06.00 POLE TYPE TRANSFORMERS - GENERAL
POLE MOUNTED TRANSFORMER MARKINGS ......................................................... 06.00-01
POLE MOUNTED TRANSFORMER CATALOG NUMBERS ......................................... 06.00-02
STANDARD OVERHEAD DISTRIBUTION TRANSFORMERS ........................................ 06.00-03
TRANSFORMER CODE DESCRIPTION ................................................................. 06.00-04

TYPICAL TRANSFORMER DIMENSIONS, WEIGHTS AND OIL CAPACITIES ......................... 06.00-12
MAXIMUM TRANSFORMER LOADING (OH) ............................................................ 06.00-14A
MAXIMUM TRANSFORMER LOADING (OH) ............................................................ 06.00-14B
DISTRIBUTION TRANSFORMER POLICIES ......................................................... 06.00-20
APPLICATION OF WILDLIFE GUARDS ON TRANSFORMER BUSHINGS ....................... 06.00-23
ELECTROSTATIC WILDLIFE GUARDS .................................................................... 06.00-25

06.02 FUSING
TRANSFORMER FUSE TABLE ............................................................................. 06.02-01

06.03 CONDUCTORS AND CONNECTIONS
TRANSFORMER RISER SIZES ............................................................................ 06.03-01A
DELTA SECONDARY TRANSFORMER BUS SIZES .................................................. 06.03-01B
SECONDARY LEAD SPECIFICATIONS ................................................................ 06.03-04
TRANSFORMER SECONDARY CONNECTION DETAILS ........................................ 06.03-05
THREE-PHASE TRANSFORMER BANK SECONDARY CONNECTORS ......................... 06.03-07

06.04 CUTOUTS AND MOUNTING BRACKETS
TRANSFORMER CUTOUT BRACKETS .................................................................. 06.04-03
TRANSFORMER BANK MOUNTING BRACKETS .................................................... 06.04-06
TRANSFORMER BANK MOUNTING BRACKETS .................................................... 06.04-07

06.06 INSTALLATIONS AND POLICIES
SINGLE-PHASE TRANSFORMER INSTALLATIONS GENERAL POLICIES ..................... 06.06-01
SINGLE-PHASE TRANSFORMER MOUNTING DIMENSIONS ...................................... 06.06-04
SINGLE-PHASE TRANSFORMER MOUNTING DIMENSIONS ...................................... 06.06-05
HORIZONTAL CONSTRUCTION SINGLE-PHASE TRANSFORMER ............................. 06.06-06

06.07 BANKING CONNECTIONS
TRANSFORMER CONNECTIONS GENERAL ......................................................... 06.07-01
DISTRIBUTION TRANSFORMER POLARITY ......................................................... 06.07-05
OPEN-WYE OPEN-DELTA TRANSFORMER BANKS GENERAL POLICIES ................. 06.07-06A
OPEN-WYE OPEN-DELTA TRANSFORMER BANKS MOUNTING DIMENSIONS ............. 06.07-06B
THREE-PHASE TRANSFORMER BANKS GENERAL POLICIES .................................. 06.07-10A
THREE-PHASE TRANSFORMER BANK MOUNTING DIMENSIONS ............................. 06.07-10B
THREE-PHASE TRANSFORMER BANK MOUNTING DIMENSIONS ............................. 06.07-12

06.08 MOUNTING PLATFORMS
TWO POLE ALUMINUM PLATFORM 16' - HEAVY DUTY ........................................... 06.08-03A
TWO POLE ALUMINUM PLATFORM 16' - HEAVY DUTY ........................................... 06.08-03B
THREE-PHASE PLATFORM MOUNTING OF TRANSFORMERS ALL VOLTAGES .............. 06.08-08
06.10 POLARITY
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 120 VOLT TWO WIRE SERVICE .............................................. 06.10-01
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 120/240 AND 240/480 VOLT SINGLE-PHASE SERVICE .................. 06.10-02
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 120/240 VOLT SINGLE-PHASE AND 240/120 VOLT THREE-PHASE
(OPEN-DELTA) SERVICE ................................................................. 06.10-03
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 240/120 VOLT THREE-PHASE (OPEN-DELTA) SERVICE ............... 06.10-04
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 240/120 VOLT THREE-PHASE SERVICE .................................. 06.10-05
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 208Y/120 VOLT THREE-PHASE SERVICE .................................. 06.10-06
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 208Y/120 VOLT THREE-PHASE SERVICE .................................. 06.10-07
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 167 KVA - ADDITIVE AND SUBTRACTIVE POLARITY ................. 06.10-08
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 480/277 THREE-PHASE FOUR WIRE SERVICES ......................... 06.10-09
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 480 VOLT 3 PHASE 3 WIRE (OPEN-DELTA) SERVICE .................. 06.10-10
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 480 VOLT 3 PHASE 3 WIRE SERVICE .................................... 06.10-11
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 480 VOLT THREE-PHASE THREE WIRE SERVICE ....................... 06.10-12
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 600 VOLT THREE-PHASE THREE WIRE SERVICE ......................... 06.10-13
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 480 VOLT 3 PHASE 4 WIRE (OPEN-DELTA) SERVICE .................. 06.10-14
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE
POLARITY - 4160Y/2400 THREE-PHASE FOUR-WIRE SERVICES ..................... 06.10-15

06.15 OPERATING PROCEDURES
WYE-DELTA TRANSFORMER BANKS OPERATING PROCEDURES TO PREVENT
OVER VOLTAGES ................................................................. 06.15-01A
GROUNDING CUTOUT FOR FLOATING WYE-DELTA TRANSFORMER BANKS
(POLE-MOUNT) ................................................................. 06.15-01B
TRANSFORMER LOAD & VOLTAGE CHECKS ........................................ 06.15-04
IDLE TRANSFORMERS .......................................................... 06.15-05
NOTES:
1. NAMEPLATE LOCATED ON UPPER HANGER BRACKET.
### NOTES:

1. SEE DWG. 12.06-01 FOR STAINLESS STEEL POLE TYPE TRANSFORMERS. THESE UNITS ARE TO BE USED ONLY IN DESIGNATED COASTAL AREAS.

#### COMPATIBLE UNIT

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>KVA</th>
<th>HV</th>
<th>LV</th>
<th>TAPS</th>
<th>FEATURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFO10SM12FF</td>
<td>10</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO15SM12FF</td>
<td>15</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO2SM12FF</td>
<td>25</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO5SM12FF</td>
<td>50</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO25DM12FF</td>
<td>25</td>
<td>7200/12470Y</td>
<td>120/240</td>
<td>2 2-1/2% A&amp;B &amp;N</td>
<td>2HV CONV</td>
</tr>
<tr>
<td>TFO50DM12FF</td>
<td>50</td>
<td>7200/12470Y</td>
<td>120/240</td>
<td>2 2-1/2% A&amp;B &amp;N</td>
<td>2HV CONV</td>
</tr>
<tr>
<td>TFO100DM12FF</td>
<td>75</td>
<td>7200/12470Y</td>
<td>120/240</td>
<td>2 2-1/2% A&amp;B &amp;N</td>
<td>2HV CONV</td>
</tr>
<tr>
<td>TFO167DM12FF</td>
<td>100</td>
<td>7200/12470Y</td>
<td>120/240</td>
<td>2 2-1/2% A&amp;B &amp;N</td>
<td>2HV CONV</td>
</tr>
<tr>
<td>TFO250DM12FF</td>
<td>167</td>
<td>7200/12470Y</td>
<td>120/240</td>
<td>2 2-1/2% A&amp;B &amp;N</td>
<td>2HV CONV</td>
</tr>
<tr>
<td>TFO333DM12FF</td>
<td>250</td>
<td>7200/12470Y</td>
<td>120/240</td>
<td>2 2-1/2% A&amp;B &amp;N</td>
<td>2HV CONV</td>
</tr>
<tr>
<td>TFO10SM12FF</td>
<td>10</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO15SM12FF</td>
<td>25</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO2SM12FF</td>
<td>50</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO5SM12FF</td>
<td>100</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO25DM12FF</td>
<td>100</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO50DM12FF</td>
<td>250</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO100DM12FF</td>
<td>50</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO167DM12FF</td>
<td>100</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO250DM12FF</td>
<td>167</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
<tr>
<td>TFO333DM12FF</td>
<td>250</td>
<td>12470GRDY/7200</td>
<td>120/240</td>
<td>NT</td>
<td>1HV HVLA</td>
</tr>
</tbody>
</table>

* NEW UNITS NO LONGER PURCHASED. CHECK ON AVAILABILITY PRIOR TO ORDERING.
<table>
<thead>
<tr>
<th>TRANSFORMERS</th>
<th>VOLTAGE</th>
<th>TYPE</th>
<th>FRAMING</th>
<th>GENERAL NOTES</th>
<th>FUSE, SIZE, TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>130111-----</td>
<td>120/240</td>
<td>SINGLE BUSHING WITH EXTERNAL MOV ARRESTER</td>
<td>CUTOUTS ONLY ON &quot;L&quot; BRACKET</td>
<td>STANDARD SINGLE BUSHING CONVENTIONAL TRANSFORMER WITH EXTERNAL MOV ARRESTER</td>
<td>USE STANDARD FUSING CHART FOR ALL TRANSFORMERS</td>
</tr>
<tr>
<td>13014-----</td>
<td>120/240</td>
<td>DOUBLE BUSHING CONVENTIONAL WITH EXTERNAL MOV ARRESTER</td>
<td>CUTOUTS ONLY ON &quot;L&quot; BRACKETS</td>
<td>STANDARD DOUBLE BUSHING CONVENTIONAL TRANSFORMER WITH EXTERNAL MOV ARRESTER</td>
<td></td>
</tr>
<tr>
<td>130111-----</td>
<td>120/240</td>
<td>SINGLE BUSHING WITH EXTERNAL MOV ARRESTER</td>
<td>CUTOUTS ONLY ON BACK TO BACK &quot;L&quot; BRACKETS</td>
<td>SINGLE BUSHING EXTERNAL MOV, TRANSFORMERS. CAN BE USED IN OPEN DELTA BANKS, CAN MIX OR MATCH. DO NOT MIX WITH STANDARD SINGLE BUSHING WITHOUT ARRESTER.</td>
<td></td>
</tr>
<tr>
<td>13014-----</td>
<td>120/240</td>
<td>DOUBLE BUSHING CONVENTIONAL TRANSFORMER MOV ARREETERS TO BE LOCATED ON SOURCE SIDE OF CUTOUTS. (SEE DWG. 06.07-10A)</td>
<td>CUTOUTS AND ARREETERS ON 30 SWITCH ARM</td>
<td>STANDARD DOUBLE BUSHING CONVENTIONAL IN 3 POT BANK Y-DELTA.&quot;CLOSED DELTA.&quot; DO NOT USE SINGLE BUSHING TRANSFORMERS IN CLOSED DELTA BANK.</td>
<td>EXTERNAL MOV ARREETER TRANSFORMERS DO NOT NEED A POLE ARREETER WITH THE CUTOUT.</td>
</tr>
<tr>
<td>130111-----</td>
<td>208Y/120</td>
<td>SINGLE BUSHING WITH EXTERNAL MOV ARREETER</td>
<td>CUTOUTS ONLY ON 30 SWITCH ARM</td>
<td>STANDARD SINGLE BUSHING W/ EXTERNAL MOV ARREETER TRANSFORMER.</td>
<td>HVLA = HIGH VOLTAGE LIGHTNING ARREETER (INTERNAL UNDER OIL)</td>
</tr>
<tr>
<td>130315-----</td>
<td>480Y/277</td>
<td>SINGLE BUSHING CONVENTIONAL WITH EXTERNAL MOV ARREETER</td>
<td>CUTOUTS ONLY ON 30 SWITCH ARM</td>
<td>SINGLE BUSHING CONVENTIONAL WITH EXTERNAL MOV ARREETER TRANSFORMER. USED IN 277/480 Y/Y BANK.</td>
<td>ISLA = INTERNAL SECONDARY LIGHTNING ARREETER</td>
</tr>
</tbody>
</table>

NOTES:
1. NOTE: ANY TRANSFORMER THAT DOES NOT HAVE AN EXTERNAL MOV ARREETER (ATTACHED TO THE TRANSFORMER) MUST HAVE ONE ADDED ADJACENT TO H1 BUSHING EXCEPT ON FLOATING WYE-DELTA BANKS (SEE DWG. 06.07-10A).
### Transformer Code Description

**Primary Voltage**

<table>
<thead>
<tr>
<th>Code</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>1/0</td>
</tr>
<tr>
<td>02</td>
<td>1/2</td>
</tr>
<tr>
<td>03</td>
<td>1/3</td>
</tr>
<tr>
<td>04</td>
<td>1/4</td>
</tr>
<tr>
<td>05</td>
<td>1/5</td>
</tr>
</tbody>
</table>

**Secondary Voltage**

<table>
<thead>
<tr>
<th>Code</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>20</td>
</tr>
<tr>
<td>02</td>
<td>30</td>
</tr>
</tbody>
</table>

**Type and Special Feature**

<table>
<thead>
<tr>
<th>Code</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Pole Mount</td>
</tr>
<tr>
<td>02</td>
<td>Pad Mount</td>
</tr>
</tbody>
</table>

**KVA Size**

<table>
<thead>
<tr>
<th>Code</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>1</td>
</tr>
<tr>
<td>02</td>
<td>2</td>
</tr>
<tr>
<td>03</td>
<td>3</td>
</tr>
</tbody>
</table>

### TYPICAL EXAMPLE

**Transformer Code No. 13-01-14-0025**

- **Single-Phase 12.47 GRD Y/7.2**
- **120/240 V**
- **Deadfront Loop**
- **Submersible Deadfront Loop with Capacitor Bank**
- **25 KVA Transformer**

**Material List**

- **OIL SILICONE**
- **PCB**
- **VAULT/NETWORK**

- **SPECIAL TYPE**

- **SUBMERSIBLE PIT WITH SWITCH**
- **SUBMERSIBLE PIT WITHOUT SWITCH**
- **SUBMERSIBLE DEADFRONT LOOP**

- **NOTE:** The following experimental transformer part numbers are for DFS use only. Do not use for stocking or stores. See long part description in distribution material list for details.

**Part Numbers**

- **130153**
  - **10 Pad with External Secondary Arrester**
- **130154**
  - **10 Pad with Interlaced Windings**
- **130156**
  - **10 Pad with External Gap Arrester**
- **130192**
  - **Pole Type with Internal MOV Arrester (ISLA)**
- **130191**
  - **Pole Type with External MOV Arrester (ELSA)**
- **130195**
  - **Pole Type with Magnax Interrupter**
- **130199**
  - **Pole Type with Amorphous Core**

---

**FLA**

**DWG.** 06.00-04
NOTES:

1. THE DIMENSIONS, WEIGHTS AND OIL CAPACITIES LISTED ABOVE WILL VARY WITH THE MAKES AND STYLES OF TRANSFORMERS. CONTACT DISTRIBUTION STANDARDS FOR INFORMATION ON DESIGNS FOR SECONDARY VOLTAGES OTHER THAN 120/240 VOLTS.

2. "B" AND "C" DIMENSIONS INCLUDE COOLING FINS WHEN APPLICABLE.

3. APPROXIMATE NET WEIGHTS INCLUDE WEIGHT OF OIL.
### TYPES OF COMMERCIAL AND INDUSTRIAL BUSINESSES

<table>
<thead>
<tr>
<th>TYPE OF BUSINESS</th>
<th>PEAK DEMAND DURATION (HOURS)</th>
<th>TYPE OF BUSINESS</th>
<th>PEAK DEMAND DURATION (HOURS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST FOOD</td>
<td>8</td>
<td>CONVENIENCE STORES</td>
<td>4</td>
</tr>
<tr>
<td>SUPERMARKETS</td>
<td>8</td>
<td>HOTELS</td>
<td>4</td>
</tr>
<tr>
<td>LARGE &amp; SMALL RETAIL STORES</td>
<td>8</td>
<td>SMALL OFFICE BUILDINGS</td>
<td>4</td>
</tr>
<tr>
<td>LARGE OFFICE BUILDINGS</td>
<td>8</td>
<td>RESTAURANTS</td>
<td>4</td>
</tr>
</tbody>
</table>

### MAXIMUM KVA LOADING

#### SINGLE-PHASE COMMERCIAL OVERHEAD CONVENTIONAL & CSP TRANSFORMERS

<table>
<thead>
<tr>
<th>TRANSFORMER SIZE</th>
<th>SUMMER (100%)</th>
<th>WINTER (140%)</th>
<th>TRANSFORMER SIZE</th>
<th>SUMMER (100%)</th>
<th>WINTER (140%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10</td>
<td>14</td>
<td>10</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>21</td>
<td>75</td>
<td>75</td>
<td>105</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>35</td>
<td>100</td>
<td>100</td>
<td>140</td>
</tr>
<tr>
<td>37.5</td>
<td>37.5</td>
<td>52</td>
<td>167</td>
<td>167</td>
<td>233</td>
</tr>
</tbody>
</table>

#### SINGLE-PHASE RESIDENTIAL OVERHEAD TRANSFORMERS

<table>
<thead>
<tr>
<th>TRANSFORMER SIZE</th>
<th>SUMMER 130%</th>
<th>WINTER 160%</th>
<th>TRANSFORMER SIZE</th>
<th>SUMMER 130%</th>
<th>WINTER 160%</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>13</td>
<td>16</td>
<td>50</td>
<td>65</td>
<td>80</td>
</tr>
<tr>
<td>15</td>
<td>19</td>
<td>24</td>
<td>75</td>
<td>97</td>
<td>120</td>
</tr>
<tr>
<td>25</td>
<td>32</td>
<td>40</td>
<td>100</td>
<td>130</td>
<td>160</td>
</tr>
<tr>
<td>37.5</td>
<td>49</td>
<td>60</td>
<td>167</td>
<td>217</td>
<td>267</td>
</tr>
</tbody>
</table>

### THREE-PHASE OVERHEAD CSP TRANSFORMER BANKS

<table>
<thead>
<tr>
<th>BANK SIZE</th>
<th>SUMMER 100%</th>
<th>WINTER 140%</th>
<th>SUMMER 100%</th>
<th>WINTER 140%</th>
<th>4 HOUR PEAK</th>
<th>8 HOUR PEAK</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>45</td>
<td>63</td>
<td>45</td>
<td>63</td>
<td>54</td>
<td>73</td>
</tr>
<tr>
<td>75</td>
<td>75</td>
<td>105</td>
<td>75</td>
<td>105</td>
<td>90</td>
<td>122</td>
</tr>
<tr>
<td>112</td>
<td>112</td>
<td>156</td>
<td>112</td>
<td>156</td>
<td>134</td>
<td>181</td>
</tr>
<tr>
<td>150</td>
<td>150</td>
<td>210</td>
<td>150</td>
<td>210</td>
<td>180</td>
<td>243</td>
</tr>
</tbody>
</table>

### MAXIMUM TRANSFORMER LOADING (OH)

Progress Energy

DWG. 06.00-14A
### Maximum KVA Loading (Continued)

#### THREE-PHASE OVERHEAD CONVENTIONAL TRANSFORMER BANKS

<table>
<thead>
<tr>
<th>Bank Size or Transformer Size</th>
<th>Hospital and Special Care Facilities</th>
<th>Industrials and Vaults</th>
<th>4 Hour Peak</th>
<th>8 Hour Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SUMMER 100% WINTER 140%</td>
<td>SUMMER 100% WINTER 140%</td>
<td>SUMMER</td>
<td>WINTER</td>
</tr>
<tr>
<td>45</td>
<td>45</td>
<td>63</td>
<td>54</td>
<td>73</td>
</tr>
<tr>
<td>75</td>
<td>75</td>
<td>105</td>
<td>75</td>
<td>105</td>
</tr>
<tr>
<td>112</td>
<td>112</td>
<td>156</td>
<td>112</td>
<td>156</td>
</tr>
<tr>
<td>150</td>
<td>150</td>
<td>210</td>
<td>150</td>
<td>210</td>
</tr>
<tr>
<td>225</td>
<td>225</td>
<td>315</td>
<td>225</td>
<td>315</td>
</tr>
<tr>
<td>300</td>
<td>300</td>
<td>420</td>
<td>300</td>
<td>420</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
<td>700</td>
<td>500</td>
<td>700</td>
</tr>
<tr>
<td>750</td>
<td>750</td>
<td>1,050</td>
<td>750</td>
<td>1,050</td>
</tr>
<tr>
<td>1,000</td>
<td>1,000</td>
<td>1,400</td>
<td>1,000</td>
<td>1,400</td>
</tr>
<tr>
<td>1,500</td>
<td>1,500</td>
<td>2,100</td>
<td>1,500</td>
<td>2,100</td>
</tr>
</tbody>
</table>

**Notes:**

1. SELECT THE TYPE OF BUSINESS. THE CORRESPONDING DEMAND DURATION IS HOW LONG THE CUSTOMER'S DEMAND LASTS ON PEAK DAYS BASED ON DATA FROM LOAD RESEARCH STUDIES. THE CUSTOMER'S DEMAND TYPICALLY DROPS TO 75% OF THE MAXIMUM DURING ALL OTHER TIMES.

2. NOTE THAT TRANSFORMER LOADING IS GIVEN IN KVA. ADJUSTMENTS FOR POWER FACTOR NEED TO BE DEFINED BY THE ENGINEER.

3. HIGHLY FLUCTUATING INTERMITTENT LOADS (HFIL): TAKE THE SUM OF THE HFILS AND DIVIDE BY THREE (HEIL/3), AND ADD TO THE CONSTANT LOAD. FUSE CURVES NEED TO BE CHECKED BY USING THE SUM OF THE HFIL (NOT DERATED BY 3) AND THE CONSTANT LOAD DUE TO FUSE PERFORMANCE.
REPLACEMENT POLICY

DISTRIBUTION TRANSFORMERS ARE PRIMARY COST COMPONENTS IN PROVIDING CUSTOMER SERVICE. THE ESTIMATED SERVICE LIFE FOR TRANSFORMERS IS 30 YEARS. TRANSFORMERS SHOULD NOT BE REPLACED UNLESS ABSOLUTELY NECESSARY.

DO NOT REPLACE A TRANSFORMER UNLESS:

- PHYSICAL DAMAGE OCCURS THAT CANNOT BE FIELD REPAIRED SUCH AS BROKEN BUSHINGS, RUSTING, LEAKING OIL, PROBLEMS WITH SECONDARY BREAKER, ETC.
- THE CONDITION OF THE TRANSFORMER IS AN IMMEDIATE SAFETY HAZARD.
- THE TRANSFORMER IS OVERLOADED.
- THE TRANSFORMER IS UNDERLOADED AND CAN BE ECONOMICALLY DOWNSIZED.
- THE TRANSFORMER IS KNOWN TO HAVE A PCB CONCENTRATION OF 50 PPM OR MORE.

REINSTALLATION POLICY

ONLY NON-PCB TRANSFORMERS (LESS THAN 50 PPM) AS SHOWN BY BLUE DOT, BLUE NON-PCB LABEL, OR NAMEPLATE SHOULD BE INSTALLED. ANY TRANSFORMER OF UNKNOWN PCB CONTENT THAT HAS BEEN REMOVED FROM SERVICE SHOULD HAVE A "PCB ARTICLE STORAGE FOR REUSE" LABEL PLACED ON IT (CN 440230) AND SENT TO THE WILDWOOD TRANSFORMER SHOP. THE LABEL MUST BE PLACED ON THE TRANSFORMER AS SOON AS IT ARRIVES AT THE L&S YARD.

NON-PCB TRANSFORMERS IN OPERABLE CONDITION SHOULD BE RESTOCKED AND RE-USED. DO NOT SEND OPERABLE TRANSFORMERS TO THE TRANSFORMER SHOP UNLESS THEY NEED REPAIR, PAINTING, TESTING, OR HAVE A KNOWN OR ASSUMED PCB CONTENT OF 50 PPM OR MORE.

A POLE MOUNT TRANSFORMER OF UNKNOWN PCB CONTENT MAY NOT BE TRANSFERRED FROM ONE POLE TO ANOTHER IN THE FIELD.

CSP UNITS

ANY CSP UNITS BEING INSTALLED OR REINSTALLED SHOULD HAVE A FUSED CUTOUT. IF AN ARRESTER IS BEING REPLACED ON A CSP UNIT AND A FUSED CUTOUT IS NOT ALREADY INSTALLED, THEN A FUSED CUTOUT SHOULD BE ADDED AT THE TIME THE ARRESTER IS REPLACED. FUSE THE CUTOUT WITH THE SAME FUSE SIZE REQUIRED FOR A SIMILAR CONVENTIONAL TRANSFORMER.
NOTES:

1. USE ON ALL NEW INSTALLATIONS

2. INSTALL WILDLIFE GUARD ON TOP OF TRANSFORMER PRIMARY BUSHING BETWEEN THE FIRST AND SECOND SKIRT.

3. ON DIRECT CONNECTED ARRESTERS, LEAD SHOULD BE BROUGHT OUT SIDE SLOT (KNOCKOUT) OF THE WILDLIFE GUARD. ON GAPPED ARRESTER INSTALLATIONS, REMOVE SIDE KNOCKOUT.

4. ANY "SOFT TYPE" WILDLIFE GUARDS WHICH ARE REMOVED, SHALL BE SCRAPPED AND NOT REINSTALLED.
NOTES:
1. USE THESE GUARDS ONLY WHEN AN ANIMAL GUARD MUST BE STICK APPLIED.
2. INSPECT CONDITION OF INSULATOR PRIOR TO INSTALLATION. DO NOT INSTALL ON AN INSULATOR THAT IS SUSPECT.
3. USE ON SINGLE BUSHING TRANSFORMERS OR ON PRIMARY BUSHING ON A DOUBLE BUSHING TRANSFORMER.
4. INSTALL WITH THE SPLIT OPENING POINTING TOWARDS THE LIGHTNING ARRESTER.
5. INSTALL WITH THE FLAT SIDE DOWN.
6. WHEN INSTALLED, THE OUTER EDGES SHOULD BE AT LEAST 1-1/2 INCHES FROM THE LIGHTNING ARRESTER LEAD AND 2-1/2 INCHES FROM THE ARRESTER INSULATOR. ALSO MAINTAIN AT LEAST 2-1/2 INCHES FROM THE POLE, OTHER INSULATORS OR ANY OTHER GROUNDED OBJECT.
7. DO NOT CUT OR ALTER THE GUARD TO MEET CLEARANCE REQUIREMENTS.
### Transformer Fuse Table

<table>
<thead>
<tr>
<th>Transformer Size</th>
<th>FUSE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WYE CONNECTED PRIMARY</td>
</tr>
<tr>
<td></td>
<td>PRIMARY VOLTAGE Ø-GROUND</td>
</tr>
<tr>
<td></td>
<td>7200/7620</td>
</tr>
<tr>
<td>3</td>
<td>1 MS</td>
</tr>
<tr>
<td>5</td>
<td>1 MS</td>
</tr>
<tr>
<td>10</td>
<td>2 MS</td>
</tr>
<tr>
<td>15</td>
<td>3 MS</td>
</tr>
<tr>
<td>25</td>
<td>5 MS</td>
</tr>
<tr>
<td>37.5</td>
<td>7 MS</td>
</tr>
<tr>
<td>50</td>
<td>10 MS</td>
</tr>
<tr>
<td>75</td>
<td>15 MS</td>
</tr>
<tr>
<td>100</td>
<td>25 K</td>
</tr>
<tr>
<td>167</td>
<td>40 K</td>
</tr>
<tr>
<td>250</td>
<td>50 K</td>
</tr>
<tr>
<td>333</td>
<td>65 K</td>
</tr>
<tr>
<td>500</td>
<td>80 K</td>
</tr>
</tbody>
</table>

**NOTES:**

1. For installations not covered by this table contact distribution standards.

2. When one fuse is blown on a three-phase bank, all fuses shall be replaced.

3. Fuse sizes 1-15 amps are S speed fuses. Depending on manufacturer, these are labeled S, MS, or KS. Fuse sizes 20-80 amps are K speed fuses. K speed is an industry standard so all manufacturers will label the same.
# Transformer Risers

**SINGLE-PHASE, WYE BANK OR OPEN DELTA BANK RISERS**

<table>
<thead>
<tr>
<th>Transformer Size KVA</th>
<th>Secondary 120/208V 3Ø WYE</th>
<th>Secondary 120/240V 1Ø or 3Ø 277/480V 3Ø WYE</th>
<th>Secondary 480V 1Ø</th>
<th>Primary 2.4, 7.2 or 14.4 KV 1Ø</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AL 1/0</td>
<td>AL 1/0</td>
<td>AL 1/0</td>
<td>AL 1/0</td>
</tr>
<tr>
<td>5</td>
<td>1/0</td>
<td>1/0</td>
<td>1/0</td>
<td>6 WP</td>
</tr>
<tr>
<td>10</td>
<td>1/0</td>
<td>1/0</td>
<td>1/0</td>
<td>6 WP</td>
</tr>
<tr>
<td>15</td>
<td>1/0</td>
<td>1/0</td>
<td>1/0</td>
<td>6 WP</td>
</tr>
<tr>
<td>25</td>
<td>4/0</td>
<td>1/0</td>
<td>1/0</td>
<td>6 WP</td>
</tr>
<tr>
<td>37.5</td>
<td>500</td>
<td>1/0</td>
<td>1/0</td>
<td>6 WP</td>
</tr>
<tr>
<td>50</td>
<td>100</td>
<td>2-500</td>
<td>1/0</td>
<td>6 WP</td>
</tr>
<tr>
<td>75</td>
<td>100</td>
<td>2-500</td>
<td>500</td>
<td>6 WP</td>
</tr>
<tr>
<td>100</td>
<td>167</td>
<td>3-500</td>
<td>2-500</td>
<td>6 WP</td>
</tr>
<tr>
<td>167</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CLOSED DELTA BANK RISERS**

<table>
<thead>
<tr>
<th>Transformer Size KVA</th>
<th>Secondary 120/240V 3Ø</th>
<th>Secondary 480V 3Ø</th>
<th>Primary 2.4 KV 3Ø</th>
<th>Primary 4.16, 12.5 or 24.9 KV 3Ø</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AL 1/0</td>
<td>AL 100</td>
<td>CU 6 WP</td>
<td>CU 6 WP</td>
</tr>
<tr>
<td>5-5-5</td>
<td>1/0</td>
<td>1/0</td>
<td>6 WP</td>
<td>6 WP</td>
</tr>
<tr>
<td>10-10-10</td>
<td>1/0</td>
<td>1/0</td>
<td>6 WP</td>
<td>6 WP</td>
</tr>
<tr>
<td>15-15-15</td>
<td>1/0</td>
<td>1/0</td>
<td>6 WP</td>
<td>6 WP</td>
</tr>
<tr>
<td>25-25-25</td>
<td>4/0</td>
<td>1/0</td>
<td>6 WP</td>
<td>6 WP</td>
</tr>
<tr>
<td>37.5-37.5-37.5</td>
<td>4/0</td>
<td>1/0</td>
<td>6 WP</td>
<td>6 WP</td>
</tr>
<tr>
<td>50-50-50</td>
<td>500</td>
<td>4/0</td>
<td>6 WP</td>
<td>6 WP</td>
</tr>
<tr>
<td>75-75-75</td>
<td>2-500</td>
<td>500</td>
<td>2 WP</td>
<td>6 WP</td>
</tr>
<tr>
<td>100-100-100</td>
<td>2-500</td>
<td>500</td>
<td>2 WP</td>
<td>6 WP</td>
</tr>
<tr>
<td>167-167-167</td>
<td>3-500</td>
<td>2-500</td>
<td>2 WP</td>
<td>6 WP</td>
</tr>
</tbody>
</table>

**NOTES:**

1. ALL SECONDARY TRANSFORMER HOTLEG LEADS ARE 600 VOLT ALUMINUM CABLE WITH CROSS-LINKED POLYETHYLENE INSULATION. OVERHEAD NEUTRAL CONDUCTOR CAN BE BARE ALUMINUM.

2. SINGLE SERVICE CONNECTION TO TRANSFORMERS 50KVA AND BELOW SHALL USE STEM CONNECTORS. FOR MULTIPLE SERVICES, USE SECONDARY CONNECTOR (CN 153529). FOR TRANSFORMERS ABOVE 75 KVA, LEADS ARE NOT NECESSARY IF THE SERVICES WILL BE CONNECTED DIRECTLY TO THE SECONDARY BUSHINGS. MULTIPLE UNDERGROUND SERVICES SHALL BE FED BY A SINGLE RISER. SEE DWG. 21.04-01.

3. FOR OPEN DELTA-CONNECTED BANKS, EITHER 120/240 OR 240/480 VOLTS, LEADS NOT COMMON TO TWO TRANSFORMERS ARE TO BE SELECTED FROM THE SINGLE PHASE TABLE ABOVE ACCORDING TO THE SIZE OF EACH TRANSFORMER.

4. FOR CLOSED DELTA AND OPEN DELTA-CONNECTED BANKS MADE UP OF UNEQUAL Sized TRANSFORMERS, LEADS AND JUMPERS COMMON TO TWO TRANSFORMERS ARE TO BE SIZED ACCORDING TO THE LARGER TRANSFORMER. USE TOP TABLE FOR OPEN DELTA CONNECTED BANKS AND BOTTOM TABLE FOR CLOSED DELTA CONNECTED BANKS.
# Transformer Sizes and Delta Bank Leads between Bushings

<table>
<thead>
<tr>
<th>Transformer Size KVA</th>
<th>Delta Bank Leads Between Bushings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Secondary</td>
</tr>
<tr>
<td></td>
<td>120/240V 3Ø</td>
</tr>
<tr>
<td></td>
<td>AL</td>
</tr>
<tr>
<td>5-5-5</td>
<td>1/0</td>
</tr>
<tr>
<td>10-10-10</td>
<td>1/0</td>
</tr>
<tr>
<td>15-15-15</td>
<td>1/0</td>
</tr>
<tr>
<td>25-25-25</td>
<td>1/0</td>
</tr>
<tr>
<td>37.5-37.5-37.5</td>
<td>4/0</td>
</tr>
<tr>
<td>50-50-50</td>
<td>4/0</td>
</tr>
<tr>
<td>75-75-75</td>
<td>500</td>
</tr>
<tr>
<td>100-100-100</td>
<td>500</td>
</tr>
<tr>
<td>167-167-167</td>
<td>2-500</td>
</tr>
</tbody>
</table>

## Notes:

1. All secondary transformer hotleg leads are 600 volt aluminum cable with cross-linked polyethylene insulation. Overhead neutral conductor can be bare aluminum.

2. Single service connection to transformers 50kVA and below shall use stem connectors. For multiple services, use secondary connector (CN 153529). For transformers above 75 kVA, leads are not necessary if the services will be connected directly to the secondary bushings. Multiple underground services shall be fed by a single riser. See DWG. 21.04-01.

3. For open delta-connected banks, either 120/240 or 240/480 volts, leads not common to two transformers are to be selected from the single-phase table above according to the size of each transformer.

4. For closed delta and open delta-connected banks made up of unequal sized transformers, leads and jumpers common to two transformers are to be sized according to the larger transformer.
NOTES:

1. FOR TRANSFORMERS 75 KVA AND ABOVE, NO SECONDARY LEADS ARE NECESSARY. CONNECT SERVICES DIRECTLY TO THE SECONDARY BUSHINGS.

2. SINGLE SERVICE CONNECTION TO TRANSFORMERS 50KVA AND BELOW SHALL USE STEM CONNECTORS. FOR MULTIPLE SERVICES, USE SECONDARY CONNECTOR (CN 153529).

3. ALL STEM CONNECTOR TERMINATIONS TO UNDERGROUND INSULATED CONDUCTORS ARE TO BE AQUA-SEALED AND TAPE TO PREVENT WATER INTRUSION INTO THE CABLE.

4. WHEN THE LARGEST SERVICE CABLE BEING RUN FROM THE TRANSFORMER IS EQUAL TO OR LARGER THAN THE REQUIRED SECONDARY SIZE, THE SERVICE CABLE WITH A STEM CONNECTOR SHOULD BE USED FOR THE SECONDARY LEAD.

<table>
<thead>
<tr>
<th>CATALOG NUMBER</th>
<th>CONDUCTOR SIZE</th>
<th>COLOR CODE</th>
<th>STEM SIZE</th>
<th>BURNDY</th>
<th>KEARNEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>9220195899</td>
<td>#6 STR AL</td>
<td>BLUE</td>
<td>#4 SOLID</td>
<td>W-BG</td>
<td>5/8</td>
</tr>
<tr>
<td>9220106084</td>
<td>#4 STR AL</td>
<td>ORANGE</td>
<td>#4 SOLID</td>
<td>W-BG</td>
<td>5/8</td>
</tr>
<tr>
<td>153503</td>
<td>#2 STR AL</td>
<td>RED</td>
<td>#4 SOLID</td>
<td>W-BG</td>
<td>5/8</td>
</tr>
<tr>
<td>153508</td>
<td>#1/0 STR AL</td>
<td>YELLOW</td>
<td>#2 SOLID</td>
<td>W-BG</td>
<td>840</td>
</tr>
<tr>
<td></td>
<td>#2/0 STR AL</td>
<td>GRAY</td>
<td>#1/0 SOLID</td>
<td>W-K840</td>
<td>840</td>
</tr>
<tr>
<td>153516</td>
<td>#4/0 STR AL</td>
<td>PINK</td>
<td>#1/0 SOLID</td>
<td>W-K840</td>
<td>840</td>
</tr>
<tr>
<td>153521</td>
<td>336.4 ACSR AL &amp; 350 MCM AL</td>
<td>GREEN</td>
<td>1/2&quot; DIA</td>
<td>W-K840</td>
<td>-</td>
</tr>
<tr>
<td>153523</td>
<td>500 MCM</td>
<td>PINK</td>
<td>1/2&quot; DIA</td>
<td>U34ART</td>
<td>1-1/8 - 1</td>
</tr>
</tbody>
</table>

SECONDARY LEAD SPECIFICATIONS
NOTES:

1. NEVER INSTALL AN ALUMINUM CABLE IN THE TRANSFORMER SECONDARY BUSHINGS WITHOUT USING THE STEM CONNECTOR.

2. ALL TPX CABLES AND OPEN-WIRE CONDUCTORS SHALL HAVE A MINIMUM CLEARANCE OF 3" FROM THE TRANSFORMER TANK.

3. WHEREVER POSSIBLE, KEEP SECONDARY Drip loops above the bottom of the transformer tank to avoid joint use clearance issues.

4. FOR MULTIPLE SERVICES, ON TRANSFORMERS RATED 50KVA OR LESS, USE SECONDARY CONNECTOR (CN 153529) WITH COVER. FOR AN EXISTING TRANSFORMER, SEE EXCEPTION IN NOTE 2 ON DWG. 06.03-04.

KEEP STEM CONNECTOR STRAIGHT. BENDING END CAUSES WATER INTRUSION INTO AL/CU CONNECTION.

FOR UG SERVICES SEAL HERE WITH AQUASEAL AND TAPE

SYSTEM NEUTRAL

ALUMINUM LEADS OR ALUMINUM TPX SERVICE EQUAL TO THE REQUIRED LEAD SIZE. SEE DWGS. 06.03-01A AND 06.03-01B.

SQUEEZON COVER — SEE DWG. 03.02-16C

X2 TRANSFORMER LEAD TO BE EQUIVALENT TO LARGEST SERVICE NEUTRAL SIZE. ALWAYS CONNECT SERVICE NEUTRAL TO X2 TRANSFORMER LEAD. DO NOT CONNECT SERVICE NEUTRAL TO GROUNDING CONDUCTOR OR SYSTEM NEUTRAL.

#6 5D BC

TANK GROUNDING LUG

POLE GROUND

TRANSFORMER SECONDARY CONNECTION DETAILS
THREE-PHASE TRANSFORMER
BANK SECONDARY CONNECTORS

NOTES:

1. USE THESE CONNECTORS ON THREE-PHASE BANKS OR SINGLE-PHASE TRANSFORMERS WITH MULTIPLE SERVICES. TRANSFORMER UNITS MUST BE 50KVA OR SMALLER. LARGER UNITS WILL HAVE SECONDARY SPADES.

2. ALL BANK LEADS MUST BE FULLY INSULATED. SIZE PER DWGS. 06.03-01A AND 06.03-01B.

3. PUSH CONNECTOR STEM THROUGH COVER HOLE. CONNECT CONNECTOR STEM IN TRANSFORMER LUG. CLEAN WIRE AND APPLY INHIBITOR. INSERT WIRE IN BOTTOM OF CONNECTOR.

4. BEND WIRE AS NEEDED BEFORE INSERTING IN CONNECTOR.

5. MAINTAIN AT LEAST 3" CLEARANCE FROM TANK TO INSULATED LEAD.
1. IF ARRESTER MOUNTING PROVISION EXISTS ON THE TRANSFORMER TANK, THE ARRESTERS SHOULD BE MOUNTED ON THE TANK UNLESS IT IS A 3-TRANSFORMER FLOATING WYE-DELTA BANK. LOCATE ARRESTERS FOR 3-TRANSFORMER FLOATING WYE-DELTA BANKS ON SOURCE SIDE OF CUTOUT. IF ARRESTERS COME ON TRANSFORMER TANK, RELOCATE TO SOURCE SIDE OF CUTOUTS. IF ARRESTER MOUNTING PROVISION DOES NOT EXIST, MOUNT THE ARRESTERS ON THE CUTOUT BRACKET.
RACK TYPE BRACKET
CU BKTTFMRSMALF
CN 12912507
5 THRU 50 KVA UNITS

NOTES:
1. USE TWO 3/4" BOLTS TO MOUNT BRACKET TO POLE. USE TWO 5/8" BOLTS TO ATTACH EACH TRANSFORMER TO BRACKET.

THREE UNIT WING TYPE CLUSTER BRACKET
CU BKTTFMRMEDALF
CN 070255
75 THRU 167 KVA UNITS

NOTES:
1. USE TWO 3/4" BOLTS TO MOUNT BRACKET TO POLE. USE TWO 3/4" BOLTS TO ATTACH EACH TRANSFORMER TO BRACKET.
NOTES:

1. USE TWO 5/8" BOLTS TO MOUNT BRACKET TO POLE. USE TWO 3/4" BOLTS TO MOUNT EACH TRANSFORMER TO BRACKET.

2. A PLATFORM IS THE PREFERRED MOUNTING FOR TRANSFORMERS OF THIS SIZE. CONSULT WITH DISTRIBUTION STANDARDS ON POLE SIZE AND GUYING PRIOR TO USING THIS TRANSFORMER MOUNTING BRACKET.

3. CHECK ON AVAILABILITY AS THIS IS A SPECIAL ORDER ITEM.
NOTES:
1. USE NON-LOADBREAK CUTOUTS.
   CU TFUSE15CO100F (FOR CUTOUT ON L BRACKET) (CN 221112)
2. USE 18KV LIGHTNING ARRESTERS ON A 25KV LINE.
   CU AREQOH18F (CN 220207)
3. USE 10KV LIGHTNING ARRESTERS ON A 12KV LINE.
   CU AREQOHTR10F (CN 114012033)
4. USE L BRACKET.
   CU BKTCOLASNGSTLF (CN 311263)
5. USE #6 SD COPPER WP PRIMARY RISERS.
6. FOR UNITS WITH EXTERNAL LIGHTNING ARRESTERS, ROTATE ARRESTER FROM SHIPPING POSITION TO
   STRAIGHT OUT FROM TANK.
7. INSTALL A WILDLIFE GUARD ON ALL NEW INSTALLATIONS. SEE DWG. 06.00-23.
   CU WGEQBUSHSNAPF (CN 470114)
8. FOR 50 KVA AND SMALLER, USE QUANTITY TWO - 5/8" X 12" GALVANIZED BOLTS (CU TOAMAF) TO MOUNT
   TRANSFORMER. FOR 75 KVA - 167 KVA, USE QUANTITY TWO - 3/4" X 12" GALVANIZED BOLTS TO MOUNT
   TRANSFORMER.
NOTES:

1. THE QUADRANT FOR INSTALLING THE TRANSFORMER AND CUTOUT MAY CHANGE FROM WHAT IS SHOWN IN
   THE DRAWING BASED ON FIELD CONDITIONS. THE CUTOUT SHOULD NOT BE INSTALLED DIRECTLY ABOVE
   THE TRANSFORMER.

2. 72" CLEARANCE IS FOR NEW CONSTRUCTION. IT IS ACCEPTABLE TO LEAVE SPACING AT 60" IF REPLACING A
   TRANSFORMER OR IF LOWERING THE NEUTRAL WOULD CAUSE A CLEARANCE ISSUE WITH JOINT USERS BELOW
   THE NEUTRAL.

3. MINIMUM BOLT HOLE SPACING IS 4"; NO HOLES SHOULD BE DRILLED CLOSER THAN 4".

4. THE BOTTOM OF THE TRANSFORMER TANK MUST MAINTAIN 30 INCHES OF CLEARANCE ABOVE JOINT USE
   CABLES.
NOTES:

1. THE QUADRANT FOR INSTALLING THE TRANSFORMER AND CUTOUT MAY CHANGE FROM WHAT IS SHOWN IN THE DRAWING BASED ON FIELD CONDITIONS. THE CUTOUT SHOULD NOT BE INSTALLED DIRECTLY ABOVE THE TRANSFORMER.
NOTES:

1. THE QUADRANT FOR INSTALLING THE TRANSFORMER AND CUTOUT MAY CHANGE FROM WHAT IS SHOWN IN THE DRAWING BASED ON FIELD CONDITIONS. THE CUTOUT SHOULD NOT BE INSTALLED DIRECTLY ABOVE THE TRANSFORMER.
THE DISTRIBUTION TRANSFORMER CONNECTION DRAWINGS SHOW THE MOST COMMON TRANSFORMER CONNECTIONS PRESENTLY BEING USED. PARTICULAR NOTE SHOULD BE MADE OF THE FOLLOWING:

1. TRANSFORMER CONNECTIONS (DWGS. 06.10-01 THROUGH 06.10-13) ARE SHOWN FOR BOTH SUBTRACTION AND ADDITIVE POLARITY TRANSFORMERS AND ASSUME THAT ALL TRANSFORMERS IN A BANK ARE THE SAME POLARITY. THIS IS TRUE IN MOST CASES AND AS A RESULT THE SECONDARY BUSHING MARKINGS (X₁, X₂, X₃, ETC.) WILL BE THE SAME FOR EACH TRANSFORMER IN THE BANK. THE DRAWINGS DO NOT APPLY WHERE UNITS OF DIFFERENT POLARITY ARE IN THE SAME BANK. IN THIS CASE THE SECONDARY BUSHING MARKINGS WILL BE DIFFERENT AND CARE MUST BE TAKEN IN ORDER TO ENSURE THAT CONNECTIONS ARE MADE ACCORDING TO THE BUSHING DESIGNATIONS (X₁, X₂, X₃, ETC.). IF TRANSFORMERS OF DIFFERENT POLARITIES ARE NOT CONNECTED PROPERLY, HIGH SECONDARY VOLTAGES CAN RESULT, OR SECONDARY VOLTAGES CAN CANCEL RESULTING IN HIGH CIRCULATING CURRENTS, BLOWN FUSES, ETC. SEE DWG. 06.07-05.

2. WHEN TRANSFORMERS IN A BANK ARE REPLACED, IT IS NECESSARY TO KEEP CUSTOMERS’ MOTORS RUNNING IN THE SAME DIRECTION. PHASE ROTATION SHOULD BE CHECKED BEFORE AND AFTER ANY CONNECTIONS ARE CHANGED. ROTATION MAY BE REVERSED BY SWAPPING CONNECTIONS OF TWO OF THE PHASE WIRES. IF THE BANK HAS A LIGHTING TRANSFORMER, SWAP THE TWO LARGE LIGHTING WIRES.

3. FOR CLARITY, SOME GROUND CONNECTIONS ARE SHOWN AS TAPS. WHEREVER POSSIBLE, A CONTINUOUS LOOP SHOULD BE USED BETWEEN BUSHINGS OR FROM A BUSHING TO GROUND.


5. BE SURE TO REMOVE GROUND STRAP CONNECTIONS ON THE SECONDARY OF POWER TRANSFORMERS IN BANKS WITH DELTA SECONDARIES.

6. IN CLOSED BANKS WITH A DELTA SECONDARY CONNECTION, THE VOLTAGES OF THE TAP SETTINGS OF ALL OF ALL TRANSFORMERS MUST BE IDENTICAL TO PREVENT CIRCULATING CURRENTS AND OVERHEATING. THE PERCENT IMPEDANCE SHOULD BE APPROXIMATELY THE SAME TO ESTABLISH PROPER LOAD DIVISION. FOR UNITS OF EQUAL CAPACITY WITH ONE ODD IMPEDANCE, SUCH AS WHEN A FAILED UNIT MUST BE REPLACED, THE TOTAL BANK DERATING IS APPROXIMATED IN THE FOLLOWING TABLE:

<table>
<thead>
<tr>
<th>RATIO OF ODD UNIT IMPEDANCE TO IMPEDANCE OF OTHER TWO UNITS</th>
<th>DERATING FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6</td>
<td>0.91</td>
</tr>
<tr>
<td>1.5</td>
<td>0.93</td>
</tr>
<tr>
<td>1.4</td>
<td>0.94</td>
</tr>
<tr>
<td>1.3</td>
<td>0.95</td>
</tr>
<tr>
<td>1.2</td>
<td>0.97</td>
</tr>
<tr>
<td>1.1</td>
<td>0.98</td>
</tr>
<tr>
<td>1.0</td>
<td>1.00</td>
</tr>
<tr>
<td>0.9</td>
<td>0.97</td>
</tr>
<tr>
<td>0.8</td>
<td>0.93</td>
</tr>
<tr>
<td>0.7</td>
<td>0.90</td>
</tr>
</tbody>
</table>

7. FOR 240/120 VOLT, THREE-PHASE BANKS, THE TWO POWER (WING) TRANSFORMERS SHOULD HAVE THE SAME KVA RATING AND SIMILAR IMPEDANCE (ATTEMPT TO KEEP IMPEDANCE VALUES WITH +/- 5% OF EACH OTHER). UNEQUAL KVA OR IMPEDANCE VALUES CAN LEAD TO TRANSFORMER OVERLOADS.

8. DO NOT USE SINGLE BUSHING TRANSFORMERS IN THREE TRANSFORMER BANKS EXCEPT FOR WYE-WYE 208Y/120 VOLT BANKS.

9. DO NOT MIX SINGLE BUSHING TRANSFORMERS AND DOUBLE BUSHING TRANSFORMERS TOGETHER IN THE BANK.
POLARITY IS ESPECIALLY IMPORTANT WHEN BANKING TRANSFORMERS AND WHEN TWO OR MORE TRANSFORMERS ARE TO BE PARALLELED. CONNECTIONS TO ADDITIVE AND SUBTRACTIVE POLARITY WILL BE IN DIFFERENT PHYSICAL LOCATIONS ON THE TANK. BUSHING MARKINGS ON THE NAMEPLATE WILL BE AS SHOWN BELOW. NOTE THAT THE H 4 BUSHING IS ALWAYS ON THE LEFT WHEN FACING THE LOW VOLTAGE SIDE OF THE TRANSFORMER, AND THAT THE PHYSICAL LOCATION OF THE SECONDARY BUSHINGS (X 4 X 2 X 3 ETC.) ON AN ADDITIVE POLARITY TRANSFORMER IS DIFFERENT FROM THAT OF A SUBTRACTIVE POLARITY TRANSFORMER.

ADDITIVE POLARITY - ALL SINGLE-PHASE TRANSFORMERS RATED 167 KVA AND SMALLER, HAVING HIGH VOLTAGE WINDING 7200 VOLTS AND BELOW.

CHARACTERISTICS OF ADDITIVE POLARITY
1. THE LOW VOLTAGE X 1 BUSHING IS ON THE RIGHT WHEN FACING THE LOW VOLTAGE SIDE OF THE TRANSFORMER.
2. THE DIRECTION OF INDUCED VOLTAGE FROM H 1 TO H 2 IS OPPOSITE THE DIRECTION OF INDUCED VOLTAGE FROM X 1 TO X 2

SUBTRACTIVE POLARITY - ALL SINGLE-PHASE TRANSFORMERS HAVING HIGH VOLTAGE WINDINGS OF 13200 AND ABOVE, ALL DUAL VOLTAGE (13200 X 7200) TRANSFORMERS AND ALL TRANSFORMERS LARGER THAN 167 KVA.

CHARACTERISTICS OF SUBTRACTIVE POLARITY
1. THE LOW VOLTAGE X 1 BUSHING IS ON THE LEFT WHEN FACING THE LOW VOLTAGE SIDE OF THE TRANSFORMER.
2. THE DIRECTION OF INDUCED VOLTAGE FROM H 1 TO H 2 IS THE SAME AS THE DIRECTION OF INDUCED VOLTAGE FROM X 1 TO X 2

"NEMA STANDARDS FOR LOW VOLTAGE EXTERNAL TERMINALS"

<table>
<thead>
<tr>
<th>DESCRIPTION OF CONNECTION</th>
<th>ADDITIVE POLARITY</th>
<th>SUBTRACTIVE POLARITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWO TERMINALS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SINGLE LOW VOLTAGE</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THREE TERMINALS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THREE WIRE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120/240 VOLTS (SERIES CONNECTION)</td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td>TWO WIRE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120 VOLTS OR FOUR WIRE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>208Y/120 VOLTS BANK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(PARALLEL CONNECTION)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
</tr>
<tr>
<td>FOUR TERMINALS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
</tr>
</tbody>
</table>

FOR 3-WIRE 120/240 VOLT (SERIES) OPERATION, CONNECT X 2 TO X 3 EXTERNALLY. FOR 4-WIRE 208Y/120 VOLT (PARALLEL) OPERATION CONNECT X 1 TO X 2 AND X 3 TO X 4 EXTERNALLY.
1. All general policies for single-phase transformer installations should be followed. General policies can be found on the following DWGs: 06.00-20, 06.07-01, 06.15-01A and 06.15-01B.

2. The lighting transformer should be connected to the leading phase. A phase leads B phase, B phase leads C phase and C phase leads A phase.

3. The ground strap must be removed from the secondary neutral bushing on the power transformer.

4. Do not mix one bushing units and two bushing units in the same bank due to polarity problems.

5. Lightning arresters should be mounted on the transformer tank for all primary bushings connected to an energized primary conductor. Mount arrester on cola bracket only if arrester provisions are not on tank. The H2 primary bushing should be connected to the system neutral with #6 SD BC.

6. Use bracket (CN 311263) to mount cutout.

7. A three transformer mounting bracket should be used. See DWG. 06.07-10A for available brackets.

8. See DWG. 06.07-06B for transformer bank mounting dimensions.
NOTES:

1. THE DISTANCE "X" BETWEEN THE TOP BOLT OF THE TRANSFORMER MOUNTING BRACKET AND THE BOTTOM OF THE TRANSFORMER VARIES. TYPICAL MAXIMUM DISTANCES ARE SHOWN IN THE TABLE BELOW.

<table>
<thead>
<tr>
<th>SIZE OF TRANSFORMER</th>
<th>DISTANCE &quot;X&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5 KVA AND BELOW</td>
<td>32&quot;</td>
</tr>
<tr>
<td>50-100 KVA</td>
<td>39&quot;</td>
</tr>
<tr>
<td>167 KVA</td>
<td>42&quot;</td>
</tr>
</tbody>
</table>

2. SEE DWG. 06.07-06A FOR TRANSFORMER BANKS GENERAL POLICIES

3. APPROVED TO HANG LARGER POT IN CENTER OF TRANSFORMER BRACKET.

OPEN-WYE OPEN-DELTA TRANSFORMER BANK
MOUNTING DIMENSIONS

46" TO TOP BOLT OF TRANSFORMER BANK BRACKET

LOWEST PRIMARY WIRE

LOWER NEUTRAL TO 6" UNDER TRANSFORMER BOTTOMS

CUTOUTS MAY BE ROTATED ON L BRACKET FOR EASE OF OPERATION.
NOTES:
1. ALL GENERAL POLICIES FOR TWO TRANSFORMER BANK INSTALLATIONS SHOULD CONTINUE TO BE FOLLOWED. GENERAL POLICIES CAN BE FOUND ON THE FOLLOWING DRAWINGS: 06.00-20, 06.07-01, 06.07-06A, 06.15-01A AND 06.15-01B. USE 3-TRANSFORMER BRACKET FOR 2-TRANSFORMER INSTALLATIONS.

2. THE THREE-PHASE COLA BRACKET (CU BKTCOLATRISTLF, CN 070104) SHOULD BE USED.

3. CLUSTER MOUNTING BRACKETS SHOULD BE USED.

4. ON 3-TRANSFORMER FLOATING WYE-DELTA BANKS, ARRESTERS SHOULD BE MOUNTED ON SOURCE SIDE OF CUTOUT. IF ARRESTRERS COME MOUNTED ON TRANSFORMER TANK, RELOCATE TO SOURCE SIDE OF CUTOUTS.

<table>
<thead>
<tr>
<th>TRANSFORMER SIZES</th>
<th>COMPATIBLE UNIT</th>
<th>CATALOG NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 TO 50 KVA</td>
<td>BKTTFMSMALF</td>
<td>12912507</td>
</tr>
<tr>
<td>75 TO 167 KVA</td>
<td>BKTTFMRMEDALF</td>
<td>070255</td>
</tr>
<tr>
<td>250 TO 333 KVA (CLASS 1 POLE REQUIRED)</td>
<td>BKTTFMRLGEALF</td>
<td>12912705 (NON-STOCKED)</td>
</tr>
</tbody>
</table>

FOR 50 KVA AND BELOW, USE 5/8" X 2" MACHINE BOLTS.
FOR 75 KVA AND LARGER, USE 3/4" X 2" MACHINE BOLTS.
NOTES:

1. ALL GUYS ABOVE THE NEUTRAL POSITION MUST HAVE A GUY INSULATOR (LINK) OF SUFFICIENT LENGTH TO EXTEND BEYOND THE LOWEST ENERGIZED COMPONENT BY 24".

2. 12" MINIMUM CLEARANCE MUST BE MAINTAINED BETWEEN PRIMARY RISER AND ANY GUY INSULATOR.


4. LOCATIONS OF CUTOUTS RELATIVE TO TRANSFORMERS CAN VARY.

## Grounding Details

- **208Y/120V**
  - **Grounding Strap**
  - **Neutral Bus**
  - **Common Neutral**

- **240/120V**
  - **Grounding Strap**
  - **Neutral Bus**
  - **Common Neutral**

### Size of Transformer

<table>
<thead>
<tr>
<th>Size of Transformer</th>
<th>Distance &quot;X&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 KVA AND BELOW</td>
<td>32&quot;</td>
</tr>
<tr>
<td>75-100 KVA</td>
<td>39&quot;</td>
</tr>
<tr>
<td>167 KVA</td>
<td>42&quot;</td>
</tr>
</tbody>
</table>
NOTES:

1. GUY CONFIGURATION SHOWN IS TYPICAL FOR 1/0 OR SMALLER PRIMARY CONDUCTOR AND MAY VARY PER ENGINEERING DESIGN AND INSTRUCTIONS.

2. ALL GUYS ABOVE THE NEUTRAL POSITION MUST HAVE A GUY INSULATOR (LINK) OF SUFFICIENT LENGTH TO EXTEND BEYOND THE LOWEST ENERGIZED COMPONENT BY 24".

3. 8" MINIMUM CLEARANCE MUST BE MAINTAINED BETWEEN PRIMARY RISER AND ANY GUY INSULATOR FOR 12 KV CONDUCTOR. 12" MINIMUM CLEARANCE MUST BE MAINTAINED BETWEEN PRIMARY RISER AND ANY GUY INSULATOR FOR 25 KV CONDUCTOR.


5. LOCATIONS OF CUTOUTS RELATIVE TO TRANSFORMERS CAN VARY.

<table>
<thead>
<tr>
<th>SIZE OF TRANSFORMER</th>
<th>DISTANCE &quot;X&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5 KVA AND BELOW</td>
<td>32&quot;</td>
</tr>
<tr>
<td>50-100 KVA</td>
<td>39&quot;</td>
</tr>
<tr>
<td>167 KVA</td>
<td>42&quot;</td>
</tr>
</tbody>
</table>
1. Platform requires four 3/4" machine bolts, four 3/4" lock washers and four 2-1/4" x 2-1/4" square washers for two pole mounting. Bolts should be installed with bolt head towards the platform center. Use washers at all contact points.

2. The two pole platform will support a load of 13,500 lbs (no center stub required). For greater loads, use center stub support (CU PLFCPALF).

3. The cross members can be positioned anywhere along the beams to allow equipment to be properly spaced.

4. For banks using 250 and 333 kVA transformers, an extra large cluster mount bracket (CU BKTFFHRGALF CN 12912705) is available as a more economical option to using a platform. This bracket is special order, non-stocked. Use the extra large cluster mount bracket with class 1 pole.

5. See DWG. 06.08-03B for platform assembly instructions.
PLATFORM ASSEMBLY INSTRUCTIONS

FOR EASE OF INSTALLATION, THIS ADJUSTABLE PLATFORM MAY BE PRE-ASSEMBLED IN THE SHOP AND CARRIED TO THE JOB SITE. IT MAY ALSO BE ASSEMBLED AT THE BASE OF THE POLES.

IT IS RECOMMENDED YOU PROCEED AS FOLLOWS:

1. OPEN THE BOXED PARTS. EXAMINE THE ERECTION DIAGRAM. LOCATE AND IDENTIFY ALL ITEMS LISTED ON THE DIAGRAM.

2. POSITION THE I-BEAMS AND SLIDE 1/2" X 1-1/4" BOLTS INTO PLACE.

3. CRITICAL - BEGIN ASSEMBLY OF THE CROSSMEMBERS (C14'S, B2'S ETC.) AT THE CENTER OF THE PLATFORM, WORKING OUTWARD TOWARD THE ENDS. HEX NUTS AND PAL-TYPE LOCKNUTS ARE PROVIDED FOR EACH 1/2" BOLT.

4. COMPLETE THE ASSEMBLY WITH THE "A-FRAME" POLE FACE ATTACHMENTS IN THE APPROXIMATE FINAL POSITIONS. LEAVE ONE "A-FRAME" LOOSE TO SLIDE IN THE BEAMS FOR FINAL ADJUSTMENT.

5. HOIST PLATFORM TO DESIRED HEIGHT, LEVEL AND MAKE FINAL ADJUSTMENT OF "A-FRAME" ENDS TO INSURE GOOD CONTACT WITH THE POLES. BOLT THE "A-FRAMES" TO THE POLES USING THE THRU-BOLTS AND LAG BOLTS SPECIFIED ON THE ERECTION DIAGRAM. INSTALL THE POLE THRU-BOLTS WITH THE HEADS TOWARD THE PLATFORM CENTER.

6. CHECK TO BE SURE ALL NUTS ARE TIGHT AND ALL LOCKNUTS ARE IN PLACE.

7. INSTALL EQUIPMENT DIRECTLY ON ALUMINUM CROSSMEMBERS. THE CROSSMEMBERS MAY BE ADJUSTED TO SUPPORT THE LOAD. NO ADDITIONAL EQUIPMENT MOUNTING BOLTS ARE NECESSARY FOR NORMAL APPLICATIONS.

NOTES:

1. SEE DWG. 06.08-03A FOR PLATFORM DETAIL, NOTES AND BILL OF MATERIALS.
IF TALLER POLE
40' POLE SHOWN,
IS USED ADDITIONAL
HEIGHT SHOULD BE
COMPENSATED BY
LOWERING SWITCH
ARM AND TIMBER.

NOTES:
1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
120 VOLT TWO-WIRE SERVICE
DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE POLARITY -

120/240 AND 240/480 VOLT SINGLE-PHASE SERVICE

1. **12 KV SYSTEM**
   - PRIMARY CONDUCTORS
     - A
     - B
     - C
   - SECONDARY CONDUCTORS
     - H1
     - H2
     - H3
   - -SINGLE PHASE CONNECTION-
     - 12470 GRD. Y/7200 TO 120/240 VOLT CSP TRANSFORMER
     - 120/240 VOLT SINGLE PHASE SERVICE
     - ADDITIVE POLARITY

2. **23 KV SYSTEM**
   - PRIMARY CONDUCTORS
     - A
     - B
     - C
   - SECONDARY CONDUCTORS
     - H1
     - H2
     - H3
   - -SINGLE PHASE CONNECTION-
     - 22860 GRD. Y/13200 TO 120/240 VOLT CSP TRANSFORMER
     - 120/240 VOLT SINGLE PHASE SERVICE
     - SUBTRACTIVE POLARITY

3. **12 KV SYSTEM**
   - PRIMARY CONDUCTORS
     - A
     - B
     - C
   - CONNECTED PHASE TO PHASE
     - H1
     - H2
     - H3
   - -SINGLE PHASE CONNECTION-
     - 14400/24040Y TO 240/480 VOLT CONVENTIONAL TRANSFORMERS
     - 240/480 VOLT SINGLE PHASE SERVICE
     - SUBTRACTIVE POLARITY
THREE PHASE OPEN-WYE OPEN-DELTA CONNECTION

13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
ADDITIVE POLARITY

120/240 VOLT SINGLE PHASE SERVICE
7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
SUBTRACTIVE POLARITY

23 KV SYSTEM
PRIMARY CONDUCTORS
A B C

120V 120V
240V 240V
N
SECONDARY CONDUCTORS
X1 X2 X3

-SINGLE PHASE CONNECTION -
7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
120/240 VOLT SINGLE PHASE SERVICE
-ADDITIVE POLARITY-

12 KV SYSTEM
PRIMARY CONDUCTORS
A B C

120V 120V
240V 240V
N
SECONDARY CONDUCTORS
X1 X2 X3

-SINGLE PHASE CONNECTION -
13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
120/240 VOLT SINGLE PHASE SERVICE
-SUBTRACTIVE POLARITY-

23 KV SYSTEM
PRIMARY CONDUCTORS
A B C

120V 120V
240V 240V
N
SECONDARY CONDUCTORS
X1 X2 X3

-SINGLE PHASE CONNECTION -
13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
240/120 VOLT THREE PHASE SERVICE
-SUBTRACTIVE POLARITY-

23 KV SYSTEM
PRIMARY CONDUCTORS
A B C

120V 120V
240V 240V
N
SECONDARY CONDUCTORS
X1 X2 X3

THREE PHASE OPEN-WYE OPEN-DELTA CONNECTION
7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
240/120 VOLT THREE PHASE SERVICE
-ADDITIVE POLARITY-
DISTRIBUTION TRANSFORMER CONNECTIONS

-ADDITIVE AND SUBTRACTION POLARITY-

240/120 VOLT THREE-PHASE SERVICE

NOTE: DO NOT GROUND PRIMARY NEUTRAL OF TRANSFORMER BANK.
DISTRIBUTION TRANSFORMER CONNECTIONS

- ADDITIVE AND SUBTRACTIVE POLARITY -

12 KV SYSTEM

THREE-PHASE WYE-Delta CONNECTION
7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 & 200KVA
240/120 VOLT THREE-PHASE SERVICE

NOTE: DO NOT GROUND PRIMARY NEUTRAL OF TRANSFORMER BANK
-ADDITIVE POLARITY-

12 KV SYSTEM

THREE-PHASE DELTA-Delta CONNECTION
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 THRU 500 KVA
240/120 VOLT THREE-PHASE SERVICE

-SUBTRACTIVE POLARITY-

23 KV SYSTEM

THREE-PHASE WYE-Delta CONNECTION
13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 THRU 500 KVA AND
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 THRU 500 KVA
7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 250 THRU 500 KVA
240/120 VOLT THREE-PHASE SERVICE

NOTE: DO NOT GROUND PRIMARY NEUTRAL OF TRANSFORMER BANK
-SUBTRACTIVE POLARITY-
DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
208Y/120 VOLT THREE-PHASE SERVICE
- ADDITIVE AND SUBTRACTIVE POLARITY -

**12 KV SYSTEM**

**PRIMARY CONDUCTORS**

- THREE PHASE WYE-WYE CONNECTION -
  7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA
  208Y/120 VOLT THREE PHASE SERVICE
  ADDITIVE POLARITY

- THREE PHASE DELTA-WYE CONNECTION -

**SECONDARY CONDUCTORS**

**23 KV SYSTEM**

**PRIMARIES CONDUCTORS**

- THREE PHASE WYE-WYE CONNECTION -
  13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA AND
  14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA
  SUBTRACTIVE POLARITY

**12 KV SYSTEM**

**PRIMARIES CONDUCTORS**

- THREE PHASE WYE-WYE CONNECTION -
  7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA
  208Y/120 VOLT THREE PHASE SERVICE
  SUBTRACTIVE POLARITY

**12 KV SYSTEM**

**PRIMARIES CONDUCTORS**

- THREE PHASE DELTA-WYE CONNECTION -

- THREE PHASE WYE-WYE CONNECTION -

**12 KV SYSTEM**

**PRIMARIES CONDUCTORS**

- THREE PHASE WYE-WYE CONNECTION -
  7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA
  208Y/120 VOLT THREE PHASE SERVICE
  ADDITIVE POLARITY

**SECONDARY CONDUCTORS**

- THREE PHASE WYE-WYE CONNECTION -
  13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA AND
  14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA
  SUBTRACTIVE POLARITY
DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -

480/277 THREE-PHASE FOUR-WIRE SERVICES

12 KV SYSTEM

12470/7200 TO 277 VOLT CONVENTIONAL TRANSFORMERS
480Y/277 VOLT THREE-PHASE FOUR-WIRE SERVICE
-ADDITIVE POLARITY-

23 KV SYSTEM

13200/22860 TO 277 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 277 VOLT CONVENTIONAL TRANSFORMERS
480Y/277 VOLT THREE-PHASE FOUR-WIRE SERVICE
-SUBTRACTIVE POLARITY-
14400/24940Y TO 600 VOLT CONVENTIONAL TRANSFORMERS

-THREE PHASE DELTA-DELTA CONNECTION-

600 VOLT THREE-PHASE THREE-WIRE SERVICE

NOTES:

- DO NOT GROUND PRIMARY NEUTRAL OF TRANSFORMER BANK

DISTRIBUTION TRANSFORMER CONNECTIONS

- SUBTRACTIVE POLARITY -

600 VOLT THREE-PHASE THREE WIRE SERVICE
12 KV SYSTEM

-THREE PHASE OPEN-WYE OPEN-DELTA CONNECTION-
7200/12470Y TO 240/480 VOLT CONVENTIONAL TRANSFORMERS - 100 KVA AND LESS
480 VOLT THREE-PHASE FOUR-WIRE SERVICE
-ADDITIVE POLARITY-

CAUTION: NO LOAD TO BE CONNECTED BETWEEN THE POWER LEG AND NEUTRAL

23 KV SYSTEM

-THREE PHASE OPEN-WYE OPEN-DELTA CONNECTION-
14400/24940Y TO 240/480 VOLT CONVENTIONAL TRANSFORMERS
480 VOLT THREE-PHASE FOUR-WIRE SERVICE
-SUBTRACTIVE POLARITY-

CAUTION: NO LOAD TO BE CONNECTED BETWEEN THE POWER LEG AND NEUTRAL
PRIMARY CONDUCTORS

23 KV SYSTEM

- SUBTRACTIVE POLARITY -

4160Y/2400VOLTHREE-PHASE FOUR-WIRE SERVICE

14400/24940Y TO 2400/4160VOLT CONVENTIONAL TRANSFORMERS

- THREE PHASE WYE-WYE CONNECTION -

SECONDARY CONDUCTORS

- THREE PHASE DELTA-WYE CONNECTION -

14400/24940Y TO 2400/4160VOLT CONVENTIONAL TRANSFORMERS

- SUBTRACTIVE POLARITY -

12 KV SYSTEM

- ADDITIVE POLARITY -

7200/12470Y TO 2400/4160VOLT CONVENTIONAL TRANSFORMERS

- THREE PHASE WYE-WYE CONNECTION -

12 KV SYSTEM

- THREE PHASE WYE-WYE CONNECTION -

DISTRIBUTION TRANSFORMER CONNECTIONS

- ADDITIVE AND SUBTRACTIVE POLARITY -

4160Y/2400 THREE-PHASE FOUR-WIRE SERVICES
OPERATING PROCEDURES FOR WYE-DELTA CONNECTED TRANSFORMER BANKS

WHEN ENERGIZING OR DE-ENERGIZING WYE-DELTA TRANSFORMER BANKS, THE BANK ARRESTERS MAY BE TEMPORARILY SUBJECTED TO 2.65 TIMES PHASE TO GROUND VOLTAGE, RESULTING IN ARRESTER FAILURE AND OTHER DAMAGES IF THE BANK IS NOT TEMPORARILY GROUNDED. NEWER, MOV ARRESTERS ARE MORE SUSCEPTIBLE TO THIS TYPE OF FAILURE THAN OLDER, SILICON CARBIDE ARRESTERS.

1. ENERGIZING WYE-DELTA BANK
   - INSTALL A TEMPORARY MECHANICAL GROUND OR CLOSE THE GROUNDING CUTOUT IF ONE EXISTS, ON THE TRANSFORMER BANK HIGH SIDE (FLOATING) NEUTRAL.
   - ENERGIZE THE TRANSFORMER BANK BY CLOSING ALL THREE PRIMARY CUTOUTS.
   - REMOVE TEMPORARY MECHANICAL GROUND OR OPEN THE GROUNDING CUTOUT IF ONE EXISTS.

2. DE-ENERGIZING WYE-DELTA BANK
   - INSTALL A TEMPORARY MECHANICAL GROUND OR CLOSE THE GROUNDING CUTOUT IF ONE EXISTS, ON THE TRANSFORMER BANK HIGH SIDE (FLOATING) NEUTRAL.
   - OPEN ALL PRIMARY CUTOUTS SERVING THE TRANSFORMER BANK.

3. PARTIAL POWER ON WYE-DELTA BANK (1 OR 2 CUTOUTS FOUND OPEN)
   - OPEN REMAINING PRIMARY CUTOUT(S).
   - INSTALL A TEMPORARY MECHANICAL GROUND OR CLOSE THE GROUNDING CUTOUT IF ONE EXISTS, ON THE TRANSFORMER BANK HIGH SIDE (FLOATING) NEUTRAL.
   - VISUALLY INSPECT TRANSFORMER BANK AND DETERMINE CAUSE OF TROUBLE.
   - AFTER TROUBLE HAS BEEN CORRECTED, RE-FUSE ALL PRIMARY CUTOUTS AND RE-ENERGIZE THE TRANSFORMER BANK BY CLOSING ALL THREE PRIMARY CUTOUTS.
   - REMOVE TEMPORARY MECHANICAL GROUND OR OPEN THE GROUNDING CUTOUT IF ONE EXISTS.

NOTES:
1. TEMPORARY MECHANICAL GROUND WILL NOT SERVE AS A PROTECTIVE GROUND. FOLLOW ALL APPLICABLE COMPANY SAFETY RULES FOR PROTECTIVE GROUNDING.
2. IF GROUNDING CUTOUT EXISTS, IT SHALL BE A 300-AMP SOLID-BLADE CUTOUT.
NOTES:
1. GROUNDING CUTOUT IS 300 AMP SOLID-BLADE.
2. SEE DWG. 06.15-01A FOR THE OPERATING PROCEDURES FOR WYE-DELTA CONNECTED TRANSFORMER BANKS.
3. THE GROUNDING CUTOUT SHALL BE OPEN DURING NORMAL OPERATION.
4. THE GROUNDING CUTOUT SHALL BE CLOSED DURING ENERGIZING OR DE-ENERGIZING A WYE-DELTA BANK.
5. THE GROUNDING CUTOUT WILL NOT SERVE AS A PROTECTIVE GROUND. FOLLOW ALL APPLICABLE COMPANY SAFETY RULES FOR PROTECTIVE GROUNDING.
6. GROUNDING CUTOUT MOUNTING BRACKET IS L-BRACKET (CN 311263).
7. MOUNT GROUNDING CUTOUT BRACKET WITH BOTTOM BOLT 4" ABOVE TOP BOLT OF TRANSFORMER HANGER.
8. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
CURRENT CHECK POINTS - A, B, C
VOLTAGE CHECK POINTS - A TO N, B TO N, C TO N

KVA = \frac{\text{CURRENT} \times \text{VOLTAGE (AN)} + \text{CURRENT} \times \text{VOLTAGE (BN)}}{1000}

TRANSFORMER A (LIGHTING TRANSFORMER)
KVA = \frac{\text{CURRENT} \times \text{VOLTAGE (BD)}}{1000}

TRANSFORMER C
KVA = \frac{\text{CURRENT} \times \text{VOLTAGE (CD)}}{1000}

TRANSFORMER A (LIGHTING TRANSFORMER)
KVA = \frac{\text{CURRENT} \times \text{VOLTAGE (AN)} + \text{CURRENT} \times \text{VOLTAGE (BN)}}{1000}

TRANSFORMER B
KVA = \frac{\text{CURRENT} \times \text{VOLTAGE (CD)}}{1000}

TRANSFORMER C
KVA = \frac{\text{CURRENT} \times \text{VOLTAGE (EF)}}{1000}

TRANSFORMER A (LIGHTING TRANSFORMER)
KVA = \frac{\text{CURRENT} \times \text{VOLTAGE (AN)} + \text{CURRENT} \times \text{VOLTAGE (BN)}}{1000}

TRANSFORMER B
KVA = \frac{\text{CURRENT} \times \text{VOLTAGE (CD)}}{1000}

TRANSFORMER C
KVA = \frac{\text{CURRENT} \times \text{VOLTAGE (EF)}}{1000}

NOTE: TRANSFORMERS USED IN A 480Y/277 BANK WILL HAVE 2 BUSHINGS INSTEAD OF 3 AS SHOWN ABOVE
**PROGRESS ENERGY STANDARD PROCEDURES BULLETIN**

**IDLE TRANSFORMERS**

**DEFINITION:**

An idle transformer is a transformer that is installed on the distribution system but is serving no useful purpose. There is no customer being served, no lights, no traffic signals. There is also no reasonable potential for serving a customer in the future. A transformer installed in a new underground development that is serving no customers but will in the future is not considered idle because it will be serving customers in the near future.

**EXAMPLES ARE AS FOLLOWS:**

1. A transformer that was used for temporary construction service is idle after the construction is completed and the transformer is no longer needed for construction service.

2. A transformer that served a residential customer is idle if the home is no longer occupied and there is no prospect of serving a customer at the same location.

3. A transformer bank that served a commercial/industrial customer is idle if the customer is no longer in business and the transformer bank is not needed for a potential new customer at the same location.

**ISSUES WITH IDLE TRANSFORMERS:**

There are several reasons why idle transformers should be removed from the system. One that is left energized experiences “no-load” core losses even when idle. These are annual losses. A 25 kVA transformer is estimated to have $35 of annual core losses. A 167 kVA transformer is estimated to have $200 of annual core losses. A transformer that is idle is a potential for vandalism, resulting in an environmental issue, an oil spill. There have been a number of spills due to vandalism of idle transformers and some of these required significant costs for cleanup.

A transformer that is idle is a potential hazard for criminals who would attempt to vandalize the units to steal copper. They will take extraordinary risks with no regard for their own safety or property of others.

Transformer costs have increased substantially since 2004 due to the rising costs of raw materials: copper, core steel, mineral oil. Costs will increase again significantly in January, 2010 as new Department of Energy (DOE) efficiency requirements are implemented. It is a significant financial benefit to the company to remove and re-use idle transformers versus buying new ones at significantly higher prices. Ones that have been removed and re-used do not have to meet the more stringent efficiency requirements of DOE.

**PROCEDURE:**

Any transformer that is idle but left on the pole shall be de-energized to save annual core losses. Transformers with no cutouts (CSP) shall have the hot line clamp removed from the primary and grounded to the system neutral. Transformers with cutouts may be de-energized by opening the cutout and removing the cutout barrel.

When a transformer has been de-energized, Asset Engineering shall be notified. Asset Engineering will evaluate and determine if the transformer should be removed and if so, prepare a work order to remove. Associated equipment (cutouts, arresters, service conductors, etc.) should be removed at the same time the transformer is removed.

For transformer banks serving commercial or industrial customers, contact with account managers will be required to determine if there is potential for future customers occupying a vacant facility.

Transformers that have been removed shall be placed in stock at the local storeroom, if the transformer is in good condition and is non-PCB. If not in good condition, or the PCB content is unknown, the transformer shall be returned to the Wildwood Transformer Shop where it will be evaluated, repaired, repainted and returned to stock, if possible.