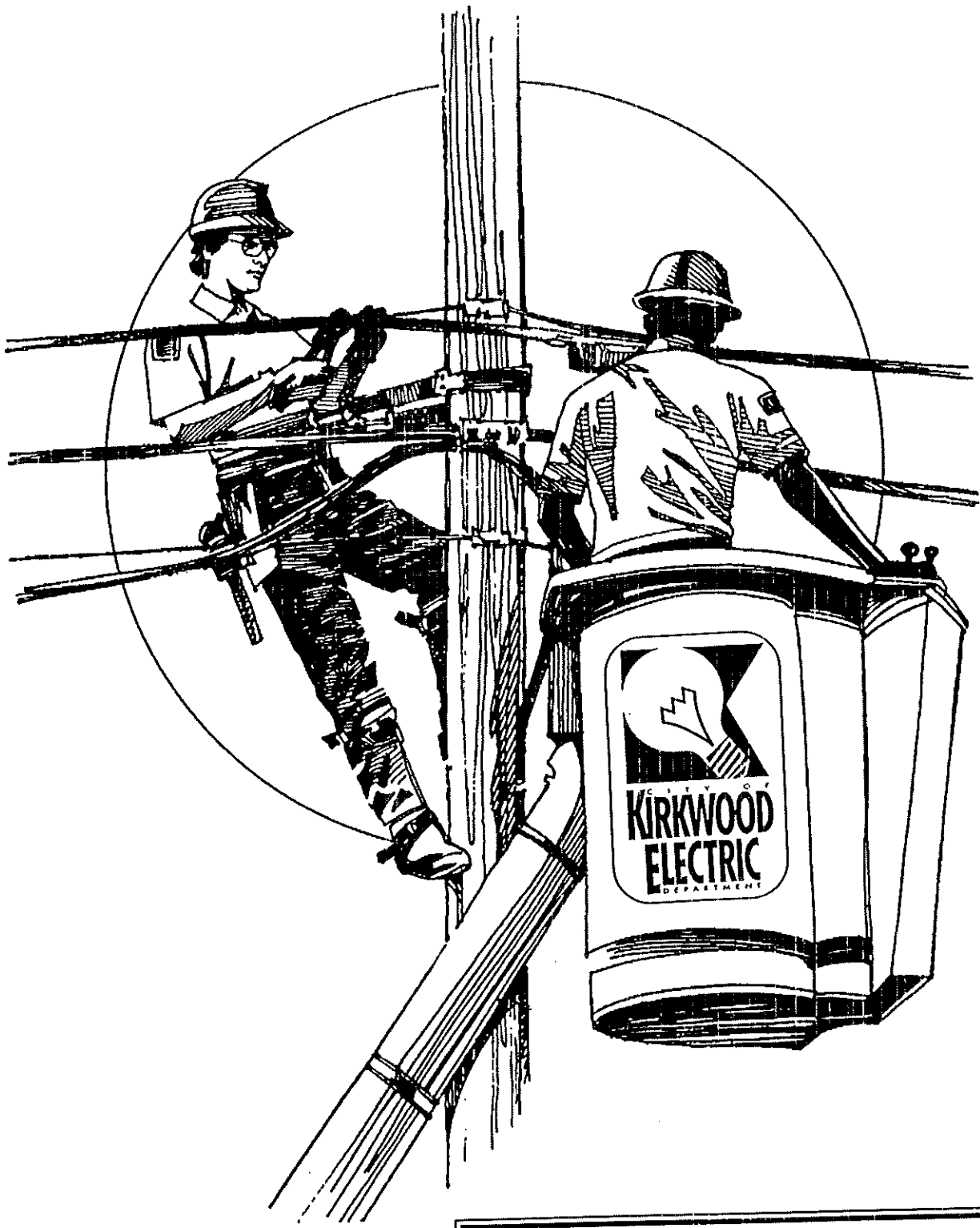

Service Manual For Kirkwood Electric Customers

AUGUST 1993

FOREWORD

The City of Kirkwood Electric Department appreciates the opportunity to serve your electrical needs.

This manual is presented to assist you in planning your electric service. The information contained in this publication is intended to make it easier for us to work together to provide quality customer service. The services requirements are stated in this manual in order to facilitate our mutual understanding, to promote safety and to expedite service connections. When your service requirements differ from what is set forth in this manual, we will be happy to work with you to develop mutually acceptable alternatives. Our goal is to provide quality customer service and this manual will help us to expedite all jobs and minimize delays and costly rework.

This manual is based on applicable codes and practices established by the utility, local authorities and the electrical industry. This includes the National Electric Code and the National Electrical Safety Code. If you have a conflict between this manual and the requirements of the city, electrical inspection authorities or the national codes, the conflict should be brought to our attention before proceeding with your electrical work.

We must emphasize that it is your responsibility and that of your electrical contractor to properly select the meter and service equipment, to locate and to install as appropriate to meet Kirkwood Electric's service requirements. Some installations due to their size or complexity require that drawings be submitted to Kirkwood Electric so we can plan and coordinate the work.

This manual supersedes all previous understandings either written or oral where such understandings are in conflict with this manual. Anything contained in this manual that is determined to be in violation with any present or future ordinance of the City of Kirkwood shall be null and void. As used herein, Utility refers to City of Kirkwood Electric Department, Customer refers to the party using electric service and Contractor refers to the party doing the electrical work.

CITY OF KIRKWOOD
ELECTRIC DEPARTMENT

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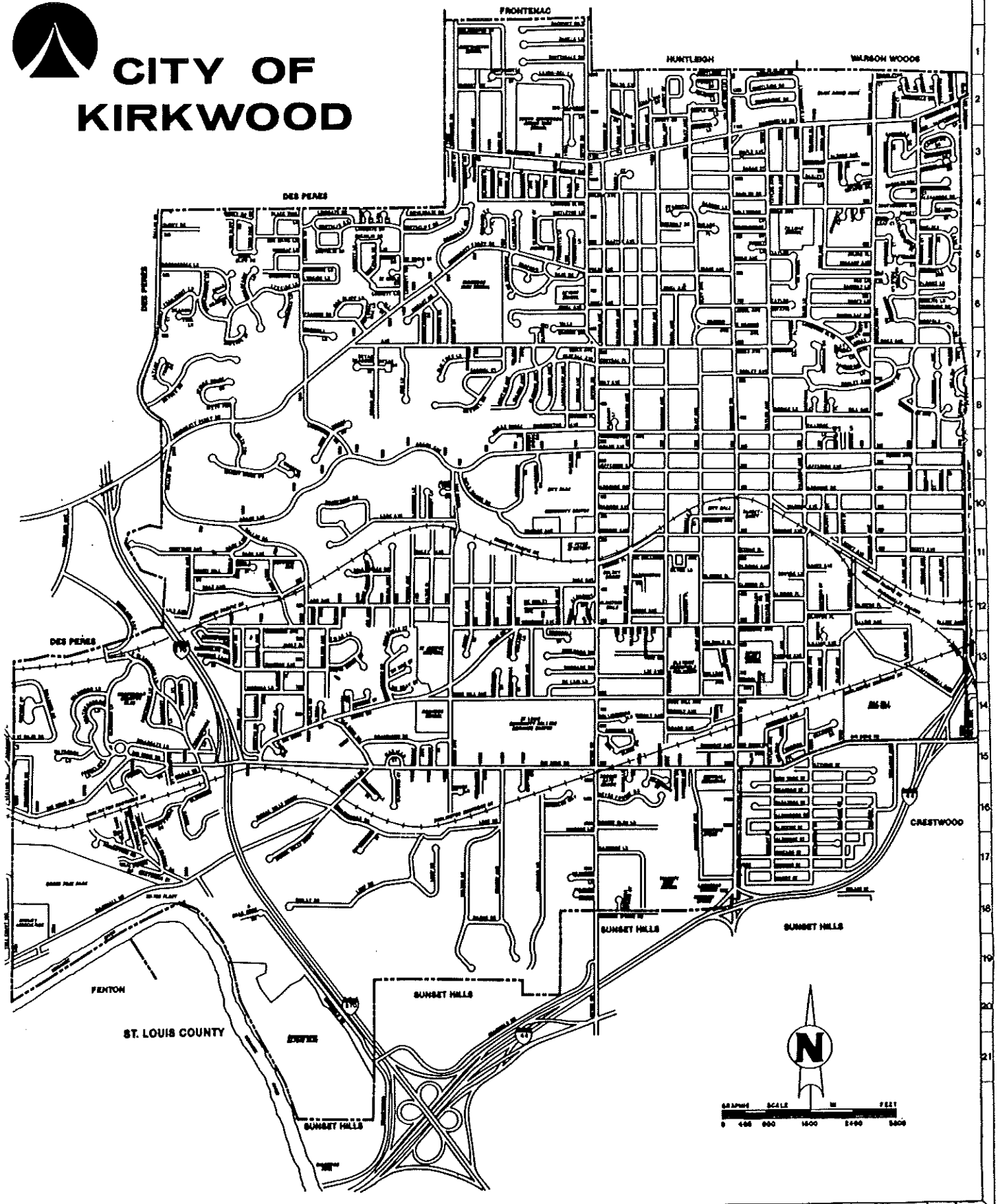
CITY OF KIRKWOOD



1. GENERAL INFORMATION

1.1 CUSTOMER SERVICE CENTERS

CITY HALL
139 S. Kirkwood Rd.
Kirkwood, MO 63122

KIRKWOOD ELECTRIC DEPARTMENT
212 S. Taylor Avenue
Kirkwood, MO 63122

For electric permits and inspections, call	822-5823
To request electric service, call	822-5836
For meter locations, call	984-5925
For temporary electric service installation, call	984-5925
For permanent electric service installation, call	984-5925
For construction plans and estimates, call	984-5925
For general utility information, call	822-5842

1.2 FOR UNDERGROUND LOCATIONS CALL 822-5848

1.3 UTILITY OFFICES

Director	822-5847
Line Superintendent	822-5848
Distribution Planner	984-5925
Meter Department	822-5965
Utility Billing Department	822-5843
Customer Accounts	822-5836

2. SERVICE RULES

2.1 TYPE OF SERVICE, VOLTAGE AND PHASE

Before purchasing heavy-duty residential, commercial or industrial equipment for installation on Utility service, transferring such equipment to a new location or before starting to rewire an existing installation which may necessitate a relocation of the service entrance, elimination of obsolete service, or increasing the capacity of the main service switch or of the wiring, etc., Customer or Contractor is requested to contact Utility. The purpose of this request is to determine the type of service which will be available for the load contemplated, the voltage and phase at which the service will be supplied, and the point on Customer premises to which Utility will connect the service conductors.

Compliance with this request will enable Utility to meet requests for electric service more promptly. It will help to reduce delays in providing the required service facilities and avoid the installation of equipment not suitable for operation on the type of service which Utility will supply.

The standard electric service offered by Utility is 60 Hertz alternating current.

Utility will supply single-phase or three-phase, four wire secondary service on underground systems. Single-phase and three-phase three-wire or three-phase four-wire may be supplied on overhead systems.

All secondary service provided is **solidly grounded** at the distribution transformer. Secondary service requires that the grounded neutral or grounded phase conductor be terminated at Customer main service disconnect and approved ground, see 6.7 herein. Customer desiring ungrounded or impedance grounded service should provide isolation transformers or consider primary service for this purpose.

2.1.1 Single-Phase Service, 120/240 V, Grounded Neutral

This service is suitable for lighting, small motors and general household appliances nominally rated from 110 V to 120 V or from 220 V to 240 V. The 120/240 V three-wire service is normally limited to 800 A.

Single-phase installations requiring in excess of 800 A in service capacity at 120/240 V, may be increased beyond 800 A by preferably installing 120/208 V three-phase, four wire service entrances, or subject to Utility approval installing multiple single-phase, 120/240 V services.

The 120 V, two-wire service is no longer generally available. It is limited to locations based on Utility engineering requirements, which can be served from existing two wire secondary services. Single-phase,
240 V, 3 wire service can be utilized for two wire needs, see D-6 herein. If permitted, the two wire service is limited to 30 A.

2.1.2 Three-Phase, Four-Wire Service, 120/208 V, Grounded Wye (Includes Two-Phase Service)

Three-phase four-wire service will normally be designated for new connections for the following conditions:

a. The load cannot, in Utility judgment, be supplied from a single-phase supply.

b. The power load is of such character as not to interfere with the lighting load.

If this service is not appropriate for the power load, Utility should be consulted.

Service is supplied from a Y-connected secondary from which 120/208 V two-phase, three-wire, or 120/208 V three-phase, four-wire service may be supplied. The 120/208 V, two-phase, three-wire service is available up to 200 A per individual service subject to Utility approval. Multiple two-phase, 3 wire services connected at a common three-phase, four-wire distribution point shall be balanced between phases.

Service entrance panel ampacity is limited to 3000 amperes for 120/208 V three-phase, four-wire service. Service entrance requirements greater than 3000 A at 120/208 V shall be reviewed with Utility.

2.1.3 Three-Phase, Four-Wire Service, 277/480 V, Grounded Wye

Three-phase, four-wire 277/480 V service will be designated for qualifying customers whose load is of such nature as to be unable to be supplied at 120/208 V. It may also be requested by Customer in lieu of 120/208 V service. Where this voltage may be designated by Utility or desired by the Customer, Utility should be consulted before purchasing equipment or the start of wiring on the premises. **If this service is requested for loads less than 225 kVA demand, there may be a charge to Customer.**

Service is supplied from a Y-connected secondary from which 277/480 V, two-phase, three-wire or 277/480 V, three-phase, four-wire service may be supplied. The 277/480 V, two-phase, three-wire is limited to 60 A service, except where multiple services can be balanced, it may be 100 A.

Service entrance panel ampacity is limited to 3000 A for 277/480 V, three-phase, four-wire service. Service entrance requirements greater than 3000 A at 277/480 V shall be reviewed with Utility.

2.1.4 Three-Phase, Four-Wire Service 120/240 V Delta

120/240 V Delta. This type of service exists in some areas, it is not available for new connections. Utility shall be consulted before adding to or changing existing connections.

2.1.5 Three-Phase, Three-Wire Service, 240 V, One Phase Grounded

Utility will make such service available at its sole discretion. This service is limited to commercial areas on the overhead distribution system and is not available on underground distribution systems. Customer, or representative should contact Utility before purchasing equipment or the start of wiring on the premises.

Service entrance panel ampacity is limited to 3000 A for 240 V, three-phase, three-wire service. Service entrance requirements greater than 3000 A at 240 V shall be reviewed with Utility.

2.1.6 Three-Phase, Three-Wire Service, 480 V, One Phase Grounded

Utility will make such service available at its sole discretion. Customer, or representative, should contact Utility before making plans to use this type of service.

Service entrance panel ampacity is limited to 3000 A for 480 V, three-phase, three-wire service. Service entrance requirements greater than 3000 A at 480 V shall be reviewed with Utility.

2.1.7 Three-Phase Primary Distribution Service

Primary service is offered at voltages designated by Utility. Such service is normally supplied by extending primary distribution lines to a substation located on customer's premises. However, there are locations within Utility service territory to which circuits at these distribution voltages have not been extended and for engineering, economic or other reasons Utility may, in some cases, elect to supply primary service from a substation located on Customer property. Customer is requested to discuss power requirements with Utility before purchasing equipment or the start of Customer wiring.

2.2 USE OF SERVICE

Rules regarding use of service apply to all utility customers.

2.2.1 Power Factor Requirements

Utility rates applicable to all customers are based upon a required average power factor of not less than 90% lagging during all periods of normal operation. Customer shall install corrective equipment necessary to meet this requirement on its side of Utility meter. Such equipment shall be controlled and maintained by Customer in order to avoid a leading power factor at any time and to avoid high voltage conditions during periods of light load. To enforce this power factor requirement, Utility will install appropriate metering equipment for the monthly billing of a kilovar reactive charge as applicable for all Primary Service Rate customers. For all customers receiving service under other rate schedules, not voluntarily complying with this power factor requirement, Utility may, where practical, install corrective equipment on its side of the meter and charge customer a lump sum amount for the current cost of such equipment and the cost of any subsequent additions to or replacement of such equipment whenever said future installations occur. Failure of Customer to install such corrective

equipment or to pay for that installed by Utility currently, or in the future, shall be grounds for the disconnection of electric service.

2.2.2 Objectionable Customer Load Characteristics

All equipment installed by customer shall have operating characteristics which enable Utility to maintain a satisfactory standard of service to both the customer being served and all other customers in the immediate area. In cases of high motor starting current, Customer loads resulting in harmonic distortions or significant loads with wide and/or frequent fluctuations, etc. Customer shall install, on its side of Utility meter, all corrective equipment necessary to enable Utility to maintain the integrity of its electric distribution system. For Customers not voluntarily complying with this requirement, Utility, where practical, may install corrective equipment on its side of the meter and charge Customer a lump sum amount for the current cost of such equipment and the cost of any subsequent additions to or replacement of such equipment, whenever said future installations occur. Failure of Customer to install such corrective equipment or to pay for that installed by Utility currently, or in the future, shall be grounds for the disconnection of electric service.

2.2.3 Continuity of Service

Utility will make all reasonable efforts to provide the service requested on an adequate and continuous basis, but will not be liable for service interruptions, deficiencies or imperfections which result from conditions which are beyond the reasonable control of Utility. Utility cannot guarantee the service as to continuity, freedom from voltage and frequency variations, reversal of phase rotation, single-phasing or reversal of direct current polarity. Utility will not be responsible or liable for damages to Customer apparatus resulting from failure or imperfection of service beyond the reasonable control of Utility. In cases where such failure or imperfection of service might damage

Customer apparatus, Customer should install suitable protective equipment.

2.2.4 Increase or Reduction in Customer Load

When making application for service, Customer shall specify the electrical load to be connected to Utility lines so Utility can provide sufficient electrical capacity for the operation of the equipment specified.

Customer connected load is not to be increased until Customer has given Utility notice, and additional capacity has been provided by Utility, if necessary; otherwise, Customer will be liable for any damage to Utility equipment resulting from the increase in load.

If Customer load is permanently reduced on a service metered with current transformers and the reduction from the rated service ampacity is more than 50 percent, Utility should be notified. A meter revision or rewiring may be necessary.

2.2.5 Temporary Service

Utility will furnish temporary service provided it has service in the area and has sufficient capacity available. A charge will be made for installation and removal of a temporary service connection. Application for temporary service should be made to the Customer Service Department or Utility Planning Department, at least one month prior to expected date of need. Temporary service must be metered.

Where temporary service is to be provided from an overhead line, Customer shall provide the support for attachment of the service wire and metering, as shown on drawing D-1. For service from underground lines, Customer shall provide the support for meter, cable and service equipment, as shown on drawing D-2.

Customer using temporary service is requested to give prompt notice to Utility when such service is to be disconnected. Such notice should be given at least three working days prior to the time when disconnection of service is required. Notice shall include account number and meter number to insure proper identification.

2.2.6 Resale of Service

The furnishing of metered electric service by Customer to a third party for a specific identifiable charge based on metered consumption is prohibited except where such practice originated prior to July 24, 1958. Where such practice has continued since July 24, 1958, the charge for electric service from Customer to a third party shall not exceed the charge which would result from the application of appropriate Utility rate for comparable electric service. For such exceptions, the practice of resale shall be discontinued when such premises are remodeled, rebuilt or replaced.

2.2.7 Balancing Load

When three-wire, single-phase alternating current is supplied, all 120 V apparatus must be connected as equally as possible on the two sides of the circuit.

Where single-phase load is connected to a meter measuring three-phase, three-wire or four-wire service, the unbalancing of the phases arising from the use of such single-phase load shall not exceed 10 percent of the total demand in kilowatts measured at the time of maximum use.

2.2.8 Customer Apparatus

Neither by inspections nor the rendering of emergency repairs or advisory service does Utility give any warranty, expressed or implied, as to the adequacy, safety or other characteristics of any equipment, wires, appliances or device owned or maintained by Customer.

2.2.9 Power Supply Transient Disturbances

Standard electrical supply is subject to disturbances on the electrical lines such as impulses, momentary outages, voltage sags and surges, which may cause sensitive electronic devices to malfunction. The origin of the disturbances is usually close to the affected equipment and often there is little the utility can do to correct these problems. However, Customers have the ability to reduce the impact of such disturbances on their equipment through the installation of devices such as surge suppressors, isolation transformers, and interruptible power supplies to filter transients and ride through momentary outages. All of these devices are commercially available and each of them are for specific Customer needs.

2.2.10 Radio and Television Interference

Radio and television interference reports are promptly investigated to determine if the interference is originating in Utility lines or equipment.

Common causes of radio and television interference are defective house wiring, loose connections in the switch boxes, heaters for fish tanks or furnaces, electric blankets and heating pads, adjustable light switches, door bells, garage door openers, ungrounded refrigerator motors, medical diathermy machines, fluorescent lights, welding equipment and electrified fences.

Customer should be sure that the interference is not due to a defective radio or TV set before reporting interference. If other sets in the house do not have the same noise, the trouble is probably in the radio or television itself.

2.2.11 Disconnection and Reconnection of Service

In addition to any other rights reserved by Utility in its schedules, rules and regulations, Utility reserves and shall have the right to disconnect service for:

> Refusal to grant access at reasonable times to equipment installed on Customer premises for the purpose of inspection, meter reading, maintenance or replacement.

Utility also reserves and shall have the right to interrupt or deny service without prior notice for reasons of maintenance, health, safety or state of emergency, (including unauthorized interference, diversion or use of service), or in cases where Utility is directed to disconnect service by a governmental agency or officer. In such cases Utility will make a reasonable effort to inform Customer of the reasons for disconnection of service.

2.2.12 Cogeneration

There are rules and regulations that govern the installation and operation of Customer owned cogeneration equipment. Safety rules prohibit the energizing of deenergized service supply lines from cogeneration equipment. Special metering is necessary to register both "IN" and "OUT" kilowatt hours and demand as appropriate. Consult the Utility Planning Department for information.

2.3 UTILITY PROPERTY ON CUSTOMER PREMISES

2.3.1 Access to Customer Premises

Utility representatives shall have access to Customer premises at all reasonable times to read and test meters, install, remove and repair Utility property and inspect equipment used by Customer when required by Utility for the proper administration of its rules, regulations and rates under which Customer is taking service.

Failure to provide reasonable and adequate access may cause service to be refused or disconnected.

Upon the discontinuance of service for any reason, Utility shall have the right to enter the premises and remove the meters, wires and other equipment which are the property of Utility.

2.3.2 Installation of Utility Transformers on Customer Property

Where construction, safety or engineering requirements do not permit the installation of Utility transformers on easements or public property, Customer shall provide sufficient space for transformers, switches and related equipment **adjacent to paved surfaces intended for normal vehicular traffic or parking, for the purpose of installing or changing Utility equipment**. This equipment will be installed in one of the following ways, as determined by specific conditions through consultation with Utility.

a. Pole Installation - Used where equipment can be pole mounted. Requires relatively little space.

b. Pad Mounted Transformer Installations - The transformer must be located and/or protected from the hazard of physical damage. The transformer must also be located away from building walls, fences, decorative or protective walls and barriers and shrubbery to permit maintenance and operation of the unit. Clearance requirements and protective barriers are shown on drawings D37 and D38 herein. Those installing the foundation pad must receive Utility approval of pad orientation for primary and secondary cable access.

c. Pole Type Platform Installation - Used for large installations where equipment cannot be pole or pad mounted. Requires greater space than pole installation. Normally limited to 750 kVA.

d. Pad and Fence Installation - Used on large installations where equipment cannot be pole or platform mounted or where this type installation is preferable because of engineering or other reasons. Requires greater space than platform installation and Customer must provide pad, grounding, fence or other suitable enclosure in accordance with Utility specifications.

e. Indoor Transformer Room - Used where outdoor space is not available, where required by municipal ordinance, or other valid reasons when agreed to by Utility. Utility will provide specifications for the room and will install, own and maintain primary switches, primary busses, and transformers and will control access. Customer will at his cost provide, own, and maintain the physical requirements including grates, ladders, doors, ventilators, sewers, oil holding pits, pulling eyes, lights, outlets, secondary busses, and

ground rods.

2.3.3 Misuse of Utility Property

The wires, cables and all other equipment and apparatus furnished by Utility on Customer premises are and will remain the property of Utility, and are to be used for no other purpose except in the delivery of service to Customer. Customer is not permitted to interfere with or allow others to interfere with the wires, meters, padmounted transformers or any other equipment or apparatus of Utility. Any complaint as to the condition or the operation of Utility equipment should be reported directly and promptly to Utility.

Utility owned equipment on Customer premises will be maintained and operated by the Utility only. Customer will not plant shrubs, install fences or otherwise obstruct the maintenance and operation of this equipment.

2.3.4 Unsafe or Dangerous Conditions

If Utility equipment either inside or outside of Customer premises appears unsafe or dangerous to life or property, particularly broken or fallen wires, Customer is requested to call Utility at once. In the meantime, if at all possible, someone should be posted in the vicinity of the dangerous location to warn children and others who may pass of the danger or unsafe conditions until Utility serviceman arrives.

2.4 SERVICE CONNECTIONS

Service connections may be at primary or secondary voltage, delivered from overhead or underground facilities, and may involve a customer substation. These circumstances are described in the following paragraphs.

SERVICE RULES

2.4.1 Number of Services

Number of services is governed by Local Ordinance and/or the latest edition of the National Electrical Code. The following is taken from the N.E.C. - 1990 Section 230-2.

A building or other structure served shall be supplied by only one service (Utility shall designate one point of delivery).

(Special Facilities Charges Apply to some Exceptions)

Exception No. 1: For fire pumps where a separate service is required.

Exception No. 2: For emergency, legally required standby, optional standby or parallel power production systems where a separate service is required.

Exception No. 3: Multiple-Occupancy Buildings. By special permission, in multiple-occupancy buildings where there is no available space for service equipment accessible to all the occupants.

Exception No. 4: Capacity Requirements. Two or more services shall be permitted:

a. Where the capacity requirements are in excess of 2000 A at a supply voltage of 600 V or less **(Note: Utility will supply an individual three-phase service up to 3000 A capacity)**; or

b. Where the load requirements of a single-phase installation are greater than the serving agency normally supplies through one service **(Note: Utility limits single-phase service to 800 A)**; or

c. By special permission.

Exception No. 5: Buildings of Large Area. By special permission, for a single building or other structure sufficiently large to make two or more services necessary.

Exception No. 6: For different characteristics, such as for different voltages, frequencies, or phases, or for different uses.

Exception No. 7: For the purpose of (N.E.C.) Section 230-40, Exception 2 only, underground sets of conductors, size 1/0 and larger, running to the same location and connected together at their supply end but not connected together at their load end shall be considered to be one service lateral.

2.4.2 Secondary Voltage Service Connection

2.4.2.1 Secondary Service-General

The standard service installation is a single overhead span of service wires, called a service drop, extending from a pole on an easement strip or public right of way to the premises.

Customer is to provide access for the service drop to attach to building and to connect to the service head at a location nearest agreed upon Utility service point (refer to Section 3 Service Wiring).

On 1-4 family dwellings, Contractor will normally locate the service entrance based on rules herein. If there is doubt as to which point on the building will be nearest Utility service point, a request should be made for Utility to designate the point where the service drop will be attached to the building.

When commercial, industrial, or larger apartment building or an extensive remodeling of existing buildings are planned, Customer, architect or Contractor shall consult with Utility for the appropriate service entrance location. Drawings are to be submitted for the purpose of securing adequate service facilities, meter locations and proper Customer owned service and meter equipment.

2.4.2.2 Residential Underground Service

a. Subdivisions and Developments: Underground service is available on a contract basis for residential subdivisions and developments. The applicant is required to provide trenching and conduit for the service portion of the underground system. Contractor is urged to notify Utility of proposed work because approval of construction plans and arrangements for payment of charges will have to be completed prior to lateral installation. The normal service connection point to a single family subdivision home shall be on the side or front of the house proper within ten (10) feet of the corner of the house proper, nearest the direction from which the service lateral enters the property to be served. Customer installations must be in accordance with Utility specifications.

b. Individual residences: Applicant for underground service to individual residence not in a subdivision has the option of (1) installing a service lateral direct buried or in conduit or (2) installing the conduit for installation of the service conductors by Utility. Customer charges may apply.

c. Utility assumes cable only maintenance on single family residential service laterals that Utility installed in Customer conduit and all multi-metered, secondary distribution laterals.

2.4.2.3 Non Residential Underground Service

The developer of non-residential property is required to install the total conduit system within the boundaries of the development project. Construction requirements are stated in "Specification for Developer Installed Commercial Underground Distribution Facilities", which should be secured from Utility when first considering such development plans.

2.4.2.4 Underground Service

The basic distribution voltage is 120/208 V, three-phase, four-wire. For engineering reasons, Utility may offer 277/480 V, three-phase, four-wire service where the load warrants this voltage. Large loads, at Utility option maybe supplied directly from Primary radial feeders.

Choice of voltage and type of system offered depends on location and size of load. Customer should consult Utility to determine the voltage and method of supply that will be available.

2.4.3 Primary Voltage Service Connection

Those planning primary service connections should promptly contact the Utility Planning Department. Customer, developer or Contractor must obtain Utility specification on connection requirements, relaying and fuse coordination, meter equipment and location, before ordering service equipment. Utility reserves the right to specify whether primary service connection will be made overhead or underground.

Utility will install and own all facilities to point of delivery of service, where connection is made to Customer receiving facilities.

Customer will install and own, on Customer property, service disconnecting facilities, relays and transforming equipment necessary to provide the required utilization voltages, including extensions of metered primary circuits. Customer will also furnish space and supporting structure for Utility metering equipment and potheads.

Utility standard substation inspection service is available for contract.

3. SERVICE WIRING

3.1 SERVICE SUPPLY CONDUCTORS-OVERHEAD

3.1.1 Clearances-Service Wires, 600 V or Less

Service drop clearances shall comply with appropriate requirements of the National Electric Safety Code and the National Electric Code. Service drop conductors shall not be readily accessible to physical contact and shall comply with (a) through (d) below for services not over 600 V, nominal. Changes, additions and/or grading on Customer premises shall not cause clearances under and around service wires to be less than indicated herein. Utility shall be advised when clearance problems exist. In some cases, Customer may be responsible for costs incurred to restore clearances. Improper clearance is reason for disconnection of service.

(a) **ABOVE ROOFS.** Conductors shall have a vertical clearance as appropriate for pedestrian and vehicular traffic on roofs as shown on Drawing D-20/20A herein.

Exception No. 1: Where the voltage between conductors does not exceed 300 and the roof has a slope of not less than 4 inches in 12 inches, a reduction in clearance to 3 feet shall be permitted.

Exception No. 2: Where the voltage between conductors does not exceed 300, a reduction in clearance above only the overhanging portion of the roof to not less than 18 inches shall be permitted if (1) not more than 4 feet of service-drop conductors pass above the roof overhang, and (2) they are terminated at a through-the-roof raceway or approved support.

(b) **VERTICAL CLEARANCE FROM GROUND.** Service-drop conductors where not in excess of 600 V, nominal, shall have minimum clearance from final grade as shown on Drawing D-20/20A herein.

(c) **CLEARANCE FROM BUILDING OPENINGS.** Service conductors shall have a clearance of not less than those indicated on Drawing D-18 herein.

Service conductors shall not be installed beneath openings through which materials may be moved, such as openings in farm and commercial buildings. Overhead wires shall not be run such that they obstruct entrance to these building openings.

(d) **CLEARANCE FROM SWIMMING POOLS.** Refer to Drawing D-21 herein for appropriate clearance to the water surface and structures.

3.1.2 SERVICE ENTRANCE LOCATION

The service drop and attachment point, service bus or service entrance shall not be enclosed in any building, alteration, facade or addition.

a. <u>Single family residences and one to four family apartment buildings:</u>

Service entrance and service drop attachment shall be located at a point closest to Utility supply point. Customer may determine this location subject to the requirements contained herein. Utility will endeavor to attach to the service entrance if the service drop attachment is within 15 feet. See Drawings D-18 and D-19. If any doubts exist as the proper location, please consult Utility.

b. Commercial, Industrial and Apartment buildings of more than four units:

Utility Distribution Planner or representative shall designate the service entrance and service drop attachment point.

For multi-tenant buildings, service entrances of less than 400 A per tenant shall be grouped at a location (s) designated by the Distribution Planner or representative to facilitate connection to a single service drop(s). Services of 400 A or more per tenant for multi-tenant buildings shall be case handled.

As an alternate to grouping service risers, pre-bussed services boxes and associated risers, may be provided by the developer. They shall be sized to accommodate the proposed services and installed on the outside of the building wall at designated locations. Individual conduits or service cable shall be provided from the service box to the meter location to assure integrity and security of the unmetered circuit. Meters shall be located as close as practical to service box. Combination pre-bussed ganged meter bases, are also an acceptable alternate.

3.1.3 Service Drop Attachment

The service entrance must be located where there is adequate material and strength for Utility to attach its service drop. The attachment must have sufficient height to provide the required service drop and drip loop clearances as specified herein. The attachment point must be accessible by ladder.

SERVICE WIRING

Preferred points of attachment are building studs or solid masonry at least one foot from a corner. Some trim and soffit boards are acceptable when substantially reinforced. These details are shown on Drawing D-19.

On residential construction, Utility will install the attachment in typical situations as shown on D-19. In other situations, Customer/Contractor shall be responsible for the installation of an adequate attachment. If in doubt, Utility should be consulted as to what constitutes an adequate attachment.

3.1.4 Service Entrance-Height

a. The point of attachment of the service wires to a building shall be as indicated on Drawings D-18, D-19, and D-20.

b. When the building is too low to obtain proper clearance for the service wire attachment, Customer must provide an approved upright or service mast of rigid metal conduit of sufficient strength and height for the attachment of the service drop wires. When an acceptable upright or mast is installed, Utility will supply and install triplex service cable from pole to residence in accordance with drawings herein.

3.1.5 Service Entrance-Spacing

When more than one service entrance is provided on a building for the same class of service, the spacing between the service entrances should not exceed twenty-four inches.

3.1.6 Service Entrance-Adjoining Property

Thirty-six (36) inches is required as the minimum permissible clearance between the wall through which the service entrance is brought out and the adjacent property line. The service entrance shall not overhang adjoining property.

3.1.7 Service Entrance-Capacity

a. Services 800 A or less: Service entrance conductors shall extend at least 24 inches beyond the raceway and be left free for Utility to make the attachment to the service drop.

b. Services over 800 A: A bus bar outlet with enclosed service drop connectors is preferred. Multiple weatherheads are acceptable per Drawings D-23 and D-24.

3.1.8 Rewire Existing Service Entrance From Utility Service Bus on Building

One to Four Family Residential Dwellings:

The service entrance from an existing supply bus on a building may be changed or increased in capacity at its present location, except: (1) on a building wall which is less than thirty-six inches from an adjoining property line, (2) on a building wall facing a street which has been cleared of overhead circuits or poles (3) any place without proper clearance due to additions to the structure such as rooms, fire escapes, etc., (4) inside an enclosed porch, (The term "enclosed porch" includes a "screened in" porch) and (5) where the existing service drop is attached to an adjacent building.

SERVICE WIRING

Commercial and Residential Dwellings More Than 4 Family:

A change in service entrance from an existing supply bus must be reviewed with the Distribution Planner for approval to rewire prior to doing work.

Height of Attachment

Where Utility service bus exists at a height greater than 18 feet above ground level, the service entrance should be terminated at the 18-foot level, and Utility will wire down to this level and connect.

3.2 UNDERGROUND SERVICES

3.2.1 Location-General

Service entrance provided from underground distribution systems shall be located and terminated in accordance with Utility design standards. The service lateral shall not be enclosed within or covered by any alteration, facade or addition to the building.

3.2.2 Customer Owned Service Conduit

a. In situations where the service conduit is Customer owned, installed and maintained, the conduit will extend from Customer service entrance to Utility designated point of service on Customer property, on public property or on utility easements adjacent to Customer property. Utility requires PVC Schedule 40, rigid non-metallic electrical conduit for this purpose. See Drawings D-25/25A and D-26 herein.

b. The riser bend shall be provided and installed by Customer between the conduit and the pole. The bend shall be PVC Schedule 40, rigid non-metallic electrical conduit, except in the 2 1/2 inch diameter size, the bend may be flexible non-metallic conduit. The bend shall be installed at the time of conduit installation. Utility will extend conduit up pole. The proper location of the riser bend on the pole (quadrant) shall be obtained from Utility representative. Where the riser bend is to be extended to a location requiring pole setting, replacement or alteration by Utility, such extension shall not be made until the pole work is completed by Utility. See Drawing D-27 herein.

c. Conduit installations for Utility maintained cables shall not include conduit elbow fittings (LB). Standard conduit bends must be used.

d. Conduits are to be installed by Customer into existing transformer compartments. Customer should contact Utility to schedule the opening of the transformer and safety cover up of energized parts.

3.2.3 Customer Owned Service Cable

Service cables shall be provided in lengths adequate to extend up the pole to the secondary or the transformer terminals (including street crossings). Customer will install cable to base of pole and coil remainder for completion by Utility.

Cables exposed to sunlight at the top of the pole shall be ultra violet (U.V.) resistant.

Cables to be installed in conduit or buried in direct contact with the earth shall be a type designated or approved by the Distribution Planner.

SERVICE WIRING

Cable ownership remains with Customer and any necessary repairs, including that portion extending up the pole, are the customer's responsibility.

For future maintenance, Utility will remove Customer cable from the pole to allow repair or replacement and re-attach same to the pole upon completion of the work.

See Drawing D-28 herein.

3.2.4 CONDUIT SEALS

Termination of secondary distribution conduits within the building below grade is not a preferred installation due to water seepage problems. It has proven to be very difficult to insure long term water tightness of the conduit and cables through the building wall. **It is Customer responsibility to provide drainage and sealing as needed to prevent damage to the electrical facilities and other property inside the building.**

3.2.5 CABLE TERMINATIONS

Termination space for Utility maintained secondary distribution conductors shall be of sufficient space to allow for pulling and termination of cables. Utility maintained cables shall not be landed directly on breaker terminals. In network areas, extra space for limiter lugs is required. Termination space is considered dedicated and will be sealed by Utility. Other wiring is not allowed to pass through this space. See drawing D31-31A for bending space and minimum terminal box size. See also paragraph 4.6 herein.

4. METERING

4.1 METERING RULES

4.1.1 One Main Meter For Service Of Same Type

Utility will furnish and install only one main watthour meter to register all energy of the same type of service supplied to Customer at any individual premises, unless accuracy of measurement, engineering, safety reasons, rates or legal provisions require the installation of more than one meter. There may be Customer expense for additional requested meters.

For secondary service customers receiving both single and three-phase service, one single and one three-phase meter will be furnished by Utility.

4.1.2 Meter Installation

On all new wiring and rewiring of electric services, Customer is required to purchase and install appropriate meter mounting equipment in accordance with the requirements of the latest Electric Service Manual.

4.1.3 Demand Monitoring

In the event that demand customers wish to monitor and control KWH use, Utility, as engineering permits, will provide KWH pulses to the Customer equipment. Utility will own, install and maintain the output device. There is a one time installation charge and monthly maintenance fee for this service. The kilowatt-hour pulse is available from transformer rated meters only. The end of interval, timing pulse is not provided.

4.1.4 Off Peak Demand Metering

If General Service customers wish to take advantage of off peak demand rate provisions, a time of use meter can be installed in place of the normal meter for a monthly charge.

4.1.5 Individual Electric Meters

Utility requires the installation of individual electric meters on all units in multi-occupancy residential and commercial buildings.

4.2 METER LOCATIONS AND WIRING

4.2.1 Meter Location Policy

In general, all electric meters must be located outdoors at the point closest to the service drop or lateral termination except as defined in paragraph 4.2.2, Indoor Meter Locations. This policy applies to all new installations and rewire work where the meter and/or service equipment is involved. All meters shall be located and mounted in devices in accordance with the requirements of this manual.

Meter locations required for new or rewire work will conform to this policy even though other existing meters on the premise may not conform. It is recommended but not required that existing meters which are not involved in the wiring work be upgraded to present standards.

Meter locations must meet the following conditions in addition to other Electric Service Manual requirements:

a. Meters shall be grouped at locations approved by the Distribution Planner or representative.

b. Indoor meters, if permitted per Section 4.2.2, shall be located in public or semi-public access areas or special rooms which will allow access by Utility personnel for meter reading, testing and servicing. All keys necessary for access to the property, the building and the meters shall be furnished to Utility. Meters shall not be permitted inside individual tenant or occupant space.

c. On secondary services, the meters, including current transformers, shall be located on the line side (ahead) of service disconnecting device. Exception to allow Customer switching device ahead of the meter must be specifically approved by the Distribution Planner. See paragraph in 4.6.c., for exception.

d. Meter shall be located to directly measure Customer load.

e. All C.T.s located outdoors shall be installed in weather tight, approved cabinets.

4.2.2 Indoor Meter Locations

Indoor metering will be allowed only in certain limited situations. These situations are:

a. In designated underground areas, such as Downtown, if supplied from indoor transformer rooms or network manholes or vaults.

b. General Service Rate (commercial) current transformer cabinets for underground services and C.T. cabinets for overhead services greater than 800 A. (C.T. cabinets for overhead services 800 A or less and all Residential services shall be located outdoors). The associated meter shall usually be mounted outdoors unless approved indoors by the Distribution Planner.

c. Multiple Occupancy Buildings:

1. Buildings with four (4) or more floors constructed for multiple occupancy.

2. General Service Rate buildings, three (3) occupancy floors or less with more than six (6) meters per service. Six (6) meters or less per service must be located outdoors.

3. Residential Service Rate buildings, three (3) occupancy floors or less with sixteen (16) or more meters per service. Fifteen (15) or less meters per service must be located outdoors.

d. Primary meters

e. Outdoor locations that may subject the meter to physical harm.

If Customer/Contractor plans to install meters indoors as permitted in the above situations, Utility must be furnished with information detailing location, access, unmetered wiring methods and security provisions to meet the requirements of the Service Manual. This information must be submitted to the Utility and must be approved by the Distribution Planner before wiring work is started.

4.2.3 Rules Defining Rewire Work and Meter Location on Existing Buildings

4.2.3.1 Definitions:

Rewire work is defined as electrical work that involves (1) relocation, (2) replacement or (3) ampacity changes of customer owned service cables, service entrance conductors or service equipment. Rewiring work shall include the updating of metering equipment and requires that all meters be installed and located in accordance with the requirements of the Electric Service Manual.

Service entrance conductors are defined as the conductors between the terminals of the service equipment and the tap or splice to the service drop, service lateral or secondary distribution.

Service equipment is defined as consisting of the circuit breaker(s) or switch(s) and fuse(s) and their accessories located near the point of entrance of the supply conductors to a building and intended to constitute the main control and means of cutoff of the supply.

4.2.3.2 Additional Meters

New meters may be added to the existing service subject to the ampacity limitations of the service entrance conductors or service equipment. If existing meters are indoors, the added meters may be located indoors. If the added loads served from the new meters require rewiring, then all (new and existing) meters shall be located in accordance with the meter location policy.

4.2.3.3 Additional Service Entrances

a. On residential buildings of 15 meters or less (on three occupied floors or less), additional service entrance conductors and/or ampacity requires all meters to be relocated outdoors per the meter location policy.

b. On residential buildings exceeding 15 meters (on three occupied floors or less), if additional service entrances are wired to the building, meters associated with the new services shall be located outdoors if there are 15 or less meters per additional service entrance. Exception: If all meters and services are in one approved location, meters may remain indoors.

4.2.3.4 Rewiring Exceptions:

a. In multi-tenant buildings of six units or less, with indoor meters, where all units are served from a common service and each unit has its own means of disconnect, the ampacity of the disconnect may be increased without relocating the meter(s) outdoors subject to the limitation of the service entrance conductor ampacity. Work to increase the service entrance conductor ampacity, however, is rewire work and requires <u>all</u> indoor meters on the service to be relocated outdoors.

b. The C.T.s for rewired 800 A services may be left indoors if the rewiring can reuse the existing C.T. cabinet as-is. Appropriate C.T.s shall be installed. The meter will be located outdoors.

METERING

4.3 UNAPPROVED METER AND CURRENT TRANSFORMER LOCATIONS

Service will be refused if meters and current transformers are not installed in accordance with paragraph 4.2.1, Meter Location Policy.

Specific prohibited locations are:

a. Over stairs and in stair wells either indoors or outdoors.

b. In basements where the only entrance is through a trap door.

c. On lattice or metal lath partitions.

d. In or on walls of storage lockers or bins.

e. Meter locations inside occupant or tenant space, in single or multi-occupant buildings.

f. In bedrooms, bathrooms, toilet rooms, restaurant kitchens, stairways, elevator or ventilating shafts, or in any place where it will cause inconvenience to either Customer or Utility representatives.

g. Over windows, doors, stoves, furnaces, radiators, heaters, boilers, sinks, tubs or any place subject to flying objects or dust, grease, excessive heat, moisture or fumes.

h. Under water pipes or other pipes from which condensation may drop, or within twelve inches of gas, steam, water or other piping, or within five feet of belts or moving machinery.

i. In that part of a basement extending under a sidewalk.

j. Where the meter would be subject to excessive vibration.

k. On a wall abutting a street or alley when subject to mechanical damage.

l. On outside walls over air conditioning units where units are less than three feet from wall. (This covers air conditioning units installed after meter equipment is mounted).

m. Current transformers are not permitted in padmounted transformers serving more than one customer or on Utility distribution poles.

4.4 METER MOUNTING HEIGHTS

Meter mounting heights are shown on Drawing D-4 herein.

Overhead supplied individual meter sockets shall be mounted such that the bottom of the meter opening is between 5'0" and 5'6" above grade.

Underground supplied individual meter sockets shall be mounted such that the bottom of the meter opening is no lower than 3'0" above grade and no higher than 5'6" above grade.

METERING

Exception: **Residential Service only**: If meter socket is located over a driveway or walkway 36" in width or narrower the meter socket shall be raised to 6'6" as measured from bottom of meter opening to final grade.

General Service (Commercial) Rate meter sockets and enclosures **shall not be elevated to avoid hazards** but must be protected from pedestrian and vehicular traffic or parking hazards by Customer. Details of suggested barrier are shown on Drawing D-5.

Current transformer enclosures shall be mounted such that the bottom of the enclosure is no higher than 10 feet above grade or lower than 1'6" above grade.

Vertically grouped multi-meter centers shall be installed such that the top meter as measured from the bottom of the meter opening to grade shall not exceed 6'6". The lowest meter measured as above shall be no lower than 2'0" outdoors and 1'6" indoors.

Horizontally ganged meter centers shall be installed at the same heights as individual meter sockets.

Utility provided transformer rated, three-phase meter mounting equipment shall be mounted between 5'0" and 5'6" as measured from bottom of the meter window on enclosures or meter opening on sockets to final grade. Utility provided single-phase transformer rated meter socket shall be located between 3'0" and 5'6" from bottom of meter opening to final grade. Residential sockets may be elevated to 6'6", see exception above.

In **flood areas,** the bottom of the meter device shall normally be raised above the highest water line on record. General Service (Commercial) Rate meters if necessary to raise above 5'6" to grade, shall have a permanent platform and ladder installed and maintained at the meter by Customer for access purposes. The Distribution Planner should be consulted for specific requirements.

4.5 ACCESS TO METER EQUIPMENT

Customer shall maintain a clear access pathway to and in front of meters and metering transformers for Utility employees at reasonable times for readings, testing, changing, removing, inspecting and servicing such equipment. The clear space in front of the meter equipment shall be 36" deep, as wide as the equipment or 30" whichever is greater and as high as the top of the equipment or at least 6'6" high. This area shall be clear of all obstructions including piping, ventilating ducts, tanks, steps, rubbish, storage shelves, drums, pumps, air conditioning equipment, decks and other equipment. See also Paragraph 2.3.1.

Working space provisions of the N.E.C. 1990, or the latest revision, Section 110-16 shall be adhered to.

Failure to provide reasonable and adequate access and clearance may be cause for service to be delayed, refused or disconnected.

4.6 MULTI-METER INSTALLATIONS

a. Refer to meter mounting equipment (sockets) specification, Section 5.

b. Up to six meters may be supplied at a single point of delivery without a main means of disconnect. The equipment shall connect each meter to the service entrance conductors on the line side of each individual service disconnecting device. See Exception 4.6.c.

c. In situations where the number of meters and/or fault duty requires a main service disconnect, the individual meters shall be located on the line side (ahead) of each Customer disconnect. This is referred to as "Hot" metering. **Exception: On 480 V wye and delta services, Customer disconnect shall be located on line side of meter.**

d. Utility maintained underground secondary distribution conductors shall not be terminated on a Customer owned disconnect switch or breaker. Customer shall provide own and maintain an appropriate pull box with landing lugs with adequate cable bending space for terminating these cables. See Drawings D-30, D-31 and D-31A and paragraph 3.2.5 herein.

e. Custom designed, combination multi-meter equipment with fused or circuit breaker type disconnects may be provided subject to Utility approval of meter sockets, location, electrical one line, cable landing space, security provisions, etc., **before** fabrication.

f. All disconnecting devices located ahead of meters shall be provided with lock-off capability to permit isolating of service.

g. Meters shall be grouped in location(s) approved by the Distribution Planner. Customer is responsible to permanently mark the flat, apartment, office or location identification at each meter before the meter is set.

4.7 REQUIREMENTS, SECURITY AND WIRING

a. **METERED AND UNMETERED WIRES SHALL NOT BE INSTALLED IN THE SAME WIREWAY, PULL BOX, ENCLOSURE, ETC.**

b. Adequate provisions must be made for the sealing and security of meter, unmetered service equipment and circuits. Covers of all unmetered service equipment, pull boxes, troughs, wireways, busways, etc., shall be drilled and tapped for one or more 1/4" x 20 bolts to adequately seal the covers. Sealing bolts shall be furnished with the equipment or by Contractor. "Guard Nuts" to secure the 1/4" x 20 bolts shall be furnished and installed by Utility. Maintenance access to unmetered disconnects, ie., breakers, fuses, will not normally be sealed.

c. All unmetered feeder busway shall be approved by Utility. Busway openings shall be Customer preengineered for installation. "Plug-in" busway shall not be used. Busway approval is required before equipment is purchased.

d. When aluminum service entrance conductors are used in the meter device, the wire should be thoroughly cleaned with a wire brush and then liberally coated with oxide inhibitor.

e. A minimum clearance of three inches shall be maintained from the outer edge of the meter base and the service entrance switch, another meter base, wiring troughs, or any obstruction such as downspouts, doors, chimneys, shutters or building projections.

f. All sockets energized before a meter is set are a hazard and shall be covered with a meter socket cover furnished by Utility. These may be obtained by calling for them at the Utility Service Center.

g. Unused hubs or openings shall not be left open. Hubs shall be closed with a threaded pipe plug and knockouts with knockout closers.

h. Raceway or conduit connections at top of meter device shall be watertight and the bottom knockouts closed.

i. Meter socket mounting must be plumb and rigidly supported to prevent movement, sway and vibration. Meter sockets not mounted to a permanent structure must be supported in a manner approved by the Distribution Planner. Refer to Drawing D-8 for a preferred meter socket support.

j. Meter mounting equipment shall be surface mounted including line side conduits.

k. Meter cabinet covers, pull box covers, C.T. cabinet covers and any miscellaneous service equipment covers shall be limited to 3 feet by 3 feet unhinged. Unhinged covers shall be equipped with two handles for removal. All doors shall be equipped with hasps for padlocking.

1. Customer/Contractor shall provide appropriate cable lugs for the termination of Utility maintained conductors.

4.8 CURRENT TRANSFORMER INSTALLATIONS - FOR SERVICES UNDER 600 V

4.8.1 Services Requiring Current Transformers

Current transformers (C.T.s) shall be installed on services whose rated ampacity is greater than 400 A. **EXCEPTION:** After April 1, 1994, C.T.s shall be installed on three-phase services rated larger than 600A.

4.8.2 Installations Requirements

4.8.2.1 C. T. Cabinet

C.T.s shall be installed in Customer provided, owned, installed and maintained enclosure, compartment, box or as part of panel boards as specified herein. The C.T. enclosure, compartment, box, etc., is dedicated for metering purposes only, see paragraph 4.8.2.6. Unauthorized access is not permitted. **No Customer equipment or other wiring shall be allowed in or to pass through the dedicated space.** Outdoor or indoor C.T. enclosure locations are specified in Section 4.2.2. Mounting height limitations are stated in Paragraph 4.4. C.T.s shall normally be installed on the line side of the service disconnect - unless otherwise approved by the Distribution Planner.

4.8.2.2 Meter Enclosure and Sockets

The transformer rated meter enclosure and sockets listed below are furnished by Utility and installed by Customer. The meter device shall normally be mounted on an outdoor building wall or as

second choice, on an interior wall outside the electrical equipment room. The Distribution Planner must approve all indoor locations. The meter enclosure or socket, subject to meter location policy, should be located as close as practical to the C.T.s.

If the C.T. cabinet is located outdoors only, and has an adequately hinged cover capable of supporting Utility provided meter socket, the socket may be mounted on the cabinet door as long as the required meter socket height is maintained. Contractor shall use the rear knockout and nipple through C.T. cabinet door. Utility will install wire pack through the door.

Service Rating	Utility Furnished Meter Device Number	Dimensions W x H x D
Single-phase, all voltages	'210' (6 terminal socket)	8"x12"x4"
Three-phase, 3 wire less than 600v.	'246' (Socket, 8 terminal)	10"x17"x5"
Three-phase, 4 wire less than 600v.	'245' (Socket, 13 terminal)	10"x17"x5"
Primary Services	'043' (double enclosure)	27"x30"x12"

4.8.2.3 Service Ampacity up to and including 1200 A

Utility provides for Customer installation, bar type C.T.s for this range of service ampacities. Customer provides the C.T. enclosure, mounts the C.T.s and installs line and load side wiring. The C.T. enclosure for three-phase shall be a minimum 32" x 36" x 9" deep and for single-phase shall be a minimum 24" x 32" x 9" deep. Up to three cables per phase may be connected to the C.T.. **Two bolt** cable to flat connectors shall be provided.

4.8.2.4 Service Ampacity Larger than 1200 A

Utility provides, for Customer installation, window type C.T.s for this ampacity service. The C.T. enclosures are usually part of service panels or switchgear. Utility should be consulted for review

of compartment size and service plan before purchasing and installing equipment. The C.T. space shall have bus bars through the C.T.s that are removable from within the C.T. compartment space. Cables must be landed on hardware independently supported from the removable bus link through C.T. window. **Cables shall not be brought through the C.T. window.**

4.8.2.5. METER LOOP

a. The meter "loop", ie., wires and conduit between C.T.s and meter device, are customer installed. The conduit shall have a minimum diameter of 1" and shall be intermediate or rigid metallic or non-metallic electrical conduit with a minimum of conduit fittings. Customer wiring is not permitted in this conduit. Utility will provide the meter "loop" wires consisting of a wire pack of 10 ea., No. 12 AWG, solid copper wires with individually colored insulation. See also meter grounding below. Splicing of meter loop wires and the installation of pull boxes are prohibited.

b. Contractor should specify the length of wire at the time of pick up. If length is not specified, Utility will provide the following lengths based on C.T. size furnished. Sufficient wire shall be left for Utility termination of C.T.s and meters. Three C.T.s are required for 4 wire service and two C.T.s are required for 3 wire service.

METERING

Service Ampacity	C.T. Furnished	Wire Pack Length Provided
600 A.*	600 A. (bar type)	15 Ft.
800 A.	600 A. (bar type)	15 Ft.
1200 A.	800 A. (bar type)	20 Ft.
1600 A.	1200 A. (window)	25 Ft.
2000 A.	2000 A. (window)	25 Ft.
and larger	2000 A. (window)	25 Ft.

*Single-phase only after April 1, 1994.

c. The meter loop length with the No. 12 AWG wire pack shall not exceed to 100 feet. (Length of conduit between C.T. cabinet and meter device). If the Distribution Planner approves greater separation between C.T.s and meter, Contractor shall provide No. 10 AWG solid copper wires up to a maximum length of 175 feet. Contractor provided No. 10 AWG wires must be identified at each end. (6 wires are required for single-phase service, 7 wires for 3 phase, 3 wire and 10 wires for 3 phase 4 wire services.)

d. METER GROUNDING: Contractor shall provide and install a No. 10 AWG solid or stranded copper wire in the same conduit with the meter loop wire pack.

e. Utility personnel will terminate meter loop and ground wires in C.T. box and on meter equipment in the meter enclosure or socket. It shall be Contractor responsibility to install sufficient length of wire pack to permit these terminations. Contractor shall coil ends of wire pack without separating the pack or cutting wrap.

METERING

4.8.2.6 C.T. Cabinet Covers and Sealing

All Customer provided C.T. enclosure covers shall be provided with a hasp for padlocking if hinged or, if not hinged, shall be sealed with 1/4" x 20 sealing studs as needed to prevent removal of cover. Utility will use "Guard Nuts" for sealing covers in place. If the C.T. space is part of panel boards or switchgear, the C.T. space shall be barriered from within and covered with its own, separately sealable steel cover or door.

Unhinged covers shall be limited to 36" x 36" in one piece. Unhinged covers shall be equipped with two handles to assist in removal. Outdoor located C.T. cabinets shall be weather and rain resistant.

4.9 Pickup of Utility Furnished Meter Items:

Utility furnished meter enclosures, sockets, C.T.s and wire packs are to be picked up by Customer or Contractor at:

City of Kirkwood
Electric Department
212 S. Taylor Avenue
Kirkwood, MO 63122

5. CUSTOMER FURNISHED METER MOUNTING EQUIPMENT REQUIREMENTS

Customer shall furnish, install and maintain meter mounting equipment which meets Utility requirements stated herein, for the purpose of mounting self-contained electric watthour meters both in individual and multi-meter installations. The watthour meters will be furnished, installed and maintained by Utility.

Utility will no longer maintain lists of approved manufacturer's catalog numbers. Utility will assist the manufacturer in meeting these requirements by reviewing and commenting on designs and/or manufactured samples.

Failure by Customer/Contractor to install a meter mounting device, also known as meter socket, meeting these requirements may lead to the delay of service until these requirements are met. Other sections of the Electric Service Manual pertain to mounting location, mounting heights and other service requirements.

5.1 General Requirements

5.1.1 The meter socket and any integrated electrical equipment shall meet requirements of the Underwriters Laboratories (UL) and shall be labeled UL approved for the type of service equipment being provided. Meter sockets shall meet standards contained in the latest revision of UL414 and ANSI C-12, Code for Electricity Metering.

5.1.2 Devices shall be labeled as to ampacity class, maximum voltage and manufacturer's name and catalog number.

5.1.3 Individual meter sockets shall be installed on the line side, ahead of Customer service disconnect.

CUSTOMER FURNISHED METER MOUNTING REQUIREMENTS

5.1.4. All meter socket equipment and line side wiring shall be surface mounted. Flush or semi-flush equipment is prohibited. **NOTE:** Location and method of **unmetered** wiring **inside Customer premises** must be Utility approved before installation.

5.1.5 The meter socket shall be of **steel construction**, weather and rain resistant and have a baked painted finish over galvanized steel sheet. Fabrication with aluminum sheet, fiberglass or non-metallic material is prohibited.

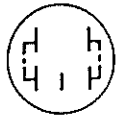
5.1.6 **All meter socket covers shall be ringless, see 5.5.7 for sealing.**

5.2 Single Position Meter Socket Identification Numbers & Requirements

Refer to Chart 5.2.1 for meter socket ID numbers based on service voltage, wire, phase and ampacity class. Refer to Chart 5.2.2 for meter socket requirements based on socket ID.

Chart 5.2.1

Chart 5.2.1 Single Position Meter Socket Identification Numbers

Rate	Service Voltage, Wire and Phase	Socket Terminals	Socket I.D. Number(2) Based on Service Ampacity			
			100A	200A	400A	600A
Residential	120 V, 2 wire, Single-Phase, 30 A Max (1)	 4 Jaw No Bypass	086(OH) 228(UG)	N/A	N/A	N/A
	120/240 V, 3 wire Single-Phase			193(OH) 228(UG)	235 Class 320	use C.T.s
	120/208 V, 3 wire, Two-Phase, 200 A Max (derived from 4 wire, Three-Phase system)	 5 Jaw No Bypass	086 with 5th terminal added at 9 o'clock	193(OH) 228(UG)	N/A	N/A
Non-Residential (Commercial)	120V . 2 wire, Single-Phase, 30 A Max., no bypass (1)	4 Jaw, No Bypass	086	N/A	N/A	N/A
	120/240V, 3 wire, Single-Phase 240/480 V, 3 wire, Single-Phase	 5 Jaw Clamp Jaw Bypass	225	225	236 Bolt-in	use C.T.s
	120/208V, 3 wire, Two-Phase, 200 A . Max 277/480 V, 3 wire, Two-Phase, 100 A . Max				N/A	N/A
	240 V, 3 wire, Three-Phase 480 V, 3 wire, Three-Phase				237 (bolt-in) (3)	237 (bolt-in) (3)
	120/208 V, 4 wire, Three-Phase 277/480 V, 4 wire, Three Phase	 7 Jaw Clamp Jaw Bypass	218	218	238 (bolt-in) (3)	238 (bolt-in) (3)

N/A indicates service installations are not permitted.

(1) 120 V, 2 wire, single-phase service is limited, see 2.1.1.

(2) Refer to chart 5.2.2 for socket requirements

(3) Effective 4/1/94, ID 237 and 238 shall be UL labled Class 480 for 201 A to 600 A, three-phase service.

Chart 5.2.2

Chart 5.2.2 Single Position Meter Socket Requirements by I.D. Number

I.D. Number See Chart 5.2.1	Socket Class	Maximum Service Ampacity	Bypass	Terminals	Maximum Wire Size (kCMIL)	Lugs/ Connectors	Hub	Service OH/UG	Rated Voltage	Approximate Dimensions W x H X D (2)
086	100	100	None	4 or 5(9 o'clock)	2/0 AWG	Lay-in	Hub	O.H. Only	300	8"x9"x3 1/2"
193	200	200	None	4 or 5(9 o'clock)	250	Lay-in	Hub	O.H. Only	300	8"x14"x5"
218	200	200	Clamp Jaw	7	350	Lay-in	Cover Plate	Both	600	12"x18"x5"
225	200	200	Clamp Jaw	5 (6 o'clock)	350	Lay-in	Cover Plate	Both	600	12"x16"x5 1/2"
228 (1)	200	200	None	4 or 5(9 o'clock)	350	Lay-in	Cover Plate	Both	300	12"x14"x5"
235	320	400	Clamp Jaw	4	600 or 800	Stud	Cover Plate	Both	600	14"x26"x5"
236	400	400	Built-in	4 bolt-in	800	Stud	Cover Plate	Both	600	18"x31"x6"
237 (3)	400 480	400 600	Built-in	5 bolt-in	800	Stud	Cover Plate	Both	600	20"x34"x 6"
238 (3)	400 480	450 600	Built-in	7 bolt-in	800	Stud	Cover Plate	Both	600	20"x34"x6"

(1) Socket 228 maybe substituted for 193 at Contractors discretion

(2) 1992 UL wire bending requirements may effect sizes. Refer to mfgr. for dimensions.

(3) Effective April 1, 1994.Bolt-in meter sockets ID 237 and ID 238 shall be UL labled Class 480 for 201 A to 600 A three- phase service.

CUSTOMER FURNISHED METER MOUNTING REQUIREMENTS

5.3 Bypass Requirements

5.3.1 Clamp jaw bypass meter sockets are required in the following individual meter situations:

a. All three-phase meter sockets.

b. All 480 V services

c. Single and Two-phase, Non-residential services, see 5.3.2 for exceptions.

d. Traffic lights and railway crossing signals.

e. Class 320 residential service meter sockets.

The clamp jaw bypass meter socket shall be rated Class 200 (except 'e' above) and shall be heavy duty, lever operated, clamp jaw with jaw tension release design with plastic protective shield similar to the Landis and Gyr HQ-4, HQ-5 or HQ-7 bypass mechanisms. Bypass mechanisms failing to meet the requirement to visibly open, close and clamp the socket jaws shall be rejected. Clamp jaw bypass mechanisms not previously used on Utility system may be offered to the System Meter Division for review. The clamp jaw bypass shall be rated to carry 100% of class ampacity continuously.

5.3.2 Bypass type meter sockets **are not required** in the following individual meter situations:

a. Residential services up to Class 200.

b. Temporary services.

c. Lighting only, limited to 100 A, 240 V, single and two-phase, on apartment hallways, outside areas, streets, highways and signs.

5.3.3 Multi-meter socket equipment requires bypass capability in the following situations:

a. Without main disconnect, six or less meters per service:

(1) Residential: No Bypass
(2) Non-Residential: Clamp jaw bypass

b. With main disconnect, generally more than six meters per service

(1) Residential: Horn type bypass

(2) Non-Residential:
Single and two-phase: Horn type bypass
Three-phase: Clamp jaw bypass

c. Note:

(1) All three-phase and 480 V services require the clamp jaw bypass.

(2) The **slider bypass** is not permitted.

CUSTOMER FURNISHED METER MOUNTING REQUIREMENTS

5.4 Bolt-in Meter Sockets

5.4.1 Bolt-in meter sockets equivalent to Landis and Gyr type K-4, K-5 and K-7 meter sockets rated Class 400, shall be used on all non-residential services rated 201A to 400A. **NOTE**: Class 320 meter sockets shall be used on **residential** single-phase service rated 201A to 400A.

5.4.2 **Effective April 1, 1993**: Bolt-in meter sockets type K-5 and K-7, rated Class 480, shall be installed on all **three-phase** services rated 201A to 600A wired for energizing after April 1, 1994. (Single-phase bolt-in meter sockets, type K-4, remain limited to 400A maximum).

5.4.3 Bolt-in meter sockets shall be wired with line side connections to the top terminals of the socket.

5.4.4 **Contractor must adhere to instructions posted inside the meter socket regarding the installation of the "Belleville Washer", see drawings D-9, D-13 and D-16 herein.**

5.4.5 The bolt-in meter sockets have built-in bypass capability.

5.5 Miscellaneous Requirements

5.5.1 **CAUTION - Class 320, five and seven jaw meter sockets shall not be permitted on any two or three-phase meter installation.** Class 320 single-phase sockets are not permitted on non-residential service.

5.5.2 Meter sockets for up to and including Class 200 service shall be equipped with lay-in lugs. Class 200 sockets shall be suitable for a range of conductors up to and including 250 kCMIL and/or 350 kCMIL.

CUSTOMER FURNISHED METER MOUNTING REQUIREMENTS

Lay-in lugs and stud type connectors shall be tinned and suitable for aluminum or copper conductors. **CAUTION: Only one conductor per lay-in lug or lug barrel shall be permitted. All line side connectors shall be Contractor furnished and suitably sized for Utility specified or provided line side conductors.** Stud connectors shall be the pressure screwhead type.

5.5.3 On all individual meter sockets for underground service, the line conductors will be installed to wrap around the socket interior to the top lugs. Side wire way designs for direct upward connection of U.G. cables are not permitted. **The left hand bottom knockout shall be reserved for the incoming service cables.**

5.5.4 Bypass type meter sockets shall be provided with a clear polycarbonate safety shield over the socket interior.

5.5.5 The 5th jaw on non-bypass and horn bypass sockets shall be located in the 9 o'clock position and on clamp jaw bypass sockets the 5th jaw shall be located in the 6 o'clock position.

5.5.6 The meter neutral terminal on 5 and 7 terminal sockets shall be bonded to the neutral conductor. Where needed due to local requirements, the socket shall include a grounding electrode bonding clamp.

5.5.7 **Sealing - All covers shall be equipped with no more than one securely fastened hasp or stud for padlocking and sealing by Utility.** Depending on the cover size, non-sealable fasteners may be used to mechanically secure the cover in addition to the single sealing hasp. Covers that secure more than one meter shall similarly be secured with only one sealing and padlocking hasp or stud.

CUSTOMER FURNISHED METER MOUNTING REQUIREMENTS

5.6 Special Requirements

5.6.1 Where Customer disconnects and/or fuses are combined with the meter equipment, the cover for the meter and the cover for Customer access to the switch/fuse and load side wiring shall be separated such that Utility meter and line side service compartments may be secured and sealed separately from Customer side. On such combination units, internal barriers shall be permanently installed to prevent access to meters and unmetered wiring via Customer compartments. On multi-meter equipment, the line side cable terminal compartments shall have sealable and lockable covers separate from meter covers.

5.6.2 Multi-metered equipment shall be equipped with meter bypass, as stated in 5.3.3 herein. For other requirements refer to 4.6 herein.

5.7 Meter Pedestal Installations

5.7.1 Meter pedestals shall meet UL requirements and be appropriately labeled. The pedestal shall be equipped with post extension and footing base. The meter pedestal installation shall meet the requirements as shown on drawing D-32. Pedestal owner is responsible to maintain pedestal in plumb (vertical) position and fulfill all other maintenance requirements of Section 5.8.

5.7.2 Other types of installations may use acceptable meter sockets suitably mounted and wired to main disconnecting equipment, refer to Drawing D-33.

CUSTOMER FURNISHED METER MOUNTING REQUIREMENTS

5.8 Meter Socket Maintenance

It is the responsibility of Customer/Building Owner to maintain, repair and replace the meter mounting (socket) equipment in order to keep such equipment in a safe, secure and useable condition. When such equipment is subject to vandalism or damage, it is the responsibility of Customer/Building Owner to remedy the situation by protective measures or by changing location.

Utility will perform emergency repair in an attempt to maintain or restore service and to protect the public safety. In the event that the hazard posed by the equipment is critical to safe operation, immediate disconnection of service may be necessary until corrections are made by the Customer/Building Owner. Utility will notify Customer/Building Owner and the Inspection Authority when an unsafe meter socket and/or service equipment problem is found. Utility will allow a reasonable time, normally not to exceed 30 days, for the repair or replacement of meter socket equipment, subject to the hazard involved. Utility emphasizes the need for the responsible Building Owner to minimize safety hazards to all concerned by maintaining meter socket equipment and service compartments in a safe and good working order.

6. CUSTOMER WIRING AND INSTALLATION

6.1 Notify Utility of New or Rewire Work

Customer or Contractor should promptly notify Utility (refer to Section 1) of the electrical work planned. Prompt notification will minimize wiring problems and avoid unwanted delays when work is completed.

6.2 Inspections Of Wiring

Customer wiring may be subject to inspection and approval by local code authority. Contact City Building Commissioner's office for requirements.

When inspections are required, Utility will not provide service until Customer wiring has been approved by the proper authorities. In certain cases, inspection authorities will issue a temporary wiring approval prior to the completion of the entire installation, whereupon Utility is permitted to proceed with the service connection and the installation of the meter. Such installations require a final inspection and approval when completed.

6.3 Wiring Approval

The following is a guide when wiring approval is necessary in the City of Kirkwood.

6.3.1 A wiring approval is generally not required for:

1) United States (Federal) and Missouri (State) government agencies if the property and building is owned (not leased) and occupied by them. This includes Federal and State highway lighting and traffic signals.

2) Reconnection of service that was previously disconnected for less than six months by Utility for delinquent payment, unknown user, or non-access, unless changes in the customer wiring have been made or the wiring is unsafe.

6.3.2 Circumstances or conditions which generally require wiring approval before service can be connected or reconnected are:

1) New wiring is installed or existing wiring is added to, repaired or altered.

2) Meter and/or service removed because of vacancy.

3) Disconnected for delinquent payment, unknown user, or non-access for more than six months.

4) Fire - Service has been ordered disconnected by the Fire Department, disconnected by the Fire Department themselves, or disconnected by Utility personnel because of hazard to the public.

5) Storm or Vandal Damage - Disconnected by Utility personnel because of danger or hazard to the public. Utility will promptly notify the inspection authority.

6) Ordered disconnected by an electrical inspection authority because of defective or hazardous wiring.

7) Disconnected by Utility personnel upon observing a hazard to the public caused by customer wiring. Utility will promptly notify the electrical inspection authority.

8) Disconnected by Utility personnel at the request of the customer or their electrical contractor in order to add to, repair, or change the wiring. (Contractor can usually arrange by telephone for the electrical inspection authority to give verbal wiring approval to Utility.)

6.3.3 Emergency repairs after hours, weekends and holidays:

Reconnection can be made for emergency reasons if Contractor provides Utility with electrical license number. Utility will promptly notify electrical inspection authority of this action.

6.4 Cut-in-Flat of Rewired Services

After receiving the wiring OK, Contractor may make temporary connections at the outlet and bypass the meter socket in order to provide service to the **rewired Customer** that would otherwise experience hardship before the meter is set. Such hardship could include the inability to operate the furnace, refrigerator, range, air conditioning, etc. It is not necessary to advise Utility when the cut-in-flat is made.

While "Cut-in-flat" is permitted the Distribution Planner should be contacted before proceeding in this manner.

Should Utility determine that a "cut-in-flat" is without wiring OK, Utility will notify Customer and the electrical inspection authority. Failure to secure the inspection wiring OK could result in the disconnection of service.

NOTE: THE BYPASS OF METERS ON NEW SERVICE CONNECTIONS IS <u>NOT</u> PERMITTED.

CUSTOMER WIRING AND INSTALLATION

6.5 Diversion of Service

It is illegal to tamper with Utility meter and to make unauthorized connections and reconnections in service and C.T. equipment, at service outlets, to service cables and overhead wires with the intent to divert electric service. Such diversion is subject to service cutoff and legal action.

6.6 Contractor Access

Contractor may access Customer owned and Utility secured meter and C.T. equipment in the pursuit of legitimate work. The Contractor is requested to inform Utility within 24 hours of this action and the work intended, by calling the Distribution Planner, see Section 1, herein. The Utility requires prior approval for such access, contact the utility office. Failure to provide prompt notification will cause access to be considered unauthorized and subject to legal action.

When a new service or rewired service originates from an energized, unmetered **Customer owned** service compartment (i.e., connection box, pull box, terminal box, trough, etc.), Contractor must inform Utility of the purpose and extent of the work **before** starting any work. Generally, a job site meeting with Utility will be necessary to review capacity and suitability of the service compartment and to schedule the work. Only after specific Utility approval, will Contractor be permitted to terminate service wires within the compartment. Contractor is not permitted to energize new wiring **beyond the meter socket** unless emergency situations exist and such work is specifically approved by Utility before work is started. **Contractor and Owner should schedule outages to other tenants as needed to complete the wiring. The "cut-in-flat" of newly wired meters to energize new services is not permitted.**

CUSTOMER WIRING AND INSTALLATION

6.7 Grounding (See drawings herein)

All secondary A.C. supply systems shall have a grounded neutral or grounded phase conductor run from Utility point of distribution to Customer service entrance disconnect equipment and approved ground. Customer desiring three-phase, three wire service from a Utility three-phase, four-wire source must run the fourth, neutral wire to their approved service entrance ground. See paragraph 2.1 regarding requirements for ungrounded A.C. supply.

Customer/contractor shall install a grounding conductor as prescribed in National Electrical Code or by local regulations. When grounded to a cold water pipe, the ground wire shall be attached by means of an approved ground clamp and connected to the ground terminal of the service switch as shown in diagram, D-3-1.

A ground wire connection to the water pipe must consider the location of the **water meter**. If the water meter is inside the house, a bonding jumper of the same size as the ground wire is usually required around the water meter, using two ground clamps, and installed in such manner as to permit the removal of the water meter, see D-3-1.

If an external grounding electrode is used, the grounding electrode conductor from the service equipment may exit the meter socket at the approved knockout. As an option, the grounding electrode conductor may extend from the grounding electrode to an approved grounding lug inside the meter socket, if the socket is so equipped. Refer to Drawings D-3-1 and
D-3-2.

Telephone and/or other electronic equipment may require grounding external to Customer premises. Such ground connections are not permitted inside Utility sealed and secured cable and meter compartments.

CUSTOMER WIRING AND INSTALLATION

6.8 Distribution Center Pole

A Customer may desire service at a number of locations making it uneconomical to distribute from a meter located at the residence. In such cases, Customer can provide and own a distribution center pole on which Utility meter is installed and from which Customer extends service to the various locations, see drawings D-34 and D-35.

6.9 Connection of Service

The connection of service to energize Customer load is usually made by Utility when the meter is set.

7. MOTORS AND APPARATUS

7.1 General

Customer is invited to consult Utility before purchase, installation, or wiring of motors or other apparatus to determine the kind of service that will be supplied and the manner in which such equipment should be connected.

All motors, apparatus and appliances shall have such characteristics which enable Utility to maintain a satisfactory standard of service to Customer being served and all other customers in the immediate area. See paragraph 2.2.2.

Utility reserves the right to select the type of service to be supplied and should be consulted before equipment is purchased or ordered. The characteristics of motors 7 1/2 H.P. and larger or where the aggregate load of smaller motors is more than 20 H.P. require consideration.

7.2 Phase & Voltage

In general, 7 1/2 H.P. and larger motors will be three-phase and motors smaller than 7 1/2 H.P. will be single-phase. There are, however, a number of exceptions to this rule.

a. In areas where customers are supplied from a 120/208 or 277/480 V, three-phase four-wire system, service is sometimes available for motors smaller than 7 1/2 H.P.

b. In outlying and residential areas where three-phase energy is not readily available, larger single-phase motors may be permitted, but only with the prior approval of Utility.

c. Where Customer is already using three-phase energy, motors smaller than 7 1/2 H.P. may be added to the three-phase service.

d. Three-phase service is not normally available for residential customers.

The types of voltage which are supplied by Utility and the conditions under which each is available are described in Section 2.1, Type of Service, Voltage and Phase.

7.3 Protection Against Abnormal Conditions

All motors and special apparatus should be equipped with suitable undervoltage time delay tripping devices to protect against sustained undervoltage or service interruption and to prevent automatic disconnection of equipment upon momentary voltage disturbance.

Three phase motors should be equipped with suitable protective devices to prevent single phase operation, improper direction of rotation and excessive heating due to overcurrents.

Utility will not be responsible in any way for damage to Customer equipment due to failure of Customer to provide adequate protection.

Customer should install an uninterruptible power source (UPS) or voltage suppressors where momentary or extended outages or voltage fluctuations will cause inconvenience, loss of electronic memory or trip alarms, etc.

8. DIAGRAMS

Drawings contained here illustrate items of text and some typical service and meter arrangements. Further detail on these and other types of service arrangements may be obtained from Utility. All installations must comply with the current National Electric Code and local ordinances or other requirements. Where the term "approved ground" is used, refer to Section 6.7 Grounding.

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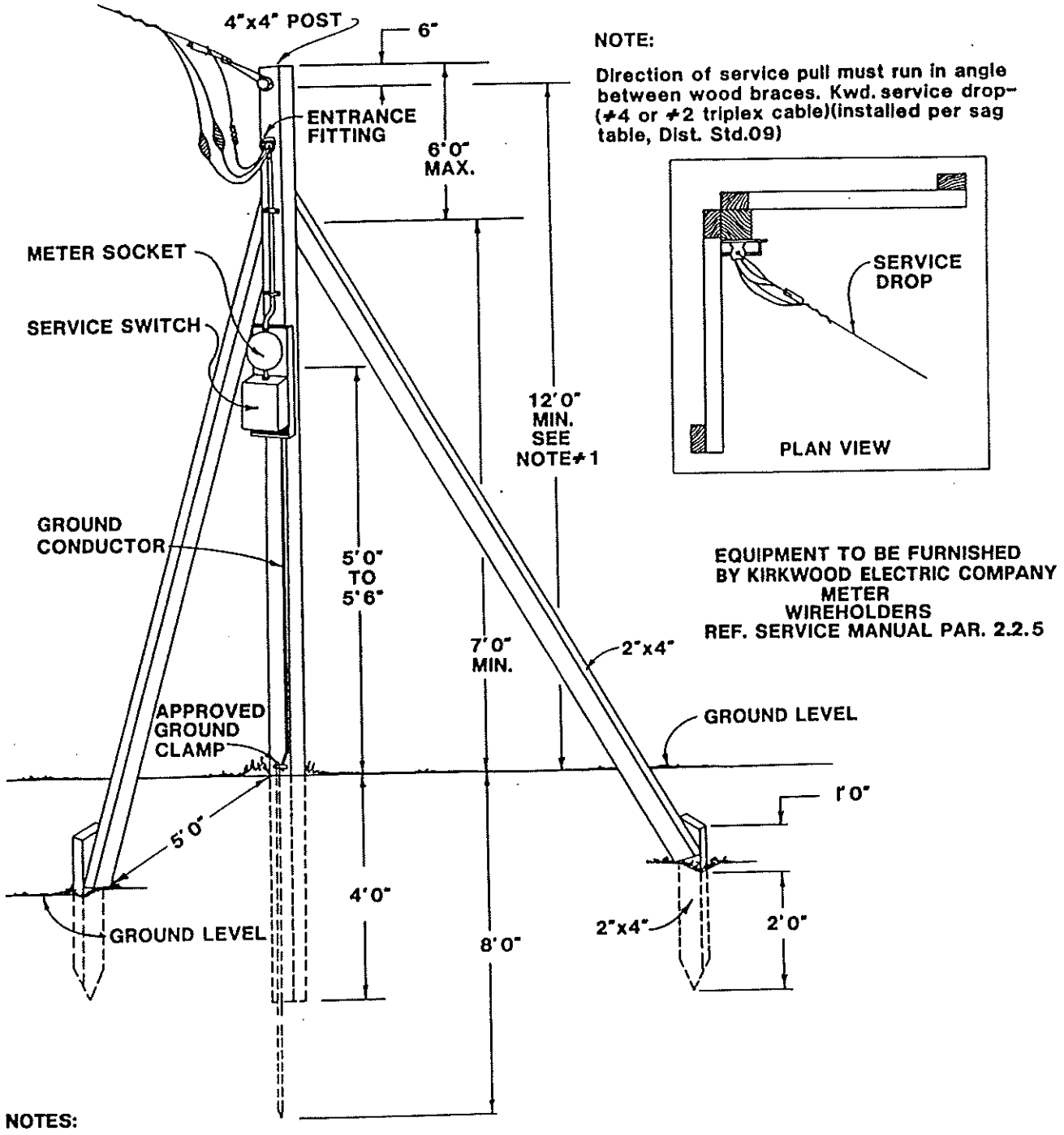
SERVICES
OVERHEAD TEMPORARY SERVICE POLE CLEARANCE AND METER POLE PROVIDED BY CUSTOMER FOR ANCHORAGE OF UTILITY'S SERVICE DROP AND INSTALLATION OF UTILITY'S METER



NOTE:

Direction of service pull must run in angle between wood braces. Kwd. service drop-(#4 or #2 triplex cable)(installed per sag table, Dist. Std.09)

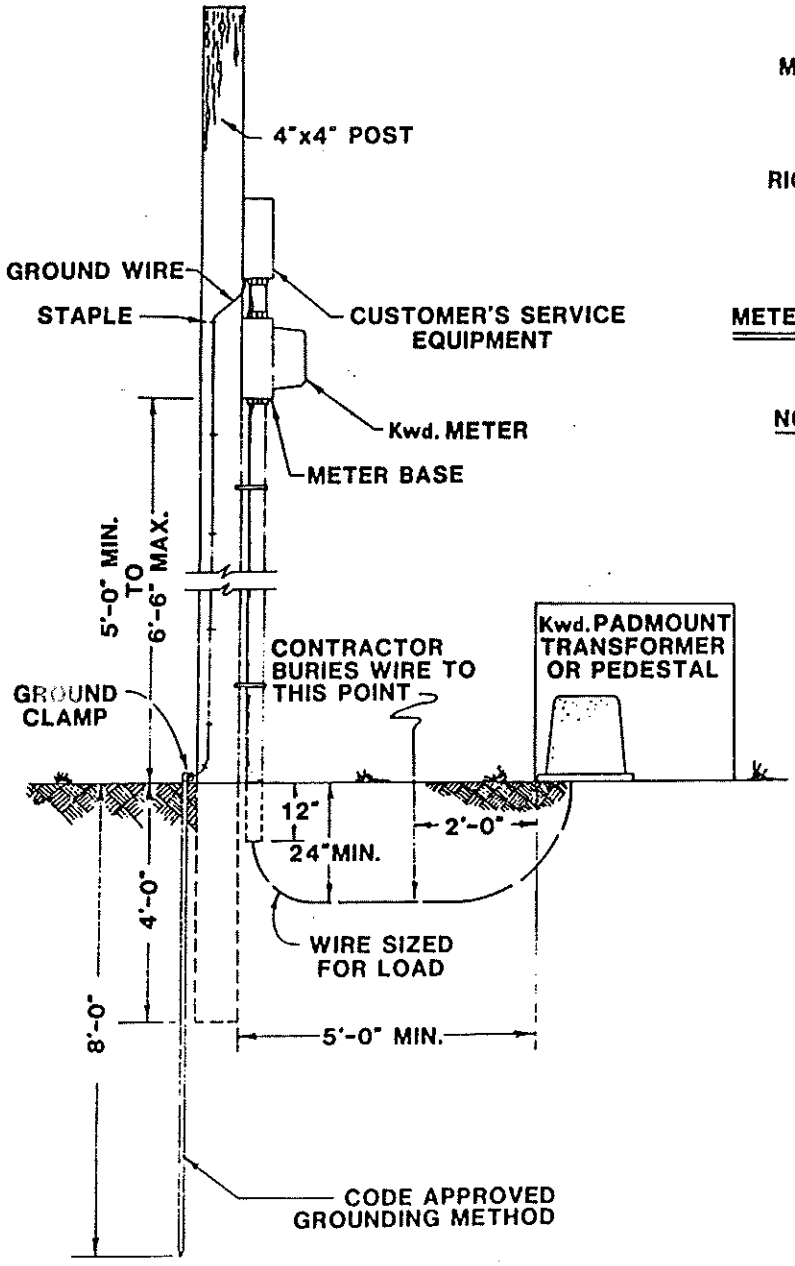
EQUIPMENT TO BE FURNISHED BY KIRKWOOD ELECTRIC COMPANY
METER
WIREHOLDERS
REF. SERVICE MANUAL PAR. 2.2.5

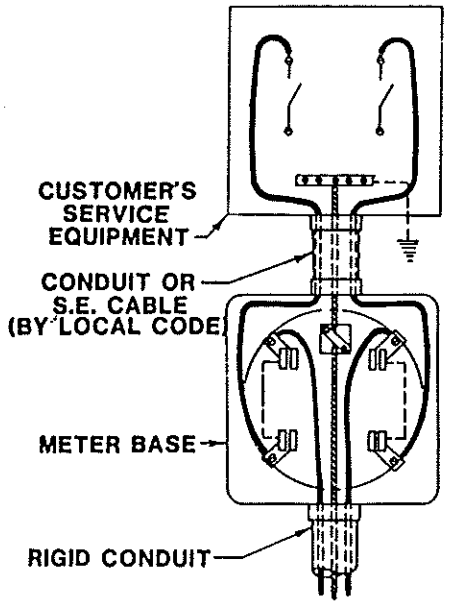
NOTES:

1. See Page No. D-20 for minimum height of wire above ground at point of greatest sag.
2. Where practical, the service to the temporary connection should be installed in a manner suitable for transfer to the permanent location.
3. Minimum of four 16 penny nails to be used at each joint.
4. Temporary pole shall be located between 5 ft. and 75 ft. away from a Kirkwood Electric pole.

UNDERGROUND LINES INSTRUCTION
UNDERGROUND TEMPORARY SERVICE

NOTE: Customer's service equipment may be mounted below meter base but base must be mounted 5'0" to 6'6" above grade.





120/240V-3 WIRE

METER BASE WIRING

NOTE: Customer to install 3 wire direct burial cable from meter base to this point & leave sufficient length for Kwd. to install in pedestal or transformer.

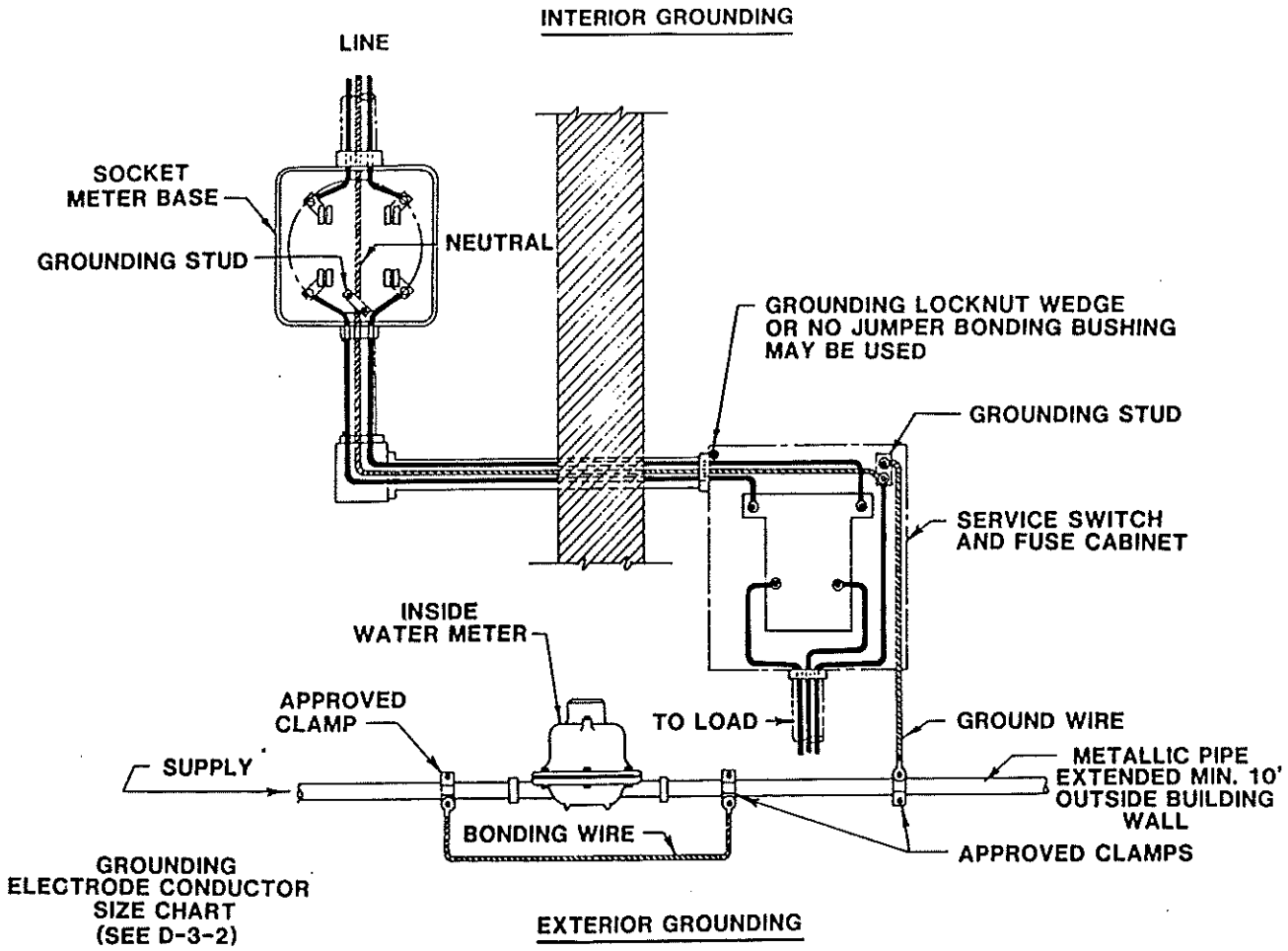
EQUIPMENT FURNISHED BY KIRKWOOD ELECTRIC:

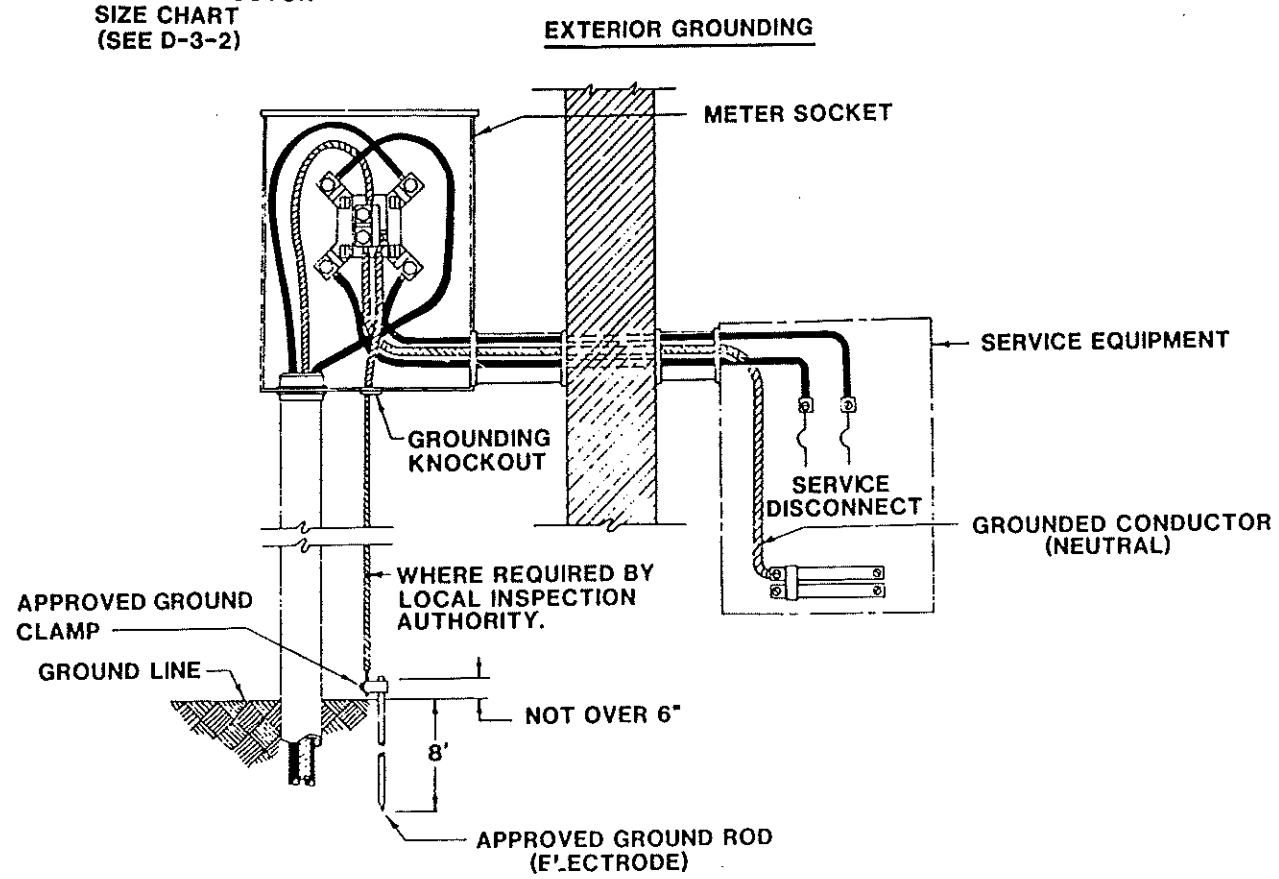
(1) METER

(2) PEDESTAL OR PADMOUNTED TRANSFORMER

ALL OTHER MATERIAL TO BE FURNISHED AND INSTALLED BY CUSTOMER.

GROUNDING METHODS



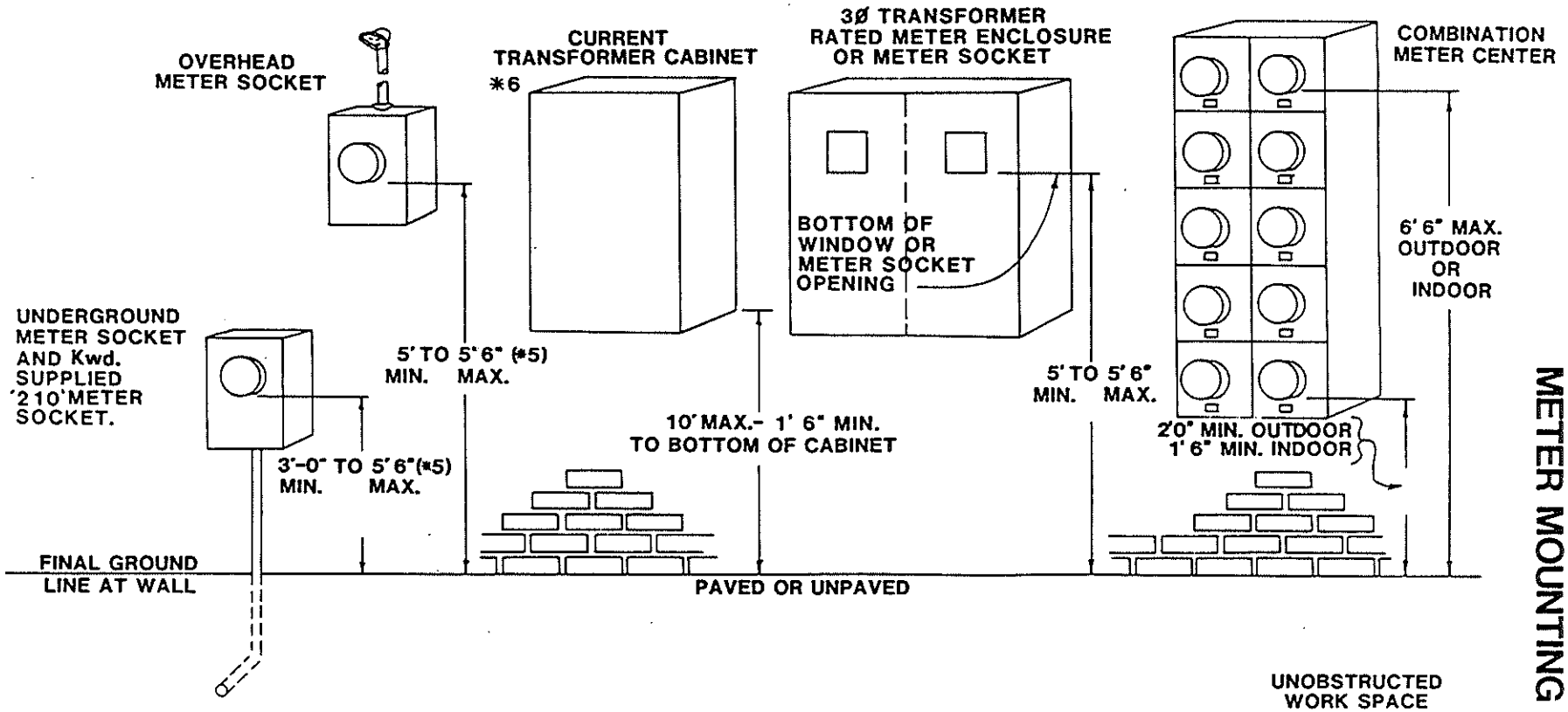


GROUNDING ELECTRODE CONDUCTOR FOR A.C. SYSTEMS

SIZE OF LARGEST SERVICE - ENTRANCE CONDUCTOR OR EQUIVALENT AREA FOR PARALLEL CONDUCTORS		SIZE OF GROUNDING ELECTRODE CONDUCTOR	
COPPER	ALUMINUM OR CU CLAD AL	COPPER	ALUMINUM OR CU CLAD AL
2 OR SMALLER	1/0 OR LESS	8	6
1 OR1/0	2/0 OR 3/0	6	4
2/0 OR 3/0	4/0 OR 250 KCMIL	4	2
OVER 3/0 THRU 350 KCMIL	OVER 250 KCMIL THRU 500 KCMIL	2	1/0
OVER 350 KCMIL THRU 600 KCMIL	OVER 500 KCMIL THRU 900 KCMIL	1/0	3/0
OVER 600 THRU 1100 KCMIL	OVER 900 THRU 1750 KCMIL	2/0	4/0
OVER 1100 KCMIL	OVER 1750 KCMIL	3/0	250 KCMIL

TAKEN FROM 1990 NEC ARTICLE 250-94

METER MOUNTING HEIGHTS

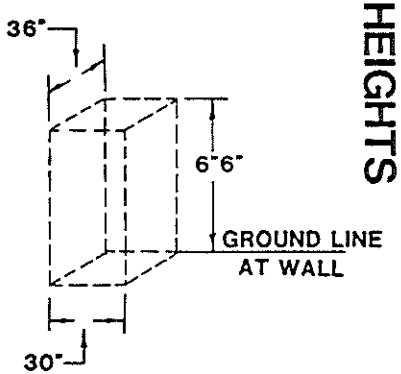


1. IMPORTANT: General Service (Commercial) Rate Meter Sockets shall be mounted no higher than 5'6" from bottom of meter opening to final grade. (See Note 2 below)
2. If meter is subject to mechanical damage, vehicular traffic, or presents hazard to the public, the customer/contractor shall install protective barrier. See Page No. D-5
3. Ground slope at wall shall not exceed 4 inches in 12 inches in any direction.
4. Meters shall be mounted outdoors unless special permission has been granted for indoors by district engineer.

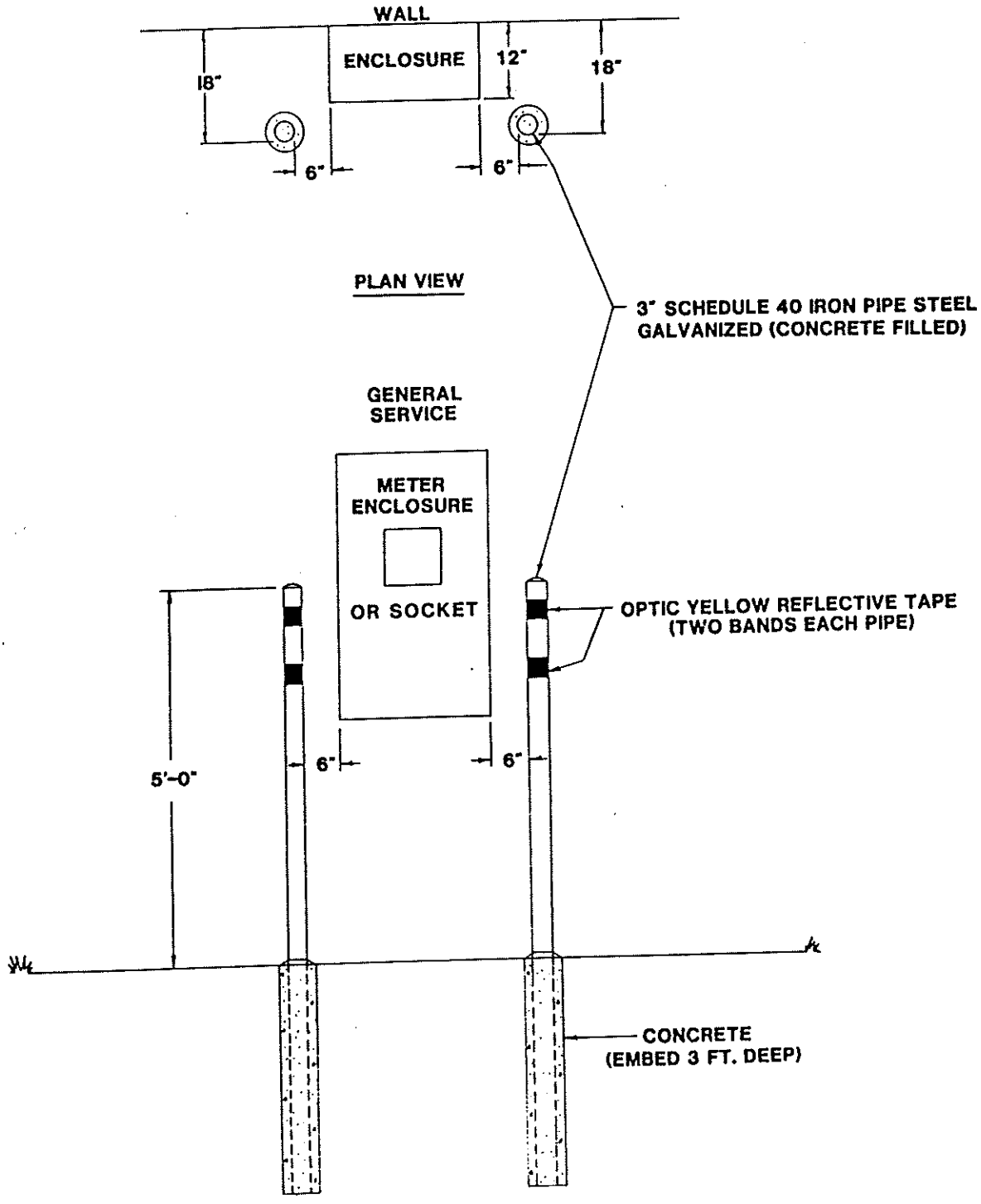
* 5. Residential service rate only: This dimension shall be 6'6" if meter socket is located over abutting walkways 36" or less in width and DRIVEWAYS.

* 6. Residential service rate C.T cabinets shall be located outdoors.

UNOBSTRUCTED WORK SPACE



METER EQUIPMENT PROTECTIVE BARRIER
(METER ENCLOSURES SHOWN-
OTHER DEVICES SHALL BE SIMILAR)

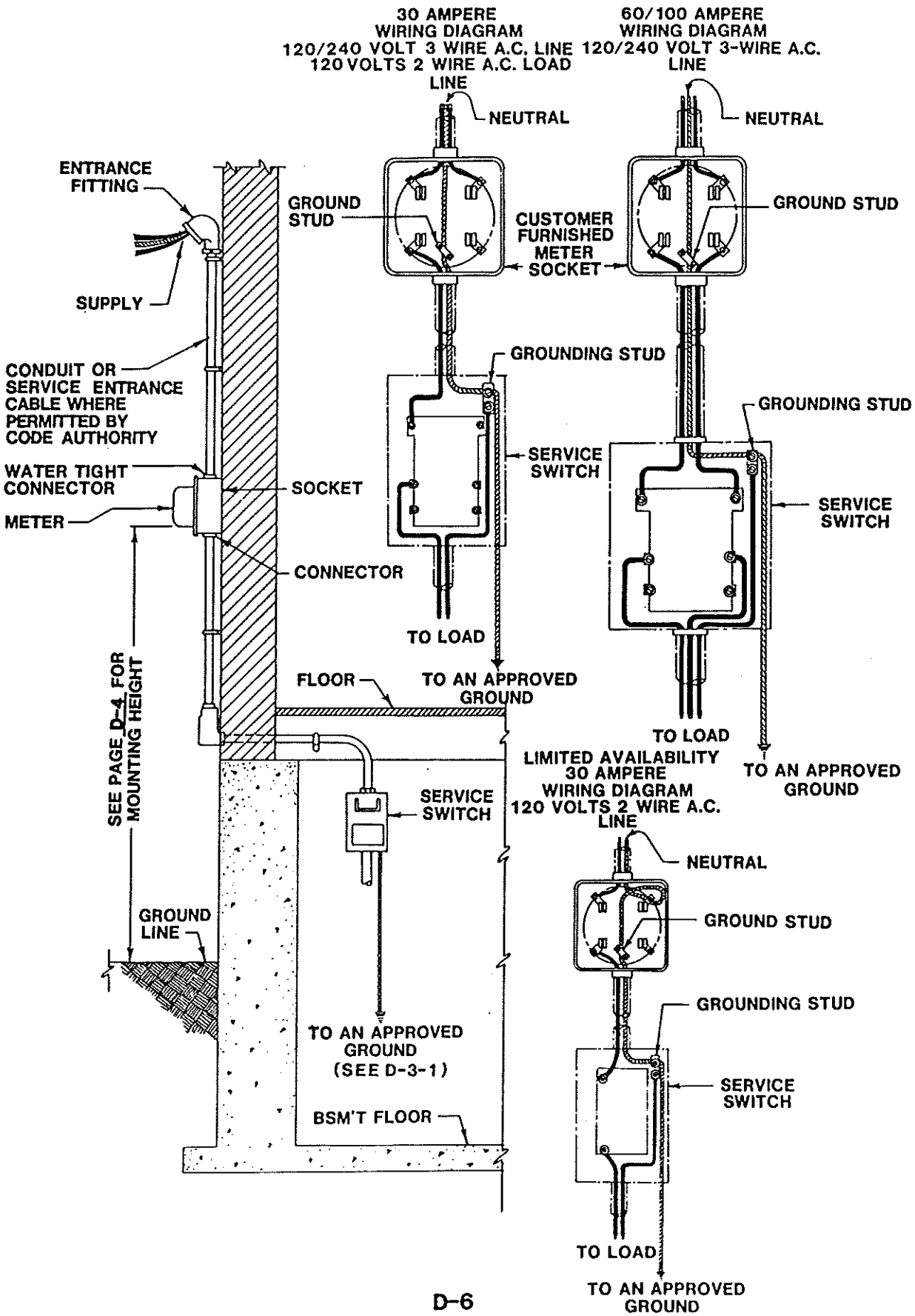


ELEVATION

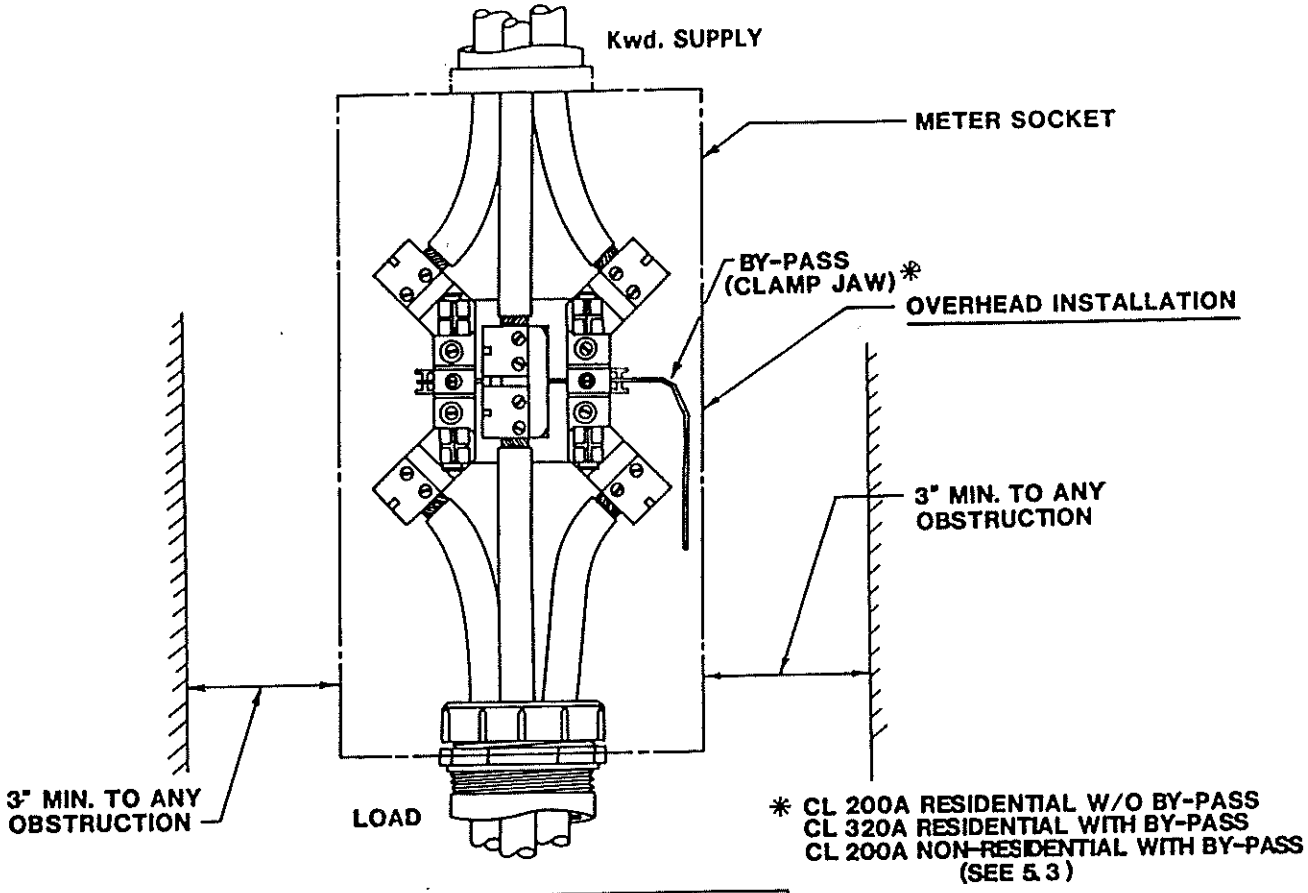
ALTERNATIVE BARRIERS INCLUDE:

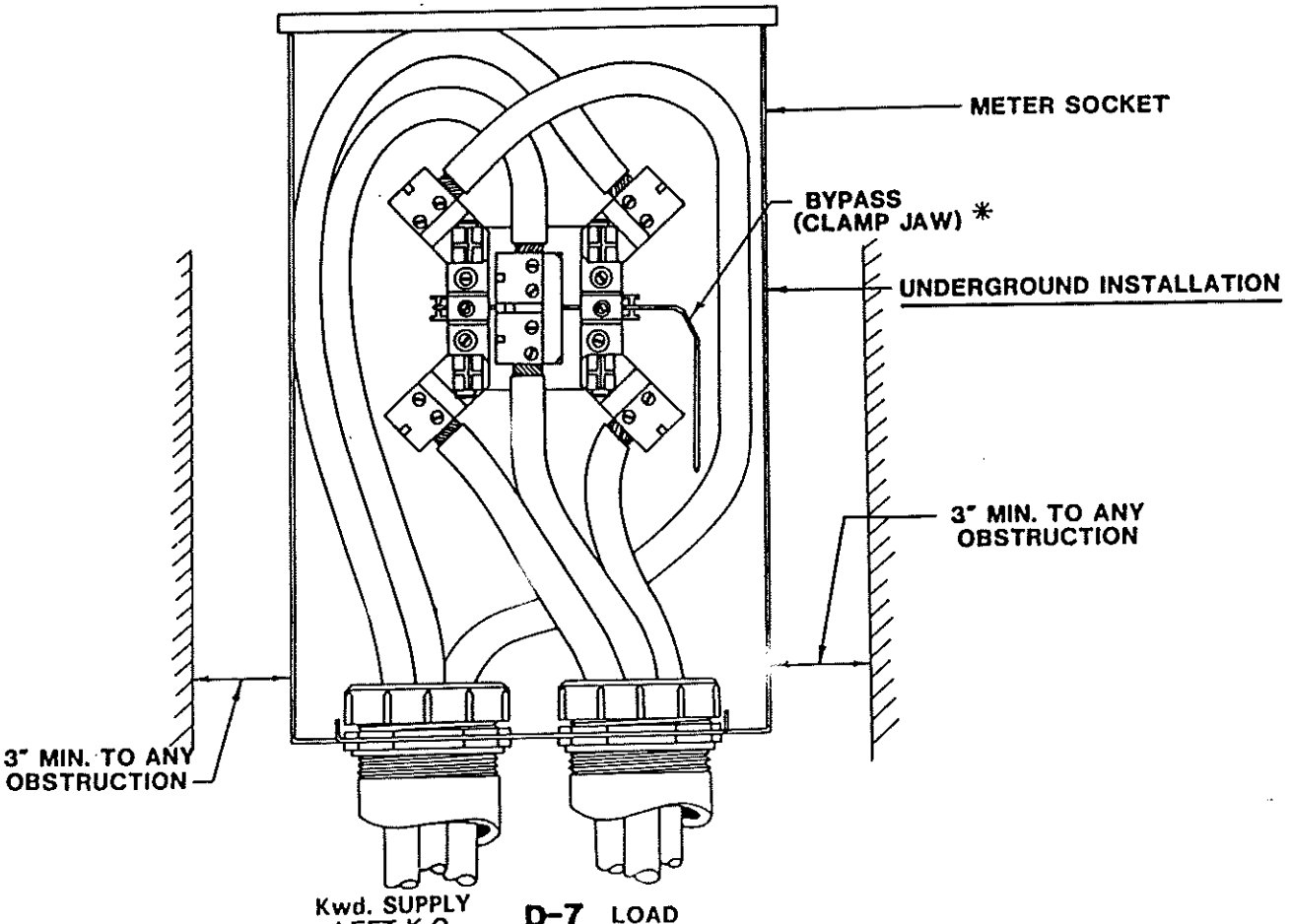
A. WALL SUPPORTED BRACKETS FOR PUBLIC SAFETY
B. CONCRETE CURBS FOR VEHICULAR BARRIER

SINGLE PHASE INSTALLATION
120 VOLTS 2 WIRES A.C.
120/240 VOLTS 3 WIRE A.C.



SINGLE PHASE INSTALLATION
UP TO 400 AMPERE RES. AND 200 AMPERE NON-RES.
120/240 VOLTS 3-WIRE A.C.
OVERHEAD OR UNDERGROUND





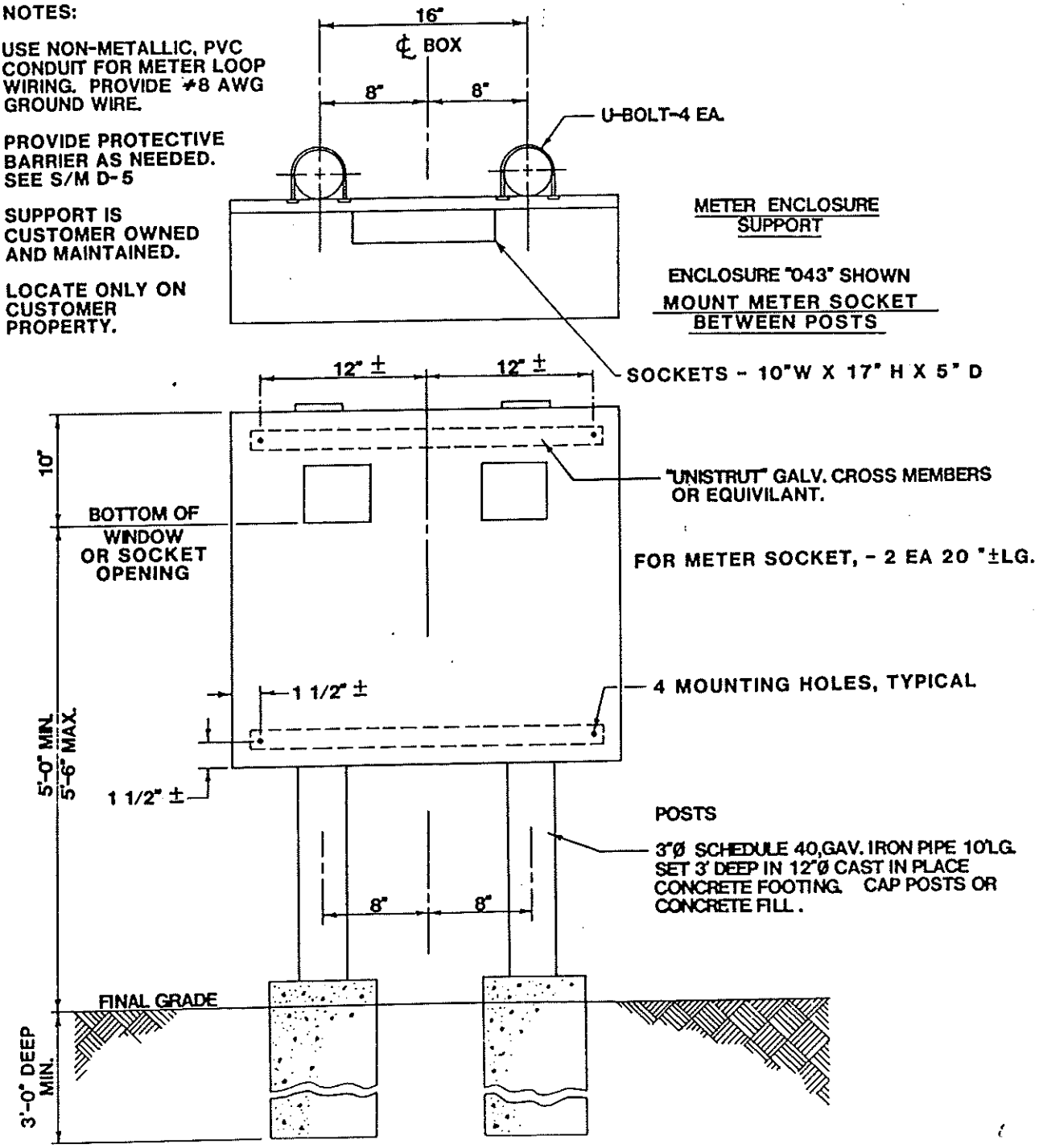
METER SUPPORT

FOR UTILITY PROVIDED TRANSFORMER RATED METER ENCLOSURES AND SOCKETS

FOR METER LOCATIONS AWAY FROM BUILDING-REFER TO DIST. PLANNER FOR LOCATION APPROVAL PRIOR TO INSTALLATION.

NOTES:

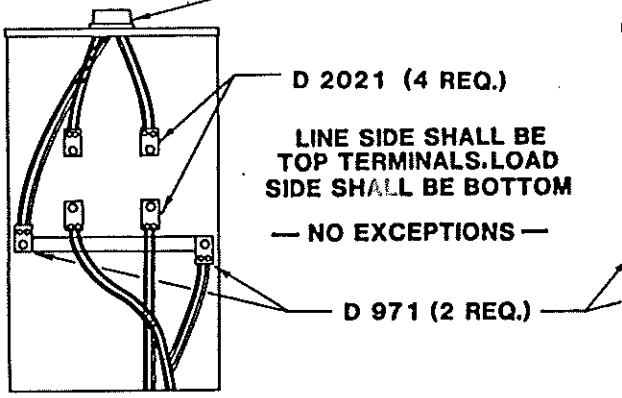
1. USE NON-METALLIC, PVC CONDUIT FOR METER LOOP WIRING. PROVIDE #8 AWG GROUND WIRE.
2. PROVIDE PROTECTIVE BARRIER AS NEEDED. SEE S/M D-5
3. SUPPORT IS CUSTOMER OWNED AND MAINTAINED.
4. LOCATE ONLY ON CUSTOMER PROPERTY.



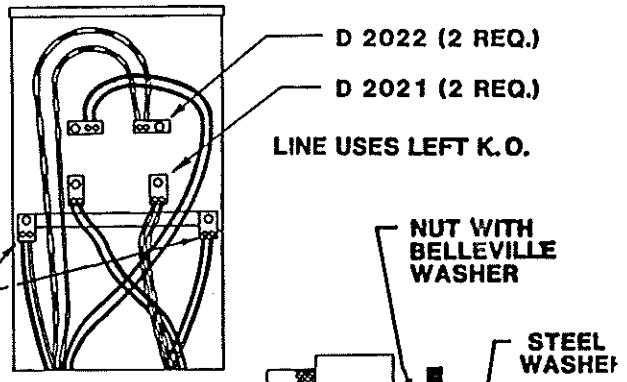
NON - RESIDENTIAL
SINGLE PHASE INSTALLATION
201-400 AMP SERVICE
120/240 VOLT 3 WIRE A.C.
OVERHEAD OR UNDERGROUND

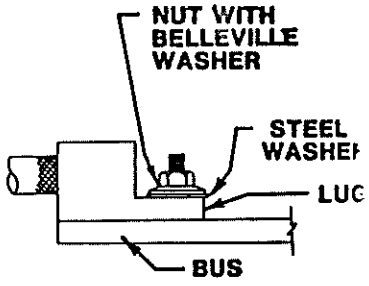
CONNECTORS FOR PARALLEL SERVICE *

O.H.



U.G.

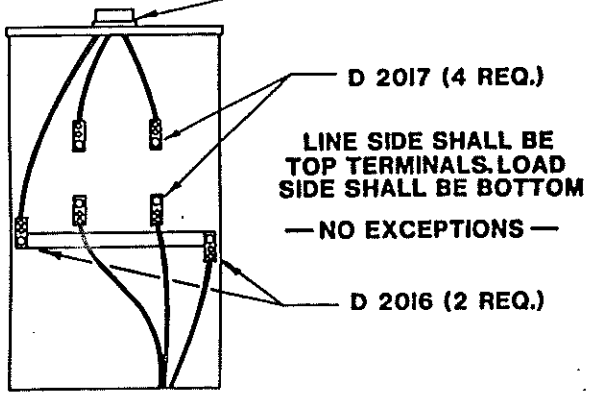




DETAIL OF LUG CONNECTION

CONNECTORS FOR SINGLE CONDUCTOR SERVICE *

O.H.



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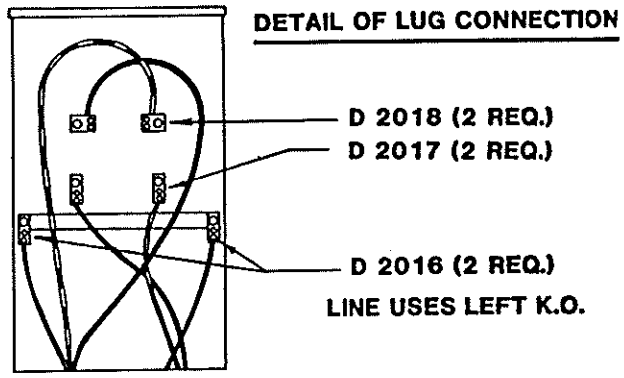
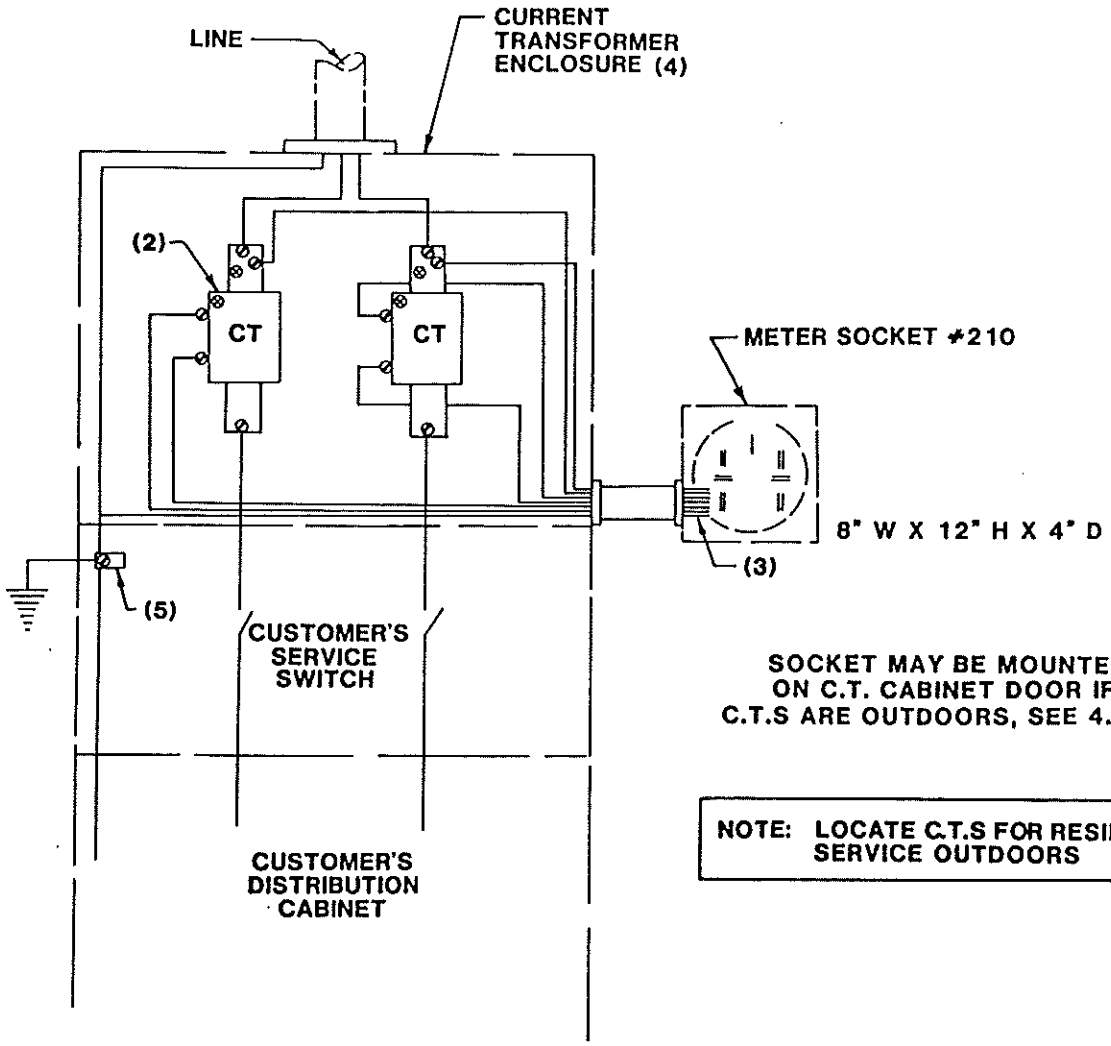


BOLT-IN METER SOCKET REQUIRED

ILSCO NO.	LANDIS GYR (DUNCAN) NO.	DESCRIPTION
D-2018	56733	LUG-250 TO 800 MCM-TOP, U.G.
D-2017	56477	LUG-250 TO 800 MCM-TOP, O.H. BOTTOM O.H. OR U.G.
D-2016	56476	LUG-250 TO 800 MCM-NEUTRAL
D-2022	56427	LUG-TWO #6 TO 350 MCM-TOP, U.G.
D-2021	56425	LUG-TWO #6 TO 350 MCM-TOP, O.H. BOTTOM O.H. OR U.G.
D-971	56732	LUG-TWO #6 TO 350 MCM-NEUTRAL

* COMBINATION PARALLEL AND SINGLE CONDUCTORS MAY BE USED.

SINGLE PHASE INSTALLATION
401-800 AMPERES, 120/240 VOLTS, 3 WIRE,A.C.
METERED WITH CURRENT TRANSFORMERS



SOCKET MAY BE MOUNTED ON C.T. CABINET DOOR IF C.T.S ARE OUTDOORS, SEE 4.8.2.2

NOTE: LOCATE C.T.S FOR RESIDENTIAL SERVICE OUTDOORS

EQUIPMENT FURNISHED BY UTILITY:

(1) METER SOCKET, METER, AND CONNECTIONS. SOCKET IS MOUNTED BY CUSTOMER.

(2) CURRENT TRANSFORMERS; MOUNTED BY CUSTOMER; (X) INDICATING POLARITY MARK, SHALL ALWAYS BE ON LINE SIDE OF C.T.

(3) SEE PAR 4.8 FOR METER LOOP WIRE PACK.

EQUIPMENT FURNISHED BY CUSTOMER:

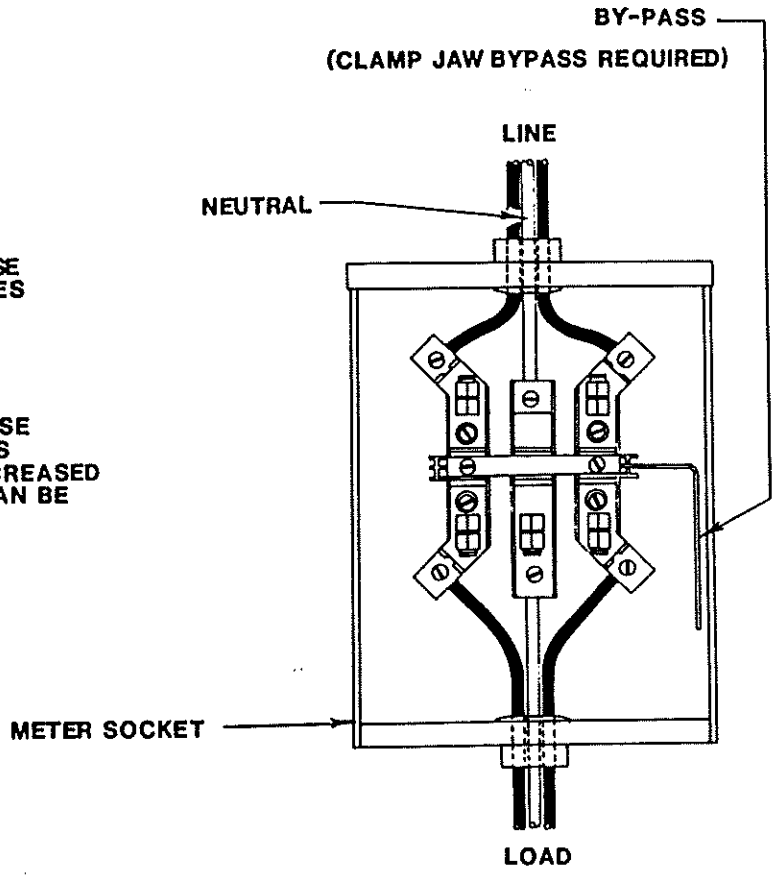
(4) C.T. ENCLOSURE: FOR SIZE REFER TO PAR. 4.8 NO CONNECTIONS IN THIS COMPARTMENT EXCEPT FOR METERING. IT MAY BE PART OF A PANEL ASSEMBLY, OR SEPARATELY MOUNTED.

(5) GROUNDING STRIP OR LUG AND CONNECTION TO AN APPROVED GROUND.

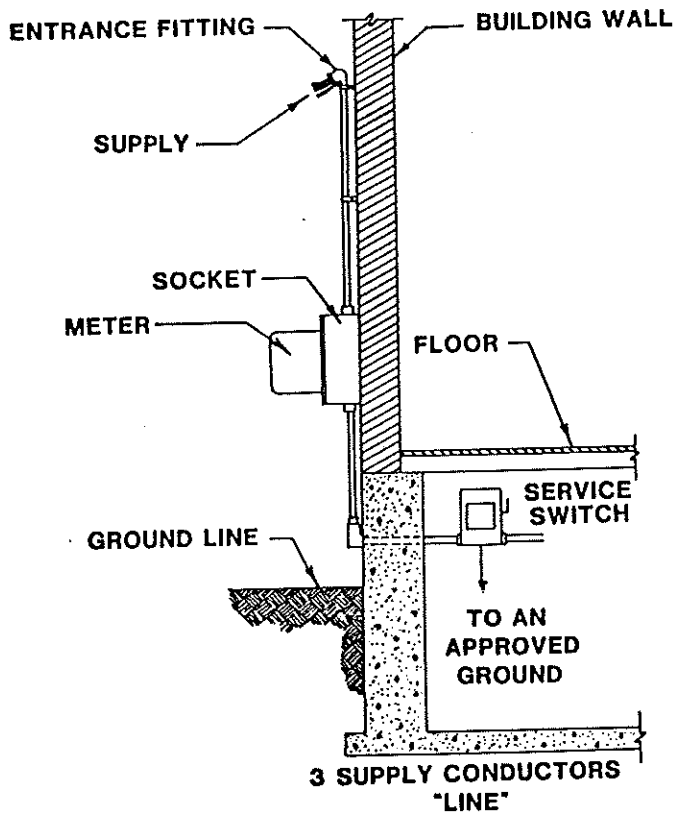
GENERAL RATE
TWO PHASE 3-WIRE
DERIVED FROM THREE PHASE 4-WIRE
120/208 VOLT OR 277/480 VOLT SYSTEM

120/208 VOLT 3 WIRE TWO PHASE
MAXIMUM SERVICE SIZE-200 AMPERES
WHERE LOADS CAN BE BALANCED.

277/480 VOLT 3 WIRE TWO PHASE
MAXIMUM SERVICE SIZE-60 AMPERES
BY SPECIAL PERMISSION MAY BE INCREASED
TO 100 AMPERES WHERE LOADS CAN BE
BALANCED.

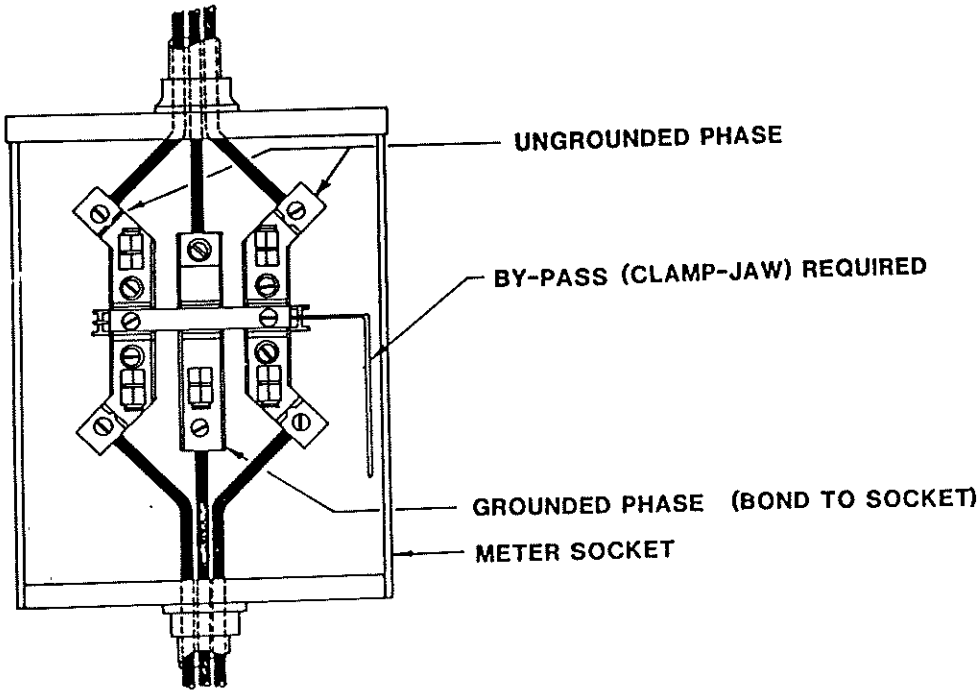


THREE PHASE INSTALLATION
240 OR 480 VOLT 3 WIRE SELF CONTAINED METER
UP TO 200 AMPERES



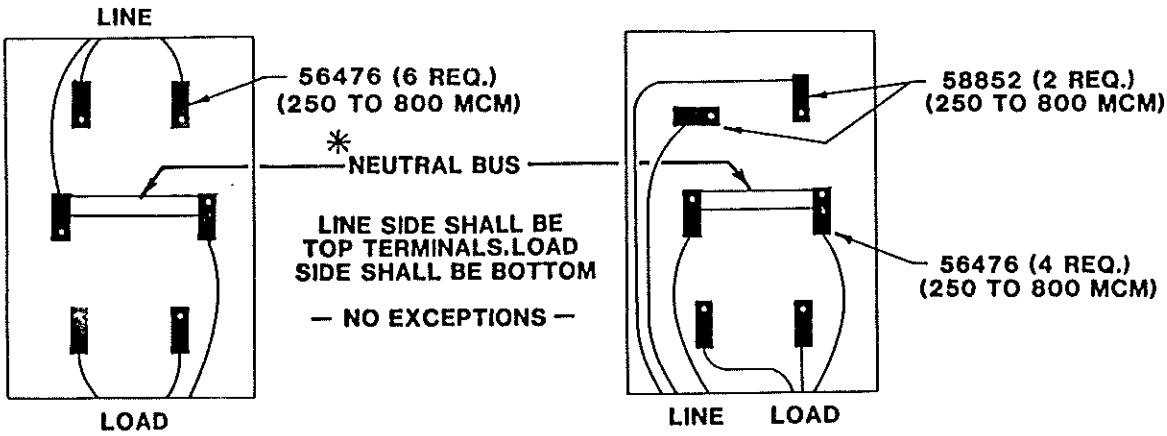
METER SOCKET FURNISHED BY CUSTOMER

SEE PAGE D-4 FOR MOUNTING HEIGHT

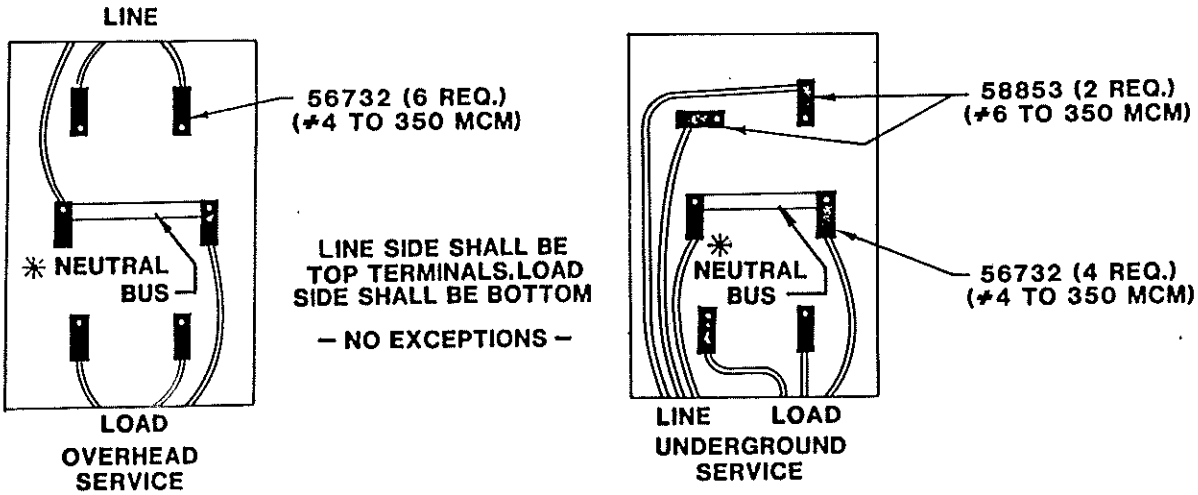


THREE PHASE
240 OR 480 VOLT 3 WIRE
201 TO 400 AMPERE SERVICE
BOLT-IN METER SOCKET REQUIRED
EFFECTIVE 4/1/94-201 TO 600A SERVICE

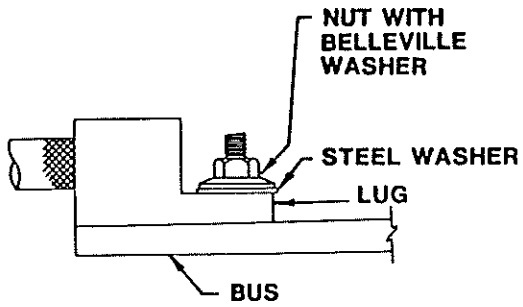
CONNECTORS FOR SINGLE CONDUCTOR PER TERMINAL



CONNECTORS FOR TWO CONDUCTORS PER TERMINAL



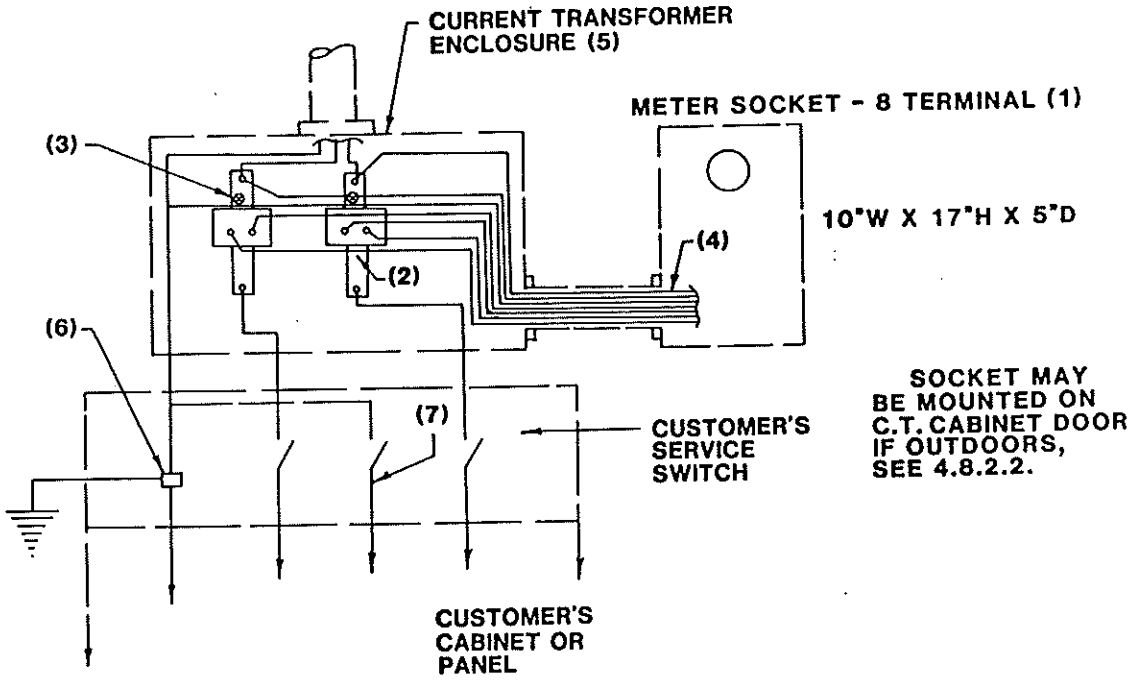
✳ GROUNDED PHASE



DETAIL OF LUG CONNECTION

THREE PHASE-3-WIRE INSTALLATION OVER 400 AMPERES METERED WITH CURRENT TRANSFORMERS 240 OR 480 VOLTS A.C. SERVICE

EFFECTIVE 4/1/94-OVER 600 A METERED WITH C.T.S



EQUIPMENT FURNISHED BY UTILITY:

(1) METER SOCKET, 8 TERMINAL: SELECT FROM PAR. 4.8. SOCKET MOUNTED BY CUSTOMER.

(2) CURRENT TRANSFORMERS: MOUNTED BY CUSTOMER.

(3) (X) POLARITY MARKS SHALL ALWAYS BE ON LINE SIDE OF C.T.

(4) SEE PAR 4.8 FOR METER LOOP WIRE PACK.

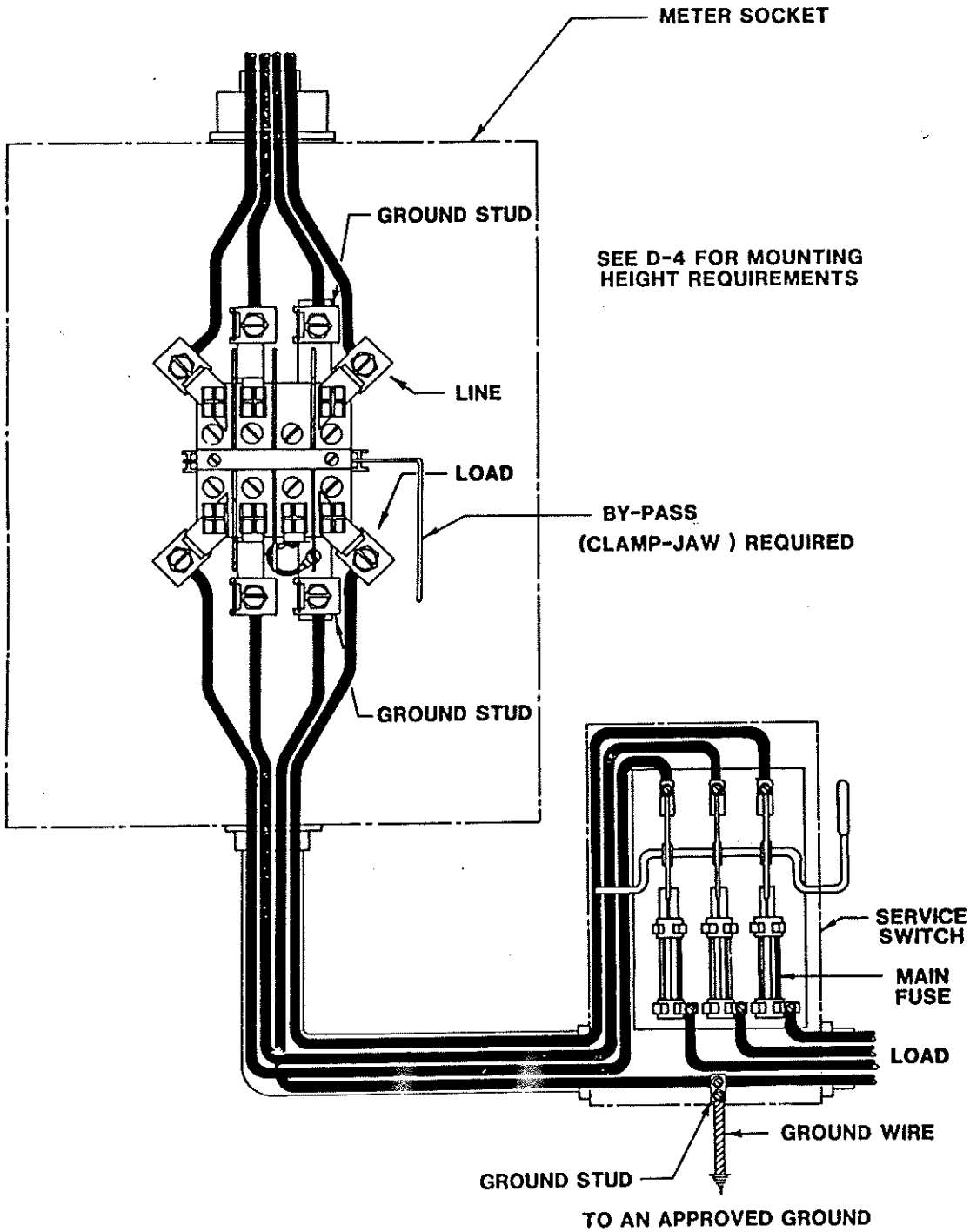
EQUIPMENT FURNISHED BY CUSTOMERS:

(5) CURRENT TRANSFORMER ENCLOSURE FOR SIZE REFER TO PAR. 4.8. NO CONNECTIONS IN THIS COMPART - MENT EXCEPT FOR METERING.

(6) APPROVED GROUND: AND CONNECTION TO GROUNDING LUG OR STRIP.

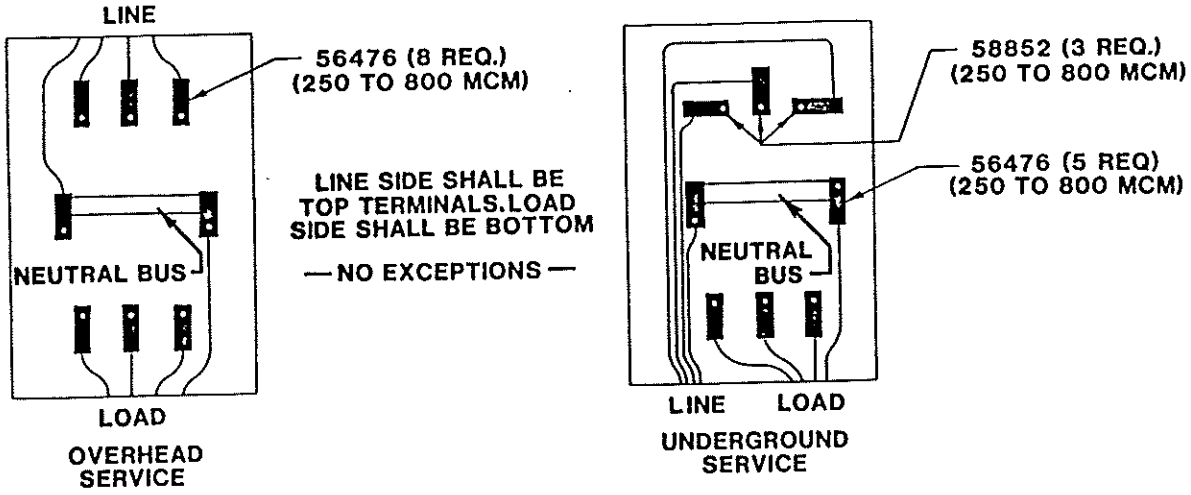
(7) CENTER LEG OMITTED WHEN 2-POLE SWITCH (UNDER 250 V) IS USED.

THREE PHASE INSTALLATION
60 TO 200 AMPERES
SELF CONTAINED METER
120/208 OR 277/480 VOLT - 4 WIRE A.C.

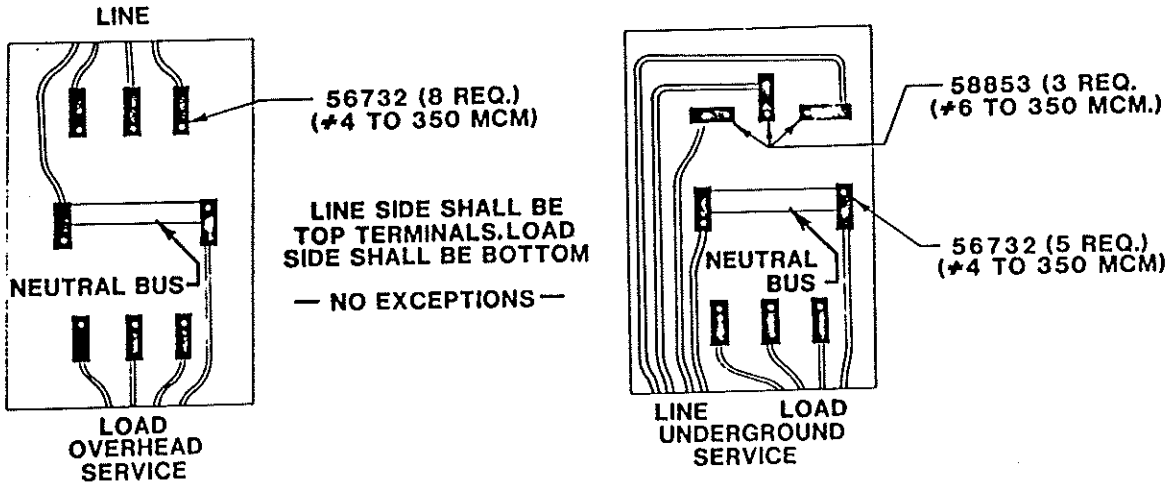


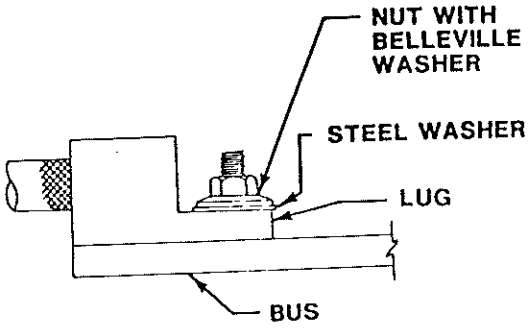
THREE PHASE
120/208 OR 277/480 VOLT 4 WIRE
201 TO 400 AMPERE SERVICE
BOLT IN METER SOCKET REQUIRED
EFFECTIVE 4/1/94-201 TO 600A SERVICE

CONNECTORS FOR SINGLE CONDUCTOR PER TERMINAL



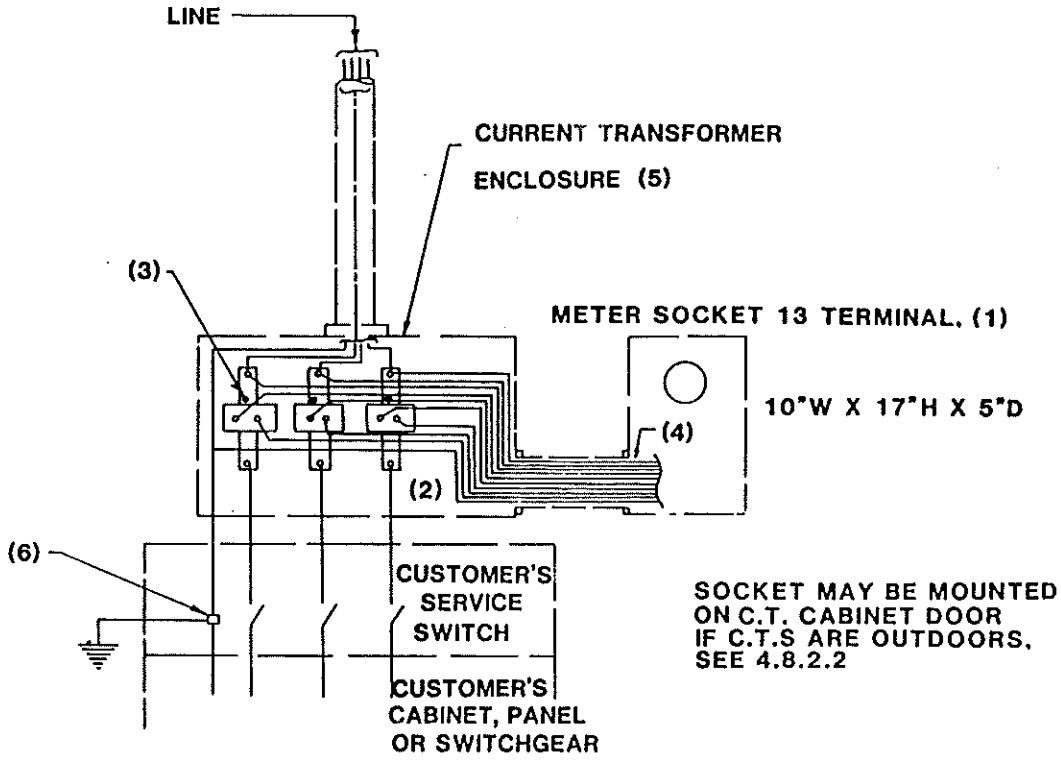
CONNECTORS FOR TWO CONDUCTORS PER TERMINAL





DETAIL OF LUG CONNECTION

THREE PHASE-4-WIRE INSTALLATION
OVER 400 AMPERES
METERED WITH CURRENT TRANSFORMERS
120/208 OR 277/480 VOLTS A.C. SERVICE
EFFECTIVE 4/1/94-OVER 600 A METERED WITH C.T.S



EQUIPMENT FURNISHED BY UTILITY:

1) Meter socket, 13 terminal:
Select from Par. 4.8.
Socket is mounted by customer.

2) Current transformers: mounted by customer.

3) (X) Polarity marks. Should always be on line side.

4) See Par 4.8 for meter loop wire pack

EQUIPMENT FURNISHED BY CUSTOMERS:

5) Current transformer enclosure: for size refer to Par. 4.8. No connections in this compartment except for metering.

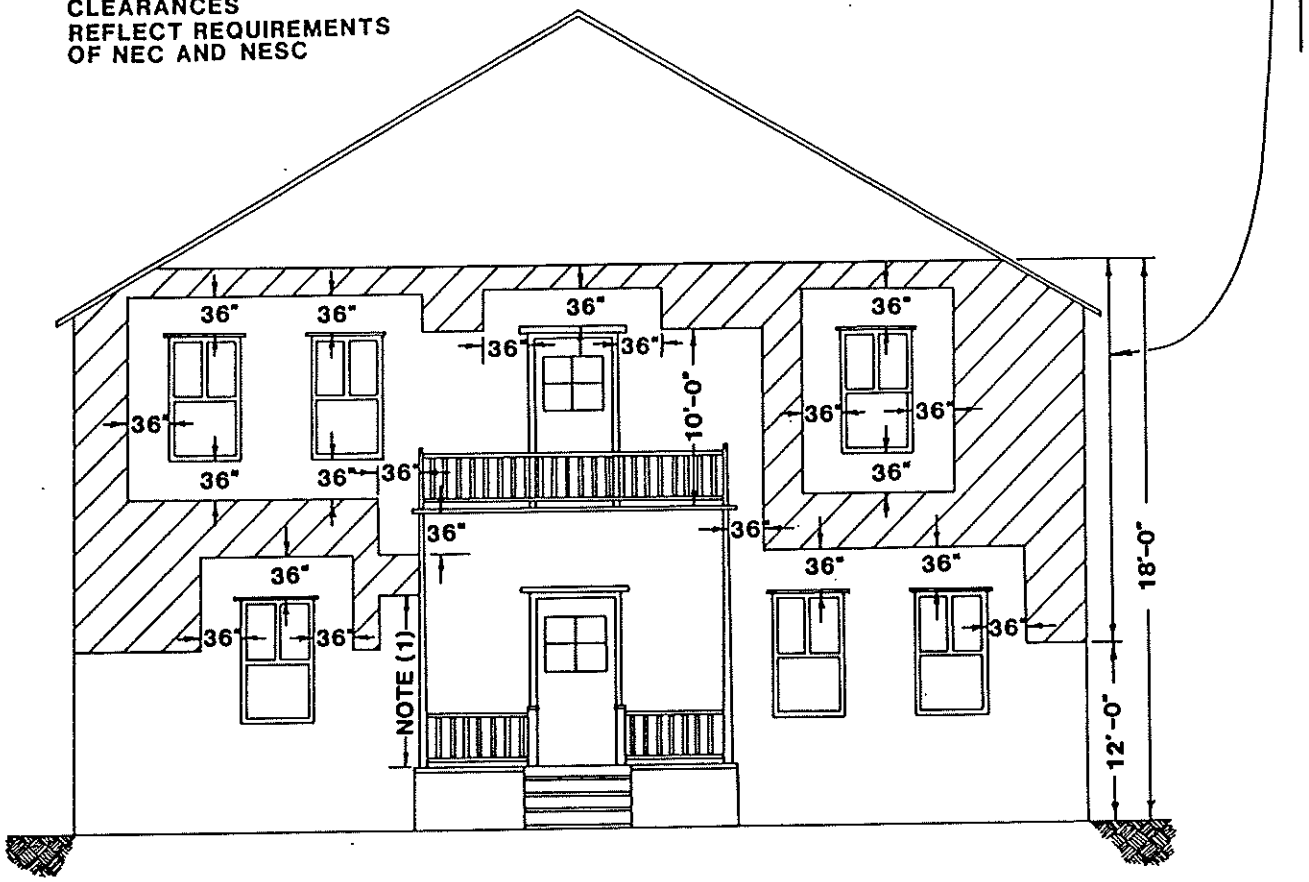
6) Approved ground: and connection to grounding lug or strip.

OVERHEAD SERVICE ATTACHMENT TO BUILDINGS 0 TO 600 VOLTS

~ TRIPLEX SERVICE ~

NEW ELECTRIC SERVICE ENTRANCE SHALL BE IN SHADED SPACES NOT LESS THAN 12' NOR MORE THAN 18' ABOVE GROUND IN ORDER TO MEET MINIMUM GROUND CLEARANCES PAGE D-20.

CLEARANCES REFLECT REQUIREMENTS OF NEC AND NESC



NOTES:

1. The first point of attachment for service wires shall be in the shaded spaces or higher. The minimum height of attachment shall be adjusted so that the lowest point of the service conductor meets the clearances specified on Page D-20. A service mast may be used if necessary to obtain the minimum clearances.
2. The customer's service outlet shall not be located above 18', but it may be necessary to attach services higher than 18' to meet the minimum ground clearances on Page D-20.
3. Triplex cable or separate open wire service busses on buildings shall be placed in the spaces shown shaded.
4. Service conductors passing by doors, porches, fire escapes or similar locations, shall have a clearance of not less than 36 inches. Service conductors passing by windows shall have a clearance of not less than 36 inches
5. Where the form of the building will not permit triplex cable or open wire service busses from the point of attachment to the service outlets, service entrance cable may be used for runs up to 15'. For runs in excess of 15', specific authority must be obtained from the Engineering Dept.
6. When service entrance cable is used, clearances between windows, openings, fire escapes, etc., and the service attachment or the service busses on the building may be reduced to 6 inches. This is a preferred minimum which may however be reduced if necessary.
7. Service conductors shall not be installed beneath openings through which materials may be moved, such as openings in farm and commercial buildings. Overhead wires shall not be run such that they obstruct entrance to these building openings.

SERVICES
ATTACHMENT TO BUILDINGS
0 TO 600 VOLTS

ACCEPTABLE POINTS OF ATTACHMENT

A. BUILDING STUDS
B. MORTAR JOINTS
C. RAFTERS

UNACCEPTABLE POINTS OF ATTACHMENT

* 1. OUTSIDE TRIM BOARD
* 2. INSIDE TRIM BOARD (BRICK BUILDINGS)
* 3. SOFFIT BOARD
4. FACIA BOARD
5. FIRE WALLS, PARAPET WALLS OR CHIMNEYS

* MAY BE ATTACHED TO IF ADEQUATELY REINFORCED.

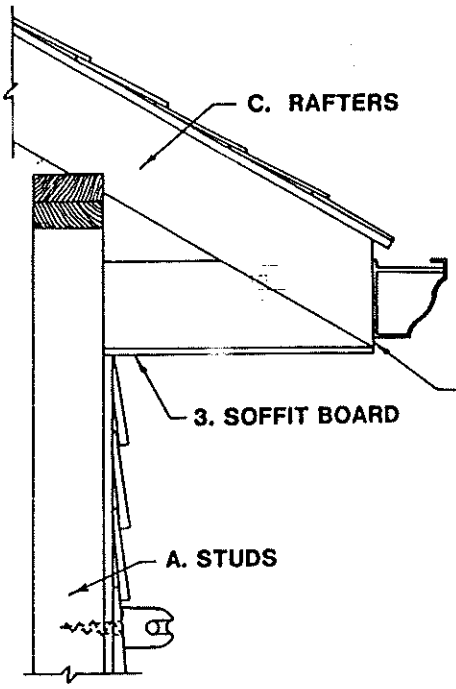


FIGURE 1
FRAME-COMPOSITION SHINGLE
OR BRICK VENEER CONSTRUCTION

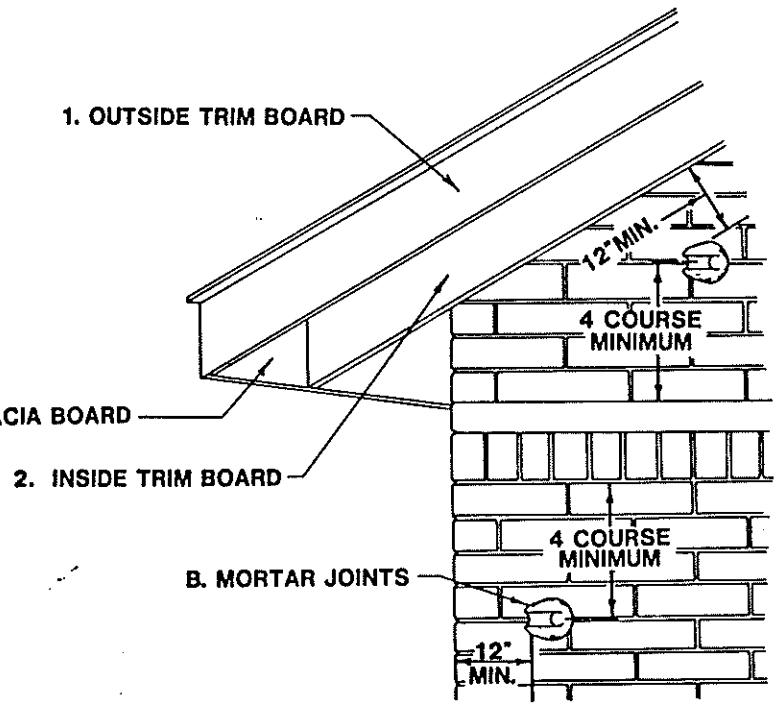


FIGURE 2
BRICK OR SOLID MASONRY CONSTRUCTION

REF: SERVICE MANUAL, PAR. 3.1.3

CLEARANCE
SERVICES OVER GROUND & ROOFS

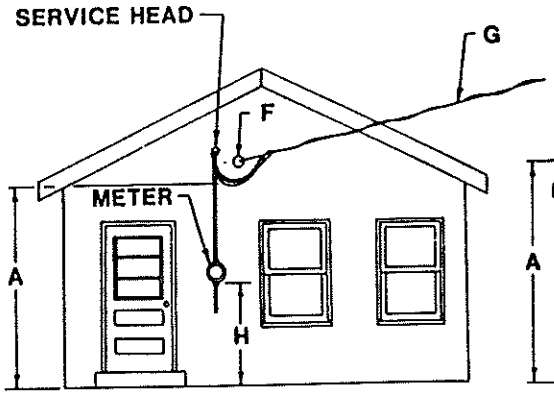


FIG 1

USUAL INSTALLATION

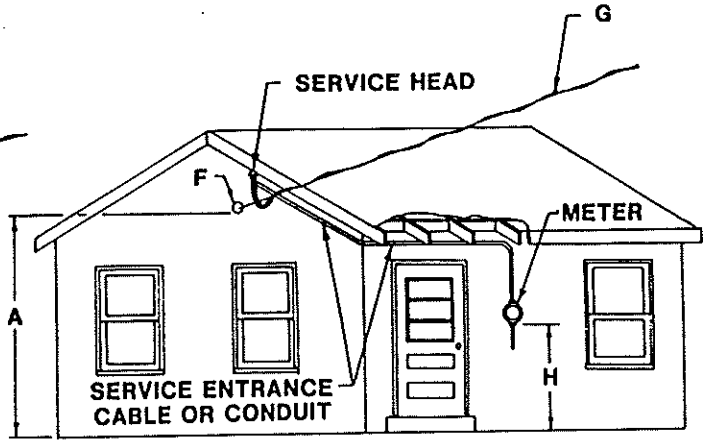
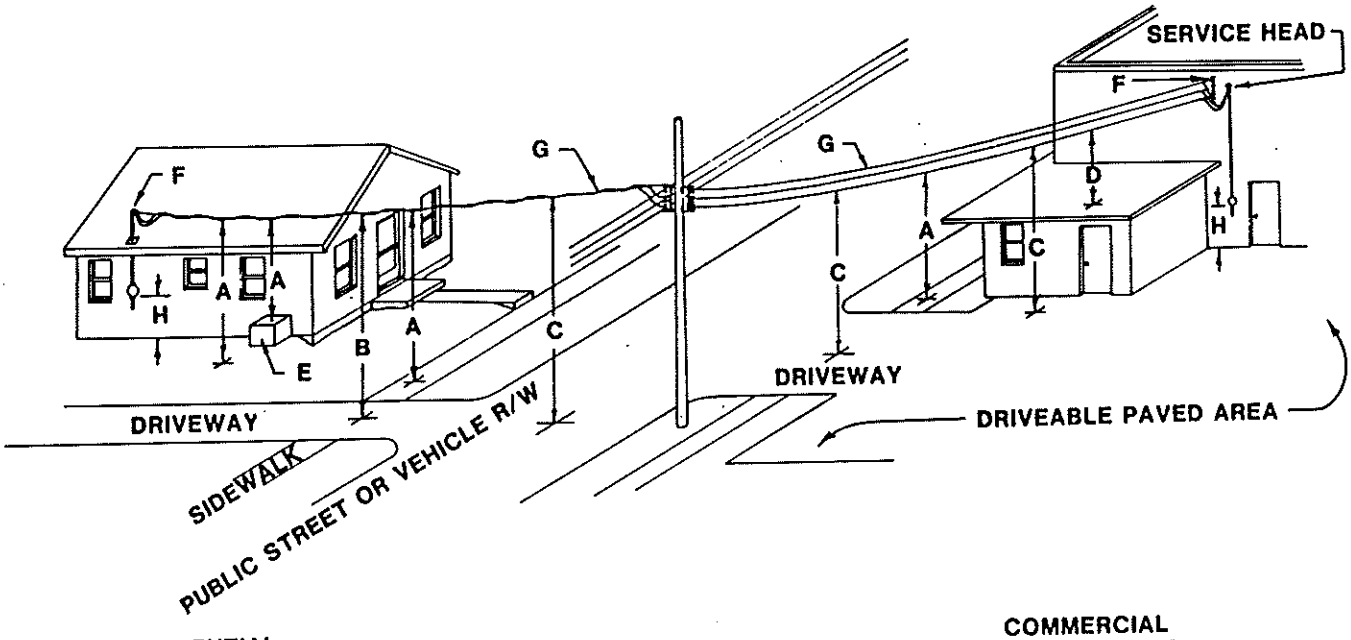


FIG 2

WALL CARRYING CUSTOMER'S SERVICE ENTRANCE IS OF INADEQUATE HEIGHT TO GIVE KWD. NECESSARY GROUND CLEARANCES. CUSTOMER EXTENDS SERVICE ENTRANCE CABLE TO KWD.'S POINT OF ATTACHMENT.



RESIDENTIAL

COMMERCIAL

OPEN WIRE OR TRIPLEX

MINIMUM REQUIRED CLEARANCES AND NOTES:

OVER GROUND

A 12ft. over spaces and ways subject to pedestrian or restricted traffic only (no vehicles over 8 ft high)

EXCEPTION: Clearance may be reduced to 10 ft. at the drip loop or service drop cable limited to 150 volts to ground.

EXCEPTION: Clearance must be increased to 15 ft. for service voltages between 300 and 750 volts to ground.

B 15ft. Residential driveways, commercial areas not subject to truck traffic.

EXCEPTION: Clearance may be reduced to 10 ft. at the drip loop for service drop cable limited to 150 volts to ground.

EXCEPTION: Clearance may be reduced to 12 ft. for triplex service cable limited to 150 volts to ground.

C 18ft. Roads, streets, alleys, non residential driveways, parking lots and other areas subject to truck traffic.

OVER ROOFS (INCLUDES PARKING GARAGES)

D Clearances from highest point in roof shall be not less than:

1. 3 feet-Roof not accessible to pedestrians (see note J)
2. 8 feet-Roof accessible to pedestrians.
3. 10 feet-Roof accessible to vehicles, but not truck traffic
4. 18 feet-Roof accessible to truck traffic

EXCEPTIONS:

1. For open wire service with voltages between 300 and 750 volts to ground, the 3 foot clearance described above must be increased to 8 feet.
2. Where voltage between conductors does not exceed 300 volts, a reduction in clearance over the roof to not less than 18 inches shall be permitted if :
   (1) They do not pass over more than 4 feet of the overhang portion of the roof.
   (2) They are terminated at a through the roof raceway or approved support.

NOTES:

E Any equipment housing including air conditioning, platform or projection which a person might stand on.

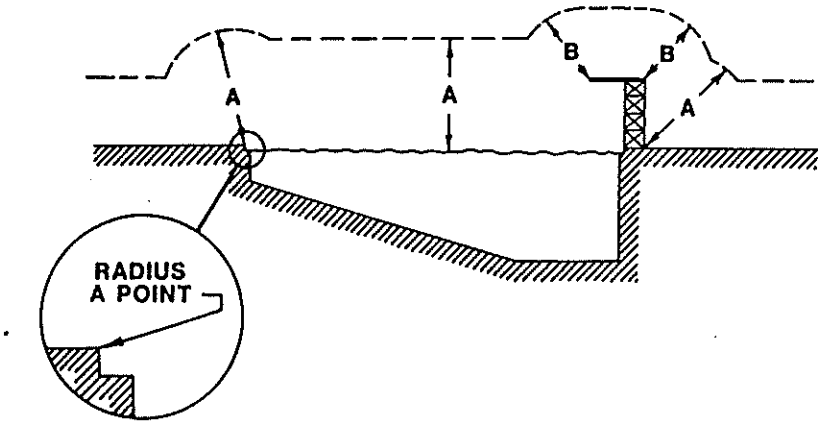
F Service mast (D-22) or bracket attachment or upright of adequate size and height to support services required.

G Normally triplex conductors, but may also be separate conductors as shown for commercial.

H See Page D-4

J A roof is considered accessible to pedestrians if there is a means of access through a doorway, ramp, stairway, or permenently mounted ladder, or if slope of roof is less than 4 inches per foot.

OVERHEAD SERVICES
CLEARANCE FROM SWIMMING POOLS



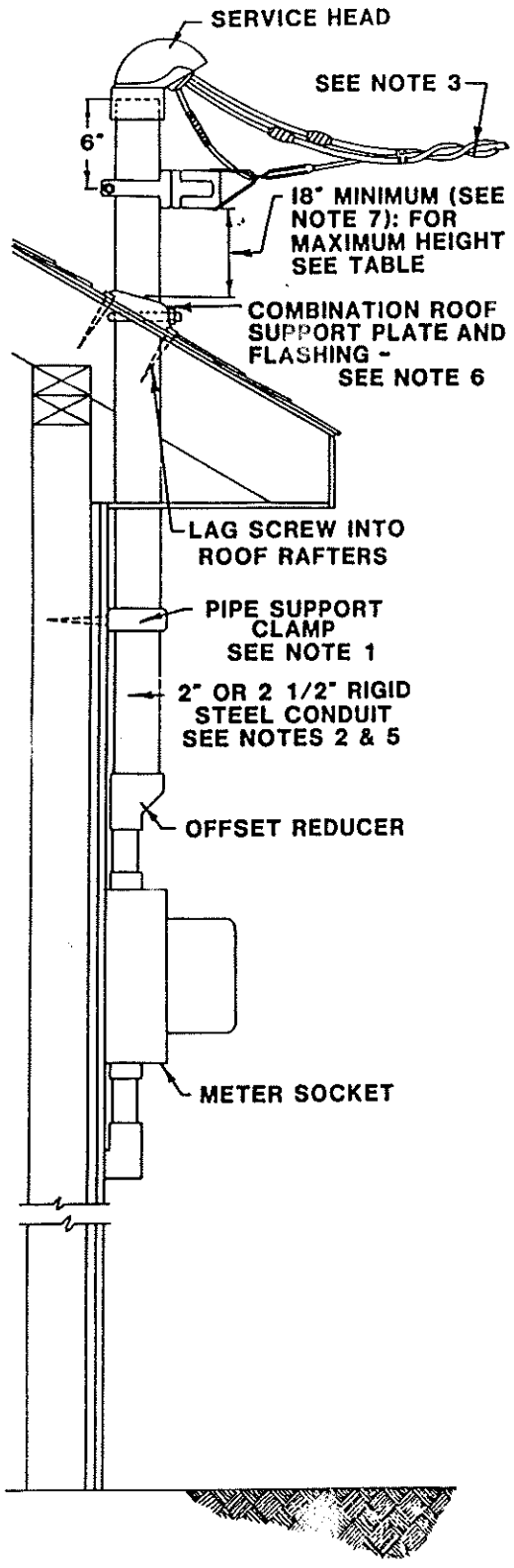
	TRIPLEX * 0-750 VOLTS TO GROUND
A. CLEARANCE IN ANY DIRECTION TO THE EDGE OF WATER SURFACE OR BASE OF DIVING PLATFORM	22.5 FT.
B. CLEARANCE IN ANY DIRECTION TO THE DIVING PLATFORM OR TOWER	14.5 FT.

* NOTE

In Missouri these clearance limitations do not apply to triplex conductors 0-750 Volts, that are 10 ft. or more horizontally from the edge of the pool, diving platform or diving tower.

All other conductors contact Kwd. for correct clearances.

SERVICE MAST INSTALLATION
(SUPPLIED AND INSTALLED BY CUSTOMER)
0 TO 300 VOLTS



MAXIMUM ATTACHMENT HEIGHT		
TRIPLEX CABLE SIZE	CONDUIT SIZE	STEEL
#4	2"	3' 4"
#4	2 1/2"	6' 5"
#2	2"	2' 9"
#2	2 1/2"	5' 2"
#1/0	2"	2' 2"
#1/0	2 1/2"	4' 1"
#4/0	2 1/2"	3' 2"
#1/0 QUAD X.	2 1/2"	4' 0"

NOTES:

1. Pipe support clamps must be made of galvanized heavy duty malleable iron or heavy gauge steel. This clamp may be either a two hole pipe clamp (one req'd), single hole pipe clamp (two req'd) or heavy duty clamp that completely encircles pipe (one req'd). Support clamp shall be attached securely to wall with either lag screws into building framework, bolts thru building studs or toggle bolts into wall cavities. Lag screws and lead expansion shields should be used for solid masonry construction.

2. Rigid metal conduit must be continuous from service head to offset reducer or meter socket. If over 10 ft. length required, reducer or splice shall be located at lower end of mast conduit.

3. Clearance required between low point of service cable an finished ground grade: refer to page D-20 Par. 3.1.1.

4. Triplex service cable and wireholder insulator will be supplied and installed by Kirkwood Electric.

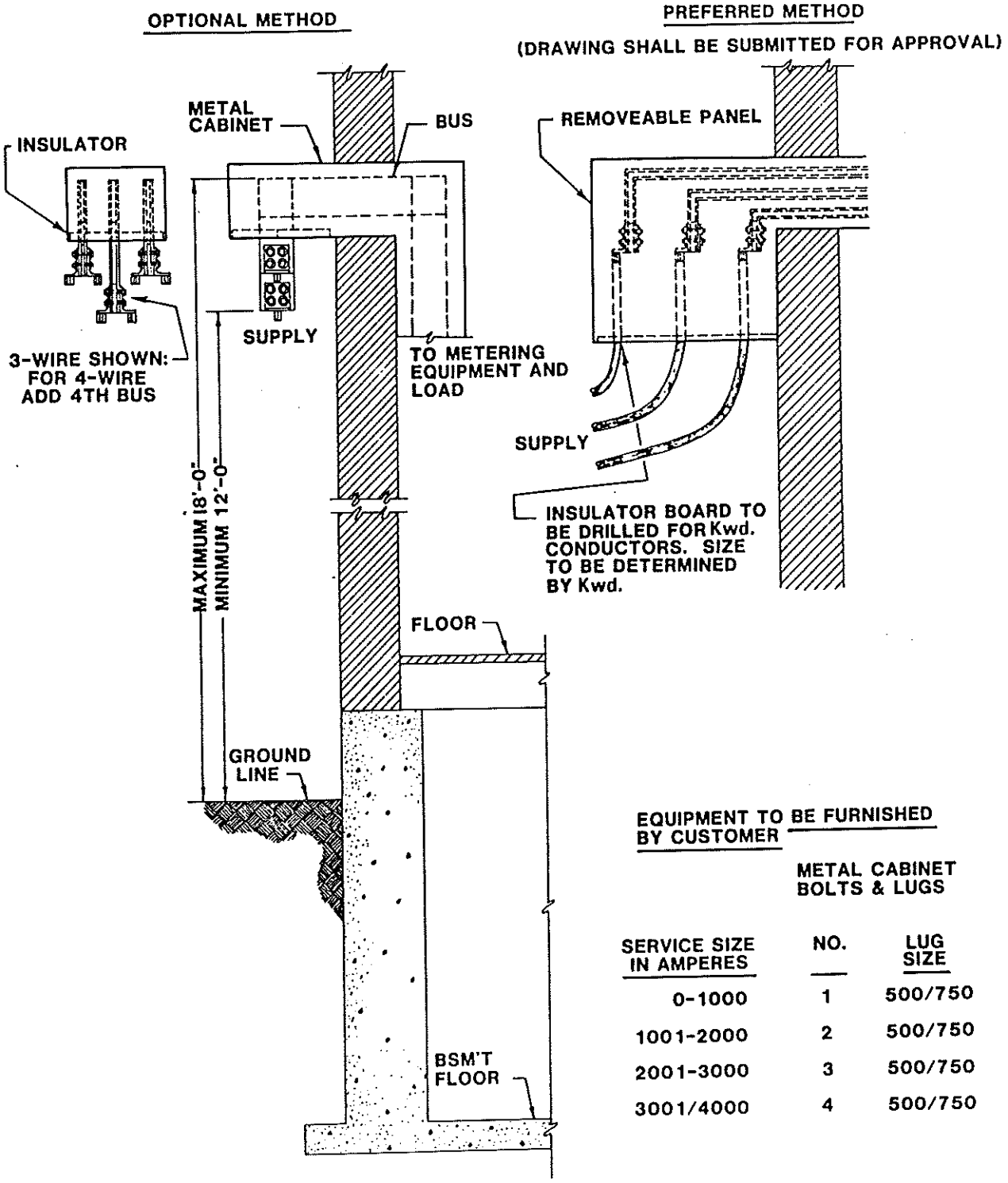
5. #4, #2, #1/0 and #4/0 triplex cable shall not be used where the span length exceeds 140'. #4 triplex shall normally be used for service entrances below 200 amps. & 2 or 1/0 triplex for 200 amps. & larger service entrances.

6. The roof support plate provides the main means of support for the mast. It shall be securely lagged to roof rafters. The following manufacturers roof support plates are acceptable for use on the Kirkwood Electric system.

MANUFACTURERS	2" CONDUIT	2 1/2" CONDUIT
Porcelain Products Inc.	7520	7521
M. & W. Elec. Mfg. Co.	2900	3000

7. 18" minimum permitted, providing voltage between conductors does not exceed 300 volts, they do not pass over more than 4 feet of the overhang portion of the roof, and they are terminated at a service mast.

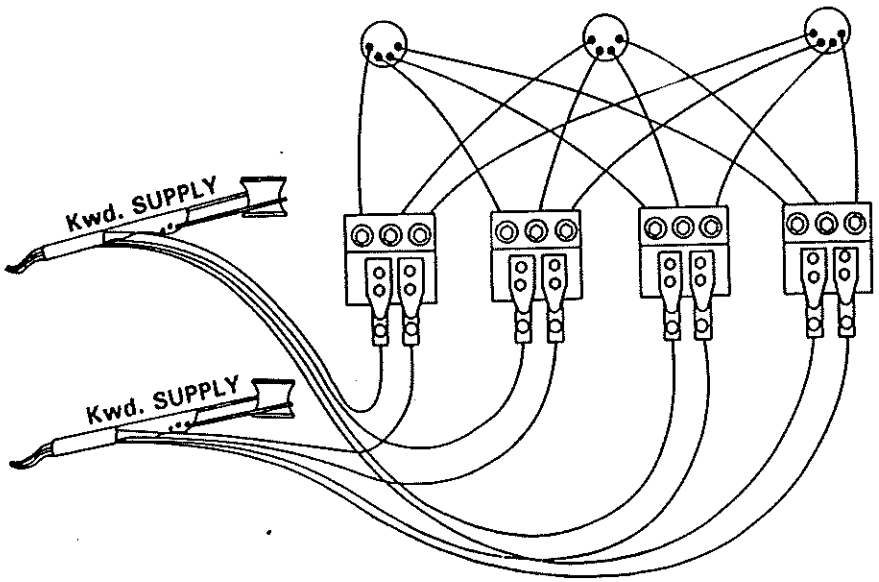
THREE PHASE INSTALLATION
SERVICE ENTRANCE USING BUS BAR
FOR CAPACITIES OVER 800 AMP
240-480 VOLTS



EQUIPMENT TO BE FURNISHED BY CUSTOMER

SERVICE SIZE IN AMPERES	METAL CABINET BOLTS & LUGS NO.	LUG SIZE
0-1000	1	500/750
1001-2000	2	500/750
2001-3000	3	500/750
3001/4000	4	500/750

SERVICES
OVER 800 AMPS
ALTERNATE METHODS



CUSTOMER:

Gather service entrance conductors

Provide 2 and 3 barrel NEMA 4 Hole Lugs and Bolt together

UTILITY:

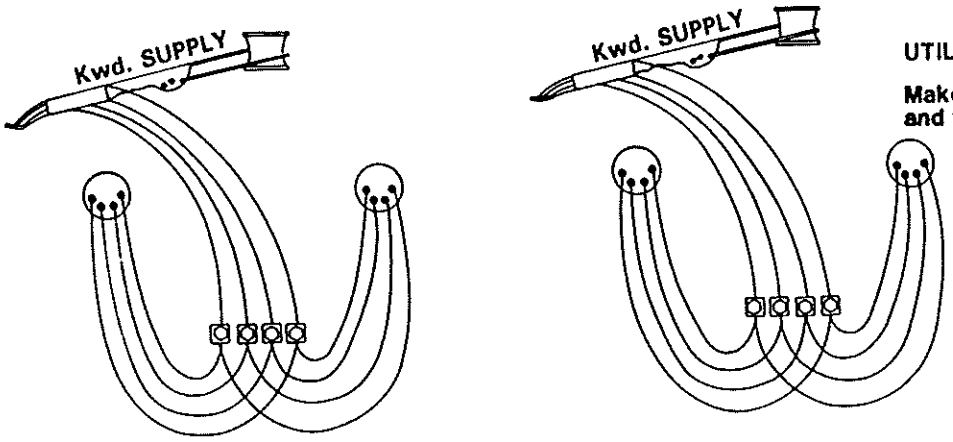
Make final connection to 2 barrel

Tape Lugs

2 TO 3 CONNECTION

CUSTOMER:

Provide connectors



UTILITY:

Make final connection and tape.

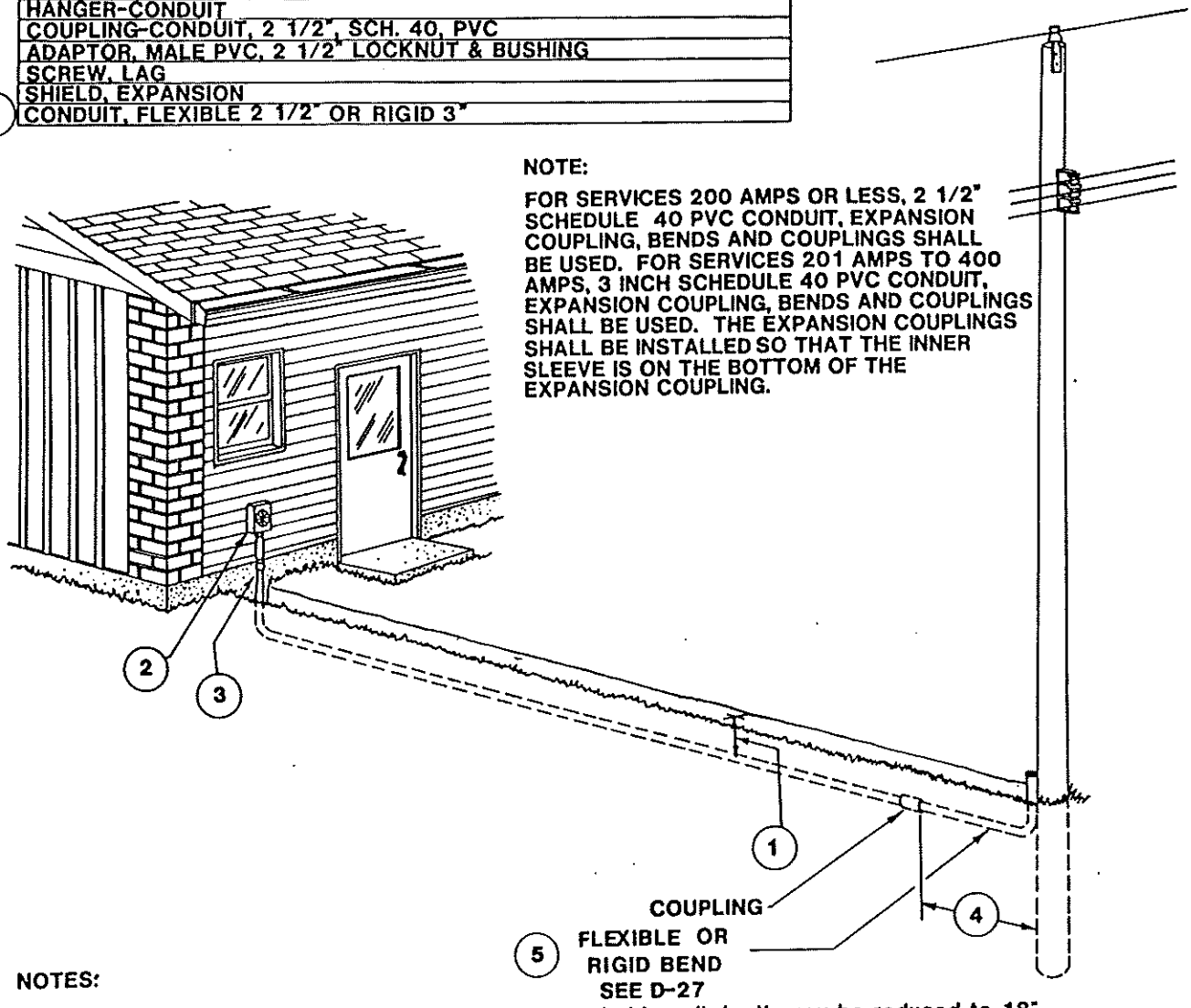
2 TO 4 CONNECTION

UNDERGROUND LINES INSTRUCTION
CUSTOMER OWNED AND INSTALLED
SERVICE CONDUIT CONNECTION TO OVERHEAD

MATERIAL FURNISHED AND INSTALLED BY CUSTOMER
SOCKET-METER
CONDUIT- SCH 40, 2 1/2", PVC
BEND-CONDUIT 2 1/2" 90 , 24" RADIUS, SCH 40 PVC
COUPLING-CONDUIT, 2 1/2" EXPANSION (ALLOWS 12") SCH 40 PVC
HANGER-CONDUIT
COUPLING-CONDUIT, 2 1/2", SCH. 40, PVC
ADAPTOR, MALE PVC, 2 1/2" LOCKNUT & BUSHING
SCREW, LAG
SHIELD, EXPANSION
(5) CONDUIT, FLEXIBLE 2 1/2" OR RIGID 3"

NOTE:

FOR SERVICES 200 AMPS OR LESS, 2 1/2" SCHEDULE 40 PVC CONDUIT, EXPANSION COUPLING, BENDS AND COUPLINGS SHALL BE USED. FOR SERVICES 201 AMPS TO 400 AMPS, 3 INCH SCHEDULE 40 PVC CONDUIT, EXPANSION COUPLING, BENDS AND COUPLINGS SHALL BE USED. THE EXPANSION COUPLINGS SHALL BE INSTALLED SO THAT THE INNER SLEEVE IS ON THE BOTTOM OF THE EXPANSION COUPLING.



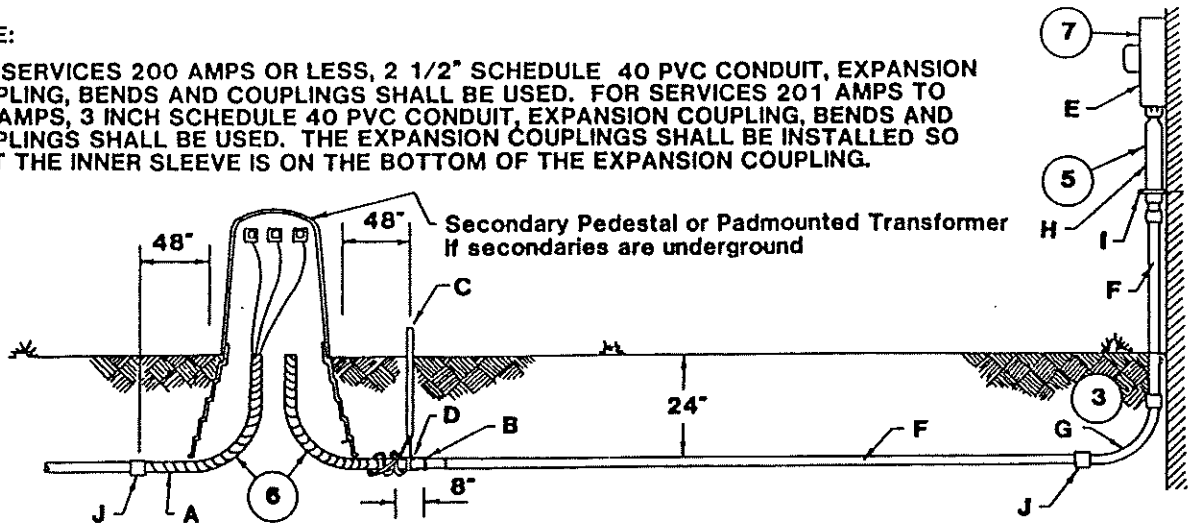
NOTES:

1. Minimum burial depth is 24". In rock or untrenchable soil depth may be reduced to 18". Between 18" and 12" cover with 2" of concrete. Depths less than 12" are not permitted.
2. For Meter Socket Mounting Height see page D-4 of the Service Manual.
3. See Page D-25A, 26 for Installation Instruction and Material Requirements.
4. Service conduit shall terminate a nominal distance from the terminal pole. The riser bend between this point and the pole shall be PVC flexible conduit, see D-27.
   A. The location where the riser will be on the pole (quadrant) shall be obtained from a Kirkwood Electric representative.
   B. Where customer is to extend riser bend to a pole location requiring pole setting, replacement, or alteration by Kwd., such extension shall not be made until pole work is completed by Kwd.
   C. Conduit seals on customer service conduit are his responsibility and should be accomplished at the building wall.
5. Flexible conduit shall be gray in color and have dimensions that allow the use of standard schedule 40 fittings and accessories. These fittings and accessories shall be attached to the flexible conduit with PVC solvent cement .
6. There shall be a maximum of 3-90degree, 24 inch radius bends for any installation.
7. Approved ground required. See D-3-1.

UNDERGROUND LINES INSTRUCTION
CUSTOMER OWNED AND INSTALLED SERVICE CONDUIT CONNECTION TO PEDESTAL OR TRANSFORMER

NOTE:

FOR SERVICES 200 AMPS OR LESS, 2 1/2" SCHEDULE 40 PVC CONDUIT, EXPANSION COUPLING, BENDS AND COUPLINGS SHALL BE USED. FOR SERVICES 201 AMPS TO 400 AMPS, 3 INCH SCHEDULE 40 PVC CONDUIT, EXPANSION COUPLING, BENDS AND COUPLINGS SHALL BE USED. THE EXPANSION COUPLINGS SHALL BE INSTALLED SO THAT THE INNER SLEEVE IS ON THE BOTTOM OF THE EXPANSION COUPLING.



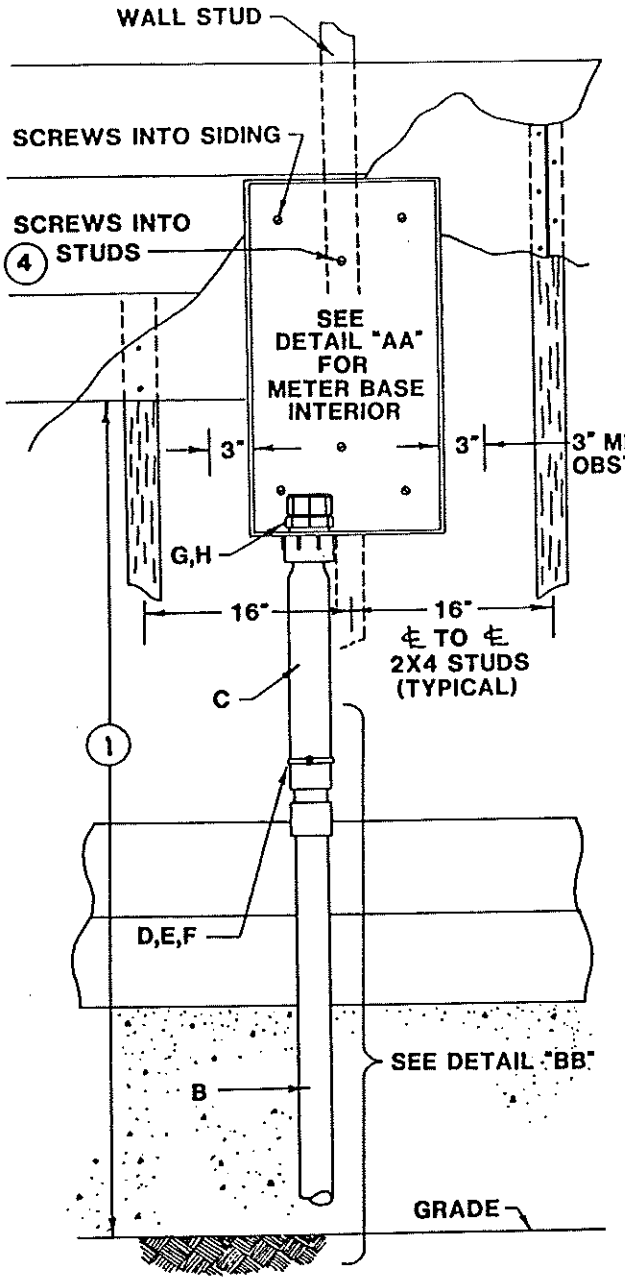
	MATERIAL FURNISHED AND INSTALLED BY KIRKWOOD ELECTRIC		
		59 81 40 41	
	U.E. STK. NO.	DESCRIPTION	
A	12 51 267	Conduit-Plastic, Flexible, 2-1/2", Corrugated	7'
B	12 51 002	Plug - Conduit, 3"	1
C	49 05 520	Marker - Buried Conduit, Red, 1"Wx7'4" L	1
D	12 01 152	Conduit-3" Plastic (8")	1

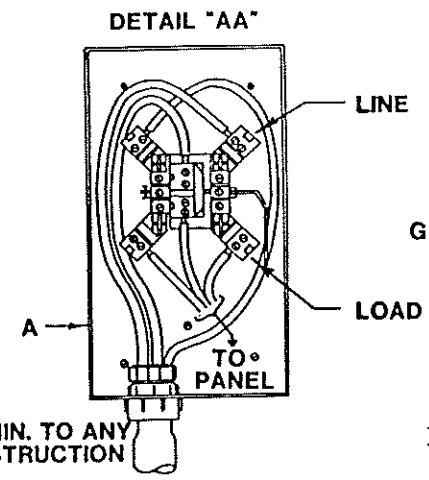
	MATERIAL FURNISHED AND INSTALLED BY CUSTOMER
E	Socket-Meter
F	Conduit-Sch. 40, 2-1/2" PVC
G	Bend-Conduit 2-1/2, 90°, 24" Radius, Sch. 40, PVC
H	Coupling -Conduit, 2-1/2" Expansion (Allow 12" Fall) Sch. 40, PVC
I	Hanger-Conduit
J	Coupling-Conduit, 2-1/2", Sch. 40, PVC

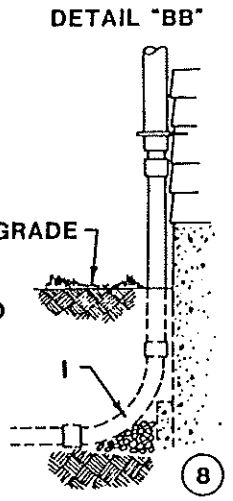
1. Customer installed conduit shall be installed along the shortest route and the number of bends shall be kept to a minimum. There shall be a maximum of 3-90 degree, 24 inch radius bends for any installation. All sections shall be securely fastened together using standard grade cement. Minimum burial depth is 24". In rock or untrenchable soil, depth may be reduced to 18". Between 18" and 12" the conduit shall be covered with 2" of concrete. Depths less than 12" are not permitted.
2. The trench bottom shall be undisturbed, firm and uniform for its entire length. If it is impossible to achieve uniformity in the trench bottom it must be over-excavated 4 to 6 inches and the bottom refilled with good quality properly compacted bedding material. Approved materials: sand, limestone screenings, concrete slurry, concrete.
3. Minimum bend radius is 24".
4. Conduit seals on customer service conduit are his responsibility and should be accomplished at the building wall.
5. See Page D-26 for required meter socket and riser attachment.
6. Kwd. installed flexible conduit shall point in the direction of the service. The conduit will extend 48" beyond the edge of the pedestal and/or transformer pad. ✳✳
7. For meter socket mounting height see Page D-4 of the Kwd. Service Manual.
8. Kwd. installed equipment is not in place, the location where it will be installed shall be obtained from a utility representative. The end of the customer installed conduit shall be sealed and marked similar to the Kwd. method with materials furnished and installed by the customer.
9. To attach the conduit to the Kwd. installed flexible conduit, first locate the end of the conduit by digging down by the red marker until the protective PVC cover is located. After removing the cover, plug and conduit marker, join the flexible conduit to the rigid conduit using standard grade cement. Leave the conduit plug and marker at the pedestal and/or transformer. In cases where the developer is required to install a 3 inch conduit and Kirkwood Electric has stubbed out a 2 1/2" conduit, Kirkwood Electric will be responsible for making the conduit connection.
10. Approved ground required. See D-3-1.

✳✳ Flex conduit will be gray in color and have dimensions that allow the use of standard Sch 40 fittings and accessories.

EQUIPMENT-CONNECTIONS
SERVICE CABLE AND METER CONNECTIONS
SINGLE FAMILY DWELLING







NOTE:

FOR SERVICES 200 AMPS OR LESS, 2 1/2" SCHEDULE 40 PVC CONDUIT, EXPANSION COUPLING, BENDS AND COUPLINGS SHALL BE USED. FOR SERVICES 201 AMPS TO 400 AMPS, 3 INCH SCHEDULE 40 PVC CONDUIT, EXPANSION COUPLING, BENDS AND COUPLINGS SHALL BE USED. THE EXPANSION COUPLINGS SHALL BE INSTALLED SO THAT THE INNER SLEEVE IS ON THE BOTTOM OF THE EXPANSION COUPLING.

	MATERIAL FURNISHED AND INSTALLED BY CUSTOMER FOR SERVICE INSTALLED IN CONDUIT
A	SOCKET, METER, 200 AMP
B	CONDUIT, 2-1/2" PVC SCHEDULE 40
C	COUPLING, EXPANSION, 2-1/2", SCH 40, PVC, 12"
6 D	HANGER, CONDUIT
E	SCREW, LAG
F	SHIELD, EXPANSION
G	NUT, LOCK, 2-1/2"
H	BUSHING, CONDUIT 2-1/2"
I	BEND, CONDUIT, 2-1/2"-90°, 24 RADIUS, SCH 40, PVC

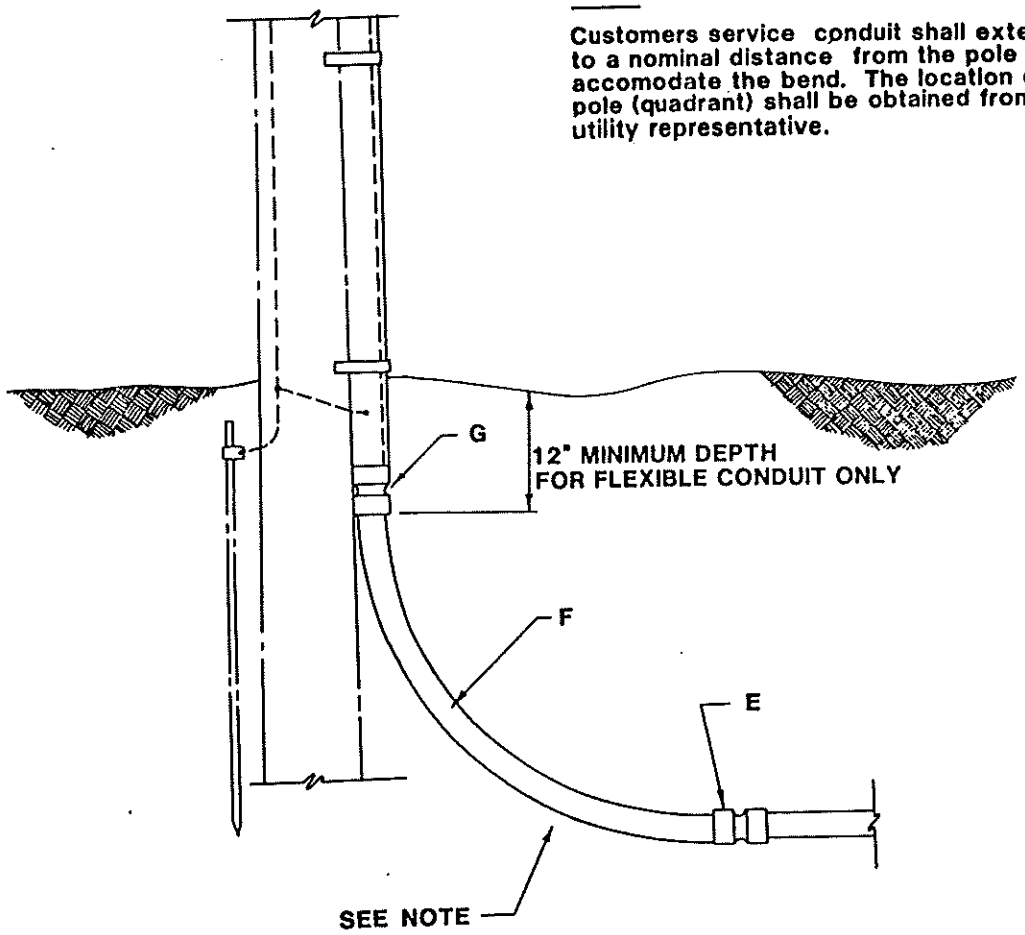
NOTES:

1. See Page D-4 of the Service Manual for Mounting Height.
2. All materials except the supply cables shall be furnished, installed and connected by customer.
3. Where subject to mechanical damage provide protection.
4. To properly secure the meter socket use #14x3" wood screws. In brick use expansion shields & lag screws.
5. See Pages D-25 and D-25-A for additional service conduit instructions and materials.
6. The conduit hanger shall be secured by a lag screw into the floor joist. If attached to the foundation a lead expansion shield shall be used. An alternative to the expansion shield is a stud shot into the foundation.
7. When backfilled, expansion coupling "C" shall be fully closed.
8. The area underneath the bend shall consist of good quality fill material and dirt free of debris. The area shall be compacted to a density in excess of 90% of the soil density outside the disturbed area around the foundation wall. Acceptable fill materials: Sand, limestone screenings, concrete slurry, concrete.
9. Approved ground required. See D-3-1.

UNDERGROUND LINES INSTRUCTION
BENDS FOR CUSTOMER OWNED SERVICE CONDUIT

NOTE:

Customers service conduit shall extend to a nominal distance from the pole to accomodate the bend. The location on the pole (quadrant) shall be obtained from a utility representative.



MATERIAL FURNISHED AND INSTALLED BY CUSTOMER

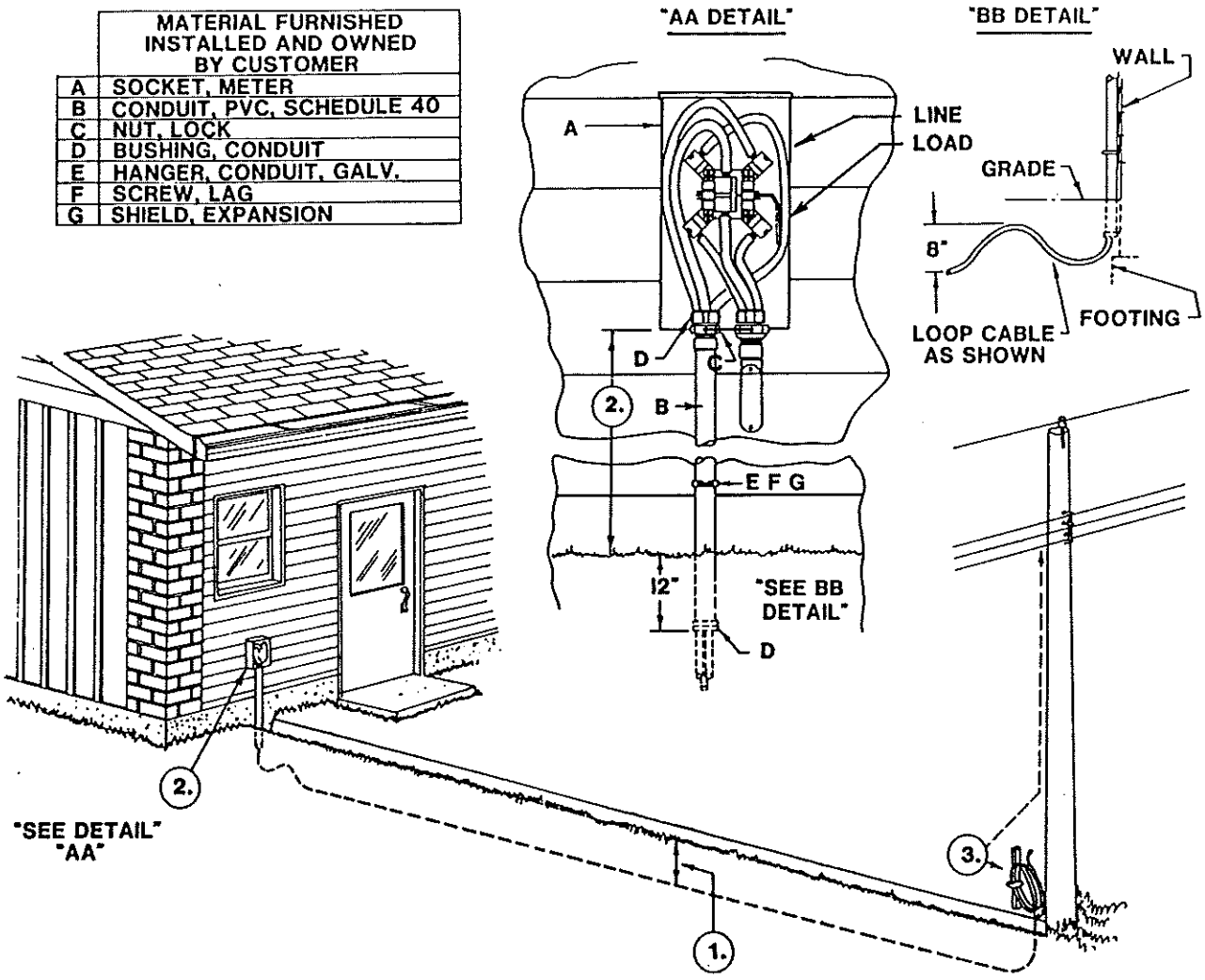
ITEM		DESCRIPTION	REQ'D
E	COUPLING:	FLEX-TO-RIGID PVC 2 1/2"	1 EA
		OR	
		RIGID-TO-RIGID PVC 3" AND GREATER	1 EA
	AND PVC CEMENT.		
F	APPROVED BEND:	FLEXIBLE FOR 2 1/2" CONDUIT	7 FT
		OR	
		RIGID FOR 3" AND GREATER	1 EA (24" RADIUS)

MATERIAL FURNISHED AND INSTALLED BY Kwd.

G	COUPLING:	FLEX-TO-RIGID PVC 2 1/2"	1 EA
		OR	
		RIGID-TO-RIGID PVC 3" AND GREATER	1 EA

UNDERGROUND LINES INSTRUCTION
CUSTOMER OWNED AND INSTALLED
UNDERGROUND SERVICE
DIRECT BURIED CABLE CONNECTION TO OVERHEAD

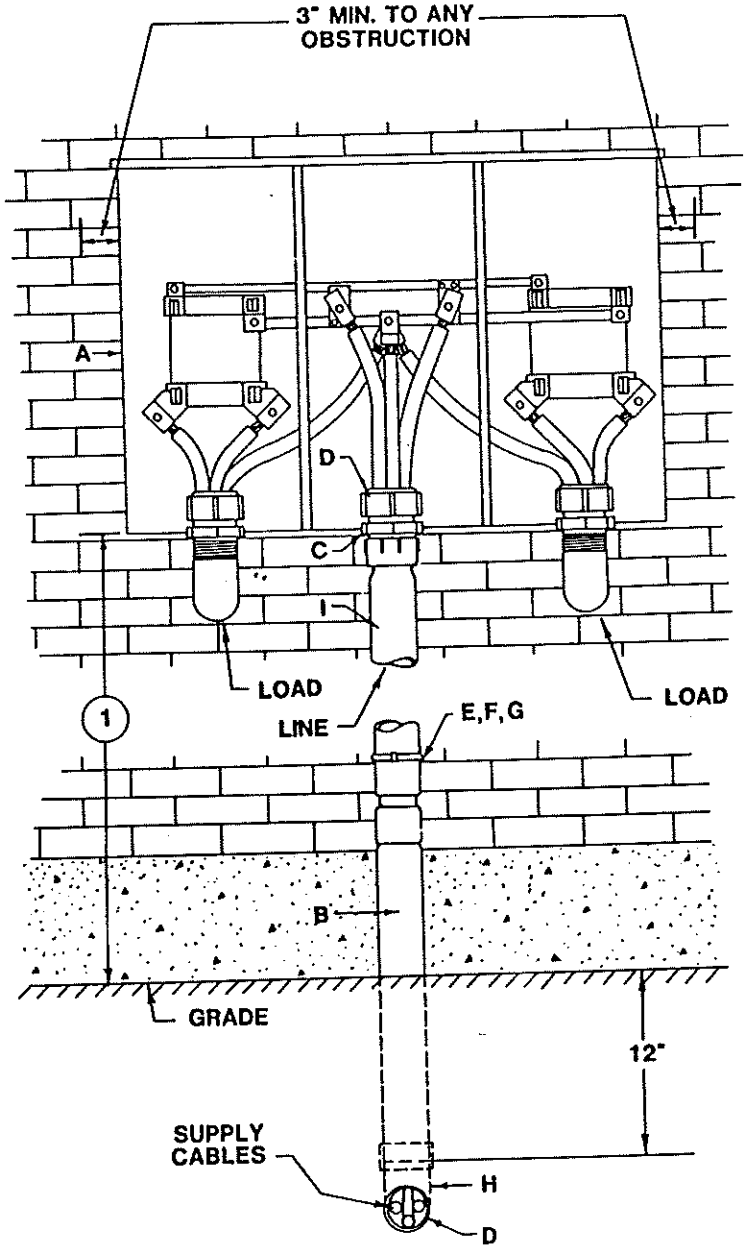
	MATERIAL FURNISHED INSTALLED AND OWNED BY CUSTOMER
A	SOCKET, METER
B	CONDUIT, PVC, SCHEDULE 40
C	NUT, LOCK
D	BUSHING, CONDUIT
E	HANGER, CONDUIT, GALV.
F	SCREW, LAG
G	SHIELD, EXPANSION



NOTES:

1. Minimum burial depth 24" See National Electric Code paragraph 300-5 for exceptions.
2. For meter socket mounting height see page D-4 of the Kwd. Service Manual.
3. Service cables to be provided by customer shall extend to the base of the pole and shall be provided in lengths sufficient, (This length to be determined by Kwd. Estimator) to extend up the pole to the secondary or transformer terminals.
   - A. Conductor insulation shall be impregnated with carbon black (black in color).
   - B. Conductor insulation must be designated by the letter "W" (water resistant) where installed in direct buried conduit.
   - C. Conductor insulation must be designated as type "U.S.E." (underground service entrance) where installed in direct contact with the earth.
4. Kirkwood Electric will install cable up the pole and make final connections at that point after applicable building/wiring inspection is made.
5. Sizes determined by service capacity installed.
6. Approved ground required. See D-3-1.

EQUIPMENT-CONNECTIONS
SERVICE CABLE AND METER CONNECTIONS
MULTIPLE FAMILY DWELLING
FOR 2 TO 6 METERS



		MATERIAL FURNISHED, INSTALLED, AND OWNED BY CUSTOMER.
(4)	B	CONDUIT, RIGID METAL OR INTERMEDIATE
(4)	C	NUT, LOCK, 3" CAD. PLATED, GRD. TYPE
(4)	D	BUSHING, CONDUIT, INSULATING, 3"
	E	HANGER, CONDUIT, 3" GALV.
	F	SCREW, LAG
	G	SHIELD, EXPANSION
(5)	H	BEND, CONDUIT, 3", 45°
(3)	I	COUPLING, EXPANSION, 3", SCH 40, PVC, 12"

(1) See page D-4

(2) All materials except supply cables shall be furnished by customer.

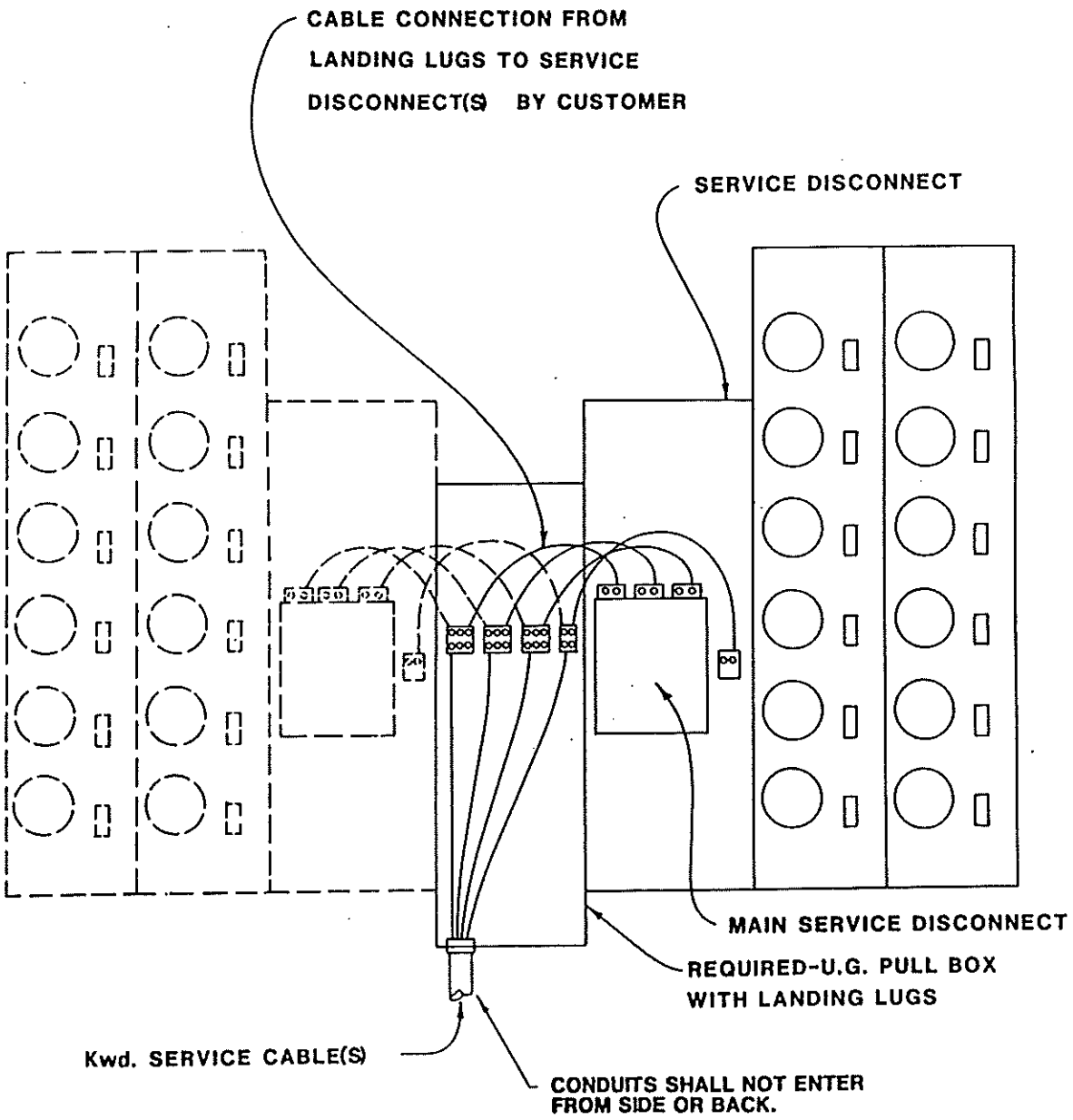
(3) When concrete sidewalks, driveways, patios, etc. are located within 3' of meter location, extend conduit to edge of pavement. In this situation, and with total conduit systems, use expansion coupling.

(4) Where authorized by local inspection authorities, rigid non metallic may be used, with necessary junction box adapter and bell end substituted for bushings and lock nut.

(5) To be installed where the footing provides an obstruction to or possible mechanical damage to service cable entrance in the meter riser.

(6) Approved ground required. See D-3-1.

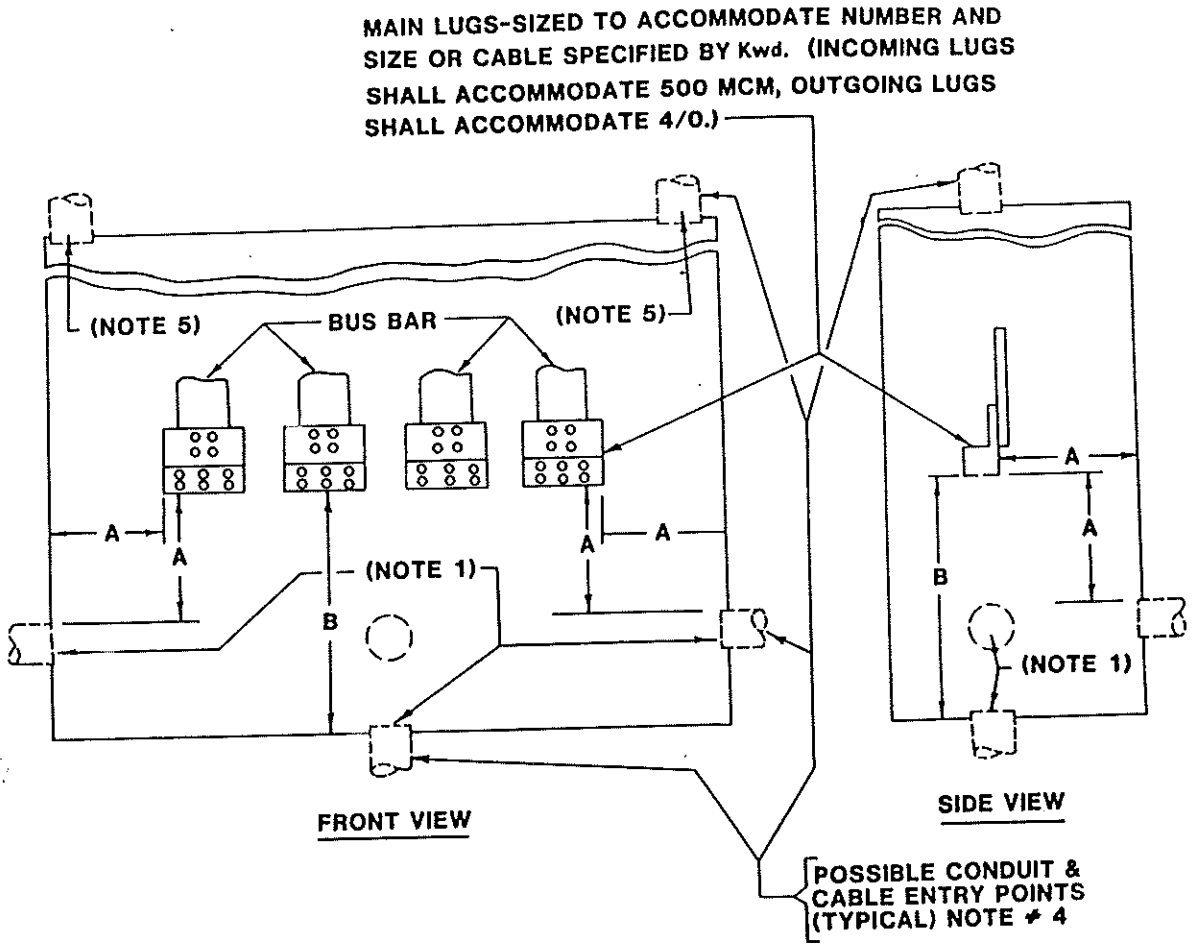
TYPICAL VERTICAL GANGED METER STACK
UNDERGROUND SERVICE BY U.E.
4, 5 OR 7 TERMINAL SOCKET
ONE OR TWO SERVICE DISCONNECT



MINIMUM WIRE BENDING AND TERMINATING SPACE LOW VOLTAGE SWITCHBOARD, PANELBOARDS, AND PREBUSSED TERMINAL BOXES

MINIMUM WIRE BENDING AND TERMINATING SPACE
LOW VOLTAGE SWITCHBOARDS AND PANELBOARDS
WHERE Kwd. INSTALLS AND/OR MAINTAINS THE CABLE.

NOTE: FOR SERVICE AMPACITY UP TO AND INCLUDING 1200 AMPS, THE PREBUSSED TERMINAL BOX SHALL HAVE AN INSIDE SURFACE AREA OF AT LEAST 16 SQ. FT. WITH A 12" MIN. DEPTH AND PROVIDE WIRE BENDING SPACE AS INDICATED BELOW.



"A" DIMENSION-IN INCHES (NOTE 2)

WIRE SIZE	WIRES PER TERMINAL 1	2	3	4 OR MORE
500	6	8	10	12

"B" DIMENSION-IN INCHES (NOTE 2)

WIRE SIZE	WIRES PER TERMINAL 1	2	3	4 OR MORE
500	14	14	15	16

NORMAL BENDING RADIUS

3-500x1-4/0 CU NW - 8" (NOTE 3)

- CONTINUED -

Note #1: When the conduits enter a surface that is cut by a flat plane containing the lugs then the conduits must be centered on the lugs. If they are not additional wire bending space may be required. In addition, the area directly above or below the ducts must be free of all obstructions. All conduit shall terminate with an approved bushing or adapter to protect the cable from abrasion.

Note #2: The dimensions are in agreement with Table 373-6 (a) and (b) of the 1990 NEC.

Note #3: In the network area, the Underground Department shall be consulted for the limiter lug space requirements.

Note #4: The maximum length of conduit between transformer and panel-board shall not exceed 250 feet and contain no more than 2-36" radius, 90° bends. Additional bends and/or length require the written approval of the Distribution Planner before construction is started. A maximum of four (4) 90° bends (equivalent of 360°) may be permitted but may require restrained bends or a pull box to keep pulling tensions within acceptable limits.

Connection of underground service laterals to the line side lugs of a main service disconnect is not permitted under any circumstances.

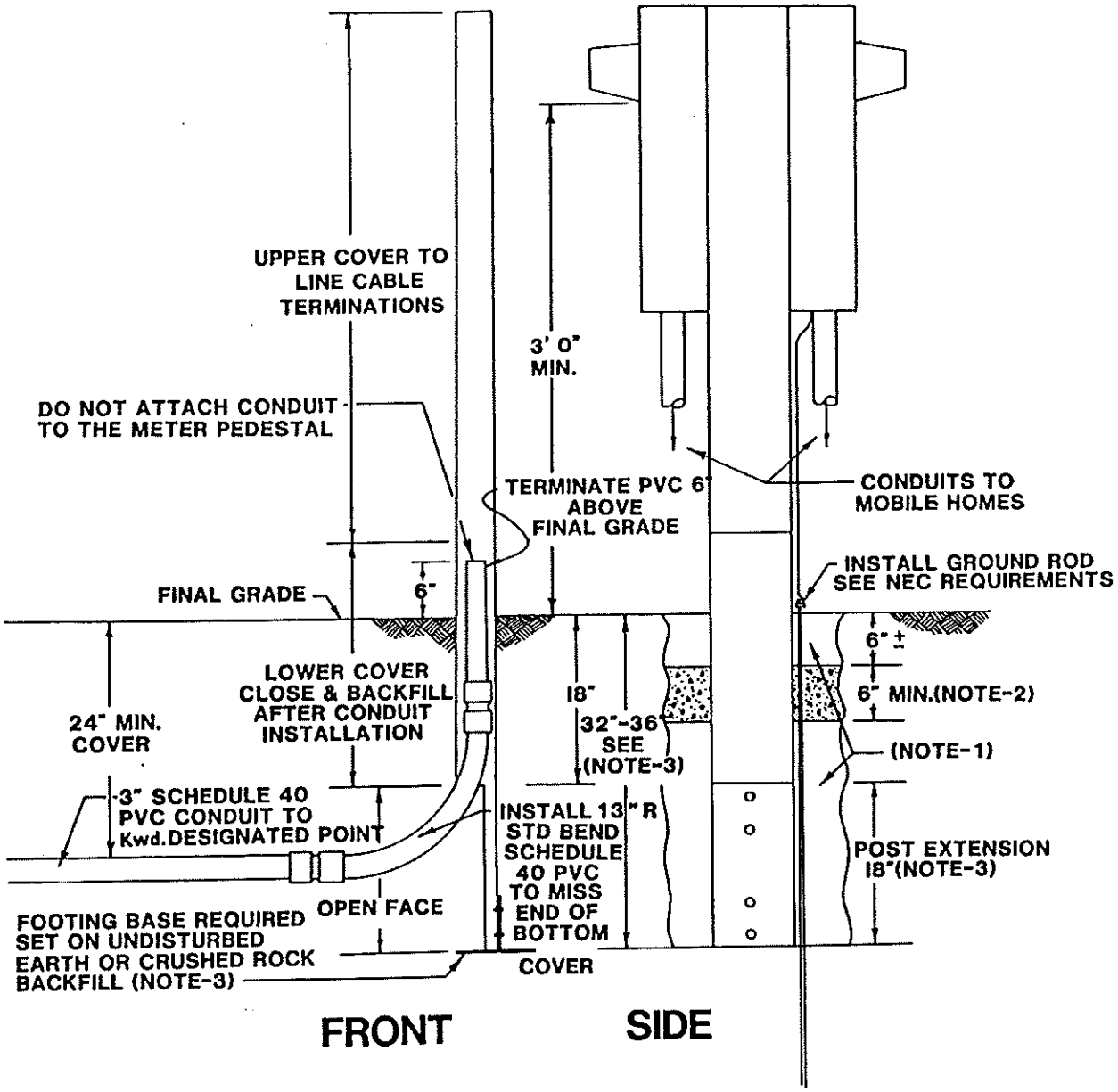
Note #5: If the incoming cables must traverse the height of the switchboard or panelboard and a separate sealed wireway or trough is not provided, then the "A" dimension must be doubled to allow proper bending radius to the nearest connection and the contractor must provide an integral sealable wireway.

METER
PEDESTAL INSTALLATION
SINGLE OR DUAL METER

NOTE:

(a) All materials except supply cables shall be furnished and installed by customer.

(b) Pedestals shall be labeled for service equipment by U.L. and approved by Kirkwood Electric.



NOTES:

(1) Backfill with tamped crushed rock screening including entire conduit elbow.

(2) Place concrete collar 6" thick, min., 6" below grade to firm earth as shown.

(3) 32" to 36" pedestal embedment required. Order post extention and footing base with meter post as shown.

(4) Owner shall be responsible to see that pedestal is firmly embedded in ground, and plumb to within 1" in 12" vertical.

(5) Conduit shown 3" for dual pedestal, use 2 1/2" conduit and 11" Radius bend for single pedestal.

METER INSTALLATIONS
CUSTOMER-OWNED SECONDARY METERING
UNDERGROUND DISTRIBUTION INSTALLATION
100 OR 200 AMPERE, SINGLE-PHASE

NOTES:

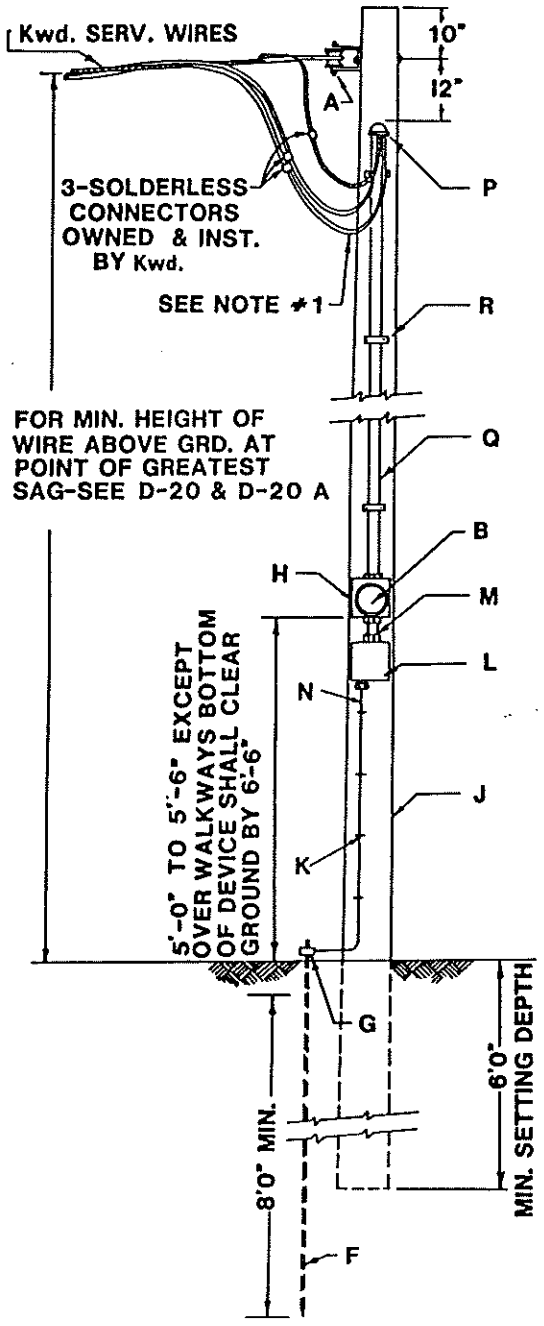
(1) Leave minimum of 24 inches leads.

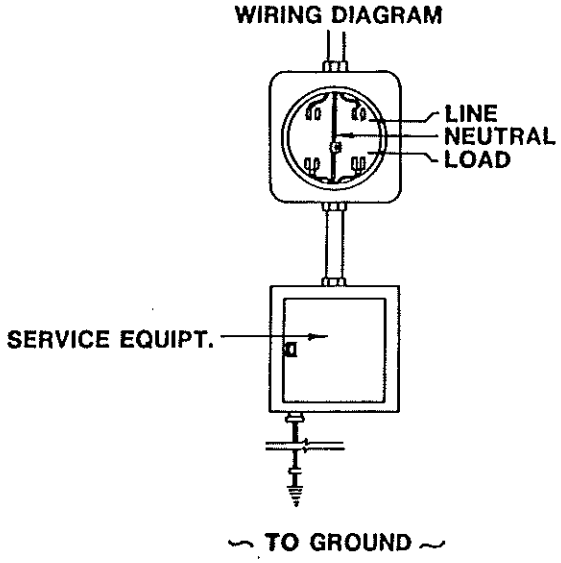
(2) All wiring installed and owned by customer to be in accordance with the National Electrical Code.

(3) For clearances and rules other than shown, see National Electrical Code and National Electric Safety Code.

(4) If customer installs a yard light on this pole, such yard light shall clear Kwd. service wires by not less than 24 inches.

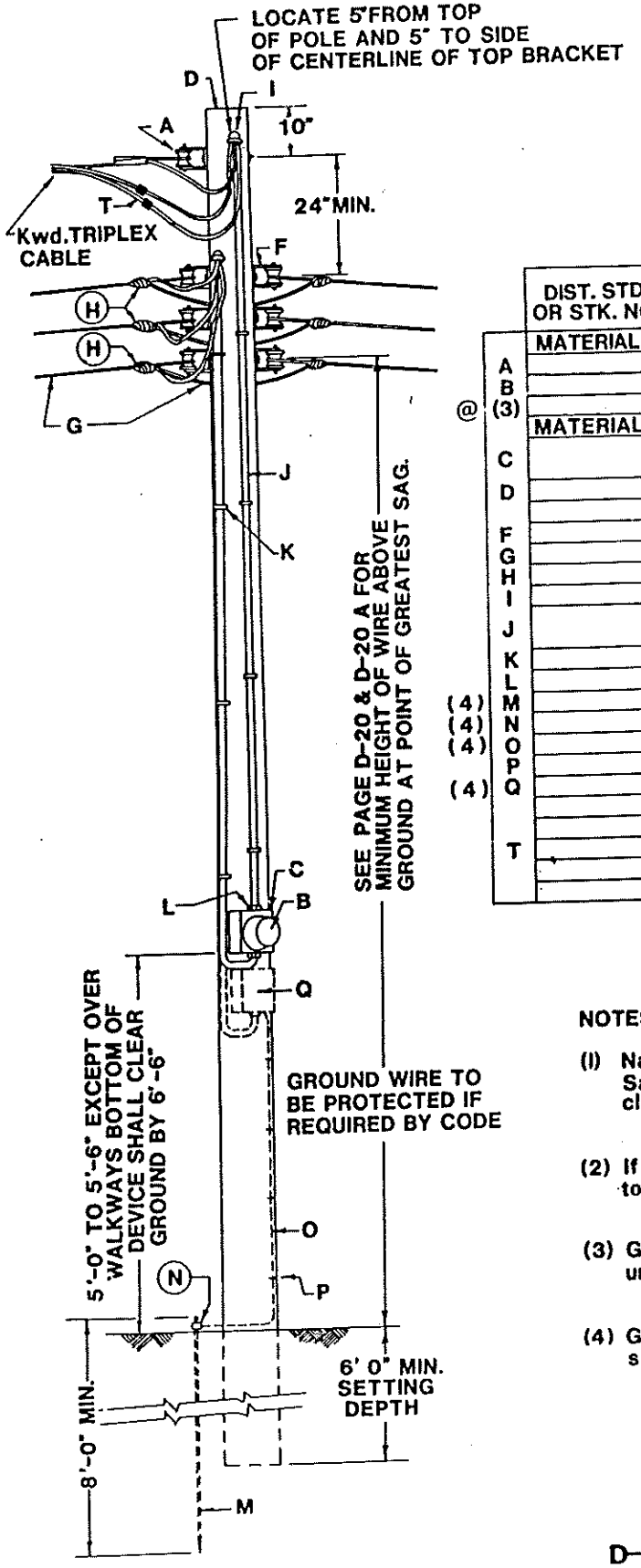
(5) Guy and anchor to be used when required to hold any unbalanced conductor load which pole cannot sustain.

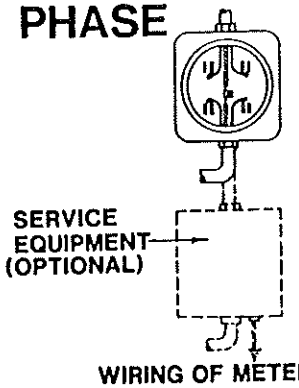




		STK. NO. OR STD.	DESCRIPTION	REQ'D
		MAT'L INSTALLED AND OWNED BY Kwd.		
	A		CLEVIS - SECONDARY	1
	B		METER	1
@	(5)		GUY	1
		MATERIAL OWNED BY CUSTOMER		
	F		ROD-GROUND 1/2" X 8"	1
	G		CLAMP-GROUND 1/2"	1
	H		METER SOCKET	1
	J		POLE,30' CLASS 5	1
(6)	K		STAPLE	AS REQ'D
	L		DISCONNECT DEVICE WEATHERPROFF	1
	M		NIPPLE	1
	N		GROUND WIRE	AS REQ'D
	P		ENTRANCE CAP	1
	Q		CONDUIT OR CABLE	AS REQ'D
	R		STRAP-COND. OR CABLE	AS REQ'D

METER INSTALLATIONS
CUSTOMER-OWNED SECONDARY METERING
OVERHEAD DISTRIBUTION INSTALLATION
100 OR 200 AMPERE, SINGLE PHASE





WIRING OF METER BASE

	DIST. STD. OR STK. NO.	DESCRIPTION 25 01 01 **	REQ'D 01	REQ'D 02
		MATERIAL OWNED & INSTALLED BY Kwd.		
A		SEC.CLEVIS	1	1
B		METER	1	1
@ (3)		GUY	1	1
		MATERIAL OWNED & INSTALLED BY CUSTOMER:		
C		METER SOCKET 100A	1	
		METER SOCKET 200A		1
D		POLE (CLASS 5 MINIMUM)	1	1
F		DISTRIBUTION RACK		
G		DISTRIBUTION WIRE		
H		SOLDERLESS CONNECTOR		
I		ENTRANCE CAPS		
J		SER. ENTRANCE CABLE OR WIRE & CONDUIT		
K		STRAPS, CONDUIT	2	
L		CONNECTORS	1	1
M (4)		CODE APPROVED GROUND	1	1
N (4)		GROUND CLAMP (BRONZE)		
O (4)		GROUND WIRE (COPPER)		
P		STAPLES		
Q (4)		DISC. DEVICE, OPTIONAL		
T		4/0 (MAX) SERVICE LOOP	1	1

NOTES:

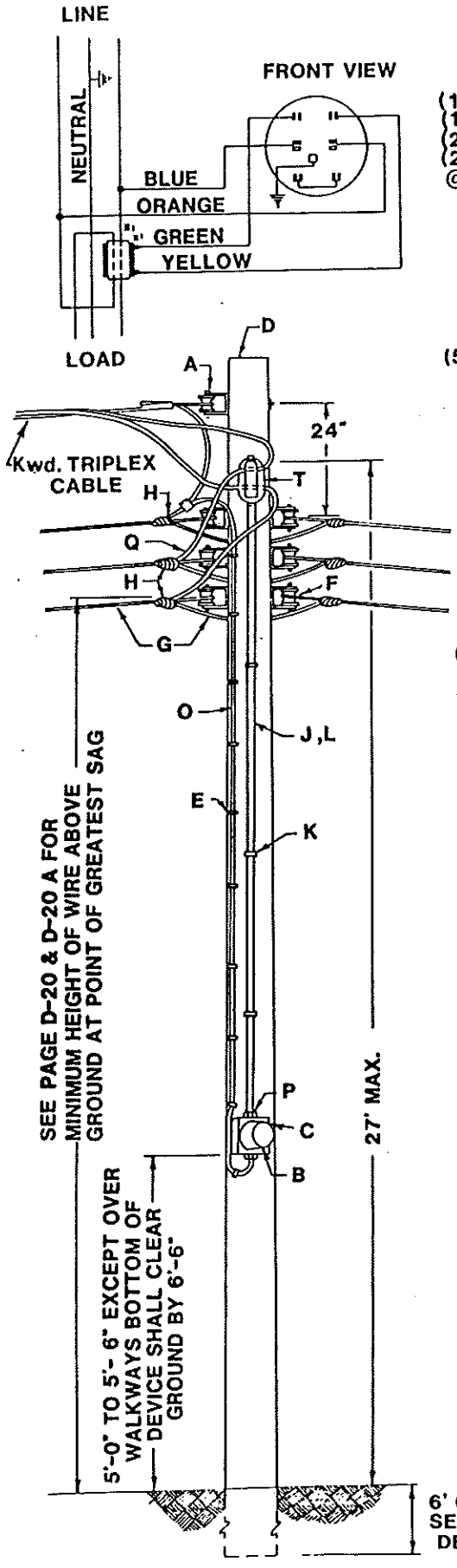
(1) National Electrical Code and National Electric Safety Code shall govern all customer wiring, clearances, and other features not shown.

(2) If a yard light is mounted on this pole, clearance to Kwd. service wires shall be at least 24 inches.

(3) Guy and anchor to be used when required to hold any unbalanced conductor load which pole cannot sustain.

(4) Grounding not required at this location except when service equipment (item Q, optional) is installed.

METER INSTALLATIONS
CUSTOMER-OWNED SECONDARY METERING
OVERHEAD DISTRIBUTION INSTALLATION
OVER 200 AMPERE, SINGLE-PHASE



		DIST. STD. OR STK. NO	DESCRIPTION	REQ'D
			MATERIAL INSTALLED AND OWNED BY Kwd.	
(1)	A		SECONDARY CLEVIS	1
(1)	B		METER	1
(2)	C		METER SOCKET #210	1
(2)	T		CURRENT TRANS., W/FITTING	1
@ (7)			GUY	1
			MATERIAL OWNED & INSTALLED BY CUSTOMER:	
	D		POLE (CLASS 5 MINIMUM)	
	E		STAPLES	
	F		DISTRIBUTION RACKS	
	G		DIST. WIRE, SIZED FOR LOAD	
	H		SOLDERLESS CONNECTORS	
	J		CONDUIT - 3/4"	
	K		CONDUIT STRAPS	
(5)	L		WIRE # 12 600V. SOLID	
	O		GROUND WIRE-MINIMUM #8 CU.	
	P		CONDUIT REDUCER-1" TO 3/4"	
	Q		WIRE SIZED FOR LOAD	

NOTES:

(1) Provided in place and owned by utility.

(2) Furnished and owned by utility - installed by customer.

(3) National Electrical Code and National Electric Safety Code shall Govern all customers wiring, clearances, and other features not shown.

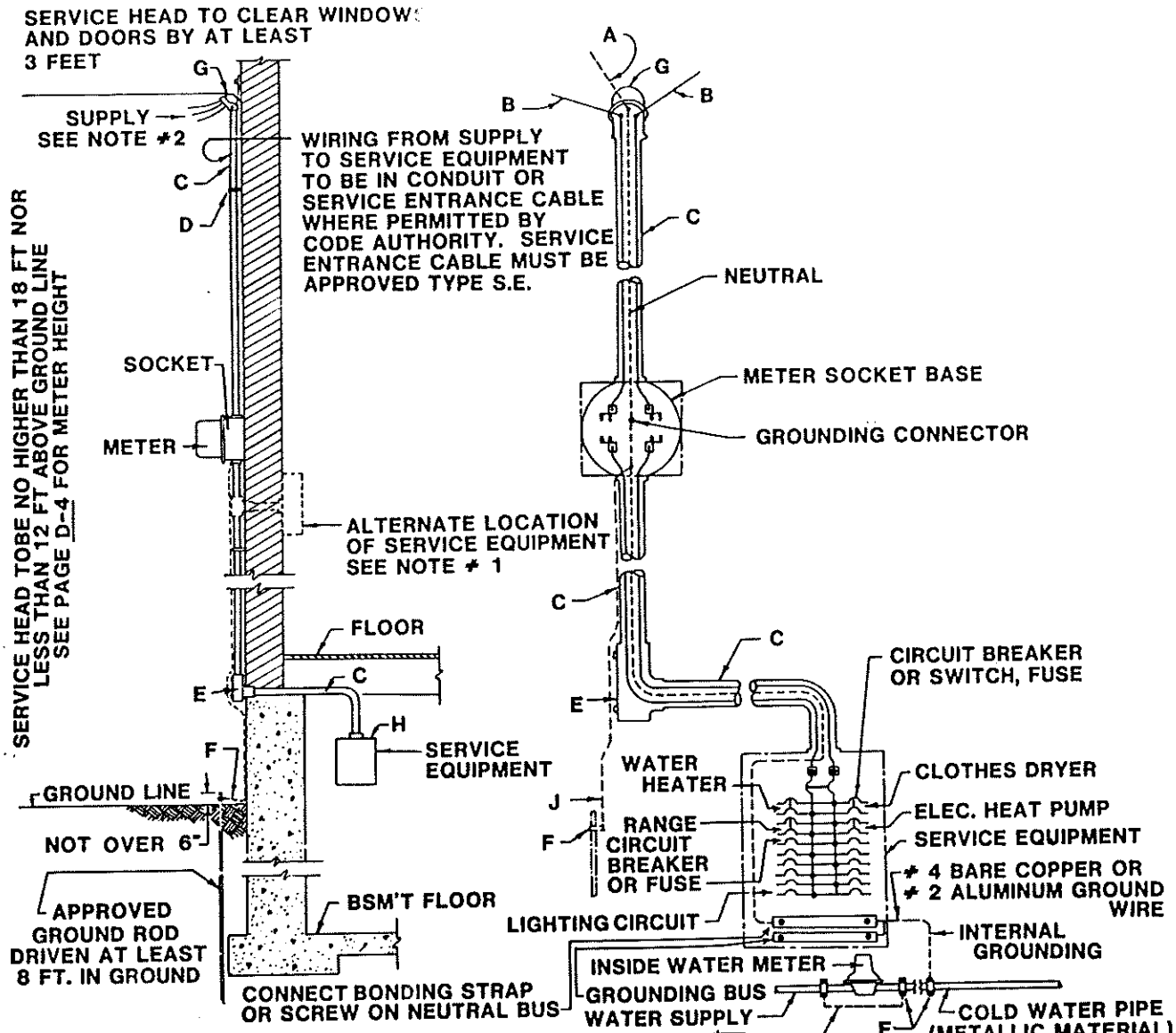
(4) If a yard light is mounted on this pole, clearance to Kwd. service wires shall be at least 24 inches.

(5) Customer shall run four #12 - 600V. insulated identified wires from current transformer thru 3/4 conduit to meter socket and allow sufficient wire on each end (Min of 24") for connection. Kwd. will connect both ends of these four wires and connect ground wire to system neutral. For color coding see drwg. above.

(6) Customers will install wiring from his distribution wires thru the current transformer and leave sufficient wire for Kwd. to make connection to Kwd. service wires.

(7) Guy and anchor to be used when required to hold any unbalanced conductor load which pole cannot sustain.

RESIDENTIAL
TYPICAL 200 AMPERE
SERVICE ENTRANCE INSTALLATION
SINGLE PHASE 120/240 VOLTS - 3 WIRE A.C.



	200 AMP SERVICE ENTRANCE	REQ'D
A	2/0 BARE COPPER OR 4/0 INSULATED ALUMINUM	AS REQ'D
B	2/0 COPPER OR 4/0 ALUMINUM 75°C INSULATED BLACK CONDUCTOR	AS REQ'D
C	2" CONDUIT	AS REQ'D
D	2" CONDUIT CLAMP	AS REQ'D
E	2" WATERTIGHT FITTING	1
F	APPROVED GROUND CLAMP	4
G	APPROVED SERVICE HEAD	1
H	APPROVED SERVICE EQUIPMENT - 200 AMPS	1
J	#4 BARE COPPER CONDUCTOR	AS REQ'D

NOTES:

(1) Service equipment may be located inside house, as shown in alternate location. The wiring will remain the same as shown in wiring diagram.

(2) Service entrance conductors shall extend at least 24 inches beyond service head.

(3) When aluminum conductors are used, the wire shall be throughly cleaned with a wire brush and coated with Oxide Inhibitor before making connections.

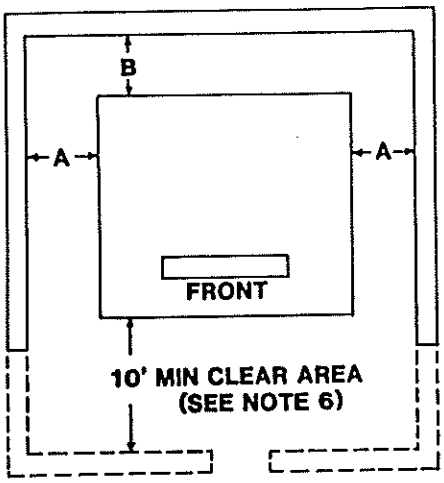
(4) Install bare copper ground wire from neutral terminal in service entrance switch to approved grounding clamp on cold water pipe. The water meter shall have a bonding wire installed as shown in drawing.

(5) Kirkwood Electric will furnish meter.

PADMOUNTED TRANSFORMER CLEARANCE REQUIREMENTS

FOR PAD DIMENSIONS
REFER TO SECTION 2.4.2.3

IF PAD MOUNT IS ENCLOSED ON ALL 4 SIDES, 10' MINIMUM CLEARANCE FROM THE FRONT OF TRANSFORMER TO INSIDE OF WALL MUST BE MAINTAINED FOR HOT STICK OPERATIONS.



KVA	A	B
0-167, 1Ø DEADFRONT	30"	30"
112 1/2 THRU 300, 3Ø	30"	35"
500 & 750, 3Ø	45"	43"
1000 THRU 2500, 3Ø	44"	56"

NOTES:

1. This drawing covers clearances for pad mount transformers installed at ground level.
2. If a 4 sided enclosure is used, an opening or doorway shall be provided. If a lock is required provisions shall be made to provide Kwd. personnel access.
3. Developer to provide drainage away from enclosed areas to prevent oil and/or water from standing.
4. If a 4 sided enclosure is used, a minimum of 10 square feet of venting space in the form of 50% effective louvers or 5 square feet of opening shall be provided, to be located along the bottom of each wall. If a 3 sided wall is used, wall venting space is desirable, but not required.
5. Location must be accessible for installing or replacing transformer with utility derrick or crane.
6. The 10' distance between the front of the pad and the wall may be reduced to 48" if an opening or gate is provided. The opening or gate should be centered on the front of the pad and should provide for a minimum opening of 3 1/2' for 1Ø and 9 1/2' for the 3Ø installation. A 10' clear area in front of the pad must still be available with the opening or when the gate is open for hot stick operations.
7. To provide for transformer replacement, enclosed area is to be free of overhangs or overhead obstructions. Wall height not to exceed 8' unless the above mentioned gate or opening is provided or an easily removable wall is used.
8. Should upgrading be required, the dimensions as shown provide adequate ventilation & space for 1 size larger transformer.
9. Walls shown in drawing, but clearances are required for any obstruction, i.e. switchgear, dumpsters, etc.

PROTECTIVE BARRIER RAIL INSTALLATION FOR PADMOUNTED TRANSFORMERS

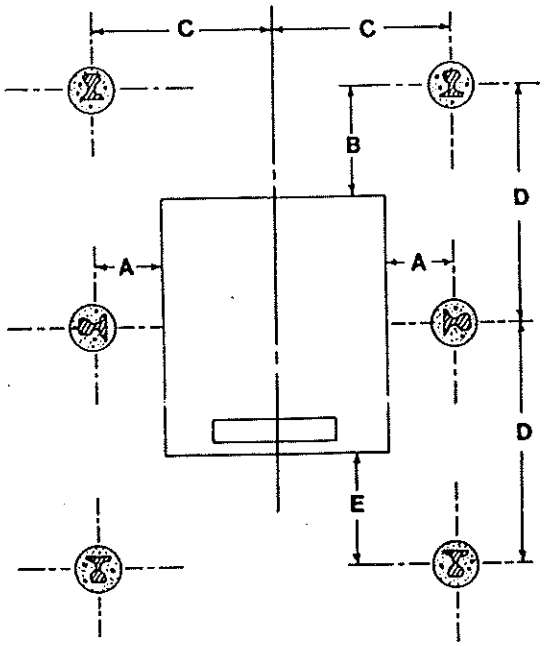


FIGURE I

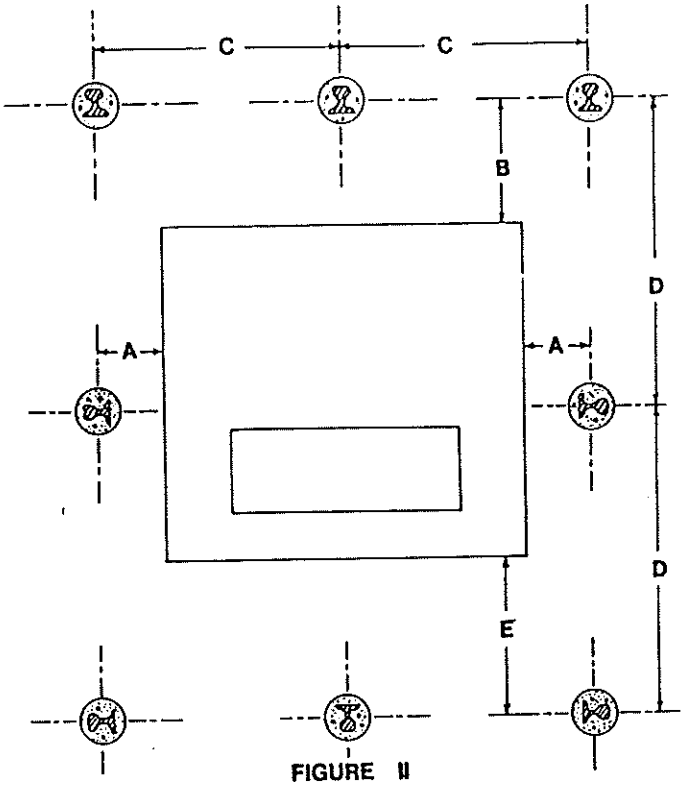
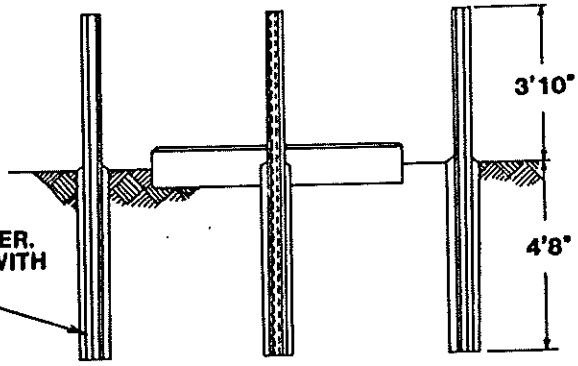


FIGURE II

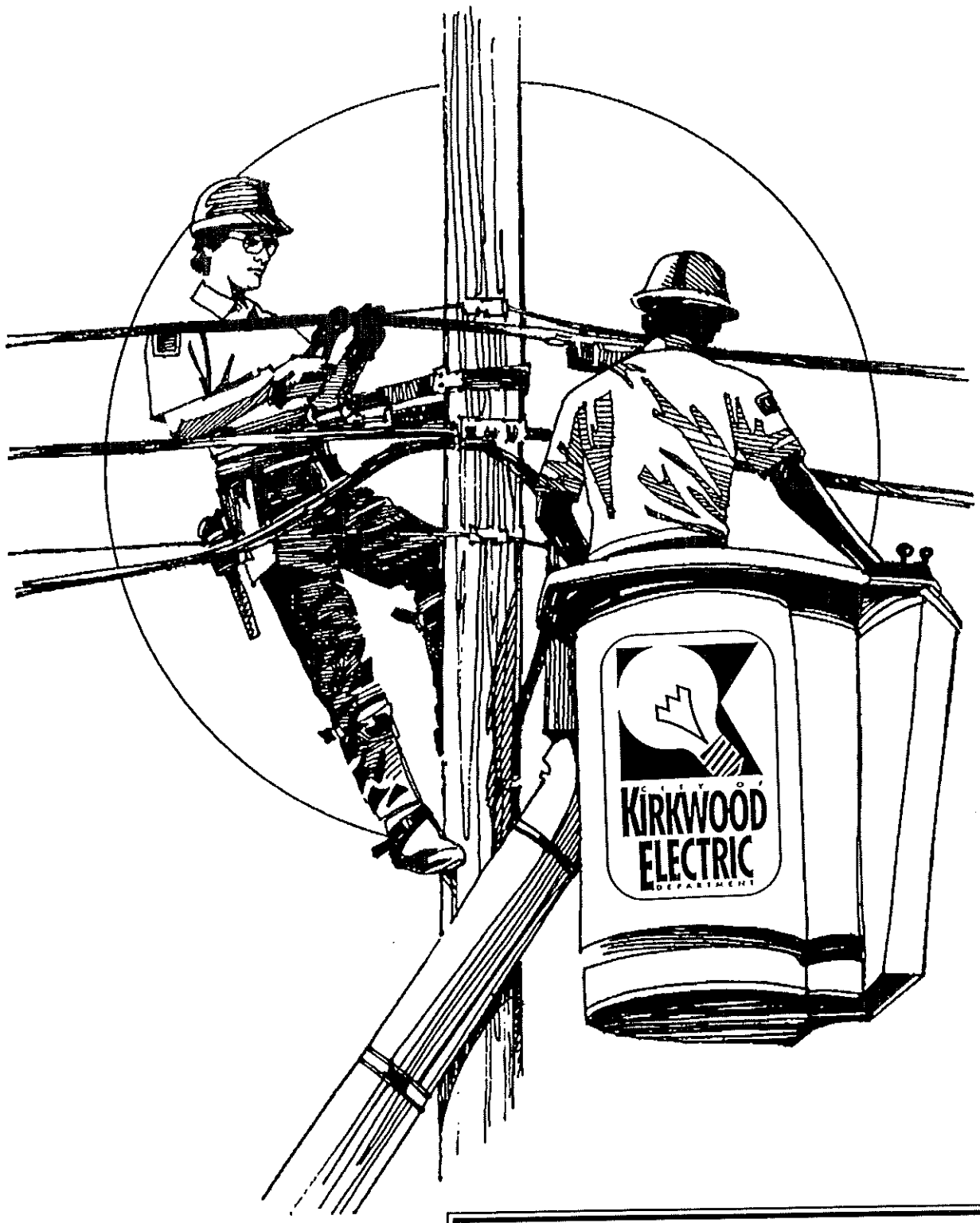
	TRANSFORMER SIZE	A	B	C	D	E
FIGURE I	0-167 KVA, 1Ø, DEADFRONT	12"	18"	32"	40"	18"
FIGURE II	112-750 KVA, 3Ø	32"	26"	69"	64"	36"
FIGURE II	1000-2500 KVA, 3Ø	26"	38"	68"	73"	36"



HOLES TO BE DRILLED WITH 8" AUGER. AFTER RAILS ARE SET FILL HOLES WITH CONCRETE

1. Barrier iron to be railroad rails, 8'6" long, 50-100 lbs. per yard. An acceptable alternate is 4" iron pipe, 8'6" long, concrete filled.
2. Barriers on sides not accessible to vehicles may be omitted.
3. All materials and labor for protective barrier rail installation shall be provided by customer.
4. Customer is encouraged to paint barrier rails with yellow street marking lacquer.

CAUTION: INSTALLATION OF BARRIER RAILS MUST BE COORDINATED WITH ELECTRICAL CONDUIT INSTALLATION TO AVOID MUTUAL INTERFERENCE.



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