ILLUSTRATED RESIDENTIAL

ELECTRICAL CODE REQUIREMENTS

Electrical Inspections
200 3rd Street North
Fargo ND 58102
701-476-6626 (South of Interstate 94)
701-476-4181 (North of Interstate 94)

Addenda to This Booklet

Updated July 1, 2017

This handout does not address any covenants or easements assigned to the property, nor does it relieve you of code compliance with items that may not have been included from the 2017 National Electric Code. If you have any questions or need more information, please contact the electrical inspector at 476-6626 (South of Interstate 94) or 476-4181 (North of Interstate 94).

- For rough-in inspections, only boxes and lights must be spliced out.

- All receptacles on 15 Amp, 20 Amp, 120v, and 250v circuits **must be tamper-resistant**.

- All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit kitchens, laundry areas, family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination-type breaker, installed to provide protection of the branch circuit.

- When wiring fireplaces, the wire for power and the wire for the gas valve ***must*** have a barrier between them if mounted in the same box because of the different voltages on the wires.

- Recessed lights can be wired with the clamps provided with them or by using connectors listed for that purpose.

- Be aware of "box fill" when wiring with romex. Each size 14 wire requires 2 cubic inches in the box, size 12 wire requires 2.25 cubic inches, and size 10 wire requires 2.5 cubic inches. The switch or receptacle requires a double volume allowance – 2x cubic inches per device. The ground wires are counted as 1 wire.

For example:	4 14-2 romex wires	(8x2=16)
	1 receptacle	(2x2=4)
	+ 1 ground	(1x2=2 total)
	This would require a box of a minimum	(22 cubic inches)

- When using dimmers and GFCI receptacles, a larger cubic inch box is desirable.

- Code only allows 1/2" of the outer jacket of NMB cable to be present in switch and outlet boxes.

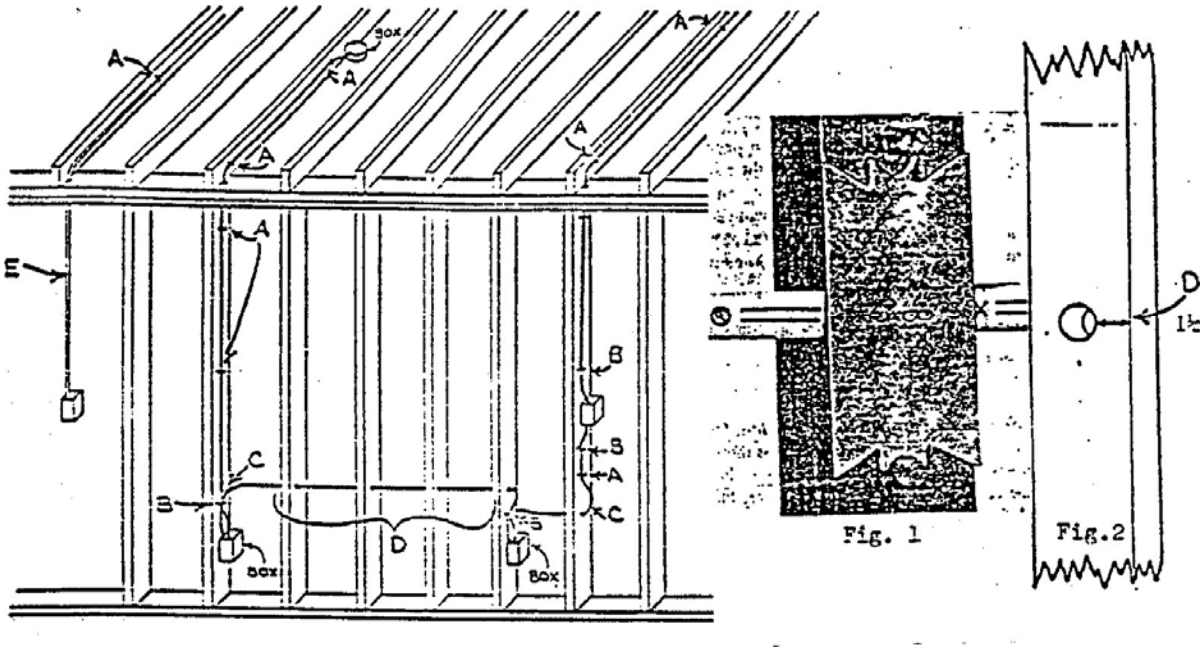
- You are allowed 1 1/4" of space from the side of a 2x4 to the edge of the cable. Center all cables on studs and use stacker straps if more than two cables are run under a staple.

- No more than two cables may be run through a maximum 5/8" hole in a stud. Such holes must be centered in the stud.

- No outlets are allowed above electric baseboard heaters.

- **Garages:** At least one 120 volt, 20-ampere branch circuit shall be installed to supply receptacle outlets in attached garages and detached garages with electrical power. This circuit shall have no other outlets. At least one receptacle outlet shall be installed in each vehicle bay and not over 5 1/2 feet.

WIRE PLACEMENT AND INSTALLATION



A. NM CABLE MUST BE SECURED BY STAPLES, DESIGNED AND INSTALLED SO AS NOT TO DAMAGE THE CABLE, EVERY 54”.

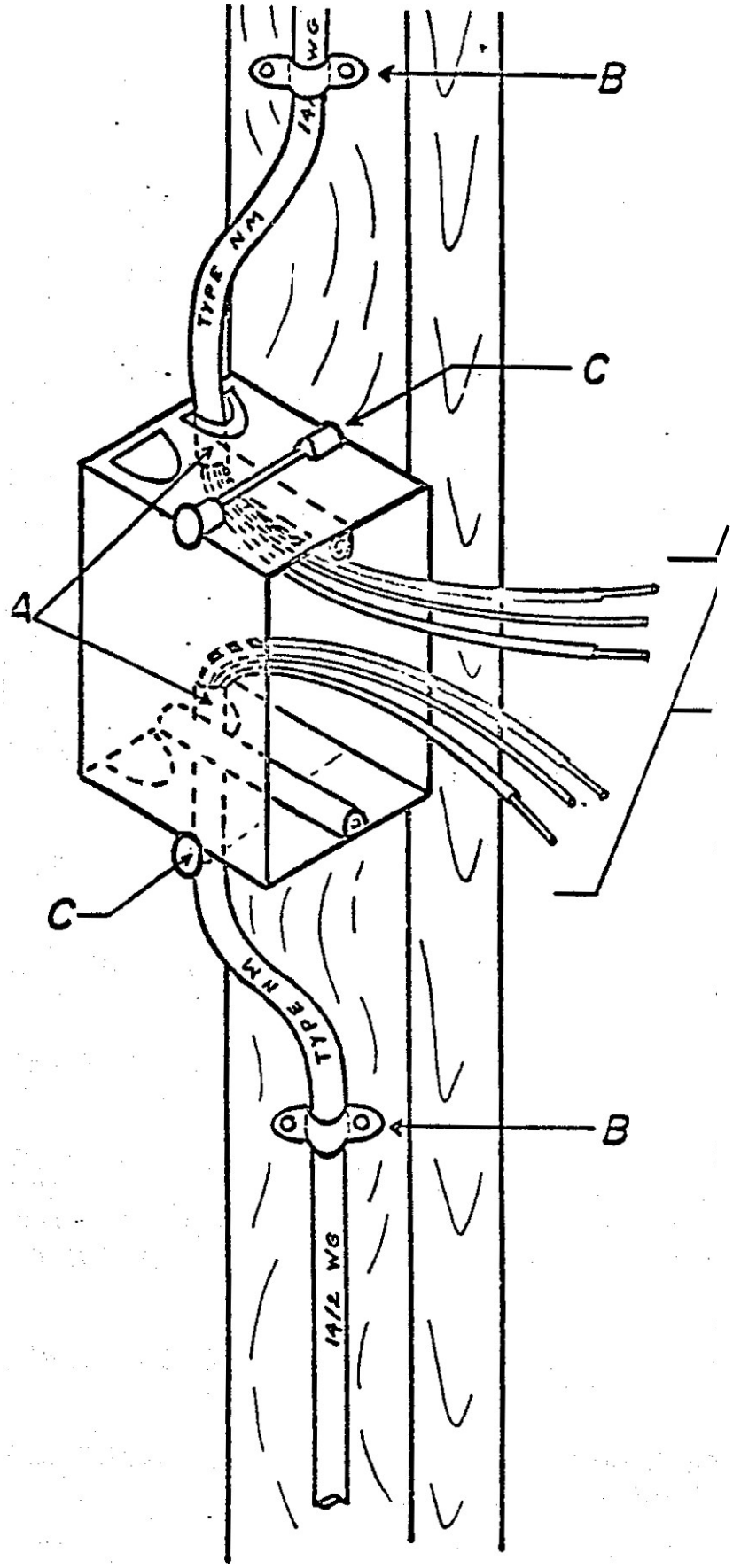
B. A STAPLE MUST BE INSTALLED NO FURTHER THAN 12” FROM A METAL BOX WITH NM CABLE CLAMPS OR 8” FROM A PLASTIC BOX WITHOUT CLAMPS.

C. NM CABLE BENDS MUST NOT BE SHARPER THAN 5 TIMES THE DIAMETER OF THE CABLE. WIRES MUST NOT BE TIGHT.

D. HOLES MUST BE DRILLED IN THE CENTER OF 2X4 STUDS AND PLACED IN STRAIGHT LINES. 1 1/4” INCHES OF WOOD MUST COVER WIRE. (CENTER DRILLED 2X4’S ARE ACCEPTABLE) IF 1 1/4” COVER CANNOT BE OTBAINED, METAL PROTECTIVE PLATES MUST BE INSTALLED. METAL PLATES MUST BE 1/16” THICK STEEL. SEE FIGURE 1 AND FIGURE 2.

E. ON CONCRETE WALLS OR SURFACE WIRING, CONDUIT (PLASTIC OR METAL), WIREMOLD OR OTHER APPROVED MEANS OF PROTECTION MUST BE USED.

F. IN UNFINISHED BASEMENTS, NM CABLE MUST BE RUN AND FASTED ON THE SIDE OF THE JOISTS OR THROUGH BORED HOLES IN THE JOIST.



WIRES MUST EXTEND OUT OF BOX AT LEAST 6"

(PLASTIC BOX ILLUSTRATED)

A. CABLE SHEATHING MUST EXTEND AT LEAST 1/2" INSIDE OF BOX.

B. WIRE MUST BE STAPLED WITHIN 8" OF ANY BOX NOT EQUIPPED WITH CLAMPS AND WITHIN 12" OF ANY BOX EQUIPPED WITH CLAMPS.

C. BOX MOUNTING MUST BE OF AN APPROVED TYPE - NAILS OUTSIDE OF BOX OR IMMEDIATELY INSIDE OF BOX OR BRACKETS SECURED TO BOX.

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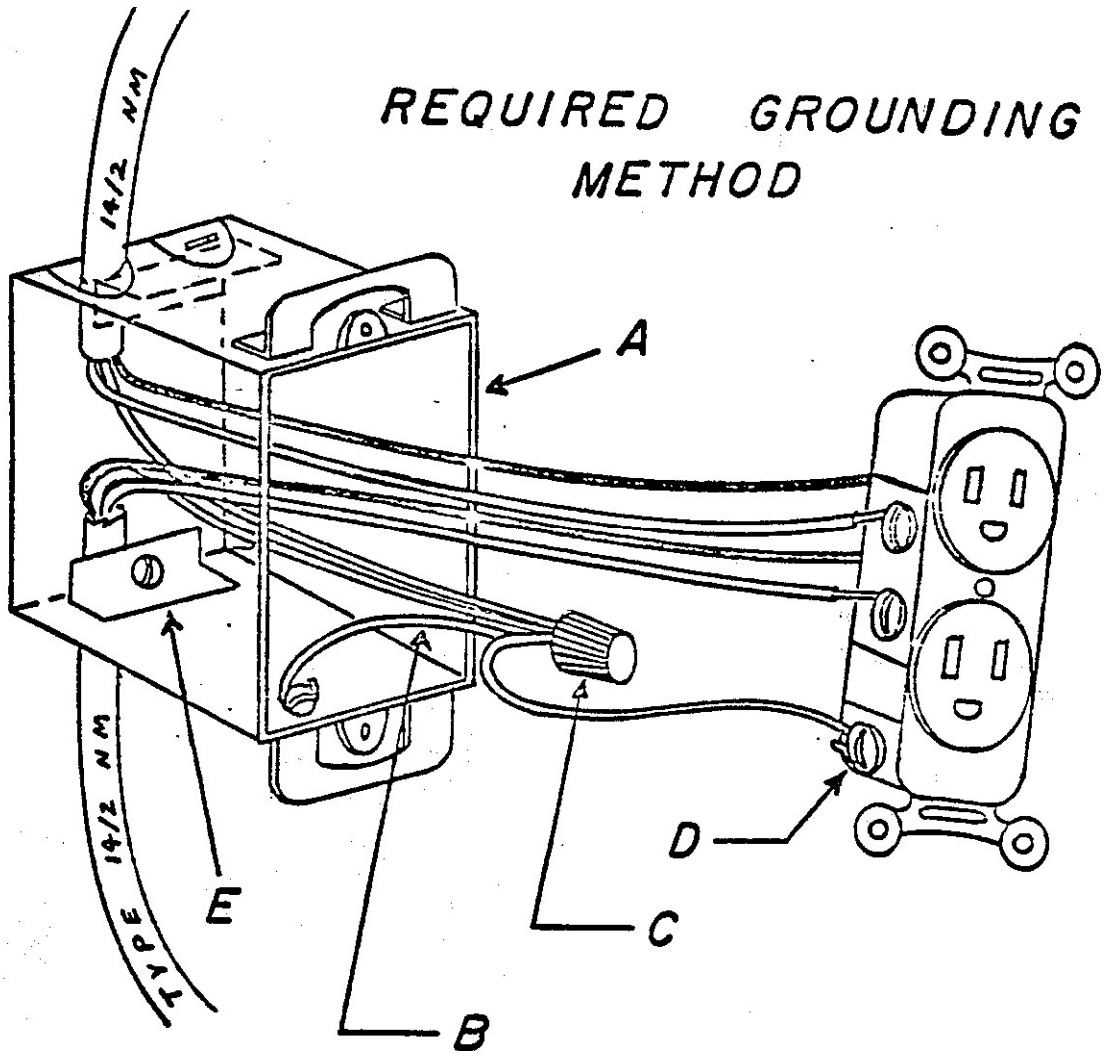


A. METAL BOX ILLUSTRATED. IF PLASTIC BOX IS USED, BONDING JUMPER (B) IS NOT REQUIRED.

B. BONDING JUMPER REQUIRED WHEN USING METAL OUTLET BOXES. MUST BE ATTACHED WITH A SCREW OR UL APPROVED CLIP DESIGNED FOR SUCH USE.

C. APPROVED WIRE CONNECTOR MUST BE USED FOR GROUND WIRE JUNCTION. SOLDER IS NOT APPROVED.

D. ONLY ONE (1) WIRE MAY BE PLACED UNDER A TERMINAL SCREW ON ANY DEVICE (SWITCH, OUTLET, ETC.).

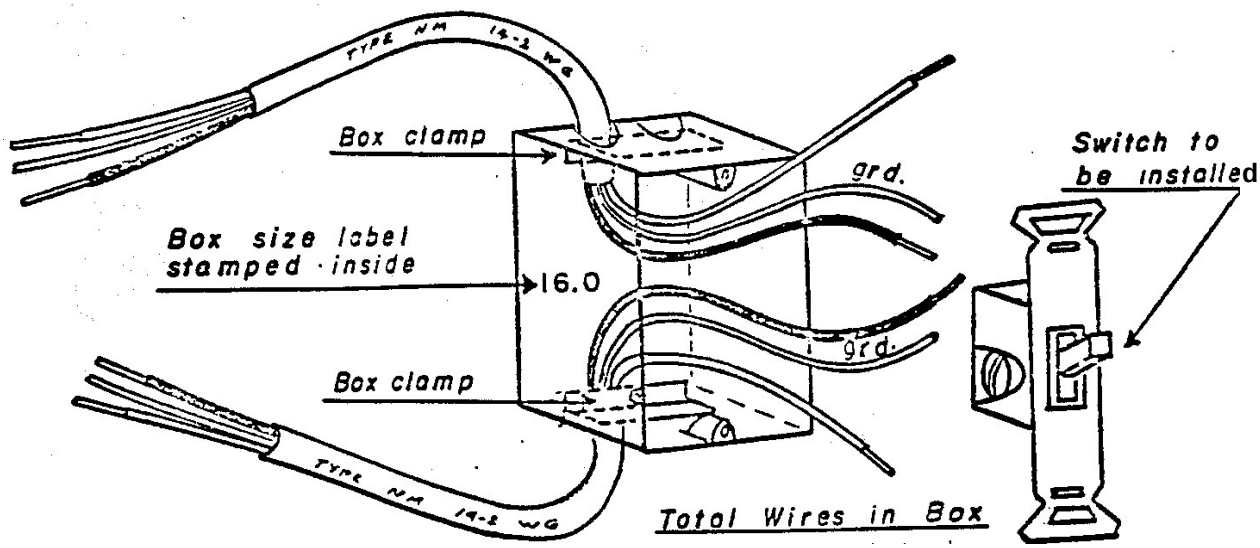
E. CABLE STRAPS REQUIRED IN STEEL BOXES AND PLASTIC CUT-IN BOXES.

WHAT SIZE BOX MEETS CODE?

1. All boxes are calculated in cubic inches (cu. in.) of volume.

2. Wires, clamps, switches, and outlets are designated in cubic inch numbers for calculation purposes.

EXAMPLE



4 – insulated
2 – bare grounds

NOTES:

A. Each insulated wire in the box (not cable sheath) must be counted. In the example above, we have four insulated wires in the box.

B. Ground wires (no matter how many) count only the same as **one** insulated wire.

C. Cable clamps (if in the box) count as one wire.

D. The switch or outlet counts as **two wires**.

E. The table for calculating is:
   2.0 cu. in. for each #14 wire
   2.25 cu. in. for each #12 wire
   2.50 cu. in. for each #10 wire

WHAT SIZE BOX MEETS CODE?

The illustrated box in the example (page 5) would require what size box?

4 – insulated wires, #14 @ 2.0 cu. in. for each wire (see notes A & E)		= 8.0 CU. IN.
2 – ground wires #14 (see notes B & E)	Count as 1 insulated wire	= 2.0 CU. IN.
1 – set of clamps (see notes C & E)		= 2.0 CU. IN.
1 - switch		= 4.0 CU. IN.
	TOTAL	16.0 CU. IN.

Therefore, the minimum size box that code would allow would be 16.0 cubic inches.

Please keep in mind that a larger box is legal, is much easier to work with, and that the difference in cost is minimal. This is especially true when installing GFCI outlets and dimmer switches.

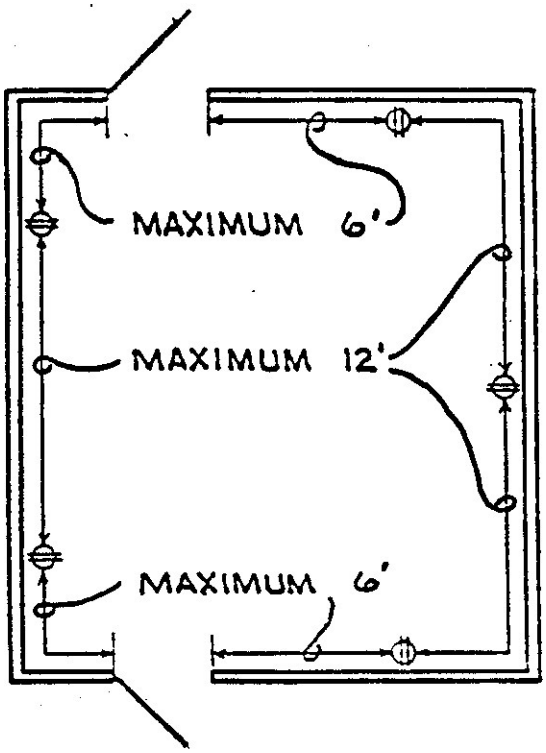
PROPER WIRE SIZES

General lighting and outlet circuits: minimum #14 fused 15 amps. Appliance circuits in kitchen, dining room, pantry, family room, or breakfast room: minimum #12 (3 circuits, minimum-fused 20 amps) Laundry: one 20 amp (#12) circuit.

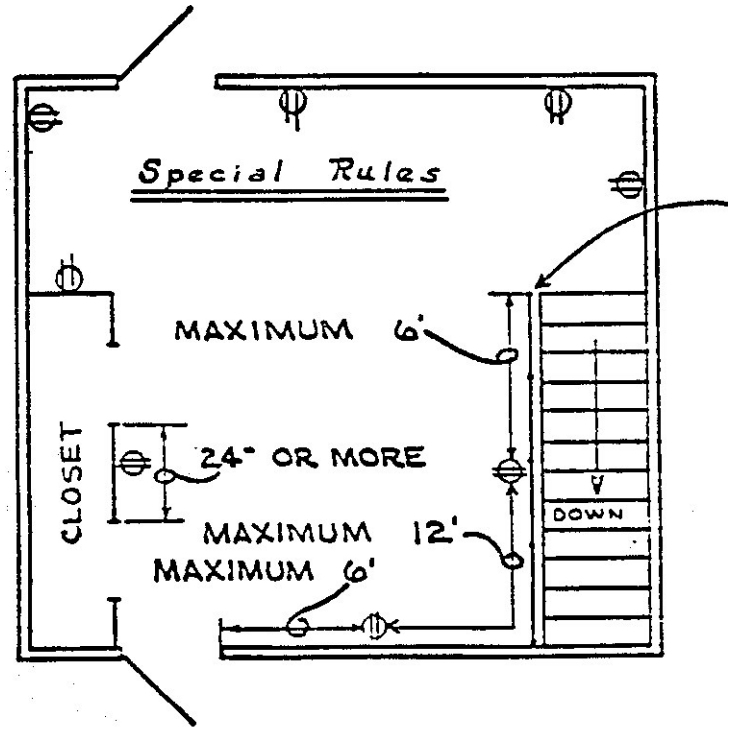
CIRCUIT LOAD

A maximum of 10 lights and outlets per circuit should be used as a guideline where minimum loads are expected.

REQUIRED OUTLETS



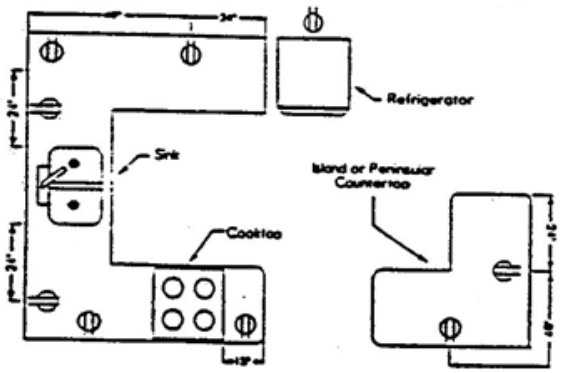
RULE - MAXIMUM OF 6' TO FIRST OUTLET FROM ANY OPENING - PLUS A MAXIMUM OF 12' BETWEEN ANY TWO OUTLETS MEASURE ALONG THE WALL LINE. (THIS IS A MINIMUM, YOU MAY ADD MORE IF YOU WANT)



- RAILING ALONG STAIRWELL COUNTS AS WALL SPACE.
- ANY WALL SPACE 24" OR MORE REQUIRES OUTLET.
- STATIONARY PART OF SLIDING DOOR INCLUDED AS WALL SPACE.

- OUTLETS MUST BE WITHIN 5 ½' OF THE FLOOR TO COUNT AS REQUIRED OUTLETS.
- FLOOR OUTLETS MUST BE WITHIN 18" OF THE WALL TO COUNT AS REQUIRED OUTLETS. ALL FLOOR OUTLETS MUST HAVE A LISTED FACEPLATE.

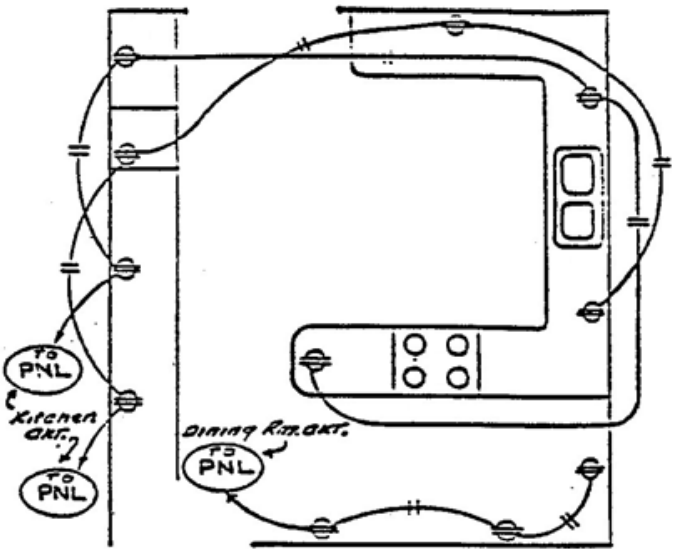
RECEPTACLE SPACING OF KITCHEN AND DINING ROOM COUNTERTOPS



THE SPACING FOR RECEPTACLES AT COUNTER TOPS IN KITCHENS AND DINING AREAS OF DWELLING UNITS HAS BEEN REVISED SO THAT NO POINT ALONG THE WALL LINE IS MORE THAN 24 INCHES MEASURED HORIZONTALLY FROM A RECEPTACLE OUTLET. ISLAND AND PENINSULAR COUNTER TOPS 12 INCHES OR WIDER SHALL HAVE AT LEAST ONE RECEPTACLE FOR EACH FOUR FEET OF COUNTER TOP.

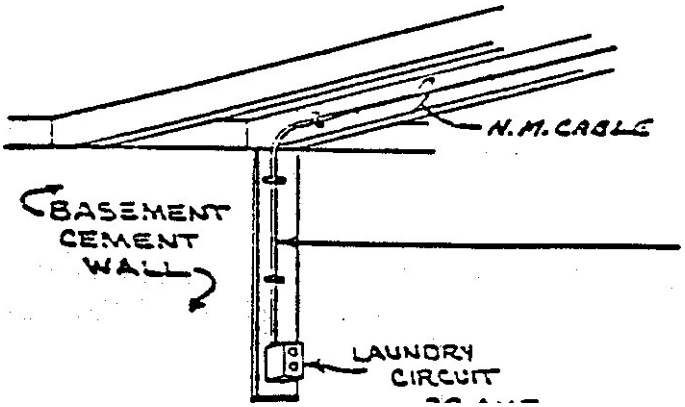
KITCHEN

ALL 20-AMPERE RECEPTACLES REQUIRED BY SECTION 210-52(B) FOR COUNTER TOP SURFACES SHALL HAVE GROUND FAULT CIRCUIT INTERRUPTER PROTECTION FOR PERSONNEL AND ARC-FAULT PROTECTION. THEY SHALL BE LOCATED WITHIN 18" ABOVE THE COUNTERTOP.



#12 WIRE – 20 AMP CKTS. WIRING OF KITCHEN OUTLETS HOP SCOTCH SO NO TWO ADJACENT OUTLETS ARE ON THE SAME CIRCUIT. (AS ILLUSTRATED).

TWO 20 AMP KITCHEN CIRCUITS ARE REQUIRED AS IS ONE 20 AMP DINING ROOM CIRCUIT. KITCHEN AND DINING ROOM 20 AMP CIRCUITS ARE ALLOWED TO FEED OUTLETS ONLY. RANGE HOODS, DISPOSAL UNITS, AND OTHER APPLIANCES MUST BE FED FROM OTHER CIRCUITS.



PROTECTED IN PIPE OR STAPLED ON WOOD STRIP

CODE REQUIRES A SEPARATE 20 AMP CIRCUIT FOR LAUNDRY ROOM RECEPTACLE(S). THE OUTLET(S) IN THE LAUNDRY ROOM MUST BE LOCATED WITHIN 6' OF APPLIANCES.

A. AT LEAST ONE WALL-SWITCHED LIGHTING OUTLET MUST BE INSTALLED IN EVERY:

HABITABLE ROOM
HALLWAY
STAIRWAY
ATTACHED GARAGE, AND AT EACH OUTDOOR ENTERANCE.

B. AT LEAST ONE WALL-SWITCHED OR PULLCHAIN LIGHTING OUTLET MUST BE INSTALLED IN EVERY:

ATTIC
UNDERFLOOR SPACE
UTILITY ROOM AND
BASEMENT USED FOR STORAGE OR CONTAINING EQUIPMENT REQUIRING SERVICE.

(NOTE) – WALL-SWITCHED RECEPTACLE(S) MAY BE USED INSTEAD OF A LIGHTING OUTLET IN HABITABLE ROOMS OTHER THAN KITCHENS AND BATHROOMS.

<u>RECEPTACLE OUTLETS REQUIRED</u>

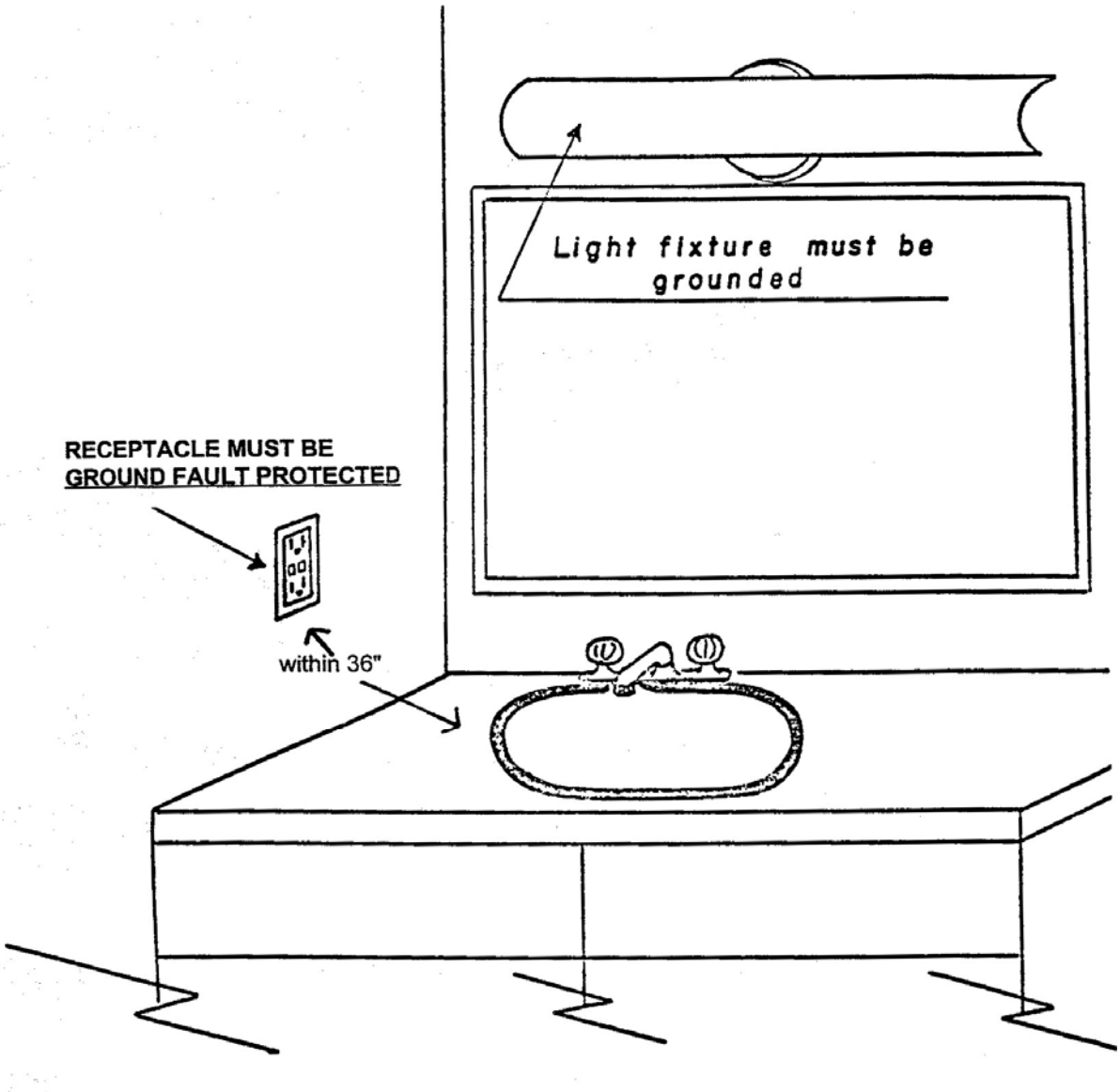
AT LEAST ONE RECEPTACLE OUTLET MUST BE INSTALLED IN EACH BASEMENT OF A DWELLING OCCUPANCY.

FOR A ONE FAMILY DWELLING AND EACH UNIT OF A TWO FAMILY DWELLING THAT IS GRADE LEVEL, AT LEAST ONE RECEPTACLE OUTLET WITHIN 6 1/2' OF GRADE SHALL BE INSTALLED AT THE FRONT AND BACK OF DWELLING.

RECEPTACLES MAY NOT BE INSTALLED DIRECTLY OVER ELECTRICAL BASEBOARD HEATERS.

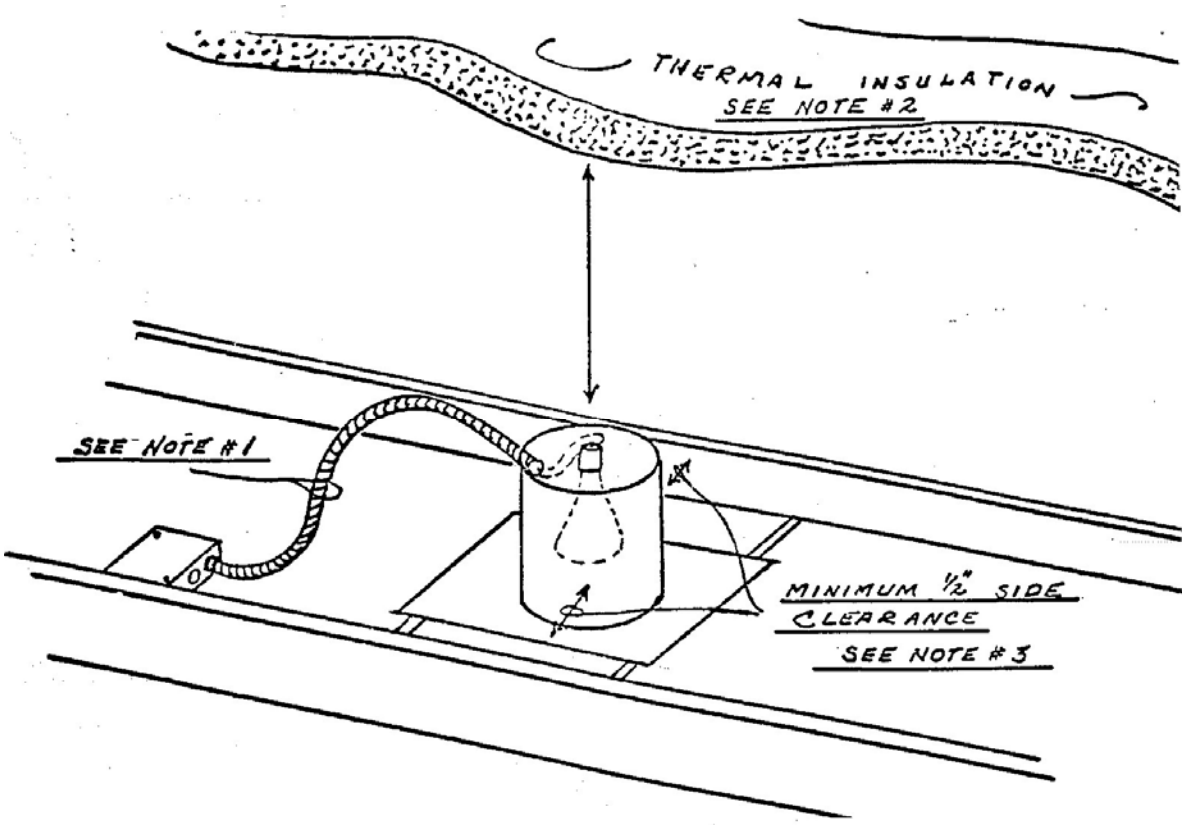
GFCI PROTECTED OUTLETS ARE REQUIRED IN:

1. BATHROOMS
2. GARAGES (ATTACHED OR DETACHED) & ACCESSORY BUILDINGS
3. OUTDOORS
4. CRAWL SPACES
5. UNFINISHED BASEMENTS
6. KITCHENS (OUTLETS THAT SERVE COUNTERTOP)
7. SINKS (WITHIN 6' OF SINK)
8. BATHTUBS AND SHOWER STALLS (WITHIN 6' OF OUTER EDGE)
9. LAUNDRY AREAS
10. DISHWASHER
11. CRAWL SPACE LIGHTING OUTLETS



CODE RULE SECTION 210 11-(C)(3): AT LEAST ONE 20 AMP BRANCH CIRCUIT SHALL BE PROVIDED TO SUPPLY BATHROOM RECEPTACLES, SUCH CIRCUITS SHALL PROVIDE NO OTHER OUTLETS. BATHROOM OUTLETS SHALL BE WITHIN 36" OF THE SINK(S).

EXCEPTION: WHEN 20 AMP CIRCUIT SUPPLIES A SINGLE BATHROOM, OUTLETS FOR OTHER EQUIPMENT WITHIN THE SAME BATHROOM SHALL BE PERMITTED. OTHER EQUIPMENT SHALL NOT EXCEED 10 AMPS.



RECESSED LIGHTING FIXTURE REQUIREMENTS

NOTE 1:
FLEX CONDUIT NOT LESS THAN 18” BUT NOT MORE THAN 6’ WIRED WITH 90 DEG. C WIRE UNLESS U.L. APPROVED “REWIRED” AND DESIGNED FOR CONNECTION TO 60 DEG. RATED WIRE.

NOTE 2:
THERMAL INSULATION SHALL NOT BE INSTALLED ABOVE OR WITHIN 3” OF THE SIDE OF A RECESSED FIXTURE ENCLOSURE, WIRING COMPARTMENT, OR BALLAST UNLESS LABELED FOR THE PURPOSE.

NOTE 3:
RECESSED PORTIONS OF ENCLOSURES OTHER THAN AT POINTS OF SUPPORT, SHALL BE SPACED AT LEAST 1/2” FROM COMBUSTIBLE MATERIAL.

NOTE 4:
ALL RECESSED FIXTURES MUST BE LABELED AS THERMALLY PROTECTED.

NOTE 5:
LIGHT FIXTURES MUST BE INSTALLED ACCORDING TO MANUFACTURES INSTRUCTIONS. BE CAREFUL ON LIGHT FIXTURES WITH JUNCTION BOXES MOUNTED ON TOP OF HOUSING.

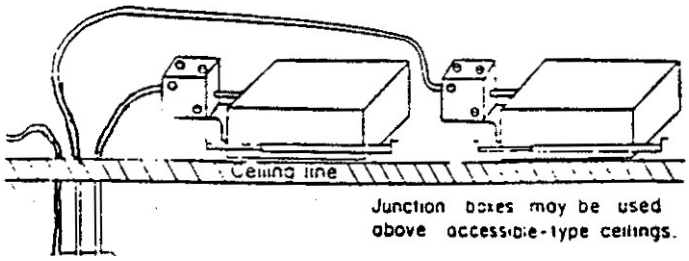


FIGURE 1: BRANCH-CIRCUIT CONDUCTORS TERMINATING AT EACH FIXTURE (NO FEEDTHROUGH)

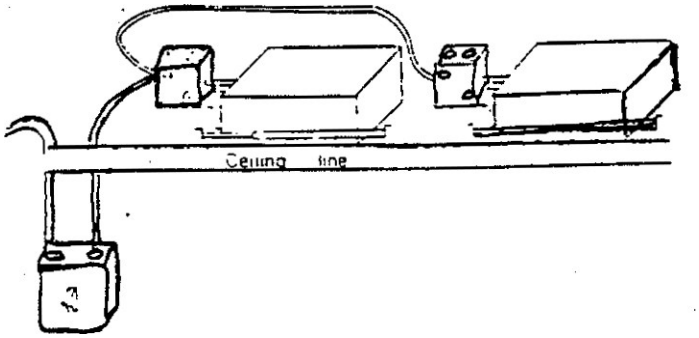


FIGURE 2: LIGHTING FIXTURES THAT ARE DESIGNED FOR “FEED-THROUGH” BRANCH-CIRCUIT CONDUCTORS.

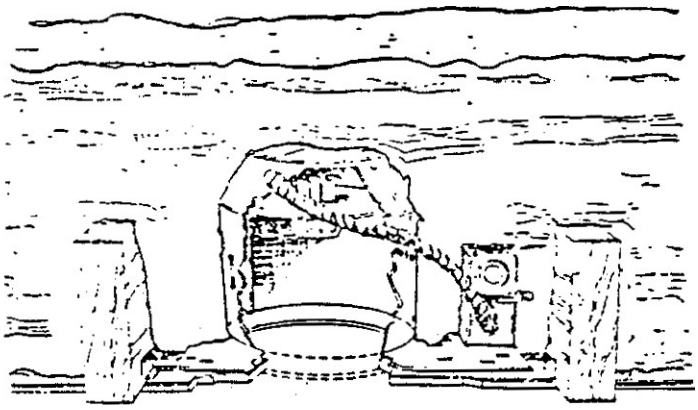


FIGURE 3: A LISTED RECESSED FIXTURE SUITABLE FOR USE IN INSULATED CEILINGS IN DIRECT CONTACT WITH THERMAL INSULATIONS (THOMAS INDUSTRIES INC)

<u>NOTE 1:</u> THESE ARE CLASSIFIED AS PRE-WIRED FIXTURES AND THEREFORE DO NOT NEED THE FLEX AND JUNCTION BOX AS SHOWN ON PAGE 11 NOTE 1. SEE FIGURES 1 & 2

<u>NOTE 2:</u> THIS TYPE OF FIXTURE CAN BE USED IN DIRECT CONTACT WITH THERMAL INSULATION BUT MUST BE LISTED OR LABELED AS I.C. RATING. SEE FIGURE 3.

SERVICE SPECIFICATIONS

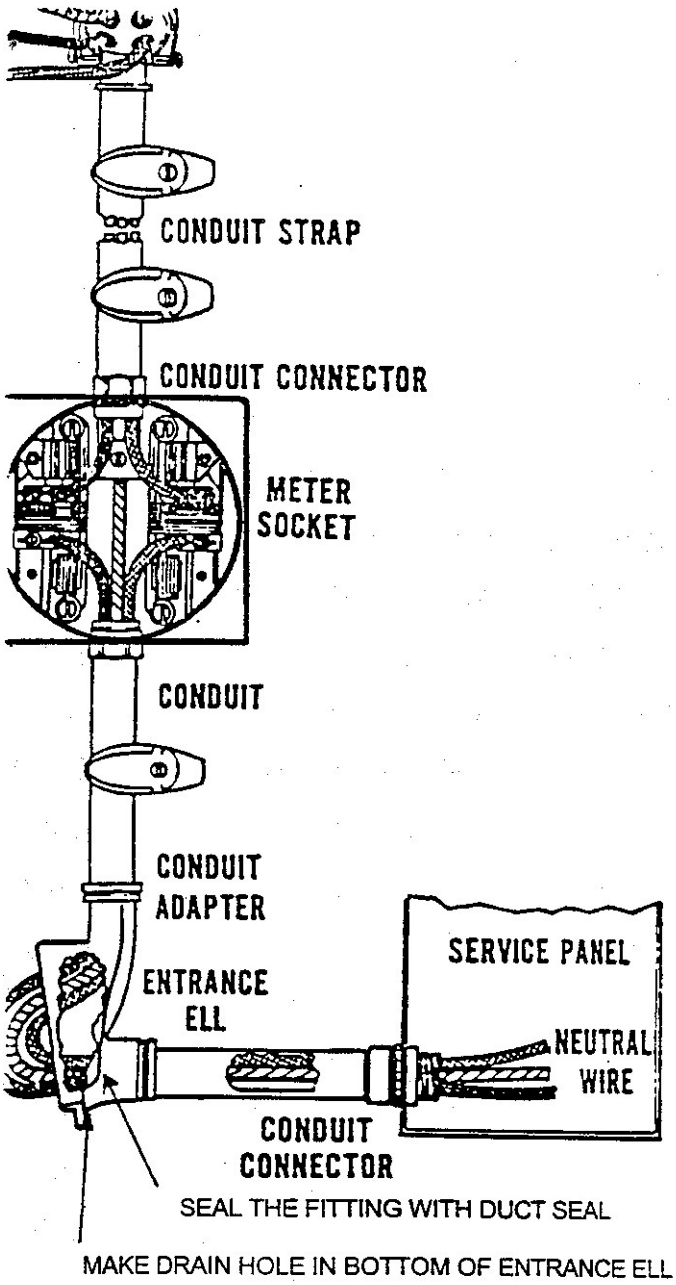
ALL SIZES ARE MINIMUM

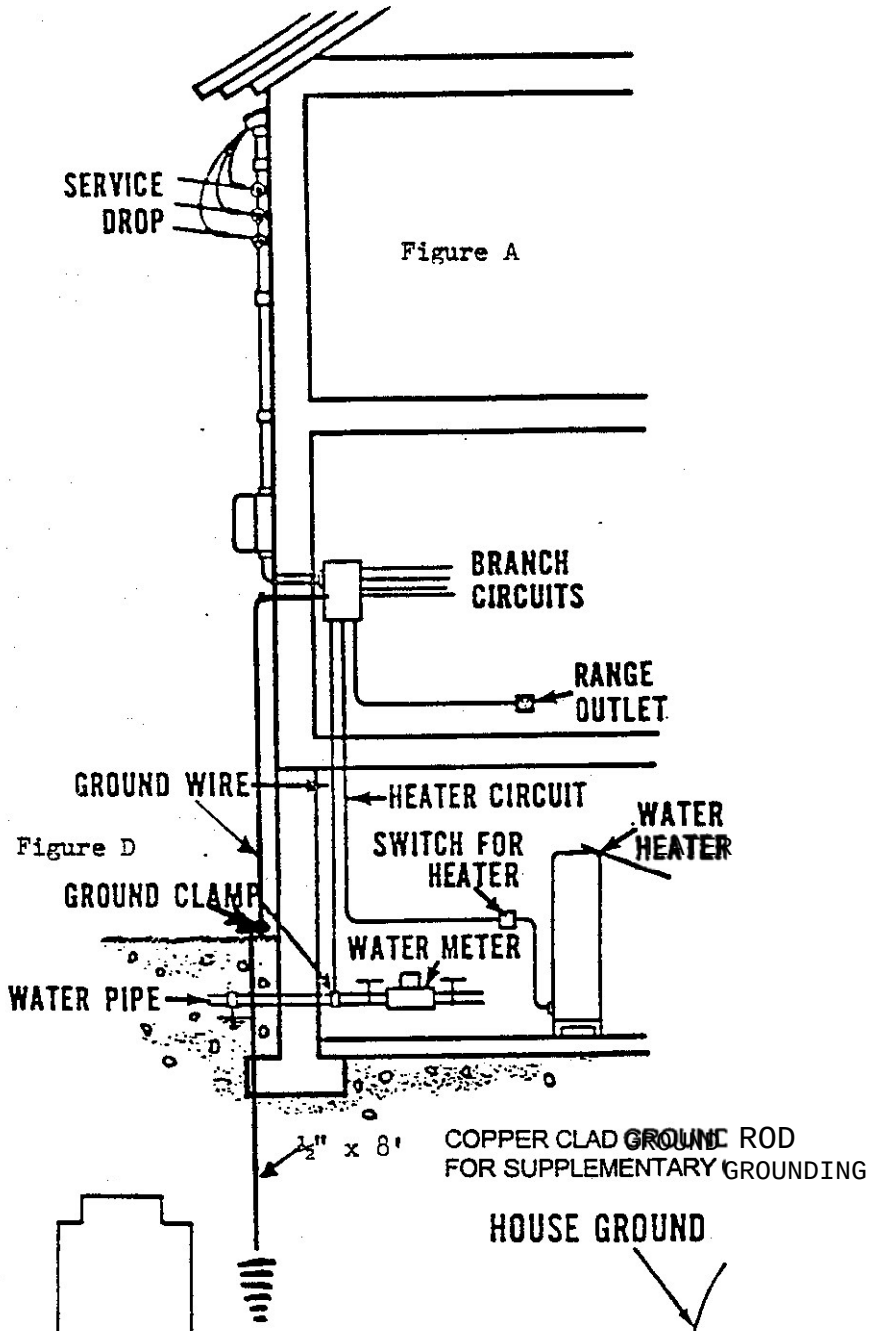
AMP SIZE	CONDUIT SIZE	ALUMINUM CONDUCTOR	COPPER CONDUCTOR	CONDUIT SIZE	COPPER GROUNDING CONDUCTOR SIZE
100	1 1/4”	2	4	1”	8
110	1 1/4”	1	3	1 1/4”	8
125	1 1/2”	1/0	2	1 1/4”	8
150	1 1/2”	2/0	1	1 1/4”	6
175	2	3/0	1/0	1 1/2”	6
200	2	4/0	2/0	1 1/2”	4

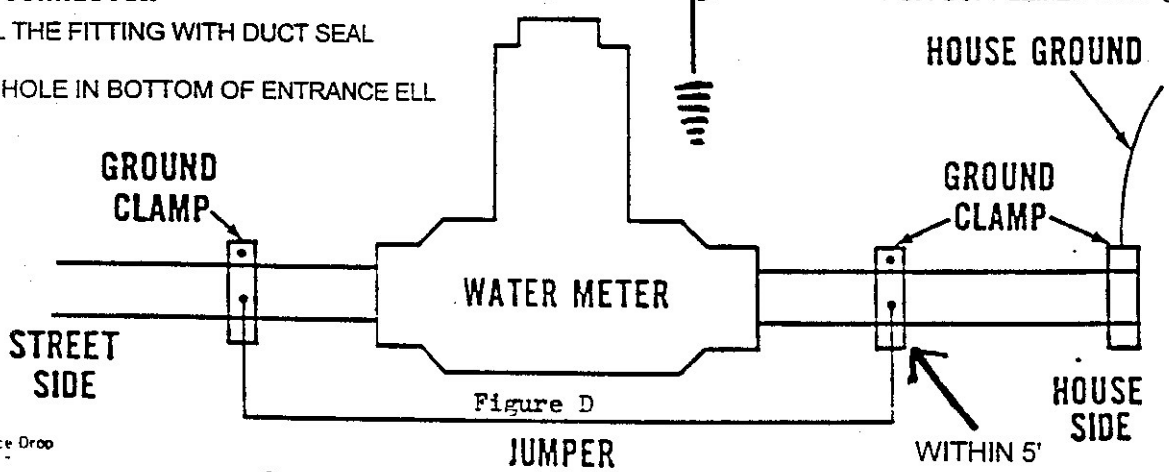
The service entrance can be rigid steel, steel thin-wall (E.M.T.), rigid non-metallic (PVC) may be used when using installation type. Figure A as on Page 15.

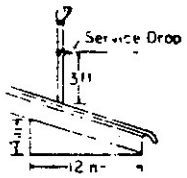
If a mast installation (see Figures B and C on Page 15) is used, 2” rigid steel conduit must be used for the upper part or from the meter base up through the roof and a roof flashing kit installed.

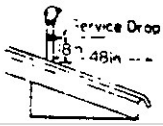
- 2" rigid for service mast (when used for support)
- By-pass meter socket (required by utility company)
- 40-space panel for 200-AMP service


CONDUIT STRAP
CONDUIT CONNECTOR
METER SOCKET
CONDUIT
CONDUIT ADAPTER
ENTRANCE ELL
SERVICE PANEL
NEUTRAL WIRE
CONDUIT CONNECTOR
SEAL THE FITTING WITH DUCT SEAL
MAKE DRAIN HOLE IN BOTTOM OF ENTRANCE ELL


SERVICE DROP
Figure A
BRANCH CIRCUITS
RANGE OUTLET
GROUND WIRE
HEATER CIRCUIT
WATER HEATER
Figure D
SWITCH FOR HEATER
GROUND CLAMP
WATER METER
WATER PIPE
½" x 8'
COPPER CLAD GROUND ROD FOR SUPPLEMENTARY GROUNDING


HOUSE GROUND
GROUND CLAMP
GROUND CLAMP
WATER METER
STREET SIDE
HOUSE SIDE
Figure D
JUMPER
WITHIN 5'


Service Drop
3'
12 in


Service Drop
48in

SMOKE DETECTORS

In dwelling units, a smoke detector must be installed in each sleeping room and at a point centrally located in the corridor or area giving access to each separate sleeping area. When the dwelling unit has more than one story and in dwellings with basements, a detector must be installed on each story and in the basement.

In dwelling units where a story or basement is split into two or more levels, the smoke detector must be installed on the upper level, except that when the lower level contains a sleeping are a detector must be installed on each level. When sleeping rooms are on an upper level, the detector shall be placed at the ceiling of the upper level in close proximity to the stairway.

In dwelling units where the ceiling height of a room open to the hallway serving the bedrooms exceeds that of the hallway by twenty-four inches (60.96 centimeters) or more, smoke detectors must be installed in the hallway and in the adjacent room. Detectors must be installed in accordance with the approved manufacturer's instructions.

Inspections Division

200 Third Street North
Fargo ND 58102
phone 701-241-1561
fax 701-476-6779

Memorandum

DATE: March 10, 2017

TO: Electrical and Residential Remodeling Contractors

FROM: Bruce Taralson

SUBJECT: Smoke and Carbon Monoxide Alarms

As there has been some continuing question regarding the requirements for smoke and carbon monoxide alarms, this memorandum seeks to clarify the enforcement of the code sections relating to smoke alarms and carbon monoxide alarms for remodeling projects.

The 2015 International Residential Code was adopted as the City of Fargo's building code under Fargo Municipal Code section 21.1-0101. As of January 1, 2017, all projects requiring permits are required to comply with the provisions of that code.

Any interior remodel triggers the requirement, under Section R314.2.2, that these alarms be brought up to current code for new construction. This includes one smoke alarm in each bedroom, one outside each sleeping area, one on each story even if there are no bedrooms, and one in the main living area of the house where the ceiling height of a room exceeds that of the sleeping area by 24 inches or more.

The code requires that smoke alarms be interconnected, whether physically, using a wireless system, or some combination of the two. If you use physical interconnection you must hard-wire those alarms to the building's wiring.

Carbon monoxide alarms are required in each sleeping area, in the immediate vicinity of the bedrooms. Combination smoke and carbon monoxide alarms are permitted.

The permit holder is responsible for complying with the code and requesting all required inspections. If you choose to install a wireless system and not to hard-wire your alarms *the alarms to be installed must be on-site at the time of the electrical rough-in inspection* so that the inspector can accurately perform his assessment of any wiring requirements. Compliant smoke and carbon monoxide alarms are required for the final building inspection.

Please see the specific code language on the enclosed page. Emphasis has been added via underline to clarify the provisions of these sections.

R314.2.2 Alterations, repairs and additions. Where *alterations*, *repairs* or *additions* requiring a permit occur, or where one or more sleeping rooms are added or created in existing *dwellings*, the individual *dwelling unit* shall be equipped with smoke alarms located as required for new *dwellings*.

Exceptions:

1. Work involving the exterior surfaces of *dwellings*, such as the replacement of roofing or siding, the *addition* or replacement of windows or doors, or the addition of a porch or deck, are exempt from the requirements of this section.
2. Installation, alteration or repairs of plumbing or mechanical systems are exempt from the requirements of this section.

R314.4 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual *dwelling unit*. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.

Exception: Interconnection of smoke alarms in existing areas shall not be required where *alterations* or repairs do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available that could provide access for interconnection without the removal of interior finishes.

R314.6 Power source. Smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Smoke alarms installed in accordance with Section R314.2.2 shall be permitted to be battery powered.