



**Request for Bids
Cable Bus Duct Bid
Bid No.: B16-014**

**Purchasing Department
73 Harlow Street
Bangor, Maine 04401
207-992-4282**

Issue Date: September 3, 2015

I. Introduction

The City of Bangor requests bids from qualified vendors to remove, install, and test electrical distribution equipment in accordance with attached documents and specifications.

II. General Information

General information is available on the City's website at the following web address: www.bangormaine.gov/proposals. By submitting a response to this solicitation, the bidder accepts the responsibility for downloading, reading and bidding by the terms and conditions set forth in the City's "General Information for Vendors". All questions shall be directed in writing to bids@bangormaine.gov.

III. Submission

To be considered, please return the Bid Form (page 3) and any other requested documentation in an envelope clearly marked "**Bid No.: B16-014: Cable Bus Duct Bid**" by **2:00 PM, Wednesday, September 23, 2015**, to the Purchasing Department, City Hall, 73 Harlow Street, Bangor, Maine 04401.

Bids may also be submitted via email by using the link at the top of this page or by sending to: bids@bangormaine.gov. If emailing bid, please reference "**Bid No.: B16-014: Cable Bus Duct Bid**" in the subject line. Bids will be publicly opened at the time stated above.

IV. Pre-Bid Meeting & Questions

A **mandatory pre-bid meeting** will be held at **10:00 A.M. on September 11, 2015** at the Waste Water Treatment Plant, Administration Building, 760 Main Street, Bangor, ME. All questions or request for clarifications must be submitted during the pre-bid meeting and they will be answered at that time or in the form of an addendum, if necessary.

V. Award

The bid award will be based on one or more of the following:

- Price of the unit offered and cost of replacement parts.
- Quality and performance of the unit offered.
- Availability of the unit.
- Prior history or experience with the Bidder, and prior history or experience with the unit offered.

VI. Information for Bidders

All specifications and other related information is attached, following the bid form.



Bid Form
Cable Bus Duct Bid
Bid No.: B16-014

Bid Deadline:
2:00 PM, Wednesday
September 23, 2015

Note: Item must be bid by using this Bid Form. Failure to comply may result in disqualification.

Item	Description	Qty.	Total Price
1	Cable Bus Duct	2	\$ _____
2	All personnel, labor, and other materials necessary for the completion of requested work.	Lump Sum	\$ _____
		Total:	\$ _____
Manufacturer: _____			
Number of days to complete the work upon receipt of a purchase order: _____ days			
<i>Price must include all miscellaneous charges: permits, fuel, transportation etc. No other charges will be accepted.</i>			

Business Name:			
Street or PO Box:			
City, State, Zip:			
Telephone Number:			
Fax Number:			
Email Address:			
Signature:			
Contact Name:			
Title:		Date:	

DOCUMENTS AND SPECIFICATIONS

FOR

480V BUS DUCT REPLACEMENT

**BANGOR WASTE WATER TREATMENT PLANT
BANGOR, MAINE**



Revision 1
Issued For Construction

AECOM Technical Services, Inc.
701 Edgewater Drive
Wakefield, Massachusetts 01880

J.N. 60427606

JULY 2015

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Section 16113 Procurement Specification Cable Bus Systems	16 plus 3 drawings
Section 16949 Electrical Demolition	2
Section 16998 Field Inspection and Acceptance Tests	6

NOTE: Bidders shall check the attached documents with the above list before submitting a Bid.

END OF TABLE OF CONTENTS

SECTION 16050

ELECTRICAL WORK - GENERAL

PART 1 - GENERAL

1.0 DEFINITIONS:

- A. Owner: City of Bangor, Bangor, Maine including all authorized representatives.
- B. Manufacturer: Organization furnishing cable bus systems under Specification 16113
- C. Electrical Contractor: Organization installing and testing cable bus systems.
- D. Engineer: Designated technical representative of the Owner.

1.01 DESCRIPTION:

- A. Remove, install, and test electrical distribution equipment, as indicated and specified. The Electrical Contractor shall perform the work in accordance with the Sequence of Work shown on the Contract Drawings.
- B. Cable bus systems, provided under Specification Section 16113, shall be purchased and installed by the Electrical Contractor. The Electrical Contractor shall review the cable bus system shop drawings when submitted and provide any comments and all required field measurements to allow fabrication of the cable bus systems by the Manufacturer. The Electrical Contractor shall install and test the cable bus systems in accordance with the Manufacturer's instructions and the requirements of these specifications.
- C. Demolish existing temporary cables, pull boxes and wireway at the interface of transformer TR-2 secondary termination enclosure and 480V switchgear MB1B. Turn over the temporary cables to the Owner and dispose of other materials.
- D. Demolish the existing 480V bus duct system at the interface of transformer TR-1 secondary termination enclosure and 480V switchgear MB1A. Turn over the bus duct materials to the Owner.
- E. Only one main 480V breaker on the double ended switchgear and its associated power transformer will be permitted to be out of service at a time. All testing shall be completed on one main breaker cable bus system and shall be fully operational before the Electrical Contractor will be permitted to perform any demolition and associated installation of the second main breaker cable bus system.
- F. The Electrical Contractor shall review the proposed sequence of work and identify any additions or change to the Owner.

- G. The existing low voltage conduit and wire associated with the transformers and 480V switchgears, i.e. heaters and protection circuits, shall only be de-energized with approval of the Owner.
- H. The Electrical Contractor shall provide heaters, wiring and associated modifications to accommodate the installation of the heaters within the existing 480V switchgear and transformer secondary termination enclosures as indicated.

1.02 RELATED WORK:

- A. Specification Section 16049: Electrical Demolition of Existing Electrical Equipment
- B. Specification Section 16113: Procurement Specification Cable Bus Systems
- C. Specification Section 16998: Field Inspection and Acceptance Tests

1.03 QUALITY ASSURANCE:

- A. Install all electrical work in conformance with the latest rules and requirements of National Fire Protection Association Standard No. 70 (National Electrical Code), and all state and local codes in effect at the time of contract award.

1.04 INTERFERENCE AND ERRONEOUS LOCATIONS:

- A. Locations of electrical equipment, cable bus layout, transformer secondary enclosures and 480V switchgear, as identified on the Contract Drawings, are approximate only. Exact locations are to be determined by detailed field measurement of the existing components by the Electrical Contractor prior to the fabrication of any equipment.
- B. Verify, in field, any data required for the work, and final locations of equipment to allow acceptable installation of the equipment.

1.05 APPROVAL AND EQUIPMENT IDENTIFICATION:

- A. Provide UL listed and labeled devices and materials.
- B. Where Underwriters' Laboratories listing is not available for equipment, submit test reports of an independent testing laboratory, approved by the Owner, indicating that the equipment is in conformance with applicable codes and standards.
- C. Provide all specified tests and inspections required for approval of the equipment installation.

1.06 TESTING AND ACCEPTANCE:

- A. Perform all field and functional testing as specified herein and in accordance with Sections 16998.

1.07 WORK PERMITS AND INSPECTIONS:

- A. Obtain all required work permits from the local authorities having jurisdiction.
- B. Pay all fees associated with permitting.
- C. Coordinate all inspections and approvals by local code enforcement inspectors.

PART 2 - PRODUCTS :

2.01 Heaters

- A. Provide space heaters for installation within the two (2) transformer secondary enclosures and the two (2) main switchgear main breaker cable entry compartments.

- B. Specifications:

1. Heaters shall have an aluminum housing with face mounted thermostat.
2. Thermostat range adjustable from 0 F to 100 F (-18 C to 38 C).
3. Four 10-32 x self-tapping screws to mount to equipment enclosures.
4. Ball bearing fan
5. Terminal strip with clamp connector that accepts both solid and stranded wire.
6. UL 508A Component Recognized; File No. E61997.
7. Rated 120V, 200 watts.
8. Provide Hoffman Model Number DAH2001A.

2.02 In-Line Fuses and Holders

- A. In-line fuse holders, single-pole, 250V, 20 A rated with 5 amp fuse and crimp terminals sized to accommodate existing control wiring; Cooper Bussmann HFA Series In-Line Fuse Holders
- B. Cooper Bussmann fuses, 5A, 250V rated.

PART 3 - EXECUTION

3.00 HOISTING, SCAFFOLDING, STAGING, AND PLANKING:

- A. Provide, set-up, and maintain all required hoisting equipment, scaffolds, and staging planking, and perform all hoisting required to complete work of this Section as indicated and specified.
- B. Scaffolds shall have solid backs and floors to prevent materials from dropping to the floors or ground.

3.01 PROTECTION OF ELECTRICAL EQUIPMENT DURING STORAGE AND CONSTRUCTION:

- A. Cable bus systems shall be shipped to the project site and stored in accordance with Manufacturer's instructions.
- B. All electrical equipment is considered "in storage" regardless of location until first energized. Manufacturer's recommendations for storage precautions, conditions, and care shall be followed.

3.02 CABLE BUS INSTALLATION:

- A. Perform installation of the cable bus systems in accordance with the Manufacturer's drawings and instruction manuals.
- B. Any cutting, drilling and modifications to existing equipment enclosures and busses shall be approved by the Owner and Engineer prior to performance of this work.
- C. Miscellaneous hardware, copper bus spacers, etc. required to complete the installation of the cable bus systems shall be provided by the Electrical Contractor at no cost to the Owner.
- D. Electrical Contractor shall utilize calibrated crimping tools and dies that match the crimp style lugs. to be provided by the cable bus systems Manufacturer under Section 16113, when installing the lugs to the cables.
- E. Final installation of heat shrinking at each termination to be performed by the Electrical Contractor.
- F. After testing is complete install all panels and hardware to close the system enclosures prior to energizing.

3.03 INSTALLATION OF ADDITIONAL SPACE HEATERS

- A. Install a heater and inline fuse holder to the internal vertical surface of the:
 - Transformer TR-1 secondary termination compartment
 - Transformer TR-2 secondary termination compartment
 - 480V Switchgear MB1A breaker compartment.
 - 480V Switchgear MB1B breaker compartment
- B. Extend existing wiring as required to connect to in-line fuse holders and heaters.
- C. Within 480V switchgear, wire fuse holder and heater in parallel to existing.
- D. Install 5 amp rated fuses within fuse holders.
- E. Verify operability of heater circuits and set thermostats to 45 degrees.

3.04 TESTING:

A. GENERAL:

1. Provide testing in accordance with Section 16998.

END OF SECTION

SECTION 16113

PROCUREMENT SPECIFICATION CABLE BUS SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Provide two (2) complete engineered cable bus systems rated 4000 Amp/600 V 3-phase, 3-wire with ground for outdoor installation as indicated on the drawings.
- B. Systems shall be complete and include horizontal or vertical assemblies with installation kits, complete with the fittings, elbows, offsets, terminations, termination kits, hanging devices, adapter bars, expansion fittings, transformer terminations, switchgear terminations, bushing stud connectors, enclosure connectors, water tight environmental seals, flanges, and accessories to provide a complete system as specified and as indicated.
- C. The 600 volt rated cable bus systems shall be installed between transformer TR-1 secondary termination enclosure and Switchgear MB1A and between transformer TR-2 secondary termination enclosure and Switchgear MB1B.

1.02 RELATED WORK BY ELECTRICAL CONTRACTOR:

- A. Section 16050: Electrical Installation Work - General
- B. Section 16949: Electrical Demolition of Existing Electrical Equipment
- C. Section 16998: Field Inspection and Acceptance Tests

1.03 REFERENCE STANDARDS:

- A. IEEE: Institute of Electrical and Electronics Engineers:
 - 1. ANSI/IEEE C37.23 – IEEE Standard for Metal Enclosed Bus.
- B. NEC: National Electrical Code NFPA 70
- C. NETA: International Electrical Testing Association
- D. NEMA: National Electrical Manufacturers Association
- E. ICEA: Insulated Cable Engineers Association

- F. UL: Underwriters Laboratories
- G. ASTM B3: American Society for Testing and Materials Standard Specification for Soft or Annealed Copper Wire
- H. State and Local Codes.

1.04 SUBMITTALS:

- A. Submit four (4) copies of a complete engineered submittal as indicated below to the Owner for review prior to release for fabrication.
 - 1. Equipment material lists keyed to plan and cross-sectional drawings. Drawings shall show outline dimensions and arrangements of the equipment, including plans and elevation drawings, catalog designations, materials of construction, and the approximate weights of each assembly. Also submit details of interface requirements between new cable bus and existing switchgear and existing transformers.
 - 2. A complete dimensioned, physical layout, to scale, of all cable bus runs, including plans, elevations and sections, showing cable bus runs, connections to existing transformer secondary enclosure enclosures and the existing switchgear bus duct throat opening, elbows and fittings, cable supports, expansion fittings, thru-box weather tight seal transitions, and all other information required or recommended for a complete installation.
 - 3. Torque requirements listed in foot-pounds for cable bus assembly connecting bolts.
 - 4. Spacing, type, and size of cable supports used in horizontal and vertical runs of cable bus systems.
 - 5. Provide cable bus conductor temperature rise calculations and conductor current balance calculations per IEEE requirements, stamped by registered professional engineer (PE).
 - 6. Provide a computer model of the phase arrangement of current carrying conductors within the cable bus system. The computer model will include phase arrangement for conductors under a single conductor fault scenario so as to ensure current balance between remaining conductors.
 - 7. List of special tools required for erection, maintenance and adjustment of the equipment.
 - 8. Spare parts listing.

9. Complete submittal for the modification of the existing substation transformer secondary enclosure enclosures and the existing switchgear main service entry enclosures.

1.05 QUALITY ASSURANCE:

- A. Coordinate the cable bus size, rating and quantities with the actual equipment selected to ensure that equipment will operate as specified.
- B. Perform factory testing and inspections during and after fabrication to verify products are in accordance with the approved shop drawing submittal
- C. Identify any field measurements to be taken by the installing Electrical Contractor at the project site to allow for fabrication, installation and termination of the cable bus systems.

1.06 SITE CONDITIONS:

- A. Environment: Outdoors- -20 degree F to 100 degree F, salt air, snow, rain, sleet and blowing contaminants.
- B. Altitude above sea level: 20 ft.
- C. Maximum wind velocity: 100 miles per hour (3 second gust).
- D. Ice load: 10 pounds per square foot.
- E. Snow load: 40 pounds per square foot.

1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Ship all cable systems equipment prepaid to the project site in sturdy containers designed to prevent damage due to standard shipping and handling activities.
- B. Provide any special storage and handling required to maintain factory warranty of the installed systems.

1.08 WARRANTY:

- A. For a period of two (2) years from the date of installation the Manufacturer warrants to the Owner that the Power System Sections and Components provided under this Purchase Specification section conforms to these specifications and is free from defects in materials and workmanship. Any materials found to be defective within said warranty period shall be repaired or replaced by the Electrical Contractor and Manufacturer.

- B. Said warranty, containing no exclusions or limitations, shall be in a form acceptable to, and for the benefit of the Owner and shall be submitted by the Electrical Contractor as a condition of final payment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Superior Tray; ATT: Dave Mullally, 508-435-6800.
- B. Powell Delta/Unibus; ATT: Reggie Aguida, 708-409-1944.
- C. MDF Cable Systems; ATT: Mike Miller, 888-808-1655.

2.02 CABLE BUS - GENERAL:

A. General:

1. The cable bus systems shall be intended for outdoor installation and shall include fittings, elbows, offsets, terminations, termination kits, hanging devices, adapter bars, expansion fittings, bushing stud connectors, pull box enclosures, connectors, weather proof entrance seals, flanges, and accessories as specified and as indicated.
2. The cable bus system shall be capable of withstanding the site conditions as defined in Paragraph 1.06.

B. Enclosure:

1. All load carrying members of the cable bus system shall be fabricated from aluminum.
2. Outdoor cable bus shall have solid top covers, peaked to shed rain, and ventilated per the Manufacturers standard design.
3. Pull box enclosures to be provided with two removable covers to allow for cable and material installation and future inspection of cables.
5. Expansion fittings shall be supplied as required.
6. All hardware shall be 316 stainless steel.
7. All elements of the cable bus enclosure shall be so designed to eliminate any sharp edges or protrusions that may injure personnel or conductor insulation.

C. Low Voltage Cable Bus:

1. Ratings:

- a. 600V cable bus shall have rating as follows:
 - 1. Minimum Rated Voltage: 600V RMS
 - 2. Short Circuit Withstand Current: 100 KA symmetrical

2. Conductors:

- a. Provide copper conductors. Material and stranding of conductors to conform to ASTM B3.
- b. All current carrying conductors shall be type RHW-2 rated 90 deg C wet and dry, with ethylene propylene rubber insulation and with a chloro-sulfonated polyethylene outer jacket.
- c. The conductors shall be phased and supported to maintain low, balanced impedance and provide the strength necessary to prevent cable movement or damage under the rated short circuit currents.
- d. Conductors shall be of continuous length and be installed after the cable bus enclosure is installed.
- e. Provide aluminum equipment ground conductor, to be bonded to all aluminum enclosures of the cable bus systems.

1. Boxes:

- a. Provide NEMA 4 aluminum boxes to be secured to the top of the existing substation transformer secondary enclosures and existing switchgear bus duct throat openings.
- b. Each box to be provided with 2 removable covers and shall be sized in accordance with the requirements of the NEC
- c. Boxes shall also allow for installation to the existing electrical distribution equipment with neoprene seals at enclosure interfaces to prevent moisture entry.
- d. Provide stainless steel nuts, bolts, washers and lock washers for system installation.

D. Terminations:

1. Provide quantity 36 two (2) hole compression-type cable lugs with NEMA 2 hole spacing with heat shrinkable jacketing material.
2. Provide stainless steel hardware as required to mate with the existing bus configurations. Request special bolting hardware compatibility requirements from the Electrical Contractor prior to Provideing this hardware.

D. Additional Materials and Methods:

1. Bottom isolation blocks pre-installed at factory.
2. Glass fiber reinforced composite polymer isolation support blocks UL-V0 fire rated.
3. Top and bottom punched ventilated covers (14 gauge Heavy Duty).
4. Bottom covers welded in place.

E. Field Testing By Electrical Contractor. Refer to Section 16998.

1. Non-compliance of materials and equipment due to defects during fabrication with specified inspection and testing requirements will result in rejection of equipment.
2. In the event that the any portions of the cable bus systems are found to be defective, Provide new equipment which meets specified requirements at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION – BY ELECTRICAL CONTRACTOR:

APPENDIX I

Existing Equipment Reference Drawings

1. Switchgear Front View; General Electric Drawing Number 0172D8456 Sh 1.
2. Transformer Termination Secondary LV Flange; General Electric Drawing 175C1532PB Sh 1.
3. Transformer Termination Secondary LV Flange; General Electric Drawing 175C1532PB Sh 3.

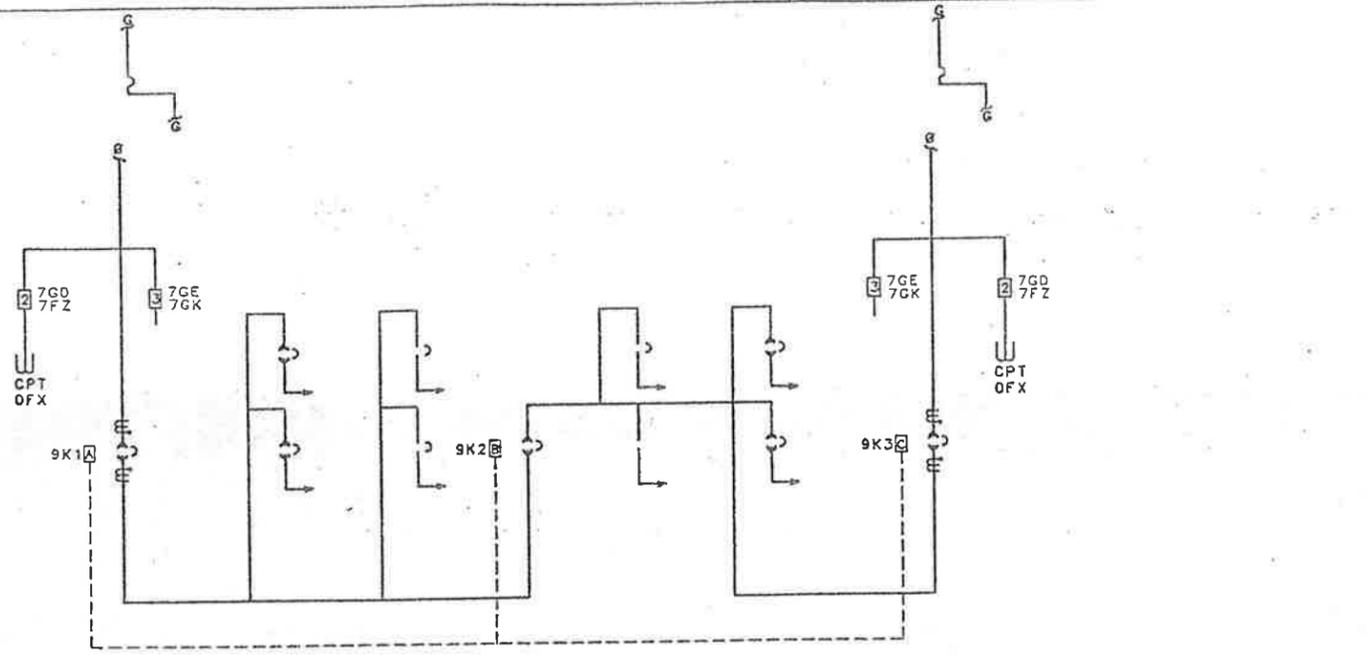
ANSI SHORT CIRCUIT RATING : 65 KA RMS (SYM)
 BASED ON RATING OF SMALLEST FRAME RATING.
 BUS BRACING : 65 KA RMS (SYM)

THIS DRAWING NOT TO SCALE

REV. 01
 0172D8456
 CCHTON SH. 2 SH. NO. 1
 POWERBREAK 11 & AV3 SWITCHBOARD
 FRONT VIEW
 REON. 440-78354B
 S.O. 962246

CUSTOMER : BANGOR WWTP
 CUSTOMER ORDER NO. : DS115400-08
 STATION :
 LOCATION : BANGOR, MAINE
 CONTRACTOR :
 CONSULTANT :
 DISTRIBUTOR : STANDARD ELECTIC CO.
 DISTRIBUTOR ORDER NO. :
 CONSTRUCTION : PROTECTED-AISLE
 RATED : 480V-3PH-3W-60HZ
 MAIN BUS : 4000A/CU
 NEUTRAL BUS :
 GRD BUS : 800A/CU
 G.E. SUB NO. : 1
 INSTALLATION NO. :

CUSTOMER SUB.
 MB1A, MB1B

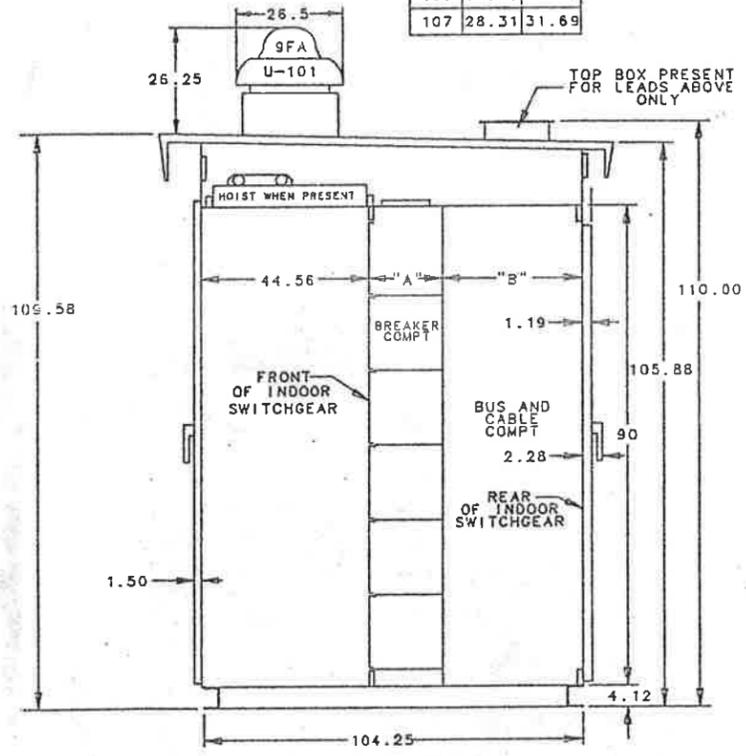
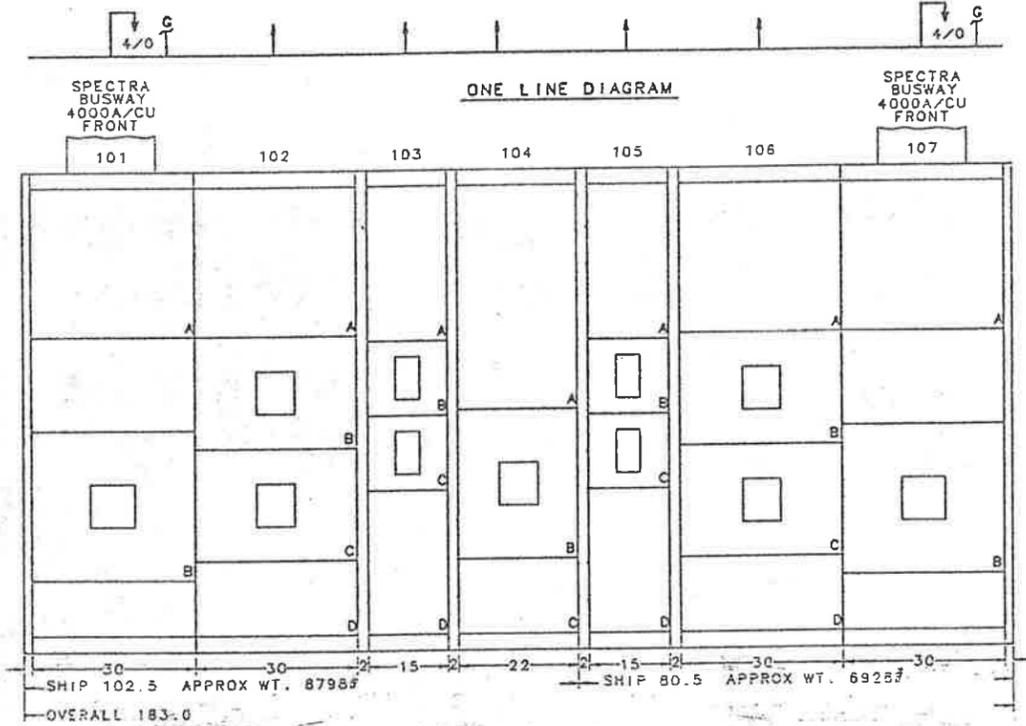


"A" - "B" DIM.

UNIT NO.	"A" BKR. COMPT	"B" CABLE COMPT
101	28.31	31.69
102	17.00	43.00
103	11.69	48.31
104	17.00	43.00
105	11.69	48.31
106	17.00	43.00
107	28.31	31.69

BREAKER DATA-TABLE 1

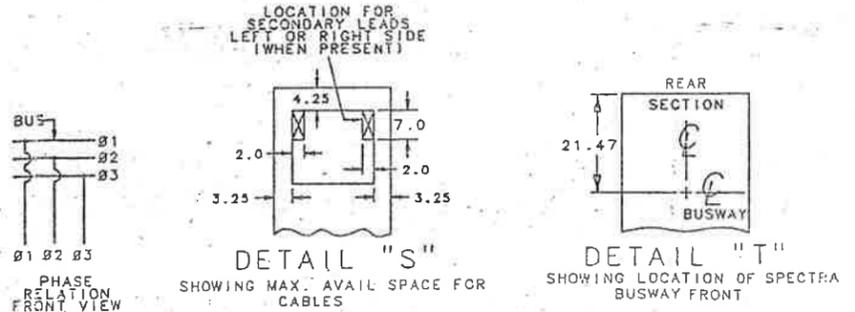
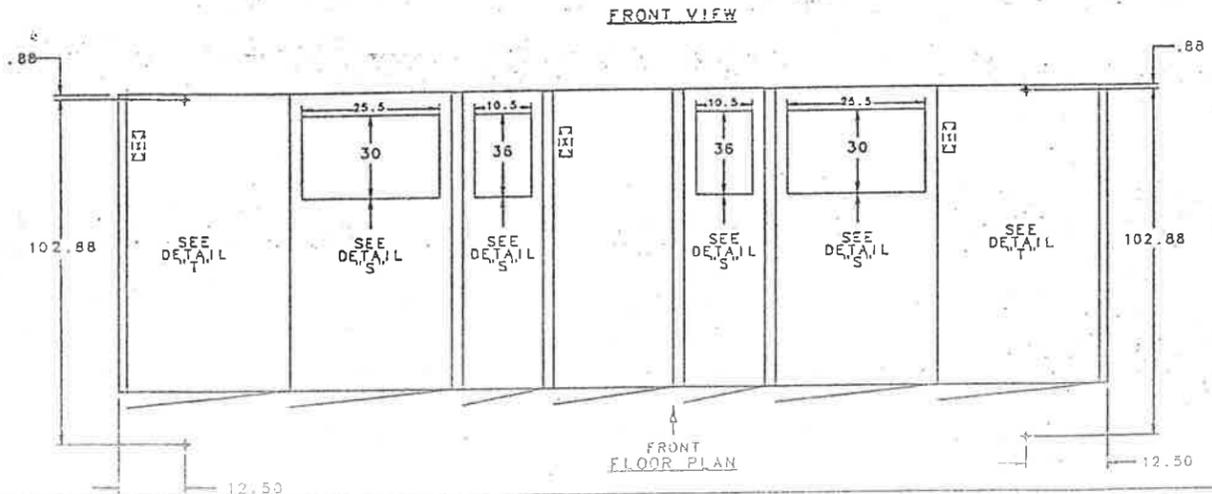
SECT AND COMPT	BREAKER NO.	BREAKER TYPE	FUSE AMPS	E OR M	SENSOR AMPS	TRIP/PLUG RATING
101B	0337A6490 -001	TC4040SS		M	4000	4000
102B	0337A6490 -003	TC1616SS		M	1600	1600
102C	0337A6490 -003	TC1616SS		M	1600	1600
103B	0337A6490 -6WZ	TFL236225		M		225
103C	0337A6490 -6WN	TEL136100		M		100
104B	0337A6490 -002	TC2020SS		M	2000	2000
105B	0337A6490 -6WZ	TFL236225		M		225
105C	0337A6490 -9F1	TFL236225		M		FUT
106B	0337A6490 -003	TC1616SS		M	1600	1600
106C	0337A6490 -003	TC1616SS		M	1600	1600
107B	0337A6490 -001	TC4040SS		M	4000	4000



TYPICAL SIDE VIEW
 PROTECTED AISLE POWERBREAK & AV-3 SWITCHBOARD

BREAKER DATA-TABLE 2

SECT AND COMPT	C.T. MK NO. & SIZE	TERMINALS		
		PHASE	NEUTRAL	GROUND
101B	5J4 3-4000/5			
102B		5-400MCM		5-4/0
102C		5-400MCM		5-4/0
103B		3-4/0		1-#4
103C		3-#2		1-#8
104B				
105B		3-4/0		1-#4
105C				
106B		5-400MCM		5-4/0
106C		5-400MCM		5-4/0
107B	5J4 3-4000/5			



POWERBREAK 11 & AV3 SWITCHBOARD
 FRONT VIEW
 ENGR. MARK KOZLOWSKI SMY 0337A6490 DESIGNER DANA HAMMER
 ISSUED REON 440-78354B S.O. 962246
 MADE BY M.K. APPROVAL SWITCHGEAR 0172D8456
 DATE 7-11-91 BURLINGTON, IA CONTON SH. 2 SH. NO. 1

TITLE

OUTLINE (LV FLG)

NEMA-8

DAD-PB

NOTE

△ 3 2.50 X 2.50 ANGLE BRACE.
(LOCATION WILL VARY WITHIN SHADED AREA)

LEGEND

33. ONE INCH STD. PIPE FROM HV FLG.

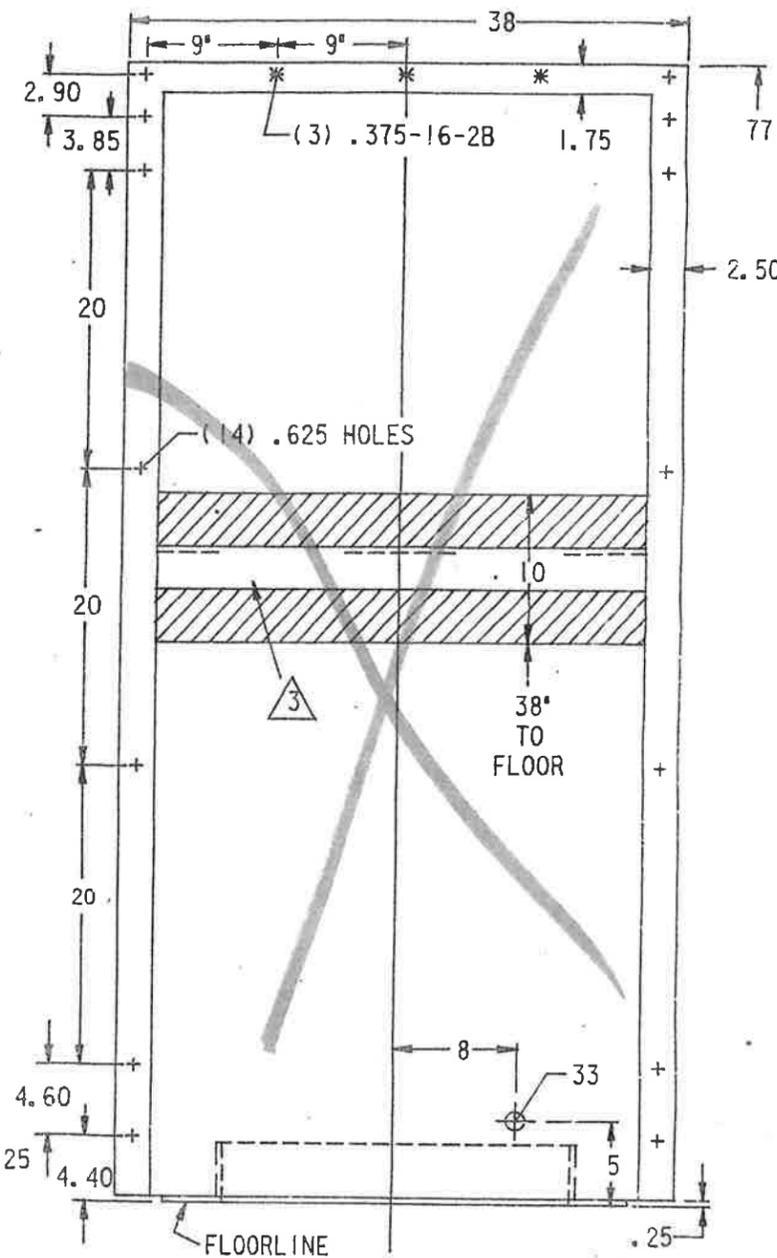
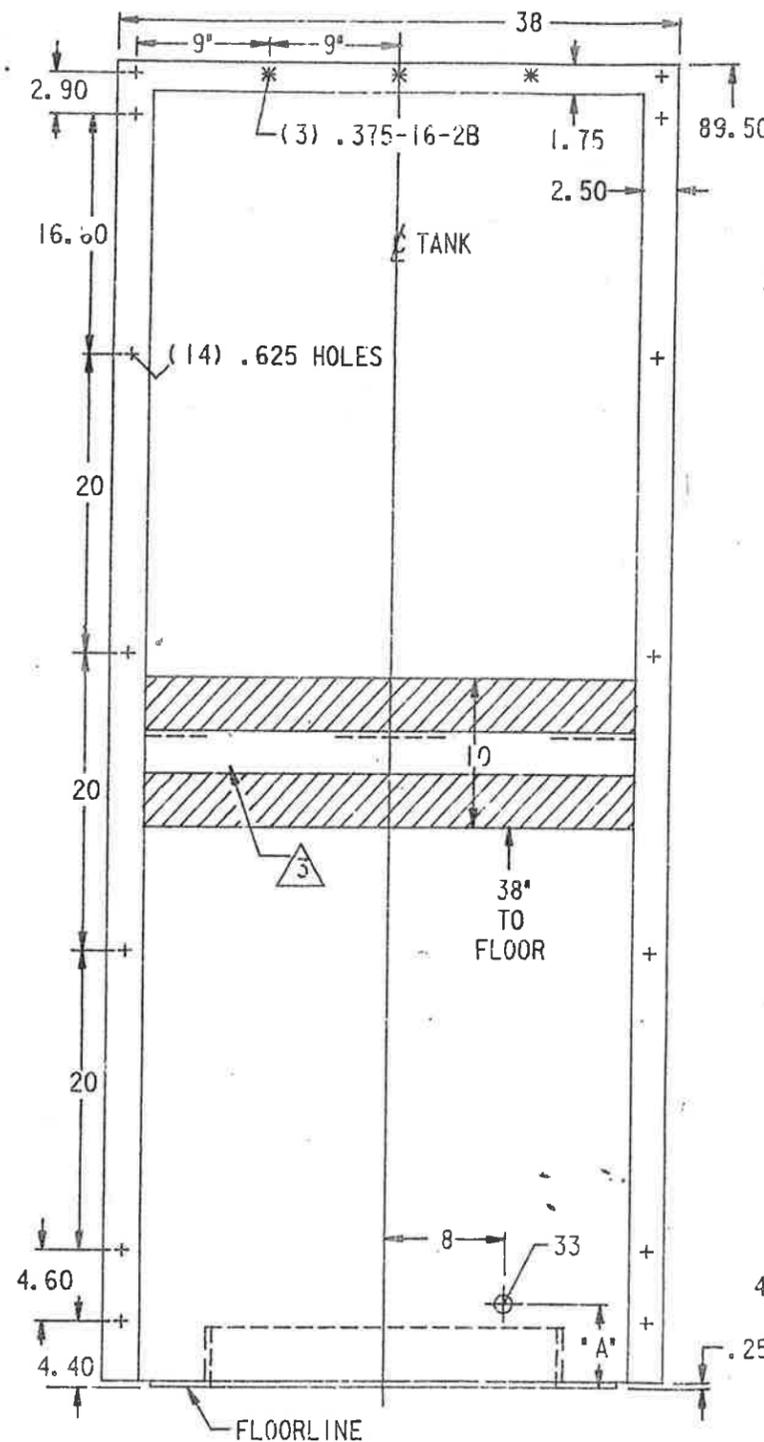
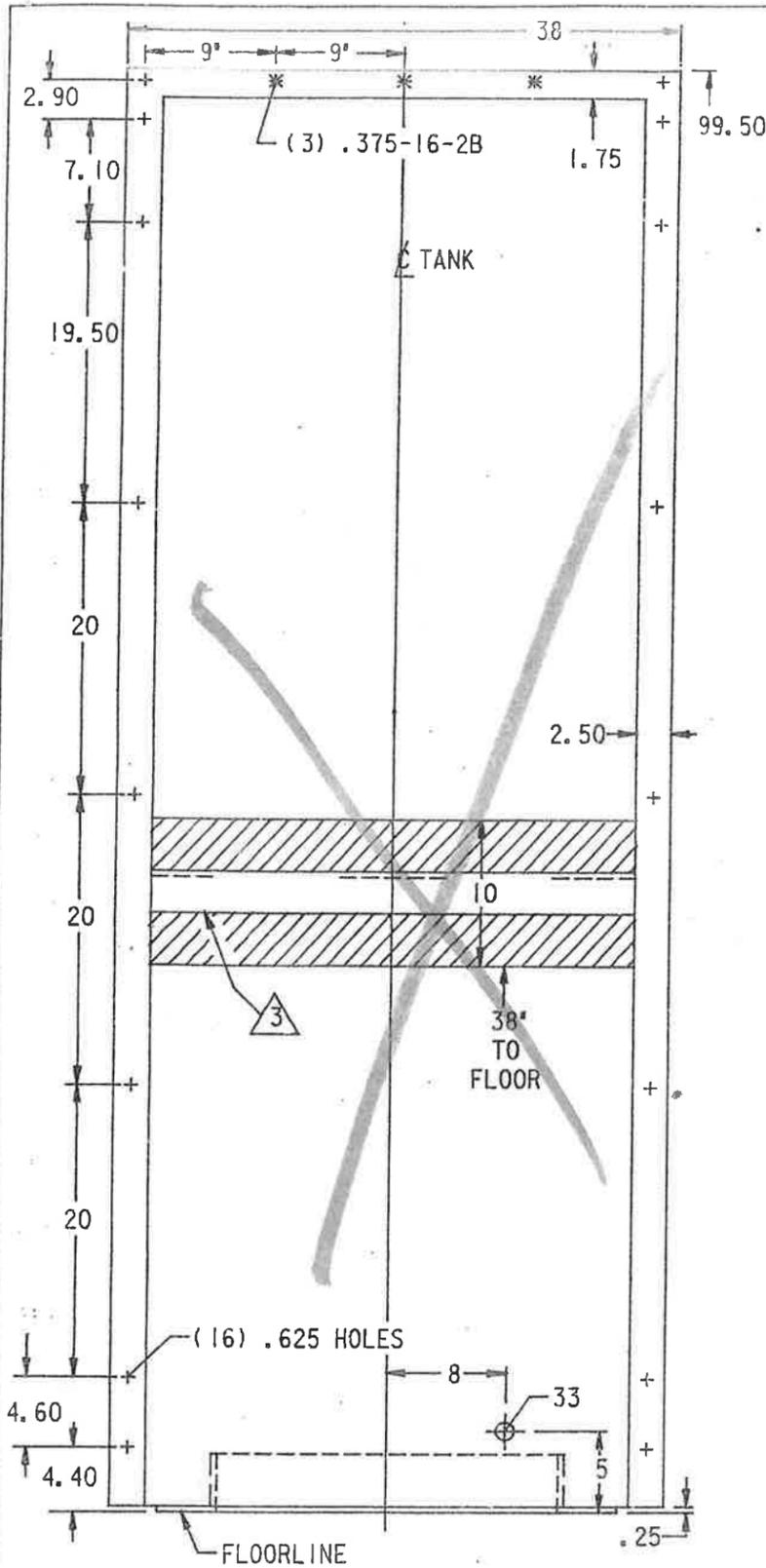


FIG. 1 (WITHOUT IT. 33)

FIG. 2 (WITH IT. 33)

FIG. 3 (WITHOUT IT. 33)

FIG. 4 (WITH IT. 33 A=5)

FIG. 19 (WITH IT. 33 A=6")

FIG. 5 (WITHOUT IT. 33)

FIG. 6 (WITH IT. 33)

REVISIONS PRINTS TO

NO.	DESCRIPTION	DATE	BY	CHKD.
1	As Shown			
2	Change to 33" dia. pipe	5/21/58		
3	Change to 33" dia. pipe	5/21/58		
4	Change to 33" dia. pipe	5/21/58		

MADE BY
APPROVALS

M T D
ROME, GA.

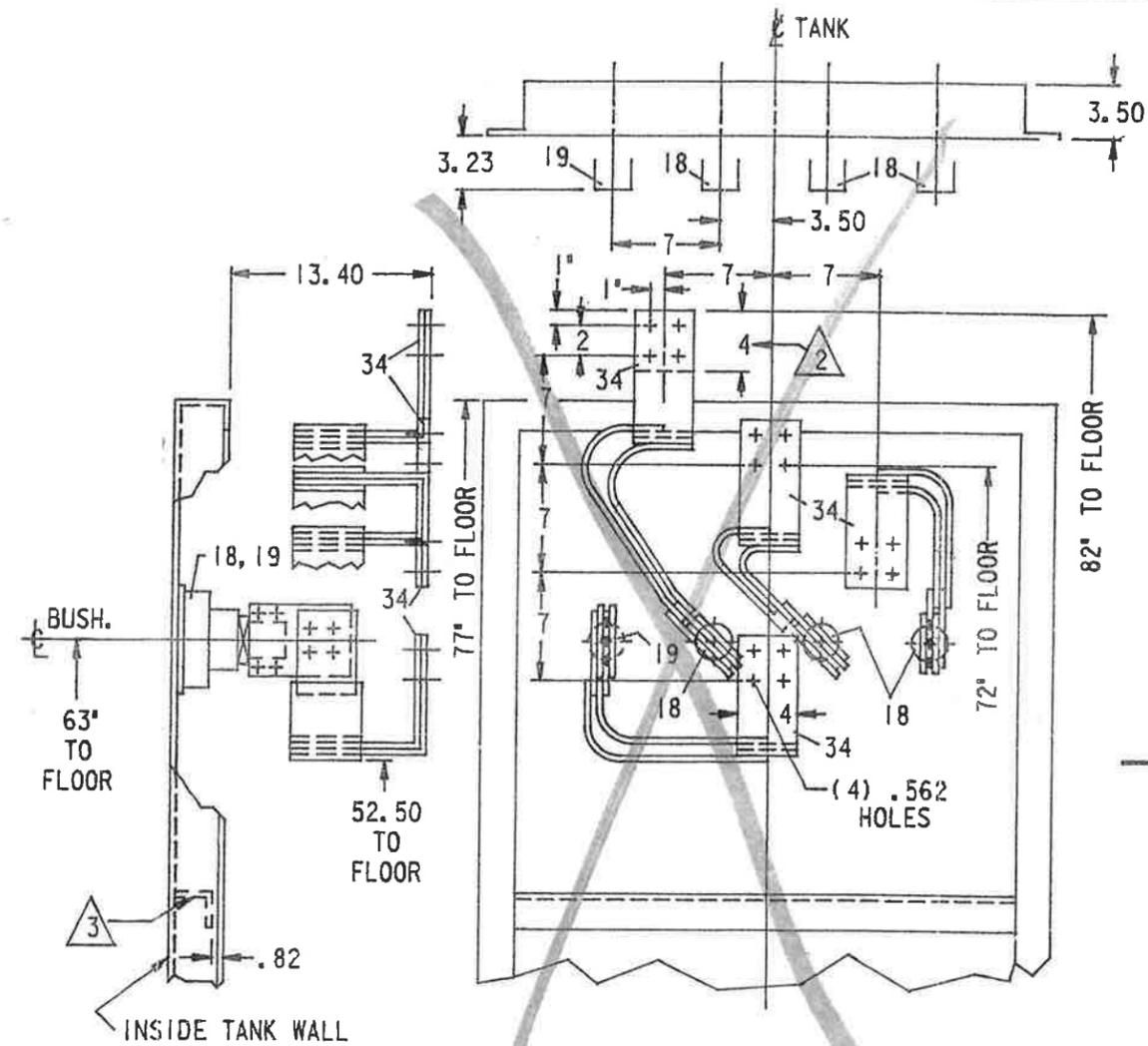
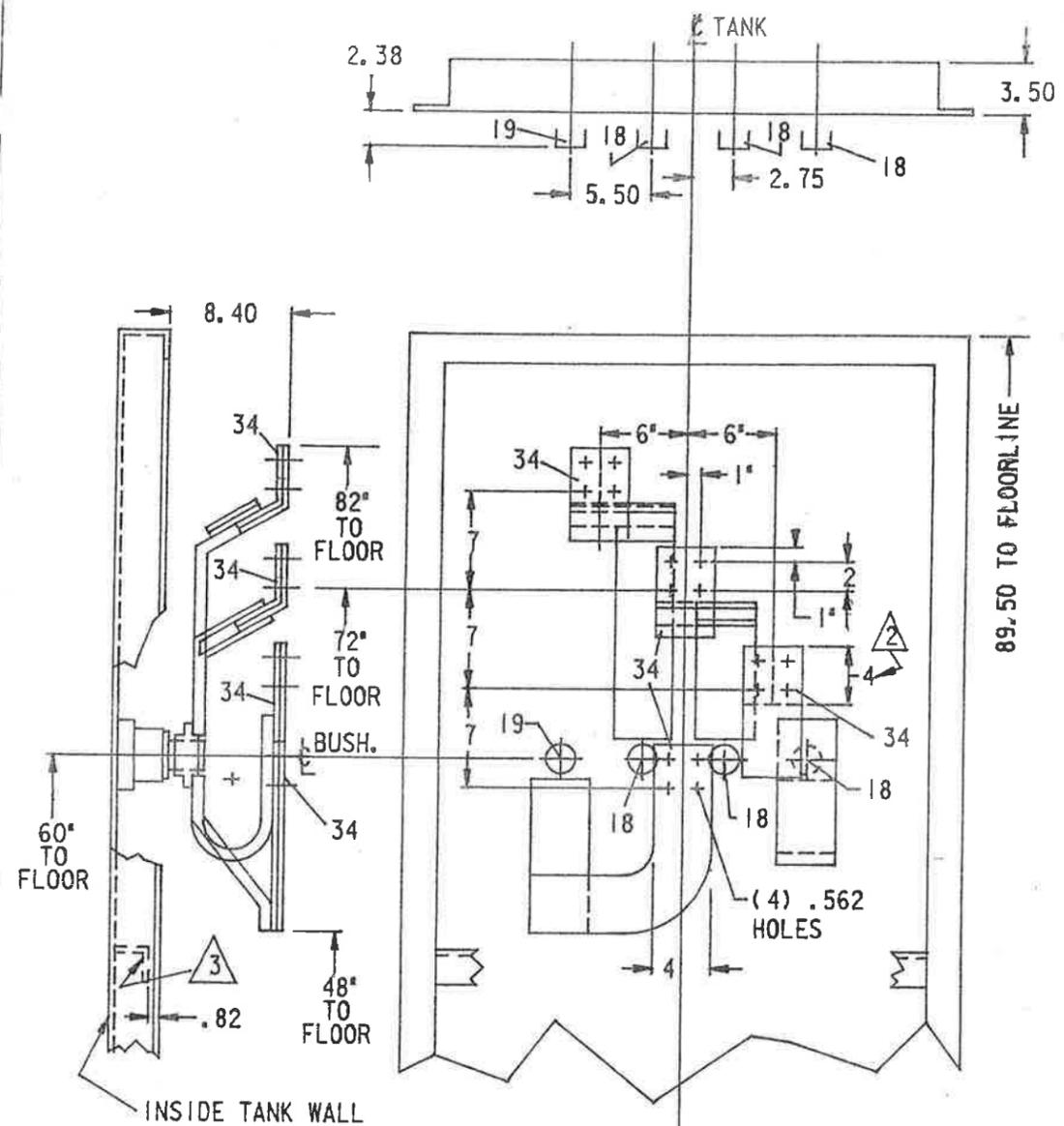
175C1532PB
CONT ON SH 2 SH NO. 1

TITLE

OUTLINE (LV FLG.)

FIRST MADE FOR NEMA-8

DAD-PB



LEGEND

- 18. BUSHING FOR LV WINDING
- 19. NEUTRAL BUSHING FOR LV WINDING
- 33. ONE INCH STD. PIPE FROM HV FLG.
- 34. CONNECTOR FOR ITEMS 18, 19
- 35. USER'S ENTRANCE FOR POWER TO FANS (WHEN FURNISHED) STD. ARR. UNITS ONLY.
- 36. USER'S ENTRANCE FOR POWER TO FANS (WHEN FURNISHED) REV. ARR. UNITS ONLY.

NOTES

- 1 SILVER PLATED CONTACT SURFACE (2" X 4")
- 2 SILVER PLATED CONTACT SURFACE (4" X 4")
- 3 2.50 X 2.50 ANG. BRACE (FOR LOCATION SEE SH. 1)

REVISIONS	PRINTS TO
1 DAD JUN 23 1979	
2 DAD JUN 25 1979	
3 DAD JUN 19 1979	

MADE BY
 APPROVALS

M T D
 POME, GA.

175C1532PB
 CONT ON SH 4 SH NO. 3

APPENDIX II

Existing Equipment Photographs

PHOTO II-1

TEMPORARY CABLE SYSTEM WITH WIREWAYS AND BOXES
INSTALLED AT 480V SWITCHGEAR MB1B (LEFT) AND
TRANSFORMER TR-2 SECONDARY TERMINATION ENCLOSURE (RIGHT).
NOTE EXISTING BUS DUCT BETWEEN 480V SWITCHGEAR MB1A AND
TRANSFORMER TR-1 SECONDARY TERMINATION ENCLOSURE IN BACKGROUND

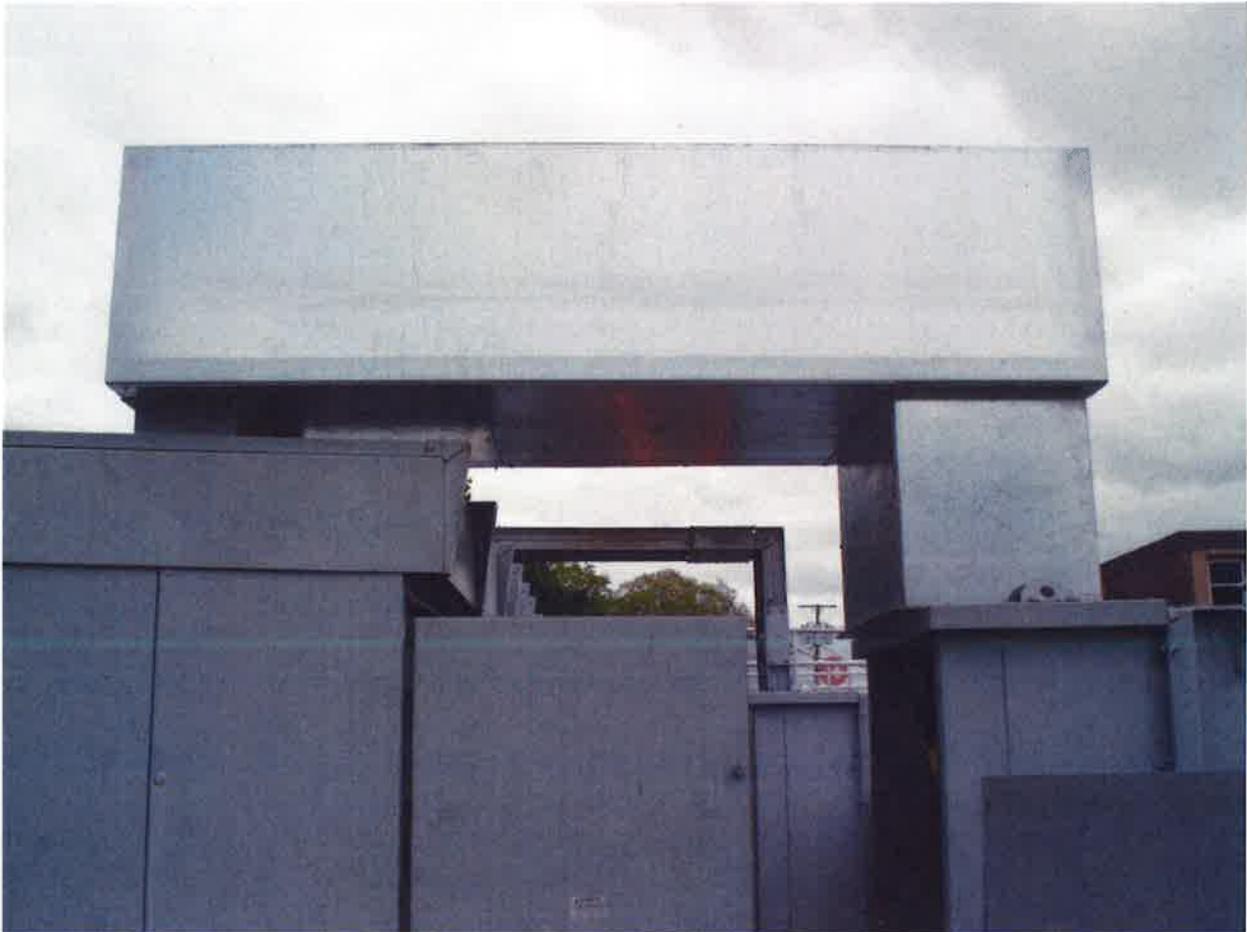


PHOTO II-2

EXISTING 480V BUS DUCT ENTERING 480V SWITCHGEAR MB1A
AT BUS DUCT THROAT EXTENSION

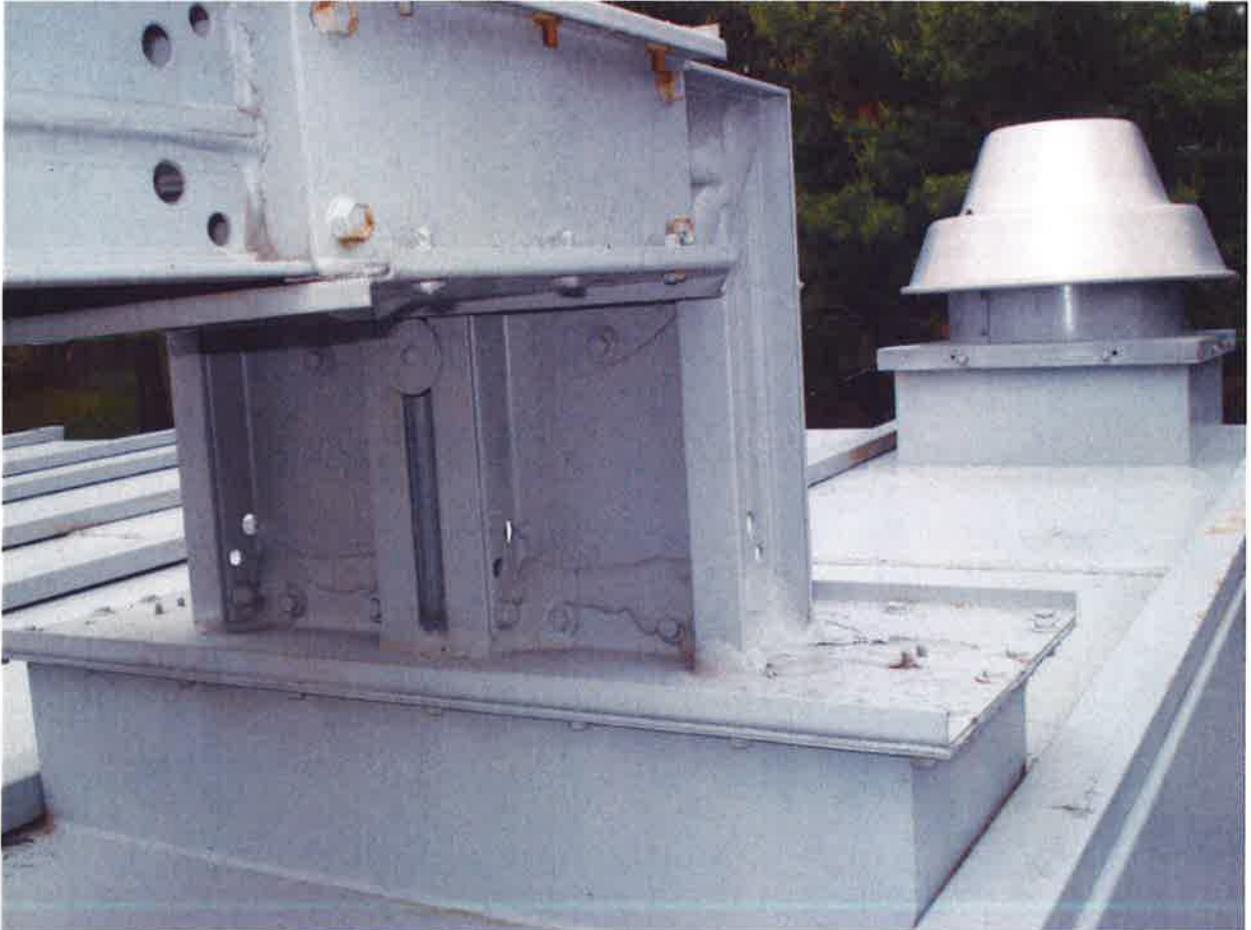


PHOTO II-3

EXISTING BUS DUCT ENTRY INTO TOP OF TRANSFORMER TR-1
SECONDARY TERMINATION ENCLOSURE

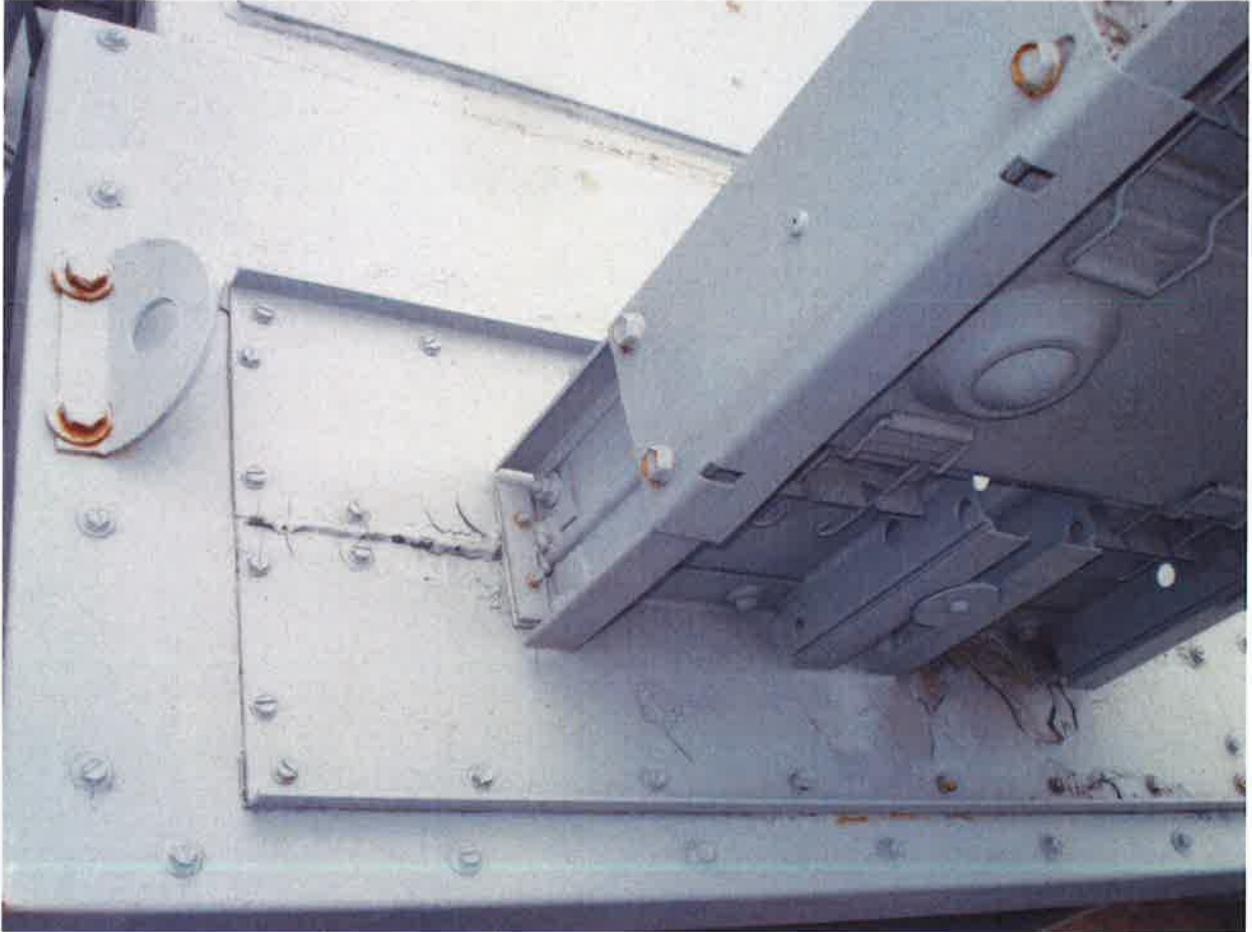


PHOTO II-5

EXISTING 480V BUS DUCT TERMINATED TO SWITCHGEAR MB1A
TERMINATION BUSES

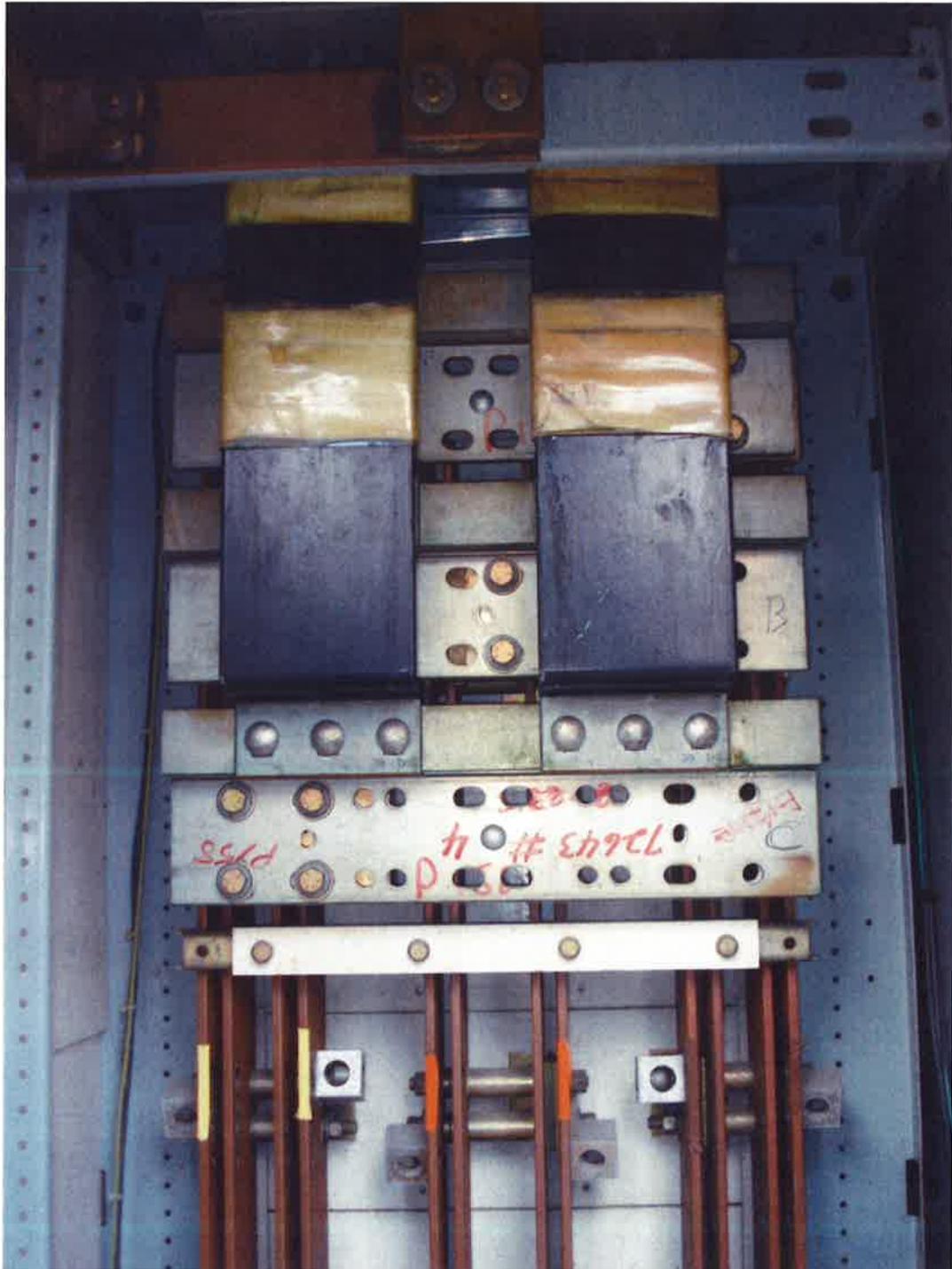


PHOTO II-6

EXISTING TEMPORARY CABLES TERMINATED TO TRANSFORMER TR-2
SECONDARY TERMINATION BUSES



PHOTO II-7

EXISTING 480V TEMPORARY CABLES TERMINATED TO SWITCHGEAR MB1B TERMINATION BUSES

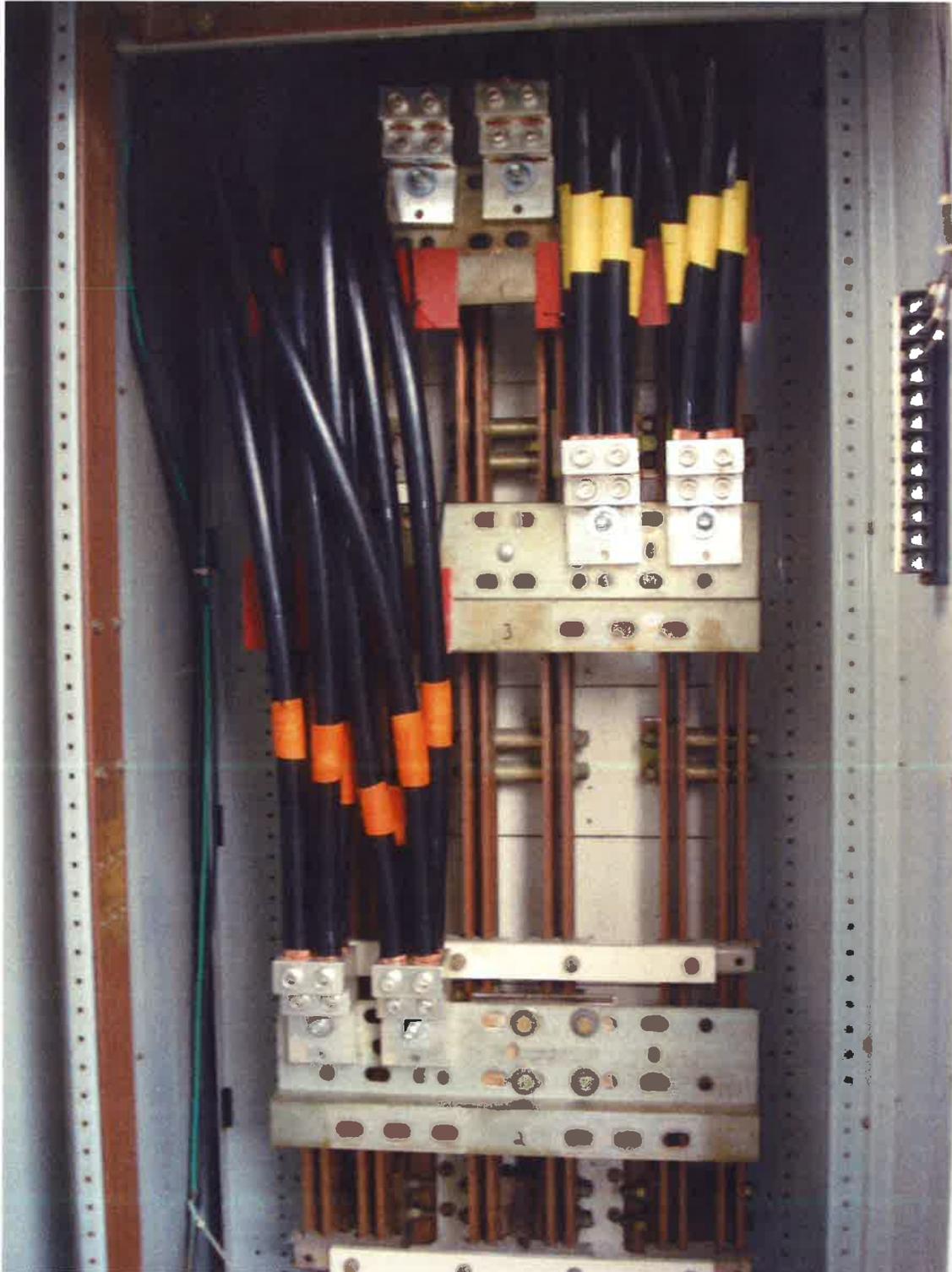
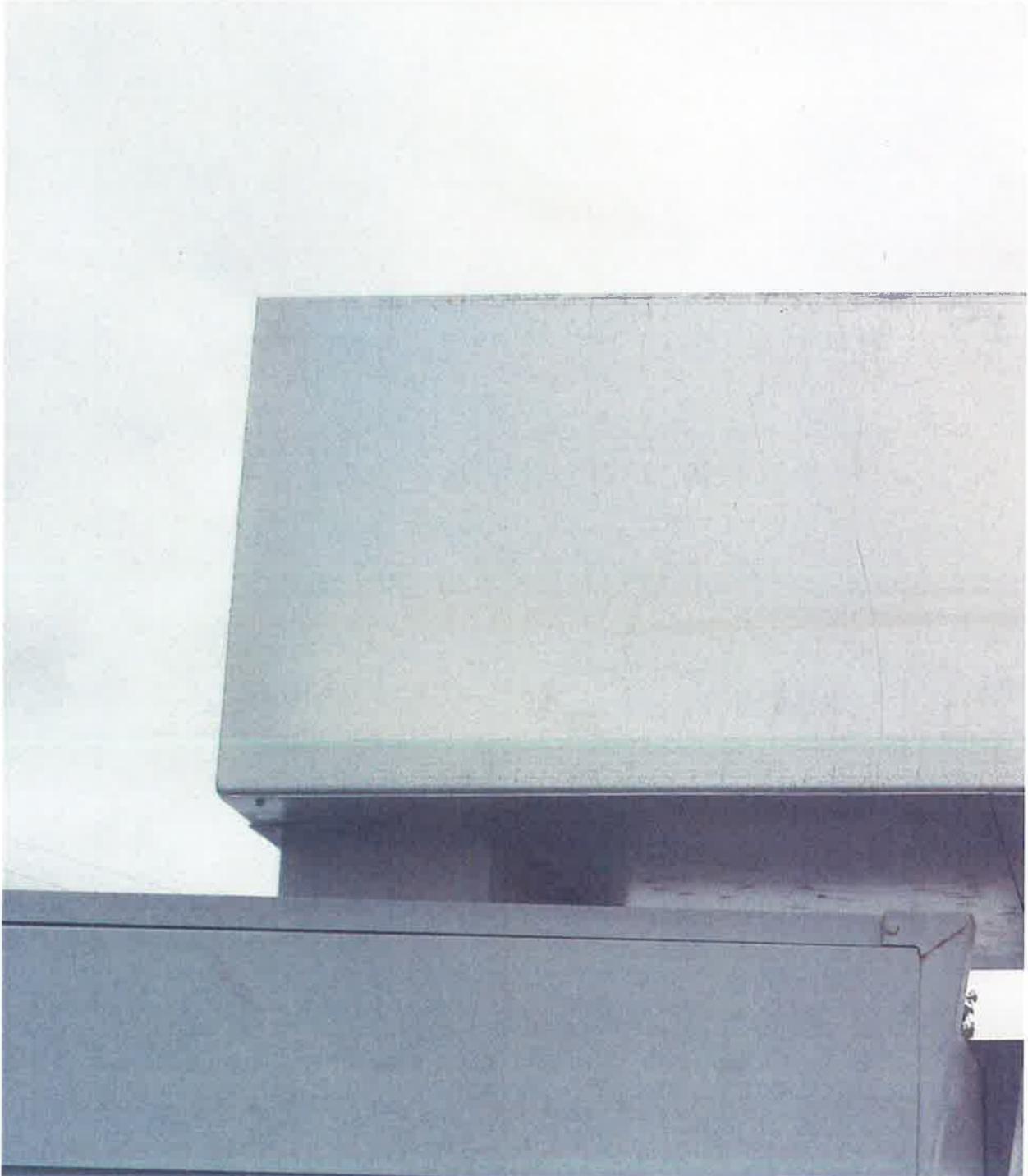


PHOTO II-8

CLOSE UP OF TEMPORARY ENCLOSURE BOLTED TO TOP OF EXISTING 480V SWITCHGEAR BUS DUCT ENTRY THROAT EXTENSION



END OF SECTION

SECTION 16949

ELECTRICAL DEMOLITION OF EXISTING ELECTRICAL EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Provide labor to remove items defined by Contract Drawings, provide materials and hardware for patching, plugging and refurbishing equipment intended for re-use.
- B. Perform bus and enclosure modifications at existing equipment where required for the installation of the new cable bus systems.

1.02 REFERENCE STANDARDS:

- A. National Electrical Manufacturers Association - NEMA.
- B. National Electrical Code.
- C. State and Local Codes.
- D. UL: Underwriter's Laboratories Inc., Pfingsten Road, Northbrook, IL
- E. OSHA: Occupational Safety & Health Administration, North St., Boston, MA.

1.03 QUALITY ASSURANCE:

- A. Provide the services of a licensed electrician skilled in the voltage levels and materials used within the electrical demolition work.
- B. Disconnect all electrical equipment indicated to be removed, relocated or demolished.
- C. All reconnection or temporary wiring required by the demolition shall be done by licensed electrical craftsmen in accordance with the NEC and all state and local codes as required by the local wiring inspector.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 ELECTRICAL DEMOLITION:

- A. The Electrical Contractor shall submit a demolition plan to the Owner for review fourteen days prior to any demolition. The demolition plan shall indicate the extent of equipment being removed or disconnected and the period of time the facility will remain in operation with reduced capability. Only one side of each bus system can be taken out of service at any time. No demolition shall take place without the written acceptance of the demolition plan from the Owner.
- B. Erect temporary dust and mist tight barriers prior to the start of demolition in areas where electrical equipment is to remain energized.
- C. Dispose of the demolished equipment and materials by hauling off-site and disposing of at a state licensed facility with the exception of the temporary cables and bus duct assembly which shall be turned over to the Owner. Receipts for any hazardous material showing transportation carrier, and ultimate destination shall be turned over to the Owner for permanent record.
- D. Extent of Demolition:
 - 1. Demolition includes de-energizing and disconnecting all electrical equipment within the areas to be demolished as indicated. The Electrical Contractor is required to examine the Contract Drawings, visit the site, and discuss these areas with the Owner prior to the start of work.
 - 2. The removal of electrical equipment after de-energization and disconnection will be the responsibility of the Electrical Contractor.
- E. Ensure that all equipment and hardware items are on hand before attempting any demolition or remedial work.
- F. Provide any temporary connections that may be required for plant operations.

END OF SECTION

SECTION 16998

FIELD INSPECTION AND ACCEPTANCE TESTS

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Provide field inspections and acceptance testing as specified herein.
- B. After the electrical installation is complete, perform tests to demonstrate that each cable bus system is in working order and in accordance with applicable codes, manufacturer's instructions, drawings and specifications.
- C. Testing shall be performed per International Electrical Testing Association (NETA): Acceptance Testing Specification for Electrical Power Distribution System and Equipment (STD), Section 7.3 Cables, including all optional tests.
- D. Tests are in addition to, and not a substitution for, tests of individual items at the manufacturer's facilities. Perform insulation and ground resistance tests before operating tests. Determine proper phase rotation before permanent connections are made.
- E. Tests are also intended to accomplish the following:
 - 1. Provide initial acceptance tests and recorded data that can be used as a bench mark for future routine maintenance and trouble shooting by plant operating personnel.
 - 2. Provide a successful start-up with a minimum of last minute interruptions and problems.
 - 3. Determine the suitability of the equipment and systems for energizing and placing into operating service.
 - 4. Confirm that each system component is not only installed as specified and per manufacturer's instructions, but performs and will continue to reliably perform its function in the system.
- F. It is the Electrical Contractor's responsibility to provide all necessary supervision, labor, materials, tools, test instruments or other equipment or services and expenses required to test, adjust, set, calibrate, functionally and operationally check all work and components of the various electrical systems and circuitry throughout the installation.
- G. The listings and descriptions of the tests, and checks described herein is not to be considered as complete and all inclusive. Additional standard checks and tests may be necessary throughout the job, prior to substantial completion.

- H. Retests required by defects and failures of equipment to meet specifications shall be conducted at no additional cost to the Owner.
 - 1. Replace wiring and equipment found to be defective, or failing to meet specified requirements, at no additional cost to the Owner.
 - 2. The Owner shall supply the power necessary for all testing.

1.02 RELATED WORK:

- A. Division 16: All Sections

1.03 SUBMITTALS:

- A. Shop Drawings: Submit the following:
 - 1. Submit inspection and testing forms for all electrical distribution equipment to be inspected and tested under this section.
 - 2. Submit data sheets for the insulation resistance testing of conductors prior to performing operating testing. List all cables to be tested.
 - 3. Provide space on data sheet forms to enter the results of testing, instruments used with serial numbers, and name of personnel performing testing. This data to be filled out during testing in the presence of the Owner and/or Engineer.

1.04 REFERENCES:

- A. All inspections and tests shall be in accordance with the following applicable codes and standards latest revisions except as provided otherwise herein.
 - 1. National Electrical Manufacturer's Association – NEMA
 - 2. American Society for Testing and Materials – ASTM
 - 3. Institute of Electrical and Electronics Engineers – IEEE
 - 4. International Electrical Testing Association – NETA – Acceptance Testing Specification for Electric Power Distribution Equipment and Systems (STD).
 - 5. American National Standards Institute – ANSI:
 - a. ANSI C2: National Electrical Safety Code
 - b. ANSI Z244-1: American National Standard for Personnel Protection

- c. ANSI/NECA/FOA 301-2004: Installing and Testing Fiber Optic Cables
- 6. State and Local Codes and Ordinances
- 7. Insulated Cable Engineers Association – ICEA
- 8. Association of Edison Illuminating Companies – AEIC
- 9. Occupational Safety and Health Administration:
 - a. OSHA Part 1910; Subpart S, 1910.308
 - b. OSHA Part 1926; Subpart V, 1926.950 through 1926.960
- 10. National Fire Protection Association – NFPA:
 - a. ANSI/NFPA 70B: Electrical Equipment Maintenance
 - b. NFPA 70E: Electrical Safety Requirements for Employer Workplaces
 - c. ANSI/NFPA 70: National Electrical Code
 - d. ANSI/NFPA 78: Lightning Protection Code
 - e. ANSI/NFPA 101: Life Safety Code

B. All inspections and tests shall utilize the following references:

- 1. Project Design Specifications
- 2. Project Design Drawings
- 3. Manufacturer’s instruction manuals applicable to each particular apparatus

1.05 SCHEDULING:

- A. The Electrical Contractor is responsible for the preparation of proposed procedures, testing and inspection forms, and schedules for all inspections, tests, settings and calibrations specified or otherwise required prior to or during the check out for start-up and acceptance of all the electrical components, equipment and systems
- B. The procedures must provide specific instructions for the checking and testing of each component in addition to the system functional checks.
- C. Prior to check out and testing for start-up, check and tighten all terminals and connection points, remove all shipping blocks and hardware, thoroughly clean all equipment, inspect for broken and missing parts and review and collect manufacturer’s drawings and instructions.

- D. Report all inspections, tests, and calibration in writing on Owner and/or Engineer approved report forms. The recorded data form shall have the signatures of the persons conducting the tests and authorized witnesses. The forms shall serve as the test and inspection checklist for inspection requirements. Submit all test and check out data prior to adjustments, repairs, or similar work prior to final testing and acceptance. "As-found" and "as-left" test data to be recorded and reported in writing.
- E. Sequence tests and checks such that the equipment can be energized immediately after the completion of the applicable tests.

PART 2 - PRODUCTS

2.01 TESTING EQUIPMENT:

A. Calibration:

1. The Electrical Contractor shall furnish all the material, test equipment, required for testing, calibrating and checkout. All calibration and setting checks shall be performed with the calibrated test instruments. This test equipment to have calibrations traceable to the National Bureau of Standards. Calibration labels shall be visible on all test equipment. Calibrations over 6 months old will not be acceptable on field test instruments. The accuracy of the equipment, device, relay or meter under test. All testing instruments shall be checked to verify operation prior to proceeding with the tests. Serial and model numbers of the instruments used shall be recorded on the test forms. The Owner will provide the power source for all testing equipment.
2. Make necessary openings in circuits for testing instruments and place and connect all instruments, equipment, and devices, necessary for the tests. Upon completion of tests, remove instruments and instrument connections and restore all circuits to permanent condition.

2.02 TESTING:

B. Coordination:

1. Coordinate activities, and cooperate with others on project, to ensure that systems are energized when required, loads applied, and other requirements are carried out on schedule.
2. Conduct tests in presence of the Owner and/or Engineer. Provide 3 calendar days or more advance notification of when any test is to be performed. Do not start tests without the Owner's permission.

- a. Conduct testing such that warranties or guarantees are not voided. Coordinate all testing with manufacturer's literature, where applicable.
- b. Where specified tests are not compatible with the manufacturer's recommendations, obtain the manufacturer's review prior to testing.

C. Preparation:

1. Make up no low voltage connections at transformers and switchgear permanently until correct phase rotation of all equipment is determined. Install and insulate these connections temporarily, if necessary, while determining proper rotation. Make permanent connections after proper rotation has been established and subsequent to completion of insulation resistance and dielectric tests.

PART 3 – EXECUTION

3.01 TESTS OF EQUIPMENT, CABLE, AND CIRCUITS:

A. Low voltage (480V and below) distribution equipment:

1. Perform all inspections and testing on the cable bus, substation transformer, and switchgear modifications.
2. Perform DC insulation tests for all cables.

B. The equipment, cable and systems that require testing, the maximum test voltages, and the type tests required are to be in accordance with NETA, Section 7.3.

C. List each circuit and measured resistance as test data.

D. Maintain records of all insulation resistance values. Identify conductor, or equipment, date that value was taken, and resistance value. Submit the information in neat tabular form to the Owner.

3.02 SPECIFIC TESTS AND INSPECTIONS:

A. Equipment test and Inspection during construction and prior to acceptance testing

1. Cable Bus:

- a. Before energizing, the continuity and insulation resistance of every circuit external to equipment shall be measured with a megger from each conductor to all others and ground.
- b. Insulation resistance measurements: Measure insulation resistance with connections to circuit breakers made up but with breakers open and loads not connected

- c. Provide high pot testing of all cable bus conductors, record results and provide copies to Owner.

END OF SECTION

PLANS

- MANUAL MOTOR STARTER
MAGNETIC MOTOR STARTER
COMBINATION MAGNETIC MOTOR STARTER AND DISCONNECT SWITCH
TWO SPEED MOTOR STARTER
REDUCED VOLTAGE MOTOR STARTER
MAGNETIC CONTACTOR
FUSED DISCONNECT SWITCH 600V, 3 POLE UNLESS OTHERWISE NOTED. 30A - INDICATES FUSE SIZE OR AS INDICATED ON ONE-LINE DIAGRAM
UNFUSED DISCONNECT SWITCH 600V, 3 POLE UNLESS OTHERWISE NOTED. 30A - INDICATES SWITCH SIZE OR AS INDICATED ON ONE-LINE DIAGRAM
PANELBOARD
ENGINEERED ELECTRICAL DISTRIBUTION EQUIPMENT, SWITCHGEAR, MCC, ETC.
TRANSFORMER
MOTOR FURNISHED AND INSTALLED UNDER OTHER DIVISION, CONNECTED UNDER DIVISION 16.
PACKAGED MOTOR WITH MOTOR STARTER AND CONTROL FURNISHED AND INSTALLED UNDER OTHER DIVISIONS, CONNECTED UNDER DIVISION 16.
EQUIPMENT FURNISHED AND INSTALLED UNDER OTHER DIVISIONS, CONNECTED UNDER DIVISION 16.
JUNCTION BOX
GROUND ROD: TYPE AND SIZE AS INDICATED ON PLAN OR IN SPECIFICATIONS.
EXOTHERMIC CONNECTION
GROUNDING CABLE
CONDUIT RUNS CONCEALED IN FLOOR, WALL AND UNDERGROUND
CONDUIT RUNS ABOVE SUSPENDED CEILING
CONDUIT RUNS EXPOSED
CONDUIT TURNING UP OR TOWARD OBSERVER
CONDUIT TURNING DOWN OR AWAY FROM OBSERVER
PIPE LINE HEAT TRACING. FOR RATING SEE SPECIFICATIONS AND PLANS
DIRECT BURIED CABLE, SEE SPECIFICATIONS AND PLANS FOR TYPE AND SIZE
DIRECT BURIED CONDUIT, SEE SPECIFICATIONS AND PLANS FOR TYPE AND SIZE
OVERHEAD ELECTRICAL LINE, HV DENOTES HIGH VOLTAGE, MV DENOTES MEDIUM VOLTAGE, LV DENOTES LOW VOLTAGE
OVERHEAD TELEPHONE LINE
CONDUIT NUMBER, SEE CONDUIT AND WIRE SCHEDULE
HOMERUN WHERE MORE THAN THREE WIRES INCLUDING GROUND, DIAGONAL LINES INDICATE NUMBER OF WIRES IN CONDUIT. LINE WITH FLAG INDICATES EQUIPMENT GROUND CONDUCTOR (SEE GENERAL NOTE 2)
DENOTES SECTION LETTER OR DETAIL NUMBER
DENOTES ELECTRICAL SHEET NUMBER ON WHICH SECTION OR DETAIL IS SHOWN
SEE ABBREVIATION FOR ITEM TYPE

DIAGRAMS

- CIRCUIT BREAKER, 3-POLE UNLESS OTHERWISE NOTED. UPPER NUMBER IS FRAME SIZE. LOWER NUMBER IS TRIP SETTING. WHERE ONLY ONE NUMBER IS SHOWN, NUMBER IS TRIP SETTING.
MOTOR CIRCUIT PROTECTOR
MAGNETIC STARTER
FVNR = FULL VOLTAGE, NON-REVERSING
FVR = FULL VOLTAGE, REVERSING
FVTS = FULL VOLTAGE, TWO SPEED
RVNR = REDUCED VOLTAGE, NON-REVERSING
RVR = REDUCED VOLTAGE, REVERSING
AUTO-TRANSFORMER TYPE
PW = PART WINDING
C = MAGNETIC CONTACTOR (WITHOUT OL)
RVSS = REDUCED VOLTAGE, SOLID STATE
NUMBER INDICATES NEMA STARTER SIZE
UNFUSED DISCONNECT SWITCH. NUMBER DENOTES AMPERE RATING.
FUSED DISCONNECT SWITCH, 3-POLE UNLESS OTHERWISE NOTED. UPPER NUMBER INDICATES FUSE CLIP AMPERE SIZE. LOWER NUMBER INDICATES FUSE RATING.
FUSE - LETTER DENOTES CLASS
TRANSFORMER, SIZE AS NOTED, DELTA CONNECTION-PRIMARY. WYE CONNECTION GROUND-SECONDARY (LOW VOLTAGE).
VARIABLE FREQUENCY DRIVE
SQUIRREL CAGE INDUCTION MOTOR. NUMBER DENOTES HORSEPOWER OR KW
SQUIRREL CAGE TWO SPEED TWO WINDING INDUCTION MOTOR NUMBER DENOTES HORSEPOWER. 6P INDICATES SIX POLE DISCONNECT SWITCH
PACKAGED MOTOR WITH MOTOR, STARTER AND CONTROLS. NUMBER INDICATES KILOWATT RATING OR HORSEPOWER.
ELECTRIC WATER HEATER 10KW INDICATES KILOWATT SIZE
ELECTRIC UNIT HEATER 10KW INDICATES KILOWATT SIZE
CURRENT TRANSFORMER. UPPER NUMBERS ARE RATIO. NUMBER IN () IS QUANTITY.
GROUND FAULT PROTECTION
SHUNT TRIP RELAY
INDICATING LIGHTS: R=RED, B=BLUE, G=GREEN, A=AMBER, W=WHITE
KEY INTERLOCK
MECHANICALLY INTERLOCKED (KEY)
ELECTRICALLY INTERLOCKED
NORMALLY OPEN CONTACT
NORMALLY CLOSED CONTACT
VOLT METER SELECTOR SWITCH
AMMETER SELECTOR SWITCH
CIRCUIT BREAKER CONTROL SWITCH
CURRENT TEST BLOCK
POTENTIAL TEST BLOCK
SYNCHRONIZING SWITCH
TEST BLOCK
PROTECTIVE RELAY
2-TIME DELAY RELAY
25 - SYNCHROCHECK RELAY
26 - THERMAL DEVICE
27 - UNDER VOLTAGE RELAY
43 - TRANSFER DEVICE
50 - INSTANTANEOUS OVER CURRENT RELAY
64 - GROUND PROTECTIVE RELAY
67 - DIRECTIONAL OVER CURRENT
74 - ALARM RELAY
83 - TRANSFER RELAY
86 - LOCKOUT RELAY, HAND RESET

DIAGRAMS

- A = AMMETER
D = DEMAND METER
F = FREQUENCY METER
KW = KILOWATT-HOUR METER
PF = POWER FACTOR METER
V = VOLTMETER
VAR = VAR METER
W = WATT METER
WH = WATT-HOUR METER
LIGHTNING ARRESTER, NUMBER DENOTES QUANTITY
CAPACITOR
NEUTRAL GROUNDING RESISTOR
DRAWOUT DEVICE
CPT = CONTROL POWER TRANSFORMER
PT = POTENTIAL TRANSFORMER. UPPER NUMBERS ARE RATIO. NUMBER IN () IS QUANTITY
VACUUM CONTACTOR
MEDIUM VOLTAGE POWER CIRCUIT BREAKER, DRAW OUT TYPE, ELECTRICALLY OPERATED, STORED-ENERGY. NUMBER INDICATES CONTINUOUS AMPERE RATING
LOW VOLTAGE CIRCUIT BREAKER, DRAW OUT TYPE, MANUALLY OR ELECTRICALLY OPERATED WITH STATIC TRIP DEVICES AND GROUND SENSOR. UPPER NUMBER INDICATES FRAME SIZE, LOWER NUMBER INDICATES TRIP SETTING. "E" INDICATES ELECTRICALLY OPERATED.
PRESSURE SWITCH NORMALLY OPEN
PRESSURE SWITCH NORMALLY CLOSED
LIQUID LEVEL SWITCH NORMALLY OPEN
LIQUID LEVEL SWITCH NORMALLY CLOSED
FLOW SWITCH NORMALLY OPEN
FLOW SWITCH NORMALLY CLOSED
LIMIT SWITCH NORMALLY OPEN
LIMIT SWITCH NORMALLY OPEN HELD CLOSED
LIMIT SWITCH NORMALLY CLOSED
LIMIT SWITCH NORMALLY CLOSED HELD OPEN

ABBREVIATIONS

- AA AUTOMATIC ALTERNATOR
AFF ABOVE FINISH FLOOR
AHU AIR HANDLING UNIT
AL ALARM
AN ANNUNCIATOR
ATS AUTOMATIC TRANSFER SWITCH
BTD BEARING TEMPERATURE DETECTOR
BTS BEARING TEMPERATURE SWITCH
CES CONVEYOR EMERGENCY STOP SWITCH
CLF CURRENT LIMITING FUSE
CLS CENTRIFUGAL LIMIT SWITCH
CMS COMBINATION MOTOR STARTER
CMT CONTROL POWER TRANSFORMER
CR CONTROL RELAY
CS CONTROL SWITCH
DB DOORBELL
EF EXHAUST FAN
EHH ELECTRICAL HAND HOLE
EL ELEVATION
EMH ELECTRICAL MANHOLE
EOV ELECTRICALLY OPERATED VALVE
ES EMERGENCY STOP SWITCH (MAINTAINED CONTACT) (PROVIDE DEVICE THAT CAN BE LOCKED IN THE OFF POSITION)
EUH ELECTRIC UNIT HEATER
EWC ELECTRIC WATER COOLER
FAA FIRE ALARM ANNUNCIATOR PANEL
FACP FIRE ALARM CONTROL PANEL
FC FLOW CONTROLLER
FOH FAN-OFF-HEATER
FS SPRINKLER SYSTEM FLOW SWITCH
FSL FIRE ALARM STATUS LIGHT
FIS IONIZATION SMOKE DETECTOR STATUS STATION
FSR FORWARD-STOP-REVERSE
FTC FIRE FIGHTER'S TELEPHONE STORAGE CABINET
GFP GROUND FAULT PROTECTION
GFCI GROUND FAULT CIRCUIT INTERRUPTER
GSC GROUNDED SERVICE CONDUCTOR
GSCT GROUND SENSING CURRENT TRANSFORMER
G GROUND
HA HAND-AUTOMATIC
HOA HAND-OFF-AUTOMATIC
HP HORSEPOWER
HTR MOTOR HEATER
HWT HIGH WATER TEMPERATURE SWITCH
ICP INTERCOM CONTROL PANEL
KP KEY PAD
KS KEY SWITCH
KW KILOWATT
LOR LOCAL-OFF-REMOTE
LR LOCAL-REMOTE
LS LIMIT SWITCH
MCC MOTOR CONTROL CENTER
MCP MOTOR CIRCUIT PROTECTOR
MHC MECHANICALLY HELD CONTACTOR
MOV MOTOR OPERATED VALVE
MSD MOISTURE SENSING DETECTOR
NIR NOT IN REMOTE
NO NORMALLY OPEN
NC NORMALLY CLOSED
OC OPEN-CLOSE

ABBREVIATIONS

- OL'S MOTOR OVERLOADS
OO ON-OFF
OSC OPEN-STOP-CLOSE
ROR RUN-OFF-REMOTE
SAA SECURITY ALARM ANNUNCIATOR PANEL
SCP SECURITY CONTROL PANEL
SCR SILICON CONTROL RECTIFIER
SEL SELECTOR SWITCH
SF SLOW-FAST
SFS SLOW-FAST-STOP
SH SPACE HEATER
SOFA SLOW-OFF-FAST-AUTOMATIC
SPF SHEAR PIN FAILURE CONTACT
SQ SEQUENCE SELECTOR SWITCH
SS START-STOP
SV SOLENOID VALVE
SW SWITCH
T THERMOSTAT
TC TIMED CLOSE
T/C THERMOCOUPLE
TD TIME DELAY RELAY
TG TACHOMETER GENERATOR
TO TIMED OPEN
TI TIMER
TQ TORQUE ALARM SWITCH
TR TRANSFORMER
TS TEMPERATURE SENSOR
TTC TELEPHONE TERMINAL CABINET
TYP TYPICAL
VFD VARIABLE FREQUENCY DRIVE
VIS VIBRATION SWITCH
VPS VACUUM PRESSURE SWITCH
W DENOTES WATERTIGHT EQUIPMENT
WP DENOTES WEATHERPROOF EQUIPMENT
WPG WEATHERPROOF GFCI RECEPTACLE
XFMR TRANSFORMER
XP DENOTES EXPLOSION PROOF EQUIPMENT
XST EXISTING
ZSS ZERO SPEED SWITCH

GENERAL NOTES

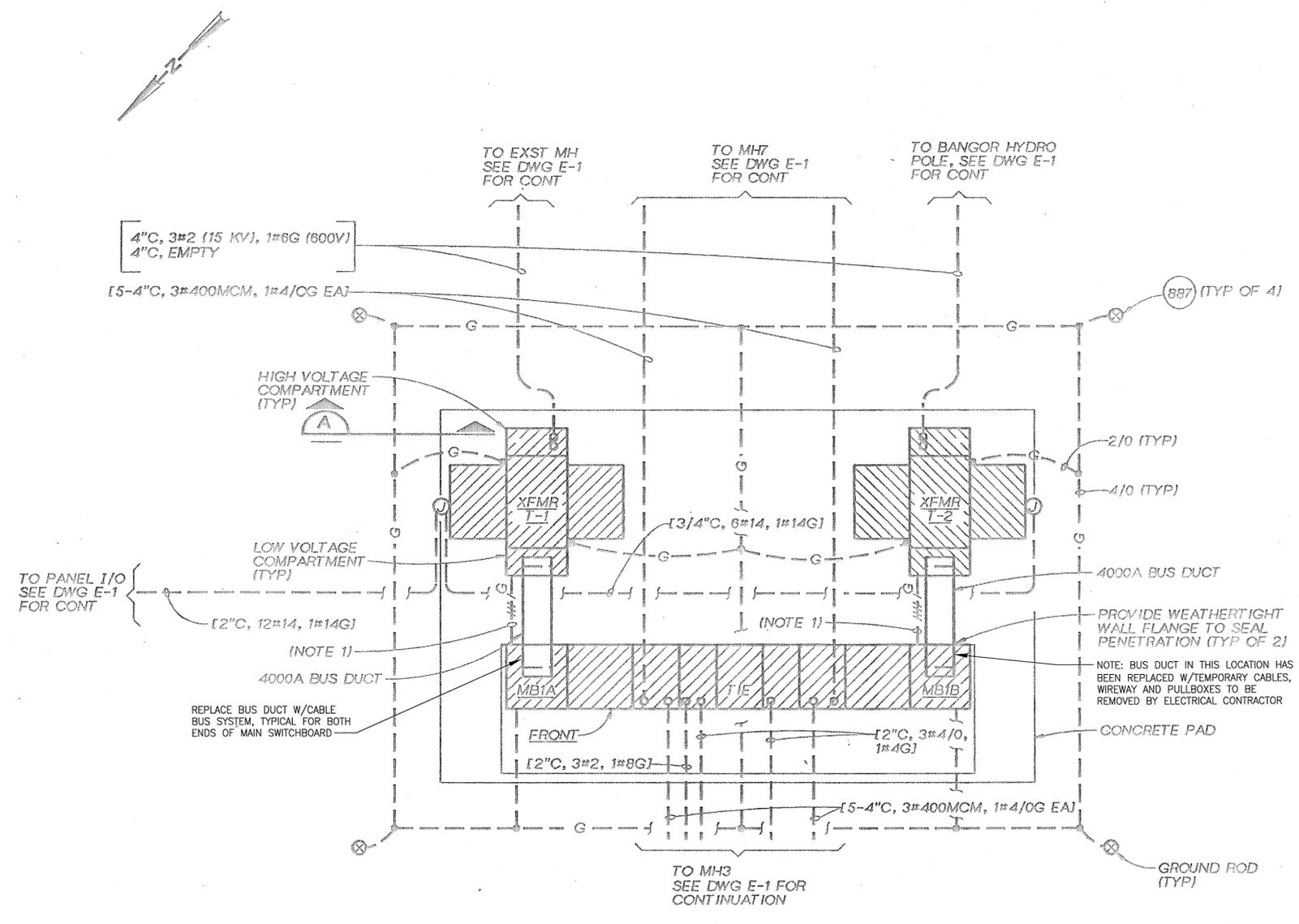
- 1. CONDUIT INSTALLATIONS ARE SHOWN DIAGRAMMATICALLY ONLY AND SHALL BE INSTALLED IN A MANNER TO PREVENT CONFLICTS WITH EQUIPMENT AND STRUCTURAL CONDITIONS. EXPOSED CONDUITS SHALL BE INSTALLED PARALLEL TO BEAMS AND WALLS.
2. THE WIRING DIAGRAMS, QUANTITY AND SIZE OF WIRES AND CONDUIT REPRESENT A SUGGESTED ARRANGEMENT BASED UPON STANDARD COMPONENTS OF ELECTRICAL EQUIPMENT. MODIFICATIONS ACCEPTABLE TO THE OWNER MAY BE MADE BY THE CONTRACTOR TO ACCOMMODATE EQUIPMENT ACTUALLY PURCHASED. THE BASIC SEQUENCE AND METHOD OF CONTROL MUST BE MAINTAINED AS INDICATED ON THE DRAWINGS AND/OR SPECIFICATIONS.
3. SWITCHES SHALL BE MOUNTED 4'-0" ABOVE FINISHED FLOOR UNLESS OTHERWISE NOTED. RECEPTACLES SHALL BE MOUNTED 4'-0" ABOVE FINISHED FLOOR UNLESS OTHERWISE NOTED, EXCEPT RECEPTACLES IN OFFICES OR AREAS WITH SUSPENDED CEILINGS SHALL BE MOUNTED 1'-6" ABOVE FINISHED FLOOR UNLESS OTHERWISE NOTED.
4. SURFACE MOUNTED PANELS AND PANEL BOARDS, SHALL BE MOUNTED TO MAINTAIN A 1/4" AIR SPACE BETWEEN THE ENCLOSURE AND THE WALL.
5. LIGHTING FIXTURES SHALL BE MOUNTED ACCORDING TO THE MOUNTING HEIGHT GIVEN ON THE DRAWINGS, WITH THE DISTANCE BEING MEASURED FROM THE BOTTOM OF THE LIGHTING FIXTURE TO THE FINISHED FLOOR.
6. FOR EXPLANATION OF INSTRUMENTATION SYMBOLS SHOWN ON ELECTRICAL DRAWINGS, SEE INSTRUMENTATION LEGEND AND NOTES ON SHEET I-1.
7. PROVIDE CONDUIT AND WIRE FOR ALL SURGE PROTECTION DEVICES AT INSTRUMENTS AND INSTRUMENTATION PANELS. SURGE PROTECTION DEVICES TO BE PROVIDED BY DIVISION 13 SUPPLIER. INSTALLATION OF INSTRUMENTATION AND ACCESSORIES BY DIVISION 13 CONTRACTOR.
8. CONDUIT AND WIRE (NOT SHOWN) FOR THE HVAC CONTROL EQUIPMENT AND MISCELLANEOUS DEVICES SHALL BE FURNISHED AND INSTALLED UNDER SECTION 15806 OF SPECIFICATIONS AND SHALL BE:
A. 3/4" (MIN.)
B. NO. 14 CU. WIRE (MIN.), NO. OF WIRES AS REQUIRED
C. CONDUIT AND WIRING TO BE IN ACCORDANCE WITH DIVISION 16.
9. CONDUIT AND WIRE (NOT SHOWN) FOR LIGHTING FIXTURES, SWITCHES AND/OR RECEPTACLES SHALL BE FURNISHED AND INSTALLED AND SHALL BE:
A. 3/4" (MIN.) RIGID METAL CONDUIT
A1. EXPOSED IN UNFINISHED AREAS.
A2. CONCEALED ABOVE SUSPENDED CEILINGS AND IN WALLS IN FINISHED AREAS.
B. NO. 12 CU. WIRE (MIN.), NO. OF WIRES AS REQUIRED, INCLUDING GROUND.
10. ITEMS SHALL BE PROVIDED WITH NEMA ENCLOSURE AS INDICATED ON THE EQUIPMENT ENCLOSURE SCHEDULE.
11. DUCT BANK CONDUIT SIZES ARE GIVEN IN THE DUCT BANK CALLOUTS. WHERE THE SAME CONDUIT NUMBER IS USED BOTH IN THE DUCT BANK AND IN A BUILDING, THE CONDUIT SIZE GIVEN IN THE CONDUIT SCHEDULE APPLIES TO THE CONDUIT IN THE BUILDING ONLY.
12. SWITCHGEAR AND MCC COMPARTMENT DESIGNATIONS AS INDICATED BELOW:
BLANK: NOT INTENDED FOR USE, PLATE ONLY.
SPACE: CONTAINS NECESSARY BUS AND HARDWARE FOR FUTURE ADDITION OF BREAKERS OR STARTERS WITHIN SIZE RANGE SHOWN
SPARE: CONTAINS A COMPLETE BREAKER OR STARTER INSTALLED, SIZE AS INDICATED AVAILABLE FOR FUTURE USE.
13. ALL SWITCHES, RECEPTACLES AND EQUIPMENT SHALL COMPLY WITH THE LATEST VERSION OF THE ADA (AMERICANS WITH DISABILITIES ACT).
14. ITEMS SHOWN WITH HEAVY LINES REPRESENTS NEW WORK UNDER THIS CONTRACT.

NOTICE:
NOT ALL SYMBOLS AND ABBREVIATIONS ARE USED IN THE CONTRACT DRAWINGS

REVISIONS table with columns: NO., DATE, MADE BY, CHECKED BY, ISSUE FOR CONSTRUCTION, DESCRIPTION. Includes AECOM logo, project title 'CITY OF BANGOR, MAINE 480V BUS DUCT REPLACEMENT', and notes 'SYMBOLS, LEGEND AND GENERAL NOTES ELECTRICAL'. Project No: 60427608, Date: 7/6/15.

PATH/FILENAME: F:\60427608 - BANGOR WWP UPGRADES\SHEETS\00 E-001.DWG
LAST UPDATE: Monday, July 27, 2015 12:04:47 PM
PLOT DATE: Monday, July 27, 2015 12:05:06 PM
ANSI D - 27-Jul-15

INFORMATION ON THIS DRAWING PROVIDED FROM CH2MHILL DRAWING NO. E-33, DATED 9-90



NOTE:
1. CONNECT XFMR HEATER & LIGHTS TO 120/240V PANEL IN MAIN SWITCHBOARD.

EXISTING MAIN SUBSTATION PLAN
N.T.S.

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
1	7/15	WS	KM	ISSUE FOR CONSTRUCTION

AECOM

AECON TECHNICAL SERVICES, INC.
150 WASHINGTON ST.
WALFORD, MA 01880
PHONE (978) 248-5200



CITY OF BANGOR, MAINE
480V BUS DUCT REPLACEMENT

**EXISTING TRANSF., SWITCHGEAR AND
BUS DUCT LOCATION PLAN**

ELECTRICAL

PROJECT NO:	60427608
CAD DWG FILE:	00 E-002
DESIGNED BY:	W. SHOSHO
DRAWN BY:	M. STEWART
DEPT CHECK:	Y. RIZK
PROJ CHECK:	K. MIGNONE
DATE:	7/6/15
SCALE:	AS NOTED

00 E-002

PATH/FILENAME: P:\60427608 - BANGOR WMP UPGRADES\SHEETS\00 E-002.DWG
LAST UPDATE: Monday, July 27, 2015 8:14:07 AM
PLOT DATE: Monday, July 27, 2015 12:05:06 PM
ANSI D - 27-Jul-15

1

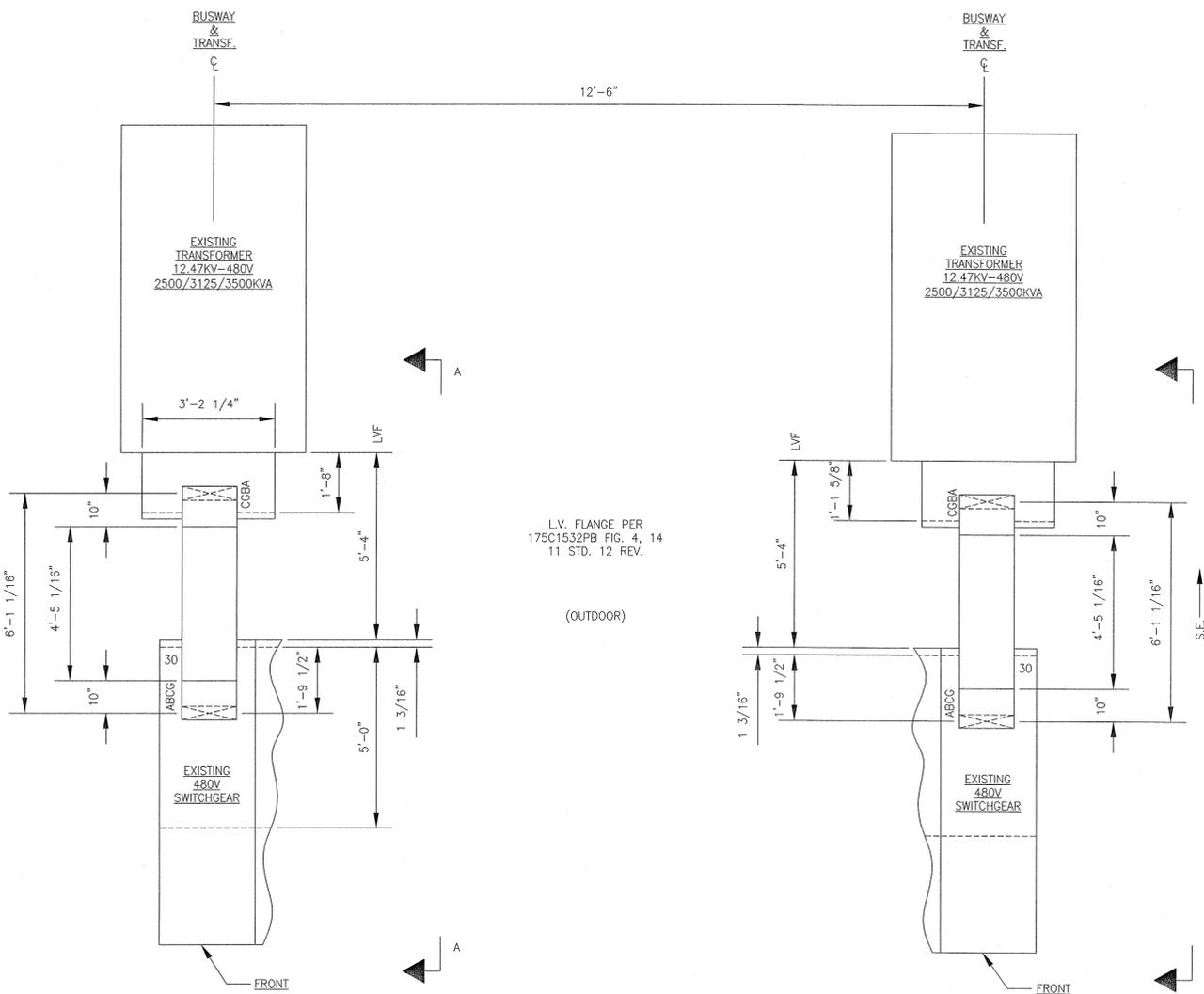
2

3

4

5

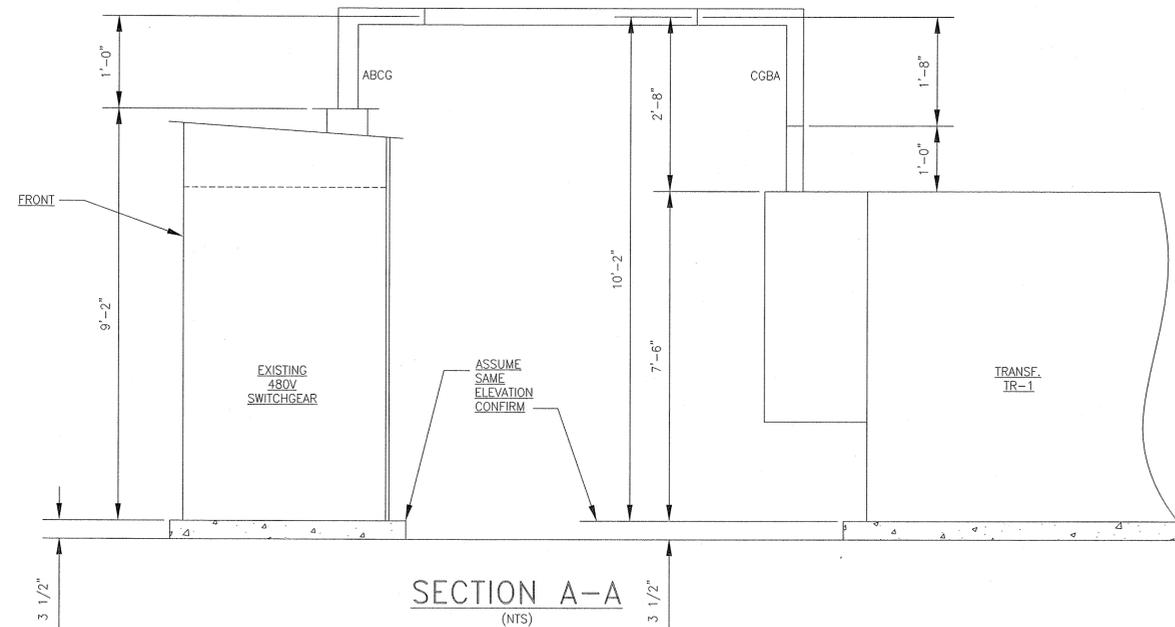
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GE DG&C DRAWING NO. 026D72643,
DATED 5-6-91



EXISTING TRANSFORMER,
SWITCHGEAR & BUS DUCT PLAN
(NTS)

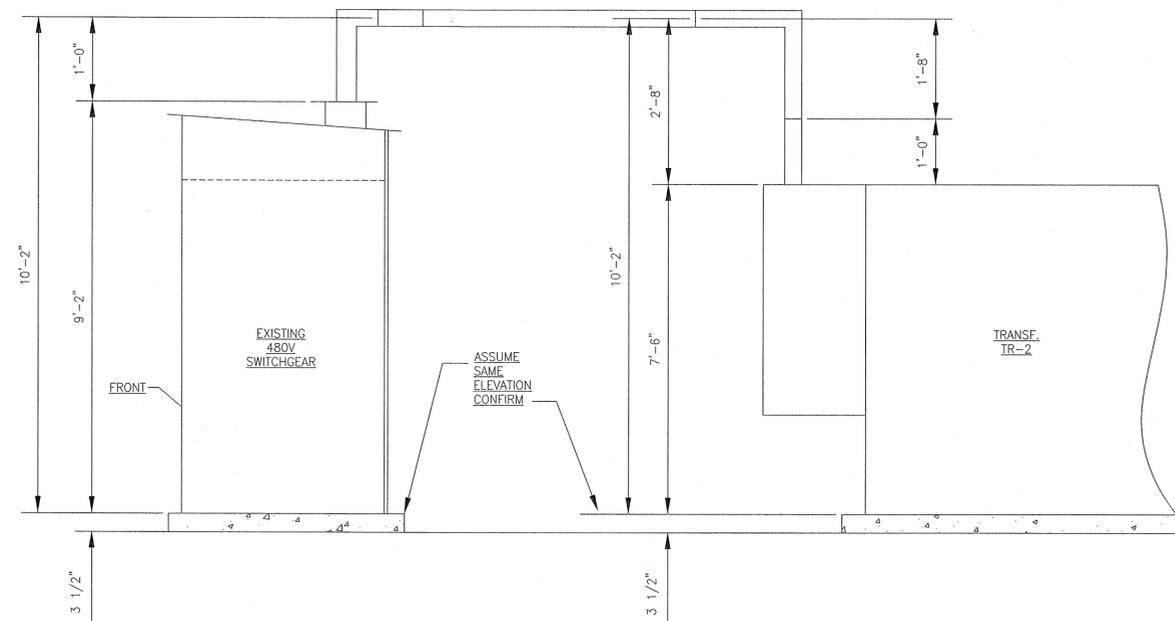
L.V. FLANGE PER
175C1532PB FIG. 4, 14
11 STD. 12 REV.

(OUTDOOR)



SECTION A-A
(NTS)

(OUTDOOR)



SECTION B-B
(NTS)

NOTES:

- EXISTING BUSWAY IS 4000A 3Ø, 3W W/GRD OUTDOOR COPPER FEEDER, SPECTRA-SERIES, HAVING (2) 1/4 X 5-3/4" BARS PER Ø, IN A 4 1/2" A8" HSG.
- ELECTRICAL CONTRACTOR TO VERIFY DIMENSIONS AND CONFIRM DURING REVIEWS OF CABLE BUS SHOP DRAWINGS.
- DIMENSIONS PERTAINING TO BUSWAY ROUTING ARE CENTERLINE DIMENSIONS.
- EXISTING POWER TRANSFORMERS ARE GENERAL ELECTRIC CO. ROME, GA 2500/2800/3500 KVA.
- EXISTING SWITCHGEAR IS GENERAL ELECTRIC CO. OUTDOOR POWER BREAK II WALK-IN 4000A, 480V-3PH-3WIRE.

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1	7/15	WS	KM	ISSUE FOR CONSTRUCTION

AECOM TECHNICAL SERVICES, INC.
701 EDEWATER DRIVE
WATERLOO, MA 01880
PHONE (508) 546-5000



CITY OF BANGOR, MAINE
480V BUS DUCT REPLACEMENT
**EXISTING TRANSF., SWITCHGEAR &
BUS DUCT PLAN AND SECTIONS**
ELECTRICAL

PROJECT NO:	60427608
CAD DWG FILE:	00 E-003
DESIGNED BY:	W. SHOSHO
DRAWN BY:	M. STEWART
DEPT CHECK:	Y. RIZK
PROJ CHECK:	K. MIGNONE
DATE:	7/6/15
SCALE:	AS NOTED

00 E-003

1

2

3

4

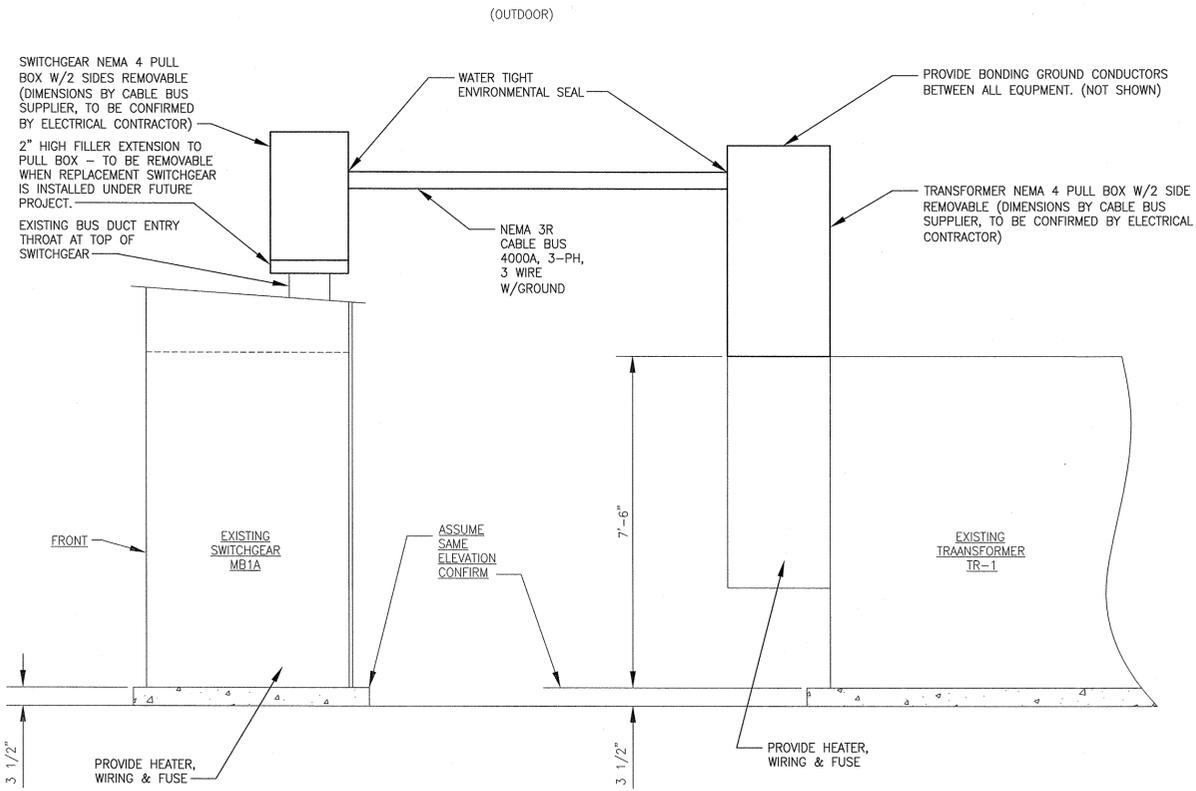
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LAST UPDATE: Monday, July 27, 2015 8:14:52 AM
PLOT DATE: Monday, July 27, 2015 12:05:09 PM

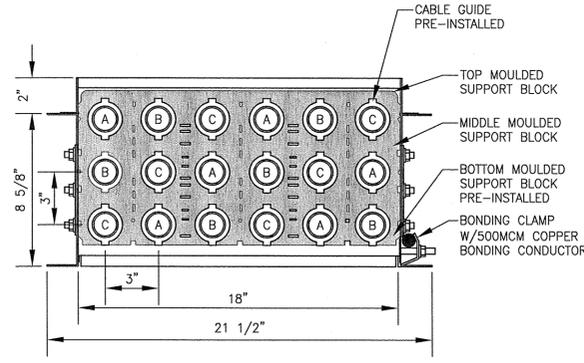
ANSI D - 27-JUL-15

ELECTRICAL CONTRACTOR SEQUENCE OF WORK:

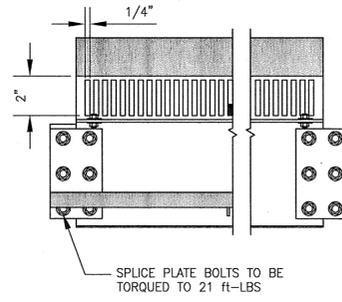
- COORDINATE ALL WORK WITH OWNER'S ELECTRICAL STAFF. WORK TO PROCEED IN FAIR WEATHER CONDITIONS ONLY AND WHEN AUTHORIZED BY OWNER.
- PERFORM WORK AT EXISTING TRANSFORMER TR-2 AND EXISTING 480V SWITCHGEAR MB1B. EXISTING CONDITIONS HAVE THE PRIMARY SWITCH AT TRANSFORMER TR-1 CLOSED, 480V BREAKER MB1A CLOSED AND 480V SWITCHGEAR BUS TIE BREAKER CLOSED WITH 480V SWITCHGEAR LOAD BUS ENERGIZED.
- REMOVE TEMPORARY 480V CABLES, BOXES AND WIREWAY BETWEEN EXISTING 480V SWITCHGEAR MB1B AND TRANSFORMER TR-2 SECONDARY TERMINATION ENCLOSURE. PREPARE EQUIPMENT BUSES AND ENCLOSURES TO ACCEPT THE INSTALLATION OF THE NEW CABLE BUS SYSTEM. NOTE THAT EXISTING LOW VOLTAGE WIRING FOR PROTECTION AND HEATER CIRCUITS ARE STILL ENERGIZED INSIDE THE EXISTING EQUIPMENT ENCLOSURES.
- INSTALL NEW CABLE BUS SYSTEM IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS BETWEEN EXISTING 480V SWITCHGEAR MB1B AND TRANSFORMER TR-2 SECONDARY TERMINATION ENCLOSURE.
- INSTALL NEW HEATERS AS SPECIFIED IN SPECIFICATION SECTION 16050 INSIDE EXISTING 480V SWITCHGEAR MB1B AND TRANSFORMER TR-2 SECONDARY TERMINATION ENCLOSURE AND WIRE TO EXISTING CIRCUITS WITH INLINE FUSE PROTECTION.
- PERFORM ACCEPTANCE TESTING ON THE CABLE BUS SYSTEMS AND HEATER CIRCUITS IN ACCORDANCE WITH SPECIFICATION SECTION 16998.
- CLOSE PRIMARY SWITCH AT EXISTING TRANSFORMER TR-2, OPEN 480V SWITCHGEAR BUS TIE BREAKER, CLOSE 480V SWITCHGEAR BREAKER MB1B AND VERIFY 480V SWITCHGEAR BUS B IS ENERGIZED.
- PERFORM WORK AT EXISTING TRANSFORMER TR-1 AND EXISTING 480V SWITCHGEAR MB1A. PRIMARY SWITCH AT TRANSFORMER TR-1 OPEN AND 480V BREAKER MB1A OPEN. CLOSE BUS TIE BREAKER AT 480V SWITCHGEAR. PRIMARY SWITCH AT TRANSFORMER TR-2 CLOSED, 480V BREAKER MB1B CLOSED AND 480V SWITCHGEAR TIE BREAKER CLOSED WITH 480V SWITCHGEAR LOAD BUS ENERGIZED.
- REMOVE BUS DUCT ASSEMBLY BETWEEN EXISTING 480V SWITCHGEAR MB1A AND TRANSFORMER TR-1 SECONDARY TERMINATION ENCLOSURE AND PREPARE EQUIPMENT BUSES AND ENCLOSURES TO ACCEPT THE INSTALLATION OF THE NEW CABLE BUS SYSTEM. NOTE THAT EXISTING LOW VOLTAGE WIRING FOR PROTECTION AND HEATER CIRCUITS ARE STILL ENERGIZED INSIDE THE EXISTING EQUIPMENT ENCLOSURES.
- INSTALL NEW CABLE BUS SYSTEM IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS BETWEEN EXISTING 480V SWITCHGEAR MB1A AND TRANSFORMER TR-1 SECONDARY TERMINATION ENCLOSURE.
- INSTALL NEW HEATERS AS SPECIFIED IN SPECIFICATION SECTION 16050 INSIDE EXISTING 480V SWITCHGEAR MB1A AND TRANSFORMER TR-1 SECONDARY TERMINATION ENCLOSURE AND WIRE TO EXISTING CIRCUITS WITH INLINE FUSE PROTECTION.
- PERFORM ACCEPTANCE TESTING ON THE CABLE BUS SYSTEMS AND HEATER CIRCUITS IN ACCORDANCE WITH SPECIFICATION SECTION 16998.
- CLOSE PRIMARY SWITCH AT EXISTING TRANSFORMER TR-1, OPEN 480V SWITCHGEAR BUS TIE BREAKER, CLOSE 480V SWITCHGEAR BREAKER MB1A AND VERIFY 480V SWITCHGEAR BUS A IS ENERGIZED.
- REMOVE ALL SURPLUS MATERIALS FROM THE PROJECT SITE.



PROPOSED CABLE BUS SYSTEM INSTALLATION
(TYPICAL 2 LOCATIONS)
(NTS)



NEMA 3R CABLE BUS PROPOSED PHASE ARRANGEMENT
SCALE: NTS



NEMA 3R CABLE BUS PEAK COVER VENTILATION
SCALE: NTS

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1	7/15	WS	KM		

AECOM
 AECOM TECHNICAL SERVICES, INC.
 201 E. BROADWAY, SUITE 200
 WASHINGTON, DC 20001
 PHONE (703) 441-2500

STATE OF MAINE
 WILLIAM SHOSHO
 No. 8336
 PROFESSIONAL ENGINEER
 PROJECT NO. 2015-001
 7/13/15

CITY OF BANGOR, MAINE
 480V BUS DUCT REPLACEMENT
PROPOSED CABLE BUS SYSTEM INSTALLATION
 ELECTRICAL

PROJECT NO:	60427608
CAD DWG FILE:	00 E-004
DESIGNED BY:	W. SHOSHO
DRAWN BY:	M. STEWART
DEPT CHECK:	Y. RIZK
PROJ CHECK:	K. MIGNONE
DATE:	7/6/15
SCALE:	AS NOTED

00 E-004

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