



Code Check Complete Electronic Edition

An Illustrated Reference for Planning, Building & Inspection

BY DOUGLAS HANSEN, SKIP WALKER & REDWOOD KARDON

Illustrations by Paddy Morrissey, Douglas Hansen & Kaia Mathewson

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Based on the 2021
in

Conventions used in this book:

rule. Figures and tables accompany into a relatively small book, we have

How to navigate this book:

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The top of every page has a row of navigation buttons. These enable quick access to all parts of the book.

(Note: In these sample views, the buttons are not interactive)

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nes that summarize a particular code se such a large amount of information very page.

book. Reader is a free [download](#).

mply click its "contents" button at the pic is to start at the table of contents.

- Every line in each table of contents is a link to the section it describes.
- Figures and tables are referenced in the text by the letters **F** and **T** followed by the figure or table number.
- Every figure reference, page reference, and table reference is a link.
- When the text references a figure or table that is not on the same page as the text, clicking on the reference number takes you to that reference, and clicking on the red "Return to Previous Page" button at the top of the screen takes you back to the text.

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As an example, suppose you wanted to look up codes for stucco, you would click on the "building" table of contents, scroll to the section on Exterior Wall Covering, then click on the line that says "stucco". That would take you immediately to the first page for stucco.

BUILDING BOOK – ABBREVIATIONS

1&2FD = 1- & 2-Family Dwellings
AAMA = American Architectural Manufacturers Association
ABW = Alternate Braced Wall
ACI = American Concrete Institute
AFF = above finished floor
AHJ = Authority Having Jurisdiction
AMI = in accordance with MFR's instructions
AMM = Alternative Materials, Design & Construction
ANSI = American National Standards Institute
ASCE = American Society of Civil Engineers
ASTM = ASTM International (formerly American Society for Testing & Materials)
BFE = base flood elevation
BIPV = building-integrated photovoltaic
BO = building official
BWL = braced wall line
BWP = braced wall panel
BTE = building thermal envelope
BUR = built-up roof
BV-WSP = WSP w/ stone/masonry veneer
C = centigrade
cfm = cubic feet per minute
CI = cast iron
CMU = concrete masonry unit
CPSC = Consumer Product Safety Commission
CPVC = chlorinated PVC pipe
CS = continuous sheathing (wall bracing)
CSA = cross sectional area
CS-G = CS-WSP adjacent garage openings
CS-PF = continuously sheathed portal frame
CS-SFB = CS structural fiberboard
CS-WSP = CS wood structural panel
cu. = cubic, as in cu. ft.
Cu = copper
DFE = design flood elevation

DFU = drainage fixture unit
DW = dishwasher
DWB = diagonal wood boards
DWV = drain, waste & vent

n/a = not applicable
NFPA® = National Fire Protection Association
NDW = naturally durable wood
NM = nonmetallic-sheathed cable

Each of the four sections has its own list of abbreviations, and these are instantly accessible through the links at the top of each page.

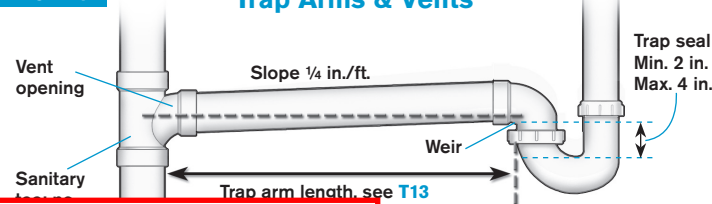
ft. = foot / feet
ga. = gauge
GB = gypsum board
HPS = hardboard panel siding
IBC = International Building Code
ICC = International Code Council
ICF = insulating concrete form
IFC = 2021 International Fire Code®
in. = inch(es)
IRC = International Residential Code
L&L = listed & labeled, listing & labeling
lb. = pound(s)
LIB = let-in bracing
LL = lot line
LVL = laminated veneer lumber
max = maximum
MEP = mechanical, electrical, & plumbing
MFD = multifamily dwelling
MFR = manufacturer
mil = thousands of an inch
min = minimum
mph = miles per hour

mitted
ter
e diameter
d strand board
as in "see p.5"
board sheathing
d cement plaster
frame at garage
portal frame w/ hold-downs
PT = preservative treated
PPT = pressure-preservative treated
psf = pounds per square foot
psi = pounds per square inch
SDC = Seismic Design Category
SDC D = SDC D₀, D₁, & D₂ inclusive
SFB = structural fiberboard sheathing
SFD = Single-Family Dwelling
SHGC = Solar heat gain coefficient
spec = specification
sq. = square, as in sq. ft
SS = stainless steel
T&G = tongue & groove
UDWS = Ultimate Design Wind Speed
UL® = Underwriters Laboratory
w/ = with
w/o = without
WR = weather-resistant
WRB = water-resistive barrier
WSP = wood structural panel
X = exception in code citation
Zi = zinc, galvanized

Trap Arms

- | | | |
|--|---------|---------|
| <input type="checkbox"/> Trap same size as trap arm _____ | 3201.7 | 1003.3 |
| <input type="checkbox"/> No crown venting – min length 2× trap arm diameter F26 | 3105.3 | 1002.2 |
| <input type="checkbox"/> Length & slope per table EXC T13 _____ | 3105.1 | 1002.2 |
| • Trap arm length from WC unlimited (UPC: 6 ft.) _____ | 3105.1X | T1002.2 |
| <input type="checkbox"/> Min slope ¼ in./ft. (IRC ⅓ in. ft. OK for ≥3 in. pipe) _____ | T3105.1 | T1002.2 |
| <input type="checkbox"/> Total fall of trap arm max 1 pipe diameter F23,T13 _____ | 3105.2 | n/a |
| <input type="checkbox"/> Vent connection not below weir of trap (except WCs) _____ | 3105.2 | 1002.4 |
| <input type="checkbox"/> Only 1 trap permitted on trap arm EXC _____ | | |
| • 2 trap arms on same level allowed to join through double-wye fitting to common vent F22 _____ | | |
| <input type="checkbox"/> Tubing traps require trap adapter F28 _____ | | |
| <input type="checkbox"/> Max 1 slip joint allowed on outlet side of trap F22 _____ | | |
| <input type="checkbox"/> C/O if direction change >45° (UPC 90°) _____ | | |
| <input type="checkbox"/> Slip joints connections must be accessible F25 _____ | | |
| <input type="checkbox"/> Access openings min 12 in. × 12 in. F25 _____ | 2 | |

There are 336 illustrations and 192 tables in the book. References to them in the text are hyperlinks. If the illustration (or table) is not on the same page as the text, clicking on the link takes you directly to the illustration, and the "RETURN TO PREVIOUS PAGE" button at the top returns you to the text.

FIG. 23**Trap Arms & Vents**

allow air to enter above the dotted line in slope or length would place the trap opening & allow the trap to siphon, bringing sewer gas to enter the house.

TABLE 13**TRAP ARM DISTANCE
IRC T3105.1 & UPC**

Trap Arm Diameter	Min. Arm Length	IRC Max. Arm Length	UPC Max. Arm Length
1¼ in.	2½ in.	5 ft. (60 in.)	2½ ft. (30 in.)
1½ in.	3 in.	6 ft. (72 in.)	3½ ft. (42 in.)
2 in.	4 in.	8 ft. (96 in.)	5 ft. (60 in.)
3 in. ^A	6 in.	12 ft. (144 in.)	6 ft. (72 in.)
4 in. or larger ^A	8 in.	16 ft. (192 in.)	10 ft. (120 in.) ^B

A. In the IRC, these arms can have ⅓ in./ft. slope. In the UPC, all arms must slope ¼ in./ft.

B. Max. developed length from a water closet to the vent is 6 ft. in the UPC & unlimited in the IRC.

For water to drain in the vertical pipe downstream of the trap, it must have air to prevent a vacuum behind it. If that air comes from the fixture tailpiece, rather than from a vent, the water in the trap also gets siphoned into the drain pipe. That can leave the trap with no water seal to keep out sewer odors & vermin.

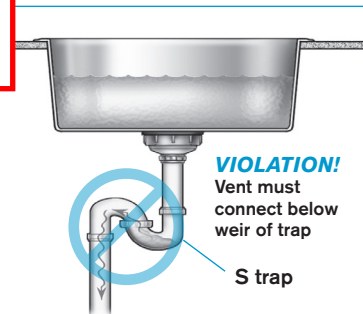


TABLE 7		ESCAPE & RESCUE OPENINGS: MIN HEIGHT & WIDTH REQUIREMENTS IN INCHES TO MEET 5.7-SQ.-FT. OPENING SIZE																											
Width	20	20½	21	21½	22	22½	23	23½	24	24½	25	25½	26	26½	27	27½	28	28½	29	29½	30	30½	31	31½	32	32½	33	33½	34
Height	41	40	39½	38½	37½	36½	35½	35	34½	33½	33	32½	32	31	30½	30	29½	29	28½	28	27½	27	26½	26½	26	25½	25	24½	24

TABLE 8		ESCAPE & RESCUE OPENINGS: 5.0-SQ.-FT. OPENING – GRADE-FLOOR OPENINGS ONLY																							
Width	20	20½	21	21½	22	22½	23	23½	24	24½	25	25½	26	26½	27	27½	28	28½	29	29½	30				
Height	36	35	34½	33½	33	32	31½	31	30	29½	29	28½	28	27½	27	26½	26	25½	25	24½	24				

EMERGENCY ESCAPE & RESCUE OPENINGS (EERO)

Required Locations & Egress Paths

21 IRC

- Every sleeping room, basements & habitable attics EXC **F29** _____ 310.1
 - Storm shelters & mechanical equipment basements ≤ 200 sq. ft. __ 310.1X1
 - In sprinklered dwellings w/ basement sleeping rooms: either 1 EERO + a means of egress path, or 2 means of egress paths (stairs) __ 310.1X2
- Open to public way or yard or court or min 36 in. width path to same __ 310.1²⁹
- Path under decks min 36 in. clear height & width to yard or court __ 310.2.4²⁹
- Additions require opening in each sleeping room _____ 310.6
- Existing basements undergoing alterations or repairs exempt EXC _____ 310.7
 - New basement sleeping rooms require escape & rescue openings __ 310.7

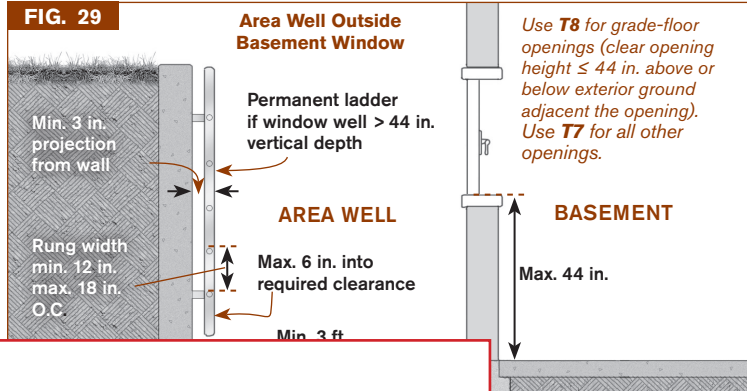
Operation & Dimensions

- Opening operable from inside _____ 310.4.1
- Security bars must be of special knowledge _____ 310.4.2
- Window fall prevention device _____ 310.4.2
- Min net clear area _____ 310.4.2
 - 5.0 sq. ft. OK _____ 310.4.2.1
 - 4.0 sq. ft. OK _____ 310.4.2.2
- Bottom of clear opening max 44 in. AFF **F29** _____ 310.2.3³²
- Min net clear height 24 in., min net clear width 20 in. **T7,8** _____ 310.2.2
- Replacement windows exempt from height & size requirements if replacement is **MEP's** largest size that will fit into existing frame or rough opening __ 310.5

Changes from the previous code edition are highlighted in the text and explained at the bottom of the page.

- 29.** Added width requirement for these egress paths.
- 30.** New rule on max height of hardware to unlatch window fall-prevention devices.
- 31.** New allowance for smaller openings for additions and basement alterations.
- 32.** Height now measured to actual opening, not simply the window sill.

FIG. 29



Use **T8** for grade-floor openings (clear opening height ≤ 44 in. above or below exterior ground adjacent the opening). Use **T7** for all other openings.

21 IRC

- Area well _____ 310.4
- Dimensions **F29** _____ 310.4.1
- F29** _____ 310.4.2
- Permanent ladder or stair _____ 310.4.2
- Ladder or steps max projection 6 in. into required well space **F29** __ 310.4.1X
- Ladder or steps min width 12 in. _____ 310.4.2.1&2
- Ladder rungs 12–18 in. O.C., min 3 in. projection from wall **F29** __ 310.4.2.1
- Steps min tread depth 5 in. max riser height 18 in. _____ 310.4.2.2³³
- Covers or bulkheads over wells min 9 sq. ft. & operable from inside __ 310.4.4
- Drainage system required unless well-draining Group 1 soils **F29** __ 310.4.3

33. Rise and run of area well stairs was not specified in previous code.

Showers

- Min area 900 sq. in. (UPC: 1,024 sq. in.) **F62** EXC ____ 2708.1 408.6
 - Fold-down seats protruding into space must allow the min 900 sq. in. area w/ seat in folded-up position ____ 2708.1X1 408.6
- Must be able to encompass 30 in. diameter circle from top of threshold to point 70 in. above drain outlet EXC __ 2708.1 408.6
 - Shower heads, valves, grab bars & soap dishes allowed to protrude into required min space ____ 2708.1 408.6
 - 25 in. cross section OK if area ≥1300 sq. in. ____ 2708.1X2 408.6
 - Not required if min 30 in. x 60 in. enclosure (tub) ____ n/a 408.6.2
- Shower walls nonabsorbent to min 72 in. above drain ____ 307.2 local
- If threshold provided, height min 1 in. below top of shower receptor membrane & min 2 in. max 9 in. above top of drain **F63** __ 2709.1 408.6
- If no threshold, adjacent floor considered a wet location local 408.6

- Door min 22-in.-wide
- Door must open outward
- Finished floor slope min 1/4 in./ft.
- Secure shower valve, handle
- Shower head cannot be used as grab bar
- Listed anti-scald/pressure balance valve 120° max ____ 2708.4 408.3
- Min 2 in. drain outlet (IRC 1 1/2 in.), strainer of equivalent area 2708.2 408.4

Shower Pan & Liner

- Site-built liner materials conform to approved standards _ 2709.2 408.7
- Slope underlayment 1/4 in./ft. to weep holes **F63** ____ 2709.3 408.7
 - Liner min 2 in. above dam or threshold (UPC: 3 in.) **F63** 2709.2 408.7
- Pan liner plastic AMI or 3 layers hot mop type 15 felt ____ 2709.2 408.7
- Special attention to hot mop corner installation; extend 4 in. all directions from corner ____ 2709.2.3 408.7
- PVC & CPE sheet lining cemented AMI ____ 2709.2.1&2 408.7.1&2
- Weep holes required at drain & must remain clear **F63** __ 2709.4 408.7
- No fasteners in liner < 1 in. above finished threshold ____ 2709.3 408.7
- Roll over top of rough threshold (no penetrations through top) & fasten to outside edge **F63** ____ 2709.3 408.7
- Water-tight connection between liner and drain flange __ 2709.4 408.7

21 IRC

21 UPC

Testing

- Pan leak test min 2 in. water measured at threshold, min 15 minutes (UPC: water level ≥ rough threshold height) ____ 2503.6 408.7.5
- Pan leak test requires plug (balloon) in pipe below flange 2503.6 408.7.5

21 IRC **21 UPC**

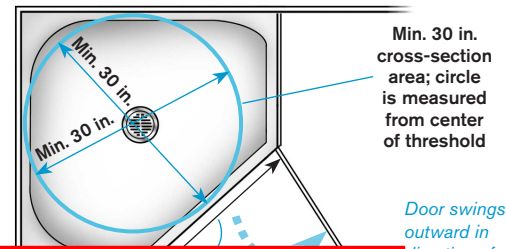
The Plumbing section references the 2021 IRC and the 2021 UPC

FIG. 62

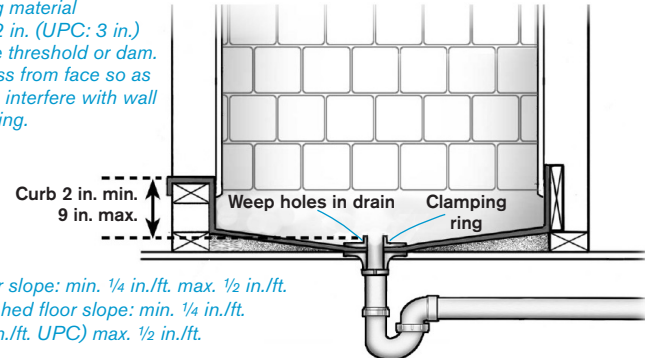
Shower Receptor

Overall net area
IRC: 900 sq. in.
UPC: 1024 sq. in.

Soap dishes, grab bars, shower heads



Lining material min. 2 in. (UPC: 3 in.) above threshold or dam. Recess from face so as not to interfere with wall covering.



Liner slope: min. 1/4 in./ft. max. 1/2 in./ft.
Finished floor slope: min. 1/4 in./ft. (1/8 in./ft. UPC) max. 1/2 in./ft.

FREESTANDING FIREPLACE STOVES (SOLID FUEL)

The IRC (section 1414.1) requires fireplace stoves to be listed, labeled & tested in accord with UL 737, which in turn references the current edition of NFPA 211. UMC section 902.10 refers to NFPA 211 for solid fuel-burning appliances. The rules for clearance, protection, and clearance reductions are virtually identical among the IRC, UMC, and NFPA 211.

Fireplace Stoves & Solid Fuel Room Heaters

NFPA 211

- Equipment must be listed & installed per L&L or be approved by AHJ _____ 13.1
- Unlisted equipment must be approved & installed AMI _____ 13.1.1
- No unlisted equipment in mobile homes _____ 13.1.9
- Not in alcove or enclosed space _____
- Not OK in garages or where flammable liquids are stored _____
- Listed appliances OK on combustible floor _____
- Noncombustible floor material 18 in. min. from appliance _____
 - L&L floor protection assemblies _____
- Unlisted appliance floor protection _____
 - If legs provide ≥ 6 in. of ventilated clearance _____
 - If legs provide ≥ 2 in. of ventilated clearance, min 4 in. thick hollow masonry + metal, cores open to allow airflow **F41** _____ 13.5.2.1
 - If legs provide ≥ 2 in. to < 6 in. of ventilated clearance, min 4 in. thick hollow masonry + metal, cores open to allow airflow **F41** _____ 13.5.2.2
- If legs provide < 2 in. clearance, floor noncombustible _____ 13.5.2.3
- Fuel storage (firewood) min 36 in. from appliance _____ T13.6.1 note a
- 36 in. side, top & front clearance from appliance to combustibles EXC _____ 13.6.1
 - Listed appliance clearance to combustibles AMI _____ 13.6.1.1
 - Reduced clearances OK per **T10, F43** _____ 13.6.2.1

The Mechanical section also references
NFPA and ASHRAE codes

Connectors

- Must be accessible for inspection, cleaning & replacement _____ 9.7.10
- Single-wall min 18 in. clearance to combustibles EXC **F43** _____ T9.5.1.1
 - Lesser clearance w/ approved clearance-reduction system **T10** _____ 9.5.1.2.1
- Not to pass through wall EXC _____ 9.7.4
 - Listed pass-through system _____ 9.7.4
 - Pass-through system constructed per NFPA 211 figure 9.7.4 _____ 9.7.4
- Maintain min $\frac{1}{4}$ in./ft. rise from appliance collar to chimney _____ 9.7.6

FIG. 41

Fireplace Stove Clearances



Proper clearances to combustibles are critical to the safe long term operation of all fuel burning systems. Improper clearances can allow heat transfer to adjacent combustible materials. Over time, heat degrades wood and lowers its ignition temperature. This process—pyrolysis— can eventually result in a fire.

Stoves & Fireplace Inserts to Masonry Fireplaces

NFPA 211

- Connector must extend to flue liner—not just to firebox _____ 13.4.5.1
- If connector enters direct through chimney wall above smoke chamber, noncombustible seal required below entry _____ 13.4.5.1
- No dilution of combustion products in flue w/ habitable space air _____ 13.4.5.1
- Flue not less than size of appliance collar _____ 13.4.5.1
- Flue diameter max 2× appliance collar if chimney walls exposed to exterior below roof, 3× if no part exposed below roof _____ 13.4.5.1
- Installation must allow for chimney inspection & cleaning _____ 13.4.5.1

GROUNDING ELECTRODES

Proper grounding & bonding of electrical systems is essential for safety. These two different but related subjects are commonly misunderstood, even by veteran electricians. Connecting the system to earth helps to limit the voltage imposed by lightning, line surges, or accidental contact with higher voltage lines. It stabilizes a system and reduces electrical “noise” on communications systems. Grounding electrodes are the metallic components within the earth to which we connect electrical systems, including one of the current-carrying conductors of the system. Common grounding electrodes in residential construction are metal underground water piping, ground rods, and concrete-encased electrodes. Other types include ground rings, metal plates, metal well casings, listed grounding electrode systems, underground tanks, and the steel frame of a building connected to earth as shown below. Gas piping is not an acceptable grounding electrode.

Grounding Electrode System (GES) F7 21 IRC 20 NEC

- Use all electrodes that are available on premises EXC ___ 3608.1 250.50
 - Concrete-encased electrode of existing building need not be included if not accessible w/o disturbing concrete ___ 3608.1.X 250.50X
- Bond all electrodes together to form the GES ___ 3608.1 250.50
- Metal underground gas piping system electrodes & pool or spa shell bond permitted as grounding electrodes ___ 3608.1 250.50

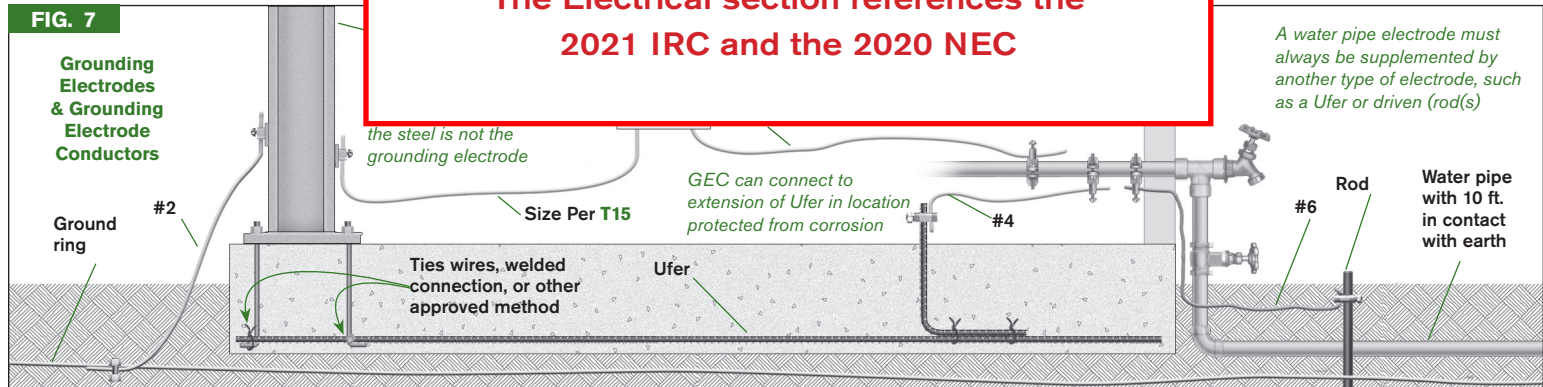
Water Pipe Electrodes

- Use metal water pipe if ≥ 10 ft. in contact w/ soil F7 ___ 3608.1.1 250.52A1
- Bond around water meters, filters, pressure regulators & similar equipment ___ 3608.1.1.2 250.53D1
- Water pipe cannot be the sole electrode – it must be supplemented by another type of electrode ___ 3608.1.1.2 250.53D2
- Metal well casing electrodes require bonding around insulating joints or pipes ___ 3608.1.1 250.52A8

Rod & Plate Electrodes

- Copper-clad rods min 5/8 in. diameter unless listed ___ 3608.1.4 250.52A5b
- Rods min 8 ft. in contact w/ soil F7 ___ 3608.1.4.1 250.53A4
- Drive rods vertical & fully below grade EXC ___ 3608.1.4.1 250.53A4
 - If bedrock encountered, rod may be buried horizontally 2 1/2 ft. deep or driven at max 45° angle from vertical ___ 3608.1.4.1 250.53A4
 - Rod end & clamps above ground require protection against physical damage ___ 3608.1.4.1 250.53A4
- Ferrous plates min 1/4 in. thick, ___ 3608.1.5 250.52A7
- of earth ___ 3608.1.5 250.53A5
- nce $>25\Omega$ ___ 3608.4 250.53A2

The Electrical section references the 2021 IRC and the 2020 NEC



Grounding & Bonding

20 NEC

- Provide terminal bar for grounding & bonding **F90** EXC _____ 450.10A
- Terminal bar may not block ventilation openings **F90** _____ 450.10A
- Size primary conductor EGCs per **T16** _____ 250.122
- Size grounded conductor of secondary & SBJ per **T52** _____ 250.28D1
- Size SSBJ per **T52** _____ 250.30A2
- Size GEC per **T52** _____ 250.30A5
- GEC to connect to same GES as building _____ 250.30A4
- Multiple separately derived systems may use common GEC _____ 250.30A6
- Common GEC can be 3 _____
- _____ of entry into building, or _____
- Bond SDS to metal pipi _____

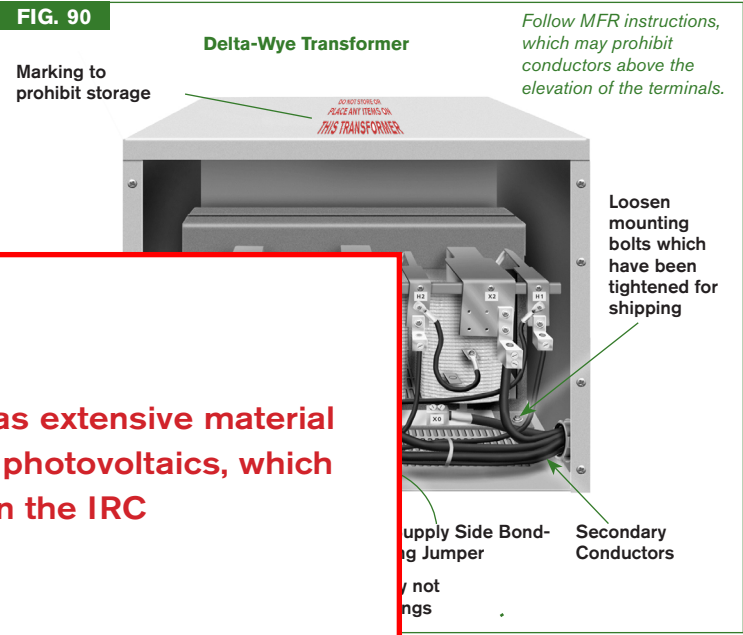
TABLE 52 **MINIMUM JUMPER, S**
BO

Largest Ungrounded Co
Area for Parallel Conduc

Cu			
≤ 2			
1 or 1/0			
2/0 or 3/0			
4/0–350kcmil			
> 350–600kcmil	> 500–900kcmil	1/0	3/0
> 600–1100kcmil	> 900–1750kcmil	2/0	4/0
> 1100kcmil	> 1750kcmil	Notes C, D, & E	

- A. The scope includes main bonding jumpers, system bonding jumpers & supply-side bonding jumpers.
- B. Services w/ multiple service disconnect enclosures or separately derived systems w/ multiple sets of secondary conductors may size the bonding jumper based on areas of conductors in each set.
- C. Min. 12½% of area of largest supply conductors or equivalent area for parallel conductors; need not be larger than largest ungrounded conductor or set of ungrounded conductors.
- D. If ungrounded conductors & bonding jumper of different materials, base bonding jumper size on size of equivalent ungrounded conductors of same material as bonding jumper.
- E. Bond to structural metal that is not intentionally grounded need not be >3/0 Cu or 250kcmil AL **F7**.

The Electrical section also has extensive material on commercial systems and photovoltaics, which are not covered in the IRC



20 NEC

- Electrically continuous grounded (neutral) conductor required to connect to supply & derived circuits EXC _____ 210.9 & 215.11
 - OK w/o grounded (neutral) conductor for 208V:240V or 240V:208V (open delta configurations) _____ 210.9X1 & 215.11X1
- Each ungrounded input conductor requires OCPD _____ 450.4A
- OCPD ≤ 125% of max rated full-load current of autotransformer EXC 450.4A
 - If 125% & ≥ 9A & between standard sizes, next higher size allowed 450.4A
- OCPD not to be in series w/ between shunt winding terminals _____ 450.4A