDING OF ELECTRICAL MANHOLES

N.T.S



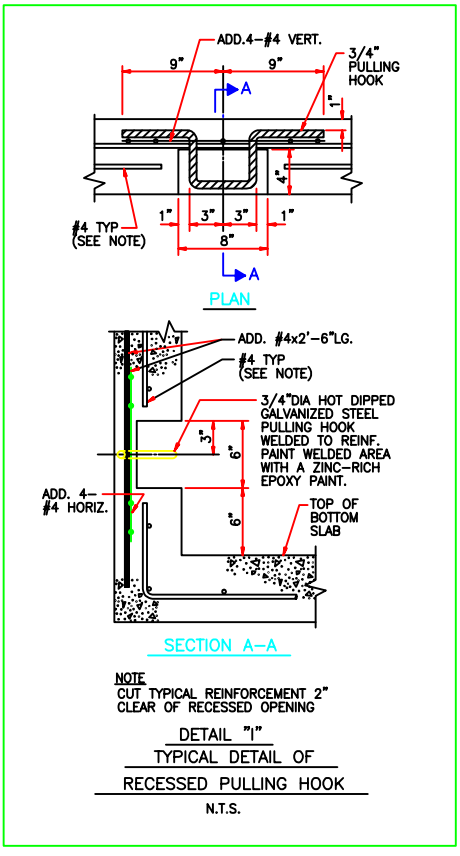
TYPICAL DETAIL OF MANHOLE COVER

N.T.S.

MANHOLE COVER DETAILS

NOTES

MANHOLE STRUCTURE AND COVER SHALL COMPLY WITH AASHTO H20 LOADING AND ASTM C978 REQUIREMENTS FOR HEAVY TRAFFIC



DETAIL "I"

TYPICAL DETAIL OF

RECESSED PULLING HOOK

N.T.S.

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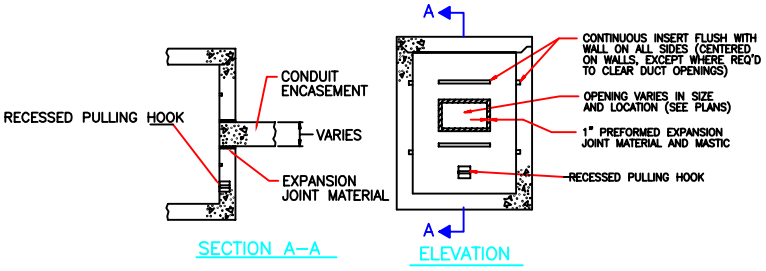
REFERENCE
GE-SKE-SUNYA-DS-001

GENERAL NOTES:

1. FRAME AND COVER FOR TRUCK LOADS SHALL BE CAST IRON CAMPBELL#1012B (MANHOLES) OR APPROVED EQUAL.
2. FOR COVER MARKINGS AND MANHOLE ID, CONSULT CAMPUS FACILITIES
3. INSERTS SHALL BE HOT-DIPPED GALVANIZED STEEL UNISTRUT SERIES P-3200 COMPLETE WITH END CAPS OF SIMILAR MATERIAL AND FINISH, AND WAXED CARDBOARD CLOSURE STRIPS.
4. INSTALL GROUNDING ASSEMBLY IN LOCATIONS SPECIFIED OR AS SHOWN ON PLANS.
5. PAINT ALL GROUND CONNECTIONS WITH ASPHALT BASE PAINT.
6. REINFORCING BARS SHALL BE ASTM A-615 GRADE 60.
6. REINFORCING BARS SHALL BE ASTM A-615 GRADE 60.

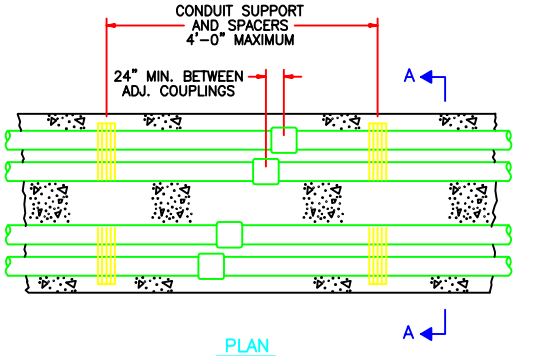
DUCT-BANK NOTES:

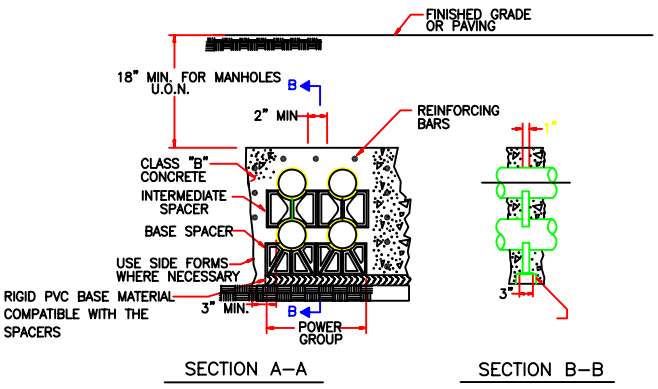
1. INSERTS SHALL BE HOT-DIPPED GALVANIZED STEEL UNISTRUT SERIES P-3200 COMPLETE WITH END CAPS OF SIMILAR MATERIAL AND FINISH, AND WAXED CARDBOARD CLOSURE STRIPS.
2. REINFORCING BARS SHALL BE ASTM A-615, GRADE 60.
3. CONCRETE STRENGTH SHALL BE A MINIMUM 4000 PSI @ 28 DAYS



TYPICAL DETAIL OF WINDOW & SIDING CONNECTION FOR DUCT

N.T.S.



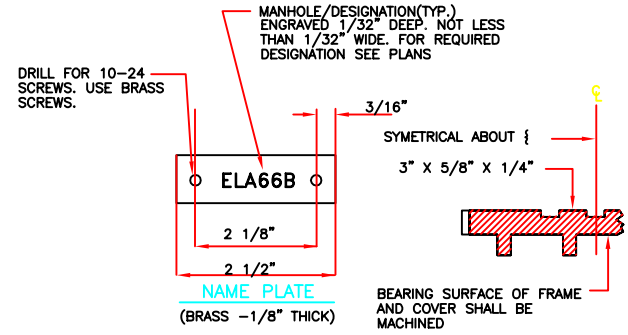


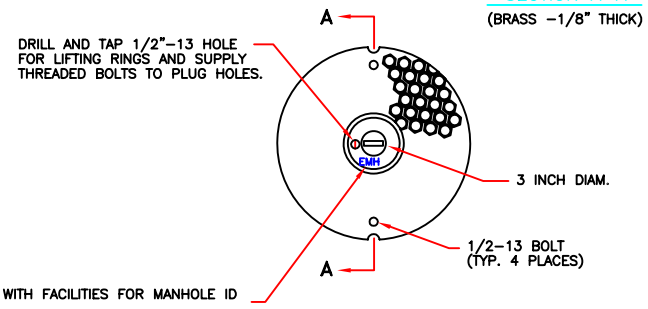
NOTES:

1. FOR SIZE AND NUMBER OF CONDUITS AS WELL AS DUCT BANK FORMATION,SEE PLANS.
2. REINFORCEMENT OF THE CONCRETE ENCASEMENT FOR CONDUIT BANKS SHALL CONSIST OF #5 LONGITUDINAL REINFORCING BARS LOCATED 3" IN FROM THE OUTSIDE SURFACE OF THE ENVELOPE AND SPACED 6" ON CENTERS ON ALL 4 SIDES: TOP, BOTTOM, AND TWO SIDES #4 REBARS @ 12" ON CENTER APART SHALL BE USED TO TIE THE LONGITUDINAL BARS TOGETHER.

DUCT BANK DETAILS - TYPICAL ARRANGEMENT

N.T.S.





N.T.S.

DUCT BANK DETAILS

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GREENWICH, CT 06830 USA

DESIGNED BY:	DATE:	SCALE:
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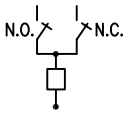
PROJECT:
ELECTRICAL MASTER PLAN DESIGN STANDARD

REFERENCE
GE-SKE-SUNYA-DS-002

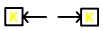
1 / 1

PRIMARY SWITCHES
&
MEDIUM VOLTAGE TRANSFORMERS

LEGEND

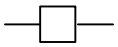


PRIMARY SELECTIVE 15 KV SWITCH ASSEMBLY WITH VACUUM INTERRUPTER



KEY INTERLOCK

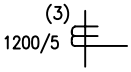
POWER TRANSFORMER



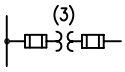
VACUUM INTERRUPTER

SEPERABLE CONNECTOR
NO LOAD BREAK, 900A
ALL COPPER

CIRCUIT BREAKER



CURRENT TRANSFORMER.
SUBSCRIPT NUMERAL IN PARENTHESIS INDICATE NUMBER OF DEVICES.
NUMERAL INDICATES RATIO.



POTENTIAL TRANSFORMER
NUMERAL IN PARENTHESIS INDICATES NUMBER OF DEVICES

DIGITAL POWER METERING SYSTEM

LIGHTNING ARRESTER

SHORT SPECS:

SF6 SWITCHGEAR:

- The switchgear shall consist of a gas-tight tank containing SF6 gas, load-interrupter switches and re-settable vacuum fault interrupters with visible open gaps and integral visible grounds, and a microprocessor-based over-current control. Load-interrupter switch terminals shall be equipped with bushings rated 600 amperes continuous, and fault-interrupter terminals shall be equipped with bushing wells rated 600 amperes continuous to provide for elbow connection. Manual operating mechanisms and viewing windows shall be located on the opposite side of the tank from the bushings and bushing wells so that operating personnel shall not be required to perform any routine operations in close proximity to high-voltage elbows and cables.

CAST COIL TRANSFORMER:

- The transformer shall be manufactured by a company certified to ISO 9001, ANSI/ASQC Q9001 for the design and manufacture of Power, Distribution, and specialty Dry type transformers.
- The high voltage windings shall be vacuum cast in a metal mold ensuring absence of voids.

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GREENWICH, CT 06830 USA

DESIGNED BY:	DATE:	SCALE:
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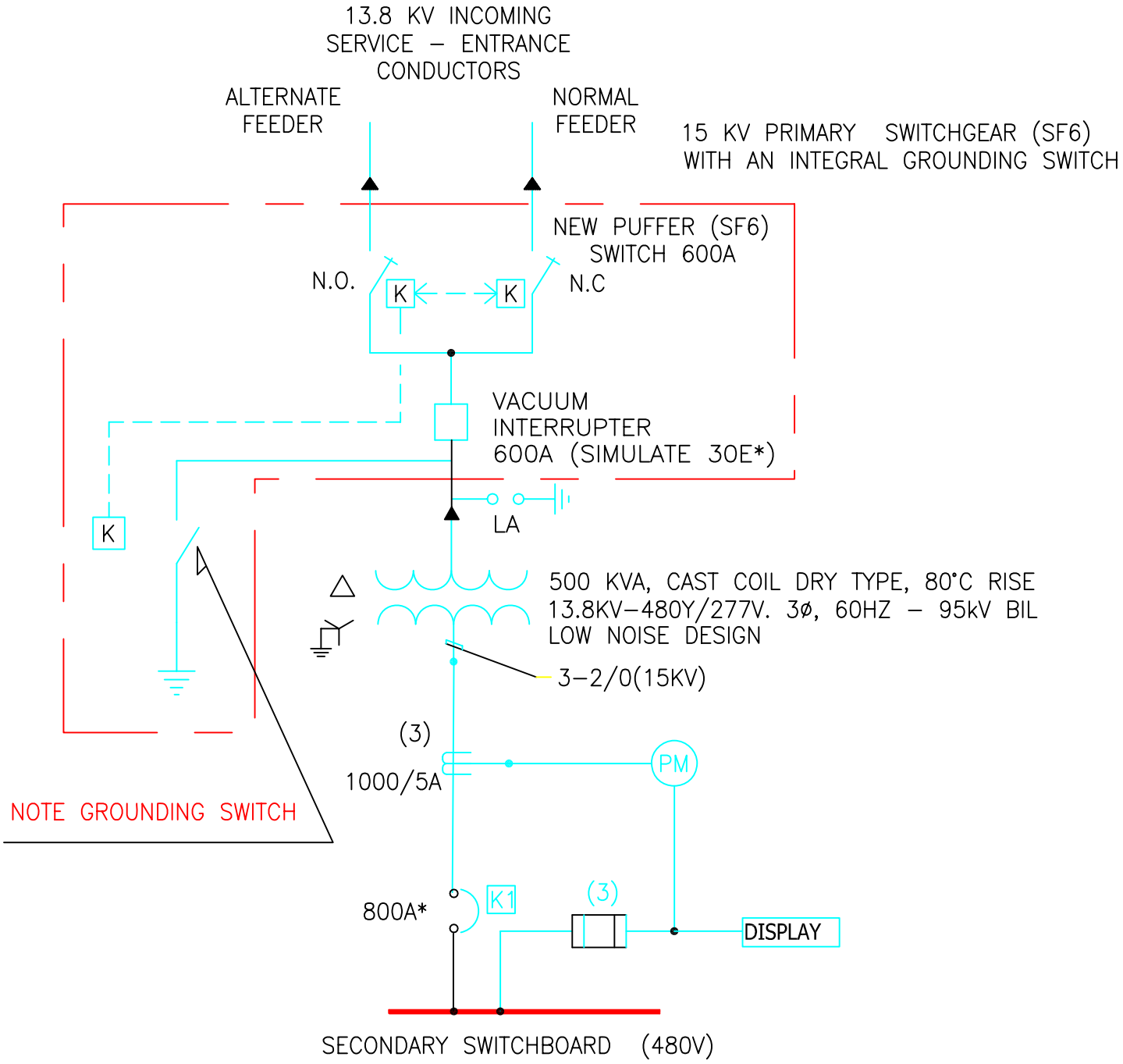
PROJECT: ELECTRICAL MASTER PLAN DESIGN STANDARDS

REFERENCE: GE-SKE-SUNYA-DS-003



PRIMARY SF6 SWITCH AND TRANSFORMER ONE LINE DIAGRAM

* FOR OTHER TRANSFORMER RATINGS REFER TO GE–SKE–SUNYA–DS–003 SHEET 3 OF 3

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PROJECT: ELECTRICAL MASTER PLAN DESIGN STANDARDS

TITLE:	SHEET:
GE-SKE-SUNYA-DS-003	2 OF 3

TRANSFORMER PROTECTION "GROSS" SETTINGS

VERIFY COORDINATED SETTINGS FOR EACH NEW APPLICATION BY RUNNING SKM SOFTWARE
CONSULT WITH GREENWICH ENGINEERING PRIOR TO ANY MODIFICATION

XFMR kVA	PRIMARY FUSE	SECONDARY CB 480V AMPS	SECONDARY CB 208V AMPS
150	7E	225	500
225	10E	350	800
300	15E	450	1000
500	25E	800	1600
750	30E	1200	2500
1000	50E	1200	3000
1500	65E	2500	NA
2000	125E	3000	NA
2500	150E	4000	NA
3000	200E	4500	NA
3750	250E	6000	NA

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DESIGNED BY: N.Y. DATE: 05/05/2005 SCALE: NTS

PROJECT: ELECTRICAL MASTER PLAN DESIGN STANDARD

REFERENCE: GE-SKE-SUNYA-DS-003

METERING, MONITORING & DATA LOGGING

POWERLOGIC® Series 3000
Circuit Monitor

This standard is not meant to exclude manufacturers who can meet or exceed the minimum requirements set herein. See approved manufacturers section.

POWERLOGIC:
Monitoring & Metering Device Selection Guide

MODIFIED BY GREENWICH ENGINEERING

	NOT USED AT SUNY-A		Circuit Monitors	Power Meters		Sub Metering NOT USED AT SUNY-A		
	CM4000T	CM4000	CM3350	PM850	PM820	Enercept Meter B/E	Energy Meter B/E	Multi-Circuit Monitor
Alarming								
Alarm Summary **	■	■	■					
Alarm Setpoint Learning	■	■						
Transient (1µs)	■							
Waveshape Alarms (Voltage & Current)	■	■						
Disturbance (10ms)	■	■	■					
Cycle by Cycle Event Recording	■	■						
High Speed (100ms)	■	■	■					
Digital Inputs/Outputs	■	■	■	■	■			
Boolean Logic	■	■	■	■				
Setpoint-Driven Alarms V,KW,KVA,I,PF,KVAR	■	■	■	■	■			V,I,KVA
Power Quality								
Disturbance Direction Detection *	■	■	■					
EN50160 Pass/Fail Summary	■	■	■	■	■			
Flicker IEC61000-4-15	■							
Sag/Swell Metering	■	■	■					
ITIC/SEMI F47/NEMA MG-1-1998	Opt	Opt	Opt					
Harmonic Power Flows	■	■	■					
Harmonic Resolution	255th	255th	63rd	63rd	63rd			
Individual Harmonic Readings, V & I	63rd	63rd	63rd	63rd	31st			
Communications								
Onboard Ethernet	w/ECC21	w/ECC21	w/ECC21	Opt**	Opt**			
Infrared Port	w/CMDVF	w/CMDVF	w/CMDVF				■ / ■	
RS-485	■	■	■	■	■	■ / ■	Opt	■
RS-232	■	■						
I/O								
Time Stamping Accuracy	1 ms	1 ms	1 ms	1 sec	1 sec			
Analog Inputs/Outputs, (Maximum)	(4)	(4)	(4)*	(4)*	(4)*			
KYZ / KY Output	■	■	■	■	■		/ ■	
Digital Inputs/Outputs, (Maximum)	(24)	(24)	(8)	(9)*	(9)*			
Metering Characteristics								
Sampling Rate, Samples/ Cycle on 60Hz	83,333/512	512	128	128	128			21
Accuracy of Voltage/Current reading	0.04%	0.04%	0.075%	0.075%	0.075%	1%	1%	1%
Voltage Input Range VAC	35-600	35-600	35-600	35-600	35-600	480/480	240/480	120-480
Current Input Range AC, STD (Maximum)	0-10 (100)	0-10 (100)	0-10	0-10(15A)	0-10(15A)			0-5
Control Power (Voltage Range)								
VAC	90-305	90-305	90-305	90-457	90-457	120-480	120/120-277	90-132
VDC	100-300	100-300	100-300	100-300	100-300			
Standards Compliance								
Accuracy IEC Class	0.2	0.2	0.5S	0.5S	0.5S			
Accuracy ANSI Class	12.20	12.20	12.20	12.20	12.20		12.16	
Other								
Onboard HTML Web Page server	w/ECC21	w/ECC21	w/ECC21					
Email on Alarm *	w/ECC21	w/ECC21	w/ECC21					
Programmable Math and Logic Functions	■	■						
Register Based Event Log	■	■	■	■	■			
Downloadable Firmware	■	■	■	■	■			
Panel Mounting	■	■	■	■	■			
DIN Rail Mounting			■	■	■			
Multiple Device Metering Capabilities								■

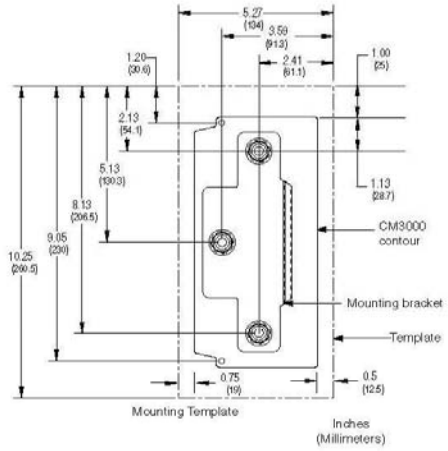
MODIFIED BY GREENWICH ENGINEERING

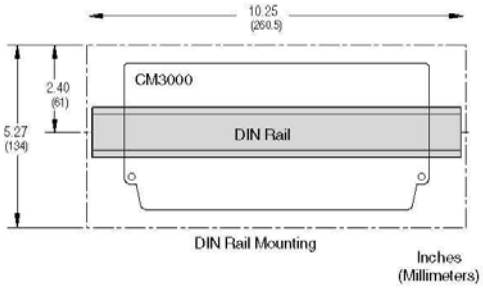
POWERLOGIC:

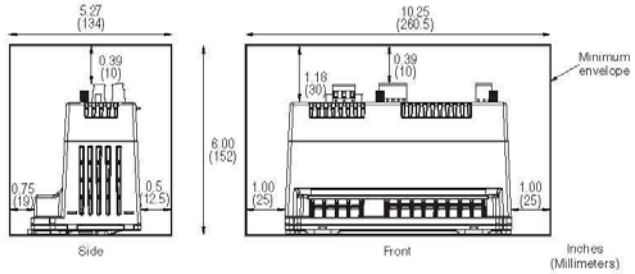
Monitoring & Metering Device Selection Guide

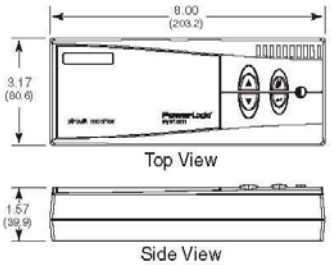
	Circuit Monitor	Power Meters	
	CM3350	PM850	PM820
Basic Instrumentation			
THD, Voltage and Current per phase	■	■	■
Min/Max Readings I, V, F, PF, THD, TOTAL KW & KVAR	■	■	■
Predicted Real/Reactive/Apparent Power Demand 3 phase total	■	■	■
Reactive & Apparent Power Demand, Present & Peak	■	■	■
Real, Reactive, Apparent Power, per phase	■	■	■
Frequency	■	■	■
Reactive Energy (kVARh) & Apparent Energy (kVAh)	■	■	■
Real & Reactive Energy IN & OUT (kWh) (kVARh)	■	■	■
Real Energy (kWh)	■	■	■
Real Power Demand, Peak	■	■	■
Real Power Demand, Present	■	■	■
Real Power, 3 phase total (kW)	■	■	■
Reactive Power, 3 phase total (kVAR & kVA)	■	■	■
Power Factor, per phase & 3 phase total	■	■	■
Voltage, per phase (L-L, L-N), 3 phase average	■	■	■
Current Demand, Max., neutral	■	■	■
Current Demand, Max., per phase	■	■	■
Current, neutral	■	■	■
Current, per phase, 3 phase average	■	■	■
Advanced Instrumentation			
Trending and Forecasting	■	■	
Fundamental Voltage/Current Magnitudes & Ang, per phase	■	■	■
Fundamental Real & Reactive Power, 3 phase, per phase	■		
Incremental Real/Reactive/Apparent Energy IN & OUT, 3 phase total	■	■	■
Voltage N-G			
Current, Ground	■		
Logging			
Memory (standard/optional)	8MB	800kb	80kb
Energy Summary **	■		
Interval Min/Max/Avg Log	■		
Alarm/Event Log	■	■	■
Billing Log		■	■
Maintenance Log	■	■	■
Min/Max Log	■		
Time Synchronization			
GPS Clock Synchronization Capability	■		
Demand Synchronization (clock, comms, input)	■	■	■
Block Interval Demand	■	■	■
Event Recording			
Adaptive Waveform Capture			
100ms Event Recordings	■		
Disturbance Waveform Capture	■		
Steady State Waveform Capture	■	■	

SQUARE D
Schneider Electric MODIFIED BY GREENWICH ENGINEERING









in. (mm)

Feature Summary	CM3350
Basic Instrumentation	
(Current&Voltage/Phase, Current Demand, Power(kW,kVAR,kVA),K-Factor, Energy(kWH,kVARh,kVAh), Power Factor, Current&Voltage THD, Min/Max Readings	✔
Advanced Instrumentation	
Current - G, Demand Voltage, 3-ph. Incremental Energy, Fundamental Current/Voltage/Power, Phase Rotation	✔
Logging	
Memory (Standard / Optional)	8MB
Alarm / Event Log	✔
Maintenance Log	✔
Min / Max Average Log	✔
Interval Min / Max Log	✔
Trending / Forecasting	✔
Time Synchronization	
Comms. Clock Synchronization	✔
GPS Clock Synchronization	Option
Alarming	
Setpoint-Driven Alarms	✔
Boolean Alarms	✔
Custom Alarms with Priority Levels	✔
High Speed (100ms)	✔
Multiple Level Alarming	✔
Disturbance (1/2 cycle)	✔
Power Quality	
Sag / Swell Monitoring	✔
Harmonic Resolution	63rd
Communications	
RS-485 Port Speed	38.4k
Onboard Ethernet Speed	10/100MB
Onboard HTML Web Pages	✔
Display	Option
Input/Output	
KYZ output	✔
Digtal I/O (available on unit)-optional	8
Event Capture	
WFC Steady State	✔
WFC Disturbance	✔
100 ms Event Recording	✔
Metering Characteristics	
Sampling Rate (Samples/Cycle)	128
Specifications	
Voltage Input-Nominal full scale (Vac)	347 L-N
Control Voltage Range DC	100 V
Control Voltage Range (Vac)	90-305 V
Current Inputs Range	0-10A
Accuracy IEC 60687 class	0.5 S
Accuracy ANSI	12.2
DIN Rail Mountable	✔

Ordering Information

Part (Type)	Description
CM3350	Circuit Monitor, same features as CM3250 with disturbance monitoring
CMDVF	4-line x 20 character Vacuum Fluorescent Display with IR port
ECC21	Ethernet Communication Card w/HTML capabilities
IOC44	Field installable I/O card with 4 inputs, 3-relay outputs, 1 pulse output
CM3MA	Bracket adapter—back to back display/meter mounting or CM2 series retrofits
CM3LA	L-Mounting bracket adapter

Critical Characteristics:

1. New meters shall be compatible with the existing meters already installed at the uptown campus under SUCF Project № 37011

2. New meters shall be compatible with Square D power logic software; such that all variables monitored can be logged and read at the existing monitoring station in the control room of the heating plant at the uptown campus.

3. For all the variables monitored, see the previous pages.

4. All new and existing software shall be routinely updated and upgraded as per the manufacturer's recommendations.

5. All meters installed at the main feeders (13.8kV) or at the main buildings service, shall meet or exceed the accuracy requirements of the utility (NIMO) revenue metering and ANSI standard C12.20

DIRECTIVE 16-7 Issue date: January 2003

CAMPUS ELECTRIC DISTRIBUTION SYSTEM

1. General: This Directive has been developed to serve as a standard for the various components of the Campus electric distribution system.

2. Policy

   a. The Campus electric distribution system shall be designed and specified to provide for a high degree of reliability, safety, and continuity of service. Special design features such as dual selective feeders or double-ended switchgear shall be provided when required by the Campus Master Plan and/or the Project Program.

   b. All projects to modify a Campus electric distribution system must be designed to provide equal or better reliability than the original system.

   c. Grounded systems are preferred because of the ability to coordinate clearing of ground faults.

   d. Working in live manholes is prohibited.

3. Design and Performance Criteria (Over 600 Volts)

   a. Cable Construction

      (1) Single conductor, EPR (Ethylene-propylene-rubber) or Kerite insulated, shielded power cables for use at conductor temperatures of 105ºC for continuous normal operation, 140ºC for emergency overload conditions, and 250ºC for short-circuit conditions. Cross-linked polyethylene insulation or lead shall not be used.

         (a) AEIC CS6 for Ethylene Propylene Rubber Insulated Shielded Power Cables (does not apply to Kerite).
         (b) ICEA Publications S-93-639 and S-97-682 and NEMA Publication WC74 for Ethylene-propylene-rubber insulated wire and cable.
         (c) UL Standard 1072 for Type MV 105.

(2) Conductor: Uncoated copper, Class B Stranded per ASTM B-8 or Part 2 of ICEA. Aluminum conductors permitted only at SUNY/Buffalo – Amherst.

(3) Conductor size: No. 6 AWG minimum. 500 kcmil maximum except 750 kcmil maximum at Stony Brook Health Science Center.

(4) Conductor shielding: An extruded semi-conducting material must be imposed between conductors and insulation. Shield shall meet or exceed electrical and physical requirements of ICEA S-97-682, AEIC CS6, and UL 1072.

(5) EPR or Kerite insulation over conductor shielding. EPR insulation shall meet or exceed electrical and physical requirements of ICEA S-97-682, AEIC CS6, and UL 1072.

(6) Insulation shield: Extruded semi-conducting thermosetting compound applied over the insulation. Shield shall meet or exceed the electrical and physical requirements of ICEA S-97-682, AEIC CS6, and UL 1072. The shield shall be free-stripping, leaving no residue on the insulation surface.

(7) Copper tape shield: Helically applied, 5 mil uncoated copper shielding tape with a minimum 12.5% lap applied directly over extruded insulation shield. This shield should not be utilized for unbalanced current in Wye-Wye systems or ground fault currents in excess of the ampacity of the shield times three (3) without a supplemental ground return path. Concentric URD cables are not acceptable.

(8) A polyvinyl chloride jacket shall be applied overall.

(9) Cables shall be manufactured and tested under a quality assurance program that meets the requirements of Section 10 CFR50, Appendix B, of the Federal Register as defined in ANSI N45.2.

(10) All cable shall be identified by means of surface ink printing indicating manufacturer, size, insulation type, insulation thickness, voltage rating, insulation level, year of manufacture, and UL designations.

(11) Certified Test Reports may be required.

b. Cable Insulation Rating: Cable minimum insulation ratings shall be based on the following:

Rating Nominal System Voltage		System Grounding *	Insulation
5 kV	2400 V	ungrounded, grounded	133%, nominal
5 kV	4160 V	grounded	133%, nominal
5 kV	4160 V, 4800 V	ungrounded	100%, nominal
15 kV	12.47 kV, 13.2 kV, 13.8 kV	grounded	133%, nominal
15 kV	12.47 kV, 13.2 kV, 13.8 kV	ungrounded	100%, nominal
25 kV	23 kV	grounded	133%, nominal
25 kV	23 kV	ungrounded	133%, nominal
35 kV	34.5/19.9 kV	grounded	100%, nominal

* Grounded system cable insulation ratings assume ground fault clearing times of less than 1 minute. If ground fault protection cannot clear ground faults in less than 1 minute, cable insulation ratings should be based on an ungrounded system.

c. Cable Installation

(1) Use pulling eye attached to conductors.

(2) Manufacturer's maximum pulling tension shall not be exceeded. Fund representative shall monitor dynamometer.

(3) A grounding conductor shall be provided in each duct to serve as a ground return path

(4) Arc-proofing: Show on drawings the extent of arc-proofing. Provide in all manholes and inside buildings where cables are run exposed.

d. Cable Testing

(1) DC high potential testing to be provided by an independent, NETA certified testing firm.

(2) Do not test existing cable.

(3) Use manufacturer recommended test voltages.

(4) Test ground back to source.

(5) Test phase rotation and sequencing for closed transition switching applications.

e. Warranty

(1) The cable manufacturer shall warrantee their cable for defects in manufacturer or design for 30 years from the time of energization.

(2) Circuit protection shall be submitted to cable manufacturer to verify that cable is properly protected.

f. Manufacturers: Consultant shall investigate manufacturers for inclusion in the specifications and be prepared to submit background data that qualifies each manufacturer specified. A minimum of three (3) manufacturers should be listed.

g. Identification

(1) All new underground circuitry shall include the installation of a metallic-lined, plastic underground marker tape. The tape shall be buried directly above the ductbank and contain the printed name repeated continuously along its length.

(2) Engraved nameplates: Provide at manholes and terminations. Include manufacturer, size, insulation type, conductor type, insulation thickness, voltage rating, insulation level, year of installation, and feeder designation.

(3) Identify rooms with services over 600 Volts with ***"Danger - High Voltage – Keep Out"*** warning signs.

h. Delivery and Storage

(1) No cable over one year old, when delivered to site, shall be used.

(2) Store at optimum temperature for installation in dry location. Seal cable ends against moisture.

i. Splices, Terminations, and Splicers

(1) Premolded preferred.
(2) Splicers experienced in splices used. Resume and certification to be submitted.

(3) Extent of arc-proofing to be shown.
(4) Ground shield at splice.
(5) Provide fault indicators at each splice.

j. Procedure for Splicing in Electric Power Manholes

(1) Comply with OHSA standards and regulations.

(2) Open and lock out all building transformer primary switches on the feeder to be spliced and verify, visually, that the switches have been cleared.

(3) In the main substation, shut down and lock out all feeders in the manhole. If in doubt, shut down and lock out all feeders to the Campus. Except in situations where it is not possible coordinate with SUCF Design & Construction Coordinators.

(4) Ground all phases of each feeder.

(5) When safe, remove grounds and verify with a meggar that all switches have cleared.

(6) Restore the grounds.

(7) In the manhole, identify the feeder to be spliced and cut it open. Ground all phases each end.

(8) In the main substation, identify the switch serving the cut cable.

(9) Provide mechanical protection and electrical insulation on remaining feeders in the manhole.

(10) Re-energize the remaining feeders.

(11) Prepare and splice the cable.

k. Ductbank and Manhole Design

(1) Size: Manholes must be adequate for new and future work and for safe clearances for working. Duct size to avoid “jam ratio” for three-conductor feeders. (NEC Ch. 9 Notes to Tables, Note 10.)

(2) Duct Shear: Provide duct reinforcement into manhole and building walls to prevent shearing at manhole and building entrances.

(3) Existing Raceway: Prior to bidding, existing spare unused raceway is to be cleaned and mandrelled. Existing conduit is also to be mandrelled by the contractor installing the new cable.

(4) Existing Manholes: Consultant shall survey existing manholes, take photographs, and prepare a report for SUCF. The report should note dimensions, duct arrangements, and describe grounding, splice, arc-proofing, duct bank shear, racking, and drainage conditions. The report should also identify any other equipment located within the manhole and provide photographs taken. Rehabilitation of detrimental existing conditions shall be included in the project scope.

(5) Where ducts cross or are close to steam or hot water pipes, the duct shall be insulated to mitigate thermal conditions beyond the cable safe operating temperature range.

(6) The Consultant shall update the campus one-line power distribution diagram at the completion of the modifications.

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