

# Philippine Electrical Code (PEC)



**“THE ESTABLISHED LEADER IN EE REVIEW”**

**MULTIVECTOR**  
**Review and Training Center**  
Rm. 867, Ground Floor, Isabel Bldg.  
F. Cayco corner España Sts.  
Sampaloc, Manila  
Tel. No. 7317423



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## PHILIPPINE ELECTRICAL CODE

As embodied in the provision of the Philippine Electrical Code, strict compliance in the application is mandatory to ensure safety in electrical installation and construction

PEC consist of two parts. Part one consist of sets of rules which regulate electrical installation done **INSIDE** the building. Part two consist of sets of rules which regulate electrical installation done **OUTSIDE** the building.

The rules are of two categories

**MANDATORY RULES** – characterized by the used of the word **SHALL**  
**ADVISORY RULES** - characterized by the used of the word **SHOULD**

### SCOPE OF PEC

1. Public and Private Buildings
2. Electrical Generating Plant
3. Industrial Plant
4. Temporary and Permanent substation
5. Transformer station
6. Railway Switchyard
7. Carnivals, Parking lots ,Yards etc
8. Watercraft
9. Dockyard
10. Airfields
11. Quarries and Mines
12. Mobile homes and recreational vehicle
13. Offshore facilities
14. Trailers

### NOT COVERED BY PEC

1. Railway rolling stock
2. Motor Vehicles
3. Aircraft

### REFERRAL CODE OF PEC

1. PD 1096- National Building Code
2. PD1185- Fire Code of the Phil
3. Structural Code

### What Covers Electrical Inspection

1. Reliability
2. Stability
3. Suitability of the design
4. Mechanical Strength
5. Spaces and dimensions
6. Grounding
7. Insulation
8. Heating effect
9. Arcing effect



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10. Availability for replacement
11. Safety
12. Class, type, sizes, ampacity, voltage and specific use

## METHODS OF WIRING

- A. Raceway for general use
  1. Rigid metallic tubing
  2. Intermediate metallic tubing
  3. Non metallic tubing
  4. Electrical metallic tubing
  5. Surface raceway
- B. Cable assembly for general use
  1. Non metallic sheathed cable
  2. Underground feeder and branch circuit cable
  3. Metal clad ( armored cable)
  4. Mineral insulated metal sheathed cable ( IMC)
  5. Aluminum sheathed cable
  6. Messenger support wiring
  7. Shielded non metallic sheathed cable
  8. Armored cable
  9. Power and control cable
- C. Conductor system for general use
  1. Open wiring on insulator
  2. Concealed knob and tube work
- D. Cable assembly system for limited use
  1. Service entrance cable
  2. Non metallic extension
  3. Underplaster extension
  4. Integrated Gas Spacer cable
  5. Medium voltage cable
  6. Flat conductor cable
- E. Raceway system for limited use
  1. Flexible metal conduit and flexible metal tubing
  2. Liquid tight flexible metal conduit and liquid tight flexible non metal conduit
  3. Underfloor raceway
  4. Cellular metal floor raceway or Cellular concrete floor raceway
  5. Wireways
  6. Cable tray





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## F. Special system

1. Busway
2. Cable bus
3. Multi Outlet Assembly
4. Electrical floor assemblies
5. Flat cable assemblies

## SERVICES

**Service-** the conductors and equipment for delivering energy from the electricity supply system to the wiring system of the premises served.

**Service drop-** the overhead service conductors from the last pole or other aerial support to and including the splices, if any, connecting to the service, entrance conductors at the building or other structure.

**Service lateral-** The underground conductors between the street main, including any risers at a pole or other structure or from transformers, and the first point of connection to the service entrance conductors in any terminal box or meter or other enclosure with adequate space, inside or outside the building wall.

**Service Entrance-** The service conductor between the terminals of the service equipment and the point of connection to the service drop or lateral.

**Service Equipment-** the necessary equipment usually consisting of a circuit breakers or switch and fuses, and their accessories, located near the point of the entrance supply conductors to a building or other structure, or an otherwise defined area, and intended to constitute the main control and means of cut off the supply.

## CLEARANCES

### OVERHEAD

1. Above roof- 2500 mm
2. Vertical Clearance from ground
  - a. 3100 mm electric service entrance to the building or at the drip loop of the building electric entrance, or above areas or sidewalks accessible only to pedestrians, measured from the final grade or other accessible surface only for service.
  - b. 3700 mm if the nominal voltage is 600 v
  - c. 4600 mm over residential property and driveway, and those commercial areas not subject to truck traffic.
  - d. 5500 mm public street, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property and other land traversed by vehicles such as cultivated, grazing, forest, and orchard.





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3. Clearance for building opening – 1000 mm

## UNDERGROUND

1. 600 mm directly buried
2. 150 mm RMC and IMC installation
3. 460 mm PVC or other approved raceway

note:

total voltage drop 5%  
for feeder 3% and for branch circuit 2-3%

## ELECTRICAL WIRES AND CABLE

**Conductor-** A material, usually in the form of wire, cable, or bus bar, suitable for carrying an electric current.

- a. Bundled conductor
- b. Covered conductor
- c. Grounded conductor
- d. Grounding conductor
- e. Insulated conductor
- f. Lateral conductor
- g. Line conductor
- h. Open conductor

**Stranded wire-** consist of group of wires twisted to form a metallic string

**Cord-**A small, very flexible insulated cable

**Cable-** strands of insulated electrical conductors laid together, usually around a central core, and surrounded by heavy insulation.

**Electrical Insulation-** A material having high electrical resistivity and therefore suitable for separating adjacent conductors in an electric circuit or preventing possible future contact between conductors.

**Ampacity-** the current in ampere a conductor can carry continuously under the condition of use without exceeding its temperature rating.

## CABLE WIRING METHODS AND MATERIALS

### 1. Armored Cable ( AC, ACT, and ACL )

A fabricated assembly of insulated conductors enclosed in a flexible metal sheath used both in exposed and concealed work for branch circuit and feeders in both exposed and concealed work and in cable tray where identified for such use.



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## 2. Metal Clad Cable ( MC )

A factory assembled cable of one or more conductors, each individually insulated and enclosed in a metallic sheath interlocking tape, or a smooth or corrugated tube, used specifically for services, feeders, branch circuit, either exposed or concealed, and for indoor or outdoor work.

## 3. Metal Insulated Cable, Metal Sheathed Cable ( MI )

A factory assembled cable of one or more conductors insulated with highly compressed refractory mineral insulation and enclosed in a liquid tight and gas tight continuous copper sheath, used in a dry, wet, or continuously moist location as in service, feeders, or branch circuits, indoors or outdoors, exposed or concealed.

## 4. Non-metallic Sheathed Cable (NM and NMC)

- are factory assembled two or more insulated conductors having a moisture resistant, flame retardant and non-metallic outer sheath.
- Used specifically for one or two family dwellings, multifamily dwellings and other structure, except prohibited in section 5.5.9-

## 5. Shielded Non-metallic Sheathed Cable (SNM)

- a factory assembled two or more insulated conductors in an extruded core of moisture resistant and flame resistant non-metallic, covered with an overlapping spiral metal tape and wire shield and jacketed with an extruded moisture, flame, oil, corrosion, fungus and sunlight resistant non-metallic material.
- Used where operating temperature do not exceed the rating worked on the cable

## 6. Service Entrance Cable (SE & USE)

- a single or multi-conductor assembly provided with or without an overall covering, primarily and for services
- use for installation in cable trays, raceways or where supported by a messenger wire.

## 7. Underground Feeder and Branch Circuit Cable (UF)

- a moisture resistant cable
- used for underground, including direct burial in the earth, as feeder or branch circuit cable

## 8. Power & Control Tray cable (TC)

- a factory assembly of two or more insulated conductors with or without associated bare or covered grounded conductor under nonmetallic sheath.

## 9. Flat Cable Assemblies (FC)

- an assembly of parallel conductors formed integrally with an insulating material web specially designed for field installation in metal surface raceway.
- Used for branch circuit not exceeding 30 amp. and in locations where they will not be exposed to severe physical damage.

## 10. Flat Conductor Cable (FCC)

- consists of three or more flat copper conductor placed edge to edge & separated and enclose within an insulating assembly
- used for general purpose & appliance branch circuits and for individual branch circuits specifically in hard, smooth, continuous floor surfaces.
- Specially for under carpet (up to 914 mm<sup>2</sup>) wiring to floor outlets (floor mounted type FCC)



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## 11. Medium Voltage Cables (MV)

- are single or multi-conductor solid dielectric insulated cable rated at 2,001 or higher
- used for power system up to 35,000 volts nominal, in wet or dry locations, in raceway, cable trays.

## 12. Integrated Gas Spacer Cable (IGS)

- a factory assembled cable of one or more conductors, each individually insulated and enclosed in a loose fit nonmetallic flexible conduit rated 0 – 600 V
- a cable and conduit system
- for underground use, including direct burial in the earth, as service-entrance conductors or as feeder or branch circuit conductors
- advantages low material and installation cost, eliminate field pulling or cables into conduit, eliminates the cost of assembly of conduit in the field
- insulation: SF<sub>6</sub> (sulfuric hexafluoride gas)

## RACEWAY METHODS AND MATERIALS

### Raceways

The raceways wiring accessories or channels designed for holding wires cables, or busbars which are either made of metal or any insulating material.

They provided mechanical protection to conductors while keeping them accessible for wiring changes: conduits connectors, conduit, coupling, clamps, hangers etc. cable trays, bus metal raceway, non-metal raceways.

### Conduits

- either pipes or tubing, which are either flexible or rigid for electric wires are most common electrical raceways

### Fittings

- accessories such as locknuts, bushing couplers, adapters nipples and connectors or other part wiring system that is intended primarily to perform a mechanical rather than function.

### Connectors

- a metal sleeve, usually made of copper, that is slipped over and secure to the butted ends conductors in making a joint  
- also called a splicing sleeve.

## 1. Intermediate Metal Conduit (IMC)

- a metal raceway or circular cross-section with integral or associated couplings, connectors and fittings approved for the installation of electrical conductors
- with wall thickness less than rigid metal conduit but greater than EMT
- used in all atmospheric conditions and occupancies, or areas subject to severe corrosive influences when protected by corrosion protection.





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## 2. Rigid Metal Conduit

- one similar to that on IMC and when installed in concrete or in contact with coil does not generally require supplementary corrosion protection unless subject to severe corrosive influences

## 3. Rigid Non-metallic Conduit

- resistant to moisture and chemical atmospheres
- underground materials, fiber, soapstone, rigid polvinyl chloride (PVC), fiberglass, epoxy, and high density polyethylene, above ground (PVC)

## 4. Electrical Metallic Tubing

- a general purpose raceway of the same nature as rigid metal conduit and IMC
- used for both exposed and concealed work where it will not be subjected to severe physical damage or (unless suitably protected) to corrosive agents.

## 5. Flexible Metallic Tubing

- circular in cross-section, flexible, metallic and liquidtight without a nonmetallic jacket
- used in dry locations, in accessible locations when protected from physical damage or concealed such as above suspended ceilings and branch circuits

## 6. Surface Metal Raceway

- used for exposed wiring where the possibility of severe physical damage is not problem.
- Restricted to dry locations and voltages under 300 volts
- Its principal used is for rewiring or extending existing electrical system

## 7. Under Floor Raceways

- also called under floor ducts, consist of separate duct system buried in the concrete floor or flush with surface of the floor
- it come complete with junction boxes and fittings to provide access along the length of the duct for receptacles and telephone outlets
- may consists of single, double, or triple ducts run parallel to provide telephone signal and power raceways

## 8. Cellular Floor Raceways

- maybe metal or concrete, where cells of the cellular floor system is assigned with particular usage for power or signal wiring, and a header ducts tap into the cells and a carry the wiring to the necessary panel board or boxes.

## 9. Wire ways

- are ducts with square or rectangular cross-section made of sheet metal and the standard length of each ducts is 10 feet
- where the wiring is readily accessible through cover plates which make up one of the walls of the ducts is 10 feet.
- Its cover plate may be hinged or unhinged, screwed in place, or merely snapped into place
- Cannot be buried, concealed in walls or exposed to corrosives atmosphere for in general they are mounted exposed outdoors and may carry systems rated at 600 volts.



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## 10. Busways

- an approved completely assemble metal troughing and fitting when contain bare conductors intended for use as feeders, the conductors being suitably supported of insulators.
- Are factor made systems of copper of aluminum bars, rods, or tubes designed to carry heavy currents from 50 to 6,000 amp
- The conductors can be solid bars, square or rectangular hollow tube hollow ovals or solid I – beams
- Can be mounted horizontally or vertically and can be also used as service entrance feeders.

### Continuous plug in Busways

- used to serve equipment that may be relocated periodically, such as in wood working shops.
- Have regularly spaced openings that permitted plugging in switches or circuit breakers and conduit or flexible cable is then run from devices to the equipment being served.

### Trolley Busways

- permits travelling equipment to be connected to a power source
- a rolling power takeoff is contact with the busways conductors
- as the equipment moves, the trolley contact on the conductor.

## 11. Cable Trays

- are not raceways are open raceway like assemblies made of steel aluminum or a suitable non-metallic material
- they are used in buildings to route cables and support them out of the way of normal building activities

### Trough Type Trays

- protect cables from damages and give good support and ample ventilation through straight sections

### Ladder Trays

- provide maximum ventilations to power cables and other heat-producing cables

\*\*Cables suitable for use cable trays are marked CT (Cable Tray) on the outside of the jacket

## 12. Cablebus

- an approved assembly of insulated conductors with fittings and conductors termination in a completely enclosed, ventilated protective metal housing



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## Philippine Electrical Code

1. Which of the following wires is not suitable for both dry and wet locations?  
A. THHW                      B. RH                      C. XHHW                      D. TW
2. Which of the following colors of insulation or marking are permitted to identify "hot" phase conductors in conduit wiring methods?  
A. Black, red, and blue for 120/208-volt systems  
B. Yellow, orange, and brown for 277/480-volt systems  
C. Any colors except white, gray, or green  
D. All of the above
3. A copper THHN feeder conductor consists of 40 amperes of continuous load and 35 amperes of non-continuous load, and supplies a load that does not contain any general use receptacles but has three current-carrying conductors in a raceway with terminations rated at 75 degrees C. What is the minimum standard over-current device required for the feeder?  
A. 70 ampere                      B. 76 ampere                      C. 86 ampere                      D. 90 ampere

### EE - Sept 2011

4. What is the maximum allowable continuous load for branch circuit conductor?  
A. 0.6                      B. 0.7                      C. 0.8                      D. 0.9
5. For a 30 amp receptacle connected to a 30 amp branch circuit supplying two or more outlets, the total cord-and-plug load may not exceed which of the following sizes:  
A. 24 ampere                      B. 16 ampere                      C. 15 ampere                      D. 12 ampere
6. Disregarding any exceptions, a conductor rated 56 amperes shall be protected by a fuse sized at which of the following:  
A. 60 ampere                      B. 50 ampere                      C. 30 ampere                      D. 20 ampere

### EE - Sept 2010

7. What is the required branch circuit for a 25-A space heater?  
A. 33 A                      B. 31.25 A                      C. 28 A                      D. 25 A
8. The Branch circuit is rated 30 A. What should be the rating of the receptacle and the maximum connected load?  
A. 24 A, 24 A                      B. 30 A, 30 A                      C. 30 A, 24 A                      D. 37.5, 30 A

### EE - Sept 2009

9. The minimum size of copper conductor for a 230 volt general illumination branch circuit in a dwelling is \_\_\_\_\_ mm<sup>2</sup>.  
A. 1.25                      B. 0.75                      C. 2.0                      D. 3.5

### EE - April 2011

10. For hermetic motor compressor, how many percent of the full load current is the allowable rating of the branch disconnecting means?  
A. 125                      B. 115                      C. 150                      D. 100





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11. If a 480 volt motor has a full-load current of 34 amperes, then the standard disconnecting means must be which of the following:  
A. 66 ampere      B. 50 amp      C. 39.1 ampere      D. 40 ampere
12. The terminal for a size 50 sq. mm copper conductor without any markings to indicate the temperature rating of the terminal is assumed to have a minimum terminal temperature rating of:  
A. 30°C.      B. 60°C.      C. 90°C.      D. 75°C.
13. What is the allowable ampacity of THW insulated copper conductor with an area of 8 sq mm and exposed to an ambient temperature of 30 C.  
A. 50 A      B. 20 A      C. 30 A      D. 60 A

### ESAS – Sept 2010

14. The minimum size of copper equipment conductor required for equipment connected to a 40 Ampere circuit is?  
A. 14.0 mm<sup>2</sup>      B. 8.0 mm<sup>2</sup>      C. 5.5 mm<sup>2</sup>      D. 22.0 mm<sup>2</sup>
15. Determine the minimum standard size of over-current protective device and the minimum standard conductor size for the following circuit:  
25 amperes of continuous load  
60°C over-current device terminal rating  
Four THWN current-carrying copper conductors in a raceway  
A. 35 A, 8.0 sq mm, THHN      B. 35, 8.0 sq mm THWN  
C. 30 A, 8.0 sq mm, THHN      D. 30, 8.0 sq mm THWN

16. Which one is a standard rating of a fuse or CB?  
A. 140 A      B. 130 A      C. 120 A      D. 110 A

### ESAS – April 2012

17. Which off the following is not a standard over-current protection device rating?  
A. 50      B. 1500      C. 225      D. 150
18. In estimating the loading of a branch circuit, what loading shall be used for each receptacle?  
A. 160 VA      B. 120 VA      C. 180 VA      D. 150 VA
19. What is the maximum computed number of power outlet for a 1500 VA branch circuit?  
A. 4      B. 6      C. 8      D. 10

### ESAS – April 2012

20. For a 20 ampere receptacle connected to a 20 ampere branch circuit supplying two or more outlets, the total cord-and-plug may not exceed which of the following sizes:  
A. 20 ampere      B. 15 ampere      C. 30 ampere      D. none of these

### ESAS – April 2012

21. Receptacle rating of a non-motor load for a 40 ampere branch circuit is.  
A. 20      B. 30      C. 40      D. 50



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22. What is the required number branch circuit of a single family dwelling unit has a floor area of 145 sq. meters with a typical household appliances including one 1.5 – Hp room air conditioning unit?

- A. 3 – 20 A      B. 4 – 20 A      C. 5 – 20 A      D. 6 – 20 A

### ESAS – April 2013

23. What is the minimum lighting load required by PEC for an office measuring 20 m by 25 m?

- A. 6,000 VA      B. 7,000 VA      C. 12,000 VA      D. 14,000 VA

24. In a group of four motors, one motor draws 10 ampere, one draws 45 ampere and two draws 75 ampere. What size of conductor must be used for the feeder circuit?

- A. 224 A      B. 230 A      C. 300A      D. 124 A

25. A 5 hp single phase 208 volt induction motor has a nameplate current rating of 25.0 ampere. Disregarding exceptions, what is the MINIMUM size type THW copper conductor?

- A. 3.5 sq mm      B. 5.5 sq mm      C. 8 sq mm      D. 14 sq mm

26. Three, 230 volts, 1 phase squirrel cage induction motor each draws a current of 50 ampere are supplied by copper feeder conductors. The maximum rating of inverse time delay circuit breaker for feeder protection is:

- A. 200 A      B. 250 A      C. 225 A      D. 150 A

27. If the full load current of a 2 Hp, 115 volt and single phase motor is 24 ampere, what is the branch circuit protection to this motor using dual element time delay fuse.

- A. 30      B. 40      C. 60      D. 80

28. If the full load current of a 7.5 Hp, 208 volt and single phase motor is 24.2 ampere, what is the branch circuit protection to this motor using non time delay fuse.

- A. 30      B. 40      C. 60      D. 80

29. Four fire pump motor, rated at 230 volts, single phase squirrel cage induction motor draws an individual current of 50 ampere, 45 ampere, 30 ampere and 40 ampere are supplied by copper feeder conductors. What is the rating of the feeder conductor and the maximum rating of inverse time delay circuit breaker for feeder protection?

- A. 177.5 A, 240 A      B. 190 A, 250 A      C. 125 A, 225 A      D. 150 A, 250 A

### EE – Sept 2013

30. What is the derating factor in each of 7 to 9 conductors in a raceway?

- A. 80%      B. 85%      C. 70%      D. 75%

31. What is the current carrying capacity of each conductor if 36-8.0 sq mm THWN copper conductors are install in an auxiliary gutter?

- A. 20 A each      B. 40 A each      C. 50 A each      D. 45 a each

### EE – Sept 2012

32. What is the maximum number of conductor in a raceway that does not need to be derated?

- A. 2      B. 3      C. 4      D. 5







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46. What is the demand for twenty – 16 kW ranges?  
A. 35 kW                      B. 160 kW                      C. 42 kW                      D. 55 kW
47. What is the demand load for three 9 kW ranges, four 14 kW ranges, and five 15 kW ranges?  
A. 29.7 kW                      B. 35.6 kW                      C. 47.8 kW                      D. 52.3 kW
48. What is the feeder neutral demand for five 12 kW ranges?  
A. 14 kW                      B. 9.6 kW                      C. 18 kW                      D. 22 kW

## ESAS – Sept 2012

49. Branch circuit larger than \_\_\_\_\_ ampere shall supply only non-lighting outlet load?  
A. 20                      B. 50                      C. 15                      D. 30
50. How many 2 A lighting fixture that can be connected to a 20 A continuous duty Branch circuit  
A. 8                      B. 10                      C. 12                      D. 14

## EE – Sept 2010

51. Which of the following is not a standard classification for a branch circuit supplying several loads?  
A. 30 A                      B. 20 A                      C. 40 A                      D. 25 A

## EE – Sept 2011

52. In PEC 1, where does a bonding jumper is connected?  
A. Near distribution panel                      C. equipment enclosure  
B. Load side of service drop                      D. transformer enclosure
53. How many conductors shall be counted in a branch circuit raceway for the purpose of derating conductor ampacity given the following;  
3 bare conductors, 3 black insulated conductors, 3 white insulated conductors and 3 red insulated conductors. The service is single-phase, the load is balanced.  
A. 3                      B. 6                      C. 9                      D. 12

## EE – April 2011

54. What is the maximum distance between two outlets in dwelling units?  
A. 1500 mm                      B. 2000 mm                      C. 1800 mm                      D. 1600 mm

## ESAS – Sept 2011

55. Find the maximum vertical clearance of the receptacle outlet from the floor?  
A. 1700 mm                      B. 1800 mm                      C. 3700 mm                      D. 4000 mm

## EE – May 2009

56. Dwelling receptacles located \_\_\_\_\_ m above floors are NOT counted in the required number of receptacles along the wall.  
A. 1.7                      B. 1.8                      C. 1.6                      D. 1.5

## EE – Sept 2013

57. What is the maximum distance between two receptacles in a single family dwelling unit?  
A. 1500 mm                      B. 1600 mm                      C. 1800 mm                      D. 2000 mm



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## EE – Sept 2011

58. Floor receptacle outlets are not counted unless they are within a distance of \_\_\_\_ mm from the wall.

- A. 350                      B. 400                      C. 450                      D. 500

59. A beauty shop is located in a 6m x 10m single story building. The shop is subdivided into the following spaces;

6 m x 6 m customer service area, 4 m x 4 m office area and 4 m x 2 m storage area

What is the connected lighting load for this building?

- A. 1,462VA                      B. 1,328 VA                      C. 2,052 VA                      D. 2,388 VA

## ESAS – April 2011

60. The dwelling has a floor area of 40 sq. m. typical small appliances loads for small residential units

- a. General lighting and convenience receptacle load computed at 24 VA per sq. m.  
b. Typical appliance load

One electric flat iron	1000 VA
One television set	1000 VA
One electric fan	100 VA
One radio	20 VA

If the supply is 230 V, single phase, find the minimum size of TW wire to be used for the service use for the service entrance conductor.

- A. 2.0 sq. mm                      B. 3.5 sq. mm                      C. 5.5 sq. mm                      D. 8.0 sq. mm

## ESAS – Sept 2011

61. For 120 to 277 volt, nominal to ground shall be permitted to supply which of the following?

- A. None of these                      B. Lighting fixture  
B. Screw shell devices with loads                      D. Auxiliary equipment of electric discharge ampere

## EE – Sept 2011

62. When the temperature of the wire increases, what happens to the resistance?

- A. Varies                      B. remains the same                      C. increases                      d. decreases

## ESAS – Sept 2011

63. Metallic tubing used for insulated conductor?

- A. Steel conduit                      B. Tray                      C. flexible conduit                      D. trunking

## ESAS – Sept 2010

64. If a light is to be controlled from five different locations, \_\_\_\_\_ the following switches must be used.

- A. Two-three way and two four way                      C. three-three way and two four way  
B. Two-three way and three-four way                      D. three-three way and three four wa

## EE – Sept 2011

65. Grounding allows \_\_\_\_\_ opposition path of current flow

- A. low                      B. high                      C. effective                      D. medium



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## ESAS – April 2013

66. The minimum diameter of a steel ground electrode is

- A. 10 mm                      B. 12 mm                      C. 14 mm                      D. 16 mm

## ESAS – April 2013

67. Maximum distance for support of rigid metallic conduits.

- A. 2000 mm                      B. 2500 mm                      C. 3000 mm                      D. 3500 mm

## ESAS – April 2012

68. Maximum distance between bus way supports?

- B. 1000 mm                      B. 1500 mm                      C. 1800 mm                      D. 2000 mm

## EE – Sept 2009

69. What is the maximum number of quarter bends permitted for a single run of rigid metallic conduit between outlets?

- A. 4                                      B. 5                                      C. 2                                      D. 3

70. What is the total number of mechanical degrees of the PVC conduit run with 5 bent from pull points (pull boxes, junction boxes or utility boxes)?

- A. 90 degrees                      B. 180 degrees                      C. 450 degrees                      D. 270 degrees

71. Services using copper conductors shall have sufficient capacity and shall not be smaller than;

- A. 5.5 mm<sup>2</sup>                      B. 8.0 mm<sup>2</sup>                      C. 14 mm<sup>2</sup>                      D. 22 mm<sup>2</sup>

## EE – April 2011

72. Maximum voltage allowed in dwelling units?

- B. 230                                      B. 250                                      C. 277                                      D. 1000

## EE – April 2011

73. Where must the surge arrester be located?

- A. Away from the transformer                      B. near the air break switch  
B. Near the circuit breaker                      D. near the transformer

74. According to the Philippine Electrical Code at an ambient temperature of 30°C, 8.0 mm<sup>2</sup> copper conductors with the following insulation have the following ampacities: TW insulation – 30 A; THW insulation – 45 A; for THHN insulation – 50 A. If each of these insulated wires carries the same 40 amperes which will generate heat the fastest?

- A. TW insulated wire                      B. THW insulated wires  
C. Each will generate heat at the same rate                      D. THHN insulated wire

75. In transformer, the purpose of breather is to

- A. extracts moisture of the air.                      B. To provide cooling to the winding.  
C. To take insulating oil from conservator.                      D. To provide insulation to the winding.





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76. When a circuit breaker is selected for a particular application, which one of the following rating is usually considered most important?

- A. Interrupting rating
- B. Maximum rms current up to 1 sec.
- C. Continuous current rating
- D. Maximum rms current up to 4 sec.

77. What is the high leg voltage to ground of a 4-wire delta system with the center of one leg grounded, on a 240-volt system?

- A. 120
- B. 240
- C. 208
- D. 360

78. Determine the feeder capacity needed for a 120/240-volt fastened-in-place appliance load in a dwelling unit for the following:

Appliance	Rating	Load	
Water heater	4000 W, 240 V	4000 VA	
Kitchen disposal	1/2 hp, 120 V	1176 VA	
Dishwasher	1200 W, 120 V	1200 VA	
Furnace motor	1/4 hp, 120 V	696 VA	
Attic fan	1/4 hp, 120 V	696 VA	
Water pump	1/2 hp, 240 V	1176 VA	
A. 8944 VA	B. 6708 VA	C. 10789 VA	D. 4000 VA

## ESAS – May 2010

79. What is the neutral load for a single phase system having a 150 A of electric discharge lighting load and 250 A of incandescent lighting?

- A. 400 A
- B. 280 A
- C. 385 A
- D. 325 A

80. A 3-phase, 4-wire (208Y/120-volt, 480Y/277-volt) system is often used to supply both lighting and motor loads, if the maximum possible unbalanced load is 500 amperes, the neutral would have to be large enough to carry \_\_\_\_\_.

- A. 350 A
- B. 500 A
- C. 410 A
- D. 700 A

81. The minimum clearance of overhead wire is

- A. 3100
- B. 2500
- C. 5500
- D. 4600

82. The allowable fill of electrical conduits.

- A. 40%
- B. 53%
- C. 66%
- D. 31%

83. The neutral conductor in an electrical installation has which of the following qualities:

- A. It carries the unbalanced current.
- B. It is the white conductor.
- C. It does not apply ampacity correction.
- D. All of the above

84. A fixture with a combustible material shade shall not be installed in locations where temperatures exceed which of the following:

- A. 30 degrees C
- B. 90 degrees C
- C. 10 degrees C
- D. 25 degrees C



## MULTIVECTOR REVIEW AND TRAINING CENTER



85. Conductors that supply a fire pump motor must have a rating not less than \_\_\_ percent of the sum of the fire pump motor's full load current and \_\_\_ percent of any associated fire pump accessory equipment:
- A. 80, 100                      B. 125, 100                      C. 115, 125                      D. 100, 100
86. What is the smallest size of conductor are permitted to be connected in parallel to form a single conductor?
- A. 50 sq mm                      B. 125 sq mm                      C. 14.0 sq mm                      D. 200 sq mm
87. How much free non-heating conductor must be left at each outlet box?
- A. 100 mm                      B. 125 mm                      C. 150 mm                      D. 200 mm
88. What is the maximum loading for branch circuits for Outline Lighting?
- A. 40 %                      B. 50 %                      C. 80 %                      D. 100 %
89. The minimum size of wire used in electrical wiring is the former number 14 AWG. Under the metric system now shown the new PEC, the diameter is,
- A. 1.6 mm                      B. 2 mm                      C. 2.6 mm                      D. 3.2 mm
90. The largest size regular plug fuse used is rated at
- A. 15 amperes                      B. 20 amperes                      C. 30 amperes                      D. 40 amperes

### EE - Sept 2009

91. Luminaire type permitted in clothes closets.
- A. Incandescent fixture with open ampere  
B. Incandescent fixture with partially enclosed ampere  
C. Pendant luminaire  
D. Surface mounted or recessed incandescent fixture with a completely enclosed lamp
92. What is the maximum number of 3.5 sq. mm RHH copper conductors permitted inside a 26.25 sq. mm electric metallic conduit?
- A. 2                      B. 3                      C. 4                      D. 1

### ESAS - May 2010

93. Medium voltage cable insulation is rated for \_\_\_\_\_ volts or higher.
- A. 600                      B. 1000                      C. 230                      D. 2001
94. What is the minimum size of tap conductor permitted if the over-current device protecting the feeder conductor is 60 ampere?
- A. 10 ampere                      B. 20 ampere                      C. 30 ampere                      D. 40 ampere
95. Tap conductors supplying electric ranges, wall-mounted electric ovens, and counter-mounted electric cooking units from a 50-ampere branch circuit shall have an ampacity of not less than
- A. 20 A                      B. 60 A                      C. 30 A                      D. 40 A
96. The largest solid conductor generally permitted to be installed in raceway is size:
- A. 3.5 sq. mm                      B. 5.5 sq. mm                      C. 8.0 sq. mm                      D. 14.0 sq. mm



## MULTIVECTOR REVIEW AND TRAINING CENTER



97. In a dwelling, for the purpose of supplying cord- and plug-connected loads 1440volt-amperes or less, or less than 0.25 horsepower, the nominal voltage between conductors supplying device terminals shall not exceed:

- A. 120 volts      B. 230 volts      C. 208 volts      D. 277 volts

98. A two-family dwelling has both living units with grade level access both from the front and the back yard. The minimum number of 230-volt, 20-ampere receptacle outlets required on the outside of this building is:

- A. Three      B. One      C. Four      D. Two

99. A living area in a dwelling has a wall that is 1220 mm long, then makes a 90° corner and continues for another 6100 mm, and makes another corner and continues for 2130 mm. The minimum number of receptacle outlets permitted to be installed on this 9450 mm wall section is:

- A. Two      B. Four      C. Six      D. Three

100. A single-family dwelling has four 20 Ampere, 230-volt small-appliance branch circuits installed to serve the receptacle outlets in the kitchen and dining room. When calculating the service demand load for the dwelling, the minimum load that is permitted to be included for the small-appliance branch-circuits in this dwelling is:

- A. 1500 VA.      B. 4500 VA.      C. 7500 VA.      D. 6000 VA

101. What is the suitable marking or identification to designate the high leg voltage of a 240/120-volt delta, 4-wire electrical system where the midpoint of one phase is grounded?

- A. Red      B. Yellow      C. Orange      D. Blue.

102. What is the minimum height of service drop conductors above a driveway?

- A. 3100 mm      B. 3700 mm      C. 4600 mm      D. 5500 mm

EE – Sept 2010

103. What is the equivalent size in square millimeters ( $\text{mm}^2$ ) of the 250 MCM cable?

- A. 150  $\text{mm}^2$       B. 135  $\text{mm}^2$       C. 125  $\text{mm}^2$       D. 145  $\text{mm}^2$

ESAS – Sept 2013

104. A single grounding electrode is permitted when the resistance to ground as stated in the PEC is

- A. 30 ohms or less      B. 30 ohms or more      C. 25 ohms or less      D. 25 ohms or more.

ESAS – Sept 2014

105. What is the maximum operating temperature of type UF conductor?

- A. 75 °C      B. 90 °C      C. 60 °C      D. 110 °C

ESAS – Sept 2014

106. The equipment grounding conductor of a branch circuit shall be identified by what color?

- A. Green      B. Black      C. White      D. Gray





# MULTIVECTOR REVIEW AND TRAINING CENTER



## Supplementary

1. The code permits the use of only one circuit for small single-family dwelling unit having a floor area of not more than \_\_\_\_\_ m<sup>2</sup> with load not exceeding \_\_\_\_\_ volt-amperes.
  - a. 80, 3680
  - b. 100, 3860
  - c. 50, 3680
  - d. 60, 3860
2. What is the maximum number of over current devices allowed in a lighting and appliance panel board
  - a. 24
  - b. 30
  - c. 36
  - d. 42
3. About every 5 years new edition of PEC are issued, incorporating changes approved in the interim period. These changes are considered in the PEC by the use of
  - a. Italics
  - b. Boldface
  - c. Parenthesis
  - d. vertical Marginal line
4. At all building and structure, the PEC requires one of the FF.
  - a. Service disconnecting means
  - b. A main distribution board
  - c. A metering system
  - d. a grounding rod
5. Which two of the following are not absolute code requirement
  - I. Adequate current carrying capacity of conductor
  - II. Efficient design
  - III. Allowance for future expansion
  - IV. Accessibility of equipment
  - V. Freedom from Hazard
  - a. I and II
  - b. II and III
  - c. I and III
  - d. IV and V
6. The maximum number of quarter bends in one run of EMT is \_\_\_\_\_.
  - a. two
  - b. four
  - c. five
  - d. none of these
7. The neutral conductor shall not be \_\_\_\_\_.
  - a. stranded
  - b. solid
  - c. insulated
  - d. fused
8. Circuit Breaker shall open all \_\_\_\_\_ conductors of those circuits unless otherwise permitted.
  - a. grounded
  - b. ungrounded
  - c. neutral
  - d. grounding
9. What is the minimum diameter of wire for festoon wiring?
  - a. 1.6
  - b. 2.0
  - c. 3.4
  - d. 4.9
10. Fuses rated \_\_\_\_\_ V nominal or less shall be permitted to be used for a voltage at or below their ratings.
  - a. 24
  - b. 240
  - c. 1000
  - d. 600
11. A branch circuit larger than 50 A shall supply only
  - a. motor
  - b. lighting
  - c. non lighting
  - d. any of the above
12. What shall be the maximum height of a receptacle outside the building?



# MULTIVECTOR REVIEW AND TRAINING CENTER



- a. 3000 mm                      b. 5000 mm                      c. 2000 mm                      d. 500 mm
14. For two conductors with communication and signal conductors inside the conduit, the ampacity of the conductors shall be derated to what percent?  
a. 90%                      b. 80%                      c. 70%                      d. None of these
15. For optional calculation in dwelling units, the first 10 kW shall be computed at 100% while the remainder is at \_\_\_\_\_.  
a. 65%                      b. 60%                      c. 50%                      d. 40%
16. Given: A 120-volt lighting fixture has twelve 100-watt light bulbs which are all fed through a common fixture wire.  
The MINIMUM size fixture wire for the one common wire that feeds the entire fixture is size  
a. 2.0 sq mm.                      b. 3.5 sq mm                      c. 5.5 sq mm                      d. 8.0 sq mm
17. When sizing the wires that extend the power from the source to the disconnect for the electric motor, the conductors should be sized at \_\_\_\_\_ percent of the full-load current of the motor.  
a. 115 percent                      b. 120 percent                      c. 125 percent                      d. 250 percent
18. The insulation material with rated class "UF" has a thermal capacity up to;  
a. 75°C                      b. 90°C                      c. 60°C                      d. 50°C
19. The disconnecting means of a hermetic-type refrigerator compressor shall have an ampacity of at least \_\_\_\_\_ of the nameplate full load current.  
a. 125%                      b. 80%                      c. 100%                      d. 115%
20. According to NEC it is the acceptable voltage drop for the feeder  
a. 2%                      b. 3%                      c. 5%                      d. 2.3%
21. In number of ohms, what is the benchmark for grounding resistance?  
a. 65                      b. 25                      c. 40                      d. 10
22. What is the maximum percentage voltage drop allowable through an extension cord?  
a. 1%                      b. 2%                      c. 4%                      d. 6%
23. It is generally not good practice to supply lampere and motors from the same circuit because \_\_\_\_\_.  
I. it is more economical to operate motors on a higher voltage than that of a lighting circuit  
II. overloads and short circuits are more common on motor circuits and would put the lights out  
III. when a motor is started it would cause the lights to dim or blink  
a. I only                      b. II only                      c. III only                      d. I, II and III
24. For each 2-wire laundry branch circuit, a feeder load of NOT less than \_\_\_\_\_ shall be included.  
a. 1,800 VA                      b. 1,500 VA                      c. 2,000 VA                      d. 1,200 VA



# MULTIVECTOR REVIEW AND TRAINING CENTER



25. Branch circuits for heating and air-conditioning equipment located on the elevator car shall not have a circuit voltage in excess of \_\_\_\_\_ volts.
- a. 600                      b. 13800                      c. 2000                      d. 220
26. What is the equivalent rating of a double duplex receptacle?
- a. 180                      b. 4 x 90                      c. 360                      d. 2 x 180
27. Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors. Meaning the angle between the power conductor and the communication conductor shall be.
- a. 180°                      b. 90°                      c. 0°                      d. 45°
28. A WYE-DELTA starter for a single voltage three phase SC induction motor would require the connection of a certain number of wires from the motor. How many wires would be needed?
- a. 3 wires                      b. 9 wires                      c. 6 wires                      d. 12 wires
29. Allowable Ampacities of Insulated Conductors Rated 0 Through \_\_\_\_\_ Volts, \_\_\_\_\_°C Through \_\_\_\_\_°C (140°F Through 194°F), Not More Than \_\_\_\_\_ Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of \_\_\_\_\_°C (86°F).
- a. 13800, 75, 115, 4, 30                      b. 1000, 60, 90, 3, 26-30  
c. 600, 60, 75, 3, 26                      d. 2000, 60, 90, 3, 30
30. Fuse protection is used for current ratings up to
- a. 10 A                      b. 20 A                      c. 50 A                      d. 100 A
31. How many overload relays are required to protect a three phase motor circuit? When instantaneous trip breakers are used in a three phase branch circuit, how many overload protections are required by the code?
- a. Three                      b. two                      c. one                      d. four
32. A conductor encircling a building and interconnecting all ground terminals
- a. counterpoise                      b. Faraday cage                      c. electrode                      d. chord
33. These are standard ampere rating for inverse time circuit breakers, except:
- a. 75 Ampere                      b. 50 Ampere                      c. 60 Ampere                      d. 90 Ampere
34. The normal operating temperatures of cartridge type fuse at its rating;
- a. 100 deg. C                      b. 75 deg. C                      c. 50 deg. C                      d. 25 deg. C
35. Ampacities of conductors on most tables are based on this temperature.
- a. 30 to 40 deg. C                      b. 20 to 30 deg. C                      c. 26 to 30 deg. C                      d. 30 to 50 deg. C
36. The load of an instrument transformer consisting of delicate moving elements of ammeter, voltmeter and wattmeter is termed as
- a. Transformed power                      b. Instrument impedance  
c. Burden                      d. meter load





# MULTIVECTOR REVIEW AND TRAINING CENTER



38. Knowing the surface temperature of a certain electrical machine in degrees Centigrade, the hot spot can be determine by adding the measured surface temperature with:
- a. 15 deg. C                      b. 20 deg. C                      c. 40 deg. C                      d. 30 deg. C
39. The current-carrying conductors in cable bus shall have an insulation rating of \_\_\_\_\_ or higher
- a. 75°C                      b. 60                      c. 90                      d. 110
40. With an applied voltage of 10 percent below rating, the running current would increase \_\_\_\_\_ percent, and the operating temperature would increase by \_\_\_\_\_ percent. At the same time, torque would be reduced by \_\_\_\_\_ percent.
- a. 11, 12, 19                      b. 10,11, 12                      c. 19, 12, 11                      d. 10,10,10
41. Conductor ampacity shall be based on the individual currents determined as the sum of \_\_\_\_\_ percent of the two largest welders, plus \_\_\_\_\_ percent of the third largest welder, plus \_\_\_\_\_ percent of the fourth largest welder, plus \_\_\_\_\_ percent of all remaining welders.
- a. 100, 85, 70 60                      b. all 100                      c. 100, 90, 70 and 70                      d. all 125
42. How many supply services (of the same potential) are allowed to enter a residential bungalow?
- a. one                      b. two                      c. three                      d. four
43. What is the spacing required between open wiring conductors operating at 240 volts in dry locations?
- a. 10mm                      b. 25mm                      c. 50mm                      d. 65mm
44. A buck-boost transformer provides a means of raising or lowering (boosting or bucking) a supply line voltage by a small amount preferably \_\_\_\_%.
- a. 25                      b. 20                      c. 10                      d. 50
45. \_\_\_\_ percent of the nameplate rating(s) of electric space heating if four or more separately controlled units.
- a. 30%                      b. 40%                      c. 100%                      d. 125%
46. Primary protection for a transformer with 5 % rated impedance and is over 600 volts, the circuit breaker feeding this shall be sized at \_\_\_\_.
- a. 125 %                      b. 225 %                      c. 300 %                      d. 600 %
47. When circuit breaker is installed in enclosed switchboards, they are usually derated to a certain percentage. What is this percentage?
- a. 60%                      b. 80%                      c. 50%                      d. 70%