

**SUPPLEMENT TO
SPECIFICATIONS FOR
ELECTRICAL INSTALLATIONS**

PRIMARY SERVICE TO METAL ENCLOSED GEAR

ELECTRIC SYSTEM BULLETIN #758

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NIAGARA MOHAWK POWER CORPORATION

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This supplement provides general recommendations for a Customer who will take service at 2400 to 13200 GRD.Y/7620 volts to Customer-owned primary service equipment of the switchgear type either indoor or outdoor.

Additional information concerning the route of the primary service lateral will be furnished separately. For this purpose, the architect should furnish the Company three preliminary prints of the plot plan. The Company will return one print marked with the location to which the primary conduit should be extended and the recommended location of necessary handholes. The architect should add this information to his electrical plan.

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Figure 1 - Typical Underground Service Installation
Figure 2 - Typical Metal Enclosed Switchgear Installation.

A. INTRODUCTION

1. These requirements supplement Niagara Mohawk Power Corporation "Specifications for Electrical Installations". They provide more complete information for a CUSTOMER-OWNED electric service installation where the supply voltage designated by the Company is at 2,400 to 13,200 GRD.Y/7620 volts. Their purpose is to assure that the electric service facilities will render satisfactory service to the Customer and will not interfere with the electric supply to others served by the Company's system.

2. In this supplement, "Company" means Niagara Mohawk Power Corporation.

3. These requirements do not cover the Customer's complete electrical installation design but concern only those points in which the Customer, his consulting engineer, electrical contractor, equipment manufacturer and the Company have a mutual interest.

4. For a specific electric service installation, it is essential that the Company meet with the Customer, his consulting engineer, contractor, or equipment manufacturer to mutually establish the arrangement and location of the proposed facilities. As a result of this meeting, the voltage, current and interrupting ratings and type of equipment will be designated by the Company.

5. Specific information furnished by the Company shall be subject to review by the Company if significant changes are made in the design or scheduling of the project.

6. The complexity of modern electrical installations makes it essential that there be continuous close cooperation between all parties involved.

B. CODES, STANDARDS AND WIRING ADEQUACY

7. The Customer's electric service equipment and its installation shall conform to the requirements of the latest edition of the National Electrical Code, American National Standards Institute, Insulated Power Cable Engineers Association, National Electrical Manufacturer's Association, Institute of Electrical and Electronics Engineers, all local ordinances, building codes and Company requirements and specifications. The Customer, his engineer, contractor and supplier should aim to provide a modern, adequate electrical installation with ample provision for future needs.

C. APPROVAL AND INSPECTIONS

8. THE CUSTOMER SHALL SUBMIT HIS PLANS TO THE COMPANY BEFORE ORDERING EQUIPMENT OR STARTING WORK, to insure that the proposed design for the electric service installation conforms to Company requirements. The company normally limits its check of the plans to the details of the service lateral,

the service protective means, and the location of metering equipment. The Customer should consult his insurance carrier for any special safeguards which the carrier may require for the transformer or switchgear installations.

9. The Company will designate the pole or manhole from which the primary cable will be extended. The Customer shall furnish three (3) preliminary prints of this plot plan showing the preferred location of his service equipment. The Company will return one print, marked to show a suggested route for the service lateral conduit, and recommend handhole locations.

10. The Customer shall furnish, for review by the Company, information as follows:

Portions of the Architect's drawings and specifications relating to electric service equipment and transformers (3 copies).

Manufacturer's proposed specifications relating to primary service equipment and transformers (3 copies).

Manufacturer's approval prints relating to the physical arrangement of the primary service equipment, particularly the installation of primary metering transformers where used (3 copies).

Manufacturer's certified prints of drawings and material lists describing service equipment and transformers (3 copies).

11. To protect the Customer's interests, as well as its own, the Company requires the Customer to furnish satisfactory evidence of the safe condition of his entire electrical installation before the company will energize his service. This may be in the form of an approval or certificate from the New York Board of Fire Underwriters, or other inspection organization acceptable to the Company. When wiring is altered or extended, an approval or certificate shall also be obtained to assure compliance with safety requirements. Application for inspection should be made before work is started.

D. SUPPLEMENTAL INFORMATION

12. It is the Company's desire to assist the Customer in understanding details of his electrical service installation. When the information is not in this booklet, the company invites inquiries from the customer, his consulting engineer, his electrical contractor, or his equipment manufacturer.

E. CONTRIBUTIONS BY CUSTOMER

13. The Company's Consumer Relations Department will advise the Customer concerning any contribution which may be required from him for materials supplied and work performed by the Company.

F. ACCESS TO PREMISES BY AUTHORIZED POWER COMPANY EMPLOYEES

14. Facilities shall be provided so that authorized Company employees may have access to the Customer's electric service installation and metering facilities at any reasonable time.

G. OPERATING PROCEDURES

15. The Customer is responsible for performing the actual operating functions for his service equipment. The Customer should arrange to have trained personnel on duty at all times for the proper and safe operation of his service equipment. Personnel training should cover correct operating procedures which shall include use of rubber gloves; replacement of high voltage fuses; the opening, resetting and closing of switches and circuit breakers; and the sequence of operations for interlocked equipment.

16. The Customer shall provide such operating equipment as tongs, insulating sticks, rubber gloves, grounds, voltage detection equipment, etc., needed for the safe performance of operating functions. This equipment shall be properly maintained for the safety of the Customer's personnel.

17. The Customer is responsible for maintaining all equipment under his ownership. Proper and continuous maintenance is important to the operation of the equipment. NFPA Standard No. 70B on "Electrical Equipment Maintenance" is one publication that could be helpful in setting up a dynamic maintenance program.

H. PRIMARY CABLE IN CONDUIT

18. The Company will specify the type and size of the primary cable. The Company will furnish, install, own, and maintain this cable from its line to the Customer's primary disconnect switch. The Company will make the primary connections to the switch. At least 36 inches is required within the switchgear for termination of the cable. The customer shall provide a NEMA standard two-hole pad on his switch for this connection. The installed cost of this cable shall be borne by the customer.

19. Where conduit is required, it shall be either rigid non-metallic conduit encased in a 3-inch concrete envelope or galvanized rigid steel conduit. The Customer shall furnish, install, own, and maintain the primary conduit from the Company's pole to the switchgear. Where the supply is from an underground line, the Customer shall install this conduit from his property line to the switchgear. The conduit shall be at least 4 inches in diameter and shall slope at least 2 inches per 100 feet toward a handhole for drainage. It is recommended that a spare conduit be installed. These conduits shall normally be buried to a depth of at least 30 inches below final grade. The Customer shall install a pull wire in each conduit. The conduits should be capped or plugged until needed.

20. The riser at the pole shall consist of a 42-inch radius 90° bend and a 10-foot vertical length, both of galvanized rigid steel conduit. The riser shall be grounded by bonding to an approved ground clamp on the top of the conduit. A conductor of sufficient length shall be provided to extend 24 inches beyond the Company's neutral. The conductor shall be #4 copper minimum or larger as required by the National Electrical Code. If the riser is located next to the street, it must be galvanized rigid steel conduit; however, if the riser is located off the street and in a location where the riser would not be subjected to physical damage, rigid, non-metallic conduit-PVC Schedule 80 may be used at the discretion of the Company. The Company will designate the location from which the service will be taken.

21. One or more handholes may be required by the Company to facilitate cable pulling or to drain the conduit. Handholes shall be of masonry or concrete construction. The minimum size shall be 3 feet wide X 6 feet long X 4 feet deep, inside dimensions. A pulling iron of #6 bar and a ground rod, 5/8 inch X 8 feet, shall be installed at each end of the handhole. The handhole floor shall be sloped toward a sump, 18-inch diameter X 18 inches deep, filled with crushed stone. The conduits shall enter the handhole directly opposite each other on the three-foot walls. Conduit bells shall be installed on each conduit. The centerline of the conduit shall be approximately 6 inches from the 6-foot wall and 15 inches above the floor. Metallic conduit shall be bonded together and to the ground rods.

Handholes located in roads, driveways or sidewalks will have a three-section cover and be capable of withstanding an H-20 loading. Handholes located in other areas may be designed for a light load capability. The design of the handhole shall be approved by the Company.

22. Maximum cable pulling lengths shall be as follows:

- a. Straight run with one 90° bend at each end -200 feet
- b. Straight run handhole to handhole -425 feet
- c. As in (b) except one 90° bend at the feed-in end -400 feet
- d. As in (b) except one 90° bend at the pulling end -225 feet

I. PRIMARY DIRECT BURIED CABLE

23. Direct buried primary cable may be used by the Company where field conditions permit. The company will specify the size and type of this cable. The Company will furnish, install, own, and maintain this cable from its line to the Customer's disconnect switch. The Company will make the primary connections to the switch. At least 36 inches is required for termination of the cable. The Customer shall provide a NEMA standard two-hole pad on his switch for this connection. The installed cost of this cable shall be borne by the Customer.

24. The Customer shall install two conduit bends at the equipment pad and extend them, if necessary, to clear curbs and obstructions with straight sections of conduit installed at a minimum depth of 30 inches to the point where the cable will be directly buried.

25. Conduit sections up to 25 feet in length shall consist of two direct buried 4-inch minimum, 36-inch minimum radius, 90° bends, and necessary straight sections all Underwriters Laboratories labeled, PVC conduit. For longer lengths, up to 100 feet, conduits of the same material except with 42-inch radius bends shall be used (no more than two bends permitted). All conduit of this material shall be encased in 3 inches of concrete. If longer lengths of conduit are required, regular cable-in-conduit service shall be used. All conduits shall be capped or plugged until needed.

26. From the end of the above conduit to the Company's riser pole or other specified structure, the Customer shall provide a suitable trench for the cable and backfill, after the cable is installed. The trench shall be dug to a depth of at least 36 inches below final grade and shall be free from soft spots or large stones and a 2-inch bedding of sand or rock-free sandy loam shall be used. The minimum depth to the top of the cables shall be 30 inches. The backfill shall consist of a 4-inch layer of sand and 6-inch layers of rock-free soil placed in 6-inch layers and mechanically tamped. The Customer shall furnish backfilling the trench as required to meet local loading requirements.

J. GROUNDING

27. For outdoor installations, a ground grid shall be installed by the Customer consisting of bare copper conductor, minimum size #4/0 AWG, buried six-inches deep in the pattern of an outer loop around the switchgear pad. The loop shall be connected to at least two driven ground rods. Maximum ground resistance shall be 10 ohms. Two grounding connections shall be provided by the Customer from the ground grid to the switchgear ground bus. The metallic conduits shall be grounded by the Customer to the ground grid. Where practicable, the ground grid shall be bonded by #4/0 copper to a continuous metallic water system.

28. For outdoor installations, two grounding connections shall be provided by the Customer from the switchgear ground bus to a suitable ground. Where practicable, the ground shall be bonded by #4/0 copper to a continuous water system.

K. PANIC HARDWARE

29. It is required that doors to switchgear rooms or walk-in metalclad switchgear be equipped with panic hardware. The lock preventing access to these rooms shall not prevent egress.

L. SERVICE EQUIPMENT

30. Scope - The Customer's service equipment must provide for receiving the service lateral conductors, a circuit isolating means, a disconnecting means for safe planned interruption of the service for all conditions of loading, a protective means for automatic interruption of short circuits, and mounting and connections for billing meter facilities. The function of each cubicle shall be identified by an external permanent nameplate.

31. Multiple Sources - When Customer's service equipment is supplied by multiple sources, each source shall be provided with its own disconnecting and protective means. Company shall be consulted for additional requirements.

A means such as an accessible bare lug shall be provided for grounding each phase of the bus on both line and load side of the metering transformers.

32. Company Requirements - The Customer's service equipment will be located, arranged, and installed as agreed upon by the Company and the Customer. The Company will advise the Customer concerning requirements for the protective devices, limitations for current inrush, metering facilities, and terminal sizes to accommodate the service lateral conductors.

The cable shall enter the service receiving equipment from below. A minimum vertical distance of 36" from the top of the conduit at the base of the receiving cubicle to the bus attachment point is required for cable termination. Where the distance exceeds 36", a cable grip must be provided to adequately support the cable. The receiving bus shall be drilled to receive a NEMA standard two-hole pad. The cable terminal connection to the bus will be made by the Company. The receiving equipment shall have a minimum BIL rating of 95kV. For some services, power fuses cannot provide satisfactory coordination of protective equipment and circuit breakers may be required.

33. Isolating Means - All equipment in the Customer's switchgear shall be so arranged that it can be isolated from the Company's system by a main disconnecting switch or draw-out circuit breaker. The switch shall be group operated causing separation by a clearly visible air gap. Where the Customer utilizes fuses as the overcurrent protection, the disconnecting switch shall be of loadbreak design. The switch or breaker compartment shall have provisions for dual locking of the door to allow access by either the Customer or the Company.

34. In indoor or outdoor metal enclosed switchgear installations, these switches shall be physically isolated by steel enclosures. Switches in steel enclosures shall be accessible through a hinged door. The door shall have provision for padlocking.

35. An accessible lug shall be provided on the line side of each phase of the isolating device as an attachment point for grounding or testing. A ten foot clear space shall be made available in front of this lug. A "ground and test device" (grounding truck) may be provided in lieu of the lug when a draw-out circuit breaker is used.

36. Lightning Arresters - Lightning arresters shall be installed on the load side of the main switch. Rating shall be as shown on the single-line diagram. Consult with Company for arrester location on dual primary service (2 feeds).

37. Disconnecting Means - A means must be provided for opening each service circuit quickly, effectively, and safely under all conditions of loading. Among satisfactory disconnecting means are:

- a. A circuit breaker used as the service circuit protective means may also serve as the disconnecting means.
- b. A load interrupter switch used as the isolating means may also serve as the disconnecting means.

38. Protective Means - An automatic fault protective device shall be provided for each service circuit. The device shall have an interrupting capacity at the service voltage and frequency of not less than that specified by the Company. The two most commonly used protective means are circuit breakers or loadbreak switch and fuse combinations.

39. Power Fuses - Where power fuses can be used as the service equipment protective means, their type shall be approved by the Company. Their current rating, time-current characteristic, and interrupting capacity will be specified by the Company. The Customer should arrange to have at least four spare fuse units on hand at all times. The Company does not stock the types and sizes of fuses that would be required to replace the Customer's service fuses.

40. Power fuses shall not be inserted or removed from their mountings unless the mountings are completely de-energized. Fuse compartment shall be key interlocked with main disconnect switch. The Customer shall provide such switch sticks, rubber gloves, etc., as are needed for safe handling of the high voltage power fuses.

41. Circuit Breakers - Where circuit breakers are used as the service equipment protective means, the specification of the complete tripping circuit including the current transformer ratio and the relay type and range must be submitted for approval to the Company. The Company will then recommend a relay setting for the main circuit breaker only. No ammeter switch may be connected in the secondary of current transformers used to actuate the relays.

42. Circuit breakers in service equipment must be mechanically and electrically trip free.

43. The Company recommends that no undervoltage tripping device be used in service receiving equipment, except for automatic transfer to an emergency supply.

44. A current transformer of adequate relaying accuracy must be provided with each pole of the service equipment circuit breaker for use with the overcurrent devices. No current transfer switches shall be connected in the secondary circuits of these current transformers.

45. An overcurrent device shall be provided for each ungrounded phase of the service equipment to initiate tripping of the circuit breaker for fault current protection. Dash pots on direct trip are not accepted. Where the service supplies motors with individual rating over 100 horsepower, or where it is necessary to provide for selective tripping between the service equipment circuit breaker and those in load circuits, time delay induction type overcurrent relays without instantaneous trip attachments should be used on the main and time delay induction type overcurrent relays with instantaneous trip attachments should be used on the downstream breakers.

46. Upon notification by the Customer of the type tripping scheme to be used, the Company will specify the type and range of the relays associated with the service equipment and their settings. The Company will specify test devices, where required, connections, and associated current or potential transformer ratio.

47. Acceptable circuit breaker tripping energy sources are:

- a. Control storage batteries, rated not less than 48 volts, float charged by suitable charging equipment.
- b. A.C. tripping reactor. Where these are used, the supplier shall be responsible for matching ohmic value of tripping reactors and breaker trip coils for reliable tripping response. Control circuits shall be completely wired and connected with one current transformer secondary and supplying reactors and trip coils.
- c. Current transformers connected to series current trip coil where such tripping method can be used. See paragraph 44.
- d. A control circuit, used only for operating the circuit breaker may be connected on its line side providing the tap is protected by high interrupting capacity fuses of a type acceptable to the Company.
- e. Other sources of tripping energy should not be used unless approved by the Company.

M. METERING

48. The Company will furnish all meters, metering transformers and test devices required for billing purposes.

49. The Company will specify the quantity, type, rating and primary connections of all current and potential transformers for billing purposes. The current and potential transformers for the Company's billing meters shall not be used to operate any other devices.

50. A separate enclosing compartment, 36-inches wide minimum, shall be provided solely for the billing metering transformers. Where it will facilitate design, the current transformers with connections may be located in their own separate compartment. The metering transformers shall be so arranged as to be fully accessible and protected by hinged and padlocked doors. Where the metering equipment compartment is located in an unheated building, provisions shall be made for heating the compartment to prevent condensation.

51. The Customer shall provide space and support for the Company's current and potential transformers as part of the service entrance equipment. The supports shall be drilled for mounting bolts in accordance with dimension information concerning this equipment furnished to the Company for the design of his installation. Removable bus bars shall be furnished by the Customer to permit installation and removal of current transformers. A ten foot clear space shall be made available in front of this compartment. A means shall be provided for grounding each phase of the bus on the line and load side of the metering transformers.

52. The Customer shall furnish, install, own, and maintain conduit for the wiring from the metering transformers to the billing meter panel. The conduit should be at least 1-1/2 inch galvanized steel or equivalent approved by the Company. The conduit should be run by the shortest practicable route, using conduit bends instead of conduit fittings and of reasonable overall length (normally not exceeding 100 circuit feet with a maximum of two 90 conduit bends).

53. The Customer shall provide a panel for billing meters, together with mounting for the panel. The panel may be one of the following:

- a. 3/4 inch thick painted or stained plywood panel, wall mounted, 48 inches x 48 inches. For installation of 2,000 KW and above, a 48 inches x 60 inches panel shall be provided.
- b. 3/4 inch minimum thickness Benelex #70 panel or other approved insulating material, switchgear mounted, 30-inches wide and 60 inches high minimum. The switchgear cubicle must be 36-inches wide minimum.

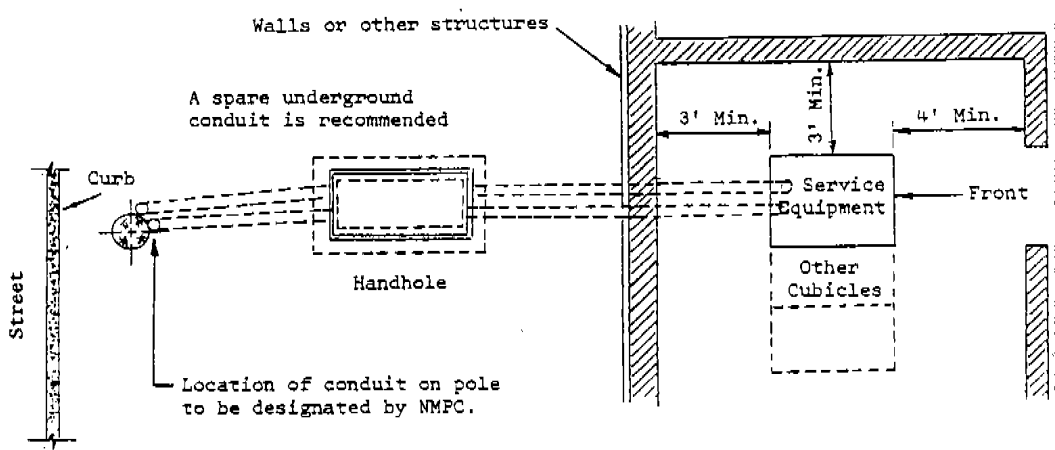
54. The billing meter panel should be located indoors in a heated and lighted location conveniently and safely accessible to authorized Company employees. The location should be clean, dry, and free of corrosive atmosphere. Provide 120 volt, 20 ampere receptacle at this location.

The wall-mounted plywood panel (53a above) shall be located with lower edge 30 inches up from the floor and so that there is a clear working space of not less than 48 inches from the panel front.

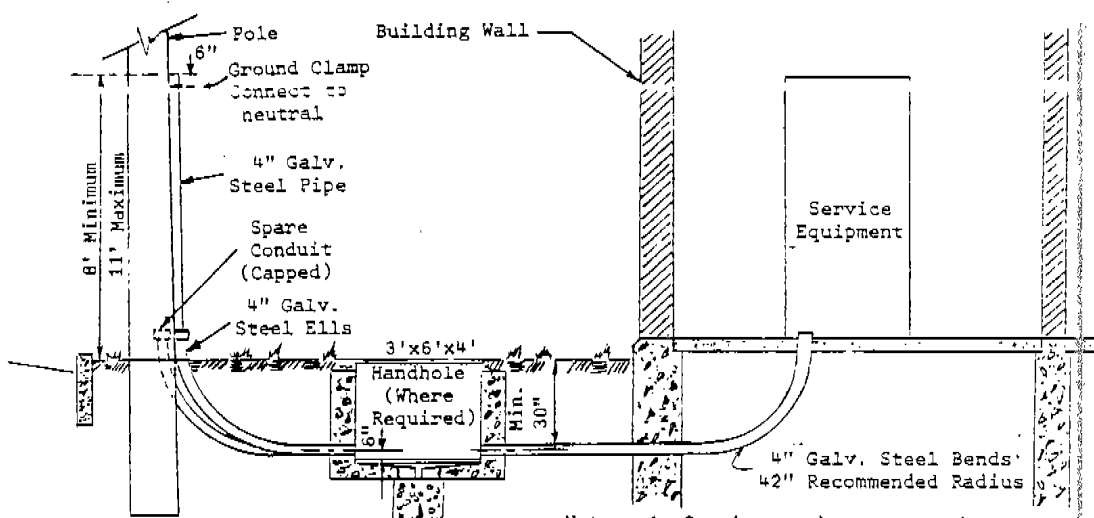
The switchgear mounted panel (53b above) should have offset hinges and a meter projection clearance of at least 16 inches from the front of the panel and stud projection clearance of at least 9 inches from the rear of the panel. There shall be a clear working space of not less than 48 inches from the panel front. This type of panel can only be furnished in an indoor location or in walk-in aisle type switchgear.

55. Where the Customer elects to install outdoor metalclad switchgear not of the walk-in aisle type, the Customer shall provide a separate walk-in cubicle, 36-inches wide minimum, to be used solely for the billing meters. The billing meters shall be located on a Benelex #70, or other approved insulating material panel furnished and installed on the back wall of the cubicle by the Customer.

The cubicle shall have a hinged door capable of being opened from the inside of the cubicle. The door shall be locked with a power company padlock. The panel shall be in one piece and a minimum of 3/4-inch thick x 30-inches wide x 60-inches high, mounted with the center point 48 inches above the floor. The cubicle shall be safely and conveniently accessible to authorized Company employees, clear of all obstructions, clean, dry, free of corrosive atmosphere, heated, ventilated, lighted, and with a 20 ampere, 120 volt single-phase convenience receptacle, served from the Customer's distribution panel, and installed at the meter panel location.

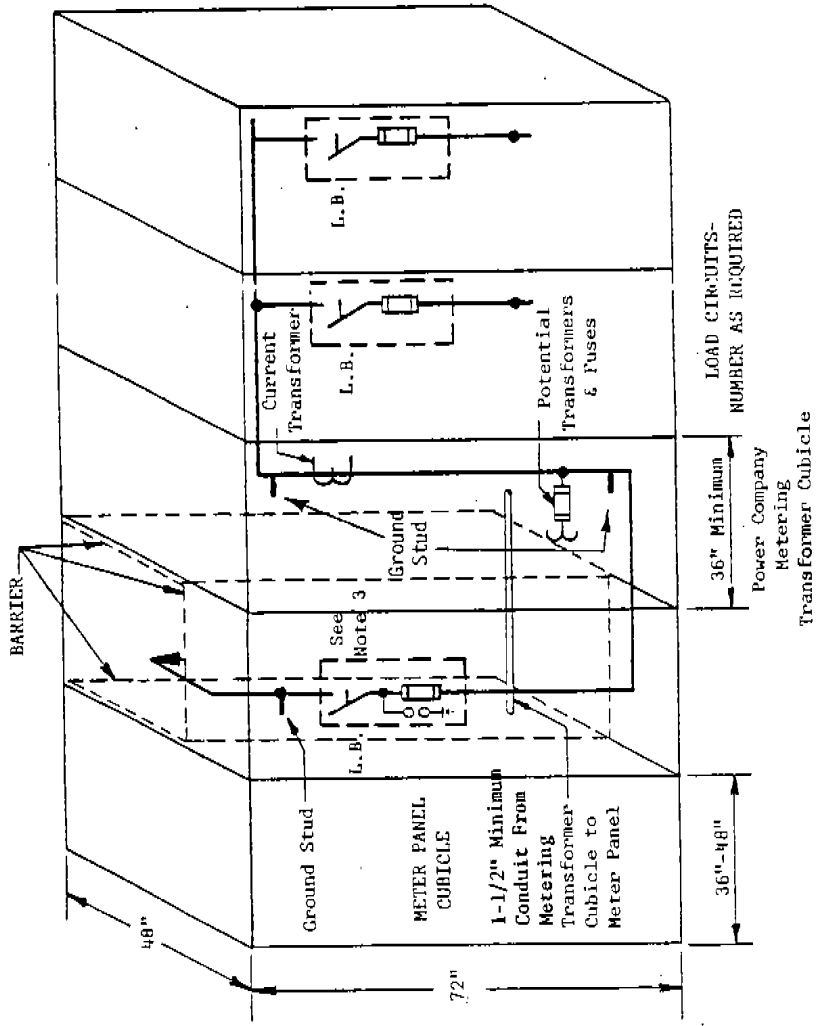


PLAN



- Notes: 1. Service equipment may also be outdoor metal-clad switchgear
 2. Where steel conduits are used connected their ends across handholes or manholes with #2 wire
 3. For non-metallic conduit see Paragraph 18

ELEVATION



NOTES

1. Meter panel cubicle shall have
 - A. Adequate heaters
 - B. Light - 75 watt minimum
 - C. 20 Ampere, 120 volt receptacle
 - D. Provisions to padlock door - 48"± from ground
 - E. Plywood Panel - Mtd. on rear wall of cubicle
 - F. See Par. #51
2. Meter Transformer compartment shall have provisions for padlocking door, 48"± from ground.
3. See detail below for drawout circuit breaker instead of fuse.



**DRAWOUT CIRCUIT BREAKER
DETAIL**

**Typical Metal Enclosed
Switchgear Installation
Fig. 2**