INSTITUTE OF INTEGRATED ELECTRICAL ENGINEERS
OF THE PHILIPPINES, INC.

PRC Cert. No. I-APO-016

CEBU CHAPTER

SERVICE ENTRANCE FACILITIES

SPEAKER:

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IIEE Cebu Chapter

SERVICE ENTRANCE FACILITIES

I.GENERAL

230.2 NUMBER OF SERVICES

A building or the other structure served shall be supplied by the only one service unless permitted in 230.40, Exception No.2 only, ***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 supplying one service.*

SERVICE ENTRANCE FACILITIES

GENERAL

➢A. Special Conditions

- Additional service shall be permitted to the following:

1. ***Fire pumps***
2. ***Emergency systems***
3. ***Legally required standby systems***
4. ***Optional standby systems***
5. ***Parallel power production systems***
6. ***System designed for the connection to multiple sources of supply for the purpose of enhanced reliability***

SERVICE ENTRANCE FACILITIES

GENERAL

- **B. Special Occupancies**

  By special permission, additional services shall be permitted for either of the following:

  1. ***Multiple-occupancy buildings where there is no available space for service equipment accessible to all occupants.***

  2. ***A single building or other structure sufficiently large to make two or more services necessary***

SERVICE ENTRANCE FACILITIES

GENERAL

➢C. Capacity Requirements

Additional services shall be permitted under any of the following:

1. ***Where the capacity requirements are in the excess of 2000 amperes at a supply voltage of 600 volts or less***

2. ***Where the load requirements of a single-phase installation are greater than the serving agency normally supplies through one's service.***

3. ***By special permission***

SERVICE ENTRANCE FACILITIES

GENERAL

- **D. Different characteristics**
  - Additional service shall be permitted for

    1. ***Different voltages***
    2. ***Different frequencies or phases*** or
    3. ***Different uses such as for different rate schedules.***

SERVICE ENTRANCE FACILITIES

GENERAL

➢ E. Identification

Where a building or structure is supplied by more than one service, or any combination of branch circuits, feeders, and services, ***a permanent plaque or directory shall be installed*** at ***each service disconnect location denoting all services, feeders, and branch circuits*** supplying that building or structure and the area served by each.

SERVICE ENTRANCE FACILITIES

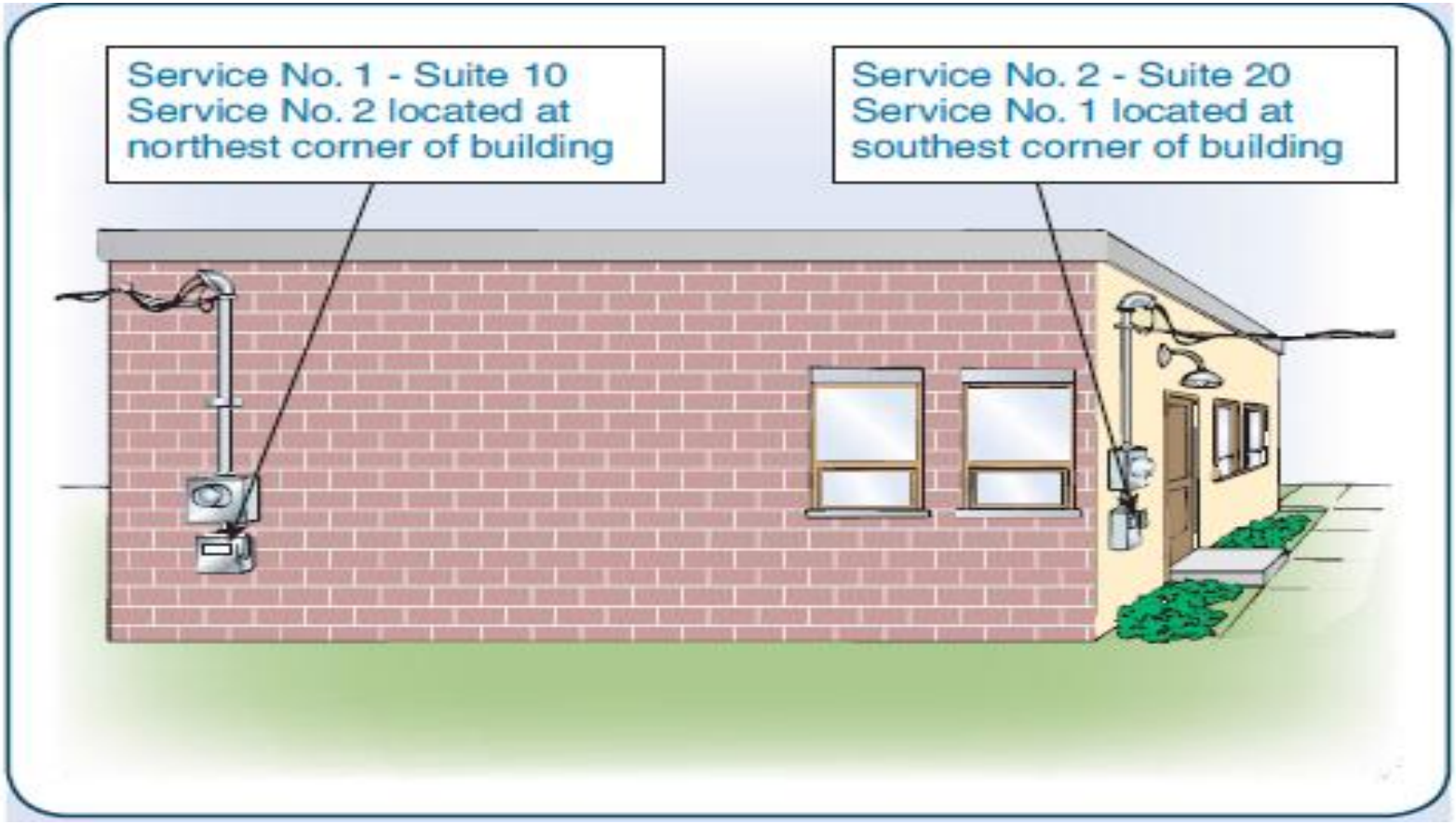


EXHIBIT 230.1 An example of two separate services installed at one building with permanent plaques or directories at each service disconnecting means location containing information describing all the other services and the area served by each.

SERVICE ENTRANCE FACILITIES

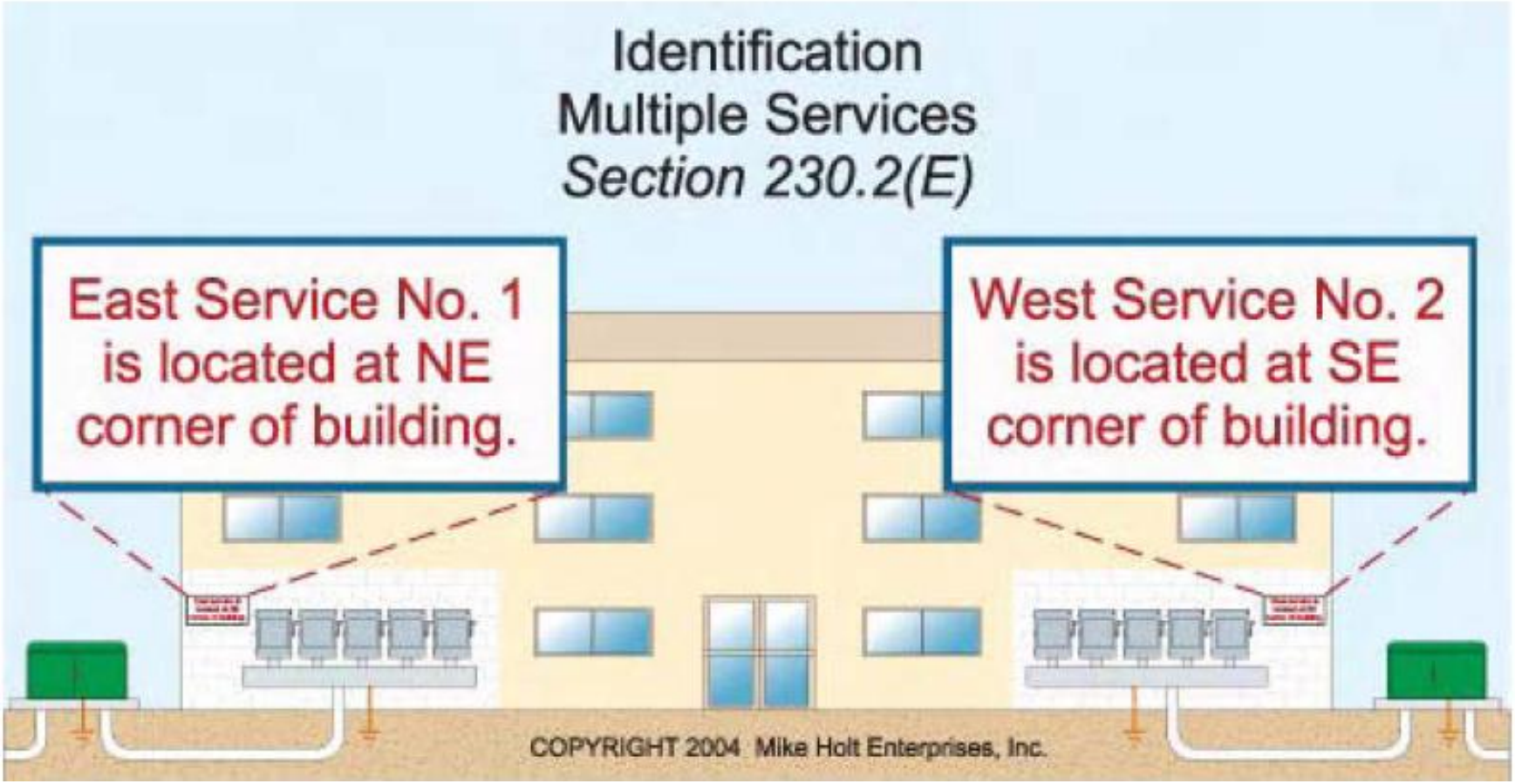


EXHIBIT 230.1 Another example of two separate services installed at one building

SERVICE ENTRANCE FACILITIES

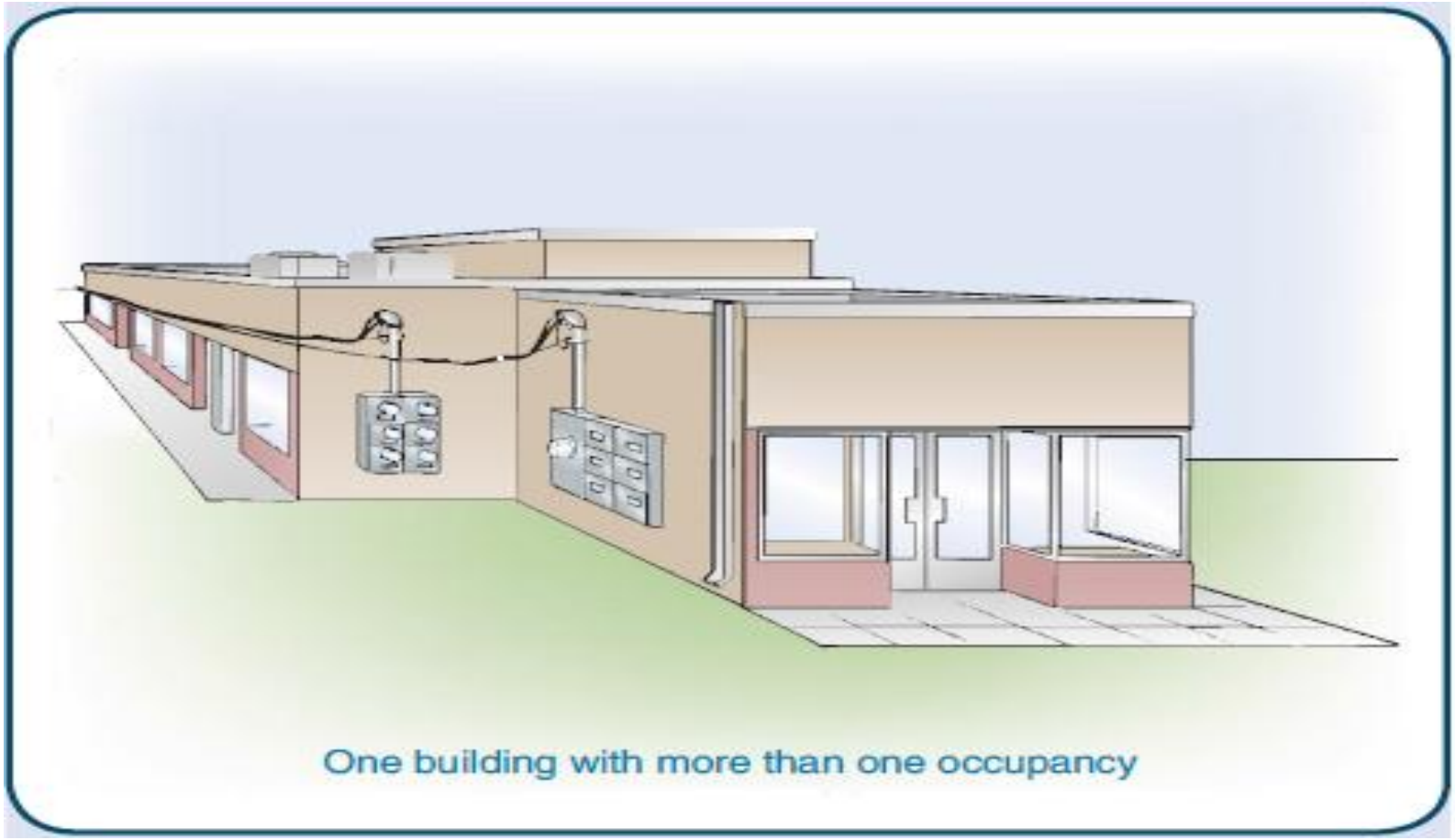
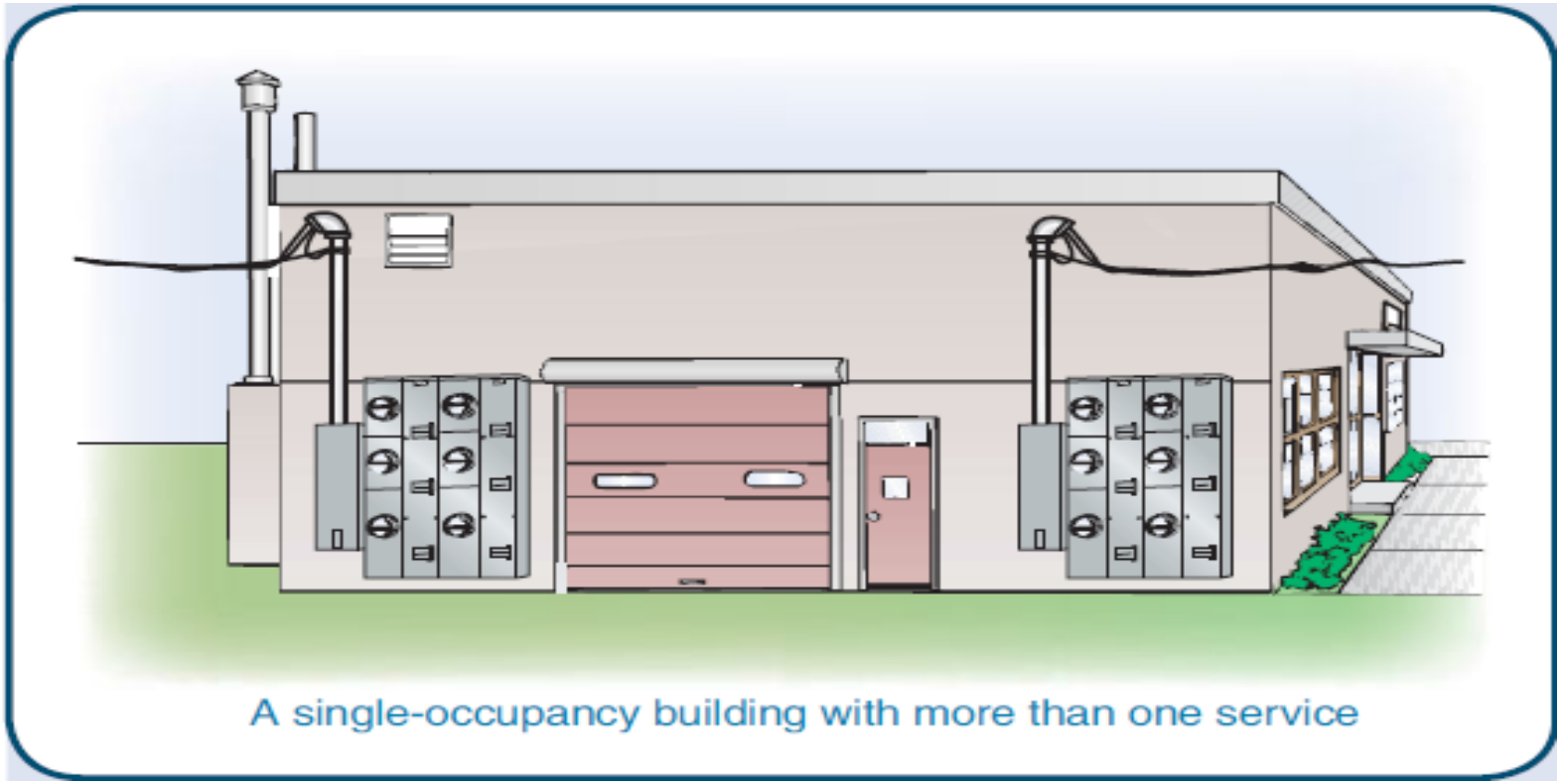


EXHIBIT 230.2 Two services per 230.2(B)(1) and 230.71(A). Two service drops or two sets of overhead service conductors supplying two services installed at separate locations for a building where there is no available space for service disconnecting means permitted for each service.

SERVICE ENTRANCE FACILITIES



A single-occupancy building with more than one service

EXHIBIT 230.3 Two services per 230.2(C)(1) and 230.71(A). Two service drops or two sets of overhead service conductors supplying two services installed at separate locations for a building with capacity requirements exceeding 2000 amperes. Maximum of six services disconnecting means permitted for each services.

SERVICE ENTRANCE FACILITIES

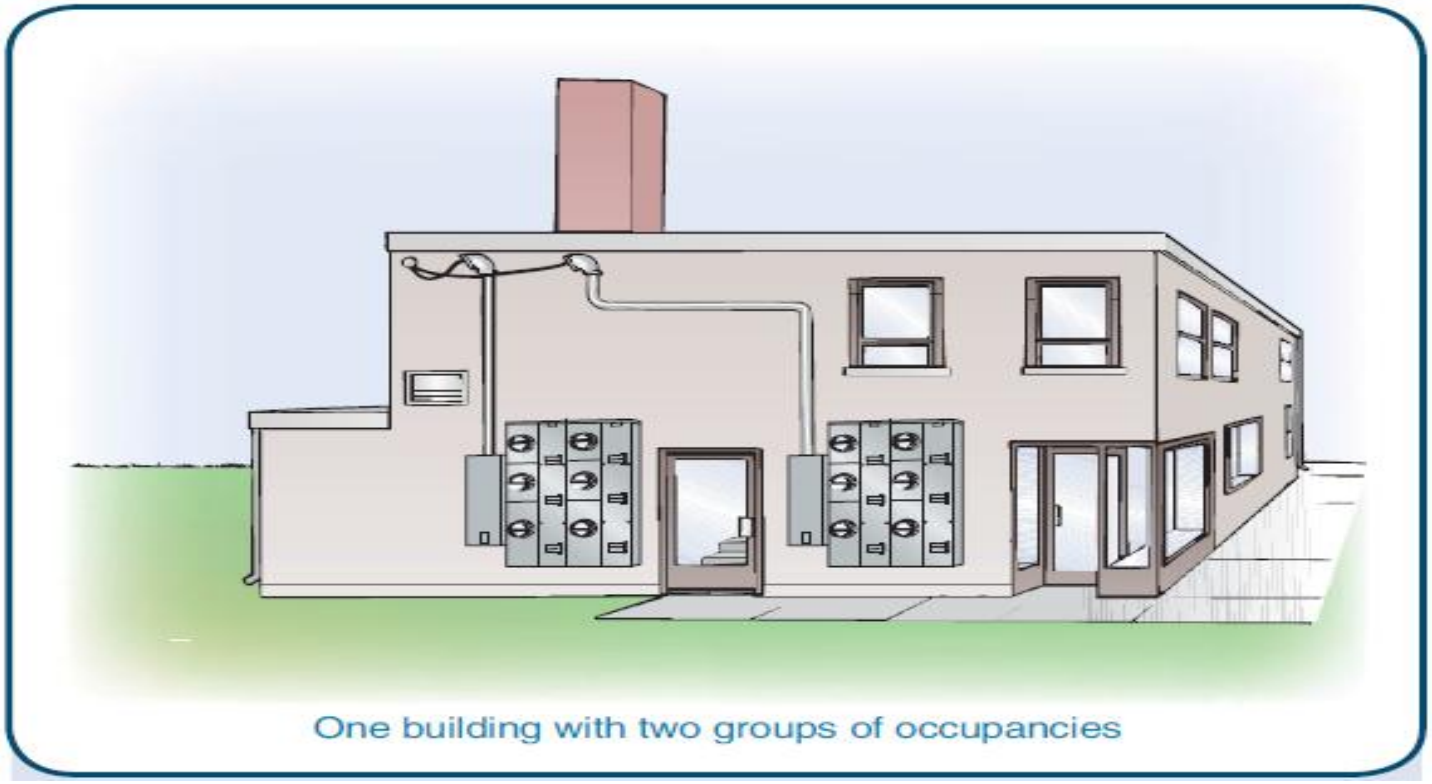


EXHIBIT 230.4 One service per 230.40, Exception No.1 and 230.71(A). One service drop or one set of overhead service conductors supplying two service equipment enclosures installed at separate locations ,each is permitted to have a maximum of six service disconnecting means.

SERVICE ENTRANCE FACILITIES

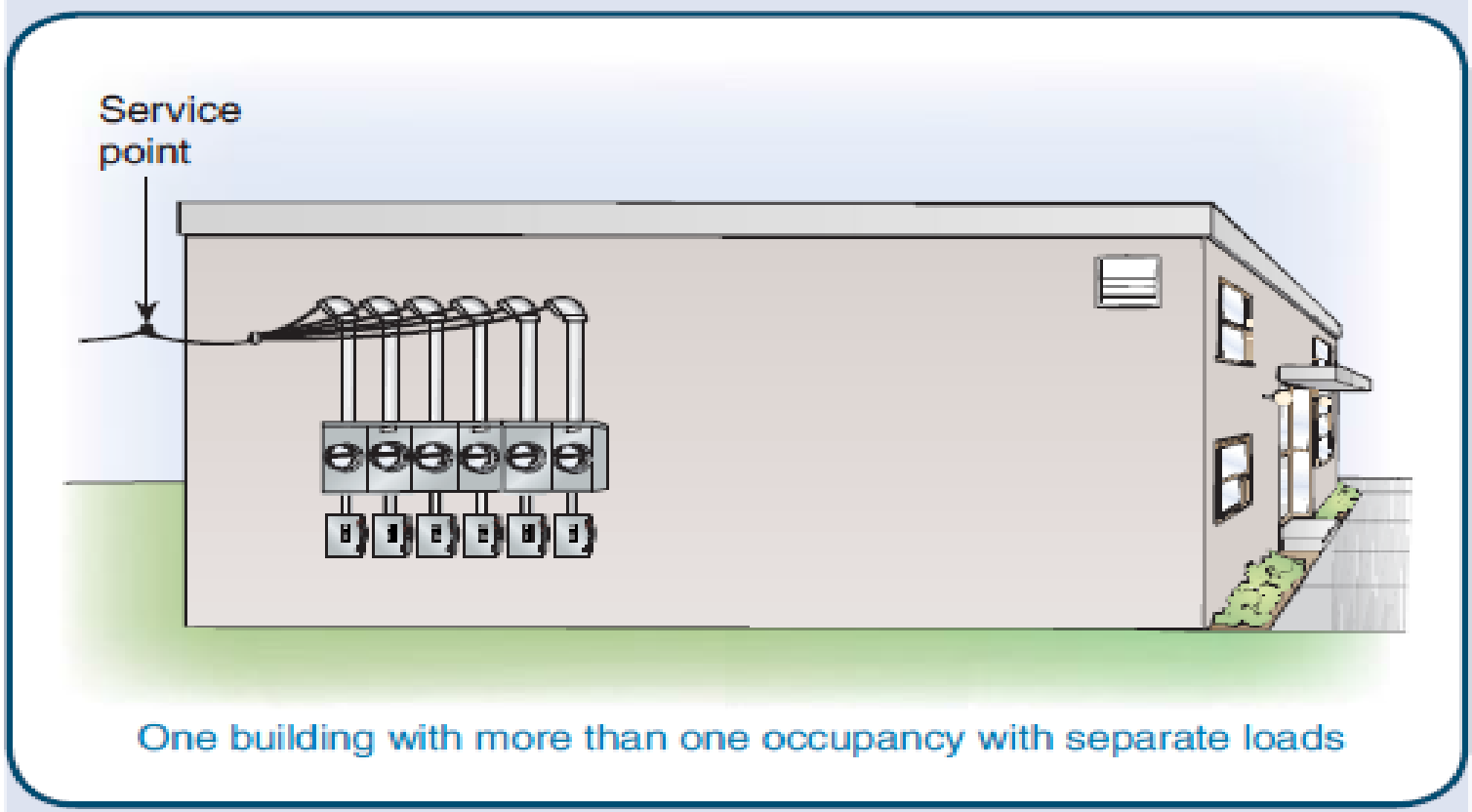


EXHIBIT 230.5 One service per 230.40, Exception No.2 and 230.71(A). One set of overhead service conductors supplying maximum of six separate service disconnecting means enclosures grouped at one location.

SERVICE ENTRANCE FACILITIES

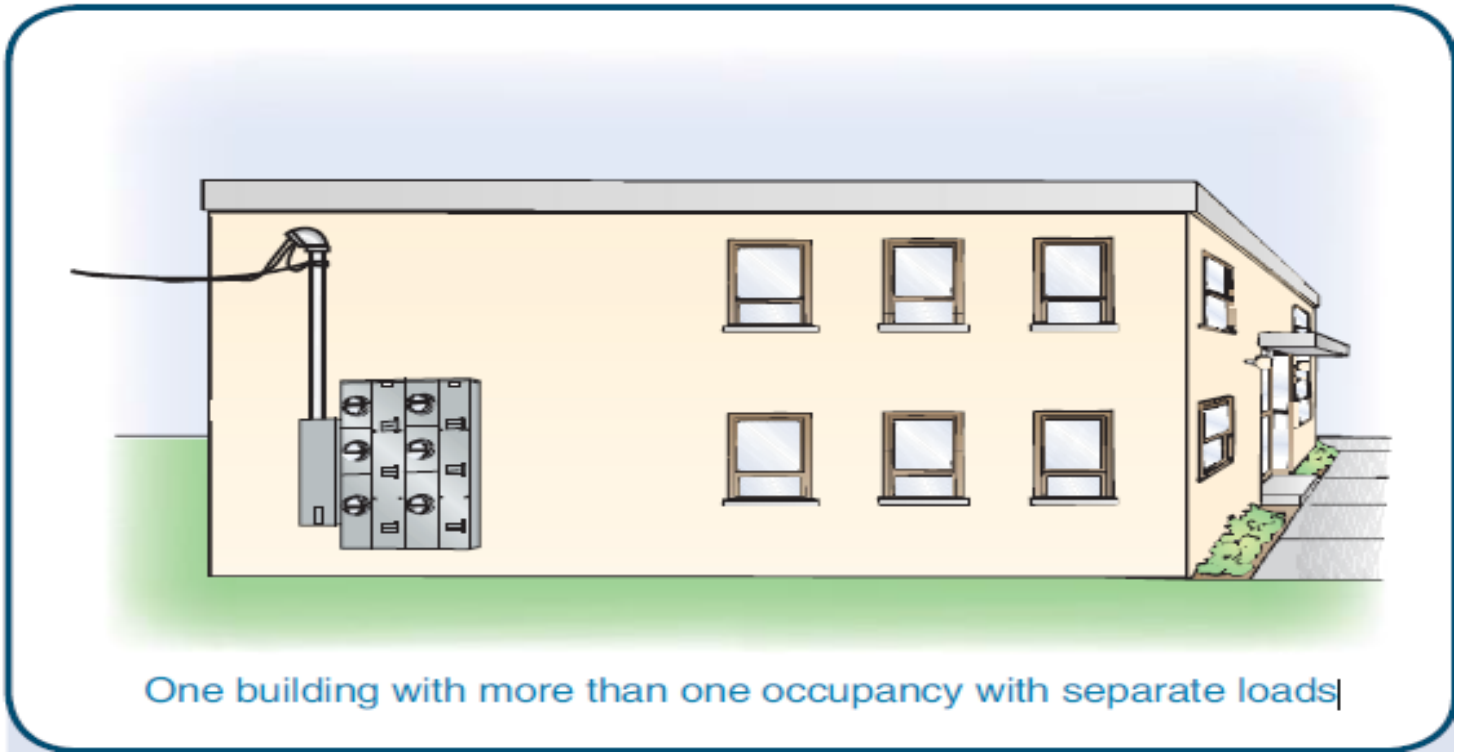


EXHIBIT 230.6 One service per 230.2and 230.71(A). One service drop or one set of overhead service conductors supplying a single service equipment enclosure with maximum of six service disconnecting means grouped at one location. Optional arrangement to that shown in Exhibit 230.5

SERVICE ENTRANCE FACILITIES

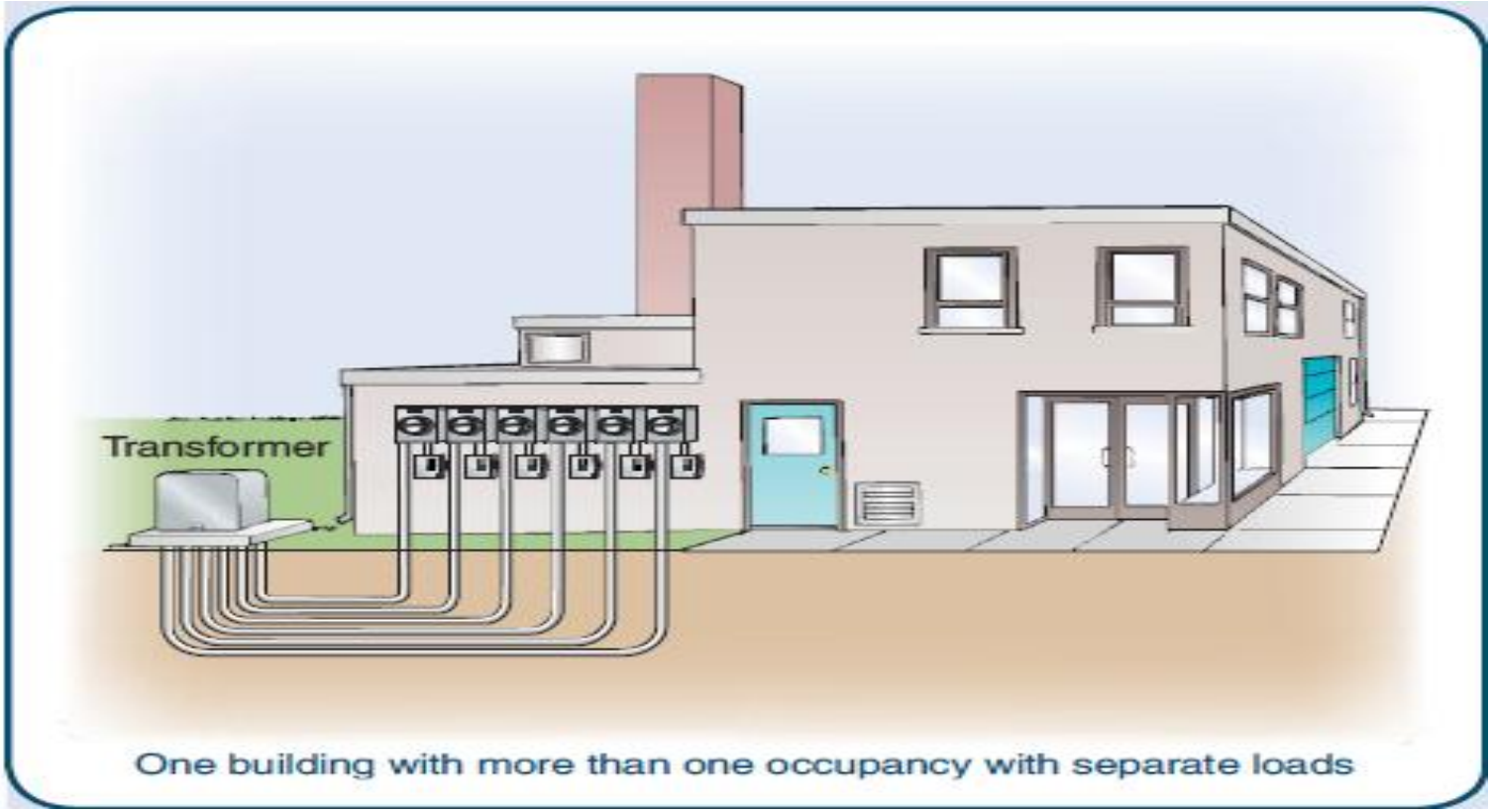


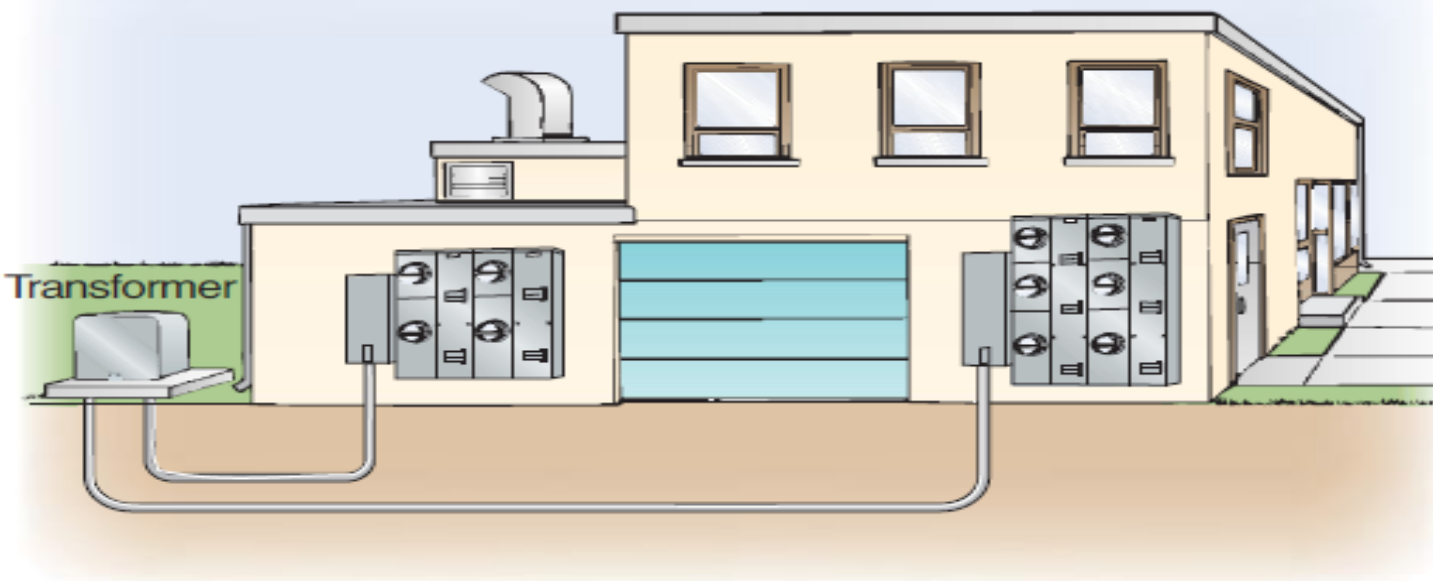
EXHIBIT 230.7 One service per 230.2,230.40, Exception No.2 and 230.71(A). One service lateral or one set of underground service conductors consisting of six sets of conductor 1/0 AWG or larger, terminating in six separate service equipment enclosures for a maximum of six service disconnecting means grouped in that one location.

SERVICE ENTRANCE FACILITIES

230.3 One Building or Other Structure not to Be Supplied Through Another

- **Service conductors supplying a building or other structure shall not pass through the interior of another building or other structure.**

SERVICE ENTRANCE FACILITIES



One building with more than one occupancy with separate loads

EXHIBIT 230.8 Two services per 230.2(B)(1) and 230.71(A). Two service laterals or two sets of underground service conductors, terminating in two service equipment enclosures installed at separate locations, with each enclosure permitted to have a maximum of six service disconnecting means.

SERVICE ENTRANCE FACILITIES

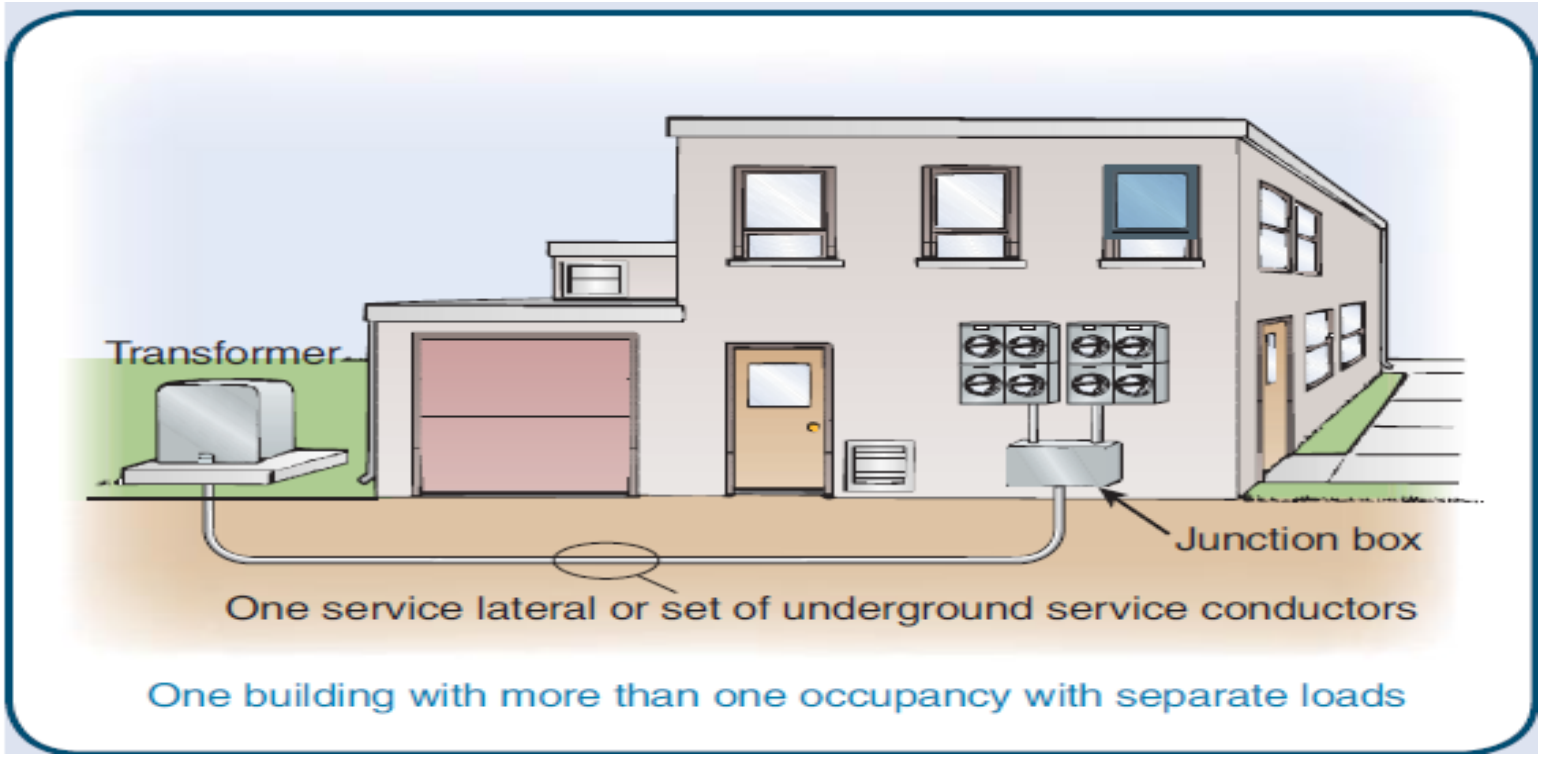


EXHIBIT 230.9 One services per 230.40, Exception No.1 and 230.71(A). One service lateral or sets of underground service conductors supplying two sets of service-entrance conductors terminating in two service equipment enclosures grouped in on location. The combines number of service disconnecting means in the enclosures cannot exceed six.

SERVICE ENTRANCE FACILITIES

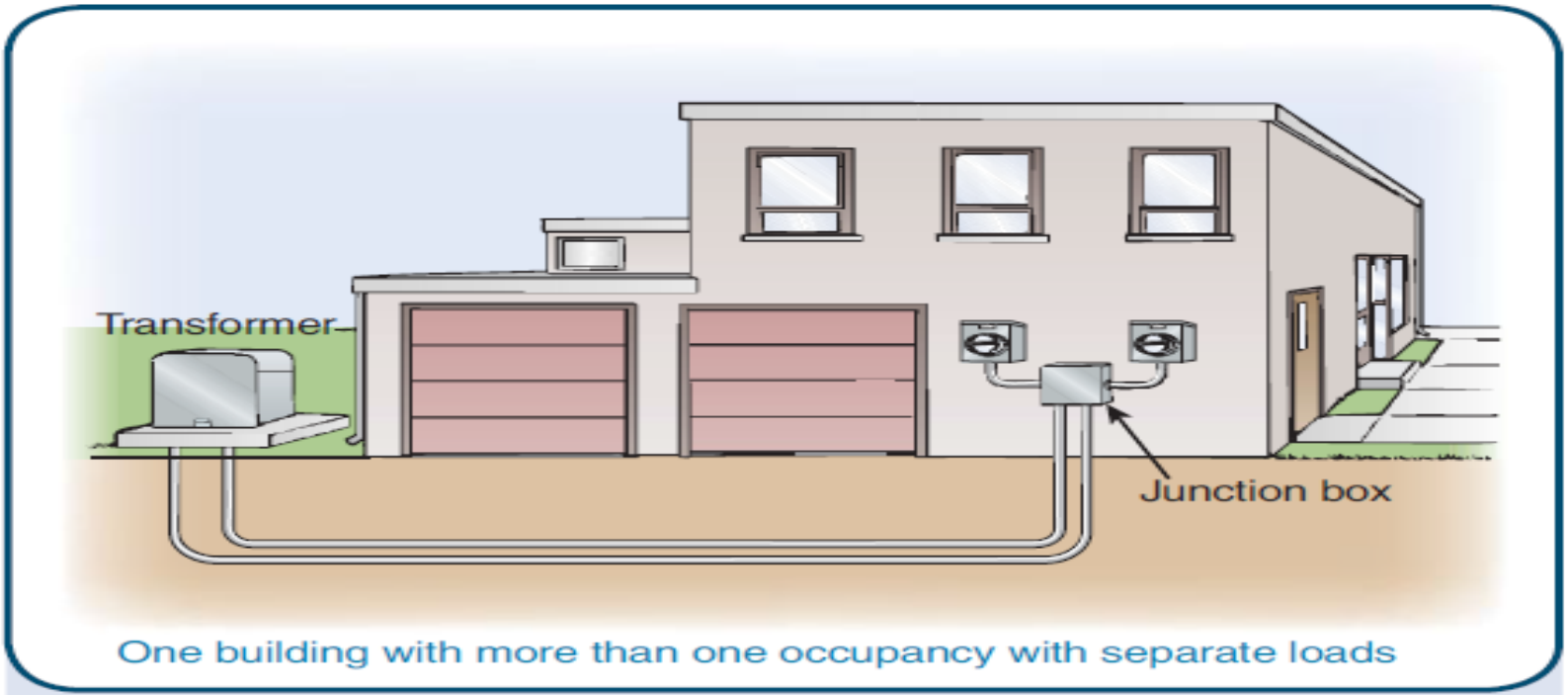


EXHIBIT 230.10 One service per 230.2, 230.40, Exception No.2 and 230.71(A). Two service laterals or two sets of underground service conductors, each consisting conductors 1/0 AWG or larger, supplying two sets of service-entrance conductors terminating in two service equipment enclosures grouped in one location. The combines number of service disconnecting means in two enclosures cannot exceed six.

SERVICE ENTRANCE FACILITIES

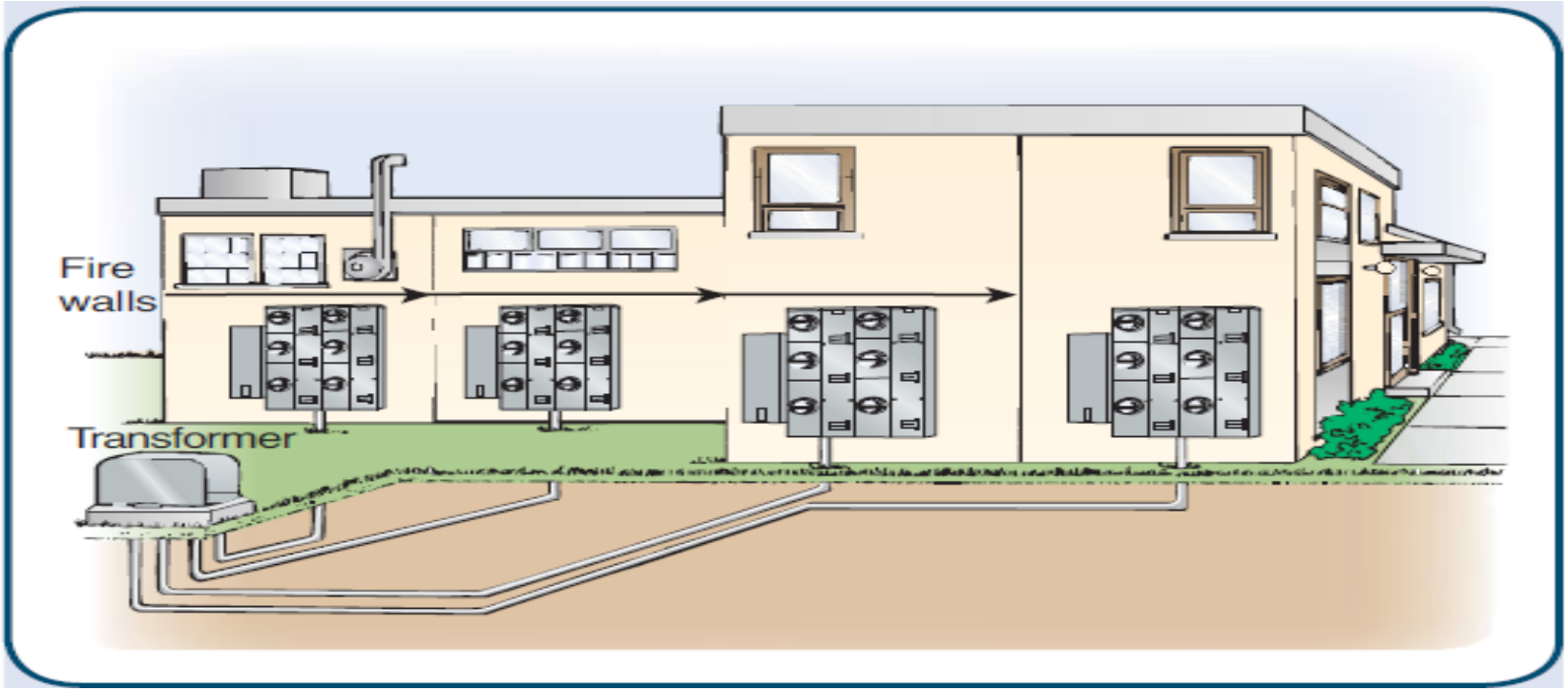


EXHIBIT 230.11 Four services per 230.2 and Article 100 definition of building. Four service laterals or four sets of underground service conductors supplying four service equipment enclosures installed at separate locations on a contiguous structure, each enclosure is permitted to have a maximum of six service disconnecting means. Note presence of firewalls. See definition of building in article 100.

SERVICE ENTRANCE FACILITIES

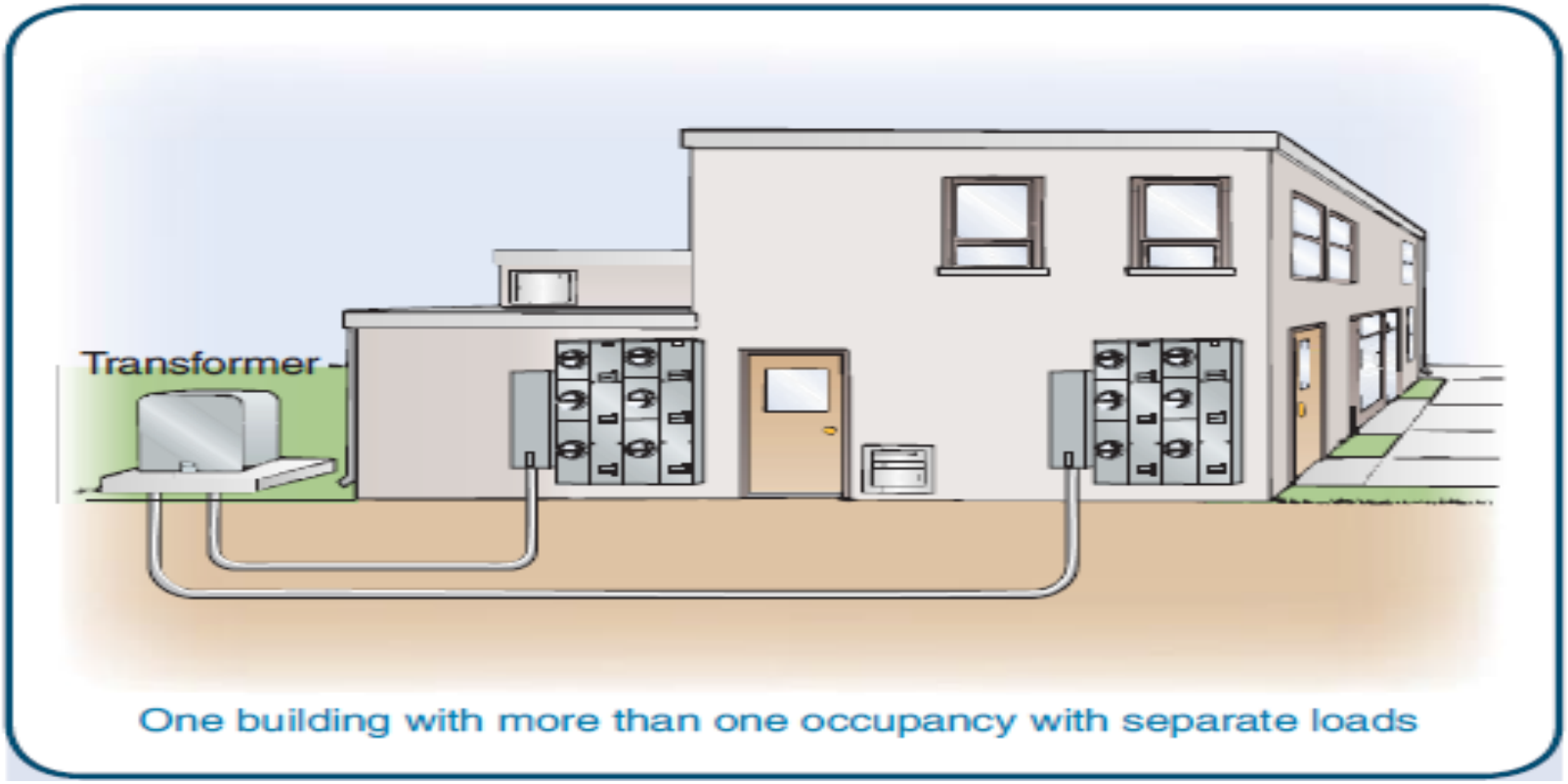


EXHIBIT 230.12 Two services per 230.40, Exception No.1 and 230.71(A). Two service laterals or two service equipment enclosures installed at separate locations, each enclosure is permitted to have maximum of six service disconnecting means.

SERVICE ENTRANCE FACILITIES

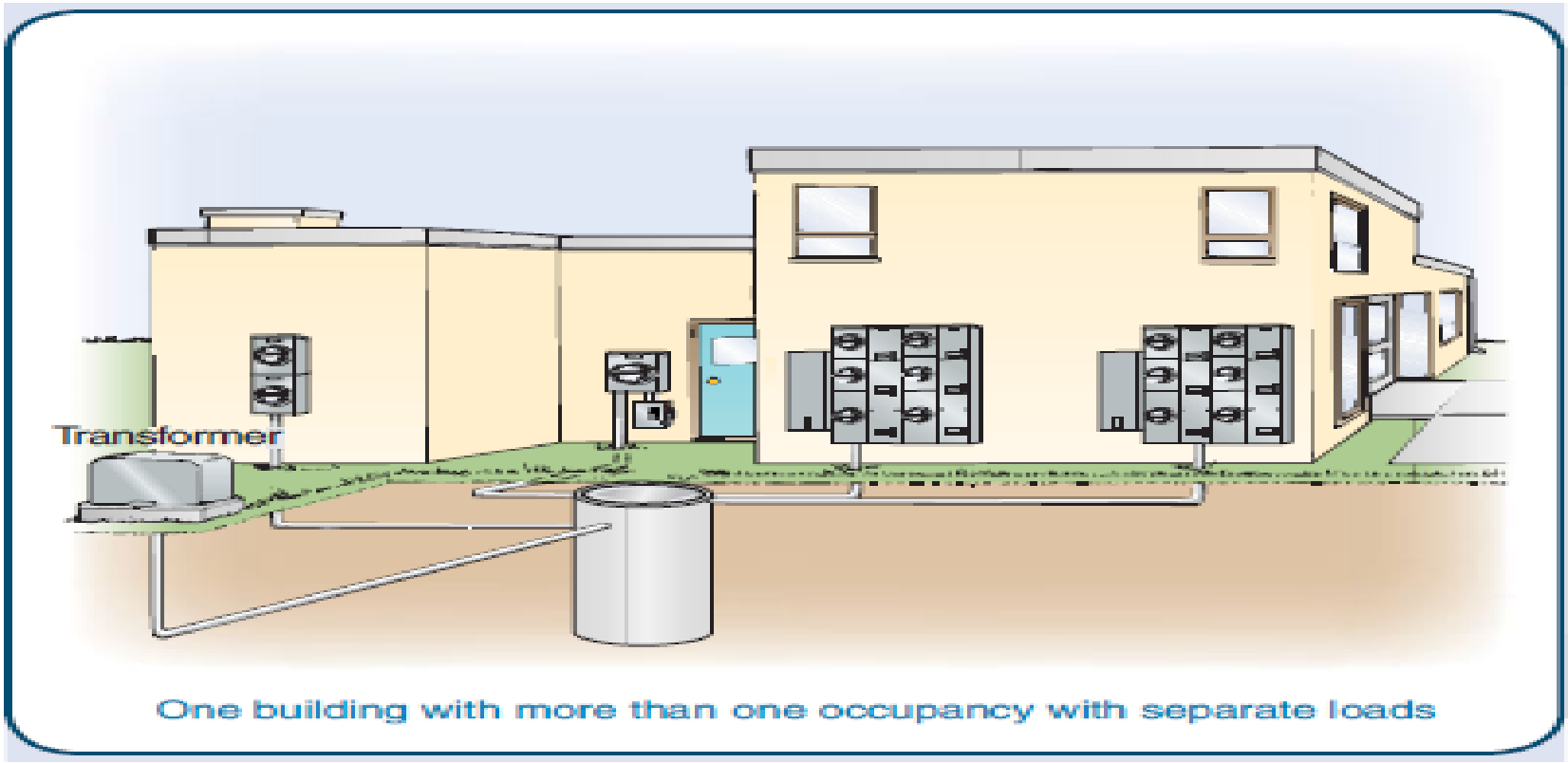


EXHIBIT 230.13 One service per 230.40, Exception no.1 and 230.71(A). One service lateral or one set of underground service conductors supplying four service equipment enclosures installed at different locations, with each enclosure permitted to have a maximum of six service disconnecting means.

SERVICE ENTRANCE FACILITIES

230.6 Conductors Considered Outside the Building

Conductors shall be considered outside of a building or other structure under any of the following conditions:

1) ***Where installed under not less than 50mm (2 in.) of concrete beneath a building or other structure***

2) ***Where installed within a building or other structure in a raceway that is encased in concrete or brick not less than 50mm (2in.) thick***

SERVICE ENTRANCE FACILITIES

230.6 Conductors Considered Outside the Building

3) Where installed in any vault that meets the construction requirements of article 450, PART 3

4) Where installed in conduit and under not less than 450mm (18 in.) of earth beneath a building or other structure

5) Where installed in overhead service masts on the outside surface of the building traveling through the eave if that building to meet the requirements of 230.24

SERVICE ENTRANCE FACILITIES

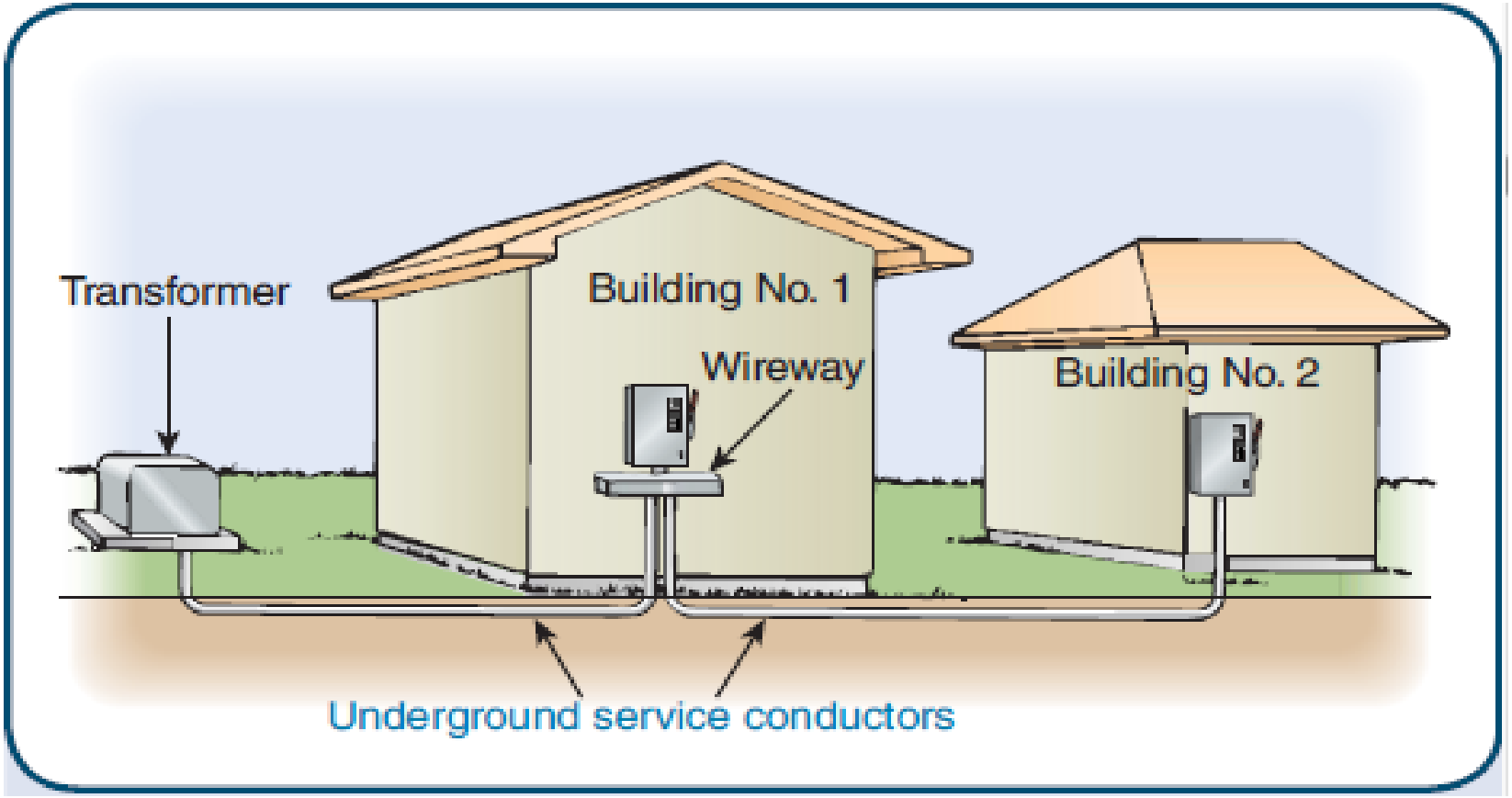


EXHIBIT 230.14 Service conductors installed in accordance with 230.3 so as not to pass through the interior of building No.1 to supply Building No.2.

SERVICE ENTRANCE FACILITIES

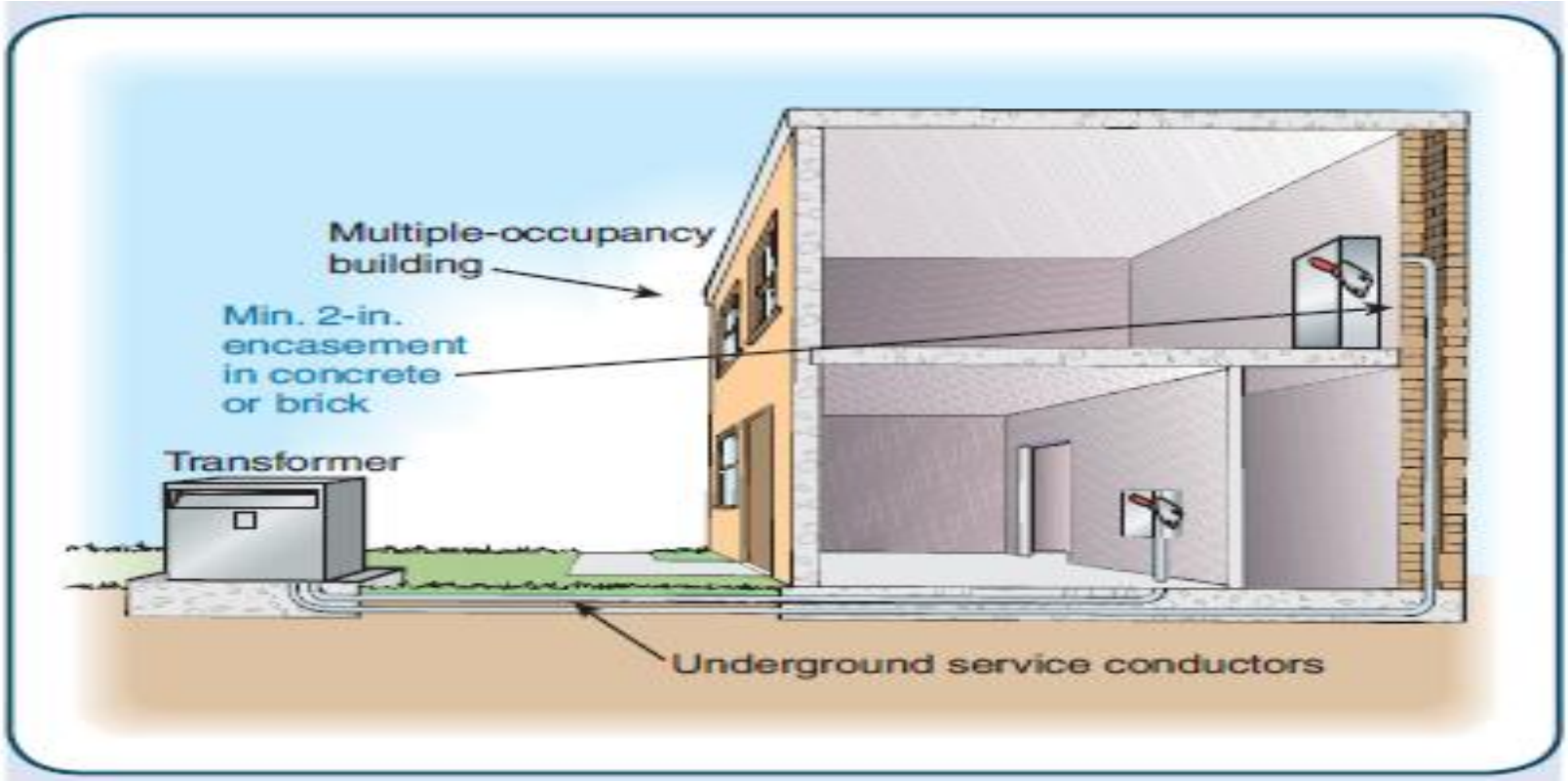


EXHIBIT 230.15 Service conductors considered outside a building where installed under not less than 2in. Of concrete beneath the building or in a raceway encased by the building or in a raceway encased by not less than 2 in. of concrete or brick within the building

SERVICE ENTRANCE FACILITIES

230.7 Other Conductors in Raceway or Cable

Conductors other than service conductors shall not be installed in the same service raceway or service cable.

Exception No.1 : Grounding conductors and bonding jumpers.

Exception No. 2: Load management control conductors having overcurrent protection.

SERVICE ENTRANCE FACILITIES

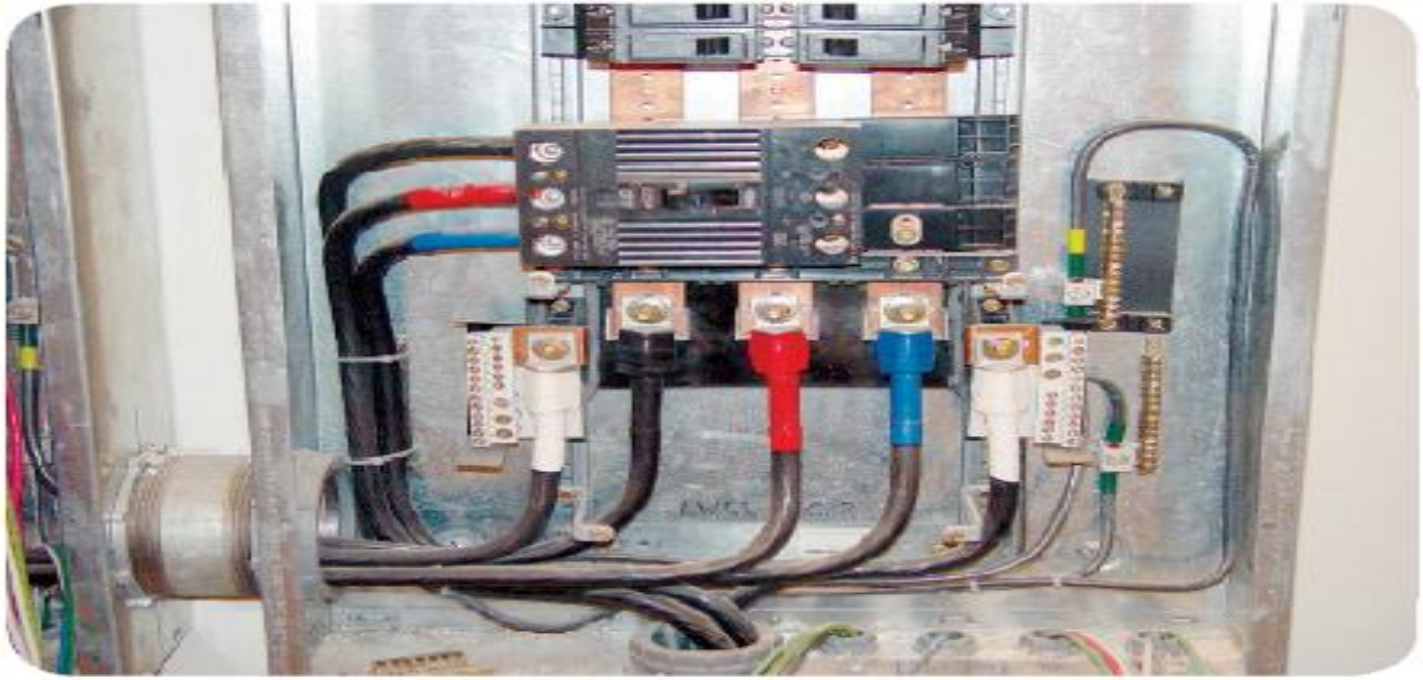


EXHIBIT 230.16 *A panelboard cabinet gutter space accommodating a set of service conductors terminating on the 200 ampere main breaker, a set of feeder conductors supplying the adjacent panelboard, and several sets of branch-circuit conductors entering the bottom of the cabinet that will connect to overcurrent protective devices installed on the panelboard. (Courtesy of the International Association of Electrical Inspectors)*

SERVICE ENTRANCE FACILITIES

230.8 RACEWAY SEAL

- ***Where a service raceway enters a building or structure from an underground distribution system, it shall be sealed in accordance with 300.5(G). Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, shield ,or other components.***

SERVICE ENTRANCE FACILITIES

230.9 Clearances on Buildings

Service conductors and final spans shall comply with *230.9(A),(B),and (C).*

A. ***Clearances*.** Service conductors installed as open conductors or multiconductor cable without an overall outer jacket shall have a ***clearance of not less than 900mm (3ft) from windows*** that are design to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the **900-mm(3ft) requirement***

SERVICE ENTRANCE FACILITIES

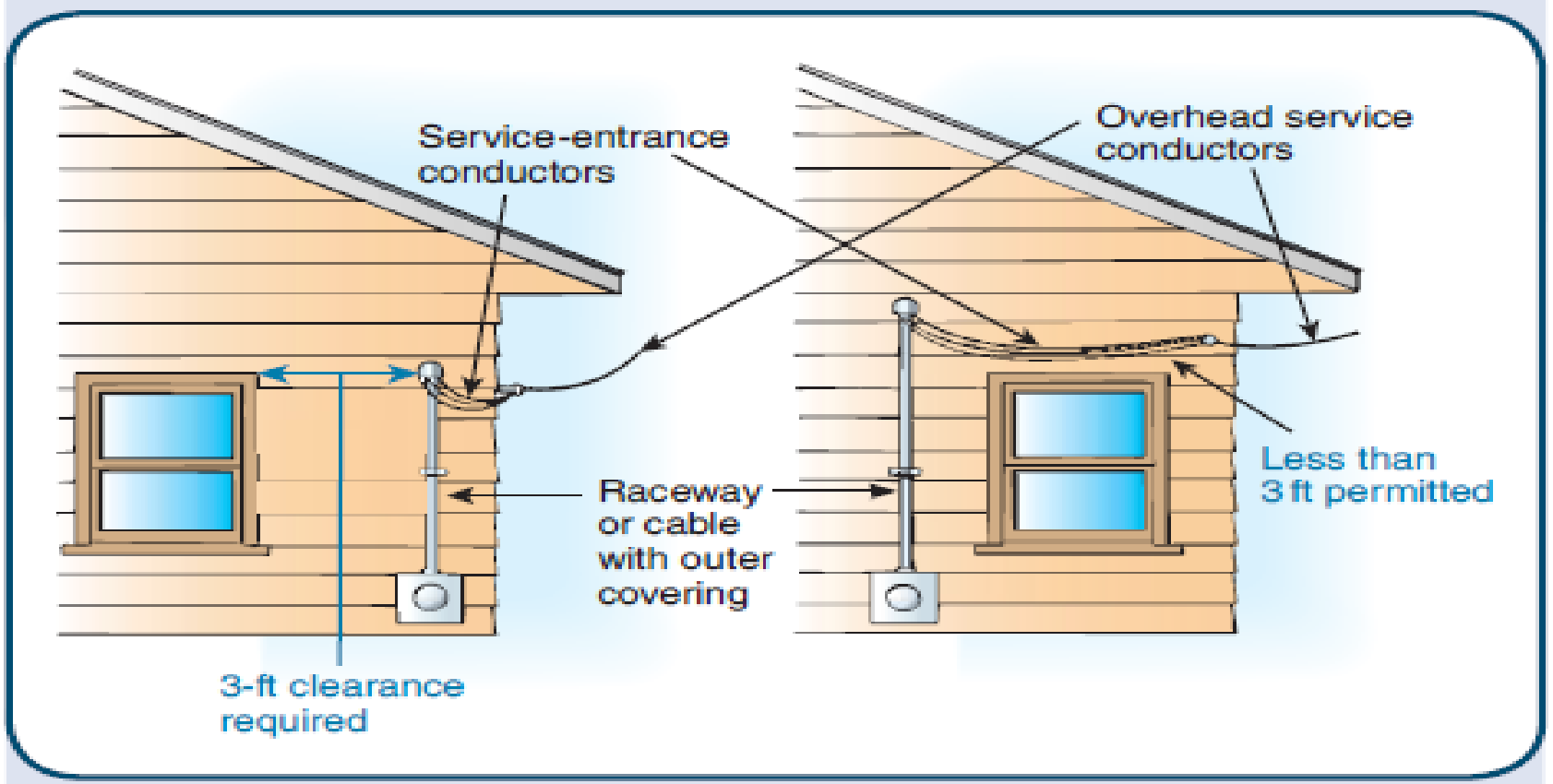


EXHIBIT 230.17 *Required dimensions for service conductors located alongside a window (left) and overhead service conductors above the top level of a window designed to be opened (right).*

SERVICE ENTRANCE FACILITIES

230.9 Clearances on Buildings

***B. Vertical Clearance*.**

The vertical clearance of final spans above, or ***within 900mm (3ft) measured horizontally*** of, platform, projections, or surfaces from which they might be reached shall be maintained in accordance with 230.24(B)

SERVICE ENTRANCE FACILITIES

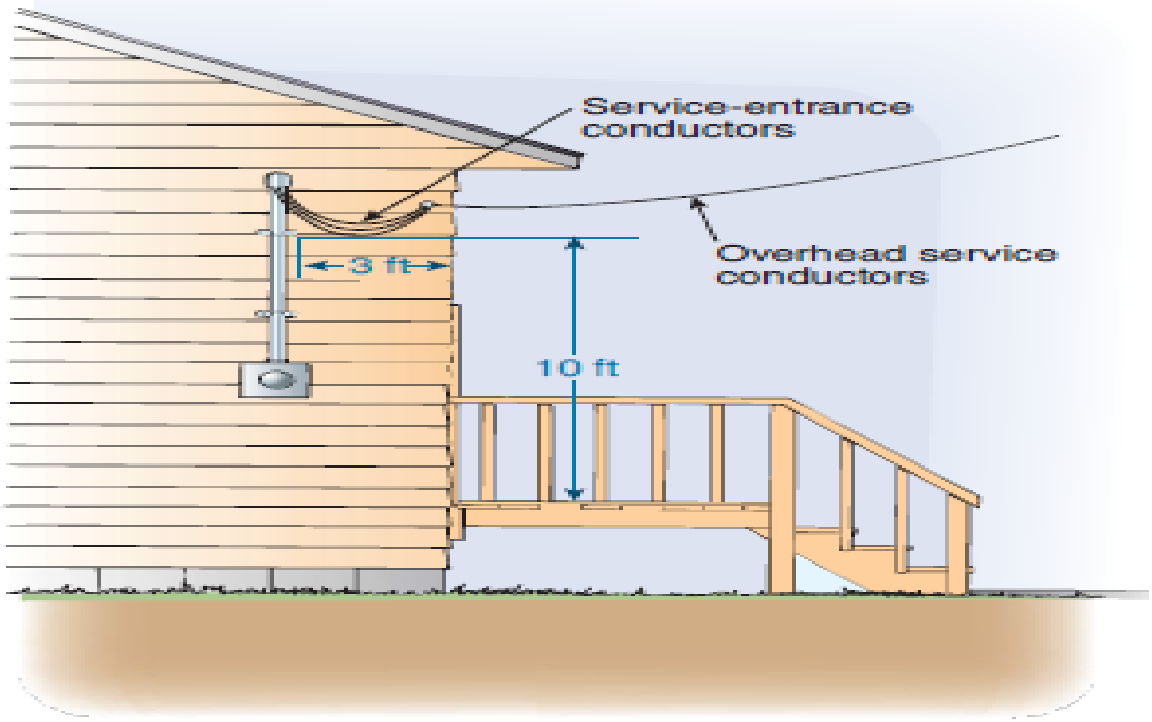


EXHIBIT 230.18 *Required dimensions for service conductors located above a stair landing, according to 230.9(B) and 230.24(B).*

SERVICE ENTRANCE FACILITIES

230.9 Clearances on Buildings

***C. Building Openings*.**

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

SERVICE ENTRANCE FACILITIES

230.10 VEGETATION AS SUPPORT

- **Vegetation such as trees shall not be used for support of overhead service conductors.**

SERVICE ENTRANCE FACILITIES

II.OVERHEAD SERVICE CONDUCTORS

SERVICE ENTRANCE FACILITIES

230.22 Insulation or Covering

- **Individual conductors shall be installed or covered.**

Exception: the grounded conductors of a multi-conductor cable shall be permitted to be bare

SERVICE ENTRANCE FACILITIES

230.23 SIZE AND RATING

A. **General**. Conductors shall have sufficient ampacity to carry the current for the load as calculated in accordance with article 220 and shall have adequate mechanical strength.

B. **Minimum Size**. The conductors shall not be smaller than ***8 AWG or 6 AWG aluminum or copper-clad aluminum***

Exception: ***Conductors supplying only limited loads of a single branch circuit-such as small polyphase power, controlled water heaters, and similar loads-shall not be smaller than 12 AWG hard-drawn copper or equivalent.***

C. **Grounded Conductors**. The grounded conductor shall not be less than the minimum size as required by ***250.24(C)***.

SERVICE ENTRANCE FACILITIES

230.24 CLEARANCES

- Overhead service conductors shall not be readily accessible and shall comply with ***230.21(A) through (E)*** for services not over 600 volts, nominal.

A. Above Roofs. Conductors shall have a vertical clearance of not less than **2.5 (8ft) above the roof surface** the vertical clearance above the roof level shall be maintained for a distance of not less than **900mm(3ft)** in all directions from the edge of the roof

Exception No.1: The area above a roof surface subject to pedestrian or vehicular traffic shall have a vertical clearance from the roof surface in accordance with the clearance requirements of 230.24(B).

SERVICE ENTRANCE FACILITIES

230.24 CLEARANCES

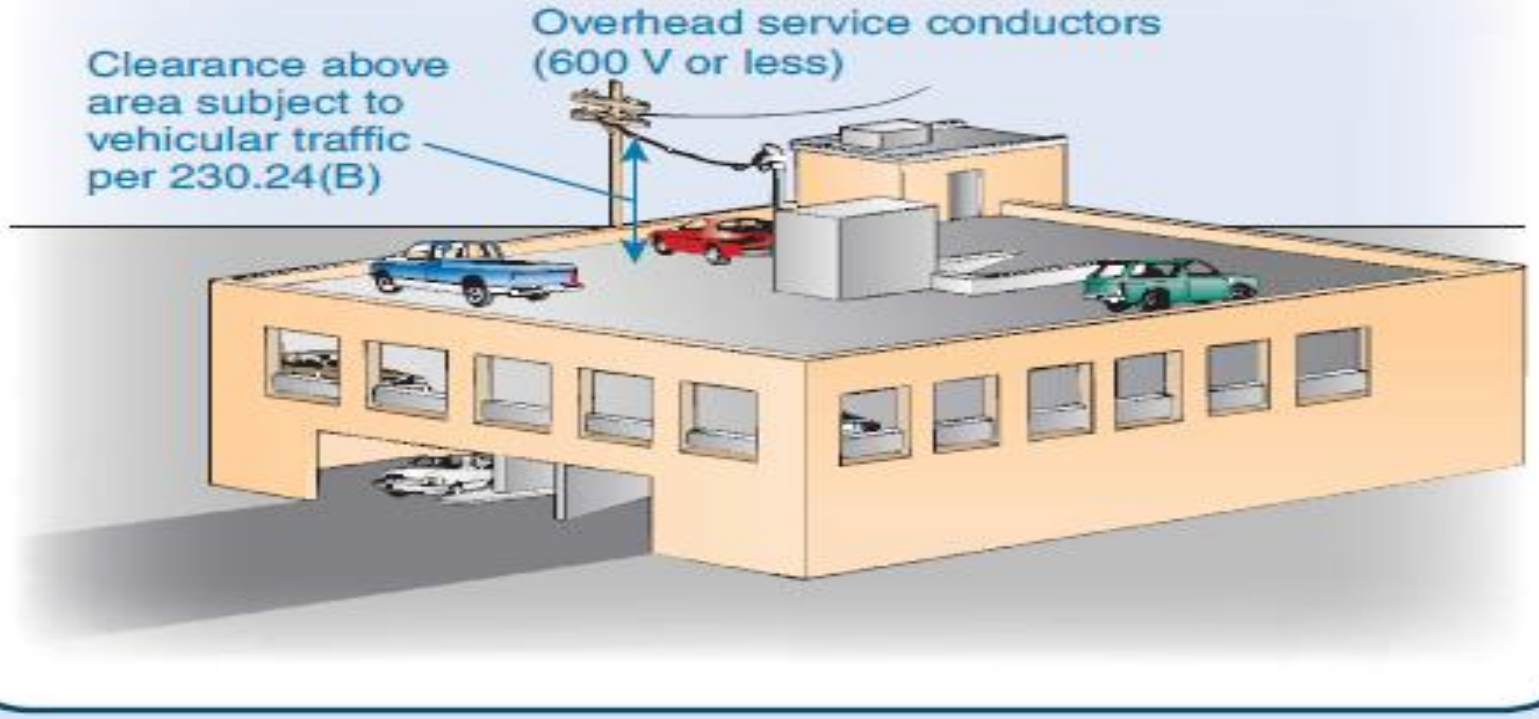


EXHIBIT 230.19 *Overhead service conductor clearance required by 230.24(A), Exception No. 1.*

SERVICE ENTRANCE FACILITIES

Exception No.2: Where the voltage between conductors ***does not exceed 300V*** *and the roof has* ***a slope of 100 mm in 300mm (4 in. in 12 in.) or greater****, a reduction in clearance to* ***900mm (3ft)****shall be permitted.*

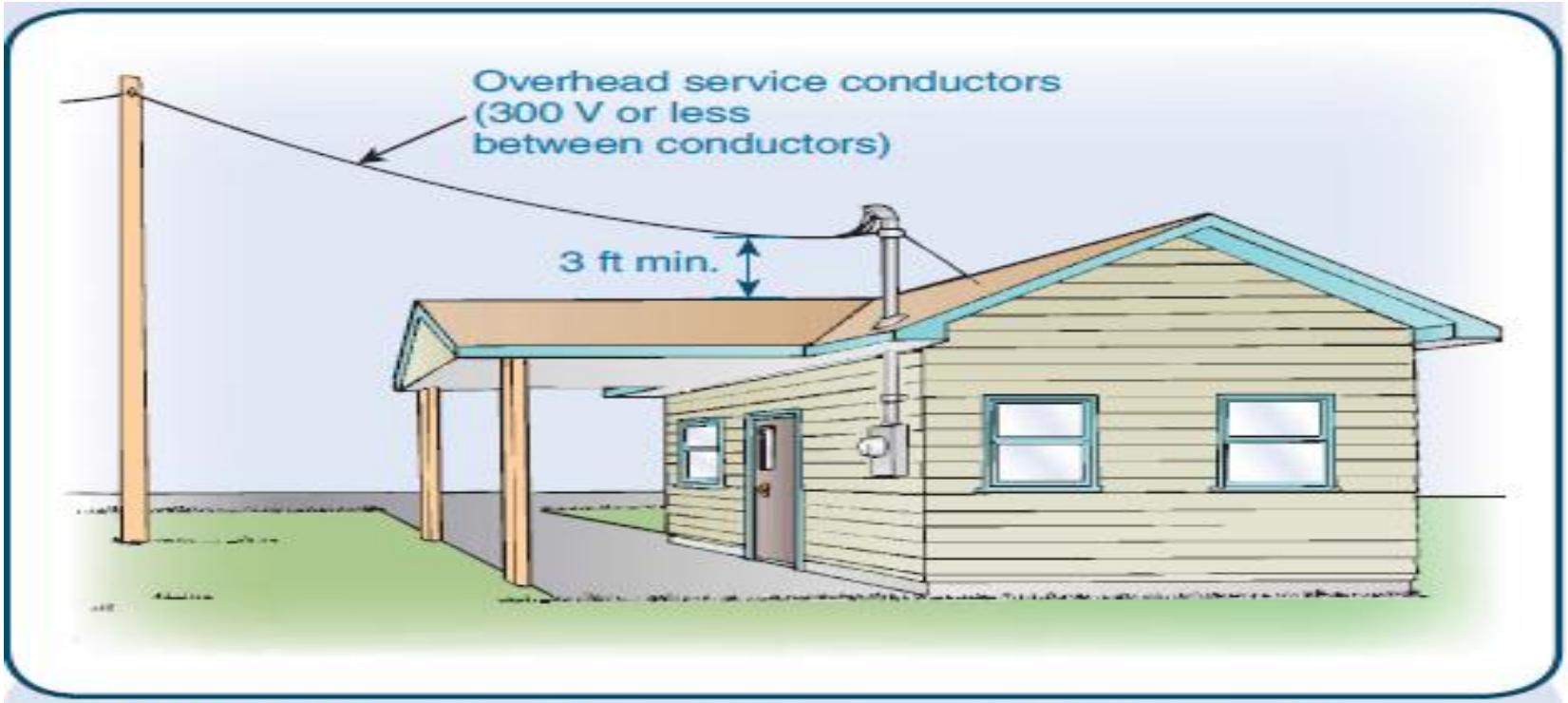


EXHIBIT 230.20 *Reduction in clearance above a roof as permitted by 230.24(A), Exception No. 2.*

SERVICE ENTRANCE FACILITIES

Exception No.3: Where the voltage between conductors does not exceed 300V, a reduction in clearance above only the overhanging portion of the roof to ***not less than 450mm (18in.)*** *shall be permitted if (1) not more than* ***1.8m (6ft)*** *of overhead service conductros,* ***1.2m (4ft) horizontally****, pass above the roof overhang, and (2)they are* ***terminated at a through-the-roof raceway*** *or approved support.*

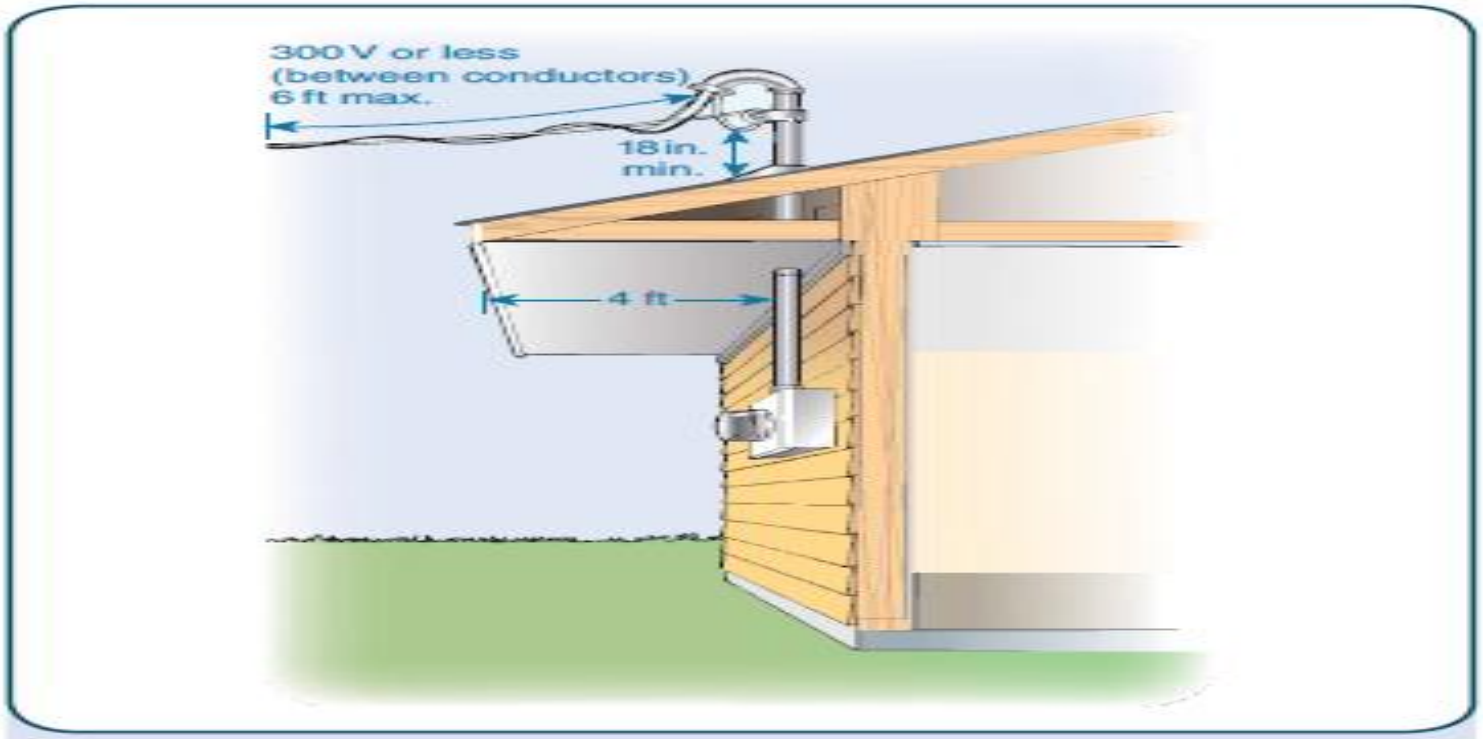


EXHIBIT 230.21 *Reduction in clearance above a roof as permitted by 230.24(A), Exception No. 3.*

SERVICE ENTRANCE FACILITIES

Exception No.4: The requirement for maintaining the vertical clearance 900mm(3ft) from the edge of the roof shall not apply to the final conductor span where the service drop is attached to the side of a building.

Exception No.5: Where the voltage between conductors does not exceed 300V and the roof area is guarded or isolated , a reduction in clearance to ***900mm (3ft)*** *shall be permitted.*

SERVICE ENTRANCE FACILITIES

B. Vertical Clearance for Overhead Service Conductors. Overhead service conductors, where not in excess of 600 volts , nominal , shall have the following minimum clearance from final grade:

1. **3.0m (10ft)**- at the electrical service entrance to buildings, also at the lowest point of the drip loop of the building electrical entrance, and above areas or sidewalks accessible only to pedestrians, measured from

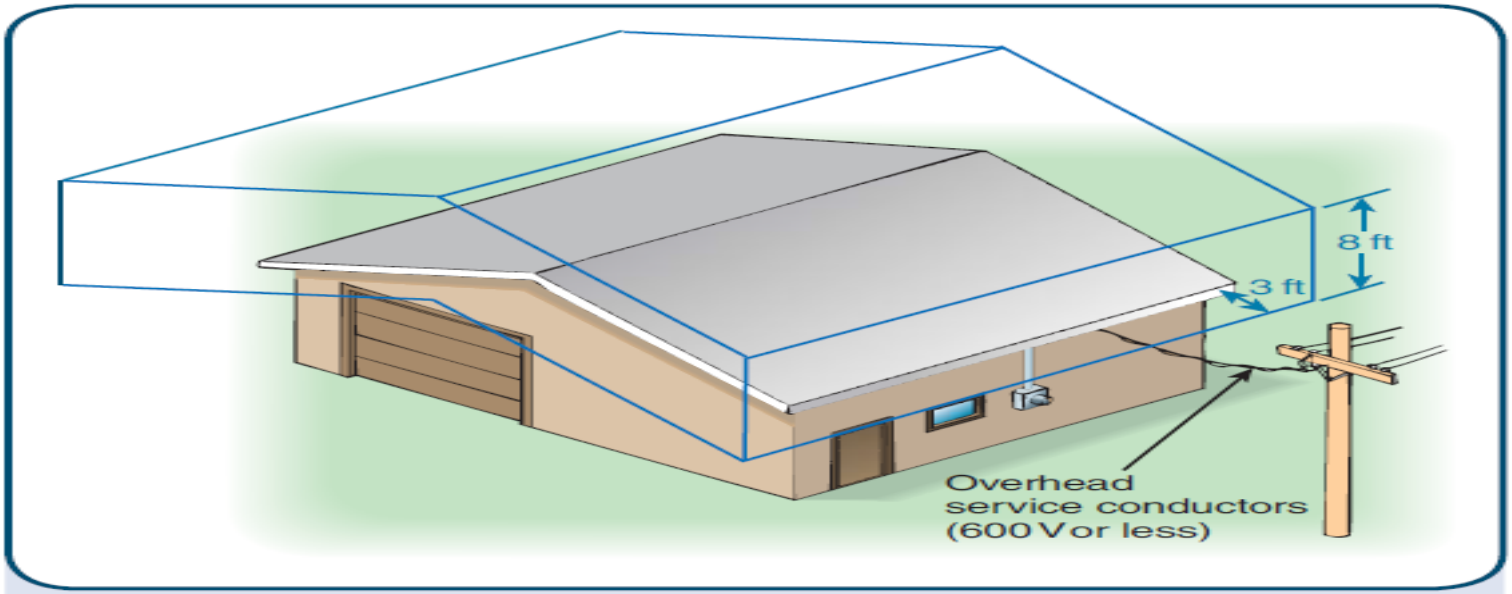


EXHIBIT 230.22 *Clearance of the final span of overhead service conductors, as permitted by 230.24(A), Exception No. 4.*

SERVICE ENTRANCE FACILITIES

2. **3.7m(12ft)** - over residential property and driveways , and those commercial areas not subject to truck traffic where the voltage does not exceed 300 volts to ground

3. **4.5m(15ft)** - for those areas listed in the **3.7-m(12ft)** classification where the voltage exceeds **300 volts** to ground

4. **5.5m(8ft)** - over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land such as cultivated, grazing, forest, and orchard

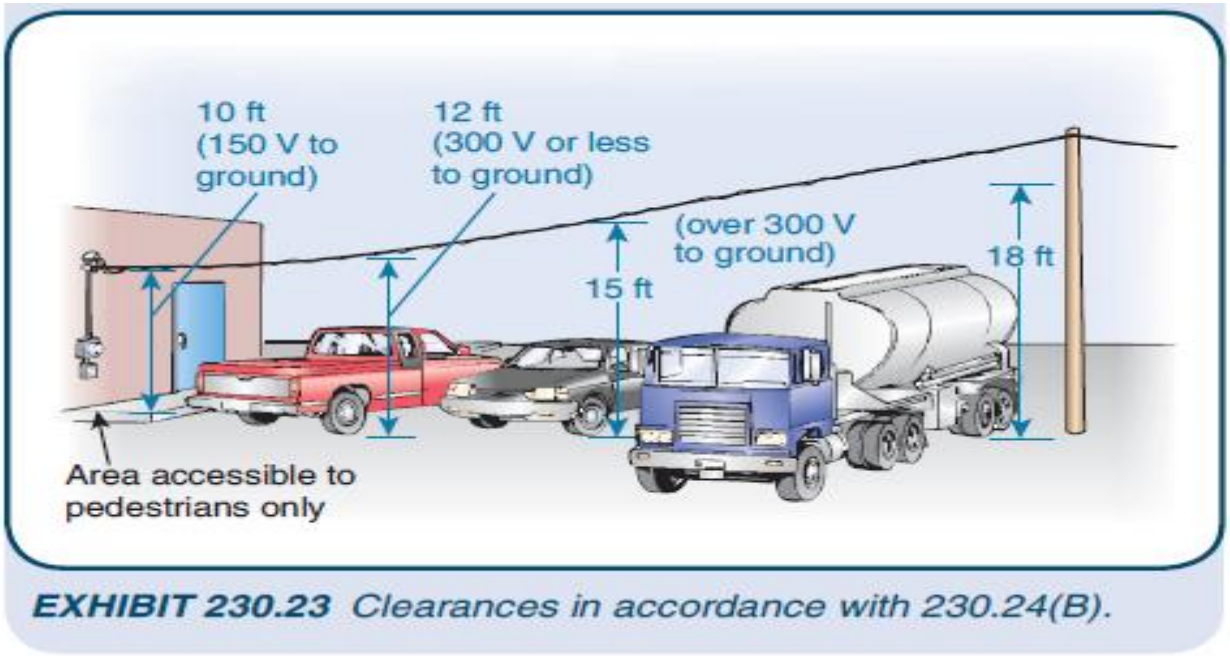


EXHIBIT 230.23 *Clearances in accordance with 230.24(B).*

SERVICE ENTRANCE FACILITIES

(C) Clearance from Building Openings. See 230.9.

(D) Clearance from Swimming Pools. See 680.8.

(E) Clearance from Communication Wires and Cables. Clearance from communication wires and cables shall be in accordance with 800.44(A)(4).

230.26 Point of Attachment

The point of attachment of the service-drop conductors to a building or other structure shall provide the minimum clearances as specified in 230.9 and 230.24. In no case shall this point of attachment be less than 3.0 m (10 ft) above finished grade.

SERVICE ENTRANCE FACILITIES

230.26 Point of Attachment

The point of attachment of the service-drop conductors to a building or other structure shall provide the minimum clearances as specified in 230.9 and 230.24. In no case shall this point of attachment be less than 3.0 m (10 ft) above finished grade.

230.27 Means of Attachment

Multiconductor cables used for overhead service conductors shall be attached to buildings or other structures by fittings identified for use with service conductors. Open conductors shall be attached to fittings identified for use with service conductors or to noncombustible, nonabsorbent insulators securely attached to the building or other structure.

SERVICE ENTRANCE FACILITIES

230.28 Service Masts as Supports

Where a service mast is used for the support of service-drop conductors, it shall be of adequate strength or be supported by braces or guys to withstand safely the strain imposed by the service drop. Where raceway-type service masts are used, all raceway fittings shall be identified for use with service masts. Only power service-drop conductors shall be permitted to be attached to a service mast.

230.29 Supports over Buildings

Service conductors passing over a roof shall be securely supported by substantial structures. Where practicable, such supports shall be independent of the building.

SERVICE ENTRANCE FACILITIES

III. Underground Service Conductors

SERVICE ENTRANCE FACILITIES

230.30 Insulation

Service-lateral conductors shall be insulated for the applied voltage.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) Bare copper used in a raceway.
(2) Bare copper for direct burial where bare copper is judged to be suitable for the soil conditions.
(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use.
(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly identified for underground use in a raceway or for direct burial.

SERVICE ENTRANCE FACILITIES

230.31 Size and Rating

(A) General. Underground service conductors shall have sufficient ampacity to carry the current for the load as calculated in accordance with Article 220 and shall have adequate mechanical strength.

(B) Minimum Size. The conductors shall not be smaller than 8 AWG copper or 6 AWG aluminum or copper-clad aluminum.

Exception: Conductors supplying only limited loads of a single branch circuit — such as small polyphase power, controlled water heaters, and similar loads — shall not be smaller than 12 AWG copper or 10 AWG aluminum or copper-clad aluminum.

(C) Grounded Conductors. The grounded conductor shall not be less than the minimum size required by 250.24(C).

SERVICE ENTRANCE FACILITIES

230.32 Protection Against Damage

Underground service conductors shall be protected against damage in accordance with 300.5. Service conductors entering a building or other structure shall be installed in accordance with 230.6 or protected by a raceway wiring method identified in 230.43.

230.33 Spliced Conductors

Service conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15.

SERVICE ENTRANCE FACILITIES

IV. Service Entrance Conductors

SERVICE ENTRANCE FACILITIES

230.40 Number of Service-Entrance Conductor Sets

Each service drop, set of overhead service conductors, set of underground service conductors, or service lateral shall supply only one set of service-entrance conductors.

SERVICE ENTRANCE FACILITIES

230.41 Insulation of Service-Entrance Conductors

Service-entrance conductors entering or on the exterior of buildings or other structures shall be insulated.

Exception: A grounded conductor shall be permitted to be uninsulated as follows:

(1) Bare copper used in a raceway or part of a service cable assembly.
(2) Bare copper for direct burial where bare copper is judged to be suitable for the soil conditions.

(3) Bare copper for direct burial without regard to soil conditions where part of a cable assembly identified for underground use.
(4) Aluminum or copper-clad aluminum without individual insulation or covering where part of a cable assembly or identified for underground use in a raceway, or for direct burial.
(5) Bare conductors used in an auxiliary gutter.

SERVICE ENTRANCE FACILITIES

230.42 Minimum Size and Rating

(A) General. The ampacity of the service-entrance conductors before the application of any adjustment or correction factors shall not be less than either 230.42(A)(1) or (A)(2). Loads shall be determined in accordance with Part III, IV, or V of Article 220, as applicable. Ampacity shall be determined from 310.15. The maximum allowable current of busways shall be that value for which the busway has been listed or labeled.

(1) The sum of the noncontinuous loads plus 125 percent of continuous loads

(2) The sum of the noncontinuous load plus the continuous load if the service-entrance conductors terminate in an overcurrent device where both the overcurrent device and its assembly are listed for operation at 100 percent of their rating

(B) Specific Installations. In addition to the requirements of 230.42(A), the minimum ampacity for ungrounded conductors for specific installations shall not be less than the rating of the service disconnecting means specified in 230.79(A) through (D).

(C) Grounded Conductors. The grounded conductor shall not be smaller than the minimum size as required by 250.24(C).

SERVICE ENTRANCE FACILITIES

230.43 Wiring Methods for 600 Volts, Nominal, or Less

Service-entrance conductors shall be installed in accordance with the applicable requirements of this *Code* covering the type of wiring method used and shall be limited to the following methods:

(1) Open wiring on insulators
(2) Type IGS cable
(3) Rigid metal conduit
(4) Intermediate metal conduit
(5) Electrical metallic tubing
(6) Electrical nonmetallic tubing (ENT)
(7) Service-entrance cables
(8) Wireways
(9) Busways

SERVICE ENTRANCE FACILITIES

(10) Auxiliary gutters
(11) Rigid polyvinyl chloride conduit (PVC)
(12) Cablebus
(13) Type MC cable
(14) Mineral-insulated, metal-sheathed cable
(15) Flexible metal conduit not over 1.8 m (6 ft) long or liquidtight flexible metal conduit not over 1.8 m (6 ft) long between raceways, or between raceway and service equipment, with equipment bonding jumper routed with the flexible metal conduit or the liquidtight flexible metal conduit according to the provisions of 250.102(A), (B), (C), and (E)
(16) Liquidtight flexible nonmetallic conduit

(17) High density polyethylene conduit (HDPE)
(18) Nonmetallic underground conduit with conductors (NUCC)
(19) Reinforced thermosetting resin conduit (RTRC)

SERVICE ENTRANCE FACILITIES

230.44 Cable Trays

Cable tray systems shall be permitted to support service-entrance conductors. Cable trays used to support service-entrance conductors shall contain only service-entrance conductors and shall be limited to the following methods:

(1) Type SE cable
(2) Type MC cable
(3) Type MI cable
(4) Type IGS cable
(5) Single thermoplastic-insulated conductors 1/0 and larger with CT rating

Such cable trays shall be identified with permanently affixed labels with the wording "Service-Entrance Conductors." The labels shall be located so as to be visible after installation and placed so that the service-entrance conductors are able to be readily traced through the entire length of the cable tray.

230.46 Spliced Conductors

Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15.

SERVICE ENTRANCE FACILITIES

230.50 Protection Against Physical Damage

(A) Underground Service-Entrance Conductors. Underground service-entrance conductors shall be protected against physical damage in accordance with 300.5.

(B) All Other Service-Entrance Conductors. All other service-entrance conductors, other than underground service entrance conductors, shall be protected against physical damage as specified in 230.50(B)(1) or (B)(2).

(1) Service-Entrance Cables. Service-entrance cables, where subject to physical damage, shall be protected by any of the following:

(1) Rigid metal conduit
(2) Intermediate metal conduit
(3) Schedule 80 PVC conduit
(4) Electrical metallic tubing
(5) Reinforced thermosetting resin conduit (RTRC)
(6) Other approved means

(2) Other Than Service-Entrance Cables. Individual open conductors and cables, other than service-entrance cables, shall not be installed within 3.0 m (10 ft) of grade level or where exposed to physical damage.

SERVICE ENTRANCE FACILITIES

230.51 Mounting Supports

Service-entrance cables or individual open service-entrance conductors shall be supported as specified in 230.51(A), (B), or (C).

(A) Service-Entrance Cables. Service-entrance cables shall be supported by straps or other approved means within 300 mm (12 in.) of every service head, gooseneck, or connection to a raceway or enclosure and at intervals not exceeding 750 mm (30 in.).

(B) Other Cables. Cables that are not approved for mounting in contact with a building or other structure shall be mounted on insulating supports installed at intervals not exceeding 4.5 m (15 ft) and in a manner that maintains a clearance of not less than 50 mm (2 in.) from the surface over which they pass.

(C) Individual Open Conductors. Individual open conductors shall be installed in accordance with Table 230.51(C). Where exposed to the weather, the conductors shall be mounted on insulators or on insulating supports attached to racks, brackets, or other approved means. Where not exposed to the weather, the conductors shall be mounted on glass or porcelain knobs.

SERVICE ENTRANCE FACILITIES

230.52 Individual Conductors Entering Buildings or Other Structures

Where individual open conductors enter a building or other structure, they shall enter through roof bushings or through the wall in an upward slant through individual, noncombustible, nonabsorbent insulating tubes. Drip loops shall be formed on the conductors before they enter the tubes.

230.53 Raceways to Drain

Where exposed to the weather, raceways enclosing service-entrance conductors shall be suitable for use in wet locations and arranged to drain. Where embedded in masonry, raceways shall be arranged to drain.

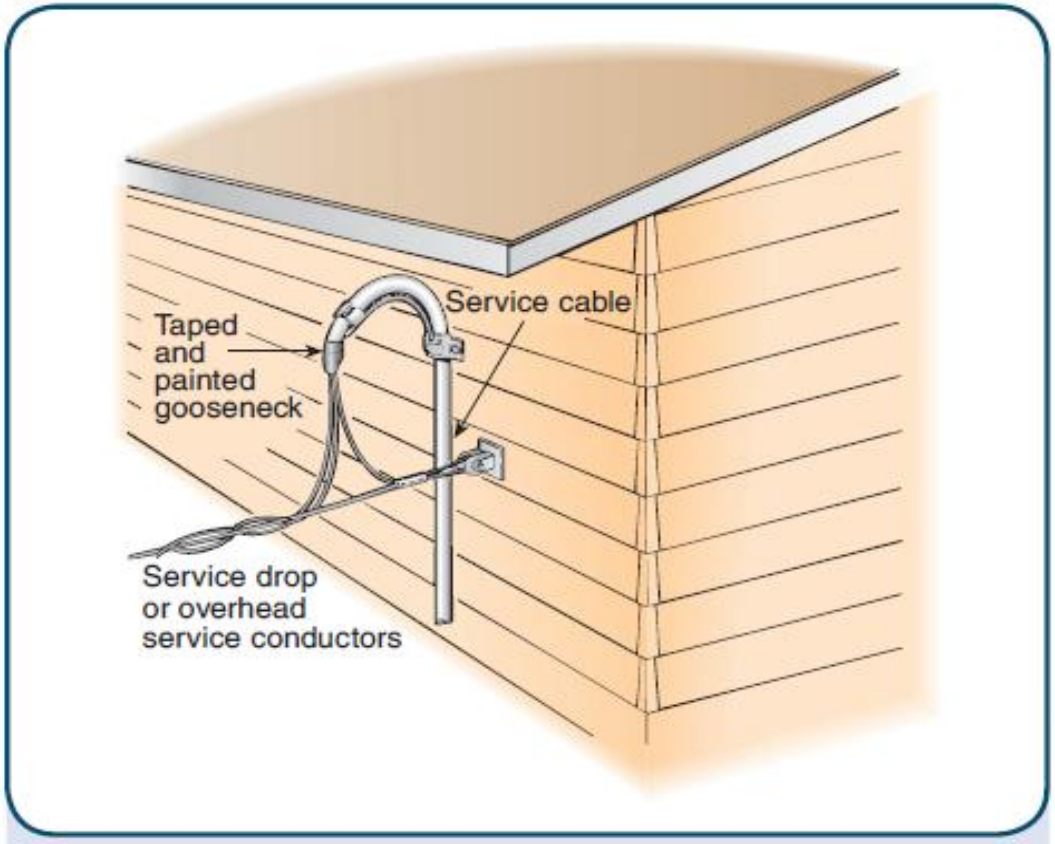
230.54 Overhead Service Locations

(A) Service Head. Service raceways shall be equipped with a service head at the point of connection to service-drop or overhead service conductors. The service head shall be listed for use in wet locations.

(B) Service-Entrance Cables Equipped with Service Head or Gooseneck. Service-entrance cables shall be equipped with a service head. The service head shall be listed for use in wet locations.

SERVICE ENTRANCE FACILITIES

(C) Service Heads and Goosenecks Above Service-Drop or Overhead Service Attachment. Service heads and goosenecks in service-entrance cables shall be located above the point of attachment of the service-drop or overhead service conductors to the building or other structure.



SERVICE ENTRANCE FACILITIES

TABLE 230.51(C) Supports

	Maximum Distance Between Supports		Minimum Clearance			
			Between Conductors		From Surface	
Maximum Volts	m	ft	mm	in.	mm	in.
600	2.7	9	150	6	50	2
600	4.5	15	300	12	50	2
300	1.4	4½	75	3	50	2
600*	1.4*	4½*	65*	2½*	25*	1*

*Where not exposed to weather.

SERVICE ENTRANCE FACILITIES

(D) Secured. Service-entrance cables shall be held securely in place.

(E) Separately Bushed Openings. Service heads shall have conductors of different potential brought out through separately bushed openings.

Exception: For jacketed multiconductor service-entrance cable without splice.

(F) Drip Loops. Drip loops shall be formed on individual conductors. To prevent the entrance of moisture, service-entrance conductors shall be connected to the service-drop or overhead service conductors either (1) below the level of the service head or (2) below the level of the termination of the service-entrance cable sheath.

(G) Arranged That Water Will Not Enter Service Raceway or Equipment. Service-entrance and overhead service conductors shall be arranged so that water will not enter service raceway or equipment.

SERVICE ENTRANCE FACILITIES

230.56 Service Conductor with the Higher Voltage to Ground

On a 4-wire, delta-connected service where the midpoint of one phase winding is grounded, the service conductor having the higher phase voltage to ground shall be durably and permanently marked by an outer finish that is orange in color, or by other effective means, at each termination or junction point.

SERVICE ENTRANCE FACILITIES

V. Service Equipment – General

SERVICE ENTRANCE FACILITIES

230.62 Service Equipment — Enclosed or Guarded

Energized parts of service equipment shall be enclosed as specified in 230.62(A) or guarded as specified in 230.62(B).

(A) Enclosed. Energized parts shall be enclosed so that they will not be exposed to accidental contact or shall be guarded as in 230.62(B).

(B) Guarded. Energized parts that are not enclosed shall be installed on a switchboard, panelboard, or control board and guarded in accordance with 110.18 and 110.27. Where energized parts are guarded as provided in 110.27(A)(1) and (A)(2), a means for locking or sealing doors providing access to energized parts shall be provided.

230.66 Marking

Service equipment rated at 600 volts or less shall be marked to identify it as being suitable for use as service equipment.

All service equipment shall be listed. Individual meter socket enclosures shall not be considered service equipment.

SERVICE ENTRANCE FACILITIES

V. Service Equipment – Disconnecting Means

SERVICE ENTRANCE FACILITIES

230.70 General

Means shall be provided to disconnect all conductors in a building or other structure from the service-entrance conductors.

(A) Location. The service disconnecting means shall be installed in accordance with 230.70(A)(1), (A)(2), and (A)(3).

(1) Readily Accessible Location. The service disconnecting means shall be installed at a readily accessible location either outside of a building or structure or inside nearest the point of entrance of the service conductors.

(2) Bathrooms. Service disconnecting means shall not be installed in bathrooms.

(3) Remote Control. Where a remote control device(s) is used to actuate the service disconnecting means, the service disconnecting means shall be located in accordance with 230.70(A)(1).

SERVICE ENTRANCE FACILITIES

(B) Marking. Each service disconnect shall be permanently marked to identify it as a service disconnect.

(C) Suitable for Use. Each service disconnecting means shall be suitable for the prevailing conditions. Service equipment installed in hazardous (classified) locations shall comply with the requirements of Articles 500 through 517.

SERVICE ENTRANCE FACILITIES

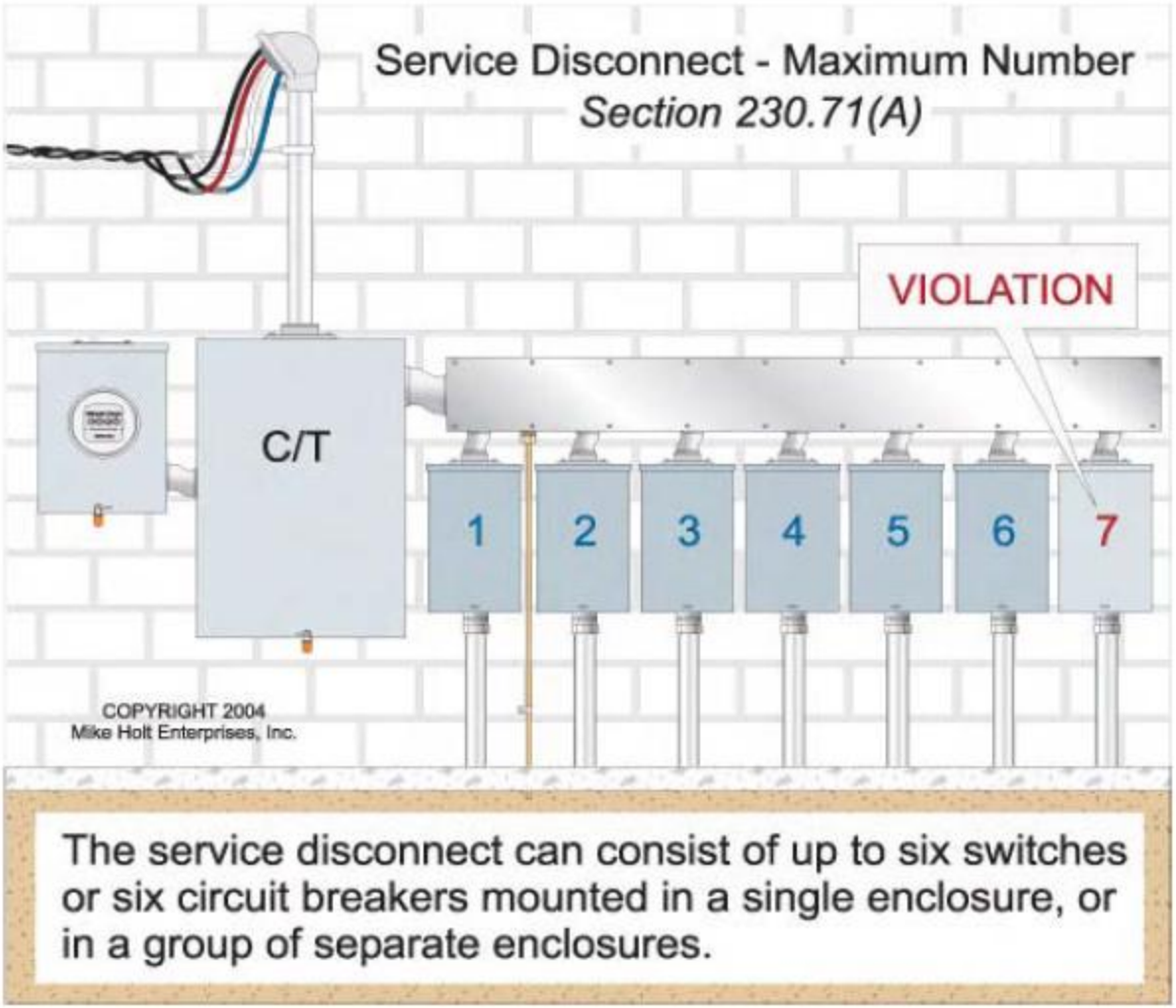
230.71 Maximum Number of Disconnects

(A) General. The service disconnecting means for each service permitted by 230.2, or for each set of service-entrance conductors permitted by 230.40, Exception No. 1, 3, 4, or 5, shall consist of not more than six switches or sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard. There shall be not more than six sets of disconnects per service grouped in any one location.

For the purpose of this section, disconnecting means installed as part of listed equipment and used solely for the following shall not be considered a service disconnecting means:

(1) Power monitoring equipment
(2) Surge-protective device(s)
(3) Control circuit of the ground-fault protection system
(4) Power-operable service disconnecting means

SERVICE ENTRANCE FACILITIES



SERVICE ENTRANCE FACILITIES

(B) Single-Pole Units. Two or three single-pole switches or breakers, capable of individual operation, shall be permitted on multiwire circuits, one pole for each ungrounded conductor, as one multipole disconnect, provided they are equipped with identified handle ties or a master handle to disconnect all conductors of the service with no more than six operations of the hand.

Informational Note: See 408.36, Exception No. 1 and Exception No. 3, for service equipment in certain panelboards, and see 430.95 for service equipment in motor control centers.

230.72 Grouping of Disconnects

(A) General. The two to six disconnects as permitted in 230.71 shall be grouped. Each disconnect shall be marked to indicate the load served.

(B) Additional Service Disconnecting Means. The one or more additional service disconnecting means for fire pumps, emergency systems, legally required standby, or optional standby services permitted by 230.2 shall be installed remote from the one to six service disconnecting means for normal service to minimize the possibility of simultaneous interruption of supply.

SERVICE ENTRANCE FACILITIES

(C) Access to Occupants. In a multiple-occupancy building, each occupant shall have access to the occupant's service disconnecting means.

230.74 Simultaneous Opening of Poles

Each service disconnect shall simultaneously disconnect all ungrounded service conductors that it controls from the premises wiring system.

230.75 Disconnection of Grounded Conductor

Where the service disconnecting means does not disconnect the grounded conductor from the premises wiring, other means shall be provided for this purpose in the service equipment. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose. In a multisection switchboard, disconnects for the grounded conductor shall be permitted to be in any section of the switchboard, provided any such switchboard section is marked.

SERVICE ENTRANCE FACILITIES

230.76 Manually or Power Operable

The service disconnecting means for ungrounded service conductors shall consist of one of the following:

(1) A manually operable switch or circuit breaker equipped with a handle or other suitable operating means
(2) A power-operated switch or circuit breaker, provided the switch or circuit breaker can be opened by hand in the event of a power supply failure

230.77 Indicating

The service disconnecting means shall plainly indicate whether it is in the open (off) or closed (on) position.

230.79 Rating of Service Disconnecting Means

The service disconnecting means shall have a rating not less than the calculated load to be carried, determined in accordance with Part III, IV, or V of Article 220, as applicable. In no case shall the rating be lower than specified in 230.79(A), (B), (C), or (D).

SERVICE ENTRANCE FACILITIES

(A) One-Circuit Installations. For installations to supply only limited loads of a single branch circuit, the service disconnecting means shall have a rating of not less than 15 amperes.

(B) Two-Circuit Installations. For installations consisting of not more than two 2-wire branch circuits, the service disconnecting means shall have a rating of not less than 30 amperes.

(C) One-Family Dwellings. For a one-family dwelling, the service disconnecting means shall have a rating of not less than 100 amperes, 3-wire.

(D) All Others. For all other installations, the service disconnecting means shall have a rating of not less than 60 amperes.

230.80 Combined Rating of Disconnects

Where the service disconnecting means consists of more than one switch or circuit breaker, as permitted by 230.71, the combined ratings of all the switches or circuit breakers used shall not be less than the rating required by 230.79.

SERVICE ENTRANCE FACILITIES

230.81 Connection to Terminals

The service conductors shall be connected to the service disconnecting means by pressure connectors, clamps, or other approved means. Connections that depend on solder shall not be used.

230.82 Equipment Connected to the Supply Side of Service Disconnect

Only the following equipment shall be permitted to be connected to the supply side of the service disconnecting means:

(1) Cable limiters or other current-limiting devices.

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(2) Meters and meter sockets nominally rated not in excess of 600 volts, provided all metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250.

(3) Meter disconnect switches nominally rated not in excess of 600 volts that have a short-circuit current rating equal to or greater than the available short-circuit current, provided all metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250. A meter disconnect switch shall be capable of interrupting the load served.

SERVICE ENTRANCE FACILITIES

(4) Instrument transformers (current and voltage), impedance shunts, load management devices, surge arresters, and Type 1 surge-protective devices.

(5) Taps used only to supply load management devices, circuits for standby power systems, fire pump equipment, and fire and sprinkler alarms, if provided with service equipment and installed in accordance with requirements for service-entrance conductors.

(6) Solar photovoltaic systems, fuel cell systems, or interconnected electric power production sources.

(7) Control circuits for power-operable service disconnecting means, if suitable overcurrent protection and disconnecting means are provided.

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(8) Ground-fault protection systems or Type 2 surge-protective devices, where installed as part of listed equipment, if suitable overcurrent protection and disconnecting means are provided.

(9) Connections used only to supply listed communications equipment under the exclusive control of the serving electric utility, if suitable overcurrent protection and disconnecting means are provided. For installations of equipment by the serving electric utility, a disconnecting means is not required if the supply is installed as part of a meter socket, such that access can only be gained with the meter removed.

SERVICE ENTRANCE FACILITIES

V. Service Equipment – Over Current Protection

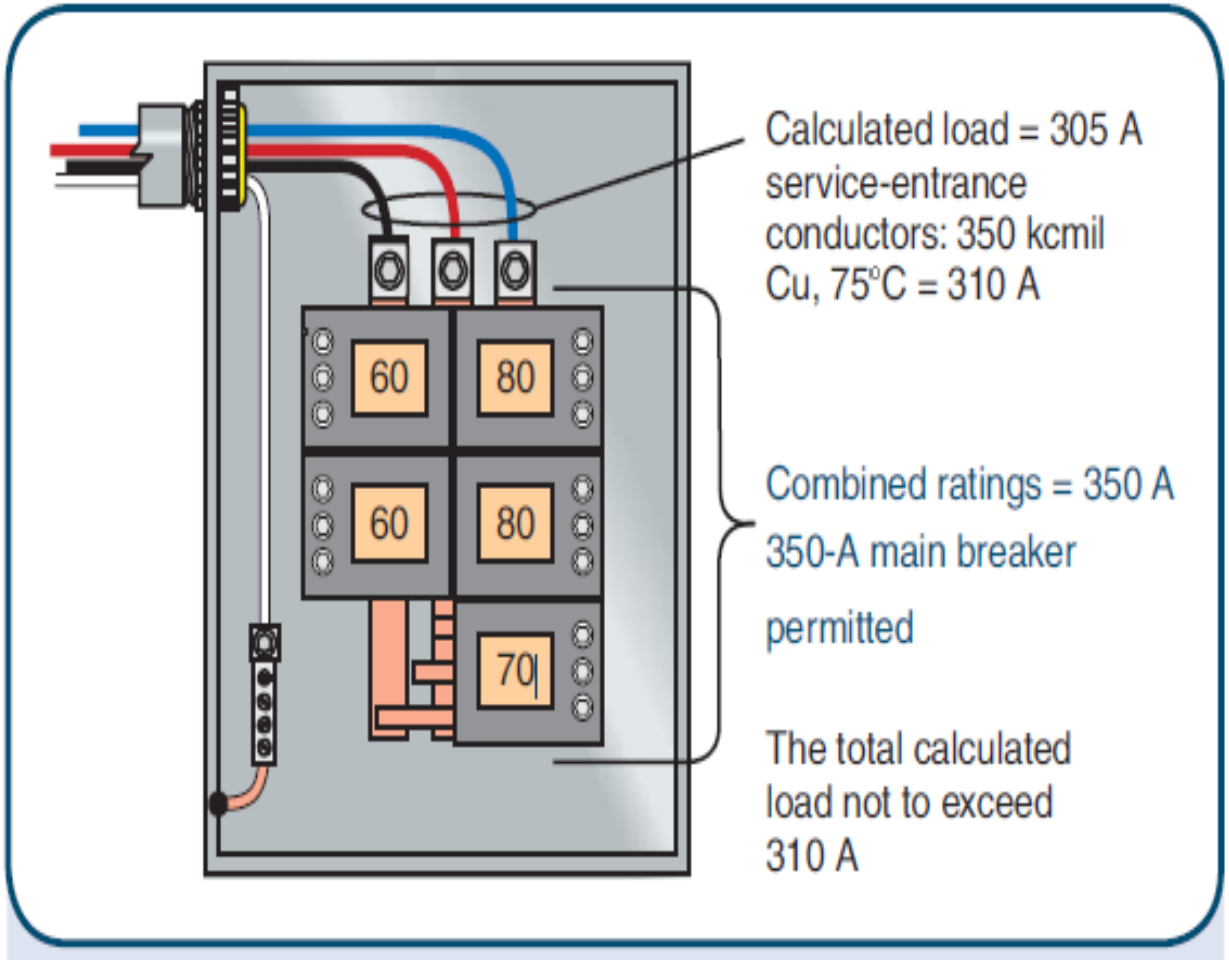
SERVICE ENTRANCE FACILITIES

230.90 Where Required

Each ungrounded service conductor shall have overload protection.

(A) Ungrounded Conductor. Such protection shall be provided by an overcurrent device in series with each ungrounded service conductor that has a rating or setting not higher than the allowable ampacity of the conductor. A set of fuses shall be considered all the fuses required to protect all the ungrounded conductors of a circuit. Single-pole circuit breakers, grouped in accordance with 230.71(B), shall be considered as one protective device.

SERVICE ENTRANCE FACILITIES



SERVICE ENTRANCE FACILITIES

(B) Not in Grounded Conductor. No overcurrent device shall be inserted in a grounded service conductor except a circuit breaker that simultaneously opens all conductors of the circuit.

230.91 Location

The service overcurrent device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto.

230.92 Locked Service Overcurrent Devices

Where the service overcurrent devices are locked or sealed or are not readily accessible to the occupant, branch-circuit or feeder overcurrent devices shall be installed on the load side, shall be mounted in a readily accessible location, and shall be of lower ampere rating than the service overcurrent device.

230.93 Protection of Specific Circuits

Where necessary to prevent tampering, an automatic overcurrent device that protects service conductors supplying

SERVICE ENTRANCE FACILITIES

only a specific load, such as a water heater, shall be permitted to be locked or sealed where located so as to be accessible.

230.94 Relative Location of Overcurrent Device and Other Service Equipment

The overcurrent device shall protect all circuits and devices.

230.95 Ground-Fault Protection of Equipment

Ground-fault protection of equipment shall be provided for solidly grounded wye electric services of more than 150 volts to ground but not exceeding 600 volts phase-to-phase for each service disconnect rated 1000 amperes or more. The grounded conductor for the solidly grounded wye system shall be connected directly to ground through a grounding electrode system, as specified in 250.50, without inserting any resistor or impedance device.

The rating of the service disconnect shall be considered to be the rating of the largest fuse that can be installed or the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted.

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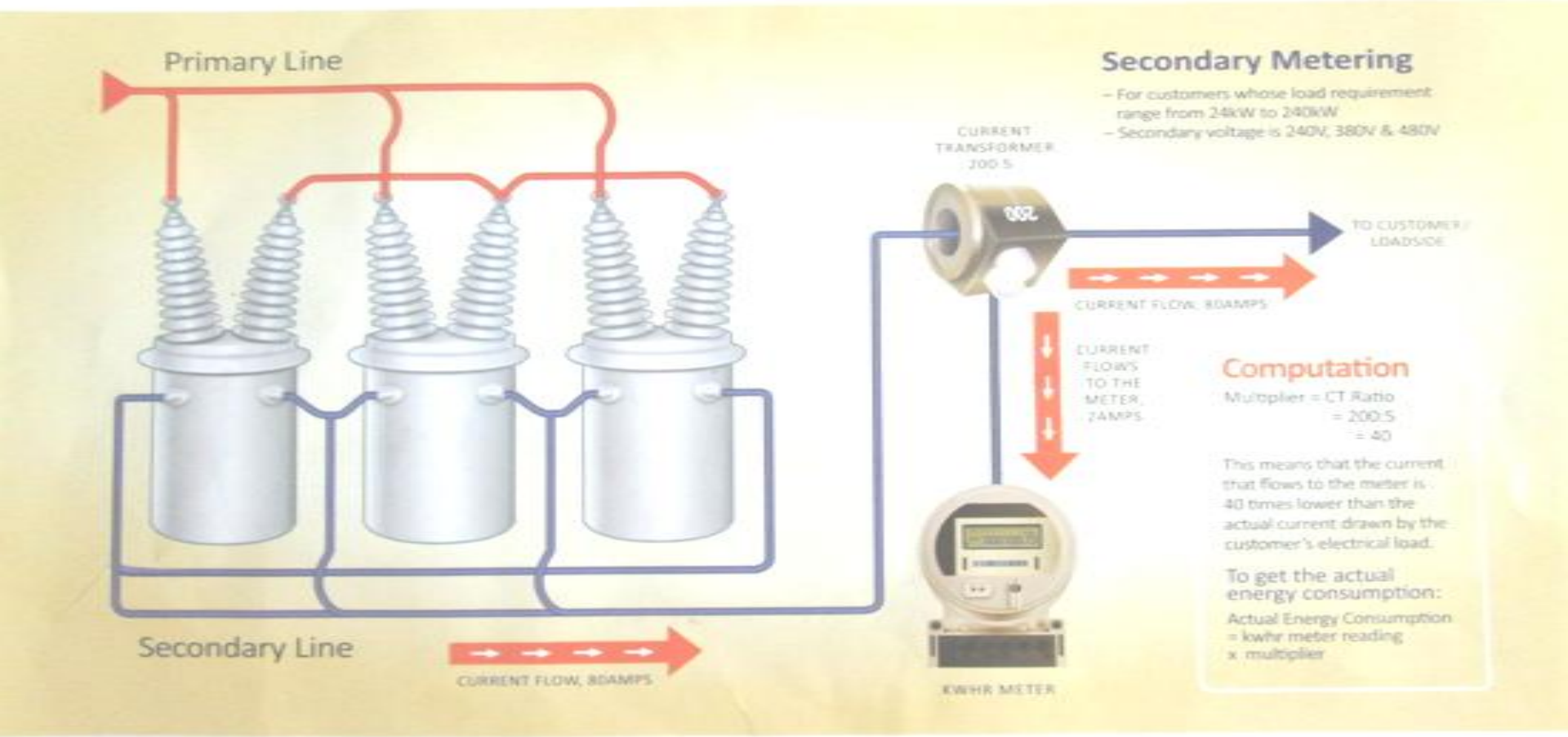
VECO METERING STANDARDS

ELECTRIC METERS FOR INDUSTRIAL CUSTOMERS

Electric Meters for Industrial Customers



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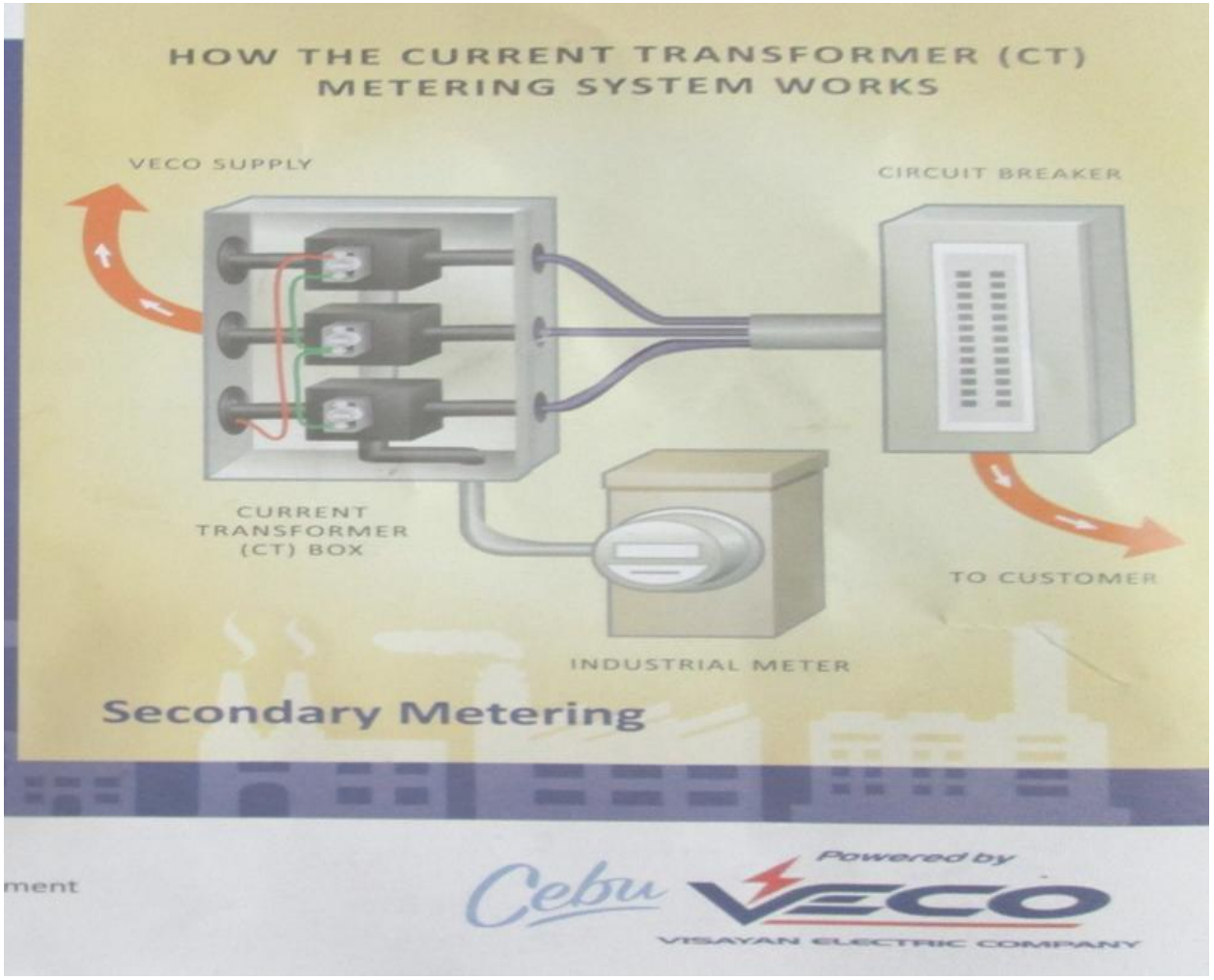
ELECTRIC METERS FOR INDUSTRIAL CUSTOMERS

Electric Meters for Industrial Customers



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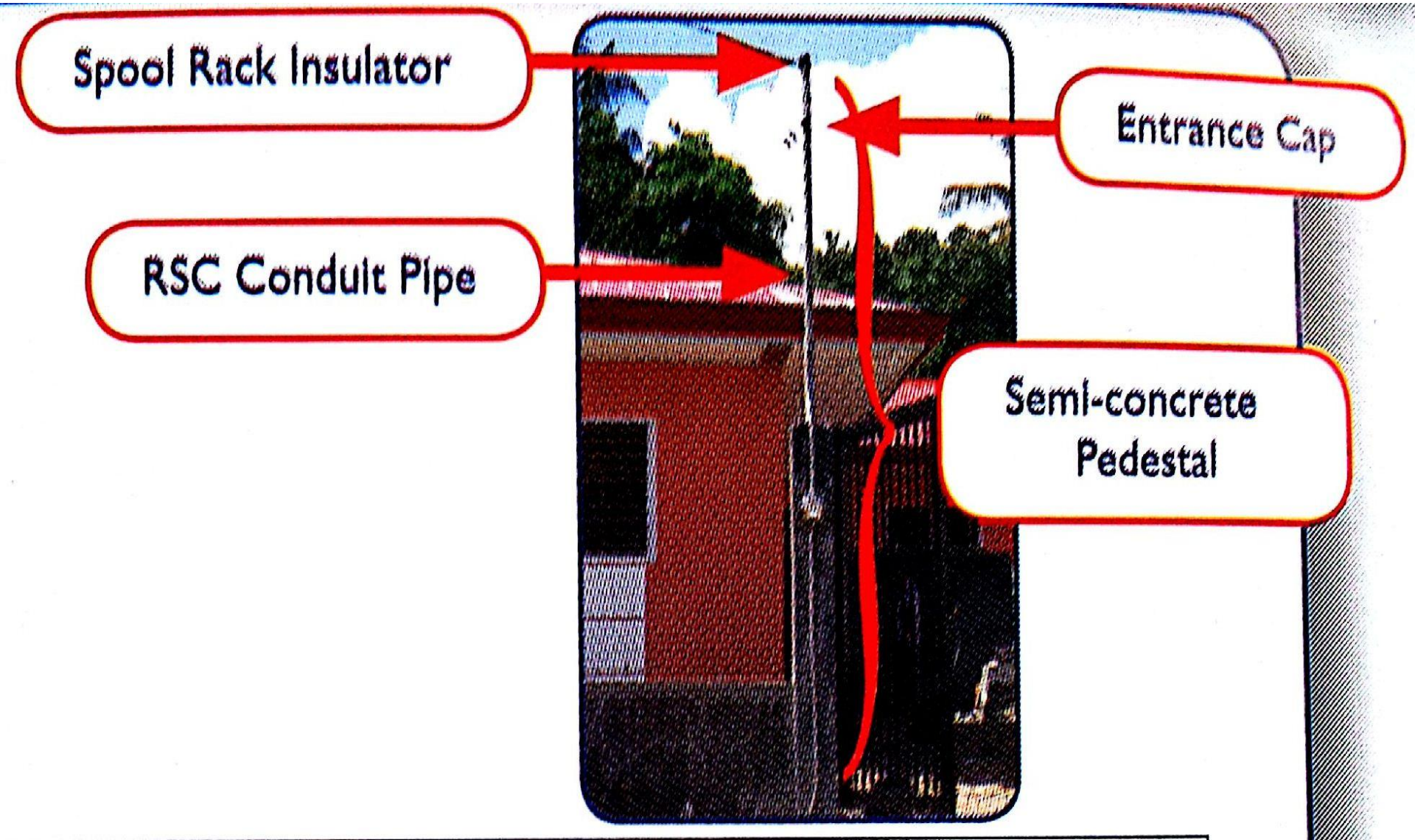

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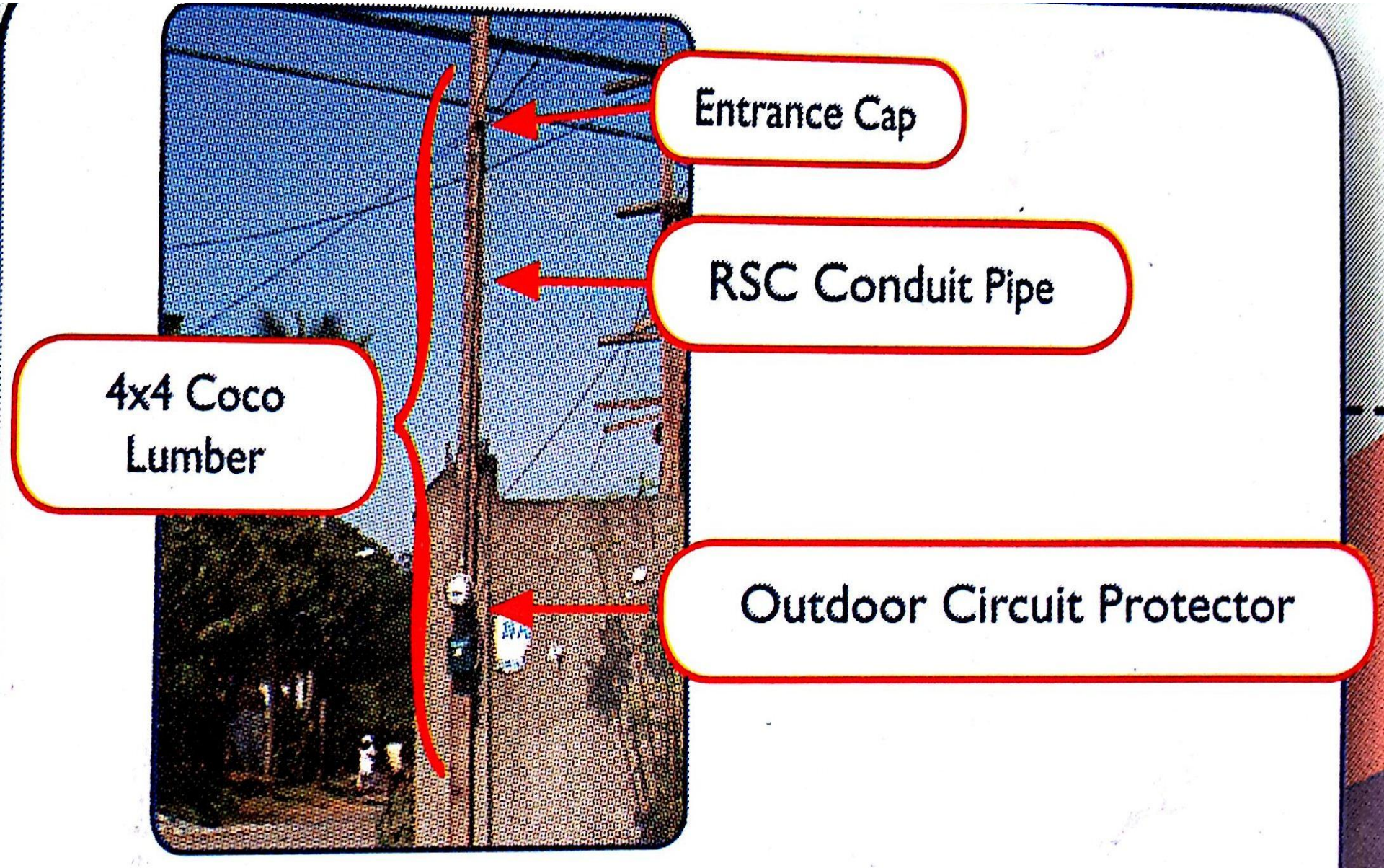

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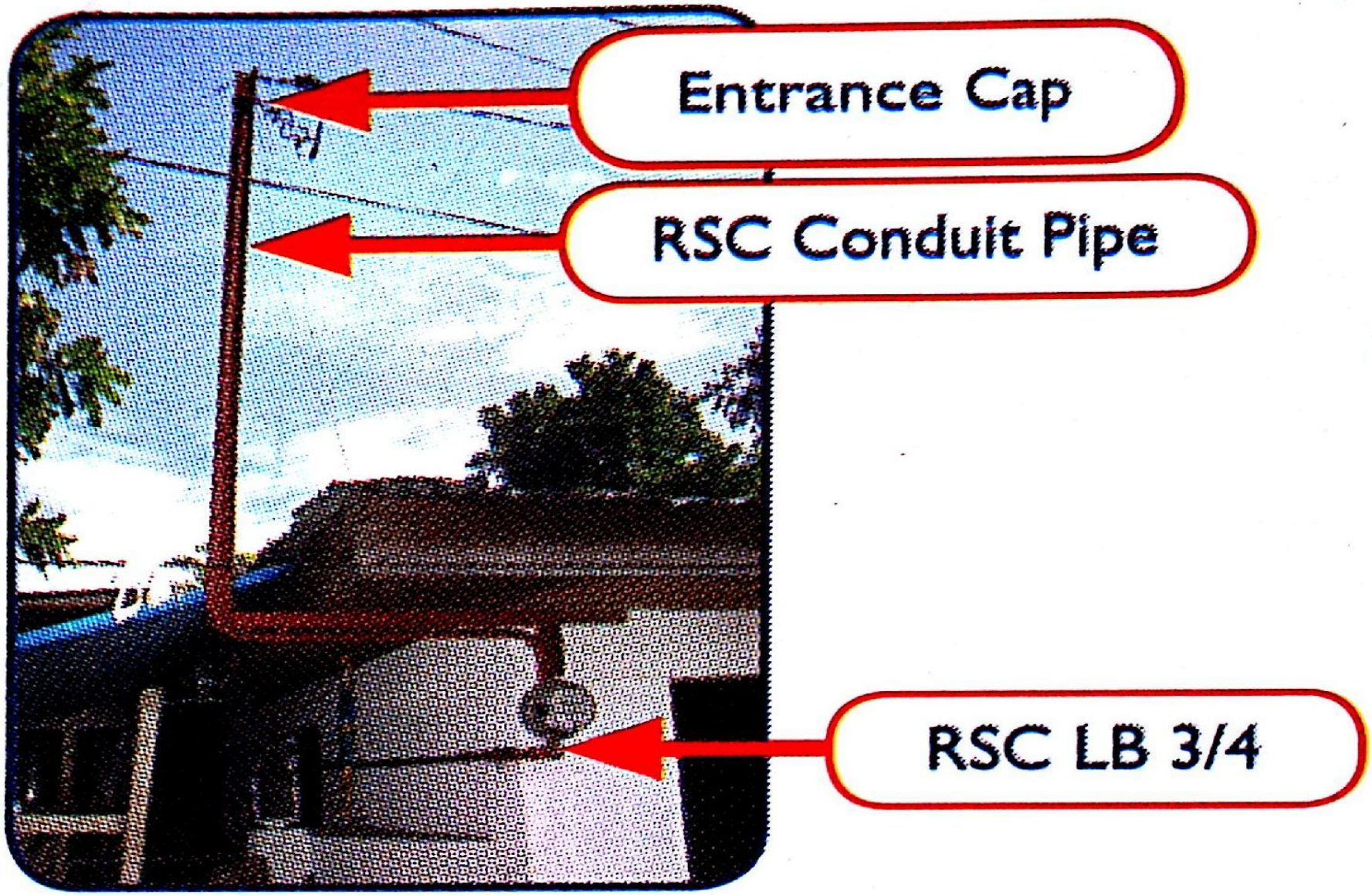

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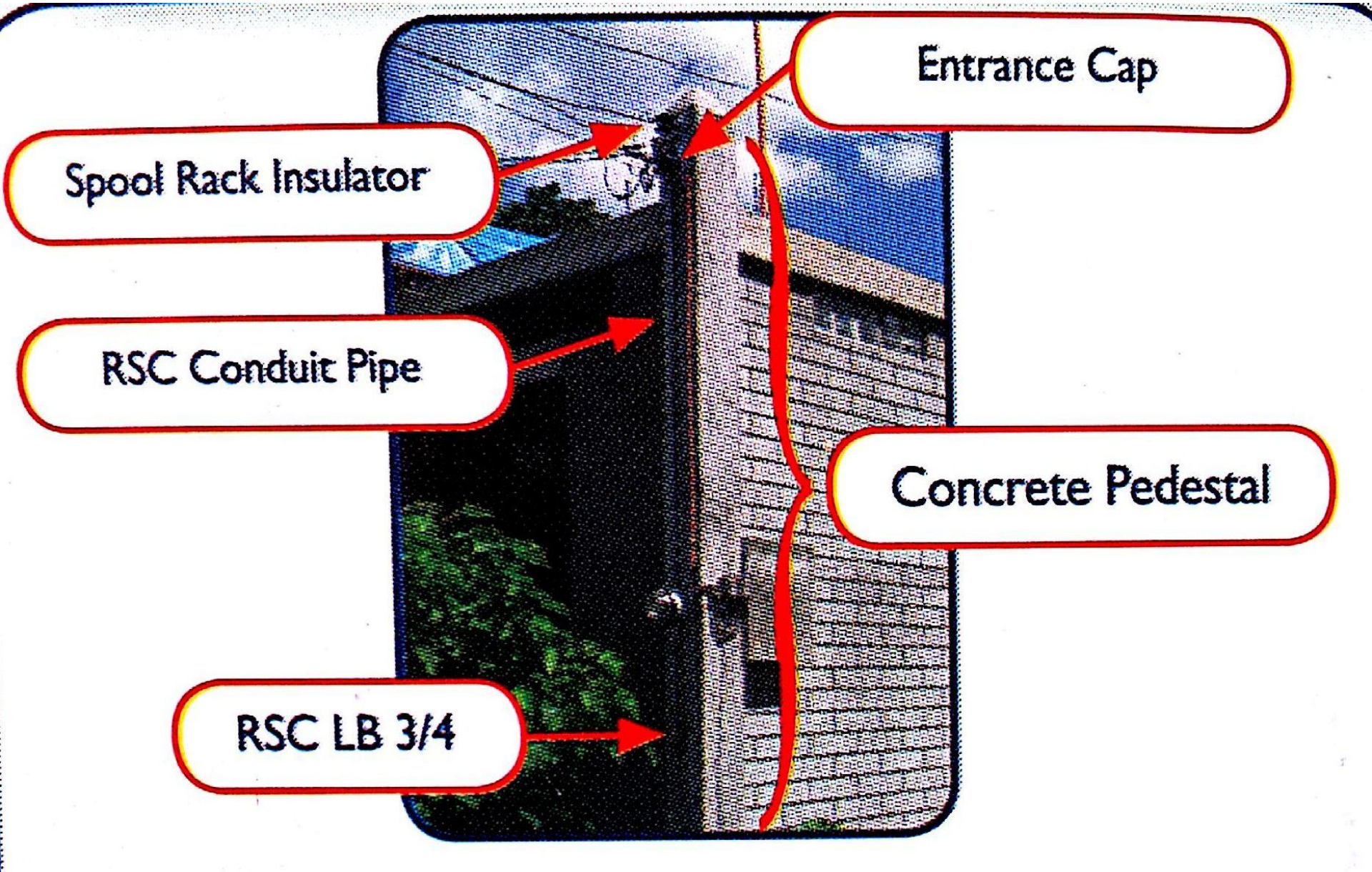

The true sign of intelligence is not knowledge but imagination.

~Albert Einstein