

ATTACHMENT NO. 23

**ELLSWORTH AFB ENGINEERING CRITERIA,
CHAPTER 4**

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4. DESIGN STANDARDS.

4.1 Purpose and Scope.

4.1.1 The purpose of this section is to set out minimum design criteria for new additions, modifications or extensions of the 15 kV primary electrical distribution system at the Ellsworth Air Force Base, South Dakota.

4.1.2 It is the intent of this section to provide Base personnel and others the necessary guidance so that future additions or modifications to the electrical distribution system will preserve the integrity of the conceptual design used for the new 15 kV system.

4.1.3 It is expected that the 15 kV electrical distribution system will expand in a structured, utility oriented manner that will result in a flexible, easily operated and maintained system. Planned, coordinated expansion will provide dependable electrical service to all base facilities into the foreseeable future.

4.1.4 The Design Standards include all electrical distribution facilities from the Ellsworth Substation up to and including individual service transformers. Low voltage, secondary electrical equipment and facilities are not included in the Design Standards.

4.1.5 Electrical distribution equipment specifications are included in the Design Standards for the purpose of maintaining functional interchangeability, adequate capacity, efficiency of operation and maintenance, and safety of operations.

4.1.6 Design criteria such as feeder circuit loading, sectionalizing philosophy, and equipment application are included in the Design Standards to promote structured growth and maintain adequate contingency capacity.

4.2 Future System Expansion.

4.2.1 General Criteria and Overview.

4.2.1.1 The backbone 15 kV primary distribution system for Ellsworth Air Force Base consists of nine distribution feeder circuits emanating from the Ellsworth Substation. For details of service area and routing of these circuits, refer to Section 2.0 of this manual and the attached drawings.

4.2.1.2 Backbone circuits having a three phase capacity of approximately 8000 KVA, utilize 336.4 ACSR in overhead sections and 500 KCMIL copper in underground sections.

4.2.1.3 Feeder circuits are configured so that each circuit has a contingency tie to another circuit which has sufficient reserve capacity for both circuits. Contingency tie points utilize pad mount or pole mount three phase gang operated switch stations. Refer to Section 2.0 of this manual, and the attached drawings, for details of contingency arrangements and switch locations.

4.2.1.4 Tap circuits from underground feeder circuits are arranged with fault interrupting protective equipment so that failures of cables or equipment on the underground tap lines will not interrupt the feeder circuit.

4.2.1.5 Padmount switchgear shall be utilized to provide tap points for new electric services or to provide contingency tie points to alternate feeder circuits. When tap points are not available in existing switchgear, new switchgear shall be installed.

4.2.2 Applicable Standards and Specifications.

4.2.2.1 Underground Lines and Equipment.

1. AFM 88-9 Electric Power Supply and Distribution
2. AFM 88-15 Design Manual and Standards
3. AASHTO HS20-44 Traffic Loading
4. ANSI C2- National Electrical Safety Code
5. ANSI C12.1- Code for Electricity Metering
6. ANSI C37.72- Deadfront Pad-mounted Switchgear
7. ANSI C57.12.25- Pad-mounted Transformers, Single Phase
8. ANSI C57.12.26- Pad-mounted Transformers, Three Phase
9. ANSI C62.1- Surge Arresters for AC Power Systems
10. ANSI F512 PVC Conduit
11. ASTM A82- Tie Wire
12. ASTM A615- Reinforcing Steel
13. ASTM B8- Stranded Copper Conductors
14. ASTM C33- Aggregates
15. ASTM C150- Portland Cement
16. AEIC CS6- EPR Insulated Power Cables
17. IES RP-8- Roadway Lighting
18. IEEE 142- Grounding of Industrial and Commercial Power Systems
19. IEEE 386- Separable Insulated Connectors above 600 Volts
20. IEEE 404 - Power Cable Joints

21. NEMA WC8 - EPR Insulated Power Cables
22. NFPA 70 - National Electrical Code
23. REA Bulletin 43-5 List of Approved Materials
24. REA Bulletin 50-6 Specifications for Underground Construction

4.2.2.2 Overhead Lines and Equipment.

1. AFM 88-9 Electric Power Supply and Distribution
2. AFM 88-15 Design Manual and Standards
3. ANSI C2- National Electrical Safety Code
4. ANSI C12.1- Code for Electricity Metering
5. ANSI C29.1- Electrical Power Insulators
6. ANSI C57.12.20- Pole Type Transformers
7. ANSI C62.1- Surge Arresters for AC Power Circuits
8. ANSI 05.1- Specifications for Wood Poles
9. ASTM A153- Zinc Coating on Iron and Steel Hardware
10. ASTM A475- Zinc Coated Steel Wire Strand
11. ASTM B232 - ACSR Conductors
12. AWPA C4- Poles, Preservative Treatment
13. AWPA C25- Crossarms, Preservative Treatment
14. IES RP-8- Roadway Lighting
15. IEEE 142 - Grounding of Industrial and Commercial Power Systems
16. NFPA 70- National Electrical Code
17. REA Specification DT-5B Wood Crossarms
18. REA Bulletin 43-5 List of Approved Materials
19. REA Bulletin 50-3 Specifications for Overhead Construction
20. REA Bulletin 160-2 Mechanical Design for Overhead Lines

4.2.2.3 Abbreviations.

AFM	Air Force Manual
AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AEIC	Association of Edison Illuminating Companies
AWPA	American Wood Preservers Association

IES	Illumination Engineering Society
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
RUS	U.S. Department of Agriculture, Rural Utility Service (formerly REA)

4.2.3 Circuit Loading and Interface.

4.2.3.1 It is essential that future additions or modifications do not increase feeder circuit loading to a point where the circuit cannot provide contingency back up for its assigned circuit. When a new or upgraded electrical service is planned, user should undertake a suitable load study to assure that sufficient contingency capacity will remain for emergency back up purposes. Refer to Section 2.0 for feeder circuit loading for normal and contingency conditions.

4.2.3.2 New underground feeder and branch circuits, when required, shall interface with the existing circuits using materials and methods consistent with the existing system. Refer to Paragraph 4.3 for materials and equipment specifications.

1. Feeder Circuits. Branch points for feeder circuits shall utilize pad mount switchgear units with solid blade, gang operated three phase switches rated 600 amps continuous. Feeder cables shall terminate with 600 amp class, dead break elbows. All elbow terminations shall be installed above ground. Elbows in below grade manholes shall not be permitted.

2. Branch Circuits. Branch circuits for individual service, or groups of services, shall connect to feeder circuits through pad mount switchgear units with three phase, gang operated switches rated 200 amps continuous. Switch positions feeding branch circuits shall have fault sensing and interrupting capability. Branch circuit cables shall terminate with 200 amp class, load break elbows. All load break elbows shall be installed in pad mounted equipment. Elbows located in below grade manholes shall not be permitted.

4.2.4 Functional Interchangeability. Extensions of existing and new feeder or branch circuits shall utilize materials and methods consistent with those detailed in this manual. Consistency of materials and methods will enhance ease of operation and maintenance, and minimize spare parts requirements.

4.2.5 Contingency Arrangements.

4.2.5.1 Each of the nine feeder circuits has an assigned contingency back up feeder circuit. Refer to Section 2.0 for normal and contingent feeder circuit assignments as well as circuit loading data for normal and contingency operation.

4.2.5.2 It is critical for system integrity, that future extensions of existing feeder circuits or additional new feeder circuits incorporate materials and methods that will maintain appropriate capacity, circuit switching capability and circuit routing. Failure to do so will result in feeder circuits that are ineffective for normal or contingency operation due to unstructured growth.

4.2.5.3 Future extensions of existing or new underground branch circuits shall incorporate above grade, pad mount equipment with 200 amp class, load break elbow cable terminations. Elbows located in subgrade manholes or vaults will not be permitted. New extensions of branch circuits shall be configured with loop feed capability when practical. Normally open points shall be maintained at above grade, pad mount equipment with 200 amp, load break elbow terminations.

4.3 Equipment and Materials Specifications.

4.3.1 Cable and Cable Pulling Criteria.

4.3.1.1 15 kV Primary Power Cable.

1. General Description. 15 kV power cable should be suitable for use in wet or dry locations in conduit, underground duct, and aerial riser installations. Conductor size shall be 500 KCMIL copper for feeder circuits, 4/0 copper for branch circuits and 1/0 copper for minor radial taps. 15 kV power cables shall be rated 90° C for normal operation, 135° C for emergency operation and 250° C for short circuit conditions.

2. Basic Construction. 15 kV power cable shall be single conductor, compressed class B stranding, bare copper conductor, extruded strand screen, flexible thermosetting dielectric based on an Ethylene-Propylene compound, extruded insulation screen, metallic shield as detailed in paragraph 7. below, and an overall insulating PVC jacket.

3. Conductor. Conductor for 15 kV power cables shall be uncoated soft drawn copper. Stranding and electrical resistance shall be in accordance with NEMA WC8.

4. Conductor Screen. Conductor screen shall consist of an extruded layer of semiconducting, thermosetting compound with volume resistivity not in excess of 50,000 ohm - cm at 90° C, and shall be applied at a minimum average thickness of 15 mils. Conductor screen shall be free stripping from the conductor and firmly bonded to the insulation. Optionally, under the extrusion there may be a layer of semiconducting tape applied over the conductor.

5. Insulation. Insulation shall be an Ethylene-Propylene type and shall be extruded and vulcanized with the conductor and insulation screens. The minimum average thickness shall be 220 mils, with the minimum thickness at any cross section of the insulation not less than 90% of the average thickness.

6. Insulation Screen. Insulation screen shall be an extruded thermosetting compound with volume resistivity not in excess of 50,000 ohm - cm at 90° C when tested per AEIC CS6. The elongation after an air oven test at 121° C for 168 hours shall be 100 percent minimum and the brittleness temperature shall be less than -30° C. The screen shall be extruded directly over the insulation. Minimum average thickness of the insulation screen shall be in accordance with NEMA WC8. Insulation screen shall be printed in ink at 24 inch maximum increments "Semiconducting - Remove when splicing or terminating."

7. Metallic Shield. Metallic shield shall consist of the following:

a. For 500 KCMIL feeder and 4/0 branch circuit cables: Two layers of 5 mil bare copper tape, helically applied with 12 ½% overlap.

b. For 1/0 branch circuit cables: Nine #14 copper concentric neutral wires.

8. Jacket. An overall 80 mil PVC jacket shall be applied to the cable. Jacket shall be installed in such a manner that metallic shield is not displaced and voids between shield and the jacket are negligible.

9. Identification. An identifying legend shall be printed on the jacket with contrasting ink indicating the manufacturer, cable type, insulation thickness, conductor size and type, rated voltage, sequential footage number and year of manufacture.

10. Factory Tests. The following certified test reports shall be furnished at the time of shipment. All final tests shall be performed on shipping lengths.

- a. Conductor DC resistance in accordance with NEMA WC8.
- b. High voltage AC and DC tests (33 kV AC @ 5 min, 80 kV DC @ 15 min.)
- c. Insulation resistance shall be measured and recorded in megohms - 1000 feet and when corrected to 60° C the SIR shall not be less than 50,000 megohms - 1000 ft.
- d. Resistance of the complete cable metallic shield system shall be measured and recorded.
- e. Complete cable shall be tested for corona discharge and shall comply with AEIC CS6 requirements. Manufacturer shall provide qualifying X-Y plots.

4.3.1.2 Cable Pulling Criteria.

1. Cable pulling calculations shall be performed for all new 15 kV power cable sections as outlined in EPRI Research Project 1519-1, EL-3333-CCM, Vol. 2 "Cable Users Guide" or equivalent cable manufacturer's reference.

2. The cable manufacturer shall be consulted for pertinent data such as cable construction, actual cable weight and diameter, recommendations for maximum allowable pulling tension, maximum allowable sidewall pressure, minimum bending radius for training, minimum bending radius for tension pulling, and recommended coefficient of friction and lubricants for the proposed new conduit/cable system.

3. New 15 kV power cables shall be installed strictly in accordance with manufacturer's instructions. Pulling tensions shall be monitored and recorded during the cable pulling process, and shall be compared to tension values calculated for each cable pull.

4. DC high voltage acceptance tests shall be performed after cable installation and termination is complete.

4.3.2 Conduit and Manholes.

4.3.2.1 Conduit.

1. Conduit for new duct bank construction shall consist of type EB PVC conduit, imbedded in steel reinforced concrete. Refer to Section 5.1 for typical trench and duct bank detail drawings.

2. Minimum conduit size shall be 5" for feeder circuits and 4 " for branch circuits. Sufficient spare conduits shall be installed for future expansion of the electrical distribution system. A minimum of one spare conduit shall be installed in all new duct banks.

3. Radius of horizontal and vertical sweep elbows, when required, shall be determined by cable pulling calculations. Minimum bend radius shall be 36 inches for vertical sweep elbows, and 48 inches for horizontal sweep elbows.

4.3.2.2 Manholes.

1. Manholes shall be precast of steel reinforced concrete. Sectional manholes shall be designed with gasketed interlocking sections to provide a positive water seal. Manhole cover and sections shall be structurally designed to AASHTO - HS20-44 traffic loading applied at finish grade. Refer to Section 5.1 for manhole detail drawing.

2. Minimum size of manholes shall be 8' x 6' x 6'-4" high with 36" diameter round manhole cover and solid floor. Provide legend "Electric" on manhole cover.

3. Manholes shall contain provisions for cable racking. Racks shall be adjustable, T-section style with insulators for cable protection. Racks shall be hot dipped galvanized. Pulling eyes, capable of 5000 lbs. working tension, shall be installed in each lower corner of the manhole. Refer to Section 5.1 for detail drawing of manhole grounding requirements.

4. New manhole location and orientation shall be determined by cable pulling calculations and future distribution system expansion. Maximum spacing between manholes shall be 350 ft. Conduit penetrations in new and existing manholes shall utilize bell end fittings. Additional conduit entrances required in existing manhole walls shall be core drilled.

4.3.3 Pad Mount Switchgear.

4.3.3.1 General Description. Padmount switchgear shall have the following characteristics.

1. Outdoor, low profile, padmount switchgear.
2. Dead front design.
3. Suitable for mounting on box pad without the use of bracing for switch tank support.
4. Ganged three phase switches for each switched way.
5. Each switched way shall be independently hook stick operable.
6. Switch insulation medium shall be insulating oil.
7. Switch interruption medium shall be vacuum.
8. Switchgear shall be constructed in accordance with ANSI Standard C37.72.
9. All access doors shall have provisions for securing doors in the open position.

4.3.3.2 Electrical Characteristics.

1. Nominal voltage: 15 kV, BIL 95 kV, 60 Hz.
2. Operating voltage: 7.2/12.5 kV grounded wye.
3. Continuous current rating: (Min.) 600 amps.
4. Momentary current rating: (min.) 15 KA (asym.)

4.3.3.3 Required Features and Accessories.

1. Switch operating handles shall be hook stick operable, and clearly marked with switch position and circuit identification.

2. 200 amp switched ways shall incorporate load break bushing wells with load break bushing inserts installed for primary cable termination. 200 amp switched ways shall include adjustable fault sensing and adjustable three phase interrupting of single phase faults. Bushing wells and inserts shall be installed in accordance with manufacturers' instructions.

3. 600 amp switched ways shall incorporate 600 amp, dead break bushings for primary cable terminations.

4. One line electrical diagrams of switch arrangements shall be mounted in clear view when all access doors are opened. Phase identification shall be clearly marked.

5. Nameplate describing all electrical parameters of switchgear shall be provided.

6. A minimum of three (3) welded, ground lug attachment points for neutral termination on lower front of each side of the switch tank shall be provided. Ground lugs shall accommodate 1/0 stranded copper ground conductor.

7. Switchgear finish shall be according to Federal Specification Standard 595a, color 33578.

8. Access doors shall have penta-head locking device and provisions for padlock. Provide 7" x 10" caution warning signs on exterior of all access doors.

9. Switchgear units shall be shipped completely filled with non-PCB insulating oil. Provide certification of PCB tests of each unit. Provide pressure relief device, oil level indicating device, and oil sampling device. Note: Drain plug does not constitute an oil sampling device.

10. Refer to Section 5.1 for typical padmount switchgear detail drawing.

11. Instruction Manuals, Test Reports and Parts Lists. Seller shall furnish complete instruction manuals covering installation, operation and maintenance for padmount switchgear. Manuals, bound in binders and properly labeled to indicate the equipment covered, shall include:

- a. Certified outline, assembly, and installation drawings; certified foundation drawings; and complete nameplate data for each item.

- b. Specific equipment instruction books.
- c. Renewal parts lists for all replaceable parts and assemblies.
- d. Applicable factory test reports.

4.3.4 Load Break Junction Enclosure.

4.3.4.1 General Description. Load break junction enclosure shall have the following characteristics.

1. Outdoor, low profile, dead front design enclosure for 200 amp class load break modules and associated load break elbows.
2. Enclosures shall be constructed of mild steel with top hinge and sized as indicated in Section 5.1 construction unit drawings.
3. Enclosure finish shall be according to Federal Specification Std. 595a, color 33578. Access door shall have penta-head locking device and provisions for padlock. Provide 7" x 10" caution warning sign on exterior of access door.
4. Enclosures shall have provisions for mounting 200 amp multipoint load break modules with stainless steel U clamps.
5. A minimum of three welded ground lug attachments points for neutral termination shall be provided. Ground lugs shall accommodate 1/0 stranded copper ground conductor.
6. Foundation for load break junction enclosures shall consist of steel reinforced concrete vault and pad as detailed in Section 5.1 construction unit drawings.

4.3.5 Fault Indicators.

4.3.5.1 General Description. Fault indicators shall have the following characteristics.

1. Fault indicators shall be installed on all load side cables and tap cables in padmount switchgear, padmount junction enclosures, and pad transformers.

2. Fault indicators shall be completely self-contained, requiring no external wiring, sealed and rated for installation in wet locations and shall be automatically resetting requiring no external tools.

3. Trip settings for fault indicators shall be 600 amperes on feeder cables, and 300 amperes on branch circuit cables. Refer to Section 5.1 for construction unit drawing for fault indicators.

4.3.6 Vaults and Pads.

4.3.6.1 General Description. Equipment vaults and pads shall have the following characteristics.

1. Vaults and pads shall be precast of steel reinforced concrete.
2. Concrete mix for vaults and pads shall be designed for the intended purpose and have the following minimum design parameters:
 - a. Minimum cement content of 5-1/2 sacks per cubic yard.
 - b. Maximum water content 6 gallons per sack.
 - c. Minimum 28 day compressive strength of 3000 psi.
 - d. Slump range 2 inches to 4 inches.
 - e. Air content shall be 5 percent by volume.
3. Reinforcing steel for vaults and pads shall be grade 60, conforming to ASTM A615. Refer to section 5.1 for construction unit drawing detailing steel requirements and dimensional data for vaults and pads.
4. Vault and pad dimensions shall be determined by equipment dimensions, weight of equipment and pulling sheave radius as determined by cable pulling calculations.

4.3.7 Padmount Transformers.

4.3.7.1 General Description. Padmount transformers shall have the following characteristics:

1. Outdoor, low provide, padmount transformers.
Note: "Unit Residential" type padmount transformers are not acceptable.

2. Dead front design for primary terminals, NEMA spade terminals for secondary terminals.

3. Mineral oil filled. Use of a less flammable fluid meeting NEC 450-23 shall be permitted. Refer to AFM 88-9 for criteria where less flammable fluid must be used.

4. Loop feed design.

5. Integral, rotary "T" blade, load break sectionalizing switch, hook stick operable.

6. Three phase transformers shall be constructed in accordance with ANSI Standard C57.12.26.

7. Single phase transformers shall be constructed in accordance with ANSI Standard C57.12.25 with Type I terminal arrangement.

8. Access doors shall have provisions for securing doors in the open position.

4.3.7.2 Electrical Characteristics.

1. Primary voltage rating: 12470 Grd. Y/7200 volts.

2. BIL 95 kV, Class OA, 60 Hz, 65° C rise.

3. Integral, load break switch and loop feed components rated 200 amps continuous current.

4. Secondary voltage for three phase service shall be 208Y/120 volts, 416Y/240 volts or 480Y/277 volts as required.

5. Transformer shall be two winding type construction. Autotransformers shall not be provided.

4.3.7.3 Required Features and Accessories.

1. Transformer finish shall be according to Federal Specification Standard 595a, Color 33578.

2. Access doors shall have penta-head locking device and provisions for padlock. Provide 7" x 10" caution warning signs on exterior of all access doors.

3. Units shall be shipped completely filled with non-PCB insulating oil. Provide certification of PCB tests of each unit. Provide pressure relief device dial type oil temperature gauge, and oil sampling device. Note: drain plug does not constitute oil sampling device.

4. Primary fuses shall be provided and installed. Primary fuse assembly shall consist of load break bayonet fuse, combined with internal current limiting backup fuse. Primary fuse assembly shall have minimum interrupting rating of 10,000 amperes. Bayonet fuse units shall be oil immersed, hot stick operable, rated for load break operation. Load sensing fuse elements shall be installed. One (1) spare fuse element for each bayonet fuse shall be provided. Oil drip tray for each bayonet fuse shall be provided.

5. Four position sectionalizing switches as described below shall be provided.

- a. Switches shall be integral, oil immersed, rotary, gang operated, rated for load break operation.
- b. Switches shall rotate full 360° without a physical stop. Movable index plate shall be provided that will limit accidental switch rotation.
- c. Switch operating handles shall be permanently attached, hook stick operable, and clearly marked for switch position and circuit identification.
- d. One line electrical diagrams of the switch arrangements shall be mounted in clear view when transformer access doors are opened. Phase identification shall be clearly marked.
- e. Primary switches shall be rated 200 amp (min.) continuous current.
- f. The switch positions and required sequences are defined below:

<u>Position</u>	<u>Description</u>
1	Source B connected to transformer winding.
2	Source A connected to transformer winding.
3	Source A connected to source B, transformer winding disconnected.
4	Source A and source B connected to transformer winding.

Note: Load Break bayonet fuse devices shall not be considered as providing a switching function.

6. 200 amp load break bushing wells with load break bushing inserts shall be provided and installed for primary cable terminations. Wells and inserts shall be installed in accordance with manufacturers' instructions.

7. NEMA standard spade bushing, per ANSI C57.12.26 shall be provided for transformer secondary terminations.

8. A minimum of two, welded, ground lug attachment points shall be provided for neutral termination on lower front of transformer tank. Ground lugs shall accommodate 1/0 str. cu. ground conductor.

9. Nameplate describing all electrical parameters of transformer shall be provided.

10. Refer to section 5.1 for typical padmount transformer detail drawing.

11. Instruction Manuals, Test Reports and Parts Lists. Seller shall furnish complete instruction manuals covering installation, operation and maintenance for padmount transformers. Manuals, bound in binders and properly labeled to indicate the equipment covered, shall include:

- a. Certified outline assembly and installation drawings; certified foundation drawings; and complete nameplate data for each item.
- b. Specific equipment instruction books.

c. Renewal parts lists for all replaceable parts and assemblies.

d. Applicable factory test reports.

4.3.8 Cable Termination Components.

4.3.8.1 Cable termination components include the following assemblies:

1. 200 ampere load break elbow connectors.
2. 600 ampere dead break elbow connector.
3. Conductor splices.
4. Bushing wells and load break inserts.
5. Multipoint bushing modules, 200 and 600 ampere.

4.3.8.2 General Description.

1. All components shall be premolded and factory tested according to ANSI standards. Components utilizing field applied tape are not acceptable.

2. Components shall be dead front design.

3. Cable termination components shall meet ANSI Standard 386 for separable insulating connectors and ANSI Standard 404 for cable joints.

4. 200 and 600 ampere elbow connectors shall be provided with capacitive test point suitable for voltage sensing.

5. Refer to Section 5.1 for component unit drawings.

4.3.8.3 Electrical Characteristics.

1. Nominal voltage 15 kV, BIL 95 kV, 60 Hz.

2. Operating voltage 7.2/12.5 kV grounded wye.

3. Continuous current rating: 200 amps or 600 amps.

4. Load break elbow connectors shall be suitable for switching on a 3 phase system and shall have a 14.4 kV maximum phase to phase voltage rating.

4.3.9 System Grounding.

4.3.9.1 General Description. System grounding shall have the following characteristics.

1. System grounding assemblies shall be installed at all transformer, switchgear and manhole locations. Refer to Section 5.1 for typical grounding construction unit drawing.

2. Grounding assemblies shall consist of two, 8 foot copperclad ground rods driven in undisturbed soil. A direct buried, 1/0 copper ground wire shall connect ground rods to the primary neutral wires, the secondary neutral, and all groundable parts of the equipment. The ground wire shall be routed so as to provide a ground plane for personnel operating the equipment.

3. A five pound magnesium sacrificial anode shall be installed for passive, cathodic protection of the ground rods. Electrical connection of the anode to the ground system shall be made at the ground bus inside the equipment enclosure.

4.3.10 Station and Cable Identification System.

4.3.10.1 Poles, padmount switchgear, sectionalizing enclosures and transformers shall be fitted with permanently marked system station numbers. Padmount equipment shall be provided with station number stenciled on the exterior and interior of the equipment enclosure.

4.3.10.2 Each phase and each circuit cable shall be identified by means of a non-metallic tag. Identification tags shall be installed at every manhole, riser pole, junction point and piece of padmount equipment. Cables shall be identified at each end. Identification shall include: Circuit Number ("CKT4-NCF"); Phase ("PhA, PhB, PhC"); and Destination Station Number ("To STA 500-L1"). Tags shall not start with the word "From". Cable identification tags shall be securely attached to cable with tie wraps. Tagging system materials shall be Reliable Type S-850. System station numbers will be assigned by the using agency. Each pole, manhole and padmount equipment will be assigned a station number that, where possible, extends the station numbering sequence established.

4.3.11 Transformer Fusing Schedule:

**Padmount Transformers with Bay-O-Net Type Fuse
and Internal Back Up Fuse**

<u>Transformer kVA</u>	<u>Single Phase</u>	<u>CL* Backup</u>	<u>Three Phase</u>	<u>CL* Backup</u>
25	C05	40		
37.5	C05	50		
45			C03	30
50	C08	80		
75			C05	40
112.5			C08	100
150			C08	100
225			C10	175
300			C10	175
500			C12	160P
750			C14	300P
1000			C14b	350P
1500			C18a	

- * - Type RTU ELSP ampacity shown
- P - Indicates parallel fuse application
- a - Grounded Y primary recommended
- b - Some overload capacity lost

Padmount Transformers with Drywell (ELX) Type Fuse

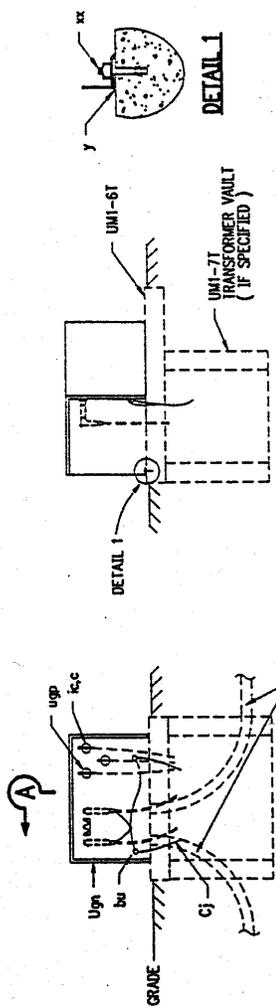
<u>kVA Three-Phase</u>	<u>Recommended Fuse Current Ratings</u>
45	6
75	6
100	8
112.5	12
150	18
200	20
225	20
300	25
500	50
750	80P
1000	100P
1500	100P
2000	*100P

- P - Indicates parallel fuse application
- * - Some overload capacity lost

Pole Type Transformers

<u>Transformer kVA</u>	<u>Delta Connected</u>		<u>Wye Connected</u>
	<u>1ϕ & Vϕ</u>	<u>3ϕ</u>	
10	3D	5D	3D
15	3D	5D	3D
25	5D	10D	5D
37.5	6T	12T	6T
50	8T	15T	8T
75	12T	25T	12T
100	15T	30T	15T
167	30T	50T	30T

ITEM	QTY.	MATERIAL
Ugn	1	TRANSFORMER, PAD MOUNTED, 1 PHASE, ANSI TYPE I FRONT PLATE
bu	2	CONNECTOR, EQUIPMENT GROUND
Cj	AS REQD	GROUND WIRE, 1/0 STRANDED - CL
P	AS REQD	CONNECTORS, COMPRESSION TYPE, COPPER, BLACKBURN TYPE CF2020 OR EQUAL
xx	4	3/4" X 2" EXPANSION STUD ANCHOR, WITH ONE NUT AND WASHER
Y	AS REQD	EQUIPMENT JOINT FILLER, URETHANE, SIKAFLEX 1A OR EQUAL
ugp	3	CONDUCTOR TERMINAL, NEMA 2-HOLE PAD, ANDERSON TYPE L
c	3	PLATED BRONZE BOLT, NUT, AND BELLEVILLE WASHER
lc	3	INSULATING COVER, 600 VOLT, BLACKBURN TYPE MPC.



ALTERNATE CONSTRUCTION WITH CONDUIT SWEEP WHEN TRANSFORMER VAULT IS NOT SPECIFIED.

SECTION A-A

FRONT ELEVATION

KVA SIZE
NOTE 6

TRANSFORMER CODE: UG7M-2S-50-1

TRANSFORMER TYPE
PRIMARY VOLTAGE CODE
SECONDARY VOLTAGE CODE

TRANSFORMER TYPE:
UG5 RADIAL FEED
UG7 LOOP FEED

PRIMARY VOLTAGE CODE:
1S 4160 GND 1/2400 V 12470 GND 1/7200 V
2S 4160 GND 1/2400 x 12470 GND 1/7200 V
3S 12470 GND 1/7200 V

SECONDARY VOLTAGE CODE:
1 240/120 V 3 BUSHING
2 120/240 V 4 BUSHING
3 240/480 V 4 BUSHING

NOTES:

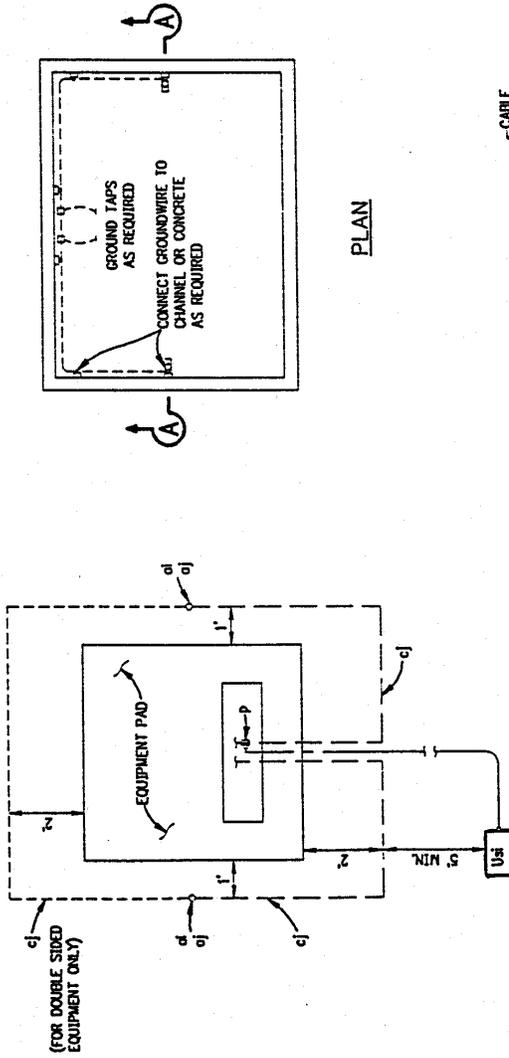
- UNIT INCLUDES INSTALLATION OF EQUIPMENT AND MATERIAL LISTED.
- PROVIDE SUFFICIENT SLACK IN PRIMARY NEUTRAL PIGTAIL AND CABLE TO PERMIT READY DISCONNECTION OF ELBOW AND MOUNTING ON PARKING STAND OR OPPOSITE BUSHING.
- UNIT INCLUDES TERMINATION OF NEW OR EXISTING SECONDARY SERVICE CONDUCTORS.
- UNIT INCLUDES STERILIZING SYSTEM STATION NUMBERS ON INTERIOR AND EXTERIOR OF ENCLOSURE.
- JOINT FILLER SHALL BE INSTALLED TO MAKE WATER TIGHT INSTALLATION.
- SUFFIX M INDICATES MINERAL OIL INSULATING FLUID. SUFFIX F INDICATES LESS-FLAMMABLE INSULATING FLUID PER NEC 450-23.

Fig.	Date	Revision	SSP Inc. ENGINEERS SOUTH, DAKOTA	Scale: NONE Date: MAY 1982 Per: 06-11-85 13:10 Proj. No: 06-007	SINGLE PHASE TRANSFORMER UG6- & UG7-	File: UG7
						Sheet 1 of 1

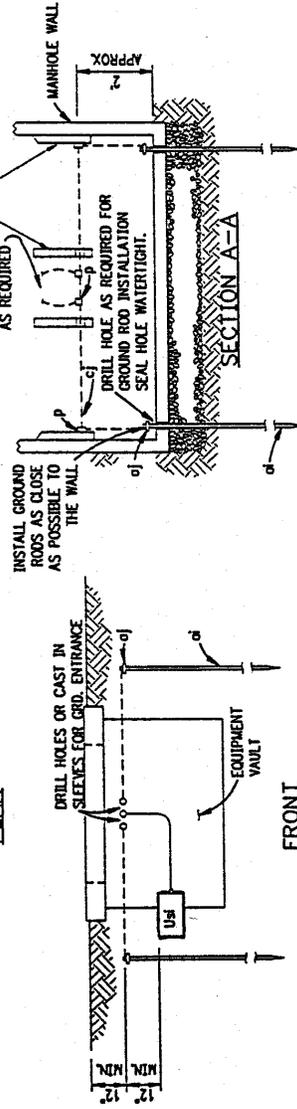
ITEM	DESCRIPTION	UM48-5E	UM48-5M
ai	GROUND ROD 3/4" x 10' COPPER/CLAD.	2	2
aj	CLAMP, BLACKBURN TYPE GUY OR EQUAL	2	2
cj	1/8" STR. COPPER GROUND WIRE	AS REQ'D	AS REQ'D
p	CONNECTORS, COMPRESSION BLACKBURN TYPE CF 2020 OR APPROVED EQUAL	AS REQ'D	AS REQ'D
usi	MAGNESIUM ANODE, 5LB. SACRIFICIAL WITH INSULATED LEAD, HARCO GALVANIZING OR APPROVED EQUAL.	1	

NOTES

- UNIT INCLUDES INSTALLATION OF EQUIPMENT AND MATERIAL LISTED.



PLAN



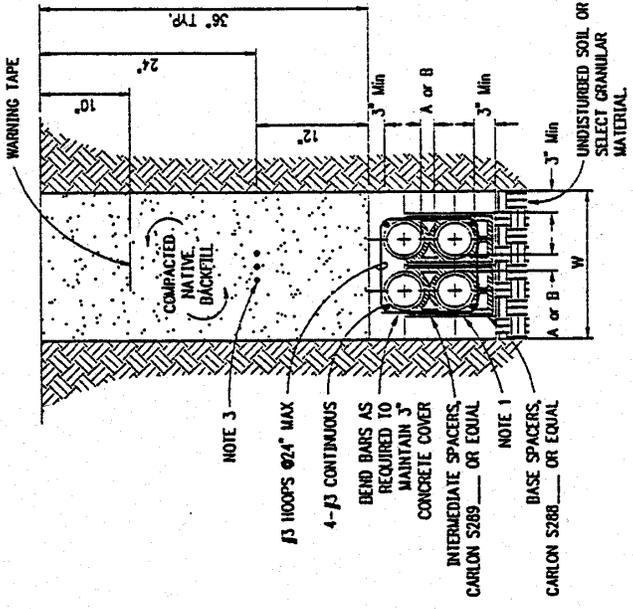
FRONT

MANHOLE GROUND
UM48-5M

EQUIPMENT GROUND
UM48-5E

Rev.	1	of	1
Sheet	1 of 1		
File	UM48-5		
Project	UM48		
Date		Drawn	CSJ
Check		Checked	CSJ
Scale	NONE		
Drawn	CSJ		
Checked	CSJ		
Date	MAY 1992		
Project	11-05-13-70		

SSi ENGINEERS
INC.
SOUTH DAKOTA



MATERIAL	A	B
FIRE CLAY-CEMENT	1 1/2"	4"
FIBER	2"	4"
PLASTIC	2"	4"
ASBESTOS CEMENT	2"	4"

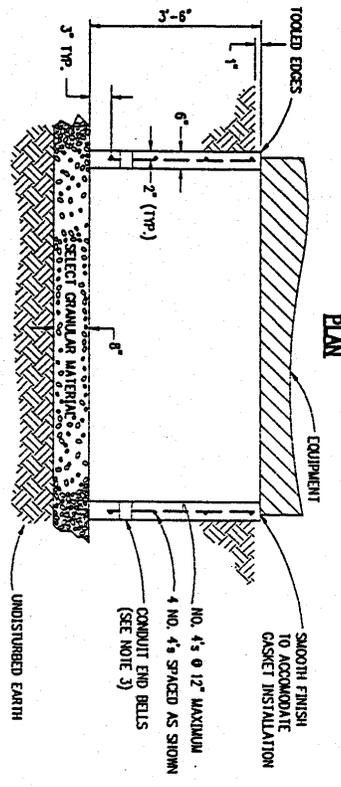
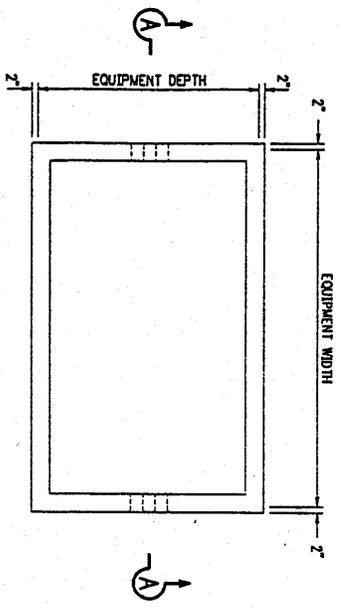
A - SEPARATION FOR ALL POWER OR ALL COMMUNICATIONS.
 B - SEPARATION BETWEEN POWER AND COMMUNICATIONS.

NOTES:

- ADJUST CONDUIT SPACING, DEPTH, AND ALIGNMENT AS NECESSARY FOR MANHOLE ENTRANCE.
- BACKFILL MATERIAL SHALL BE COMPACTED TO A MINIMUM OF 90% OF MAXIMUM DRY DENSITY AS DETERMINED THE MODIFIED PROCTOR TEST.
- DIRECT BURIED SECONDARY LINES ARE INCLUDED IN SOME OF THE TRENCHES IN THE IMPROVE. CAPERHART ELECTRICAL DISTRIBUTION ON DRAWING AF 812-40-02.
- SELECT GRANULAR MATERIAL SHALL MEET GRADATION REQUIREMENTS AS DESCRIBED IN THE WRITTEN SPECIFICATIONS.

NO. CONDUITS	CONFIGURATION	W (INCHES)
1-2"	O	10"
2-4"	O O	18"
2-5"	O O	20"
4-5"	O O O O	20"
9-5"	O O O O O O O O O	27"

Date	Revision	SSR Inc. ENGINEERS SOUTH DAKOTA	ELLSWORTH AIR FORCE BASE SOUTH DAKOTA	EGYPT D. NESS DATE: MAY 1992 PROJ: 04-11	Scale: 1"=1'-0" DATE: MAY 1992 PROJ: 04-11	TRENCH AND DUCT BANK DETAIL	File: UR2-N Sheet: 1 of 1



- NOTES:**
1. ALL DISTURBED EARTH SHALL BE COMPACTED TO A MINIMUM OF 90% MAXIMUM DRY DENSITY AS DETERMINED BY THE MODIFIED PROCTOR TEST.
 2. SELECT GRANULAR MATERIAL SHALL MEET GRADATION REQUIREMENTS AS DESCRIBED IN THE WRITTEN SPECIFICATIONS.
 3. CONDUIT ENTRANCE LOCATIONS MAY BE ANY COMBINATION OF THE FOUR SIDES OF THE VAULT. CONTRACTOR SHALL DETERMINE REQUIRED QUANTITY AND PROPERLY LOCATE EMBEDDED CONDUIT END BELLS TO COORDINATE WITH CONDUIT RUNS.

Rev.	0	DATE	DESCRIPTION
Rev.	1	DATE	DESCRIPTION
Rev.	2	DATE	DESCRIPTION
Rev.	3	DATE	DESCRIPTION
Rev.	4	DATE	DESCRIPTION
Rev.	5	DATE	DESCRIPTION
Rev.	6	DATE	DESCRIPTION
Rev.	7	DATE	DESCRIPTION
Rev.	8	DATE	DESCRIPTION
Rev.	9	DATE	DESCRIPTION
Rev.	10	DATE	DESCRIPTION

ELLSWORTH AIR FORCE BASE
SOUTH, DAKOTA

SSI Inc.
ENGINEERS

Eng. JK
Date: 04/78
Proj. No. 01C-001

Scale: NONE
Date: MAY 1992
Proj. No. 01C-001

EQUIPMENT VAULT

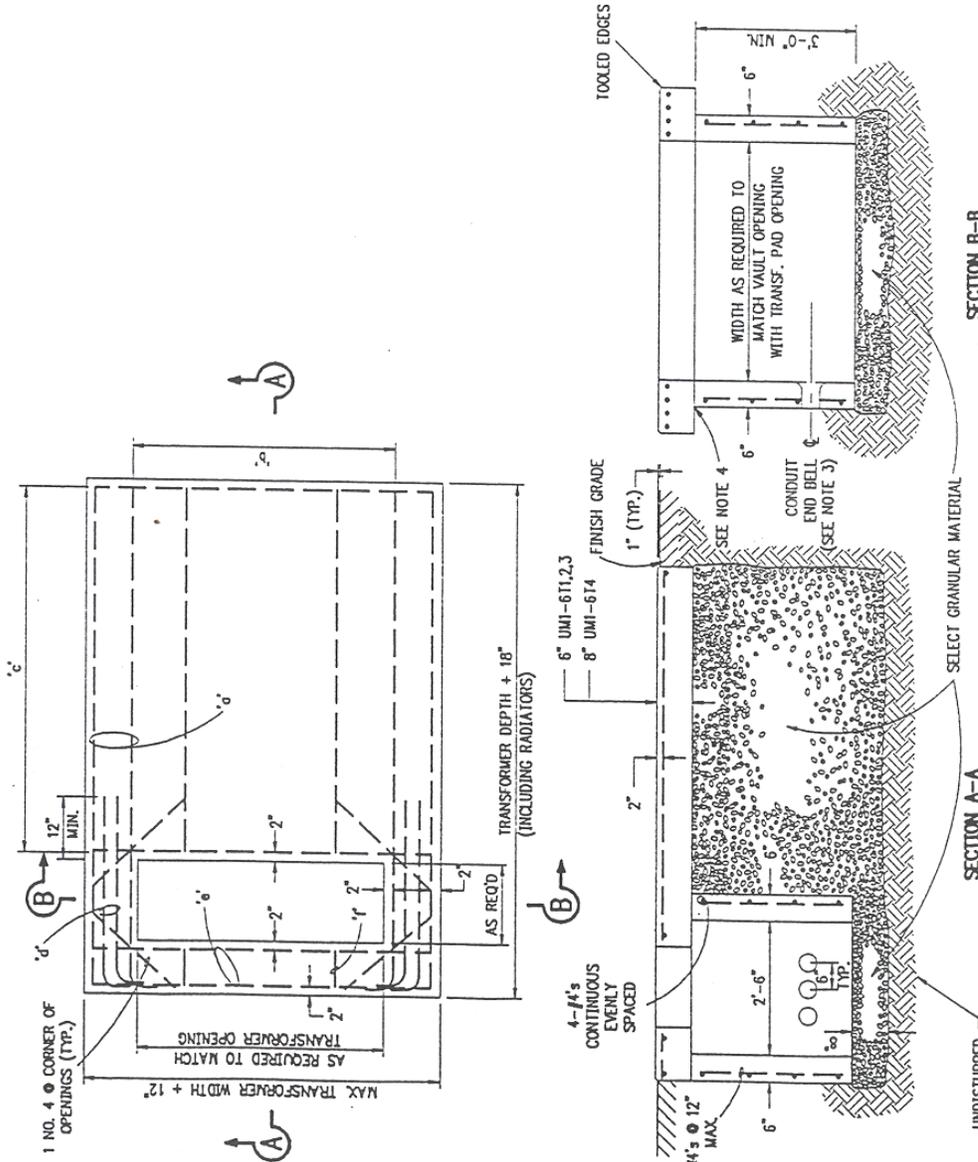
FILE UNIT-7E
Sheet 1 of 1
Rev. 0
UM1-7E

PAD AND VAULT SCHEDULE

TRANSFORMER SIZE	PAD UNIT	VAULT UNIT
25-100 KVA 1 ϕ	UMI-6T1	UMI-7T1
75-500 KVA 3 ϕ	UMI-6T2	UMI-7T2
750-2000 KVA 3 ϕ	UMI-6T3	UMI-7T3
2500-5000 KVA 3 ϕ	UMI-6T4	UMI-7T4

BAR SCHEDULE

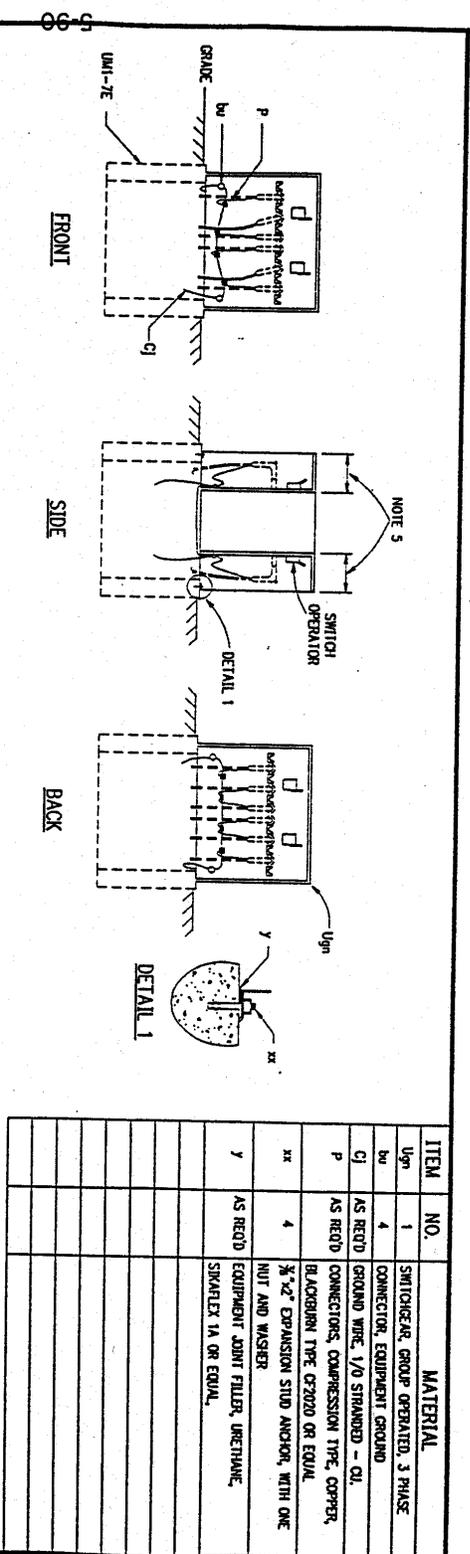
DESIG.	UMI-6T4	UMI-6T1, 2, 3
'a'	2 #5's	2 #4's
'b'	#5 @ 9" MAX.	#4 @ 2" MAX.
'c'	#5 @ 12" MAX.	#4 @ 12" MAX.
'd'	2 #5's	1 #4's
'f'	2 #5's	2 #4's
'e'	#4 @ 12" MAX.	#4 @ 12" MAX.



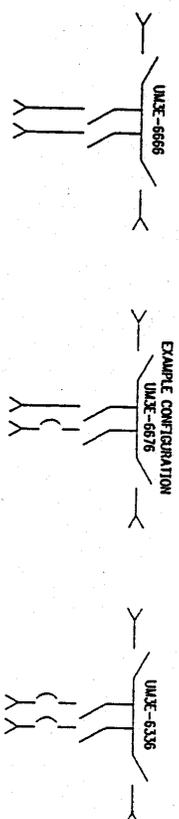
NOTES:

1. ALL DISTURBED EARTH AND SELECT FILL SHALL BE COMPACTED TO A MINIMUM OF 90% MAXIMUM DRY DENSITY AS DETERMINED BY THE MODIFIED PROCTOR TEST.
2. SELECT GRANULAR MATERIAL SHALL MEET GRADATION REQUIREMENTS AS DESCRIBED IN THE WRITTEN SPECIFICATIONS.
3. CONDUIT ENTRANCE LOCATIONS MAY BE ANY COMBINATION OF THE 4 SIDES OF THE VAULT. CONTRACTOR SHALL DETERMINE REQUIRED QUANTITY AND PROPERLY LOCATE EMBEDDED END BELLS TO COORDINATE WITH CONDUIT RUNS.
4. APPLY CONCRETE JOINT SEALANT BETWEEN VAULT AND PAD. CONSEAL BUTYL RESIN CS-202 OR APPROVED EQUAL.

<p>ESSI ENGINEERS Inc.</p> <p>SOUTH DAKOTA</p>		<p>TRANSFORMER PADS AND VAULTS</p>	
<p>Proj. No. 04-11-95 11...</p>	<p>Scale: NONE</p>	<p>File: UMI-6T</p>	<p>Rev. 0</p>
<p>App: CMJ</p>	<p>Date: MAY 1992</p>	<p>Sheet 1 of 1</p>	<p>UMI-6T - 04-11-95</p>
<p>Check: DMJ</p>	<p>Draw: DMJ</p>	<p>UMI-6T - 04-11-95</p>	<p>UMI-6T - 04-11-95</p>



ITEM	NO.	MATERIAL
Ugn	1	SWITCHGEAR GROUP OPERATED, 3 PHASE
bu	4	CONNECTOR, EQUIPMENT GROUND
CJ	AS REQD	GROUND WIRE, 1/0 STRANDED - CU.
P	AS REQD	CONNECTORS, COMPRESSION TYPE, COPPER, BLACKBURN TYPE C7200 OR EQUAL
xx	4	3/8"Ø EXPANSION STUD ANCHOR, WITH ONE NUT AND WASHER
y	AS REQD	EQUIPMENT JOINT FILLER, URETHANE, SIKAFLEX 1A OR EQUAL.



- CODE
- 2 200A SWITCH & TERMINAL
 - 6 600A SWITCH & TERMINAL
 - 7 600A SWITCH & TERMINAL, WITH FAULT SENSING & 3Ø FAULT INTERRUPTION
 - 3 200A SWITCH & TERMINAL, WITH FAULT SENSING & 3Ø FAULT INTERRUPTION
- ONE LINE DIAGRAMS

- NOTES:
1. UNIT INCLUDES INSTALLATION OF EQUIPMENT AND MATERIAL LISTED.
 2. PROVIDE SUFFICIENT SLACK IN PRIMARY NEUTRAL PIGTAIL AND CABLE TO PERMIT READY DISCONNECTION OF ELBOW AND MOUNTING ON PARKING STAND OR OPPOSITE BUSHING.
 3. UNIT INCLUDES STENCILING SYSTEM STATION NUMBERS ON INTERIOR AND EXTERIOR OF ENCLOSURE.
 4. JOINT FILLER SHALL BE INSTALLED TO MAKE WATER TIGHT INSTALLATION.
 5. SWITCH ENCLOSURE DOORS SHALL BE SIZED TO PROVIDE CLEARANCE FOR 600A TERMINATIONS AND GROUNDING ELBOWS WHEN ENCLOSURE DOORS ARE CLOSED.

Rev	Date	Revisions

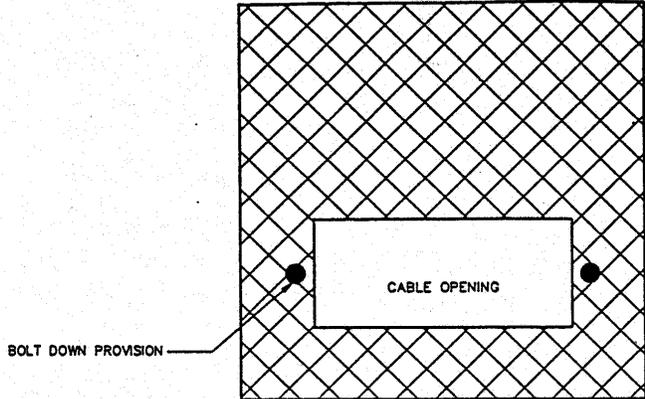
ELLSWORTH AIR FORCE BASE
SOUTH, DAKOTA

Eng: JMS	Scale: NONE
Date: 01/78	Date MAY 1982
App: CRJ	Factor: 1.0 - 1.119

SSR Inc.
ENGINEERING

SWITCHGEAR

File: UMI3E	Rev: 11
Sheet 1 of 1	



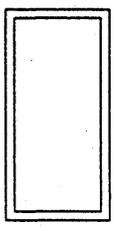
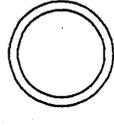
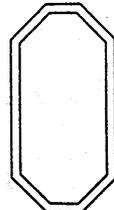
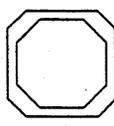
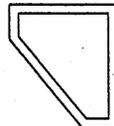
NOTES:

1. PAD ASSEMBLIES INCLUDE SITE PREPARATION, BEDDING AND DRAINAGE.
2. EQUIPMENT SHALL BE SECURED TO PAD IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
3. CABLE OPENING AND PAD DIMENSIONS SHALL BE AS REQUIRED.

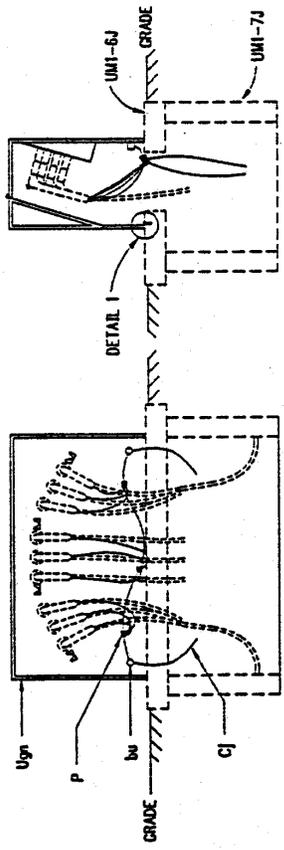
UNIT DESIGNATION:

- UM1-5C CONCRETE
- UM1-5NC NON-CONCRETE

	PAD ASSEMBLIES	
		UM1-5C UM1-5NC

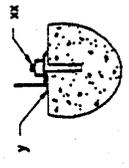
 <p>RECTANGULAR UM1-7M01 4' x 6' -7M02 4' x 9' -7M03 6' x 8' (NOTE 1) -7M04 8' x 12'</p>	 <p>SQUARE UM1-7M08 4' x 4' -7M09 8' x 8' -7M10 12' x 12'</p>	 <p>ROUND UM1-7M14 4' DIA. -7M15 5' DIA.</p>	 <p>OCTAGONAL UM1-7M18 4' x 6'-6" -7M19 4' x 8'-6"</p>	
 <p>OCTAGONAL UM1-7M20 8' x 8'</p>	 <p>OCTAGONAL UM1-7M21 8'-6" x 8'-6"</p>	 <p>TRIANGULAR UM1-7M24 6' x 6'</p>	<p>SPECIAL OVERSIZED UNITS UM1-7M(LxW)</p>	
<p>NOTES: 1. UNITS ON THIS SHEET DEPICT SIZE AND SHAPE OF EXISTING MANHOLES. FOR NEW MANHOLE UNITS REFER TO UNIT DRAWING #UM1-7M03 FOR DETAILS.</p>				
<p>SSR Inc. ENGINEERS</p> <p>Engr: RJK Dwn: JTB Ckd: DMJ App: CWI</p>		<p>Scale: NONE Date: MAY 1992 Plot: 04-11-95 13:16 Proj. No: COE-007</p> <p>ELLSWORTH AIR FORCE BASE EXISTING MANHOLES AND VAULT ROOMS</p>		<p>File: UM1-7M Sheet 1 of 1 Rev. 0</p> <p>UM1-7M</p>

ITEM	MATERIAL	QUANTITY	
		UM33-1	UM33-2
Ugn	EQUIP. ENCLOSURE, WALTON #MD1308716 OR APPROVED EQUAL	1	
bu	CONNECTOR, EQUIPMENT GROUND	2	2
CJ	GROUND WIRE, 1/0 STRANDED CU.	AS REQD	AS REQD
P	CONNECTORS, COMPRESSION TYPE, COPPER, BLACKBURN TYPE CF2020 OR EQUAL	AS REQD	AS REQD
xx	3/4" x 2" EXPANSION STUD ANCHOR, WITH ONE NUT AND WASHER	4	4
Y	EQUIPMENT JOINT FILLER, URETHANE, SIKAFLEX 1A OR EQUAL	AS REQD	AS REQD
Ugn	EQUIP. ENCLOSURE, WALTON #MD1304816 OR APPROVED EQUAL		1



SECTION A-A

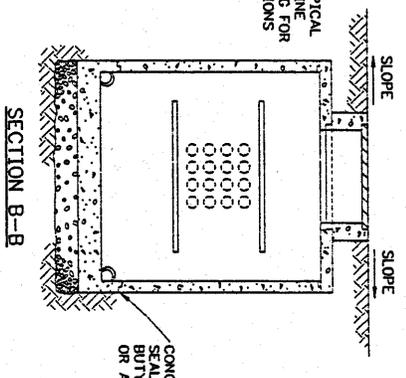
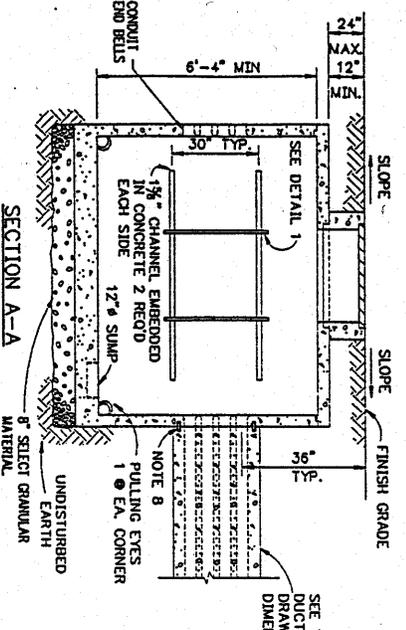
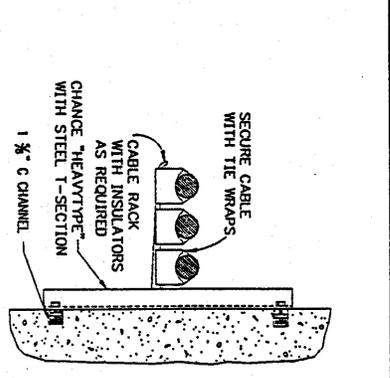
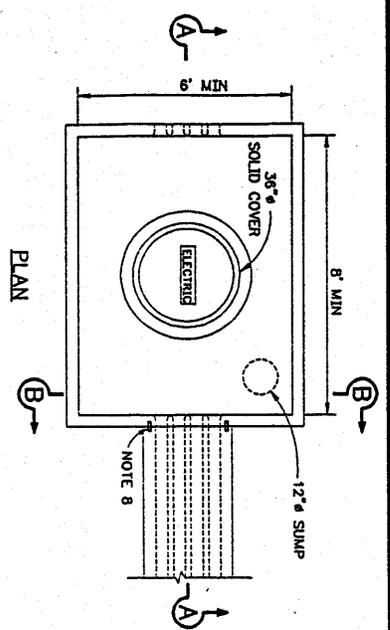
FRONT ELEVATION



DETAIL 1

- NOTES:**
- UNIT INCLUDES INSTALLATION OF EQUIPMENT AND MATERIAL LISTED.
 - PROVIDE SUFFICIENT SLACK IN PRIMARY NEUTRAL PIGTAIL AND CABLE TO PERMIT READY DISCONNECTION OF ELBOW AND MOUNTING ON PARKING STAND OR OPPOSITE BUSHING.
 - UNIT INCLUDES STENCILING SYSTEM STATION NUMBERS ON INTERIOR AND EXTERIOR OF ENCLOSURE.
 - JOINT FILLER SHALL BE INSTALLED TO MAKE WATER TIGHT INSTALLATION.

Date	Revision	Scale: NONE	Rev.
		Date: MAY 1992	Sheet 1 of 1
		Proj: 04-11-95 13-18	UNIT-1 P. 11/11
		Eng: SK	
		Des: DJ/TB	
		Chk: DJ	
		App: CMJ	
SSP INC. ENGINEERS		EQUIPMENT ENCLOSURE	
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA			



NOTES

1. THE MANHOLE MAY BE CONSTRUCTED OF PREPARED CONCRETE SECTIONS CAPABLE OF QUICK FIELD ASSEMBLY.
2. ALL JOINTS SHALL BE CASKED TO FORM A WEATHER TIGHT SEAL.
3. MANHOLE COVER AND STRUCTURAL SECTIONS SHALL BE DESIGNED FOR AASHTO-HS20-44 LOADING APPLIED AT FINISH GRADE.
4. PULLING EYES SHALL BE CAPABLE OF 5000 LB. WORKING TENSION.
5. MANHOLE SHALL BE PLUMBED WITHIN 1/2" HORIZONTAL IN 10 FT. VERTICAL.
6. ALL DISTURBED EARTH AND SELECT FILL SHALL BE COMPACTED TO A MINIMUM OF 90% MAXIMUM DRY DENSITY AS DETERMINED BY THE MOISTURE PROCTOR TEST.
7. SELECT GRANULAR FILL SHALL MEET GRADATION REQUIREMENTS AS DESCRIBED IN THE WRITTEN SPECIFICATIONS.
8. KEY DUCT BANK INTO MANHOLE WALL FOUR PLACES.
9. CONDUIT ENTRANCE LOCATIONS MAY BE ANY COMBINATION OF THE FOUR SIDES OF THE MANHOLE. CONTRACTION SHALL DETERMINE REQUIRED QUANTITY AND PROPERLY LOCATE EMBEDDED CONDUIT END BELLS TO COORDINATE WITH CONDUIT RIMS.

No.	Date	Revision

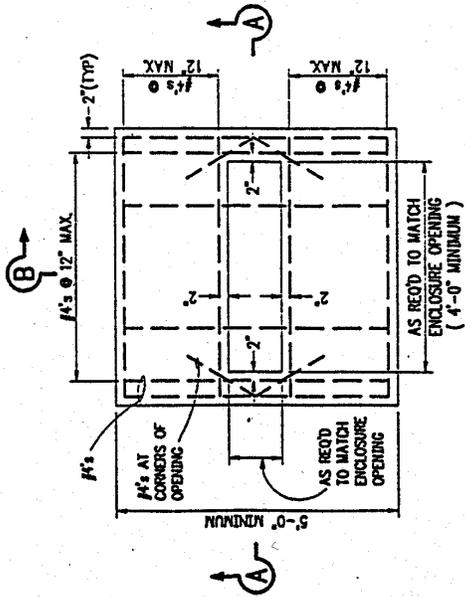
ELLSWORTH AIR FORCE BASE
SOUTH, DAKOTA

SSP Inc.
ENGINEERS

Drawn: JMK	Scale: NONE
Check: GWT	Date: MAY 1982
Design: DM	Project: 11-55-1315
Drawn: JMK	Drawn: JMK

6 FT. X 8 FT. MANHOLE (NEW)

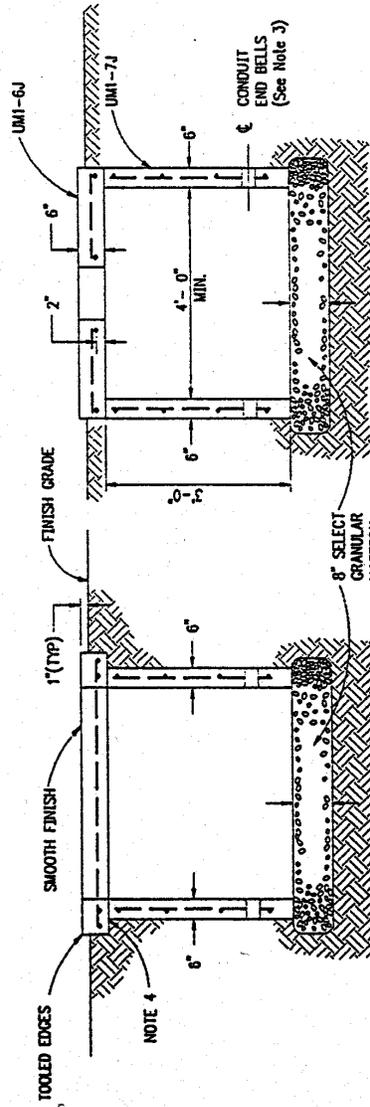
THE UNIT-7103
Sheet 1 of 1
UM1-7103



PLAN

NOTES:

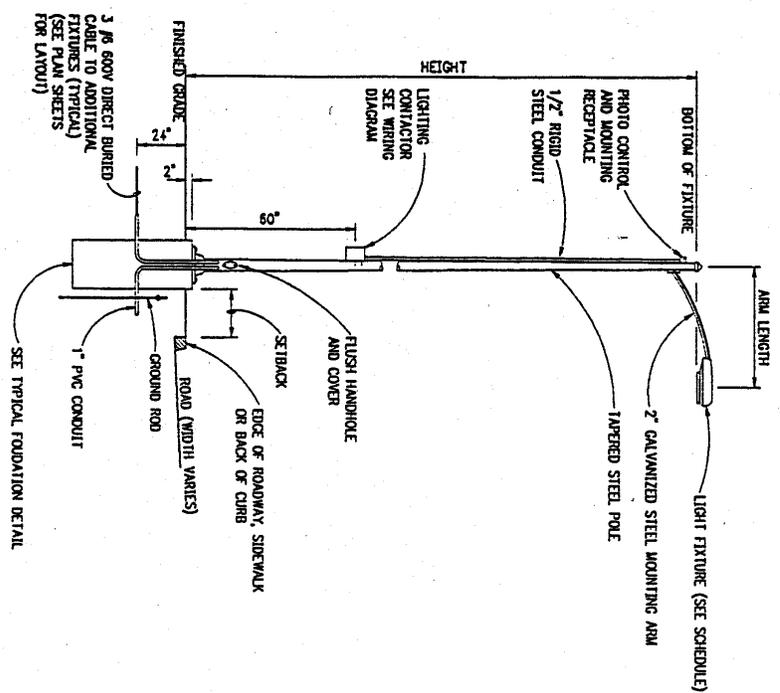
1. ALL DISTURBED EARTH AND SELECT FILL SHALL BE COMPACTED TO A MINIMUM OF 90% MAXIMUM DRY DENSITY AS DETERMINED BY THE MODIFIED PROCTOR TEST.
2. SELECT GRANULAR MATERIAL SHALL MEET GRADATION REQUIREMENTS AS DESCRIBED IN THE WRITTEN SPECIFICATIONS.
3. CONDUIT ENTRANCE LOCATIONS MAY BE ANY COMBINATION OF THE FOUR SIDES OF THE VAULT. CONTRACTOR SHALL DETERMINE REQUIRED QUANTITY AND PROPERLY LOCATE EMBEDDED CONDUIT END BELLS TO COORDINATE WITH CONDUIT RUNS.
4. APPLY CONCRETE JOINT SEALANT CONTINUOUS BETWEEN VAULT AND PAD. CONSEAL BUTYL RESIN CS-202 OR APPROVED EQUAL.



SECTION A-A

SECTION B-B

Scale: NONE	Drawn: DM/7B	Checked: DM	Proj. No: 7
Date: MAY 1982	Project: 11-95 13/12		
File: UMI-6J	Sheet: 1 of 1	Rev: J	
JUNCTION ENCLOSURE PAD & VAULT			UMI-6J (UMI-7)
SSR Inc. ENGINEERS SOUTHWEST AIR FORCE BASE SOUTH, DAKOTA			



LIGHTING FIXTURE SCHEDULE FOR UNIT UMSLP-

FIXTURE TYPE	STANDARD DETAIL	LAMP TYPE	VOLTAGE	IES DISTRIBUTION TYPE
II-100W	TYPE 405-C-2	LU 100 HPS	240V	MEDIUM, CUTOFF, TYPE II
III-150W	TYPE 405-C-3	LU 150 HPS	240V	MEDIUM, CUTOFF, TYPE III
III-100W	TYPE 405-C-3	LU 100 HPS	240V	MEDIUM, CUTOFF, TYPE III

UNIT SCHEDULE

UMSLP-	II-100W	III-150W	III-100W	II-150W-10
HEIGHT (FT)	25	25	30	25
ARM LENGTH (FT)	4	4	4	10
SET BACK (FT)	1	1	1	7

Rev.	Date	Revised

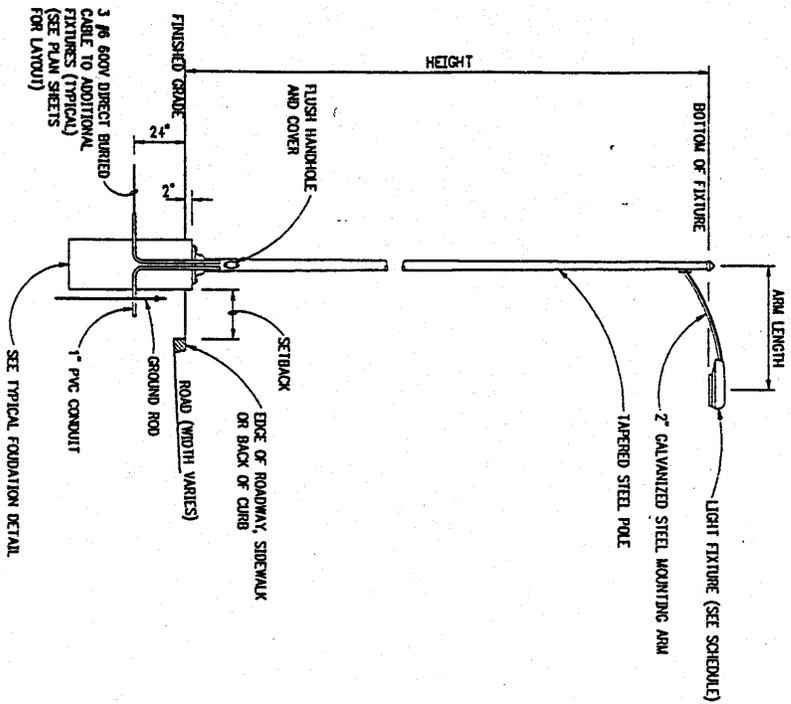
ELLSWORTH AIR FORCE BASE
SOUTH DAKOTA

SSR Inc.
ENGINEERS

Exp'd. Date	Scale
DATE 04/11/92	DATE MAY 1992
DATE 04/11/92	DATE 04/11/92
DATE 04/11/92	DATE 04/11/92

LIGHTING POLE AND FIXTURE
WITH PHOTO CONTROL.

Proj. UMSLP	Rev.
Sheet 1 of 1	0
UMSLP-	



LIGHTING FIXTURE SCHEDULE FOR UNIT UM3-

FIXTURE TYPE	STANDARD DETAIL	LAMP TYPE	VOLTAGE	IES DISTRIBUTION TYPE
II-100W	TYPE 405-C-2	LU 100 HPS	240V	MEDIUM, CUTOFF, TYPE II
III-150W	TYPE 405-C-3	LU 150 HPS	240V	MEDIUM, CUTOFF, TYPE III
III-100W	TYPE 405-C-3	LU 100 HPS	240V	MEDIUM, CUTOFF, TYPE III

UNIT SCHEDULE

UM3-	II-100W	III-150W	III-100W	III-150W-10
HEIGHT (FT)	25	25	30	25
ARM LENGTH (FT)	4	4	4	10
SET BACK (FT)	1	1	1	7

Rev.	01	DATE	01/11/92	BY	UM/esi
Rev.	02	DATE	01/11/92	BY	UM/esi
Rev.	03	DATE	01/11/92	BY	UM/esi
Rev.	04	DATE	01/11/92	BY	UM/esi
Rev.	05	DATE	01/11/92	BY	UM/esi
Rev.	06	DATE	01/11/92	BY	UM/esi
Rev.	07	DATE	01/11/92	BY	UM/esi
Rev.	08	DATE	01/11/92	BY	UM/esi
Rev.	09	DATE	01/11/92	BY	UM/esi
Rev.	10	DATE	01/11/92	BY	UM/esi
Rev.	11	DATE	01/11/92	BY	UM/esi
Rev.	12	DATE	01/11/92	BY	UM/esi
Rev.	13	DATE	01/11/92	BY	UM/esi
Rev.	14	DATE	01/11/92	BY	UM/esi
Rev.	15	DATE	01/11/92	BY	UM/esi
Rev.	16	DATE	01/11/92	BY	UM/esi
Rev.	17	DATE	01/11/92	BY	UM/esi
Rev.	18	DATE	01/11/92	BY	UM/esi
Rev.	19	DATE	01/11/92	BY	UM/esi
Rev.	20	DATE	01/11/92	BY	UM/esi
Rev.	21	DATE	01/11/92	BY	UM/esi
Rev.	22	DATE	01/11/92	BY	UM/esi
Rev.	23	DATE	01/11/92	BY	UM/esi
Rev.	24	DATE	01/11/92	BY	UM/esi
Rev.	25	DATE	01/11/92	BY	UM/esi
Rev.	26	DATE	01/11/92	BY	UM/esi
Rev.	27	DATE	01/11/92	BY	UM/esi
Rev.	28	DATE	01/11/92	BY	UM/esi
Rev.	29	DATE	01/11/92	BY	UM/esi
Rev.	30	DATE	01/11/92	BY	UM/esi
Rev.	31	DATE	01/11/92	BY	UM/esi
Rev.	32	DATE	01/11/92	BY	UM/esi
Rev.	33	DATE	01/11/92	BY	UM/esi
Rev.	34	DATE	01/11/92	BY	UM/esi
Rev.	35	DATE	01/11/92	BY	UM/esi
Rev.	36	DATE	01/11/92	BY	UM/esi
Rev.	37	DATE	01/11/92	BY	UM/esi
Rev.	38	DATE	01/11/92	BY	UM/esi
Rev.	39	DATE	01/11/92	BY	UM/esi
Rev.	40	DATE	01/11/92	BY	UM/esi
Rev.	41	DATE	01/11/92	BY	UM/esi
Rev.	42	DATE	01/11/92	BY	UM/esi
Rev.	43	DATE	01/11/92	BY	UM/esi
Rev.	44	DATE	01/11/92	BY	UM/esi
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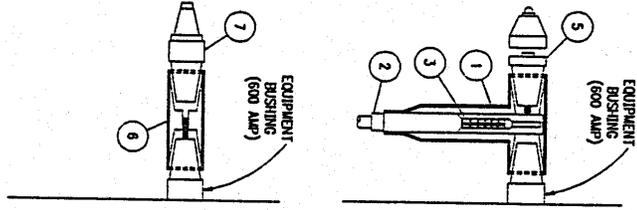
ELLSMORTH AIR FORCE BASE
SOUTH DAKOTA

SSR Inc.
ENGINEERS

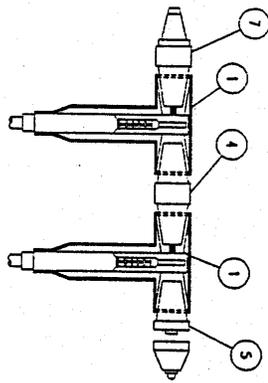
LIGHTING POLE AND FIXTURE
WITHOUT PHOTO CONTROL

Fig. UM3-
Sheet 1 of 1
UM/esi

TYPICAL ASSEMBLIES



UNIT NO.	DWG REF.	MATERIAL
UM6-3	1	ELBOW BODY
	2	CABLE ADAPTER
	3	CONNECTOR, COMPRESSION
UM6-17A	4	CONNECTING PLUG
UM6-17	5	INSULATING PLUG W/STUD
UM6-17Y	6	BUSHING EXTENSION
UM6-17X	7	200A LOADBREAK REDUCING TAP PLUG



No.	Date	Revision

ELLSWORTH AIR FORCE BASE
SOUTH, DAKOTA

SSP
INC.
ENGINEERS

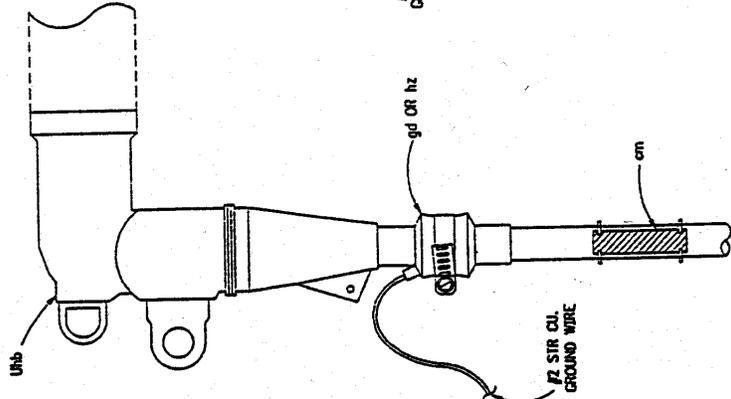
Drawn By	Scale	Date
Proj No	Proj Name	

500AMP DEAD BREAK CONNECTION
COMPONENTS

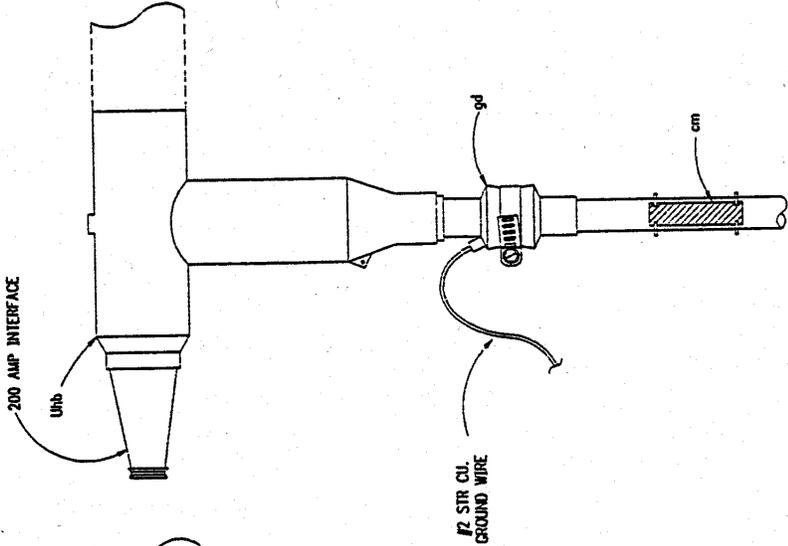
Fig	Rev
UM6-17	
Sheet 1 of 1	
UM6-3 & UM6-17	

ITEM	DESCRIPTION	QUANTITY	
		1/0	4/0
Unb	15KV CLASS 200A LOADBREAK ELBOW CONNECTOR, WITH TEST POINT, ELASTIMOLD TYPE 166LR OR APPROVED EQUAL.	1	1
Unb	15KV CLASS 600A DEADBREAK ELBOW CONNECTOR, WITH REMOVABLE 200 AMP INTERFACE, RTE T-OP OR APPROVED EQUAL.		1
hz	SEALING KIT, 3M TYPE 845Z OR APPROVED EQUAL.	1	
Cm	CABLE MARKER, RELIABLE TYPE S-850 OR APPROVED EQUAL.	1	1
gd	GROUNDING DEVICE, ELASTIMOLD 200A OR APPROVED EQUAL.		1

200 AMP LOADBREAK
UM6-1A



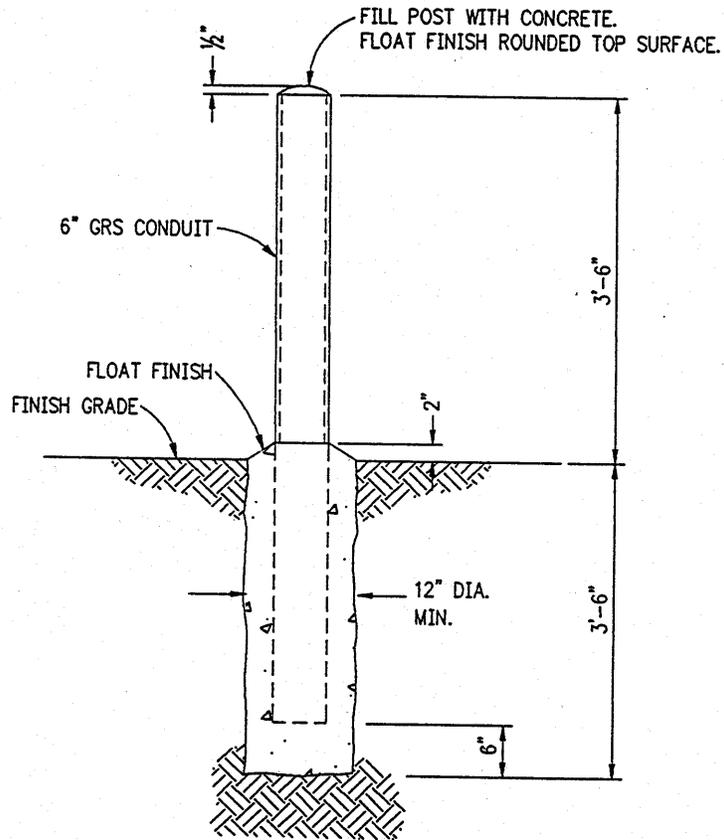
600 AMP DEADBREAK
UM6-3A



NOTES

1. UNIT INCLUDES INSTALLATION OF EQUIPMENT AND MATERIAL LISTED.
2. INSTALLATION OF CABLE ELBOWS SHALL BE IN ACCORDANCE WITH MANUFACTURERS' INSTRUCTIONS.
3. GROUND ELBOW SURFACE IN ACCORDANCE WITH MANUFACTURERS' INSTRUCTIONS.

No.	Date	Revision	SSP ENGINEERS SOUTHWORTH AIR FORCE BASE SOUTHW DAKOTA	Scale: NONE Date: MAY 1992 Proj: 04-11-95 13:25 Date: D.N. 11/16/95 C.C.K. 007	File: UM6-1A Sheet 1 of 1 (11/16-1A) 9.11.11
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA					ELBOW CONNECTORS



NOTE:

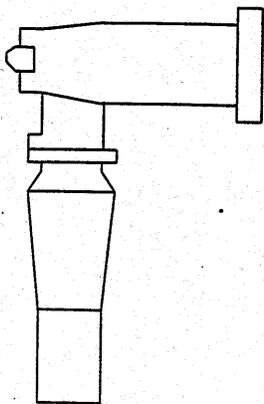
1. CONTRACTOR SHALL COORDINATE LOCATION AND PLACEMENT WITH CONTRACTING OFFICER.

SSR inc.
ENGINEERS

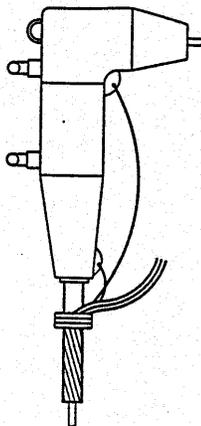
Eng/Dwn: JRK
Scale: NONE
Date: MAY 1992
Plt: 04-11-95 13: 26
Proj. No: COE-007

ELLSWORTH AIR FORCE BASE
GUARD POST

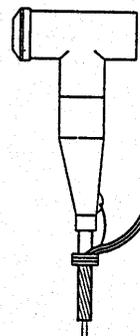
File: UM6-GP	Rev.
Sheet 1 of 1	0
UM6-GP	



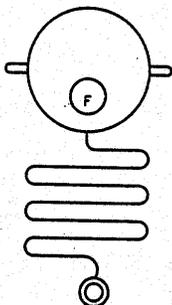
UM6-1 Uhp
LOAD BREAK ELBOW
(200 A)



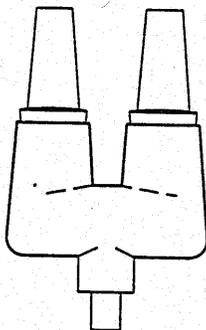
UM6-2 Uhp
FUSED ELBOW TERMINATION
(200 A)



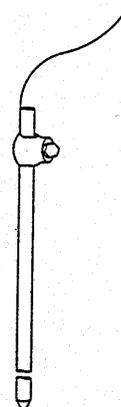
UM6-3 Uhb
DEAD BREAK TERMINATION
(600 A)



UM6-4 Ugo
FAULT INDICATOR



UM6-5 Uhb
FEED THROUGH LOAD BREAK INSERT

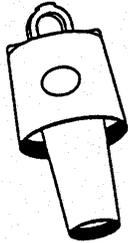


UM6-6 ol, oj, ej
GROUND ROD ASSEMBLY

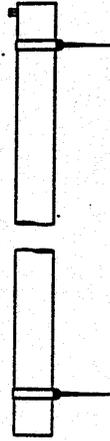
MISCELLANEOUS ACCESSORIES

Page 1 of 7

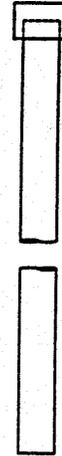
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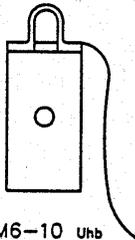
UM6-7 Uhb
BUSHING WELL PLUG
(200 A)



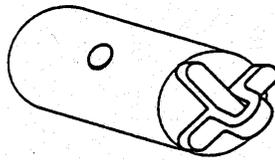
UM6-8 Ugc
RISER SHIELD (U GUARD)



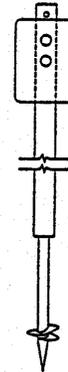
UM6-9 Ugc
CONDUIT CABLE RISER



UM6-10 Uhb
INSULATED PROTECTIVE CAP
(200 A)

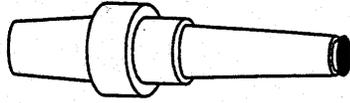


UM6-11 Uhb
INSULATED PROTECTIVE CAP
(600 A)

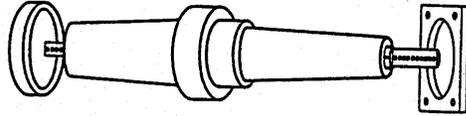


UM6-12 Uhx
CABLE MARKER ASSEMBLY

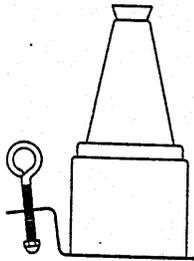
		MISCELLANEOUS ACCESSORIES	
		Page 2 of 7	UM6—



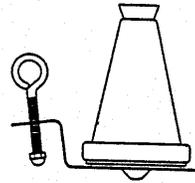
UM6-13 Uhb
LOAD BREAK INSERT
(200 A)



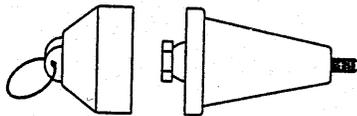
UM6-14 Uhb
DEADBREAK INSERT
(600 A)



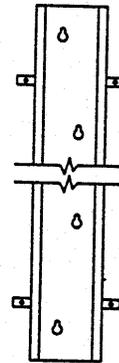
UM6-15 Uhg
STAND-OFF INSULATOR
(200 A)



UM6-16 Uhg
STAND-OFF INSULATOR
(600 A)



UM6-17 Uhb
INSULATING PLUG
600 AMP CONNECTOR

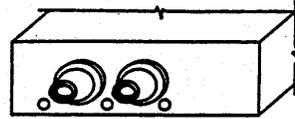


UM6-18
BACKING PLATE FOR
U-GUARD RISER SHIELD

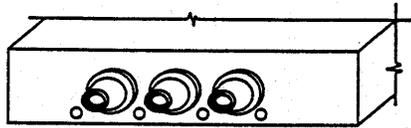
MISCELLANEOUS ACCESSORIES



UM6-19 Uhq
FEED THROUGH
(200 A)



UM6-20 Uhq
TWO POINT JUNCTION
(200 A)



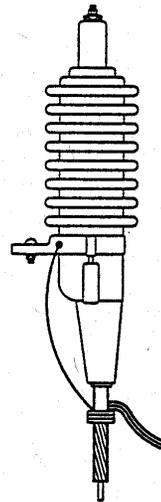
UM6-21 Uhq
THREE POINT JUNCTION
(200 A)



UM6-22 Uhq
FOUR POINT JUNCTION
(200 A)



UM6-23 Uhb
TEE CONNECTOR
(THREE POINT JUNCTION)
(500 A)



UM6-24 Ugk
PORCELAIN OUTDOOR TERMINATION

MISCELLANEOUS ACCESSORIES