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GENERAL INFORMATION

THE FOLLOWING INFORMATION APPLIES TO ALL DUKE ENERGY STANDARDS THAT REQUIRE COMPLIANCE WITH THE NATIONAL ELECTRICAL SAFETY CODE (NESC).

- THE CLEARANCES OR SPACING LISTED IN THE DUKE ENERGY STANDARDS REPRESENT INFORMATION TAKEN FROM THE NESC, 2012 EDITION. THESE VALUES REPRESENT THE MINIMUM ALLOWABLE CLEARANCE OR SPACING THAT IS TO BE OBTAINED UNDER THE MOST COMMON APPLICATION CIRCUMSTANCES. DESIGNERS MUST ALLOW FOR NORMAL DEVIATIONS IN THE DESIGN AND CONSTRUCTION PROCESS WHEN LAYING OUT AND DESIGNING DUKE ENERGY FACILITIES. ADDITIONAL CLEARANCE OR SPACING SHOULD BE INCLUDED IN THESE DESIGNS TO ACCOMMODATE NORMAL VARIATIONS IN CONSTRUCTION.

- THE NESC MAY CONTAIN FOOTNOTES, EXCEPTIONS, OR OTHER CLARIFICATIONS THAT WILL ALLOW LESSER CLEARANCES OR SPACING THAN THOSE DEFINED IN THESE STANDARDS. THE DESIGNER MUST REVIEW ALL OF THE CIRCUMSTANCES PERTAINING TO THE PROJECT AND CLEARLY IDENTIFY THE CRITERIA THAT WILL ALLOW HIM/HER TO USE CLEARANCES LESS THAN THOSE LISTED IN THE GENERAL STANDARDS. PROPER APPROVALS FROM DISTRIBUTION STANDARDS MUST BE OBTAINED BEFORE USING LESSER CLEARANCES.

- NESC STANDARDS OR DUKE ENERGY'S CONSTRUCTION STANDARDS, WHICHEVER ARE MORE STRINGENT, APPLY TO ALL NEW INSTALLATIONS. FOR EXISTING INSTALLATIONS, WHERE CONDUCTORS OR EQUIPMENT ARE ADDED, ALTERED OR REPLACED ON AN EXISTING STRUCTURE, THE STRUCTURE OR THE FACILITIES ON THE STRUCTURE DO NOT NEED TO BE MODIFIED OR REPLACED IF THE RESULTING INSTALLATION WILL BE IN COMPLIANCE WITH THE RULES THAT WERE IN EFFECT AT THE TIME OF THE ORIGINAL INSTALLATION. IF IT CANNOT BE DETERMINED WHICH RULES WERE IN EFFECT AT THE TIME OF THE ORIGINAL INSTALLATION, THE STRUCTURE OR FACILITIES ON THE STRUCTURE SHOULD BE UPGRADED TO MEET, AT A MINIMUM, THE CURRENT NESC STANDARDS.

- WHEN A STANDARD DEFINES A VERTICAL OR HORIZONTAL CLEARANCE, THESE CLEARANCES ARE TO BE BASED ON WHICHEVER OF THE FOLLOWING CONDITIONS PRODUCES THE MAXIMUM SAG OR MINIMUM CLEARANCE VALUE WITH NO WIND DISPLACEMENT:

  A. CONDUCTORS AT 120° F, FINAL SAG (USED FOR PRIMARY CONDUCTORS IF NO OTHER MAXIMUM TEMPERATURE IS KNOWN AND FOR NEUTRAL CONDUCTORS) OR  
  B. CONDUCTORS AT THE MAXIMUM OPERATING TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE, FINAL SAG OR  
  C. CONDUCTORS AT 32° F, WITH THE RADIAL THICKNESS OF ICE REQUIRED BY DWG 10.00-05, FINAL SAG OR  
  D. CONDUCTORS AT THE MINIMUM CONDUCTOR TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE, INITIAL SAG (IT IS RARE THAT THIS SITUATION IS USED. IT IS MAINLY INTENDED FOR INSTANCES WHEN A CONDUCTOR PASSES UNDER A STRUCTURE, RATHER THAN OVER. CONTACT MANAGEMENT OR DISTRIBUTION STANDARDS BEFORE APPLYING THIS CRITERION).

- IF THE HORIZONTAL DISPLACEMENT OF THE WIND MUST BE CONSIDERED IN A DESIGN, THE CONDUCTORS SHALL BE CONSIDERED TO BE DISPLACED FROM REST TOWARD THE INSTALLATION BY A 6 LB/FT2 WIND AT FINAL SAG AT 60° F. THE DISPLACEMENT OF CONDUCTORS SHALL INCLUDE DEFLECTION OF SUSPENSION INSULATORS. THE DISPLACEMENT OF CONDUCTORS SHALL ALSO INCLUDE DEFLECTION OF A FLEXIBLE STRUCTURE IF THE HIGHEST CONDUCTOR ATTACHMENT IS 60' OR MORE ABOVE GRADE.

- HORIZONTAL CLEARANCES GOVERN TO A POINT ABOVE THE LEVEL OF A ROOF OR TOP OF AN INSTALLATION TO THE POINT WHERE THE DIAGONAL EQUALS THE VERTICAL CLEARANCE REQUIREMENT. SIMILARLY, THE HORIZONTAL CLEARANCE GOVERNS ABOVE OR BELOW PROJECTIONS FROM BUILDINGS, SIGNS, OR OTHER INSTALLATIONS TO THE POINT WHERE THE DIAGONAL EQUALS THE VERTICAL CLEARANCE REQUIREMENT. FROM THIS POINT THE TRANSITIONAL CLEARANCE SHALL EQUAL THE VERTICAL CLEARANCE.

- CLEARANCES IN THESE STANDARDS ARE REQUIRED FOR PERMANENT AND TEMPORARY INSTALLATIONS.

- CLEARANCES FOR EMERGENCY INSTALLATIONS ARE DEFINED IN NESC 230.A.2

- UNLESS OTHERWISE STATED, ALL CLEARANCES SHALL MEASURED FROM SURFACE TO SURFACE AND ALL SPACINGS SHALL BE MEASURED CENTER TO CENTER. FOR CLEARANCE MEASUREMENTS, LIVE METALLIC HARDWARE ELECTRICALLY CONNECTED TO SUPPLY LINE CONDUCTORS AND COMMUNICATION EQUIPMENT CONNECTED TO COMMUNICATION LINE CONDUCTORS SHALL BE CONSIDERED A PART OF THE LINE CONDUCTORS.
VOLTAGE ADDER IS THE INCREASED CLEARANCE NEEDED WHEN THE VOLTAGE IS HIGHER THAN CERTAIN LIMITS. THE VOLTAGE ADDER CAN BE DIFFERENT DEPENDING ON THE PARTICULAR REQUIREMENT BY THE NESC, BUT IN ALL CASES, WILL BE CALCULATED AS SHOWN BELOW. THE THRESHOLD VALUES OF 8.7KV AND 22KV ARE PHASE TO GROUND VOLTAGES. THE VALUES IN THE TABLES BELOW DO NOT INCLUDE ALL POSSIBLE VOLTAGES THAT MAY BE ENCOUNTERED. THEY ARE REPRESENTATIVE ONLY.

FOR TRANSMISSION CROSSINGS, CONTACT THE APPROPRIATE TRANSMISSION LINE DESIGN RESOURCE. NEVER RELY SOLELY ON FIELD MEASUREMENTS FOR THIS, SINCE THE MAXIMUM FINAL SAG VALUES OF THE TRANSMISSION LINE MUST BE USED TO DETERMINE THE APPROPRIATE CLEARANCE WITH DISTRIBUTION FACILITIES.

VOLTAGE ADDER FOR VOLTAGES IN EXCESS OF 8.7KV

IN SOME NESC RULES, THE CLEARANCE MUST BE INCREASED AT THE RATE OF 0.4" FOR EACH 1000V OR 1KV IN EXCESS OF 8.7KV. THESE APPLY TO VERTICAL CLEARANCES ANYWHERE IN THE SPAN ON THE SAME SUPPORTING STRUCTURE BETWEEN SUPPLY CONDUCTORS OR BETWEEN SUPPLY CONDUCTORS AND COMMUNICATIONS CONDUCTORS AT SUPPORT. THE MINIMUM CALCULATED ADDERS FOR VOLTAGES OF COMMON DUKE ENERGY CIRCUITS ARE SHOWN BELOW. ALL VALUES ARE ROUNDED UP TO THE NEXT INCH.

<table>
<thead>
<tr>
<th>CIRCUIT VOLTAGE</th>
<th>ADDER FOR VOLTAGE IN EXCESS OF 8.7KV</th>
<th>CALCULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>24KV</td>
<td>3&quot;</td>
<td>((24.0/3)-8.7) \times 0.4 )</td>
</tr>
<tr>
<td>34.5KV GRD Y</td>
<td>5&quot;</td>
<td>((34.5/3)-8.7) \times 0.4 )</td>
</tr>
<tr>
<td>34.5KV (DELTA)</td>
<td>11&quot;</td>
<td>((34.5-8.7)) \times 0.4 )</td>
</tr>
<tr>
<td>69KV</td>
<td>13&quot; OR 1'-1&quot;</td>
<td>((69/3)-8.7) \times 0.4 )</td>
</tr>
</tbody>
</table>

VOLTAGE ADDER FOR VOLTAGES IN EXCESS OF 22KV

THE CLEARANCES MUST BE INCREASED AT THE RATE OF 0.4" FOR EACH 1000V OR 1KV IN EXCESS OF 22KV. THESE APPLY TO VERTICAL CLEARANCES ABOVE GROUND OR RAILS AND VERTICAL CLEARANCES BETWEEN CONDUCTORS CARRIED ON DIFFERENT SUPPORTS. THE MINIMUM CALCULATED ADDERS FOR THE VOLTAGES FOR COMMON DUKE ENERGY CIRCUITS ARE SHOWN BELOW. ALL VALUES ARE ROUNDED UP TO THE NEXT INCH.

<table>
<thead>
<tr>
<th>CIRCUIT VOLTAGE</th>
<th>ADDER FOR VOLTAGE IN EXCESS OF 22KV</th>
<th>CALCULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.5KV (DELTA)</td>
<td>5&quot;</td>
<td>((34.5-22)) \times 0.4 )</td>
</tr>
<tr>
<td>44KV</td>
<td>2&quot;</td>
<td>((44/2)-22) \times 0.4 )</td>
</tr>
<tr>
<td>69KV</td>
<td>8&quot;</td>
<td>((69/2)-22) \times 0.4 )</td>
</tr>
<tr>
<td>138KV</td>
<td>26&quot; OR 2'-2&quot;</td>
<td>((138/2)-22) \times 1.10 \times 0.4 )</td>
</tr>
</tbody>
</table>

ALL CLEARANCES FOR LINES OVER 50KV LINE TO GROUND ARE BASED ON THE MAXIMUM OPERATING VOLTAGE OF THE SYSTEM PER NESC RULE 234G2. UNLESS ACTUAL VALUES ARE KNOWN, ASSUME A MAXIMUM OPERATING VOLTAGE OF TEN PERCENT OVER THE NOMINAL VOLTAGE. THEREFORE, ANY VOLTAGE OF 100KV AND ABOVE WILL HAVE A TEN PERCENT (10%) MULTIPLIER TO DETERMINE THE VOLTAGE ADDER.
### Notes:

1. Applicable zones for the area in question must be determined prior to making any determination of conductor clearances, vertical or horizontal.

2. Only after determining the proper clearance zone can values for final sag (SF) be calculated for use in clearance determinations.

### Ice Thickness for Purposes of Calculating Clearances, NESC Table 230-1

<table>
<thead>
<tr>
<th>Radial Thickness of Ice</th>
<th>Clearance Zone (for use with Rules 232, 233, 234 and 235)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(IN)</td>
<td>Zone 1</td>
</tr>
<tr>
<td></td>
<td>0.50</td>
</tr>
</tbody>
</table>

### Diagram:

The diagram shows a clearance zone map of the contiguous United States, NESC Figure 230-1.
NOTES:

1. WHERE THERE ARE CURBS: SUPPORTING STRUCTURES, SUPPORT ARMS, ANCHOR GUYS, OR OTHER EQUIPMENT UP TO 15 FT. (HIGHER FOR DOT MAINTAINED ROADS, SEE DWG. 10.02-03) ABOVE THE ROAD SURFACE SHALL BE LOCATED A SUFFICIENT DISTANCE FROM THE STREET SIDE OF THE CURB TO AVOID CONTACT BY ORDINARY VEHICLES USING AND LOCATED ON THE TRAVELED WAY. FOR A REDIRECTIONAL CURB, SUCH DISTANCE SHALL NOT BE LESS THAN 6". FOR PAVED OR CONCRETE SWALE-TYPE CURBS, SUCH FACILITIES SHALL BE LOCATED BEHIND THE CURB.

2. WHERE THERE ARE NO CURBS, SUPPORTING STRUCTURES SHOULD BE LOCATED A SUFFICIENT DISTANCE FROM THE ROADWAY TO AVOID CONTACT BY ORDINARY VEHICLES USING AND LOCATED ON THE TRAVELED WAY.

3. GOVERNMENTAL AUTHORITIES HAVING ISSUED PERMITS OR OTHER APPROVALS FOR LOCATIONS SHALL TAKE PRECEDENCE WHERE APPLICABLE.
NOTES:
1. GREATER DISTANCE REQUIRED BY FLORIDA IS PER FLORIDA ADMINISTRATIVE CODE.
2. 4' MINIMUM PER NESC 231.A.
3. LESSER VALUES PERMITTED BY NESC 231.A, EXCEPTION 1 AND EXCEPTION 2.
<table>
<thead>
<tr>
<th>Nature of Surface Underneath Wires, Conductors or Cables</th>
<th>NESC Minimum Required</th>
<th>NESC Minimum Required</th>
<th>NESC Minimum Required</th>
<th>NESC Minimum Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Roads, Streets, and Other Areas Subject to Truck Traffic.</td>
<td>15.5 (See Note 4)</td>
<td>16 (See Note 4)</td>
<td>16.5 (See Note 4)</td>
<td>18.5 (See Note 4)</td>
</tr>
<tr>
<td>2. Driveways, Parking Lots, and Alleys</td>
<td>15.5 (See Note 3)</td>
<td>16 (See Note 3)</td>
<td>16.5 (See Note 3)</td>
<td>18.5</td>
</tr>
<tr>
<td>3. Other Land Traversed by Vehicles, Such as Cultivated, Grazing, Forest, Orchard, Etc. (See Note 5)</td>
<td>15.5</td>
<td>16</td>
<td>16.5</td>
<td>18.5</td>
</tr>
<tr>
<td>4. Spaces and Ways Subject to Pedestrians or Restricted Traffic Only</td>
<td>9.5</td>
<td>12.0 (See Note 3)</td>
<td>12.5 (See Note 3)</td>
<td>14.5</td>
</tr>
<tr>
<td>5. Water Areas Not Suitable for Sailboating or Where Sailboating is Prohibited</td>
<td>14.0</td>
<td>14.5</td>
<td>15.0</td>
<td>17.0</td>
</tr>
<tr>
<td>6. Waterways / Bodies of Water Suitable for Sailboating</td>
<td>See DWG. 10.02-07 for Clearances</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Public or Private Land and Water Areas Posted for Rigging or Launching Sailboats</td>
<td>Clearance Above Ground Shall Be 5 Ft. Greater Than On DWG. 10.02-07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Roads, Streets, or Alleys</td>
<td>15.5</td>
<td>16.0</td>
<td>16.5</td>
<td>18.5</td>
</tr>
<tr>
<td>9. Roads in Rural Districts Where It Is Unlikely That Vehicles Will Be Crossing Under the Line</td>
<td>13.5</td>
<td>14.0</td>
<td>14.5</td>
<td>16.5</td>
</tr>
</tbody>
</table>

Notes:

1. The above minimum clearances in the table must be met using the following ice and wind conductor loading. The values can be found in the sag and tension tables. Use the following loading condition that produces the greatest sag:
   - Conductor temperature 120°F and no wind displacement, or
   - Maximum conductor temperature for which the line is designed to operate and no wind displacement, or
   - 32°F with radial ice thickness specified on DWG. 10.00-05, no wind displacement.


3. Where height of attachment to building does not permit triplex service drops to meet this value, the clearance may be reduced to those values in NESC Table 232-1, Footnotes 7 and 8.

4. The minimum vertical clearance of all conductors, cables, guys, etc. may be greater for DOT maintained highways or limited access highways. See DWG. 10.02-03.

5. When designing a line to accommodate oversized vehicles, these clearance values shall be increased by the difference between the known height of the vehicle and 14 ft.
### D.O.T. CLEARANCES OVER STATE MAINTAINED ROADS AND LIMITED ACCESS HIGHWAYS

<table>
<thead>
<tr>
<th>STATE</th>
<th>REQUIRED CLEARANCE OVER STATE MAINTAINED D.O.T. ROADS (FT.)</th>
<th>REQUIRED CLEARANCE OVER LIMITED ACCESS HIGHWAYS (FT.)</th>
<th>REFERENCE MANUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLORIDA</td>
<td>18</td>
<td>24</td>
<td>UTILITIES ACCOMMODATION MANUAL, 4.2A AND 4.8.2</td>
</tr>
<tr>
<td>INDIANA</td>
<td>18</td>
<td>18</td>
<td>UTILITY ACCOMMODATION POLICY, 6.0 (2)</td>
</tr>
<tr>
<td>KENTUCKY</td>
<td>18</td>
<td>24</td>
<td>PERMITS GUIDANCE MANUAL 202-2 AND 202-3</td>
</tr>
<tr>
<td>NORTH CAROLINA</td>
<td>18</td>
<td>24 (SEE NOTE 6)</td>
<td>POLICIES AND PROCEDURES FOR ACCOMMODATING UTILITIES ON HIGHWAY RIGHTS OF WAY, P41</td>
</tr>
<tr>
<td>OHIO</td>
<td>16.5</td>
<td>16.5</td>
<td>POLICY FOR ACCOMMODATION OF UTILITIES, 8108.01.C</td>
</tr>
<tr>
<td>SOUTH CAROLINA</td>
<td>15.5</td>
<td>15.5</td>
<td>UTILITIES ACCOMMODATION MANUAL, 6.2.1</td>
</tr>
</tbody>
</table>

**NOTES:**

1. THE VALUES IN THE ABOVE TABLE APPLY TO ALL UTILITY LINES, NOT JUST THOSE OWNED BY DUKE ENERGY. THE DESIGNER SHOULD ENSURE ENOUGH HEIGHT IS OBTAINED AT THE SUPPORTING STRUCTURE TO PROVIDE ADEQUATE VERTICAL CLEARANCE FOR THE LOWEST ATTACHING UTILITY WHILE ALSO MAINTAINING THE APPROPRIATE MID-SPAN CLEARANCES BETWEEN UTILITIES.

2. AT NO TIME SHALL DUKE ENERGY LINES BE LESS THAN THE MINIMUM VALUES REQUIRED BY THE NESC.

3. THE VALUES IN THE ABOVE TABLE ARE BASED ON WHICHER OF THE FOLLOWING CONDITIONS PRODUCES THE MAXIMUM SAG OR MINIMUM CLEARANCE VALUE WITH NO WIND DISPLACEMENT:

   - A. CONDUCTORS AT 120°F, FINAL SAG (USED FOR PRIMARY CONDUCTORS IF NO OTHER MAXIMUM TEMPERATURE IS KNOWN AND FOR NEUTRAL CONDUCTORS) OR
   - B. CONDUCTORS AT THE MAXIMUM OPERATING TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO Operate, Final SAG OR
   - C. CONDUCTORS AT 32°F, WITH THE RADIAL THICKNESS OF ICE REQUIRED BY DWG. 10.00-05, FINAL SAG.

4. THE VALUES IN THE ABOVE TABLE ARE FOR THE GROUNDED NEUTRAL (WHERE THERE ARE NO JOINT USERS) FOR ALL STATES, PRIMARY CONDUCTORS MUST BE 18.5 FEET MINIMUM OVER ALL ROADWAYS AND 24' FOR SOME STATES OVER LIMITED ACCESS HIGHWAYS.

5. SEE NESC TABLE 232-1 FOR ADDITIONAL INFORMATION IF NEEDED.

6. ALL NEW CONTROLLED ACCESS CROSSINGS MUST MEET THE NEW 24' CLEARANCE REQUIREMENT. EXISTING CROSSINGS ARE GRANDFATHERED, INCLUDING SITUATIONS WHERE ROUTINE MAINTENANCE WORK IS CONDUCTED. ROUTINE MAINTENANCE INCLUDES ITEMS SUCH AS POLE REPLACEMENT, CROSSARM REPLACEMENT, GUY WIRE REPAIR, ETC. THE ONLY TIME WE NEED TO UPGRADE AN EXISTING CROSSING TO THE 24' REQUIREMENT IS WHEN NON-ROUTINE MAINTENANCE WORK SUCH AS REPLACING EXISTING CONDUCTORS, CONVERTING SINGLE-PHASE TO THREE-PHASE, CONVERTING FROM SINGLE CIRCUIT TO DOUBLE CIRCUIT, ETC. OVER THE HIGHWAY.
NOTES:

1. ALL VOLTAGES ARE Ø TO GROUND. CLEARANCES SHALL BE INCREASED AT THE RATE OF 0.4 INCHES PER KILOVOLT IN EXCESS OF 22kV.

2. CLEARANCES SHOWN HERE ARE NESC MINIMUMS. INDIVIDUAL RAILROAD CLEARANCE REQUIREMENTS WILL LIKELY EXCEED THESE VALUES. CONTACT THE APPROPRIATE DUKE ENERGY PERMIT COORDINATOR FOR ACTUAL VERTICAL AND HORIZONTAL CLEARANCES PRIOR TO SUBMITTING APPLICATION.

3. REFER TO APPLICABLE ENGINEERING AND CONSTRUCTION MANUALS FOR CONSTRUCTION GUIDELINES (DEAD-ENDS, GUYING, ETC.)

<table>
<thead>
<tr>
<th>NATURE OF SURFACE UNDERNEATH WIRES, CONDUCTORS OR CABLES.</th>
<th>NESC MINIMUM REQUIRED</th>
<th>NESC MINIMUM REQUIRED</th>
<th>NESC MINIMUM REQUIRED</th>
<th>NESC MINIMUM REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACK RAILS OF RAILROADS</td>
<td>23.5</td>
<td>24.0</td>
<td>24.5</td>
<td>26.5 (SEE NOTE 1)</td>
</tr>
</tbody>
</table>

CAUTION: SEE NOTE 2
### Notes:

1. These values are the NESC minimum clearances for lakes and bodies of water over 2000 acres in size. Since it is often difficult to determine the size of a lake or body of water and the height of sailboats that may be on the water in question, it is preferred that these clearances be used for new installations or upgrades to existing installations. If it is determined that heights of sailboats are limited by other obstacles, lesser clearances may be used. Refer to NESC Table 232-1 for additional information.

2. Where the US Army Corps of Engineers, or the state, or surrogate thereof has issued a crossing permit, clearances of that permit shall govern.

3. These sailboat clearances over navigable waters assume no bridge crossings are involved. Where there is also a bridge crossing, the permit issuer’s clearances must be maintained over the bridge rather than water.

4. Refer to applicable engineering and construction manuals for construction guidelines (dead-ends, guying, etc.)

### Table

<table>
<thead>
<tr>
<th>Nature of Surface Underneath Wires, Conductors or Cables</th>
<th>NESC Minimum Required</th>
<th>NESC Minimum Required</th>
<th>NESC Minimum Required</th>
<th>NESC Minimum Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterways / Water Areas Not Suitable For Sailboating Or Where Sailboating Is Prohibited</td>
<td>14.0</td>
<td>14.5</td>
<td>15.0</td>
<td>17.0</td>
</tr>
<tr>
<td>Waterways / Water Areas Suitable For Sailboating (See Note 1)</td>
<td>37.5</td>
<td>38.0</td>
<td>38.5</td>
<td>40.5</td>
</tr>
<tr>
<td>Public Or Private Land And Water Areas Posted For Rigging Or Launching Sailboats</td>
<td>Clearance above ground shall be 5 ft. greater than shown above.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
THIS METHOD IS USED TO DETERMINE ADEQUATE GROUND CLEARANCE FOR EXISTING INSTALLATIONS. THE FIELD ENGINEER WILL NEED TO OBTAIN THE EXISTING GROUND CLEARANCE (MGC) AT MID-SPAN OR THE POINT OF CONCERN ALONG WITH THE MEASURED SAG OF THE SPAN AND THE AMBIENT TEMPERATURE AT WHICH THE MEASUREMENTS ARE TAKEN.

EXAMPLE

GIVEN AN EXISTING CROSSING IN NORTH CAROLINA, DETERMINE IF THE CLEARANCE IS ADEQUATE UNDER THE FOLLOWING CONDITIONS. ASSUME IT WAS INSTALLED USING THE APPROPRIATE SAG AND TENSION AND HAS BEEN THROUGH AT LEAST ONE THERMAL LOADING CYCLE.

- 12.47 / 7.2 KV, 3-PHASE, 4-WIRE CIRCUIT, ASSUME BOTH PRIMARY AND NEUTRAL CONDUCTORS ARE AT THE SAME HEIGHT IN THE CROSSING.
- 280’ SPAN OF 1/0 ACSR CONDUCTOR, DEAD-ENDED ON EITHER SIDE OF THE SPAN.
- THE CROSSING IS OVER A STREET SUBJECT TO TRUCK TRAFFIC (NESC MINIMUMS ARE ADEQUATE, THERE IS NO LOCAL AUTHORITY WITH A MORE STRINGENT REQUIREMENT).
- AMBIENT TEMPERATURE IS 50°F; AT THE TIME OF MEASUREMENT THERE IS LITTLE OR NO LOAD ON THE CIRCUIT.
- MAXIMUM OPERATING TEMPERATURE OF THE CONDUCTOR IS 120°F.
- MEASURED GROUND CLEARANCE (MGC) DURING THE FIELD VISIT IS 19’.
- MEASURED SAG (MS) DURING THE FIELD VISIT IS 24”.

SOLUTION

DETERMINE MAXIMUM FINAL SAG (SF) FROM THE FOLLOWING CONDITIONS, USING SAG TABLES PROVIDED IN THE OVERHEAD CONDUCTOR SECTIONS OF THIS MANUAL.

- 120°F, WITH NO WIND DISPLACEMENT, SF = 47”.
- MAXIMUM CONDUCTOR TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE, WITH NO WIND DISPLACEMENT, SF = 47”.
- 32°F, WITH NO WIND DISPLACEMENT, WITH RADIAL THICKNESS OF ICE SPECIFIED ON DWG. 10.00-05, SF = 36” (USING THE MEDIUM CLEARANCE ZONE FOR NORTH CAROLINA AND THE CORRESPONDING 1/4” OF ICE).

SO, SF = 47”

NEXT, DETERMINE THE CALCULATED SAG CHANGE, CSC.

\[
\text{CSC} = \text{MAXIMUM FINAL SAG} - \text{MEASURED SAG} = 47” - 24”, \text{OR 23” OF SAG CHANGE FROM PRESENT CONDITIONS TO MAXIMUM SAG CONDITIONS.}
\]

DETERMINE CALCULATED GROUND CLEARANCE AT MAXIMUM SAG, CGC.

\[
\text{CGC} = \text{MEASURED GROUND CLEARANCE} - \text{CALCULATED SAG CHANGE} = 19” - 1’-11”, \text{OR 17’-1”}.
\]

SO, WHILE THIS LINE MAY HAVE APPEARED TO MAINTAIN THE MINIMUM NESC REQUIREMENT OF 18’-6” (TABLE 232-1) DURING THE FIELD VISIT, AT MAXIMUM FINAL SAG CONDITIONS, THIS LINE ULTIMATELY DOES NOT MEET CODE AND CONSEQUENTLY MUST BE CORRECTED.
KEY

| Si | INITIAL SAG @ 60°F, NO WIND (FROM SAG TABLES) |
| Sf | THE greater OF FINAL SAG AT MAXIMUM OPERATING TEMPERATURE NO WIND, OR 32°F W/ APPROPRIATE ICE LOADING FROM DWG. 10.00-05 |
| DIFF. | Sf - Si |

NOTES:
1. USE THIS METHOD WITH THE TABLE ON DWG. 10.02-01 WHEN DETERMINING MINIMUM LINE HEIGHTS ABOVE GROUND, RAILS, ETC.
2. LINE HEIGHT (AT MID SPAN) = REQUIRED MINIMUM CLEARANCE (SEE DWG. 10.02-01) PLUS (Sf - Si).
3. ROUND UP "DIFF." (Sf-Si) VALUES TO NEAREST 1/2 FT. (E.G., 32" WOULD BECOME 3'-0").
4. ASSUMING THE NEUTRAL IS THE LOWEST CONDUCTOR, USE A MAXIMUM OPERATING TEMPERATURE OF 120°F.

EXAMPLES OF USE OF INITIAL AND FINAL SAG (ASSUME THE LINE IS IN NORTH CAROLINA):
1. 3-Ø 477 AAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 300 FT. SPAN -
   
   REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD (FROM DWG. 10.02-01) ........................................... 15.5 FT.

   DIFFERENCE BETWEEN INITIAL SAG @ 60° F AND FINAL SAG @ 120° F FOR 1/0 ACSR, 300 FT. SPAN .......................... 3.0 FT.

   REQUIRED HEIGHT OF NEUTRAL ABOVE ROAD SURFACE AT INSTALLATION .......................................................... 18.5 FT.

   (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)

2. 3-Ø 477 AAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 150 FT. SPAN -
   
   REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD (FROM DWG. 10.02-01) ........................................... 15.5 FT.

   DIFFERENCE BETWEEN INITIAL SAG @ 60° F AND FINAL SAG @ 120° F FOR 1/0 ACSR, 150 FT. SPAN ......................... 1.5 FT.

   REQUIRED HEIGHT OF NEUTRAL ABOVE ROAD SURFACE AT INSTALLATION .......................................................... 17.0 FT.

   (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)
VERTICAL CLEARANCE OF EQUIPMENT CASES, SUPPORT ARMS, PLATFORMS, BRACES AND UNGUARDED RIGID LIVE PARTS ABOVE GROUND, ROADWAY OR WATER SURFACES

VOLTAGES ARE PHASE TO GROUND FOR EFFECTIVELY GROUNDED CIRCUITS AND THOSE OTHER CIRCUITS WHERE ALL GROUND FAULTS ARE CLEARED BY PROMPTLY DE-ENERGIZING THE FAULTED SECTION, BOTH INITIALLY AND FOLLOWING SUBSEQUENT BREAKER OPERATIONS.

<table>
<thead>
<tr>
<th>NATURE OF SURFACE BELOW</th>
<th>NONMETALLIC OR EFFECTIVELY GROUNDED SUPPORT ARMS, SWITCH HANDLES, PLATFORMS, BRACES AND EQUIPMENT CASES (FT.)</th>
<th>UNGUARED RIGID LIVE PARTS OF 0 TO 750V AND UNDERGROUND CASES THAT CONTAIN EQUIPMENT CONNECTED TO CIRCUITS OF NOT MORE THAN 750V (FT.)</th>
<th>UNGUARED RIGID LIVE PARTS OF OVER 750V TO 22KV AND UNDERGROUND CASES THAT CONTAIN EQUIPMENT CONNECTED TO CIRCUITS OF OVER 750V TO 22KV (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. WHERE RIGID PARTS OVERHANG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. ROADS, STREETS AND OTHER AREAS SUBJECT TO TRUCK TRAFFIC (SEE NOTE 4)</td>
<td>15.0</td>
<td>16.0</td>
<td>18.0</td>
</tr>
<tr>
<td>B. DRIVEWAYS, PARKING LOTS, AND ALLEYS</td>
<td>15.0</td>
<td>16.0 (SEE NOTE 6)</td>
<td>18.0</td>
</tr>
<tr>
<td>C. OTHER AREAS TRAVERSED BY VEHICLES SUCH AS CULTIVATED, GRASSING, FOREST AND ORCHARD LANDS, INDUSTRIAL AREAS, COMMERCIAL AREAS, ETC. (SEE NOTE 3)</td>
<td>15.0 (SEE NOTE 3)</td>
<td>16.0</td>
<td>18.0</td>
</tr>
<tr>
<td>D. SPACES AND WAYS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC ONLY (SEE NOTE 5)</td>
<td>11.0 (SEE NOTE 7)</td>
<td>12.0 (SEE NOTE 1)</td>
<td>14.0</td>
</tr>
<tr>
<td>2. WHERE RIGID PARTS ARE ALONG AND WITHIN THE LIMITS OF HIGHWAYS OR OTHER ROAD RIGHTS-OF-WAY BUT DO NOT OVERHANG THE ROADWAY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. ROADS, STREETS AND ALLEYS</td>
<td>15.0 (SEE NOTE 7)</td>
<td>16.0</td>
<td>18.0</td>
</tr>
<tr>
<td>B. ROADS WHERE IT IS UNLIKELY THAT VEHICLES WILL BE CROSSING UNDER THE LINE</td>
<td>13.0 (SEE NOTE 5)</td>
<td>14.0 (SEE NOTE 1)</td>
<td>16.0</td>
</tr>
<tr>
<td>3. WATER AREAS NOT SUITABLE FOR SAILBOATING OR WHERE SAILBOATING IS PROHIBITED (SEE NOTE 8)</td>
<td>14.0</td>
<td>14.5</td>
<td>15.0</td>
</tr>
</tbody>
</table>

NOTES:

1. FOR INSULATED LIVE PARTS LIMITED TO 150V TO GROUND, THIS VALUE MAY BE REDUCED TO 10 FT.
2. WHERE A SUPPLY LINE ALONG A ROAD IS LIMITED TO 300V TO GROUND AND IS LOCATED RELATIVE TO FENCES, DITCHES, EMBANKMENTS, ETC., SO THAT THE GROUND UNDER THE LINE WOULD NOT BE EXPECTED TO BE TRAVELED EXCEPT BY PEDESTRIANS, THIS CLEARANCE MAY BE REDUCED TO 12 FT.
3. WHEN DESIGNING A LINE TO ACCOMMODATE OVERSIZED VEHICLES, THESE CLEARANCE VALUES SHALL BE INCREASED BY THE DIFFERENCE BETWEEN THE KNOWN HEIGHT OF THE OVERSIZED VEHICLE AND 14 FT.
4. FOR THE PURPOSE OF THIS RULE, TRUCKS ARE DEFINED AS ANY VEHICLE EXCEEDING 8 FT. IN HEIGHT. AREAS NOT SUBJECT TO TRUCK TRAFFIC ARE AREAS WHERE TRUCK TRAFFIC IS NOT NORMALLY ENCOUNTERED NOR REASONABLY ANTICIPATED.
5. SPACES AND WAYS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC ONLY ARE THOSE AREAS WHERE RIDERS ON HORSEBACK OR OTHER LARGE ANIMALS, VEHICLES OR OTHER MOBILE UNITS EXCEEDING 8 FT. IN HEIGHT, ARE PROHIBITED BY REGULATION OR PERMANENT TERRAIN CONFIGURATIONS OR ARE OTHERWISE NOT NORMALLY ENCOUNTERED NOR REASONABLY ANTICIPATED.
6. THIS CLEARANCE MAY BE REDUCED TO THE FOLLOWING VALUES FOR DRIVEWAYS, PARKING LOTS AND ALLEYS NOT SUBJECT TO TRUCK TRAFFIC:
   (a) INSULATED LIVE PARTS LIMITED TO 300V TO GROUND 12 FT.
   (b) INSULATED LIVE PARTS LIMITED TO 150V TO GROUND 10 FT.
7. EFFECTIVELY GROUNDED SWITCH HANDLES AND SUPPLY OR COMMUNICATIONS EQUIPMENT CASES (SUCH AS FIRE ALARM BOXES, CONTROL BOXES, COMMUNICATION TERMINALS, Meters OR SIMILAR EQUIPMENT CASES) MAY BE MOUNTED AT A LOWER LEVEL FOR ACCESSIBILITY, PROVIDED SUCH CASES DO NOT UNDULY OBSTRACT A WALKWAY. SEE ALSO RULE 234J2c.
8. WHERE THE U.S. ARMY CORPS OF ENGINEERS, OR THE STATE, OR THE SURROGATE THEREOF HAS ISSUED A CROSSING PERMIT, CLEARANCES OF THAT PERMIT SHALL GOVERN.
**LINE CROSSING CLEARANCES**  
**ADAPTED FROM NESC TABLE 233-1**

<table>
<thead>
<tr>
<th>LOWER LEVEL</th>
<th>EFFECTIVELY GROUNDED GUYS, SPAN WIRES, NEUTRAL CONDUCTORS AND LIGHTNING PROTECTION WIRES (FT.)</th>
<th>EFFECTIVELY GROUNDED GUYS, SPAN WIRES, NEUTRAL CONDUCTORS AND LIGHTNING PROTECTION WIRES (FT.)</th>
<th>MULTIPLEX SECONDARY AND ALL SERVICES (FT.)</th>
<th>OPEN WIRE SECONDARY, 0-750 V (FT.)</th>
<th>OPEN SUPPLY CONDUCTORS OVER 750 V TO 22 kV (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMUNICATION GUYS, SPAN WIRES AND MESSENGERS, COMMUNICATION CONDUCTORS AND CABLES</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2 (SEE NOTE 5)</td>
</tr>
<tr>
<td>COMMUNICATION GUYS, SPAN WIRES AND MESSENGERS; COMMUNICATION CONDUCTORS AND CABLES</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>5 (SEE NOTE 3)</td>
</tr>
<tr>
<td>MULTIPLEX SECONDARY AND ALL SERVICES</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4 (SEE NOTE 5)</td>
<td>2 (SEE NOTE 5)</td>
</tr>
<tr>
<td>OPEN WIRE SECONDARY, 0-750 V</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2 (SEE NOTE 5)</td>
</tr>
<tr>
<td>OPEN SUPPLY CONDUCTORS, 750 V TO 22 kV</td>
<td>5 (SEE NOTE 3, 6)</td>
<td>2</td>
<td>4 (SEE NOTE 6)</td>
<td>4 (SEE NOTE 5)</td>
<td>2 (SEE NOTE 5)</td>
</tr>
</tbody>
</table>

**NOTES:**

1. NO VERTICAL CLEARANCE IS REQUIRED BETWEEN WIRES ELECTRICALLY INTERCONNECTED AT THE CROSSING.

2. THE ABOVE CLEARANCES ARE FOR ANY LOCATION WHERE THE SUBJECT WIRES CROSS OR COULD BE CLOSEST TOGETHER, REGARDLESS OF SPAN LENGTHS. REFER TO NESC RULE 233.A.1 FOR APPLICABLE WIRE LOADING CONDITIONS TO USE IN DETERMINING WIRE POSITIONS AT CROSSING OR CLOSEST POINT.

3. MAY BE 4 FT. WHERE CROSSING IS MORE THAN 6 FT. HORIZONTALLY FROM A COMMUNICATION STRUCTURE AND VOLTAGE IS LESS THAN 8.7 kV PHASE-TO-GROUND.

4. VOLTAGES ARE PHASE-TO-GROUND FOR EFFECTIVELY GROUNDED WYE AND SINGLE-PHASE SYSTEMS, AND PHASE-TO-PHASE FOR ALL OTHER SYSTEMS.

5. NESC MINIMUM CLEARANCES ARE SHOWN. TO ACCOUNT FOR SAG CONDITIONS OF OTHER UTILITIES, 4' IS PREFERRED.

6. IN GENERAL, CROSSINGS OF LOWER VOLTAGE WIRES ABOVE HIGHER VOLTAGE WIRES IS NOT RECOMMENDED. HIGHER VOLTAGE WIRES SHOULD BE POSITIONED ABOVE LOWER VOLTAGE WIRES WHENEVER POSSIBLE.

7. WHEN CONTEMPLATING UNDERBUILDING BENEATH DUKE ENERGY TRANSMISSION LINES, CONTACT THE TRANSMISSION LINE ENGINEERING UNIT.

8. FOR EXCEPTIONS AND REFINEMENTS, REFER TO NATIONAL ELECTRICAL SAFETY CODE RULE 233.

9. THE AREA BETWEEN THE NEUTRAL AND PRIMARY ON THE POLE AND IN THE SPAN IS NOT TO BE VIOLATED BY FOREIGN CONDUCTORS OR CABLES.

10. CROSSINGS SHOULD BE MADE ON A COMMON SUPPORTING STRUCTURE, WHERE PRACTICAL.

11. FOR VOLTAGES ABOVE 22kV TO GROUND, CLEARANCES SHOULD BE CALCULATED ACCORDING TO NESC RULE 233C.
### Minimum Clearances (in Feet) of Unguarded Wires from Installations to Which They Are Not Attached

<table>
<thead>
<tr>
<th>Conductor Type</th>
<th>Clearance of:</th>
<th>Effectively Grounded Neutrals; Span &amp; Lightning Protection Wires, Guy's &amp; Messengers Cabled Primary</th>
<th>Insulated Supply Cables 0 - 750V (Triplex &amp; Quadruplex)</th>
<th>0 - 750 V Open Wire Secondary &amp; Services</th>
<th>Open Wire Primary Over 750 V - 22 kV (Phase to Ground)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Lighting and Traffic Signal Supports; Poles &amp; Supports of Another Line:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Horizontal</td>
<td>3'</td>
<td>5' (3' IF &lt;300V)</td>
<td>5' (3.5')**</td>
<td>5' (4.5')**</td>
<td></td>
</tr>
<tr>
<td>B. Vertical</td>
<td>2'</td>
<td>4.5' (2' IF &lt;300V)</td>
<td>4.5'</td>
<td>4.5'</td>
<td></td>
</tr>
<tr>
<td><strong>2. Buildings:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Horizontal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. To Walls, Projections &amp; Guarded Windows</td>
<td>4.5'</td>
<td>5'</td>
<td>5.5' (3.5')</td>
<td>7.5' (4.5')</td>
<td></td>
</tr>
<tr>
<td>2. To Unguarded Windows</td>
<td>4.5'</td>
<td>5'</td>
<td>5.5' (3.5')</td>
<td>7.5' (4.5')</td>
<td></td>
</tr>
<tr>
<td>3. To Balconies and Areas Accessible to Pedestrians</td>
<td>4.5'</td>
<td>5'</td>
<td>5.5' (3.5')</td>
<td>7.5' (4.5')</td>
<td></td>
</tr>
<tr>
<td>B. Vertical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Over &amp; Under Roofs or Projections Not Accessible to Pedestrians</td>
<td>3'</td>
<td>3.5'</td>
<td>10.5'</td>
<td>12.5'</td>
<td></td>
</tr>
<tr>
<td>2. Over &amp; Under Roofs or Projections Accessible to Pedestrians</td>
<td>10.5'</td>
<td>11'</td>
<td>11.5'</td>
<td>13.5'</td>
<td></td>
</tr>
<tr>
<td>3. Over Roofs, Ramps, Decks and Loading Docks Accessible to Vehicles but Not Subject to Truck Traffic</td>
<td>10.5'</td>
<td>11'</td>
<td>11.5'</td>
<td>13.5'</td>
<td></td>
</tr>
<tr>
<td>4. Over Roofs, Ramps, Decks and Loading Docks Accessible to Truck Traffic</td>
<td>15.5'</td>
<td>16'</td>
<td>16.5'</td>
<td>18.5'</td>
<td></td>
</tr>
<tr>
<td><strong>3. Signs, Chimneys, Billboards, Radio &amp; TV Antennas, and Other Installations Not Classified as Bridges:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Horizontal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. To Portions That Are Readily Accessible to Pedestrians</td>
<td>4.5'</td>
<td>5.0'</td>
<td>5.5' (3.5')</td>
<td>7.5' (4.5')</td>
<td></td>
</tr>
<tr>
<td>2. To Portions That Are Not Readily Accessible to Pedestrians</td>
<td>3.0'</td>
<td>3.5'</td>
<td>5.5' (3.5')</td>
<td>7.5' (4.5')</td>
<td></td>
</tr>
<tr>
<td>B. Vertical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Over or Under Catwalks and Other Surfaces Upon Which Personnel Walk</td>
<td>10.5'</td>
<td>11.0'</td>
<td>11.5'</td>
<td>13.5'</td>
<td></td>
</tr>
<tr>
<td>2. Over or Under Other Portions of Such Installations</td>
<td>3.0'</td>
<td>3.5'</td>
<td>6.0'</td>
<td>8.0'</td>
<td></td>
</tr>
<tr>
<td><strong>4. Bridges:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Clearances Over Bridges</td>
<td>N/A</td>
<td>3'</td>
<td>3.5'</td>
<td>5.5'</td>
<td></td>
</tr>
<tr>
<td>2. Not Attached</td>
<td>N/A</td>
<td>10'</td>
<td>10.5'</td>
<td>12.5'</td>
<td></td>
</tr>
<tr>
<td>B. Beside, Under, or Within Structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Readily Accessible Parts (A) Attached</td>
<td>N/A</td>
<td>3'</td>
<td>3.5'</td>
<td>5.5' (4.5')</td>
<td></td>
</tr>
<tr>
<td>(B) Not Attached</td>
<td>N/A</td>
<td>5'</td>
<td>5.5' (3.5')</td>
<td>7.5' (4.5')</td>
<td></td>
</tr>
<tr>
<td>2. Inaccessible Parts (A) Attached</td>
<td>N/A</td>
<td>3'</td>
<td>3.5'</td>
<td>5.5' (4.5')</td>
<td></td>
</tr>
<tr>
<td>(B) Not Attached</td>
<td>N/A</td>
<td>4'</td>
<td>4.5' (3.5')</td>
<td>6.5' (4.5')</td>
<td></td>
</tr>
</tbody>
</table>

---

**Notes:**

- **Bridges with Supporting Structures Above the Roadway May Serve as Supporting Structures for Electrical Lines.** The Clearance Shown for Attached and Not Attached Is the Clearance Above the Bridge Supporting Structures. See DWG. 10.04-11 for Clearance to Bridges Without Supporting Structures Above the Roadway.
- **Clearances Shown Are for Conductors at Rest. The Clearance in Parentheses Is the Clearance Required With Wind Displacement.** The Wind Displacement for Various Conductors and Span Lengths Can Be Found in the Sag Tables. Subtract the Wind Displacement from the Required Clearance at Rest. The Remaining Clearance Must Be Equal to or More Than the Clearances Shown in Parentheses.

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**Duke Energy**

**Clearances to Buildings and Other Installations**

Adapted from NESC Rule 234 and Table 234-1

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**Revised by: C&I Appr.**

**10.04-01A**
### Minimum Clearances (In Feet) of Unguarded Wires

**From Installations to Which They Are Not Attached**

<table>
<thead>
<tr>
<th>CONDUCTOR TYPE</th>
<th>EFFECTIVELY GROUNDED NEUTRALS; SPAN &amp; LIGHTNING PROTECTION WIRES; GUYS &amp; MESSENGERS CABLED PRIMARY (FT.)</th>
<th>INSULATED SUPPLY CABLES 0 - 750 V (TRIPLEX &amp; QUADRUPLEX) (FT.)</th>
<th>0 - 750 V OPEN WIRE SECONDARY &amp; SERVICES; CABLED PRIMARY (FT.)</th>
<th>OPEN WIRE PRIMARY OVER 750 V - 22 KV (PHASE TO GROUND) (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. RAILROADS (WHERE WIRES RUN ALONG TRACKS): A HORIZONTAL (FROM NEAREST RAIL)</td>
<td>8.5</td>
<td>9</td>
<td>9.5</td>
<td>11.5</td>
</tr>
<tr>
<td>B. VERTICAL (FROM TOP OF RAILS)</td>
<td>23.5</td>
<td>24</td>
<td>24.5</td>
<td>26.5</td>
</tr>
<tr>
<td>7. GRAIN BINS:</td>
<td></td>
<td></td>
<td></td>
<td>SEE DWGS. 10.04-15 AND 10.04-17</td>
</tr>
</tbody>
</table>

### Notes:

1. These clearances apply under whichever of the following conductor temperature and loading conditions produces the closest approach:
   - For Column One in the Table: Neutrals at 120°F or 32°F with appropriate radial ice thickness specified on DWG. 10.00-05.
   - All other columns for energized conductors in the Table:
     - Maximum conductor operating temperature or 120°F, whichever is greater.
     - 32°F with appropriate radial ice thickness specified on DWG. 10.00-05.
     - The minimum conductor temperature for which the line is designed, no wind displacement, initial sag. (This comes into play when a line is run under something such as a catwalk.)

2. Wind displacement considerations (horizontal):
   - A. Figures shown in parenthesis are minimum clearances where consideration of horizontal displacement under wind conditions is required. In applying these clearances, the conductor is displaced from rest towards the installation by a 6 psf wind at final sag at 60°F.
   - B. Perpendicular horizontal distance required between the line and the structure (building, etc.) is the greater of the horizontal clearance or the sum of wind clearance plus wind swing.
   - C. See applicable tables for conductor wind swings.

3. This table does not apply to clearance between a service and the building to which it attaches, but does apply to clearance between services and adjacent buildings.

4. For buildings under construction, these clearances must be maintained at all times during construction.

5. Refer to NESC Rule 234 for exceptions and refinements.

6. Clearance to railroad is for NESC reference only. Before designing a railroad crossing or facility next to a railroad, check with company permit coordinator for specific railroad company clearance requirements. They may require more clearance than the NESC.

---

**Clearances to Buildings and Other Installations**

Adapted from NESC Rule 234 and Table 234-1

<table>
<thead>
<tr>
<th>10.04-01B</th>
<th>DEC</th>
<th>DEM</th>
<th>DEP</th>
<th>DEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Revision Information**

- Revised by CK'D APRIL
- DUKE ENERGY.
### Horizontal Clearances

<table>
<thead>
<tr>
<th>Source Description</th>
<th>Effectively Grounded Neutrals; Span &amp; Lightning Protection Wires; Guys &amp; Messengers; Cabled Primary (ft.)</th>
<th>Insulated Supply Cables 0 - 750V (Triplex &amp; Quadruplex) (ft.)</th>
<th>0 - 750V Open Wire Secondary &amp; Services (ft.)</th>
<th>Open Wire Primary Over 750V To 22kV (Phase To Ground) (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To Walls, Projections and Guarded Windows</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5 (3.5) (See Note 2)</td>
<td>7.5 (4.5) (See Note 2)</td>
</tr>
<tr>
<td>2. To Unguarded Windows</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5 (3.5) (See Note 2)</td>
<td>7.5 (4.5) (See Note 2)</td>
</tr>
<tr>
<td>3. To Balconies and Areas Readily Accessible to Pedestrians</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5 (3.5) (See Note 2)</td>
<td>7.5 (4.5) (See Note 2)</td>
</tr>
</tbody>
</table>

### Vertical Clearances

<table>
<thead>
<tr>
<th>Source Description</th>
<th>Effectively Grounded Neutrals; Span &amp; Lightning Protection Wires; Guys &amp; Messengers; Cabled Primary (ft.)</th>
<th>Insulated Supply Cables 0 - 750V (Triplex &amp; Quadruplex) (ft.)</th>
<th>0 - 750V Open Wire Secondary &amp; Services (ft.)</th>
<th>Open Wire Primary Over 750V To 22kV (Phase To Ground) (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over or Under Roofs or Projections Not Readily Accessible to Pedestrians</td>
<td>3.0</td>
<td>3.5</td>
<td>10.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Over or Under Balconies and Roofs Readily Accessible to Pedestrians</td>
<td>10.5</td>
<td>11.0</td>
<td>11.5</td>
<td>13.5</td>
</tr>
<tr>
<td>Over Roofs, Ramps, Decks and Loading Docks Accessible to Vehicles But Not Subject to Truck Traffic (See Note 1)</td>
<td>10.5</td>
<td>11.0</td>
<td>11.5</td>
<td>13.5</td>
</tr>
<tr>
<td>Over Roofs, Ramps, Decks and Loading Docks Accessible to Truck Traffic (See Note 1)</td>
<td>15.5</td>
<td>16.0</td>
<td>16.5</td>
<td>18.5</td>
</tr>
</tbody>
</table>

**Notes:**

1. Trucks are defined as any vehicle over 8 ft. in height.

2. Clearances are shown for conductors at rest. The clearance in parentheses is the clearance required with wind displacement. The wind displacement for various conductors and span lengths can be found in the appropriate sag tables. Subtract the wind displacement from the required clearance at rest. The remaining clearance must be equal to or more than the clearances shown in parentheses.

---

*For areas beyond the shaded portions of the sketch, see NESC Rule 232 or DWG. 10.02-01 for appropriate clearances.*
**VERTICAL CLEARANCES**

1. OVER OR UNDER CATWALKS AND OTHER SURFACES UPON WHICH PERSONNEL WALK

<table>
<thead>
<tr>
<th></th>
<th>10.5</th>
<th>11.0</th>
<th>11.5</th>
<th>13.5</th>
</tr>
</thead>
</table>

2. OVER OR UNDER OTHER PORTIONS OF SUCH INSTALLATIONS

<table>
<thead>
<tr>
<th></th>
<th>3.0</th>
<th>3.5</th>
<th>6.0</th>
<th>8.0</th>
</tr>
</thead>
</table>

**HORIZONTAL CLEARANCES**

<table>
<thead>
<tr>
<th>EFFECTIVELY GROUNDED NEUTRALS; SPAN &amp; LIGHTNING PROTECTION WIRES; GUYS &amp; MESSENGERS; CABLED PRIMARY (FT.)</th>
<th>INSULATED SUPPLY CABLES 0 - 750V (TRIPLEX &amp; QUADRUPLE) (FT.)</th>
<th>0 - 750V OPEN WIRE SECONDARY &amp; SERVICES (FT.)</th>
<th>OPEN WIRE PRIMARY OVER 750V TO 22kV (PHASE TO GROUND) (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. TO PORTIONS THAT ARE READILY ACCESSIBLE TO PEDESTRIANS</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5 (3.5) (SEE NOTE 1)</td>
</tr>
<tr>
<td>2. TO PORTIONS THAT ARE NOT READILY ACCESSIBLE TO PEDESTRIANS</td>
<td>3.0</td>
<td>3.5</td>
<td>5.5 (3.5) (SEE NOTE 1)</td>
</tr>
</tbody>
</table>

**NOTES:**

1. CLEARANCES ARE SHOWN FOR CONDUCTORS AT REST. THE CLEARANCE IN PARENTHESES IS THE CLEARANCE REQUIRED WITH WIND DISPLACEMENT. THE WIND DISPLACEMENT FOR VARIOUS CONDUCTORS AND SPAN LENGTHS CAN BE FOUND IN THE APPROPRIATE SAG TABLES. SUBTRACT THE WIND DISPLACEMENT FROM THE REQUIRED CLEARANCE AT REST. THE REMAINING CLEARANCE MUST BE EQUAL TO OR MORE THAN THE CLEARANCES SHOWN IN PARENTHESES.

FOR REFERENCE SEE NESC RULE 234, TABLE 234-1
MINIMUM CLEARANCE REQUIREMENTS FOR A TRIPLEX CONDUCTOR ATTACHMENT TO A RESIDENTIAL HOME

NOTES:

1. TRIPLEX CONDUCTORS SHALL HAVE A CLEARANCE OF NOT LESS THAN 12' FROM THE GROUND OR 10' FROM ANY PLATFORM OR PORCH FROM WHICH THEY MIGHT BE REACHED. NOT LESS THAN 16' IS REQUIRED OVER DRIVEWAYS (SEE DWG. 10.02-13 FOR EXCEPTIONS).

2. TRIPLEX CONDUCTORS SHALL HAVE A CLEARANCE OF NOT LESS THAN 3' FROM WINDOWS, DOORS, PORCHES, FIRE ESCAPES OR SIMILAR LOCATIONS.
ALL SERVICE DROPS, INCLUDING DRIP LOOPS, MUST MAINTAIN THE FOLLOWING MINIMUM VERTICAL CLEARANCES ABOVE ROOFS FOR ROOFS OR BALCONIES THAT ARE NOT READILY ACCESSIBLE PER NESC 234C 3d.

CONDUCTORS, INCLUDING DRIP LOOPS, SHALL HAVE A VERTICAL CLEARANCE OF NOT LESS THAN TEN FEET FROM THE HIGHEST POINT OF ROOFS OR BALCONIES OVER WHICH THEY PASS.

EXCEPTION #1:
THREE FEET OF CLEARANCE IS ALLOWED IF:

- THE PHASE-TO-PHASE VOLTAGE IS LESS THAN 300 VOLTS, AND
- THE ROOF OR BALCONY IS NOT READILY ACCESSIBLE, AND
- SERVICE DROP IS TRIPLEX OR QUADRUPLEX CABLE DESIGN.
MAINTAIN NOT LESS THAN 3'-0"
VERTICAL CLEARANCE ABOVE ROOF
OUTSIDE OF 6'-0" RADIUS FROM
THE SERVICE MAST.

MAINTAIN NOT LESS THAN 18"
VERTICAL CLEARANCE ABOVE ROOF
WITHIN 6'-0" RADIUS FROM THE
SERVICE MAST.

PLAN VIEW

SIDE VIEW

EXCEPTION #2:

EIGHTEEN INCHES OF CLEARANCE IS ALLOWED IF:

- THE PHASE-TO-PHASE VOLTAGE IS LESS THAN 300 VOLTS, AND
- THE CONDUCTORS DO NOT PASS OVER MORE THAN 48 INCHES OF ROOF OVERHANG, AND
- THE CONDUCTORS ARE TERMINATED AT A THROUGH-THE-ROOF RACEWAY OR APPROVED SUPPORT, AND
- THE ROOF OR BALCONY IS NOT READILY ACCESSIBLE.
NOTES:

1. ALL VOLTAGES ARE Ø-G.

2. DIMENSIONS GIVEN ARE MINIMUMS. ADDITIONAL CLEARANCE SHOULD BE PROVIDED IF POSSIBLE. BRIDGE CROSSINGS HERE ARE NOT OVER NAVIGABLE WATERWAYS.

3. DOT OR HIGHWAY PERMITS MAY DICTATE CLEARANCE HEIGHTS.

4. SEE DWG. 10.04-01A FOR LINE CLEARANCES ABOVE BRIDGES WITH A SUPER STRUCTURE ABOVE THE ROADWAY.

5. THESE ARE NESC MINIMUM CLEARANCES TO THE ROADWAY SURFACE OF THE BRIDGE. REFER TO DWG. 10.02-03 FOR APPLICABLE STATE GUIDELINES.

6. THESE CLEARANCES ARE TO THE SIDEWALK WHERE ONLY RESTRICTED TRAFFIC IS NORMALLY EXPECTED. NO HORSEBACK RIDERS OR VEHICLES GREATER THAN 8 FOOT IN HEIGHT.
NO NEW LINES TO BE INSTALLED OVER EXISTING POOLS

UNDERGROUND PRIMARY

STREET LIGHT OR SECONDARY CABLE

5' MINIMUM

5' MINIMUM

<table>
<thead>
<tr>
<th>ANGLE</th>
<th>INSULATED COMMUNICATION CONDUCTORS AND CABLES; MESSENGERS; GROUNDED GUYS; NEUTRAL CONDUCTORS, (FT.)</th>
<th>TRIPLEX AND QUADRUPLEX CABLES, 0 TO 750 V, AND NON-INSULATED COMMUNICATIONS CONDUCTORS (FT.)</th>
<th>OPEN WIRE SERVICE / SECONDARY CONDUCTORS, 0 TO 750 V (FT.)</th>
<th>OVERHEAD PRIMARY CONDUCTORS, OVER 750V TO 22kV (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>22</td>
<td>22.5</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>17</td>
</tr>
<tr>
<td>D</td>
<td>14</td>
<td>14.5</td>
<td>15</td>
<td>-</td>
</tr>
</tbody>
</table>

NOTES:

1. FIVE (5) FEET MINIMUM MUST ALSO BE MAINTAINED FOR UNDERGROUND PRIMARY AND SECONDARY CABLES. IF FIVE (5) FEET IS NOT ATTAINABLE, LESSER DISTANCES ARE PERMITTED PER NESC RULE 351c. WITH CONSIDERATION FOR FUTURE OPERATIONAL NEEDS, THE DESIGNER SHOULD STILL MAINTAIN AS MUCH CLEARANCE AS POSSIBLE. ALL INSTALLATIONS WITHIN FIVE (5) FEET MUST BE IN CONDUIT.

2. SEE DWG. 10.04-01A, "CLEARANCES TO BUILDINGS" FOR POOLS FULLY ENCLOSED BY A SOLID OR SCREENED STRUCTURE.

3. SECONDARY AND SERVICE CABLES LOCATED 10' OR MORE HORIZONTALLY FROM THE POOL EDGE, DIVING PLATFORM OR TOWER ARE EXEMPT FROM SWIMMING POOL CLEARANCE REQUIREMENTS. SEE DWG. 10.04-01A, "CLEARANCES TO BUILDINGS" FOR ACTUAL CLEARANCE REQUIREMENTS.

4. ANGLES 'C' AND 'D' ARE MEASURED FROM THE DIVING PLATFORM OR WATER SLIDE. ANGLES 'A' AND 'B' ARE MEASURED FROM THE WATER OR EDGE OF POOL.

5. FOR POOLS INSTALLED UNDER EXISTING LINES, SEE NESC TABLE 234-3 AND FIGURE 234-3.

6. POOL CONTRACTORS MUST MEET THE GREATER OF THE FOLLOWING CODES:
   - DUKE ENERGY POOL CLEARANCE POLICY.
   - CITY AND/OR COUNTY ELECTRICAL CODES.
   - STATE ELECTRICAL CODES.
P = PROBE CLEARANCE 18 FT. REQUIRED BY NESC RULE 234F1A

H = HORIZONTAL CLEARANCE 15 FT. REQUIRED BY NESC RULE 234F1B

T = TRANSITION CLEARANCE

V₁ = VERTICAL CLEARANCE ABOVE A BUILDING REQUIRED BY NESC RULE 234C, SEE DWG. 10.04-03.

V₂ = VERTICAL CLEARANCE ABOVE LAND REQUIRED BY NESC RULE 232. SEE DWG. 10.02-01.

NOTES:

1. CLEARANCES OUTSIDE THE AREA GOVERNED BY NESC RULE 234F REVERT TO THE STANDARD CLEARANCES REQUIRED BY NESC RULE 234C AND DWG. 10.04-03.

2. PROBE CLEARANCES OF NOT LESS THAN 18 FT. IN ALL DIRECTIONS ABOVE THE GRAIN BIN SHALL BE MAINTAINED FROM EACH PROBE PORT IN THE GRAIN BIN ROOF FOR ALL WIRES, CONDUCTORS AND CABLES.

3. A HORIZONTAL CLEARANCE OF NOT LESS THAN 15 FT. SHALL BE MAINTAINED BETWEEN GRAIN BINS AND OPEN SUPPLY CONDUCTORS, 0 TO 22KV. APPLY CALCULATED ADDER FOR VOLTAGES IN EXCESS OF 22KV.

4. THE VERTICAL CLEARANCE OR V₁ SHALL BE THE SAME CLEARANCE AS REQUIRED FOR A BUILDING. SEE NESC RULE 234C OR DWG. 10.04-03.

5. VERTICAL CLEARANCE OR V₂ BEYOND THE HORIZONTAL CLEARANCE, USE THE VERTICAL CLEARANCE OF CONDUCTORS ABOVE GROUND OR RAILS. SEE NESC RULE 232 OR DWG. 10.02-01.
CLEARANCES TO GRAIN BINS WITH PORTABLE AUGERS, CONVEYORS OR ELEVATORS

V = HEIGHT OF HIGHEST FILLING OR PROBING PORT ON GRAIN BIN
H = V + 18 FT.

FOR REFERENCE SEE NESC RULE 234F

NOTES:
1. CLEARANCES OUTSIDE THE AREA GOVERNED BY NESC RULE 234F REVERT TO THE STANDARD CLEARANCES REQUIRED BY NESC RULE 234C AND DWG. 10.04-03.

2. A CLEARANCE OF NOT LESS THAN 18 FT. IN ALL DIRECTIONS ABOVE THE GRAIN BIN SHALL BE MAINTAINED FROM EACH PROBE PORT IN THE GRAIN BIN ROOF FOR ALL WIRES, CONDUCTORS AND CABLES.

3. A HORIZONTAL CLEARANCE OF NOT LESS THAN 15 FT. SHALL BE MAINTAINED BETWEEN GRAIN BINS AND OPEN SUPPLY CONDUCTORS, 0 TO 22KV. APPLY CALCULATED ADDER FOR VOLTAGE IN EXCESS OF 22KV.
### Vertical Clearance Between Conductors at Supports

**Conductors and Cables Usually at Upper Levels**

<table>
<thead>
<tr>
<th>Conductors and Cables Usually at Lower Levels</th>
<th>Effectively Grounded Neutrals, Triplex and Quadruplex (in)</th>
<th>Open Supply Conductors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 8.7kV to 50kV (Phase to Ground)</td>
<td>Same Utility (see Note 5) (in)</td>
<td>Different Utilities (see Note 5) (in)</td>
</tr>
<tr>
<td>0 to 8.7kV (in)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 1. Communication Conductors and Cables

A. Located in the Communication Space

- Effectively Grounded Neutrals, Triplex and Quadruplex (in): 40
- Open Supply Conductors (in): 40

#### 2. Supply Conductors and Cables

A. Open Wire Secondary, Triplex, Quadruplex and EFFECTIVELY GROUNDED NEUTRALS

- Effectively Grounded Neutrals, Triplex and Quadruplex (in): 16
- Open Supply Conductors (in): 40

B. Open Conductors Over 750V to 8.7kV

- Effectively Grounded Neutrals, Triplex and Quadruplex (in): 16
- Open Supply Conductors (in): 40

C. Open Conductors Over 8.7kV to 22kV

(1) If working on energized with live-line tools and adjacent circuits are neither de-energized nor covered with shields of protectors

- Effectively Grounded Neutrals, Triplex and Quadruplex (in): 16
- Open Supply Conductors (in): 40

(2) If working on energized except when adjacent circuits (either above or below) are de-energized or covered by shields or protectors, or by the use of live-line tools not requiring line workers to go between live wires

- Effectively Grounded Neutrals, Triplex and Quadruplex (in): 16
- Open Supply Conductors (in): 40

#### Notes:

1. Values shown are NESC minimums. Clearances may need to be adjusted to obtain proper mid-span clearances as well. Duke Energy’s construction standards will likely exceed these minimums and should always be used as a design standard.

2. Where conductors are operated by different utilities, a vertical clearance of not less than 40 inches is recommended.

3. These values do not apply to conductors of the same circuit or circuits being carried on adjacent conductor supports.

4. The greater of phasor difference or phase-to-ground voltage.

5. See examples of calculations on DWGs. 10.05-05A and 10.05-05B.

6. No clearance is specified between triplex or quadruplex cables and effectively grounded neutrals.
NOTES:

1. LINE WIRES, CONDUCTORS AND CABLES SUPPORTED AT DIFFERENT LEVELS ON THE SAME STRUCTURES SHALL HAVE VERTICAL CLEARANCES AT THE SUPPORTING STRUCTURES SO ADJUSTED THAT THE CLEARANCE AT ANY POINT SHALL NOT BE LESS THAN 75% OF THAT REQUIRED AT THE SUPPORTS AS IN DWG. 10.05-01, FOR VOLTAGES LESS THAN 50KV BETWEEN CONDUCTORS.

EXAMPLE

GIVEN A TRIPLEX CONDUCTOR AT THE UPPER LEVEL AND A COMMUNICATION CONDUCTOR BELOW, FROM DWG 10.05-01 THE REQUIRED CLEARANCE AT THE SUPPORT IS 40" (DIMENSION 'E'). THE REQUIRED CLEARANCE BETWEEN THE TWO AT ANY POINT IN THE SPAN IS THEREFORE 40" (0.75), OR 30" (DIMENSION V).

2. THE CLEARANCE AT ANY POINT IN THE SPAN BETWEEN AN EFFECTIVELY GROUNDED NEUTRAL AND COMMUNICATION CABLES IN THE COMMUNICATIONS SPACE MAY BE REDUCED TO NO LESS THAN 12", PROVIDED THAT A CLEARANCE OF 30" IS MAINTAINED BETWEEN THE TWO AT THE SUPPORTING POLES. THIS EXCEPTION APPLIES ONLY IF THE SUPPLY NEUTRAL AND COMMUNICATIONS MESSENGER ARE BONDED AT THE PROPER INTERVALS SPECIFIED IN RULE 092C1.

3. FOR VOLTAGES GREATER THAN 50KV BETWEEN CONDUCTORS, THE REQUIRED VERTICAL CLEARANCE AT ANY POINT IN THE SPAN IS 75% OF THAT REQUIRED AT THE SUPPORT UP TO 50KV, PLUS 100% OF THE REQUIRED CLEARANCE FOR THE PORTION IN EXCESS OF 50KV.

   FOR THE SAME UTILITY, THIS IS: \[16 + (50 - 8.7)(4)\] X 0.75 PLUS 0.4" PER KV IN EXCESS OF 50KV.
   FOR DIFFERENT UTILITIES, THIS IS: \[40 + (50 - 8.7)(4)\] X 0.75 PLUS 0.4" PER KV IN EXCESS OF 50KV.

EXAMPLE CALCULATION OF VERTICAL CLEARANCE
IN THE SPAN AND AT THE SUPPORTING STRUCTURES

WHAT IS THE MINIMUM SPACING ON THE POLES BETWEEN A 69KV AND A 34.5KV DISTRIBUTION CIRCUIT?

THE LINE IS IN INDIANA. THE 69KV LINE HAS 4/0 AAAC PHASES AND THE 34.5KV DISTRIBUTION UNDERBUILD HAS 1/0 AAAC PHASES. THE RULING SPAN FOR THE LINE IS 210 FT. BOTH CIRCUITS ARE OWNED BY THE SAME UTILITY.

THE SOLUTION TO THIS PROBLEM HAS MULTIPLE PARTS. WHILE WE ARE ULTIMATELY TRYING TO DETERMINE THE VERTICAL SPACING ON THE POLES (DIMENSION 'E'), IT IS dictated BY THE SEPARATION REQUIREMENT AT ANY POINT IN THE SPAN, OR DIMENSION 'V'.

TO DETERMINE THESE CLEARANCES, FIRST DETERMINE THE APPLICABLE VOLTAGE BETWEEN THE CIRCUITS. BECAUSE THE CLEARANCE IS BETWEEN DIFFERENT CIRCUITS, THE PHASOR DIFFERENCE IN VOLTAGE MUST BE USED TO CALCULATE THE CLEARANCE. WHEN THE ACTUAL PHASOR RELATIONSHIP IS UNKNOWN, ASSUME A WORST-CASE DIFFERENCE OF 180 DEGREES. THE RESULT OF THIS ASSUMPTION IS THAT THE PHASE TO GROUND VOLTAGES OF THE CIRCUITS ARE ADDED TOGETHER, SO OUR VOLTAGE BETWEEN CIRCUITS IS 69/1.732 + 34.5/1.732, OR 59.8 KV.

FROM DWG. 10.05-01 (OR NESC TABLE 235-5), THE CLEARANCE BETWEEN CONDUCTORS OWNED BY THE SAME UTILITY IS 16", PLUS 0.4" PER KV IN EXCESS OF 8.7 KV, THIS LOOKS LIKE THE FOLLOWING:

\[
16" + (59.8 - 8.7) \times 0.4" = 16" + 20.4" = 36.4"
\]

THIS IS THE VALUE FOR DIMENSION 'E', WITHOUT ACCOUNTING FOR SAG-RELATED CLEARANCES. IT IS VERY IMPORTANT, THIS IS NOT THE FINAL ANSWER.

FROM DWG. 10.05-03 IT IS STATED IN NOTE 1 THAT THE CLEARANCE AT ANY POINT IN THE SPAN SHALL NOT BE LESS THAN 75% OF THAT REQUIRED AT THE SUPPORTS. AT FIRST IT WOULD APPEAR THIS IS SIMPLY 36.4" (0.75), OR 28" (Rounded up from 27.3"). HOWEVER, NOTE 3 FROM THE SAME DRAWING ALSO STATES THAT 75% IS REQUIRED FOR VOLTAGES UP TO 50 KV, PLUS 100% OF THE REQUIRED CLEARANCE IN EXCESS OF 50 KV. SO, THE REQUIRED CLEARANCE AT ANY POINT IN THE SPAN IS:

\[
(16 + (50 - 8.7) \times 0.4)(0.75) + (59.8 - 50)(0.4) = 24.4" + 3.9" = 28.3", OR 29"
\]

THIS CREATES ONLY A SMALL CHANGE BUT NEVER THESSST STILL SHOULD BE ACCOUNTED FOR.

NEXT, WE NEED TO ADJUST THE CLEARANCE AT THE SUPPORTS (DIMENSION 'E') TO ACCOUNT FOR SAG-RELATED CLEARANCES. FROM DWG. 10.02-09 AND NESC RULE 234A, THE CONDITION THAT CREATES THE MAXIMUM FINAL SAG IS SELECTED FROM THE FOLLOWING:

- 120°F, WITH NO WIND DISPLACEMENT
- MAXIMUM CONDUCTOR TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE, IF GREATER THAN 120°F, WITH NO WIND DISPLACEMENT
- 32°F, WITH NO WIND DISPLACEMENT AND RADIAL THICKNESS OF ICE SPECIFIED IN DWG. 10.00-05.

(CONTINUED ON DWG. 10.05-05B)
EXAMPLE CALCULATION OF VERTICAL CLEARANCE
IN THE SPAN AND AT THE SUPPORTING STRUCTURES

INDIANA IS LOCATED WITHIN ZONE 1, WHICH IS A HEAVY LOADING AREA. USING THE APPROPRIATE SAG CHART FOR 4/0 AAAC AND A 225' RULING SPAN, THE SAGS FOR EACH CONDITION ARE:

- AT 120°F, 3'-11"
- AT THE MAXIMUM OPERATING TEMPERATURE OF 212°F (FOR TRANSMISSION CIRCUITS IN INDIANA), 5'-8"
- AT 32°F WITH 1/2" RADIAL THICKNESS OF ICE, 3'-6"

THE MAXIMUM SAG CONDITION OF 5'-8" OCCURS AT THE MAXIMUM OPERATING TEMPERATURE.

THE SAG OF THE LOWER CONDUCTOR IS CALCULATED AT THE CONDITIONS SET FORTH IN NESC RULE 235C2b(1)(c). THE SAME AMBIENT CONDITIONS AS THE UPPER CONDUCTOR APPLY, WITH NO ELECTRICAL LOADING. SINCE THE MAXIMUM SAG OF THE UPPER CONDUCTOR OCCURS AT THE MAXIMUM OPERATING TEMPERATURE, AND NOT AT A DEFINED AMBIENT TEMPERATURE, IT IS NECESSARY TO DETERMINE SAGS AT TWO POINTS, 32°F AND AN APPROPRIATE MAXIMUM AMBIENT TEMPERATURE. FOR THE SAKE OF THIS EXAMPLE WE WILL SELECT 95°F.

FOR 1/0 AAAC AND A 250' RULING SPAN (THE CLOSEST TABLE VALUE TO 225' THAT WAS PROVIDED), THE SAG AT 32°F IS 1'-0" AND AT 95°F IS 2'-6", DETERMINED BY INTERPOLATING BETWEEN 90°F AND 105°F.

NOTE: THE NESC STATES THAT THE SAG BETWEEN CONDUCTORS MUST BE CHECKED FOR 2 CASES. ONE IS SHOWN ABOVE (WITH THE TOP CONDUCTOR AT MAXIMUM TEMPERATURE AND THE BOTTOM AT AMBIENT WITH NO LOAD) AND THE OTHER IS WITH THE UPPER CONDUCTOR AT 32°F AND APPROPRIATE ICE LOAD AND THE LOWER CONDUCTOR AT AMBIENT WITH NO ELECTRICAL LOAD AND NO ICE LOADING. AN EXCEPTION TO THIS IS PROVIDED WHEN EXPERIENCE HAS SHOWN THAT DIFFERENT ICE CONDITIONS DO NOT OCCUR BETWEEN THE UPPER AND LOWER CONDUCTORS, AND WE ARE ASSUMING THAT HERE. OTHERWISE, WE WOULD ALSO NEED TO CHECK THE SECOND CASE.

THE WORST-CASE SCENARIO FOR CLEARANCE IS CREATED AT THE MINIMUM SAG CONDITION AT THE TWO TEMPERATURES CONSIDERED, OR 1'-0". IF WE WERE TO STRING BOTH THE UPPER AND LOWER CONDUCTORS AT THE SAME LOCATION AT THE SUPPORT, THE UPPER WOULD SAG 4'-8" MORE THAN THE LOWER (5'-8" MINUS 1'-0"). THIS DISTANCE MUST BE ADDED TO THE 29" CLEARANCE WE MUST MAINTAIN IN THE SPAN, SO OUR OVERALL SEPARATION BETWEEN CONDUCTORS AT THE POLE IS:

\[(4'-8") + (2'-3") = 6'-11"

(Continued from DWG. 10.05-05A)
### Notes:

1. **Guy Clearances from Supply Conductors Attached to the Same Structure**

### Minimum Clearances Specification for the Installation of Guys on the Company's Distribution System

- 15.5' Clearance between streets, alleys, roads urban and rural.
- 15.5' Clearance between driveway to resident garages.
- 9.5' Clearance available to pedestrians.
- 9.5' Point of attachment.
- Bond all guys except in corrosive areas.

### Minimum Clearances in All Directions to Conductors

<table>
<thead>
<tr>
<th>Type of Guy</th>
<th>Minimum Clearances to Secondary</th>
<th>15 KV</th>
<th>25 KV</th>
<th>35 KV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span Guy Parallel to Supply Conductors</td>
<td>12&quot;</td>
<td>15&quot;</td>
<td>19&quot;</td>
<td>23&quot;</td>
</tr>
<tr>
<td>Anchor Guy Parallel to Supply Conductors</td>
<td>6&quot;*†</td>
<td>8&quot;</td>
<td>11&quot;</td>
<td>13&quot;</td>
</tr>
<tr>
<td>Other Guys (i.e. span guy not parallel)</td>
<td>6&quot;†</td>
<td>9&quot;</td>
<td>13&quot;</td>
<td>17&quot;</td>
</tr>
</tbody>
</table>

*† 6' Clearance from multiplex to anchor guys if practical. In no case shall it be less than 3'.

*Note: The above clearances are between the conductor and the guy. Down guys attached directly to thru bolts on opposite side of pole from dead end or vertical angle assemblies will meet the above clearance requirements.

2. 7.5' Required in Florida, 4' elsewhere. This clearance may be negotiated to 3' by mutual agreement.

3. For minor exceptions, see Tables 232-1, 235-6, and 239-2 of the NESC.
THE CLEARANCE OF A BUILDING BEING TRANSPORTED UNDER DISTRIBUTION LINES IS TREATED THE SAME AS A MOVING VEHICLE PER THE NESC UNIFORM SYSTEM OF CLEARANCES. THE VERTICAL CLEARANCE ABOVE GROUND CONSISTS OF A REFERENCE COMPONENT WHICH IN THIS CASE WOULD BE THE HEIGHT OF THE BUILDING ON THE TRANSPORT VEHICLE, PLUS A MECHANICAL AND ELECTRICAL COMPONENT AS FOLLOWS:

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>VERTICAL CLEARANCE REQUIRED (FT.)</th>
<th>HORIZONTAL CLEARANCE REQUIRED (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSULATED COMMUNICATIONS</td>
<td>1.5</td>
<td>3</td>
</tr>
<tr>
<td>GROUNDED NEUTRALS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROUNDED GUYS AND SPAN GUY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MULTIPLEX CONDUCTORS</td>
<td>2</td>
<td>3.5</td>
</tr>
<tr>
<td>OPEN WIRE CONDUCTORS</td>
<td>2.5</td>
<td>5.5</td>
</tr>
<tr>
<td>PRIMARY (751V-22 KV PHASE TO GROUND)</td>
<td>4.5</td>
<td>7</td>
</tr>
</tbody>
</table>

NOTES:
1. IF THE ABOVE CLEARANCES ARE DETERMINED TO BE MET AFTER A DUKE ENERGY DESIGNER RIDES THE PERMITTED ROUTE, NO FURTHER ACTION IS REQUIRED AND THE MOVE WILL OCCUR WITHOUT A DUKE ENERGY ESCORT.
LINE CLEARANCES FOR OVERSIZED LOAD MOVES
(ESCORTED)

MINIMUM APPROACH DISTANCE WHEN ESCORTED BY A DUKE ENERGY DESIGNATED QUALIFIED ELECTRICAL WORKER (FROM NESC 431-1)

<table>
<thead>
<tr>
<th>VOLTAGE RANGE (PHASE-TO-PHASE)</th>
<th>DISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 TO 300V</td>
<td>6 IN</td>
</tr>
<tr>
<td>301 TO 750V</td>
<td>1 FT-1 IN</td>
</tr>
<tr>
<td>751 TO 15KV</td>
<td>2 FT-2 IN</td>
</tr>
<tr>
<td>15.1 TO 36KV</td>
<td>3 FT-0 IN</td>
</tr>
</tbody>
</table>

NOTES:

1. NORMAL CLEARANCES DEFINED ON DWG. 10.06-03A CAN BE REDUCED IF:
   - A DUKE ENERGY DESIGNATED QUALIFIED ELECTRICAL WORKER(S) ACCOMPANIES THE OVERSIZED LOAD.
   - CONTROLLED PASSAGE UNDER THE CONDUCTORS IS MAINTAINED. CONTROLLED PASSAGE INCLUDES 3-WAY COMMUNICATION BETWEEN DUKE ENERGY LEAD PIC (PERSONNEL IN CHARGE), A DUKE ENERGY DESIGNATED QUALIFIED ELECTRICAL WORKER, AND THE DRIVER OF THE OVERSIZED LOAD VEHICLE.

2. AT NO TIME SHALL THE CLEARANCES BETWEEN THE OVERSIZED LOAD AND DUKE ENERGY FACILITIES BE LESS THAN THE VALUES SHOWN IN THE TABLE ABOVE.
   - TABLE VALUES APPLY TO COVERED AND NON-COVERED CONDUCTORS.
   - PRIMARY NEUTRALS SHALL BE CONSIDERED 0 TO 300V.
2. Poles must be truck accessible and inspected for structural integrity prior to banner attachment.

4. A banner agreement must be completed prior to attachment to company distribution poles. Any messaging or images on joint use attachment.

6. Banners attached to poles should be perpendicular to power lines.

7. The banners must have half circle air pockets cut into them.

8. For wooden distribution poles, banners must be attached using removable bands or screws that do not penetrate the entire diameter of the pole. For non-wood poles, removable bands only will be allowed. Any hardware used to secure banners is not to conflict with the operation of any company equipment.

9. Company shall not be responsible for removing and/or rebanding banners whenever the poles are replaced. Except in cases of emergency, outage response, or similar circumstance, contact the joint use department prior to the removal of any banners.

11. Customer agrees to indemnify, defend, and save harmless company from all claims, losses, injuries, damage and other demands made against it and all costs and expenses incurred by company arising out of this agreement unless same shall have resulted from sole negligence of company.
GENERAL

1. ANYONE REQUESTING TO INSTALL AND MAINTAIN ATTACHMENTS ON DUKE ENERGY POLES SHALL SUBMIT THE APPROPRIATE AUTHORIZATION TO THE JOINT USE UNIT BEFORE ANY FACILITIES CHANGES ARE MADE. A PERMIT IS REQUIRED IN ORDER TO MAINTAIN ACCURATE ATTACHMENT INVENTORIES AND TO OBTAIN TECHNICAL DATA NECESSARY TO REVIEW THE ADEQUACY OF EXISTING DISTRIBUTION AND/OR TRANSMISSION SYSTEM FACILITIES. POLE UTILIZATION REQUIRING PERMITS INCLUDE: INSTALLATION OF NEW ATTACHMENTS, REMOVAL OF EXISTING ATTACHMENTS, UPGRADE TO LARGER CABLE, LASHING OF NEW CABLES TO EXISTING MESSENGERS, REBUILDS OF CABLE SYSTEMS, LARGE SCALE RELOCATIONS FOR ROAD WIDENING, ETC. AND INSTALLATION OF SERVICE DROPS ON LIFT POLES.

2. ALL PERMITTED ATTACHMENTS SHALL BE ON THE SAME SIDE OF THE POLE, PREFERABLY THE SAME SIDE AS THE NEUTRAL. IF THE NEUTRAL IS ON THE OPPOSITE SIDE OF THE POLE FROM EXISTING JOINT USERS, A NEW JOINT USER SHALL INSTALL CABLE ON THE SAME SIDE AS EXISTING JOINT USERS.

3. NO PERMANENT CLIMBING AIDS ARE ALLOWED ON DUKE ENERGY POLES.

4. MESSENGER CABLE(S) SHALL BE BONDED WITH APPROPRIATE ELECTRICALLY RATED CONNECTORS TO THE ELECTRIC COMPANY'S VERTICAL GROUND WIRE, WHERE ONE EXISTS. PROTECTIVE MOLDING IF IN PLACE MAY BE CUT TO FACILITATE BONDING; HOWEVER, UNDER NO CIRCUMSTANCE, SHALL THE VERTICAL GROUND WIRE BE CUT.

5. ALL NEW POWER SUPPLIES AND NEW METERING EQUIPMENT SHALL BE MOUNTED ONLY ON CUSTOMER OWNED FACILITIES. ALL POWER SUPPLY INSTALLATIONS MUST HAVE APPROPRIATE DISCONNECT DEVICES. NEW STRAND MOUNTED POWER SUPPLIES WILL BE BILLED ON A METERED ACCOUNT BASIS. EXISTING INSTALLATIONS WHERE POWER SUPPLIES AND METERING EQUIPMENT ARE LOCATED ON COMPANY OWNED FACILITIES CAN REMAIN AS CURRENTLY INSTALLED. ANY UPGRADE, RELOCATION, POLE CHANGEOUT (EXCEPT IN THE CASE OF UNPLANNED EMERGENCY WORK OR OUTAGE RELATED INCIDENT) OR OTHER CHANGE TO THE FACILITIES WILL ADHERE TO THE CURRENT POLICY. IN DENSELY POPULATED DOWNTOWN AREAS OR OTHER INSTANCES WHERE EXISTING AGREEMENTS ARE IN PLACE WITH THE RIGHT-OF-WAY OWNER, POWER SUPPLIES AND METERING EQUIPMENT MAY BE ALLOWED ON COMPANY OWNED FACILITIES. THE CUSTOMER MUST PROVIDE WRITTEN VERIFICATION FROM THE RIGHT-OF-WAY OWNER THAT ADDITIONAL FACILITIES OF ANY KIND (POLE, PEDESTAL, ETC) CANNOT BE ADDED WITHIN THE RIGHT-OF-WAY. THESE REQUESTS WILL BE HANDLED ON A CASE BY CASE BASIS, AND THE COST OF ANY ENGINEERING LABOR AND MAKE-READY WORK WILL BE BORNE IN FULL BY THE CUSTOMER.

6. ONLY DEVICES SUCH AS ANTENNAS AND THEIR RELATED CABLING ARE PERMITTED ON COMPANY FACILITIES AS DESCRIBED ON THE ACCOMPANYING PAGES. CRITERIA SURROUNDING DISCONNECTS, WARNING SIGNS, ETC THAT ADDRESS PROPER WORK PRACTICES AROUND RF EMITTING DEVICES MUST BE FOLLOWED AT ALL TIMES. THESE INSTALLATIONS ARE EVALUATED INDIVIDUALLY, AND REGARDLESS OF OTHER CIRCUMSTANCES CAN BE DENIED AT THE COMPANY'S DISCRETION.

7. WHERE REQUESTS FOR INSTALLATIONS INVOLVE WOODEN STREET LIGHT ONLY POLES AND MEET THE ABOVE CRITERIA FOR INSTALLATION ON THE POLE, THE ENGINEERING ANALYSIS MUST ACCOUNT FOR THE CAPACITY AND VOLTAGE DROP OF EXISTING STREET LIGHTING CABLE AND THE STRENGTH OF THE POLE TO ACCEPT THE PROPOSED EQUIPMENT. FOR DECORATIVE, NON-WOODEN INSTALLATIONS, SPECIALLY DESIGNED POLES MAY BE RECOMMENDED IN THESE INSTANCES THAT PLACE THE CABLING AND OTHER CONDUITS WITHIN THE POLE. LEAD TIMES FOR THESE SPECIAL ORDER ITEMS SHOULD BE ACCOUNTED FOR IN ANY DISCUSSIONS WITH THE CUSTOMER.

8. UNMETERED EQUIPMENT IS NOT PERMITTED EXCEPT IN THOSE JURISDICTIONS WHERE ALLOWED BY EXISTING TARIFFS.

9. NEW AIR DRYERS, NITROGEN BOTTLES, LOAD COILS, ETC. SHALL NOT BE ATTACHED TO DUKE ENERGY POLES.

10. CLEARANCES FROM GROUND AND OTHER FACILITIES SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE NESC, OR THE REQUIREMENTS SHOWN IN THIS MANUAL, WHICHEREVER IS GREATER. EXISTING INSTALLATIONS WHICH WERE IN COMPLIANCE WITH THE NESC AT THE TIME OF THEIR ORIGINAL CONSTRUCTION NEED NOT BE MODIFIED UNLESS SPECIFIED BY LATEST EDITION OF NESC CODE HANDBOOK OR DUKE ENERGY SPECIFICATIONS.

11. ATTACHMENT LOCATIONS MAY BE ASSIGNED BY DUKE ENERGY AT SPECIFIC HEIGHTS. UNDER NO CIRCUMSTANCES WILL PROPER CLEARANCES FROM DUKE ENERGY FACILITIES BE VIOLATED.

12. ALL ATTACHMENTS ON DUKE ENERGY POLES SHALL BE TAGGED IN ACCORDANCE WITH THE LATEST DUKE ENERGY REQUIREMENTS.

13. REQUESTS FOR EXCEPTIONS TO THIS DESIGN GUIDE SHALL BE REFERRED TO THE JOINT USE UNIT. ANY EXCEPTIONS APPROVED WILL BE DISTRIBUTED TO THE REGIONS FOR UNIFORM APPLICATION ON A SYSTEMWIDE BASIS.
NOTES:

1. THIS DIMENSION OF NOT LESS THAN 30" APPLIES BETWEEN COMMUNICATION CABLES IN THE COMMUNICATION SPACE AND NON-CURRENT CARRYING PARTS OF SUPPLY EQUIPMENT THAT ARE EFFECTIVELY GROUNDED (THIS DOES NOT APPLY TO THE SUPPLY NEUTRAL OR SECONDARY WHICH REQUIRES A MINIMUM OF 40 INCHES OF CLEARANCE).

2. MINIMUM DIMENSIONS APPLY TO UPPERMOST ATTACHMENT.

3. CLEARANCES BETWEEN POWER AND COMMUNICATION LINES AT THE POLE MUST BE INCREASED IF THE PROPER MIDSPAN CLEARANCES DESCRIBED ON DWG. 10.07-07 CANNOT BE MAINTAINED.

4. A 40" MINIMUM CLEARANCE IS REQUIRED BETWEEN CLOSEST METAL PARTS OF COMMUNICATION AND UNGROUNDED POWER EQUIPMENT.

5. THE CLEARANCES ON THIS DRAWING APPLY TO BOTH GROUNDED METALLIC COMMUNICATION CABLES AND DIELECTRIC FIBER OPTIC CABLES.

6. JOINT USER SHALL BOND MESSENGER WIRES TO GROUND WIRE PER NESC REQUIREMENTS.
MINIMUM CLEARANCES MIDSPAN (IN.)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NEUTRAL</td>
<td>30</td>
</tr>
<tr>
<td>SECONDARY</td>
<td>30</td>
</tr>
</tbody>
</table>

NOTES:

1. DUKE ENERGY FIBER OPTIC CABLE LOCATED AT THE BOTTOM OF THE SUPPLY SPACE (i.e., LESS THAN 40" FROM POWER) MUST HAVE A MINIMUM CLEARANCE OF 40" BETWEEN THE FIBER OPTIC CABLE AND THE TOP COMMUNICATIONS CABLE TO ENSURE THE 40" COMMUNICATION WORKER SAFETY ZONE IS NOT VIOLATED.

2. CLEARANCES SHOWN FROM ELECTRICAL FACILITIES TO JOINT USE FACILITIES ARE MINIMUM CLEARANCES.

3. THIS DIMENSION OF NOT LESS THAN 30" APPLIES BETWEEN COMMUNICATION CABLES IN THE COMMUNICATION SPACE AND NON-CURRENT CARRYING PARTS OF SUPPLY EQUIPMENT THAT ARE EFFECTIVELY GROUNDED (THIS DOES NOT APPLY TO THE SUPPLY NEUTRAL OR SECONDARY WHICH REQUIRES A MINIMUM OF 40 INCHES OF CLEARANCE).
NOTES:

1. CLEARANCES WITHIN THE NESC ESTABLISH A COMMUNICATION WORKER SAFETY ZONE BETWEEN THE FACILITIES LOCATED IN THE SUPPLY SPACE AND FACILITIES LOCATED IN THE COMMUNICATION SPACE, BOTH AT THE STRUCTURE AND IN THE SPAN BETWEEN THE STRUCTURES. WITH FEW EXCEPTIONS, NO SUPPLY OR COMMUNICATION FACILITIES SHALL BE LOCATED IN THE COMMUNICATION WORKER SAFETY ZONE.

2. THE DRIP LOOP OF CONDUCTORS ENTERING A LUMINAIRE OR LUMINAIRE BRACKET SHALL BE AT LEAST 12" ABOVE THE HIGHEST COMMUNICATION CABLE, THROUGH BOLT OR OTHER EXPOSED CONDUCTIVE OBJECTS.

3. THE CLEARANCE STATED IN NOTE 2 MAY BE REDUCED TO 3" IF THE LOOP IS COVERED BY A SUITABLE NON-METALLIC COVERING THAT EXTENDS AT LEAST 2" BEYOND THE LOOP AS SHOWN IN DETAIL A.
NOTES:

1. DOT REQUIREMENTS:
   FOR EFFECTIVELY BONDED SPAN WIRES, THIS CLEARANCE MAY BE 4" (12" PREFERRED). FOR UNBONDED SPAN WIRES, THE CLEARANCE MUST BE 20".

2. IN THIS INSTANCE, THE DOT SUPPLY AND CONTROL CABLE IS CONSIDERED A COMMUNICATIONS CONDUCTOR WITHIN THE SUPPLY SPACE, NESC TABLE 235-5.
LOCATION OF VERTICAL RUNS

NOTES:
1. DO NOT LOCATE GROUNDED EQUIPMENT LESS THAN 1" FROM A BOLT OR STAPLE.
2. LOCATE U-GUARD ON SIDE OF POLE AWAY FROM TRAFFIC.

FOREIGN SERVICE DROPS

<table>
<thead>
<tr>
<th>DIMENSION (LETTER)</th>
<th>NESC REQUIREMENT MINIMUM (IN.)</th>
<th>DUKE ENERGY PREFERRED MINIMUM (IN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ALLOWED ON POLE 12</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
NOTES:

1. SEE DWG. 10.07-15 FOR PREFERRED INSTALLATION.

2. DUKE ENERGY WILL PROVIDE AND INSTALL:
   A. SERVICE AND CONNECTION AT WEATHERHEAD.
   B. METER

3. JOINT USE COMPANY WILL PROVIDE AND INSTALL:
   A. METER SOCKET.
   B. METER POLE, RISER AND WEATHERHEAD.
   C. SERVICE EQUIPMENT BEYOND METER (AS REQUIRED).
   D. SERVICE EQUIPMENT GROUNDS PER APPLICABLE CODES.

4. ALL JOINT USE COMPANY EQUIPMENT AND ATTACHMENTS MUST BE EFFECTIVELY GROUNDED.

5. JOINT USE COMPANY STRUCTURE IS NOT ALLOWED UNDER COMPANY LINES.

6. ALL JOINT USE COMPANY EQUIPMENT AND WIRING MUST BE INSPECTED AND APPROVED BY THE LOCAL AUTHORITY HAVING JURISDICTION.
2. JOINT USE COMPANY WILL PROVIDE AND INSTALL:
   A. METER POLE OR PEDESTAL
   B. SERVICE CONDUIT ON METER POLE OR PEDESTAL
   C. SERVICE CONDUCTORS FROM THE METER BASE TO THE PEDESTAL
   D. SERVICE EQUIPMENT GROUND
   E. METER SOCKET

3. ALL JOINT USE COMPANY EQUIPMENT AND WIRING MUST BE INSPECTED AND APPROVED BY THE LOCAL AUTHORITY HAVING JURISDICTION.

4. ALL JOINT USE COMPANY EQUIPMENT AND ATTACHMENTS MUST BE EFFECTIVELY GROUNDED.
NOTES:

1. DUKE ENERGY WILL PROVIDE AND INSTALL:
   A. UNDERGROUND SERVICE FROM TRANSFORMER OR PEDESTAL TO METER SOCKET.
   B. METER

**EXCEPTION:**

THE NORMAL POINT OF DELIVERY (POD) IS AT THE SOURCE LUGS OF THE CATV METER SOCKET. FOR THESE INSTALLATIONS, DUKE ENERGY WILL PROVIDE THE SERVICE. HOWEVER, IF A CATV COMPANY DESIRES TO INSTALL A SERVICE TO THE EDGE OF THE PAD-MOUNT OR SECONDARY PEDESTAL AND LEAVE ENOUGH CABLE TO MAKE THE CONNECTION INSIDE THE EQUIPMENT, DUKE ENERGY WILL MAKE THE CONNECTION. CATV CABLES SHALL BE TAGGED IN THE METER BASE AND AT THE SOURCE END AS OWNED BY THE CATV COMPANY. THE TAGS SHALL REMAIN WITH THE CABLE WHEN CONNECTED. PROPER CONNECTIONS WITHIN THE METER SOCKET MUST BE VERIFIED (RUNG OUT OR OHMED) BEFORE CONNECTING WITHIN ANY DUKE ENERGY EQUIPMENT.

2. JOINT USE COMPANY WILL PROVIDE AND INSTALL:
   A. METER POLE OR PEDESTAL
   B. SERVICE EQUIPMENT BEYOND METER (IF REQUIRED)
   C. SERVICE EQUIPMENT GROUND
   D. METER SOCKET

3. ALL EQUIPMENT AND ATTACHMENTS MUST BE EFFECTIVELY GROUNDED.

4. BONDING SHOULD BE PROVIDED BETWEEN ALL ABOVE GROUND METALLIC POWER AND COMMUNICATIONS APPARATUS (PEDESTALS, TERMINALS, APPARATUS CASES, TRANSFORMER CASES, ETC.) THAT ARE SEPARATED BY A DISTANCE OF 6' OR LESS.
ANTENNA SYSTEMS INSTALLED
IN COMMUNICATION SPACE

NOTES:

1. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATIONS MUST BE BUCKET TRUCK ACCESSIBLE.**

2. ONLY ONE ANTENNA PER POLE ALLOWED.

3. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS.

4. MINIMUM CLEARANCE IS BASED ON NESC TABLE 232-2(1)d. SEE DWG. 10.02-13.

5. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY.**

6. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.

7. **THE ONLY ANTENNA EQUIPMENT PERMITTED ON DUKE ENERGY’S POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA.**

8. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER’S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.

9. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USED PARTIES.

10. **CAUTION:** DISCONNECT POWER TO ANTENNA EQUIPMENT INSTALLED ON CUSTOMER POLE OR PEDESTAL BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY.**

11. **ALTERNATE LOCATION FOR ANTENNA:**

12. **CONDUIT FOR ANTENNA FEED:**

13. **DISCONNECT SWITCH:**

14. **METER INSTALLED BY DUKE ENERGY:**

15. **SERVICE CONDUIT:**

16. **COMMUNICATION CABLES:**

17. **ANTENNA EQUIPMENT INSTALLED ON CUSTOMER POLE OR PEDESTAL:**

18. **5'-0'' MIN. FOR SERVICE REQUIREMENTS:**

19. **SEE DWG. 10.07-15 FOR SERVICE REQUIREMENTS:**

20. **SEE DWG. 10.07-15 FOR SERVICE REQUIREMENTS:**

21. **RF SIGN SEE NOTE 3:**

22. **12'' MIN. SEE NOTE 9:**

23. **PREFERABLY 24'' NOT LESS THAN 12''**

24. **TO BOTTOM OF DRIP LOOP**

25. **12'' MIN. SEE NOTE 3**

26. **12'' MIN. SEE NOTE 9**

27. **SEE NOTE 9**

28. **SEE NOTE 4**

29. **ALTERNATE LOCATION FOR ANTENNA**

30. **DUKE ENERGY TRIPLEX OR NEUTRAL**

31. **FRONT VIEW**
ANTENNA SYSTEMS INSTALLED IN SUPPLY SPACE
VERTICAL PRIMARY CONSTRUCTION
SINGLE-PHASE

NOTES:
1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.

2. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSES, SWITCHES, U.G. RISERS, ETC. POLE LOCATIONS MUST BE BUCKET TRUCK ACCESSIBLE.

3. ONLY ONE ANTENNA PER POLE ALLOWED.

4. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS.

5. A MINIMUM CLASS 3 POLE IS REQUIRED. POLE HEIGHTS EXCEEDING 60' ABOVE GROUND ARE NOT ALLOWED.

6. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY**.

7. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.

8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON DUKE ENERGY'S POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA.

9. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER'S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.

10. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USE PARTIES.
NOTES:

1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.

2. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. DO NOT INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATIONS MUST BE BUCKET TRUCK ACCESSIBLE.

3. ONLY ONE ANTENNA PER POLE ALLOWED.

4. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS.

5. A MINIMUM CLASS 3 POLE IS REQUIRED. POLE HEIGHTS EXCEEDING 60' ABOVE GROUND ARE NOT ALLOWED.

6. CAUTION: DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, EXCEPT IN CASE OF EMERGENCY.

7. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.

8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON DUKE ENERGY’S POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA.

9. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER’S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.

10. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USE PARTIES.

ANTENNA SYSTEMS INSTALLED IN SUPPLY SPACE
VERTICAL PRIMARY CONSTRUCTION

SEE DWG. 10.07-15 FOR SERVICE REQUIREMENTS
**NOTES:**

1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.

2. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATION MUST BE BUCKET TRUCK ACCESSIBLE.

3. ONLY ONE ANTENNA PER POLE ALLOWED.

4. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/ UNCONTROLLED ENVIRONMENTS.

5. A MINIMUM CLASS 3 POLE IS REQUIRED. POLE HEIGHTS EXCEEDING 60' ABOVE GROUND ARE NOT ALLOWED.

6. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY.**

7. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.

8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON THE POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA.

9. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER'S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.

10. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USE PARTIES.
NOTES:

1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.

2. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATIONS MUST BE BUCKET TRUCK ACCESSIBLE.

3. ONLY ONE ANTENNA PER POLE ALLOWED.

4. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS.

5. MINIMUM CLEARANCE IS BASED ON NESC TABLE 232-2(1)d. SEE DWG. 10.02-13.

6. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY**.

7. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.

8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON DUKE ENERGY'S POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA.

9. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER'S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.

10. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USE PARTIES.
NOTES:

1. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS. ANTENNAS WITH RADIATION LEVELS BELOW THE EXPOSURE LEVELS FOR GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS DO NOT REQUIRE A WARNING SIGN.

2. RF SIGNAGE MUST BE IEEE C95.2 AND ANSI Z535.2 COMPLIANT (MOST RECENT VERSION AT TIME OF INSTALLATION).

3. RF SIGNAGE MUST INCLUDE THREE FUNCTIONAL PANELS:
   A. SIGNAL WORD PANEL (‘WARNING’ IN BLACK LETTERS ON ORANGE BACKGROUND).
   B. SYMBOL OR PICTORIAL PANEL (RF ENERGY SYMBOL SHOWN ABOVE).
   C. WORD MESSAGE PANEL (VERBIAGE AS SHOWN ABOVE).

4. SIGNS MUST BE POLYCARBONATE WITH UV RESISTANT MATERIALS AND INKS.

5. SIGNS MUST BE VISIBLE FROM THE ROAD OR FROM THE POINT OF TRUCK ACCESS.
NOTES:

1. **DO NOT** install antennas on equipment poles such as capacitor banks, reclosers, regulator, switches, U.G. DIP, etc.

2. All antenna locations must be approved by a Progress Energy Distribution Engineer.

3. Only one antenna per pole allowed.

4. Minimum clearance is based on NESC Table 232-2(1)d.
NOTES:

1. POLE LOCATIONS APPROVED BY DUKE ENERGY. DO NOT INSTALL ANTENNA ON EQUIPMENT POLE SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. DIP, ETC.
2. ONLY ONE ANTENNA PER POLE ALLOWED.
3. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY DISTRIBUTION.
4. THE ONLY JOINT USE EQUIPMENT PERMITTED ON THE POLE IS THE ANTENNA AND CABLE RISER.
5. DOT TO MOUNT WARNING SIGN ON POLE: "WARNING - TURN OFF ANTENNA AT DOT EQUIPMENT CABINET BEFORE WORKING ON POLE"