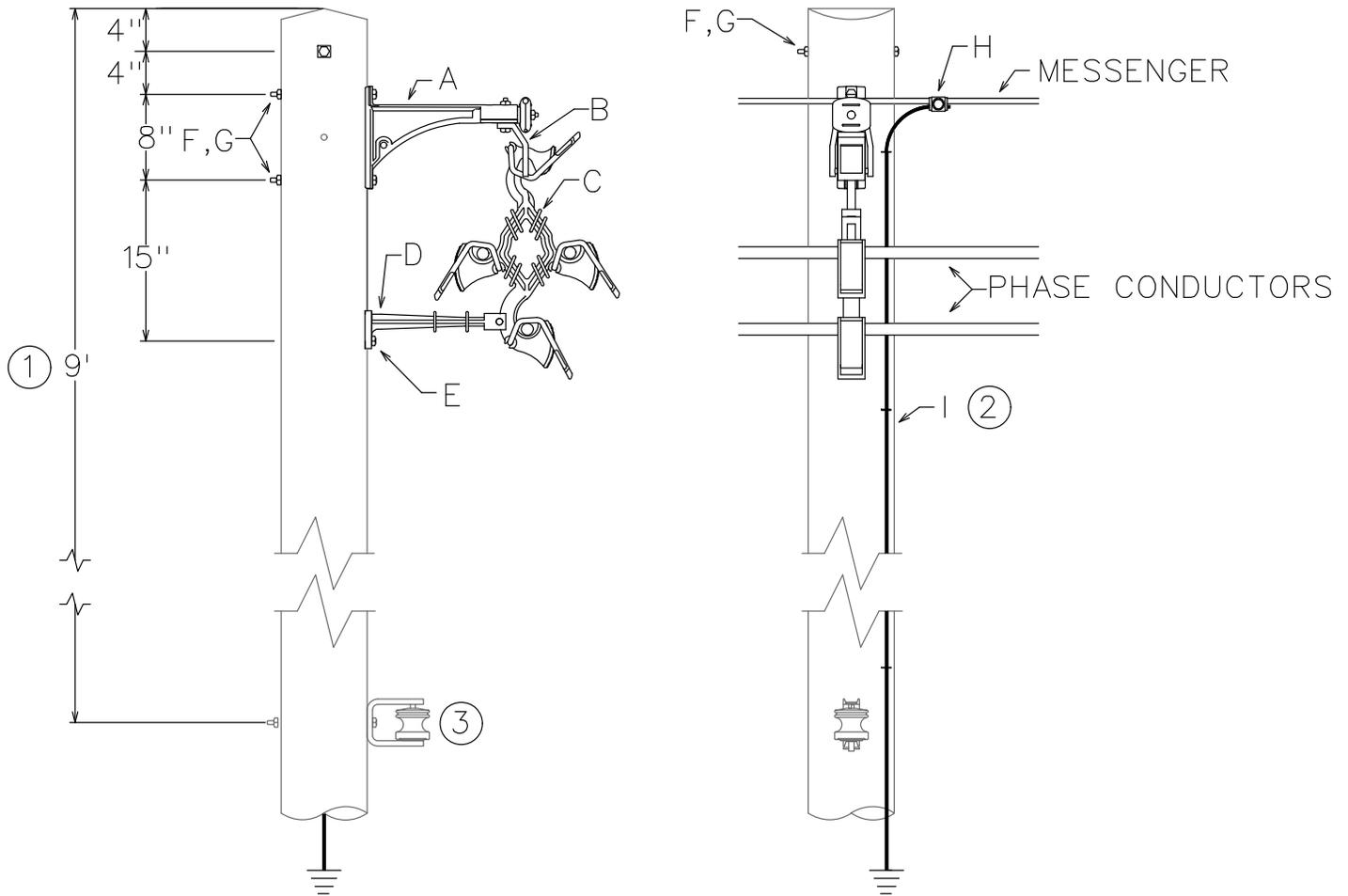


CONFIGURATIONS
15 KV & Below – Spacer Cable
Single Circuit – Tangent Structure

03 20 01 01

Sheet 1 of 1

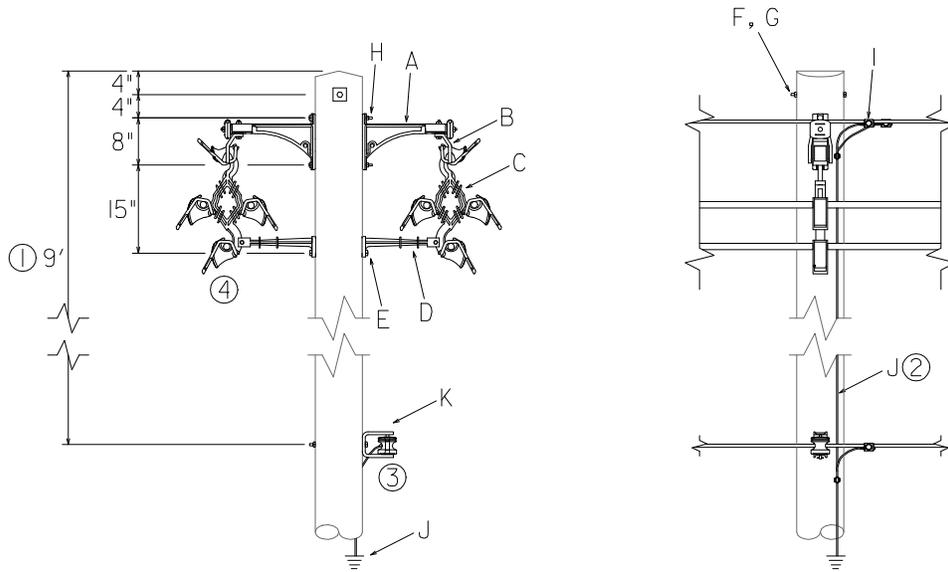


| | Std. / Stk. No. | Description | 03 20 01 01 | |
|----|-----------------|----------------------------|--|---|
| 2@ | A | 23 56 075 | Bracket, Messenger | 1 |
| | B | 23 06 124 | Stirrup, Spacer Support | 1 |
| | C | 23 67 334 | Spacer, High Density Polyethylene | 1 |
| | D | 23 06 123 | Bar, Anti-Sway | 1 |
| | E | 23 60 007 | Screw, Lag, Fetter Type, 1/2" x 4" | 1 |
| | F | 23 52 065 | Bolt, Machine, 5/8" x 12" (w/nut) | 3 |
| | G | 23 66 027 | Washer, Square 2- 1/4" x 2- 1/4" x 3/16" Thick | 3 |
| | H | 17 51 032 | Connector, PG, Pole Ground to Messenger | 1 |
| | I | 12 00 10 01 | 7#10 Grounding Unit | 1 |
| | 12 00 10 04 | #2 Cu. Poly Grounding Unit | 1 | |

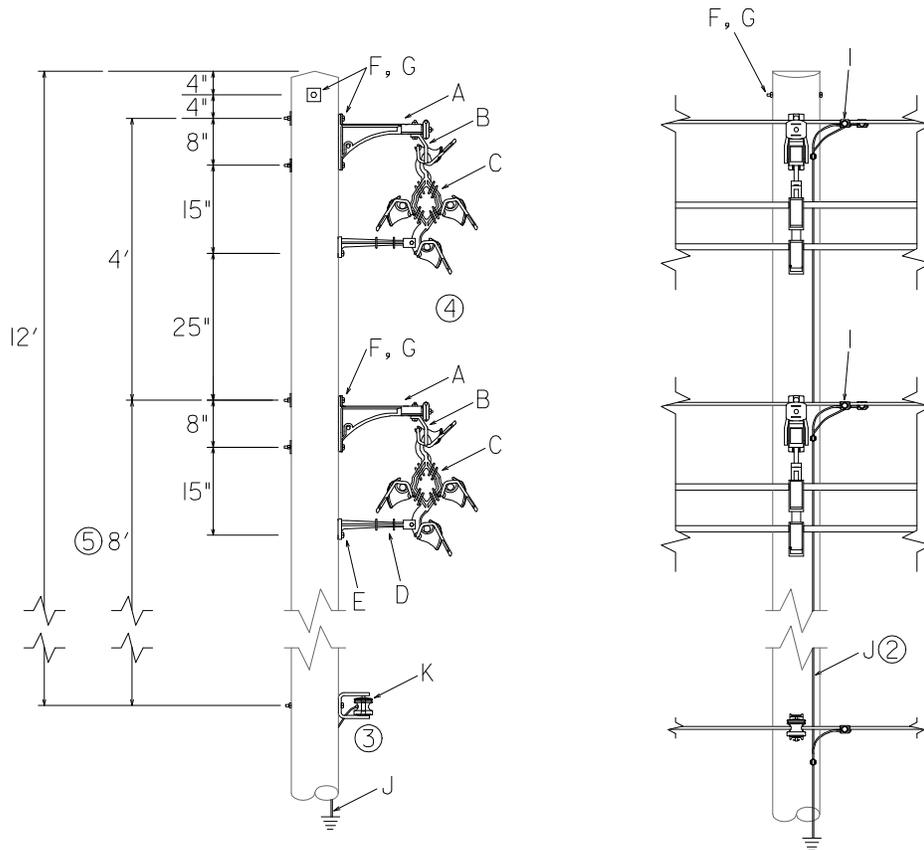
NOTES

1. This distance can be reduced to a minimum of 6ft if needed when replacing a pole in an existing line.
2. A pole ground is required on every spacer cable pole. Install a covered 7#10 pole ground if no equipment is being installed or install a covered #2 pole ground if the equipment being installed requires it such as a riser, recloser, etc.
3. Secondary location if present. Connect secondary neutral to pole ground.
4. See DCS 07 20 01 01 for spacer installation between poles.

01 - DOUBLE CIRCUIT TANGENT - BACK TO BACK CONFIGURATION



02 - DOUBLE CIRCUIT TANGENT - STACKED CONFIGURATION



CONFIGURATIONS
15kV & Below – Spacer Cable
Double Circuit – Tangent Structure

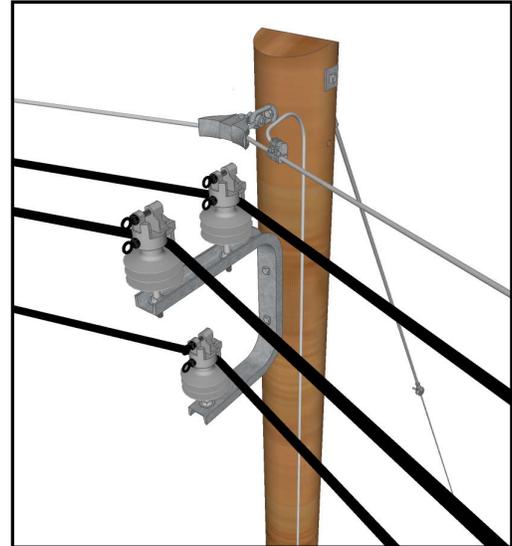
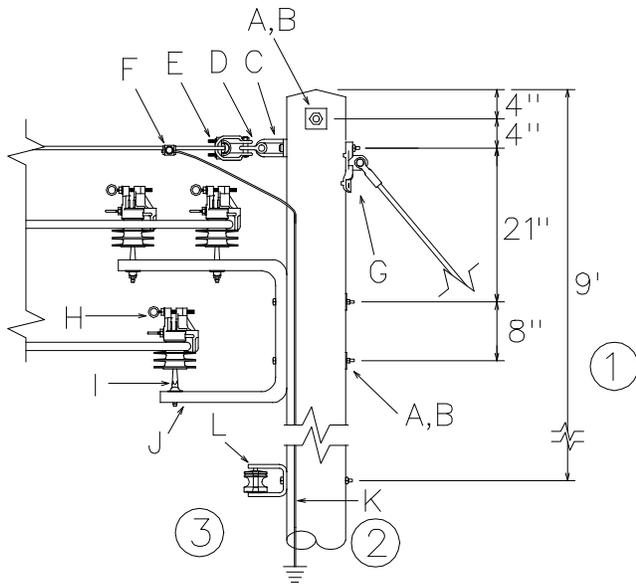
03 20 02 **

Sheet 2 of 2

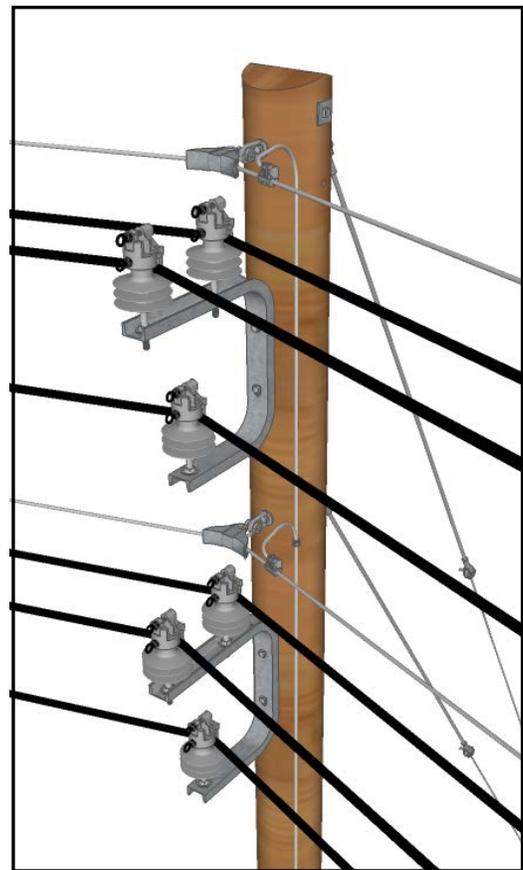
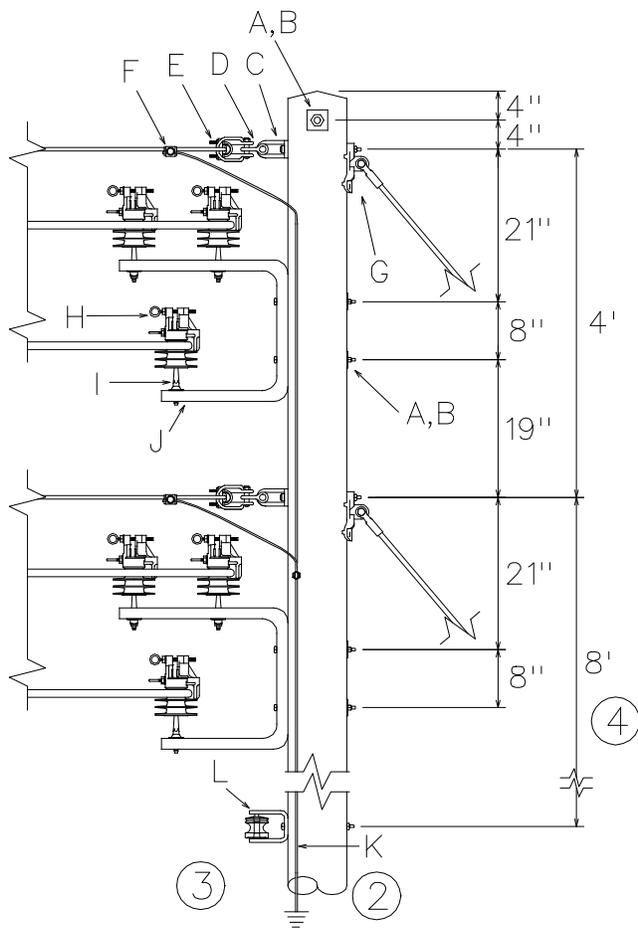
| | | Std. / Stk. No. | Description | 03 20 02 ** | 01 | 02 |
|----|---|------------------------|---|--------------------|-----------|-----------|
| | A | 23 56 075 | Bracket, Messenger | | 2 | 2 |
| | B | 23 06 124 | Stirrup, Spacer Support | | 2 | 2 |
| | C | 23 67 334 | Spacer, High Density Polyethylene | | 2 | 2 |
| | D | 23 06 123 | Bar, Anti-Sway | | 2 | 2 |
| | E | 23 60 007 | Screw, Lag, Fetter Type, 1/2" x 4" | | 2 | 2 |
| | F | 23 52 065 | Bolt, Machine, 5/8" x 12" (w/ nut) | | 1 | 5 |
| | G | 23 66 027 | Washer, Square 2-1/4" x 2-1/4" x 3/16" Thick | | 2 | 6 |
| | H | 23 52 066 | Bolt, Machine, 5/8" x 14" (w/ nut) | | 2 | |
| | I | 17 51 137 | Clamp, Parallel Groove, Aluminum – Messenger to pole ground | | 2 | 2 |
| 2@ | J | 12 00 10 01 | Grounding Unit, 7#10 Copperweld | | 1 | 1 |
| | | 12 00 10 04 | Grounding Unit, #2 Cu. Poly | | 1 | 1 |
| @ | K | 03 01 01 ** | Neutral Configuration | | | |

NOTES

1. The distance can be reduced to a minimum of 6ft if needed when replacing a pole in an existing line.
2. A pole ground is required on every spacer cable pole. Install a covered 7#10 pole ground if no equipment is being installed or install a covered #2 pole ground if the equipment being installed requires it such as a riser, recloser, etc.
3. Secondary location if present. Connect secondary neutral to pole ground.
4. See DCS 07 20 01 01 for spacer installation between poles.
5. The distance can be reduced to a minimum of 5 ft. If approved by Engineering.



03 20 03 01 - SINGLE CIRCUIT



03 20 03 02 - DOUBLE CIRCUIT

CONFIGURATIONS
4-15 kV Spacer Cable
Angle Structure 7° – 60°

03 20 03 **

Sheet 2 of 2

| | | Std. / Stk. No. | Description | 03 20 03 ** | 01 | 02 |
|---|---|------------------------|--|--------------------|-----------|-----------|
| | A | 23 52 066 | Bolt, Machine, 5/8" x 14" (w/ nut) | | 3 | 5 |
| | B | 23 66 027 | Washer, Square, 2-1/4" x 2-1/4" x 3/16" | | 4 | 6 |
| | C | 23 59 095 | Eyelet, NM, STD, 3/4" | | 1 | 2 |
| | D | 23 68 181 | Shackle, Anchor, 9/16" | | 1 | 2 |
| | E | 23 18 342 | Clamp, Suspension | | 1 | 2 |
| | F | 17 51 137 | Connector, PG, Pole Ground to Messenger | | 1 | 2 |
| @ | G | 11 00 42 ** | Guying Unit w/ FG Strain Insulator & HD Guy Hook | | 1 | 2 |
| | H | 25 05 143 | Insulator, Pin, 15 kV, Vise-Top | | 3 | 6 |
| | I | 23 62 151 | Pin, Insulator, 1" Thread, Short Shank, 5/8" | | 3 | 6 |
| | J | 23 56 073 | Bracket, Angle, Insulator Support | | 1 | 2 |
| @ | K | 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 | 1 |
| @ | L | 03 01 01 ** | Neutral Configuration | | | |

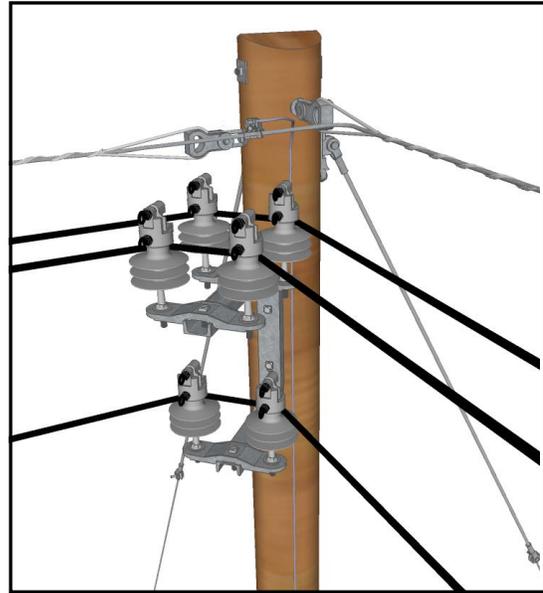
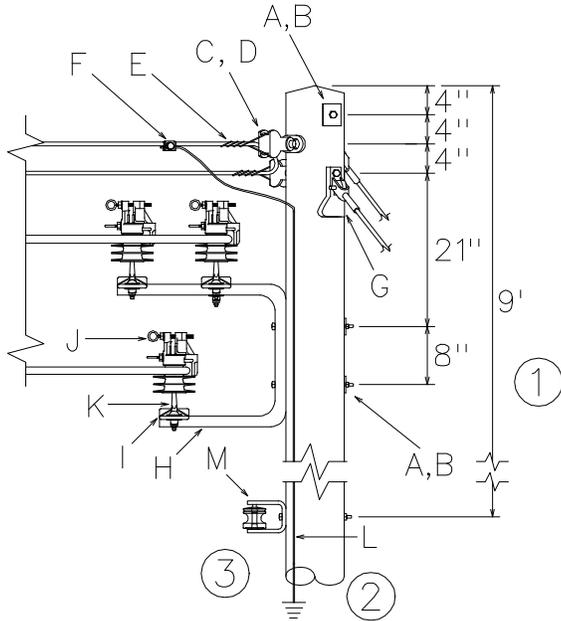
NOTES

1. The distance can be reduced to a minimum of 6ft if needed when replacing a pole in an existing line.
2. A pole ground is required on every spacer cable pole. Install a covered 7#10 pole ground if no equipment is being installed or install a covered #2 pole ground if the equipment being installed requires it such as a riser, recloser, etc.
3. Secondary location if present. Connect secondary neutral to pole ground.
4. The distance can be reduced to a minimum of 5ft. if approved by Engineering.

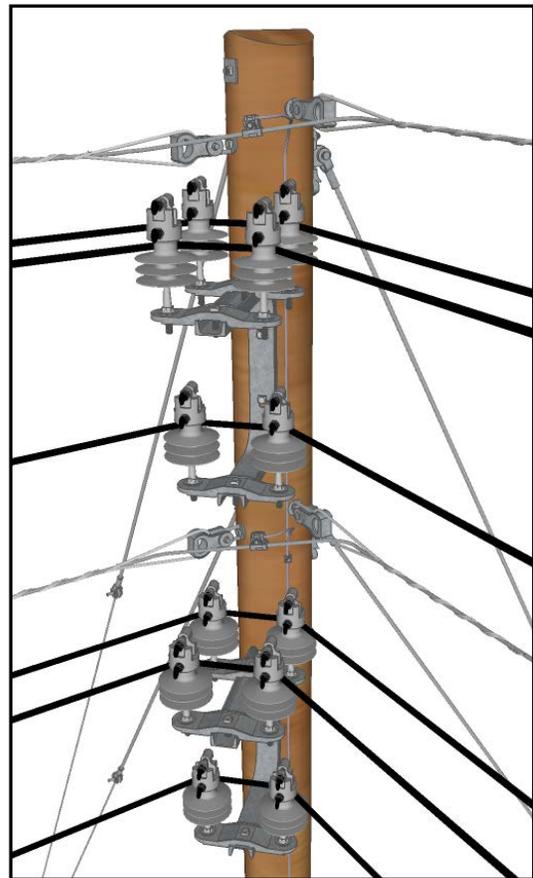
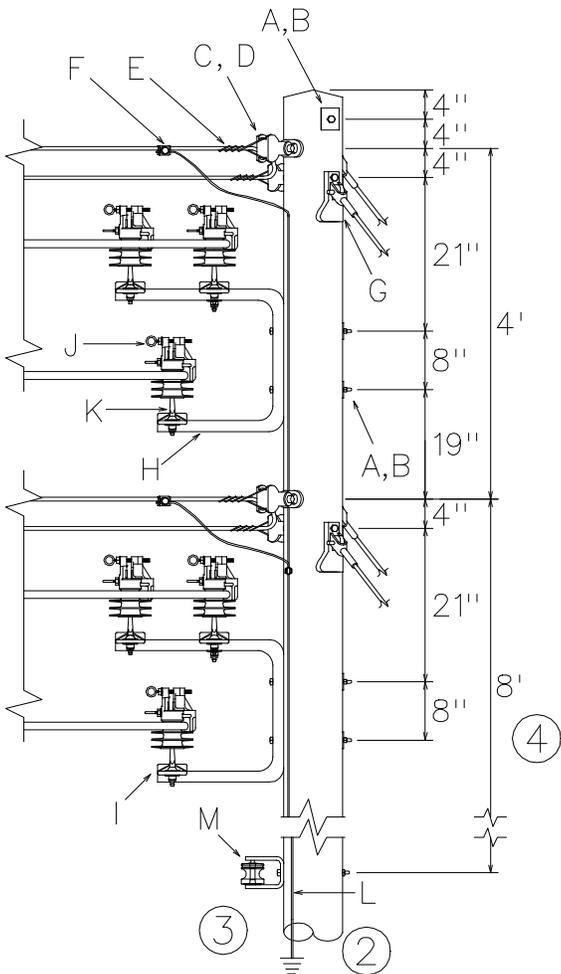
CONFIGURATIONS
 4-15 kV Spacer Cable
 Angle Structure 61° and ≤90°

03 20 04 **

Sheet 1 of 2



03 20 04 01 - SINGLE CIRCUIT



03 20 04 02 - DOUBLE CIRCUIT

CONFIGURATIONS
4-15 kV Spacer Cable
Angle Structure 61° and ≤90°

03 20 04 **

Sheet 2 of 2

| | | Std. / Stk. No. | Description | 03 20 04 ** | 01 | 02 |
|---|---|------------------------|---|--------------------|-----------|-----------|
| | A | 23 52 066 | Bolt, Machine, 5/8" x 14" (w/ nut) | | 3 | 5 |
| | B | 23 66 027 | Washer, Square, 2-1/4" x 2-1/4" x 3/16" | | 4 | 6 |
| | C | 23 59 095 | Eyelet, NM, STD, 3/4" | | 2 | 4 |
| | D | 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | | 2 | 4 |
| | E | 23 68 713 | Grip, Messenger/ Neutral, Preformed 7#6 - 052 AWA | | 2 | 4 |
| | F | 17 51 137 | Connector, PG, Pole Ground to Messenger | | 1 | 2 |
| @ | G | 11 00 42 ** | Guying Unit w/ Fiberglass Insulator & HD Guy Hook | | 2 | 4 |
| | H | 23 56 073 | Bracket, Angle, Insulator Support | | 1 | 2 |
| | I | 23 67 384 | Plate, Mounting, Dbl Pin Insulator | | 3 | 6 |
| | J | 25 05 143 | Insulator, Pin, 15kV, Vise-Top | | 6 | 12 |
| | K | 23 62 151 | Pin, Insulator, 1" Thread, Short Shank, 5/8" | | 6 | 12 |
| @ | L | 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 | 1 |
| @ | M | 03 01 01 ** | Neutral Configuration | | | |

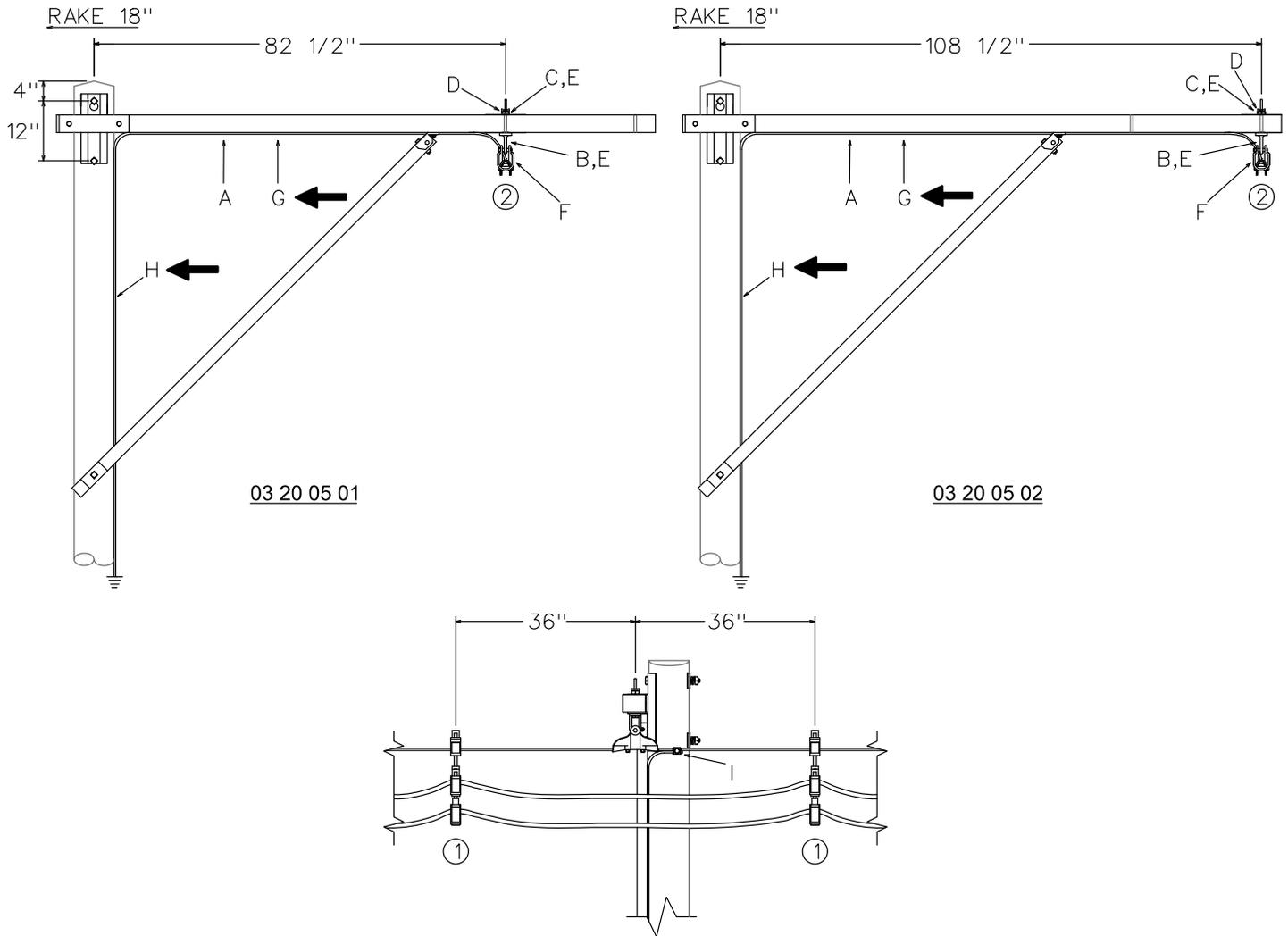
NOTES

1. The distance can be reduced to a minimum of 6ft if needed when replacing a pole in an existing line.
2. A pole ground is required on every spacer cable pole. Install a covered 7#10 pole ground if no equipment is being installed or install a covered #2 pole ground if the equipment being installed requires it such as a riser, recloser, etc.
3. Secondary location if present. Connect secondary neutral to pole ground.
4. The distance can be reduced to a minimum of 5ft. if approved by Engineering.

CONFIGURATIONS
15kV & Below – Spacer Cable
Single Circuit – Tangent Structure – Alley Arm Configuration

03 20 05 **

Sheet 1 of 1

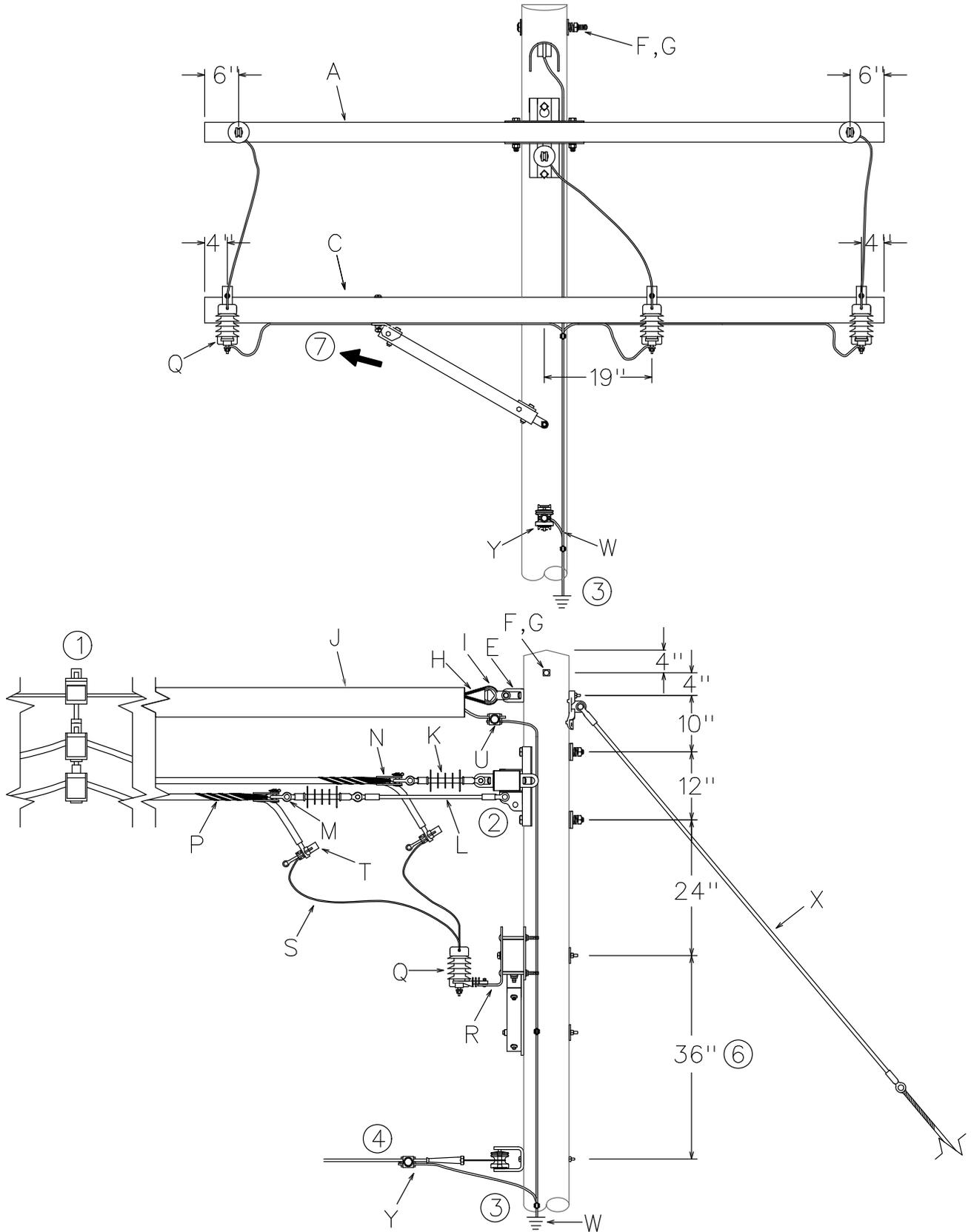


| | Std. / Stk. No. | Description | 03 20 05 ** | 01 | 02 |
|-----|-----------------|--|-------------|----|----|
| A | 04 00 41 18 | 10' FG Alley Arm Assembly | | 1 | 1 |
| B | 23 59 005 | Eyelet, NM, 5/8" | | 1 | 1 |
| C | 23 52 061 | Bolt, Mach., 5/8" x 8" | | 1 | 1 |
| D | 23 65 043 | Nut, Lock, 5/8" | | 1 | 1 |
| E | 23 66 132 | Washer, Square, Galv. 4" x 4" x 3/16" w/ 13/16" hole | | 2 | 2 |
| F | 23 18 342 | Clamp, Suspension (conductor Range: 0.312" – 0.62") | | 1 | 1 |
| G | 23 68 746 | Clip, Electrical, Grd. | | 1 | 1 |
| @ H | 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 | 1 |
| I | 17 51 032 | Connector, PG, Pole Ground to Messenger | | 1 | 1 |

NOTES

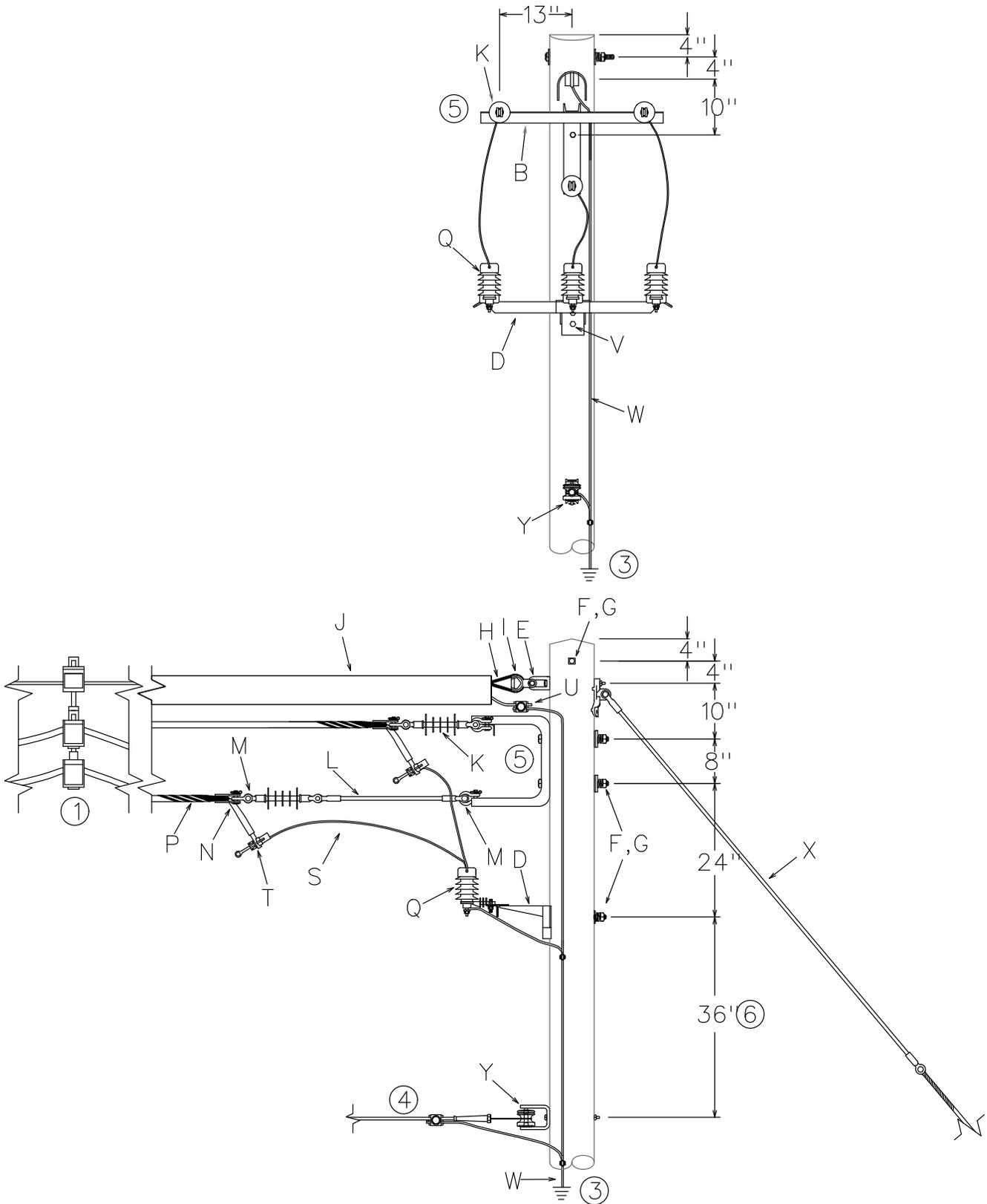
1. Install spacers 3' from crossarm in each direction. See DCS **07 20 01 01** for spacer installation between poles.
2. Vertical load limited to 1500 lbs. Max spans are: 1/0 span = 258', 477 span = 167', and 795 span = 132'.

CONFIGURATIONS
 15 kV & Below – Spacer Cable
 Single Circuit – Dead End Structure



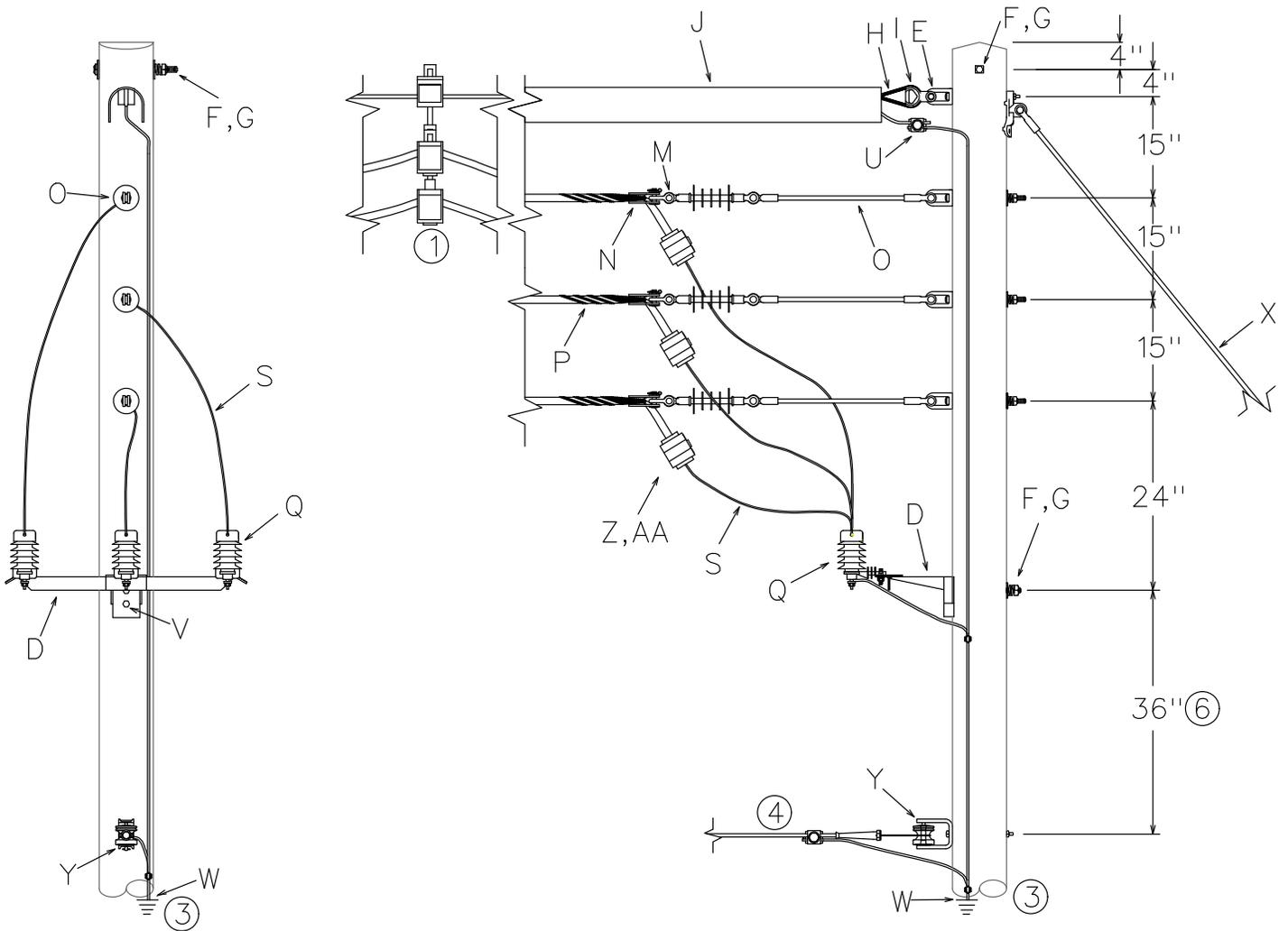
01 - DE ON FG CROSSARM - PREFERRED

CONFIGURATIONS
 15 kV & Below – Spacer Cable
 Single Circuit – Dead End Structure



02 - DE ON SPACER CABLE BRACKET

CONFIGURATIONS
 15 kV & Below – Spacer Cable
 Single Circuit – Dead End Structure



03 - VERTICAL DE ON POLE - LIMITED USE

CONFIGURATIONS
15 kV & Below – Spacer Cable
Single Circuit – Dead End Structure

03 20 10 **

Sheet 4 of 4

| | Std. / Stk. No. | Description | 03 20 10 ** | 01 | 02 | 03 |
|------|------------------------|---|--------------------|-----------|-----------|-----------|
| | A 04 00 41 04 | Deadend Assy., FG Arm, 10' | | 1 | | |
| | B 23 56 114 | Spacer Cable Dead End Bracket | | | 1 | |
| | C 04 00 20 03 | Crossarm, Sgl., Wood, 10' (use only 1/2 of V-Brace) | | 1 | | |
| | D 17 08 057 | Bracket, Mounting, Arrester | | | 1 | 1 |
| | E 23 59 095 | Eyelet, NM, STD 3/4" | | 1 | 1 | 1 |
| | F 23 52 065 | Bolt, Mach., 5/8" x 12" | | 1 | 4 | 2 |
| | G 23 66 027 | Washer, Square, 2-1/4" x 2-1/4" x 3/16" | | 2 | 5 | 3 |
| | H 23 68 713 | Grip, Messenger/ Neutral, Preformed 7#6 – 052AWA | | 1 | 1 | 1 |
| | I 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | | 1 | 1 | 1 |
| | J 69 58 293 | Line Duc Cover – (Messenger Cover), Black, 8' Long (Each) | | 1 | 1 | 1 |
| | K 25 06 052 | Insulator, Suspension, 15kV, Poly | | 3 | 3 | |
| | L 25 56 076 | Insulator, Guy Strain, Fiberglass, 26", 15kV | | 1 | 1 | |
| | M 23 68 181 | Shackle – Anchor, 9/16" | | 3 | 6 | 3 |
| | N 23 58 122 | Clevis, Thimble, 7/8" Opening, Galvanized Steel | | 3 | 3 | 3 |
| | O 06 12 30 01 | Deadend on Pole with FG Ext. | | | | 3 |
| @ | P 23 68 701 | Grip, Conductor Deadend, 15kV, 477 Spacer Cable | | 3 | 3 | 3 |
| | | Size Grip per Existing Spacer Cable Conductor (See 07 20 11 00) | | 3 | 3 | 3 |
| @ | Q 10 01 144 | Arrester, 10kV w/ Protective Cap | | 3 | 3 | 3 |
| | 10 01 133 | Arrester, 3kV w/ Protective Cap | | 3 | 3 | 3 |
| | R 17 58 054 | Bracket, Switch/ Arrester Mounting | | 3 | | |
| | S 18 51 021 | Wire, Poly #6 Cu., (FT.) | | 15 | 15 | 15 |
| @ | T 17 62 088 | Clamp, Hot Line, 1/0 Through 477 Spacer Cable | | 3 | 3 | |
| | 17 62 143 | Clamp, Hot Line, 795 Spacer Cable | | 3 | 3 | |
| | U 17 51 137 | Connector, PG, Pole Ground to Messenger | | 1 | 1 | 1 |
| 4,3@ | V 23 60 007 | Lag, Square Head, Galvanized, 1/2" x 4" | | | 1 | 1 |
| | W 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 | 1 | 1 |
| @ | X 11 00 42 ** | Guying Unit with FG Strain Insulator & HD Guy Hook | | | | |
| @ | Y 03 01 01 ** | Neutral Configuration | | | | |
| | Z 17 51 139 | PG Clamp | | | | 3 |
| | AA 38 51 608 | Cover | | | | 3 |

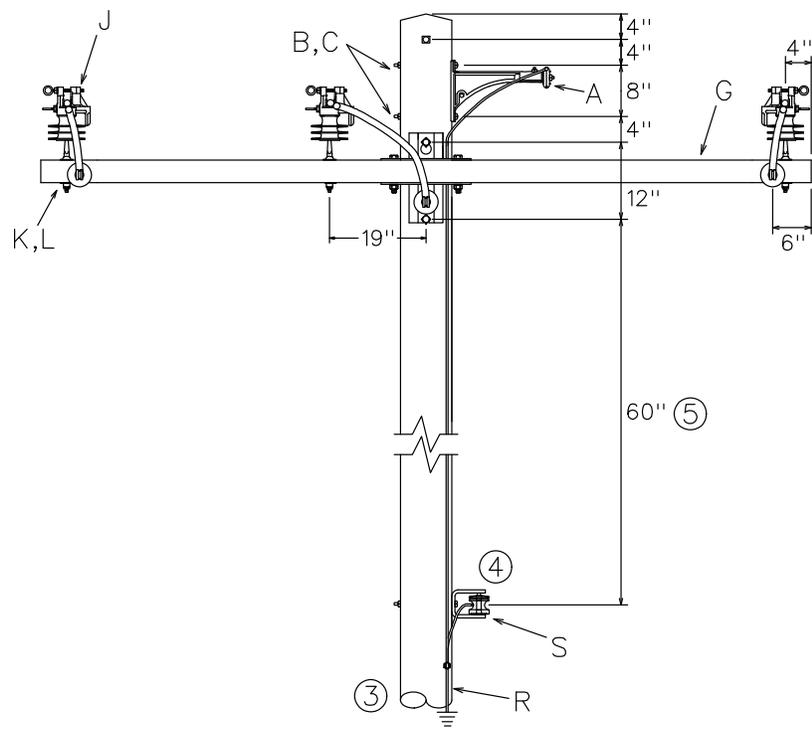
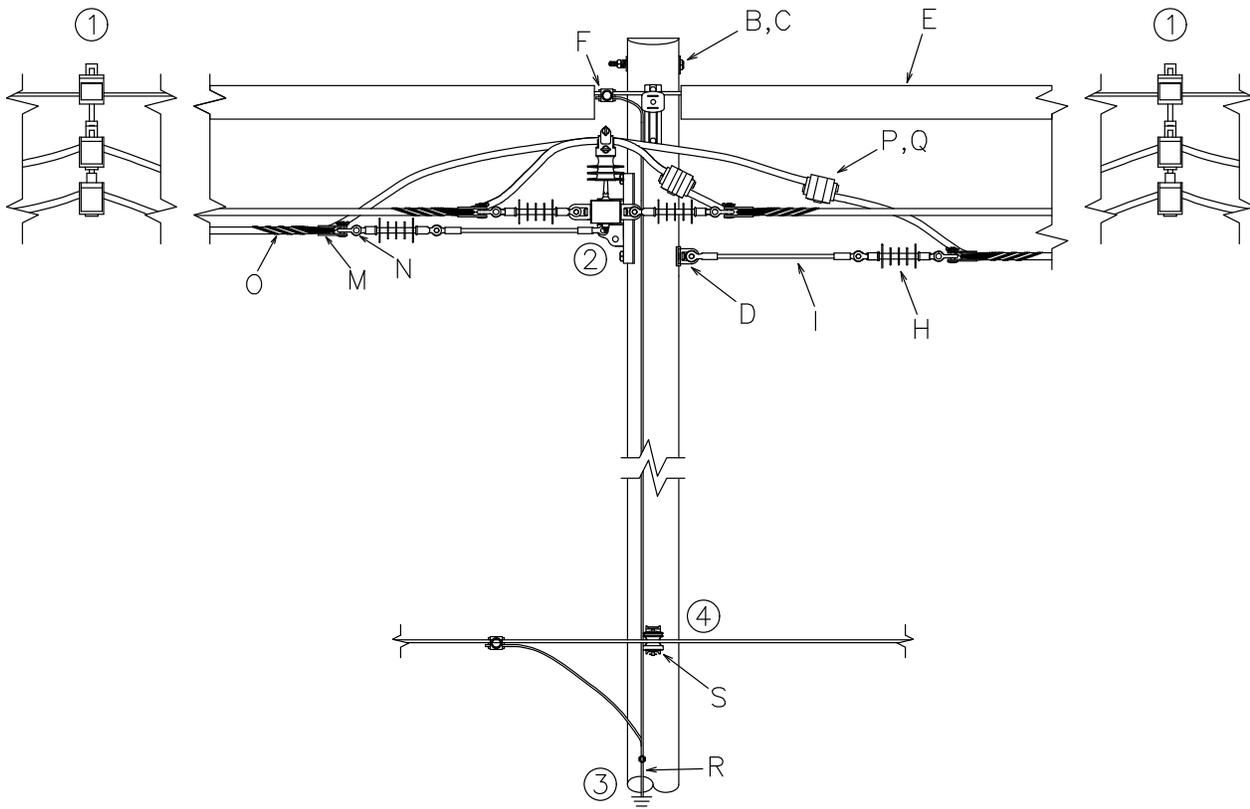
NOTES:

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS **07 20 01 01** for space installation between poles.
2. Install the center phase of the spacer cable with Fiberglass Strain Insulator into the top hole on the DE arm.
3. Use DCS **12 00 10 01** ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Only use 03 20 10 02 when extending the line with open wire is unlikely or when required by clearance restrictions.
6. Distance may be reduced to 24" if approved by Engineering.
7. For installations on a composite pole, substitute a fiberglass crossarm, Stock #41 01 285, in place of the wood arm. Use electrical ground clips, stock #23 68 746, to attach the ground wire to the bottom of the fiberglass crossarm.

CONFIGURATIONS
 15 kV & Below Spacer Cable
 Three Phase Loopover – Spacer Cable to Spacer Cable

03 20 15 **

Sheet 1 of 3

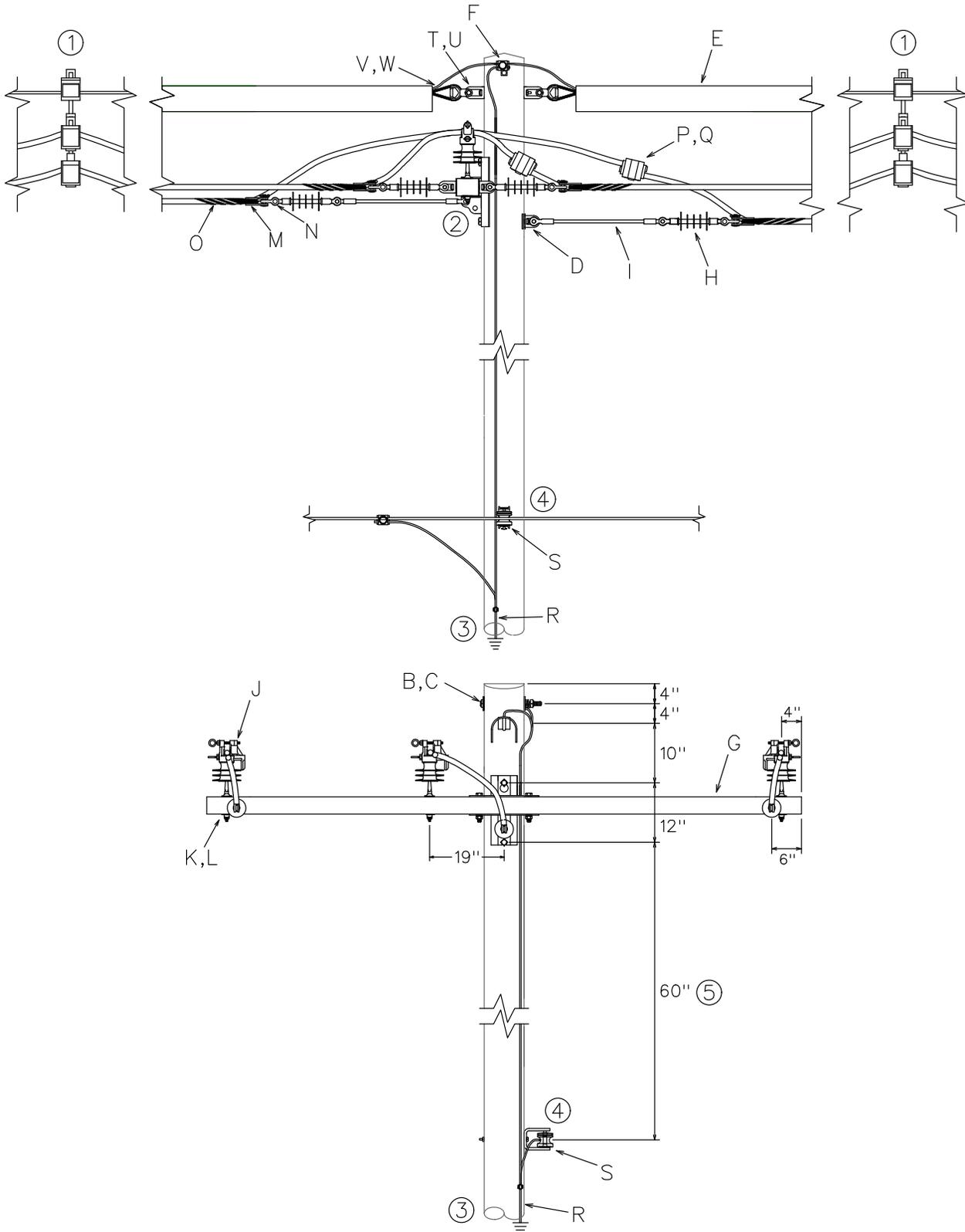


01 - TANGENT MESSENGER

CONFIGURATIONS
 15 kV & Below Spacer Cable
 Three Phase Loopover – Spacer Cable to Spacer Cable

03 20 15 **

Sheet 2 of 3



02 - DOUBLE DEADEND MESSENGER

CONFIGURATIONS
15 kV & Below Spacer Cable
Three Phase Loopover – Spacer Cable to Spacer Cable

03 20 15 **

Sheet 3 of 3

| | Std. / Stk. No. | Description | 03 20 15 ** | 01 | 02 |
|---|------------------------|---|--------------------|-----------|-----------|
| | A 23 56 075 | Bracket, Messenger | | 1 | |
| | B 23 52 065 | Bolt, Machine, 5/8" x 12" (w/ nut) | | 3 | 1 |
| | C 23 66 027 | Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick | | 4 | 2 |
| | D 23 65 018 | Eyenuit, 3/4", Galvanized Steel | | 1 | 2 |
| | E 69 58 293 | Line Duc (Messenger Cover), Black, 8' Long (Each) | | 2 | 2 |
| | F 17 51 137 | Connector, PG, Pole Ground to Messenger | | 1 | 1 |
| | G 04 00 41 04 | Crossarm, Deadend, F/G, 10' | | 1 | 1 |
| | H 25 06 052 | Insulator, Suspension, 15kV, Poly | | 6 | 6 |
| | I 25 56 076 | Insulator, Strain, Fiberglass, 26", 15kV | | 2 | 2 |
| | J 25 05 143 | Insulator, Pin, 15kV, Vise-Top | | 3 | 3 |
| | K 23 62 028 | Pin, Insulator, Long Shank | | 3 | 3 |
| | L 23 66 132 | Washer, Flat, Sq., 4" x 4", w/ 13/16" hole | | 3 | 3 |
| | M 23 58 122 | Clevis, Thimble, 7/8" opening, Galvanized Steel | | 6 | 6 |
| | N 23 68 181 | Shackle – Anchor, 9/16" | | 6 | 6 |
| @ | O 23 68 701 | Grip, Conductor Deadend, 15kV, New 477 Spacer Cable (See 07 20 11 00) | | 6 | 6 |
| | | Size Grip per Existing Spacer Cable Conductor | | 6 | 6 |
| @ | P PG*W | Clamp, Parallel Groove (See 07 00 25 00) | | 3 | 3 |
| | Q 38 51 608 | Cover, Large, Vice Type Connectors | | 3 | 3 |
| @ | R 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 | 1 |
| @ | S 03 01 01 ** | Neutral Configuration | | | |
| | T 23 59 095 | Eyelet, 3/4", Galvanized Steel | | | 1 |
| | U 23 52 097 | Bolt, 3/4" x 12" | | | 1 |
| | V 23 68 713 | Grip Messenger/Neutral, Preformed – 052 AWA | | | 2 |
| | W 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | | | 2 |

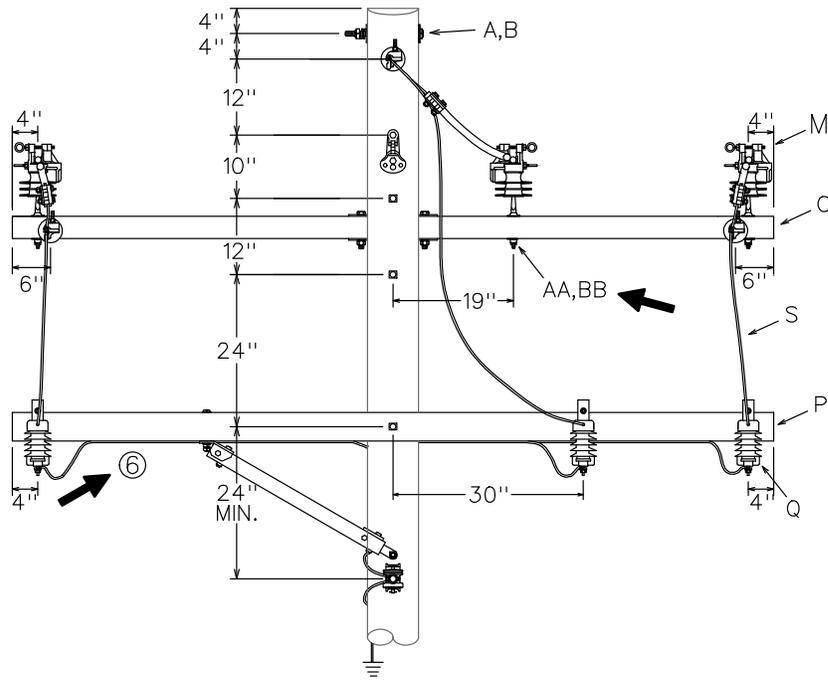
NOTES

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS **07 20 01 01** for spacing installation between poles.
2. Install the center phase of the spacer cable with fiberglass strain insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.
3. Use DCS **12 00 10 01** ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. This distance can be reduced to 40 inches if approved by engineering.

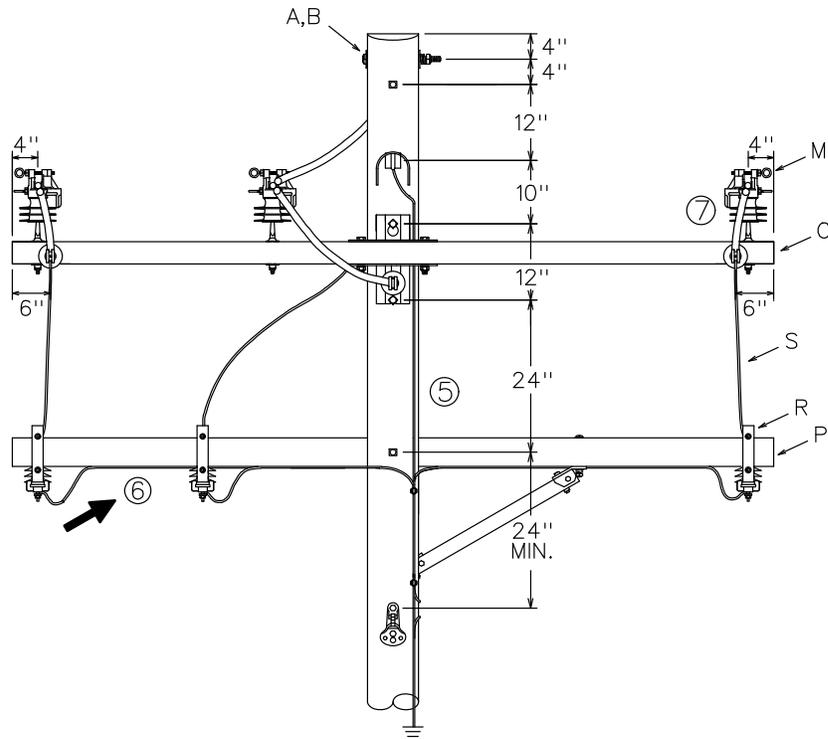
CONFIGURATIONS
 15 kV & Below – Spacer Cable
 Three Phase Loopover – Spacer Cable to Open Wire

03 20 20 01

Sheet 1 of 3



OPEN WIRE SIDE

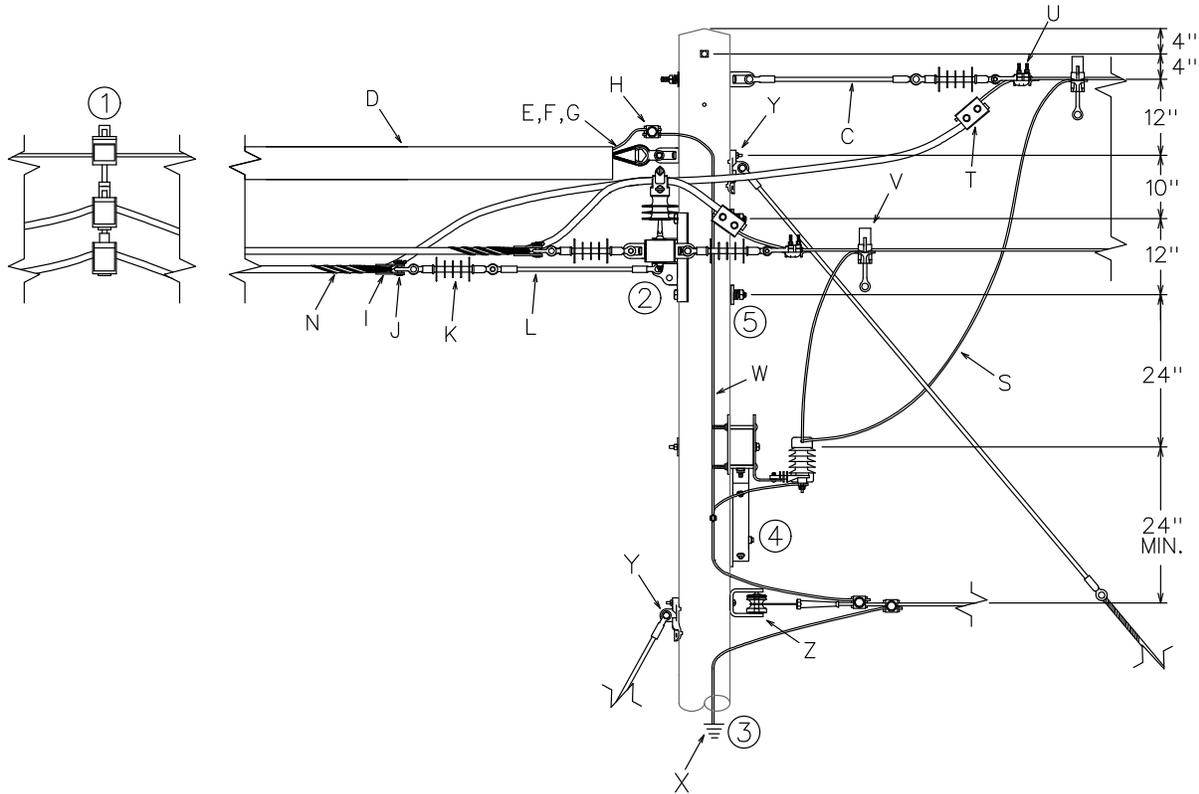


SPACER CABLE SIDE

CONFIGURATIONS
 15 kV & Below – Spacer Cable
 Three Phase Loopover – Spacer Cable to Open Wire

03 20 20 01

Sheet 2 of 3



| | Std. / Stk. No. | Description | 03 20 20 01 | 01 |
|---|----------------------|---|-------------|----|
| | A 23 52 065 | Bolt, 5/8" x 12" | | 1 |
| | B 23 66 027 | Washer, Square, 2-1/4" | | 2 |
| | C 06 12 30 01 | Deadend on Pole w/ FG Extension | | 1 |
| | D 69 58 293 | Line Duc (Messenger Cover), Black. 8' Long (Each) | | 1 |
| | E 23 68 713 | Grip, Messenger/Neutral, Preformed for - 052 AWA | | 1 |
| | F 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | | 1 |
| | G 23 59 095 | Eyelet, NM, Thimble, 3/4", Galvanized Steel | | 1 |
| | H 17 51 137 | Clamp, PG - Messenger to Open Wire Neutral | | 2 |
| | I 23 58 122 | Clevis, Thimble, 7/8" opening, Galvanized Steel | | 3 |
| | J 23 68 181 | Shackle - Anchor, 9/16" | | 3 |
| | K 25 06 052 | Insulator, Suspension, 15kV, Poly | | 5 |
| | L 25 56 076 | Insulator, Strain, Fiberglass, 26" | | 1 |
| | M 25 05 143 | Insulator, Pin, 15kV, Vise-Top | | 3 |
| @ | N 23 68 701 | Grip, Conductor Deadend, 15kV, New 477 Spacer Cable | | 3 |
| | | Size Grip per existing Spacer Cable Conductor (See 07 20 11 00) | | 3 |
| | O 04 00 41 04 | Crossarm, Deadend, F/G, 10' | | 1 |
| | P 04 00 20 03 | Crossarm, Sgl., Wood, 10', (use only 1/2 of V-Brace) | | 1 |

CONFIGURATIONS
 15 kV & Below – Spacer Cable
 Three Phase Loopover – Spacer Cable to Open Wire

03 20 20 01

Sheet 3 of 3

| | | | | |
|-----|----|--------------------|--|----|
| @ | Q | 10 01 144 | Arrester, 10kV w/ Protective Cap | 3 |
| | | 10 01 133 | Arrester, 3kV w/ Protective Cap | 3 |
| | R | 17 58 054 | Bracket, Switch/ Arrester Mounting | 3 |
| | S | 18 51 021 | Wire, Poly #6 Cu., (Ft.) | 15 |
| @ | T | PG* | Clamp, Parallel Groove (See 07 00 25 00) | 3 |
| @ | U | DEC*W | Clamp, Deadend | 3 |
| @ | V | HLC*W | Hot Line Clamp | 3 |
| | W | 18 51 019 | Wire, #2 Cu. Poly Covered (Ft.) | 15 |
| 3 @ | X | 12 00 10 ** | Grounding Unit, 7#10 Copperweld | 1 |
| @ | Y | 11 00 42 ** | Guying Unit with FG Strain Insulator & HD Guy Hook | |
| @ | Z | 03 01 01 ** | Neutral Configuration | |
| | AA | 23 62 028 | Pin, Insulator, Long Shank | 3 |
| | BB | 23 66 132 | Washer, Flat, Sq., 4" x 4" w/ 13/16" hole | 3 |

NOTES

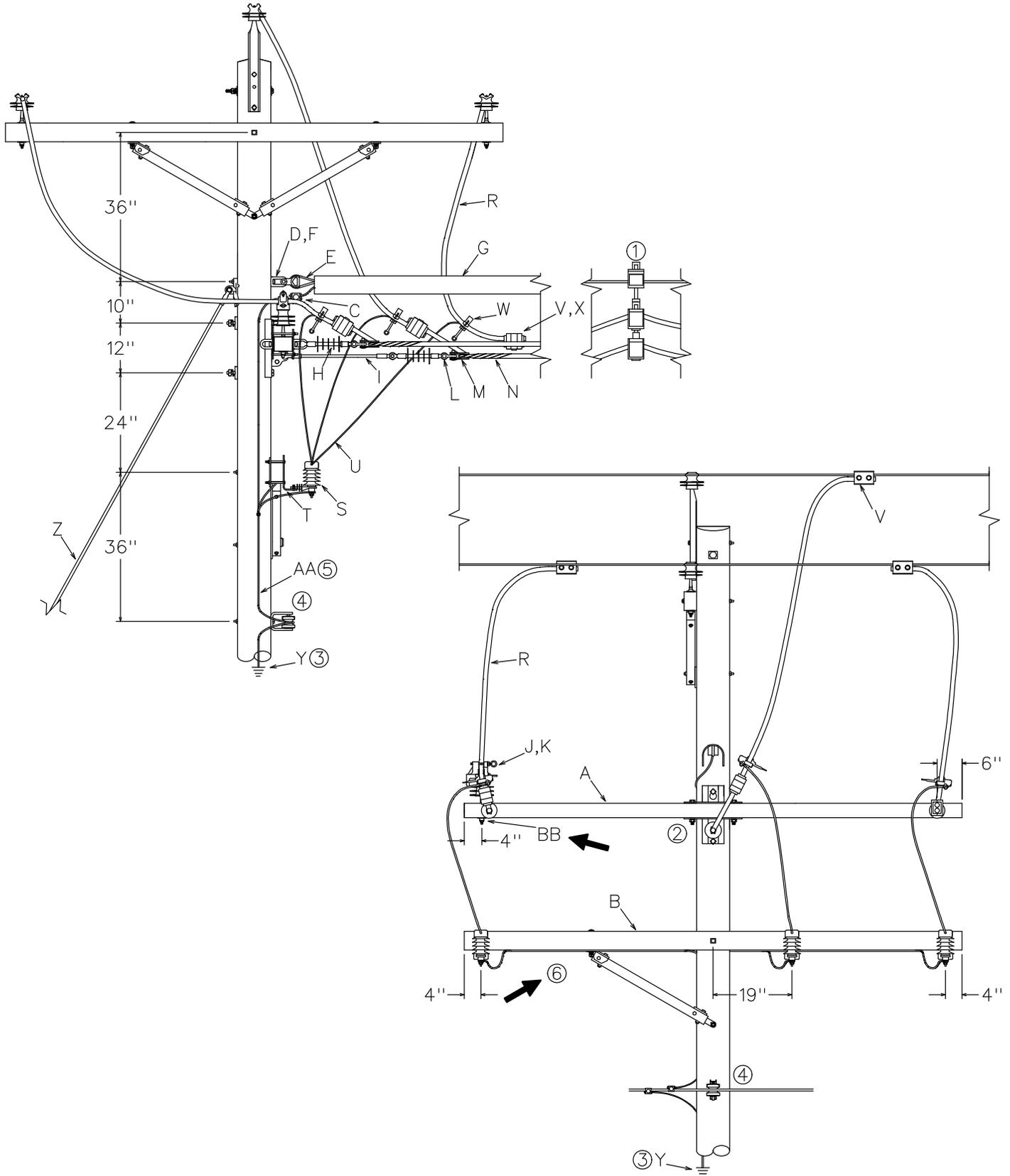
1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS **07 20 01 01** for spacing installation between poles.
2. Install the center phase of the space cable with fiberglass Strain Insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.
3. Use DCS **12 00 10 01** ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Extend #2 poly covered ground wire (18 51 019) from open wire neutral to the messenger.
6. For installations on a composite pole, substitute a fiberglass crossarm, Stock #41 01 285, in place of the wood arm. Use electrical ground clips, stock #23 68 746, to attach the ground wire to the bottom of the fiberglass crossarm.

CONFIGURATIONS

15 kV & Below – Spacer Cable Three Phase Tap From Open Wire

03 20 24 01

Sheet 1 of 2



CONFIGURATIONS
15 kV & Below – Spacer Cable
Three Phase Tap From Open Wire

03 20 24 01

Sheet 2 of 2

| | Std./Stk. No. | Description | 03 20 24 01 |
|-----|---------------|---|-------------|
| | A 04 00 41 04 | Deadend Assy, FG Arm, 10' | 1 |
| | B 04 00 20 03 | Crossarm, Sgl, Wood, 10' (use only 1/2 of V-Brace) | 1 |
| | C 17 51 137 | Connector, PG, Pole Ground to Messenger | 1 |
| | D 23 59 095 | Eyelet, NM, STD, 3/4" | 1 |
| | E 23 68 713 | Grip, Messenger/Neutral, Preformed for 7#6 – 052AWA | 1 |
| | F 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | 1 |
| | G 69 58 293 | Line Duc Cover – (Messenger Cover), Black. 8' Long (Each) | 1 |
| | H 25 06 052 | Insulator, Suspension, 15kV, Poly | 3 |
| | I 25 56 076 | Insulator, Guy Strain, Fiberglass 26", 15kV | 1 |
| | J 25 05 143 | Insulator, Pin, 15kV, Vice-Top | 1 |
| | K 23 62 028 | Pin, Insulator, Long Shank | 1 |
| | L 23 68 181 | Shackle – Anchor, 9/16" | 3 |
| | M 23 58 122 | Clevis, Thimble, 7/8" Opening, Galvanized Steel | 3 |
| @ | N 23 68 701 | Grip, Conductor Deadend, 15kV, 477 Spacer Cable | 3 |
| | | Size Grip per existing Spacer Cable Conductor (See 07 20 11 00) | 3 |
| | R LW*W | Wire, Poly Covered, S.D. (ft.) (See 07 00 80 00) | 30 |
| @ | S 10 01 144 | Arrester, 10kV w/ Protective Cap | 3 |
| | 10 01 133 | Arrester, 3kV w/ Protective Cap | 3 |
| | T 17 58 054 | Bracket, Switch/Arrester Mounting | 3 |
| | U 18 51 021 | Wire, Poly #6 CU., (FT.) | 15 |
| @ | V PG*W | Clamp, Parallel Groove (See 07 00 25 00) | 3 |
| @ | W HLC*W | Hot Line Clamp | 3 |
| | X 38 51 608 | Cover, Large, Vice Type Connectors | 3 |
| @,3 | Y 12 00 10 ** | Grounding Unit, 7#10 Copperweld | 1 |
| @ | Z 11 00 42 ** | Guying Unit with FG Strain Insulator & HD Guy Hook | |
| 5 | AA 18 51 019 | Wire, #2 Cu. Poly Covered (Ft.) | 15 |
| | BB 23 66 132 | Washer, Flat, Sq., 4" x 4" w/ 13/16" hole | 1 |

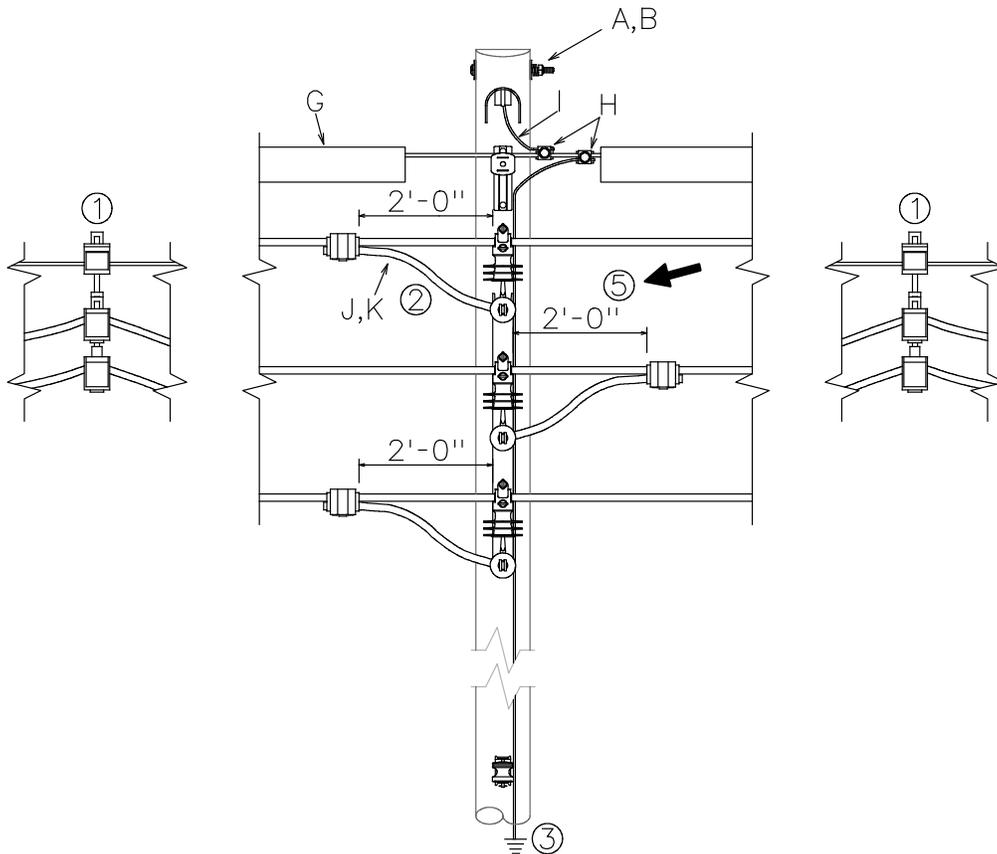
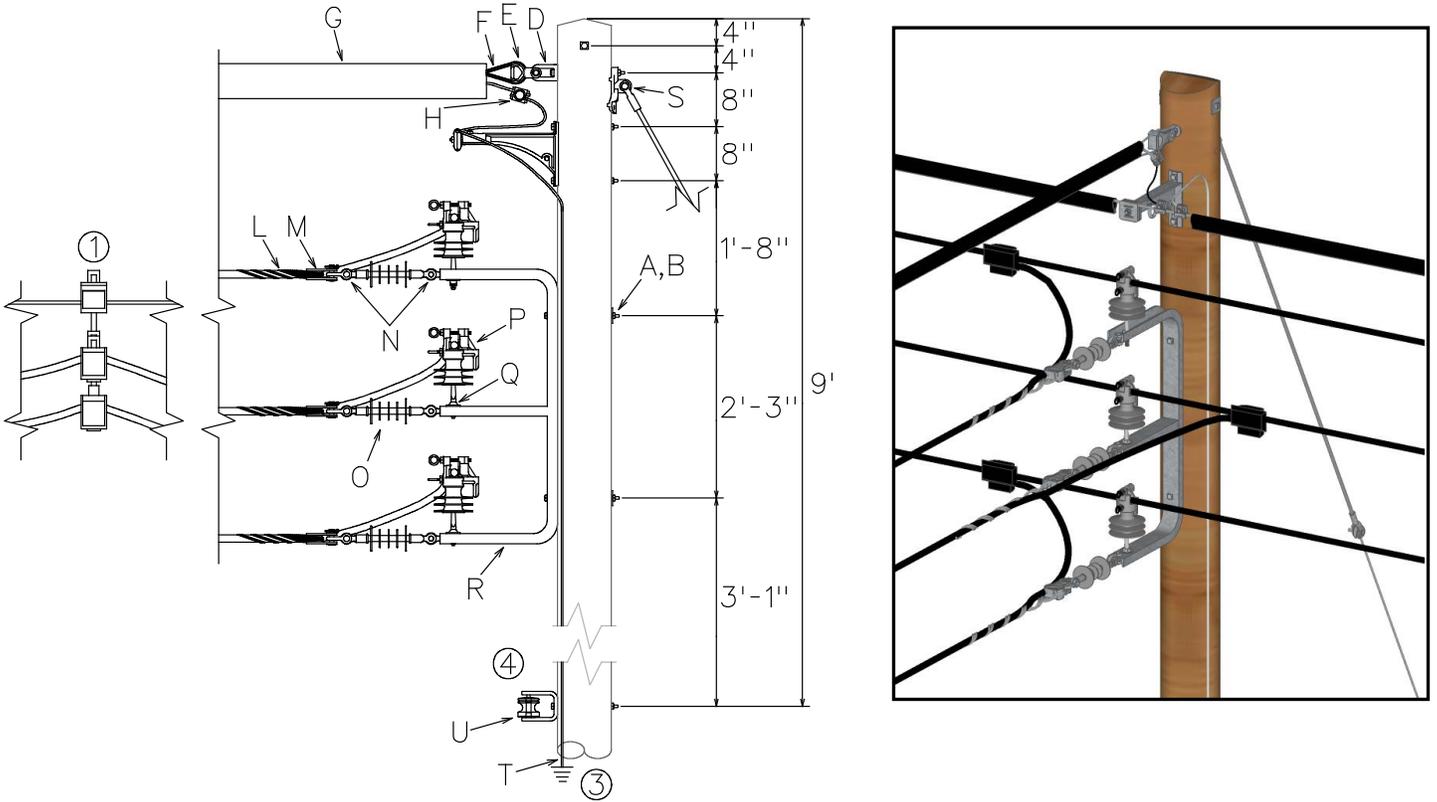
NOTES:

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS 07 20 01 01 for spacer installation between poles.
2. Install the center phase of the spacer cable with fiberglass strain insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.
3. Use DCS 12 00 10 01 ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Extend #2 poly covered ground wire (18 51 019) from open wire neutral to the messenger.
6. For installations on a composite pole, substitute a fiberglass crossarm, Stock #41 01 285, in place of the wood arm. Use electrical ground clips, stock #23 68 746, to attach the ground wire to the bottom of the fiberglass crossarm.

CONFIGURATIONS
 15 kV & Below - Spacer Cable
 Three Phase Lateral Tap

03 20 25 01

Sheet 1 of 2



CONFIGURATIONS
15 kV & Below - Spacer Cable
Three Phase Lateral Tap

03 20 25 01

Sheet 2 of 2

| | | Std. / Stk. No. | Description | 03 20 25 01 | 01 |
|---|---|------------------------|---|--------------------|-----------|
| | A | 23 52 065 | Bolt, Machine, 5/8" x 12" (w/ nut) | | 3 |
| | B | 23 66 027 | Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick | | 4 |
| | C | 23 56 075 | Bracket, Messenger | | 1 |
| | D | 23 59 095 | Eyelet, 3/4", Galvanized Steel | | 1 |
| | E | 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | | 1 |
| | F | 23 68 713 | Grip, Messenger/Neutral, Preformed - 052 AWA | | 1 |
| | G | 69 58 293 | Line Duc (Messenger Cover), Black. 8' Long (Each) | | 3 |
| | H | 17 51 137 | Clamp, PG, Pole Ground to Messenger | | 3 |
| | I | 18 51 019 | Wire, #2 Cu. Poly Covered (Ft.) | | 3 |
| @ | J | PG*W | Clamp, PG, Conductor to Conductor | | 3 |
| | K | 38 51 608 | Cover, Large, Vise Type Connectors | | 3 |
| @ | L | 23 68 701 | Grip, Conductor Deadend, 15kV, New 477 Spacer Cable | | 3 |
| | | | Size Grip per Existing Spacer Cable Conductor (See 07 20 11 00) | | 3 |
| | M | 23 58 122 | Clevis, Thimble, 7/8" opening, Galvanized Steel | | 3 |
| | N | 23 68 181 | Shackle - Anchor, 9/16" | | 6 |
| | O | 25 06 052 | Insulator, Suspension, 15kV, Poly | | 3 |
| | P | 25 05 143 | Insulator, Pin, 15kV, Vise-Top | | 3 |
| | Q | 23 62 151 | Pin, Insulator, 1" Thread, Short Shank, 5/8" | | 3 |
| | R | 23 56 105 | Bracket, Vertical Tap | | 1 |
| @ | S | 11 00 42 ** | Guying Unit w/ FG Strain Insulator & HD Guy Hook | | 1 |
| @ | T | 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 |
| @ | U | 03 01 01 ** | Neutral Configuration | | |

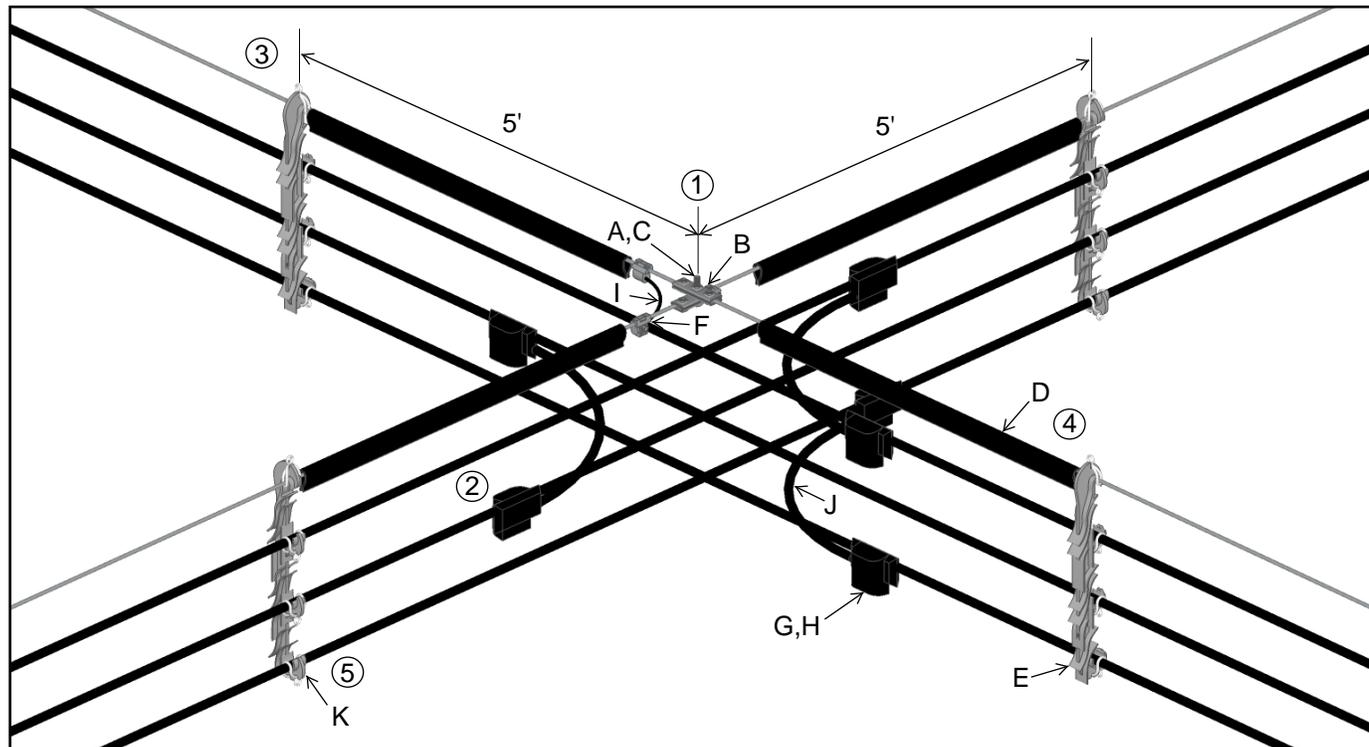
NOTES

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS **07 20 01 01** for spacing installation between poles.
2. Extend spacer cable conductor with the covering intact through the preform and connect with PG clamps to the tap/source conductor for all three primary conductors.
3. Use DCS **12 00 10 01** ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable is stripped to maintain the required 2'-0" of horizontal separation.RR

CONFIGURATIONS
15kV & Below - Spacer Cable
Three Phase Mid-Span Tap

03 20 30 01

Sheet 1 of 1



| | | Std./Stk. No. | Description | 03 20 30 01 | |
|----|---|---------------|---|-------------|----|
| | A | 23 52 438 | Bolt, Machine, 5/8" x 3" (w/ nut) | | 1 |
| | B | 23 68 657 | Clamp, Cable | | 2 |
| | C | 23 65 043 | Nut, Lock, 5/8" | | 1 |
| 4 | D | 69 58 293 | Line Duc (Messenger Cover), Black. 8' Long (Each) | | 2 |
| 3 | E | 23 67 411 | Spacer, Aerial Cable, Vertical | | 4 |
| | F | 17 51 137 | Clamp, PG, Messenger | | 2 |
| @ | G | PG*W | Clamp, PG, Conductor | | 6 |
| | H | 38 51 608 | Cover, Large, Vise Type Connectors | | 6 |
| | I | 18 51 019 | Wire, #2 Cu., Poly Covered (Ft.) | | 3 |
| | J | 18 51 052 | Wire, Poly, SD, 350 CU. (Ft.) | | 12 |
| 5@ | K | 23 67 333 | Ring, Conductor Tie | | 16 |

NOTES

1. This Standard is **Limited Use Only**. Use only to replace existing mid-span taps after close examination determines that the mid-span tap configuration cannot be engineered to be built with any other standard or configuration.
2. Alternate taps as shown in the drawing to maximize the distance between each tap. All taps are to be covered.
3. The vertical spacers are to be located 5' from the intersection of the messenger/conductors.
4. Cut the 8' pieces of line duc in 4' pieces to install between the vertical spacer and the intersection of the two messengers.
5. (4) Ring ties (23 67 333) are included with each vertical spacer (23 67 411), but may be ordered separately if existing vertical spacers are used.

Spacer Cable – Phase Conductors

| Conductor Size, Type and Stranding | Ameren Stock No. | Voltage Rating | Over-all Dia. Inches | Conductor Dia. Inches | Conductor Wt. "Lbs./ Ft." | Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft." | Horiz.-4Lbs Wind on 1/2" Ice "Lbs./ Ft." | Major Use |
|---|-------------------------|-----------------------|-----------------------------|------------------------------|----------------------------------|---|---|------------------|
| 1/0 Al. 7 Str. – Compact | 18-53-113 | 5kV | .508 | .336 | .788 | .778 | .503 | Line Wire ① |
| 1/0 Al. 7 Str. – Compact | 18-07-331 | 15kV | .638 | .336 | .909 | .909 | .546 | Line Wire ① |
| 1/0 Al. 7 Str. – Compressed | 18-07-300 | 15kV | .688 | .376 | .213 | -- | -- | Line Wire ② |
| 3/0 Al. 7 Str. – Compressed | 18-07-301 | 15kV | .764 | .452 | .323 | -- | -- | Line Wire ② |
| 350 MCM Al. 19 Str. – Compressed | 18-07-345 | 5kV | .849 | .679 | 1.276 | 1.276 | .616 | Line Wire ① |
| 477 MCM Al. 19 Str. – Compact | 18-07-346 | 5kV | .892 | .722 | 1.415 | 1.415 | .631 | Line Wire ① |
| 350 MCM Al. 19 Str. – Compressed | 18-07-302 | 15kV | .999 | .687 | .515 | -- | -- | Line Wire ② |
| 477 MCM Al. 19 Str. – Compact | 11-1337 ④ | 15kV | 1.022 | .722 | 1.579 | 1.579 | .674 | Line Wire ① |
| 477 MCM Al. 19 Str. – Compact | 18-07-347 | 15kV | 1.062 | .722 | .662 | -- | -- | Line Wire ③ |
| 500 MCM Al. 35 Str. – Compressed | 18-07-303 | 15kV | 1.089 | .777 | .646 | -- | -- | Line Wire ② |
| 795 MCM Al. 37 Str. – Compact | 18-07-351 | 5kV | 1.102 | .932 | 1.890 | 1.890 | .701 | Line Wire ① |
| 795 MCM Al. 37 Str. – Compact | 18-07-352 | 15kV | 1.232 | .932 | 2.089 | 2.089 | .744 | Line Wire ① |

NOTES

1. Legacy IP Conductor – For removal only.
2. Legacy CILCO Conductor – For removal only.
3. Ameren Standard Conductor – For all new installations.
4. This Legacy IP conductor no longer has Ameren stock number. It has been merged with the new Hendrix 477 Compact conductor in EMPRV.

Spacer Cable – Messenger

| Conductor Size, Type and Stranding | Ameren Stock No. | Voltage Rating | Over-all Dia. Inches | Ultimate Strength in "Lbs" | Conductor Wt. "Lbs./ Ft." | Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft." | Horiz.-4Lbs Wind on 1/2" Ice "Lbs./ Ft." | Major Use |
|------------------------------------|------------------|----------------|----------------------|----------------------------|---------------------------|--|--|-------------|
| 3/8" – 7 Str. C.W. | 18-53-113 | 5 &15kV | .385 | 11,440 | .3239 | -- | -- | Messenger ② |
| 3/8" – 7 Str. C.W. | 18-53-113 | 5 &15kV | .385 | 13,896 | .324 | .874 | .462 | Messenger ① |
| 7#7 Alumoweld | 27-09-122 | 5 &15kV | .433 | 19,060 | .330 | .910 | .478 | Messenger ① |
| 1/2" – 7 Str. C.W. | 42-5140 ④ | 5 &15kV | .486 | 16,890 | .515 | -- | -- | Messenger ② |
| 052 AWA – 7 Str. | 27-59-081 | 5 &15kV | .486 | 17,120 | .346 | -- | -- | Messenger ③ |

NOTES

1. Legacy IP Conductor – For removal only.
2. Legacy CILCO Conductor – For removal only.
3. Ameren Standard Conductor – For all new installations.
4. This Legacy CILCO messenger was made obsolete prior to converting it to an Ameren stock number. 1/2" CW messenger was typically only installed with 500 MCM Al. Conductor.

1. General

- a. Bare wire is the standard conductor for overhead installations of distribution facilities of 15kV or less. Bare Wire should be the first choice for any installation of overhead distribution including Spacer Cable reconductor/rebuilds.
- b. Spacer cable should not be installed in Operating Centers where spacer cable is not already installed. It would require spacer cable specific material to be stocked in the storeroom.
- c. Spacer cable is a viable alternative when clearance is an issue such as:
 - i. Inadequate horizontal clearance to buildings or structures.
 - The compact design of spacer cable offers more clearance from obstacles than open-wire.
 - 2017 NESC Table 234-1, Footnote 2 allows the horizontal clearance to be reduced by 2ft. when spacer cable is installed.
 - ii. Inadequate ROW exists and obtaining additional ROW is cost and/or time prohibitive.
 - iii. Tree trimming requirements would be too extensive to satisfy homeowners.

2. General Installation Practices

- a. Maintain 2 ft. rule:
 - i. Stagger taps and other areas where the covering has been removed to provide a minimum of 2 ft. of horizontal separation between the opening and other openings or ground points.
 - ii. Install Line Duc over the messenger anywhere the cable covering is stripped to maintain the required 2 ft. of horizontal separations.
- b. Lightning protection:
 - i. Ground the messenger at every pole.
 - ii. Install lightning arresters where:
 - The covering has been removed.
 - At all equipment locations.
 - At transitions to open wire.
 - iii. Note that arresters are not required if the covering has been reinsulated.
 - iv. There are no minimum amount of lightning arresters per mile. Arresters only need to be installed as indicated above.
- c. Spacers & Insulators:
 - i. Install a spacer with an anti-sway bracket at every tangent pole.
 - ii. Install spacers every 25 to 33 feet as evenly spaced as possible between tangent poles.
 - iii. Install spacers about 40 feet from dead-end structure to avoid stress at the first spacer.
 - iv. Replace porcelain spacers with poly spacers (stk # 23 67 334) when working on a pole.
 - v. Dead-end messenger and connector using preformed grips when available. See DCS 07 20 11 00.

3. Conductor Current Ratings

Ampacity Ratings in Amps

| Conductor Type | Stock number | Voltage Rating | Summer | | Winter | |
|----------------------------------|--------------|----------------|--------|-----------|--------|-----------|
| | | | Normal | Emergency | Normal | Emergency |
| 1/0 Al. 7 Str. – Compact | -- ① | 5kV | 200 | 262 | 327 | 365 |
| 1/0 Al. 7 Str. – Compact | 18 07 331 ① | 15kV | 188 | 257 | 322 | 359 |
| 1/0 Al. 7 Str. – Compressed | 18 07 300 ② | 15kV | 188 | 261 | 327 | 365 |
| 3/0 Al. 7 Str. – Compressed | 18 07 301 ② | 15kV | 249 | 347 | 434 | 485 |
| 350 MCM Al. 19 Str. – Compressed | 18 07 345 ① | 5kV | 401 | 564 | 701 | 788 |
| 350 MCM Al. 19 Str. – Compressed | 18 07 302 ② | 15kV | 388 | 548 | 684 | 768 |
| 477 MCM Al. 19 Str. – Compact | 18 07 346 ① | 5kV | 477 | 673 | 837 | 941 |
| 477 MCM Al. 19 Str. Compact | 18 07 347 ③ | 15kV | 461 | 654 | 816 | 917 |
| 500 MCM Al. 35 Str. – Compressed | 18 07 303 ② | 15kV | 481 | 685 | 854 | 961 |
| 795 MCM Al. 37 Str. – Compact | 18 07 351 ① | 5kV | 649 | 928 | 1151 | 1300 |
| 795 MCM Al. 37 Str. – Compact | 18 07 352 ① | 15kV | 627 | 900 | 1120 | 1263 |

Notes:

1. Legacy IP Conductor – For reference only
2. Legacy CILCO Conductor – For reference only
3. Ameren Standard Conductor – For all new installations
4. This Legacy IP Round conductor no longer has an Ameren Stock number. It has merged with the new Hendrix 477 Compact conductor in EMPRV.
5. Ampacity values are based on the following ambient temperatures: Summer Normal/Emergency at 40°C and Winter Normal/Emergency at -13°C.

1. General

The procedure for installing and sagging spacer cable is much different than bare wire conductor. The steps are:

- a. Pull in the messenger and tension it using a dynamometer.
- b. Pull in the conductors using (PBR-3) Roll-By Stringing Blocks.
- c. Tension the conductors while still in the String Blocks.
- d. Remove the Stringing Block and install spacers.

The information needed to install new cable is shown below in the "Initial Sag" section. Consult the *Hendrix Spacer Cable Installation Guide* for more details.

The conductors can be pulled through angles up to 90°, for pulling lengths up to 5,000 ft., as long as the maximum pulling tension does not exceed 4,000 lbs.

After the spacers have been installed, you have a spacer cable system that can be modeled as a whole. The sag of this system is shown below in the "Final Sag" section. This information can be used for pole selection and checking clearances.

The Final Sag Tables have been organized by ruling span lengths per messenger and conductor types. The ruling spans are "Super Short Span" (100 ft.), "Short Span" (150 ft.), "Medium Span" (200 ft.), "Long Span" (250 ft.) and "Extra Long Span" (300 ft.).

Sags given for "Final Sag" indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

The National Electric Safety Code (NESC) requires that maximum sag (for vertical clearance above ground) be checked at:

- a. 32° F (0° C) with 1/2" ice, No wind (Final) or 120° F, FINAL
- b. Maximum operating design temperature of the line (No Wind)

Other items to consider are:

- a. Conductor Blowout must be checked at 60° F (16° C) FINAL with 6 psf wind to assure necessary clearance to structures adjacent to the line.
- b. Note that spacer cable systems do not gallop thus they do not need to be modeled for galloping.

2. Initial Sag

The messenger wire supports the three conductors and can also be used as the system neutral. The Hendrix 052AWA is the only messenger to be used for new construction.

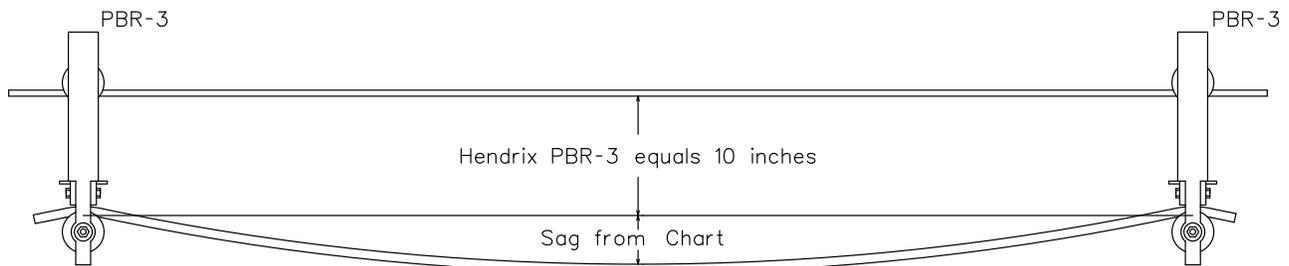
The messenger wire is pulled in and tensioned to the initial tensions shown below, prior to conductor installation.

| Initial Tension Table for 052 AWA Messenger for All Span Lengths | | | | | | |
|---|-------|-------|-------|-------|-------|-------|
| Ambient Temperature during installations (°F) | 0 | 20 | 40 | 60 | 80 | 100 |
| Tension (lbs.) – All Span Lengths | 3,400 | 3,000 | 2,600 | 2,300 | 2,000 | 1,700 |

The values shown above are 300 lbs. above the final desired tension to compensate for the loss of tension which occurs when dead-ending (catching off) the messenger and "settling in"

Once the messenger has been properly tensioned, the conductors can be installed and tensioned to the sag shown below.

| Conductor Sag Table – 477 kcmil Al, 19 Strand, Compact Hendrix Conductor | | | | | |
|---|-------|-------|-------|-------|--------|
| Ambient Temperature during installations (°F) | 10–29 | 30–49 | 50–69 | 70–89 | 90–109 |
| Sag between roll-by blocks (in) as shown in the illustration below | 3 | 4 | 5 | 6 | 7 |



PRIMARY CONDUCTORS AND FASTENINGS
 Conductor Installation
 Sagging Method

07 20 07 03

Sheet 3 of 12

3. Final Sag

052 AWA Messenger with 477 Al, 19 Strand, Compact Conductor

DE Tension = 4,912 Lbs

Super Short Span

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | | | | | | | | Tension Lbs | |
|-------------------|----------------------------|--------------------|----|----|----|----|-----|------|-----|-----|-----|-----|----------------|--|
| | | | | | | | | R.S. | | | | | | |
| | | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | | |
| -20 | | 3 | 4 | 5 | 7 | 8 | 10 | 12 | 14 | 16 | 19 | 21 | 3845 | |
| 0 | | 3 | 4 | 6 | 15 | 9 | 11 | 13 | 15 | 18 | 20 | 23 | 3548 | |
| 0° | 0.5" ice, 4 psf wind + k | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 28 | 32 | 35 | 39 | 4912 | |
| 30 | | 4 | 5 | 7 | 9 | 11 | 13 | 15 | 18 | 20 | 23 | 26 | 3206 | |
| 32° | 0.5" ice | 7 | 9 | 12 | 15 | 18 | 21 | 25 | 28 | 32 | 36 | 39 | 4527 | |
| 32° | 0.5" ice, 2 psf wind | 7 | 9 | 12 | 15 | 18 | 21 | 25 | 28 | 32 | 36 | 40 | 4574 | |
| 40 | | 4 | 5 | 7 | 9 | 11 | 13 | 16 | 18 | 21 | 24 | 27 | 3077 | |
| 50 | | 4 | 6 | 8 | 10 | 12 | 14 | 17 | 19 | 22 | 25 | 28 | 2954 | |
| 60 | | 4 | 6 | 8 | 10 | 12 | 15 | 17 | 20 | 23 | 26 | 29 | 2835 | |
| 60° | F, 6 psf wind | 5 | 7 | 9 | 12 | 14 | 17 | 19 | 22 | 25 | 28 | 32 | 3104 | |
| 70 | | 5 | 7 | 9 | 11 | 13 | 16 | 18 | 21 | 24 | 27 | 30 | 2721 | |
| 80 | | 5 | 7 | 9 | 11 | 14 | 16 | 19 | 22 | 25 | 28 | 31 | 2612 | |
| 90 | | 6 | 8 | 10 | 12 | 15 | 17 | 20 | 23 | 25 | 28 | 32 | 2509 | |
| 100 | | 6 | 8 | 10 | 13 | 15 | 18 | 21 | 23 | 26 | 29 | 33 | 2411 | |
| 120 | | 7 | 9 | 12 | 14 | 17 | 19 | 22 | 25 | 28 | 31 | 35 | 2231 | |

DE Tension = 5,873 Lbs

Short Span

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | | | | | | | | Tension Lbs | |
|-------------------|----------------------------|--------------------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|----------------|--|
| | | | | | | | | R.S. | | | | | | |
| | | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | | |
| -20 | | 10 | 12 | 14 | 16 | 19 | 21 | 24 | 27 | 30 | 33 | 36 | 3807 | |
| 0 | | 11 | 13 | 15 | 18 | 20 | 23 | 26 | 29 | 32 | 35 | 38 | 3531 | |
| 0° | 0.5" ice, 4 psf wind + k | 21 | 24 | 28 | 32 | 35 | 39 | 43 | 48 | 52 | 56 | 61 | 5873 | |
| 30 | | 13 | 15 | 18 | 20 | 23 | 26 | 29 | 32 | 35 | 38 | 42 | 3161 | |
| 32° | 0.5" ice | 21 | 25 | 28 | 32 | 36 | 39 | 43 | 48 | 52 | 56 | 60 | 5161 | |
| 32° | 0.5" ice, 2 psf wind | 21 | 25 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 57 | 61 | 5228 | |
| 40 | | 13 | 16 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 43 | 3050 | |
| 50 | | 14 | 17 | 19 | 22 | 25 | 28 | 31 | 34 | 37 | 40 | 44 | 2945 | |
| 60 | | 15 | 17 | 20 | 23 | 26 | 29 | 32 | 35 | 38 | 42 | 45 | 2846 | |
| 60° | F, 6 psf wind | 17 | 19 | 22 | 25 | 28 | 32 | 35 | 38 | 42 | 45 | 49 | 3249 | |
| 70 | | 16 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 43 | 46 | 2753 | |
| 80 | | 16 | 19 | 22 | 25 | 28 | 31 | 34 | 37 | 40 | 44 | 47 | 2665 | |
| 90 | | 17 | 20 | 23 | 25 | 28 | 32 | 35 | 38 | 42 | 45 | 49 | 2582 | |
| 100 | | 18 | 21 | 23 | 26 | 29 | 33 | 36 | 39 | 43 | 46 | 50 | 2504 | |
| 120 | | 19 | 22 | 25 | 28 | 31 | 35 | 38 | 41 | 45 | 48 | 52 | 2361 | |

Note:

- Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

052 AWA Messenger with 477 Al, 19 Strand, Compact Conductor

DE Tension = 6,749 Lbs

Medium Span

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | | | | | | | Tension Lbs | |
|-------------------|----------------------------|--------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|----------------|------|
| | | | | | | | R.S. | | | | | | |
| | | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | | 250 |
| -20 | | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 46 | 49 | 53 | 4049 |
| 0 | | 23 | 26 | 29 | 32 | 35 | 38 | 41 | 45 | 48 | 52 | 55 | 3812 |
| 0° | 0.5" ice, 4 psf wind + k | 39 | 43 | 48 | 52 | 56 | 61 | 66 | 70 | 75 | 80 | 85 | 6749 |
| 30 | | 26 | 29 | 32 | 35 | 38 | 42 | 45 | 48 | 52 | 56 | 60 | 3495 |
| 32° | 0.5" ice | 39 | 43 | 48 | 52 | 56 | 60 | 65 | 70 | 74 | 79 | 84 | 5972 |
| 32° | 0.5" ice, 2 psf wind | 40 | 44 | 48 | 52 | 57 | 61 | 66 | 70 | 75 | 80 | 85 | 6054 |
| 40 | | 27 | 30 | 33 | 36 | 39 | 43 | 46 | 50 | 53 | 57 | 61 | 3399 |
| 50 | | 28 | 31 | 34 | 37 | 40 | 44 | 47 | 51 | 55 | 58 | 62 | 3308 |
| 60 | | 29 | 32 | 35 | 38 | 42 | 45 | 49 | 52 | 56 | 60 | 64 | 3220 |
| 60° | F, 6 psf wind | 32 | 35 | 38 | 42 | 45 | 49 | 53 | 57 | 61 | 65 | 69 | 3714 |
| 70 | | 30 | 33 | 36 | 39 | 43 | 46 | 50 | 54 | 57 | 61 | 65 | 3137 |
| 80 | | 31 | 34 | 37 | 40 | 44 | 47 | 51 | 55 | 59 | 63 | 66 | 3058 |
| 90 | | 32 | 35 | 38 | 42 | 45 | 49 | 52 | 56 | 60 | 64 | 68 | 2983 |
| 100 | | 33 | 36 | 39 | 43 | 46 | 50 | 54 | 57 | 61 | 65 | 69 | 2912 |
| 120 | | 35 | 38 | 41 | 45 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 2779 |

DE Tension = 7,557 Lbs

Long Span

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | | | | | | | Tension Lbs | |
|-------------------|----------------------------|--------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|----------------|------|
| | | | | | | | R.S. | | | | | | |
| | | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 | | 300 |
| -20 | | 36 | 39 | 42 | 46 | 49 | 53 | 56 | 60 | 64 | 68 | 72 | 4304 |
| 0 | | 38 | 41 | 45 | 48 | 52 | 55 | 59 | 63 | 67 | 71 | 75 | 4095 |
| 0° | 0.5" ice, 4 psf wind + k | 61 | 66 | 70 | 75 | 80 | 85 | 90 | 95 | 101 | 106 | 111 | 7557 |
| 30 | | 42 | 45 | 48 | 52 | 56 | 60 | 63 | 67 | 71 | 75 | 79 | 3813 |
| 32° | 0.5" ice | 60 | 65 | 70 | 74 | 79 | 84 | 89 | 94 | 99 | 105 | 110 | 6715 |
| 32° | 0.5" ice, 2 psf wind | 61 | 66 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 111 | 6811 |
| 40 | | 43 | 46 | 50 | 53 | 57 | 61 | 65 | 69 | 73 | 77 | 81 | 3726 |
| 50 | | 44 | 47 | 51 | 55 | 58 | 62 | 66 | 70 | 74 | 78 | 83 | 3644 |
| 60 | | 45 | 49 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 | 3564 |
| 60° | F, 6 psf wind | 49 | 53 | 57 | 61 | 65 | 69 | 73 | 77 | 82 | 86 | 91 | 4139 |
| 70 | | 46 | 50 | 54 | 57 | 61 | 65 | 69 | 73 | 77 | 81 | 86 | 3488 |
| 80 | | 47 | 51 | 55 | 59 | 63 | 66 | 70 | 75 | 79 | 83 | 87 | 3415 |
| 90 | | 49 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 | 89 | 3346 |
| 100 | | 50 | 54 | 57 | 61 | 65 | 69 | 73 | 78 | 82 | 86 | 90 | 3279 |
| 120 | | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 85 | 89 | 93 | 3153 |

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

PRIMARY CONDUCTORS AND FASTENINGS
 Conductor Installation
 Sagging Method

07 20 07 03

Sheet 5 of 12

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions
 3/8" EHS Copperweld Messenger

1/0 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|------|
| | | | | R.S. | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 4 | 12 | 19 | 28 | 44 |
| 0°, 0.5" ice, 4 psf wind + k | | 19 | 35 | 55 | 74 | 98 |
| 60°F | | 7 | 15 | 25 | 38 | 54 |
| 120°F | | 10 | 19 | 30 | 47 | 63 |
| Heavy Loading Tension (Lbs) | | 4000 | 4650 | 5300 | 5900 | 6420 |

477 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|------|
| | | | | R.S. | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 11 | 22 | 36 | 53 | 72 |
| 0°, 0.5" ice, 4 psf wind + k | | 23 | 42 | 66 | 74 | 121 |
| 60°F | | 13 | 26 | 42 | 60 | 80 |
| 120°F | | 18 | 29 | 48 | 67 | 88 |
| Heavy Loading Tension (Lbs) | | 4600 | 5600 | 6400 | 7150 | 7950 |

795 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|
| | | | | R.S. | |
| | | 100 | 150 | 200 | 250 |
| 0° | | 14 | 29 | 45 | 68 |
| 0°, 0.5" ice, 4 psf wind + k | | 26 | 48 | 76 | 104 |
| 60°F | | 17 | 33 | 51 | 73 |
| 120°F | | 20 | 37 | 56 | 79 |
| Heavy Loading Tension (Lbs) | | 5100 | 6200 | 6900 | 8050 |

Note:

- Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions
7#7 Alumoweld Messenger

1/0 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|------|
| | | R.S. | | | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 4 | 10 | 18 | 28 | 40 |
| 0°, 0.5" ice, 4 psf wind + k | | 18 | 34 | 54 | 75 | 99 |
| 60°F | | 7 | 15 | 24 | 37 | 51 |
| 120°F | | 11 | 21 | 32 | 48 | 63 |
| Heavy Loading Tension (Lbs) | | 4360 | 5190 | 5880 | 6550 | 7225 |

477 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|------|
| | | R.S. | | | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 10 | 22 | 35 | 51 | 69 |
| 0°, 0.5" ice, 4 psf wind + k | | 22 | 41 | 63 | 88 | 115 |
| 60°F | | 13 | 27 | 41 | 59 | 78 |
| 120°F | | 17 | 32 | 48 | 66 | 86 |
| Heavy Loading Tension (Lbs) | | 5030 | 6100 | 7000 | 7925 | 8700 |

795 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|------|
| | | R.S. | | | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 10 | 22 | 35 | 51 | 69 |
| 0°, 0.5" ice, 4 psf wind + k | | 22 | 41 | 63 | 88 | 115 |
| 60°F | | 13 | 27 | 41 | 59 | 78 |
| 120°F | | 17 | 32 | 48 | 66 | 86 |
| Heavy Loading Tension (Lbs) | | 5450 | 6450 | 7730 | 8560 | 9650 |

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

PRIMARY CONDUCTORS AND FASTENINGS
 Conductor Installation
 Sagging Method

07 20 07 03

Sheet 7 of 12

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions
 3/8" EHS Copperweld Messenger

1/0 SAC 15kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|------|
| | | R.S. | | | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 6 | 14 | 25 | 37 | 51 |
| 0°, 0.5" ice, 4 psf wind + k | | 20 | 38 | 57 | 75 | 115 |
| 60°F | | 9 | 19 | 30 | 45 | 64 |
| 120°F | | 12 | 23 | 36 | 55 | 72 |
| Heavy Loading Tension (Lbs) | | 4100 | 4800 | 5540 | 6220 | 6700 |

477 SAC 15kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|------|
| | | R.S. | | | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 11 | 24 | 39 | 57 | 78 |
| 0°, 0.5" ice, 4 psf wind + k | | 24 | 46 | 69 | 98 | 137 |
| 60°F | | 14 | 28 | 45 | 64 | 85 |
| 120°F | | 18 | 32 | 51 | 71 | 89 |
| Heavy Loading Tension (Lbs) | | 4880 | 5800 | 6800 | 7600 | 8300 |

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

PRIMARY CONDUCTORS AND FASTENINGS
 Conductor Installation
 Sagging Method

07 20 07 03
 Sheet 8 of 12

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions
 7#7 Alumoweld Messenger

1/0 15kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|------|
| | | | | R.S. | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 5 | 11 | 18 | 28 | 40 |
| 0°, 0.5" ice, 4 psf wind + k | | 16 | 31 | 49 | 69 | 90 |
| 30° | | 6 | 12 | 21 | 32 | 45 |
| 32°, 0.5" ice | | 16 | 30 | 47 | 65 | 86 |
| 32°, 0.5" ice, 2 psf wind | | 16 | 30 | 47 | 66 | 87 |
| 60°F | | 7 | 15 | 25 | 36 | 50 |
| 60°F, 4 psf wind | | 9 | 18 | 29 | 42 | 56 |
| 60°F, 6 psf wind | | 10 | 20 | 32 | 46 | 61 |
| 90°F | | 9 | 18 | 29 | 41 | 55 |
| 120°F | | 11 | 21 | 33 | 46 | 61 |
| 167°F | | 15 | 27 | 39 | 54 | 69 |
| Heavy Loading Tension (Lbs) | | | | | | |
| | | 4219 | 4935 | 5604 | 6228 | 6813 |

477 SAC 15kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|------------------------------------|----------------------------|--------------------|------|------|------|------|
| | | | | R.S. | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 10 | 21 | 34 | 49 | 67 |
| 0°, 0.5" ice, 4 psf wind + k | | 20 | 38 | 58 | 81 | 107 |
| 30° | | 11 | 23 | 37 | 53 | 71 |
| 32°, 0.5" ice | | 20 | 37 | 57 | 80 | 104 |
| 32°, 0.5" ice, 2 psf wind | | 20 | 38 | 58 | 80 | 105 |
| 60°F | | 13 | 40 | 40 | 57 | 75 |
| 60°F, 4 psf wind | | 14 | 27 | 42 | 59 | 78 |
| 60°F, 6 psf wind | | 15 | 29 | 44 | 62 | 82 |
| 90°F | | 15 | 43 | 43 | 60 | 79 |
| 120°F | | 17 | 46 | 46 | 64 | 83 |
| 167°F | | 20 | 51 | 51 | 70 | 90 |
| Heavy Loading Tension (Lbs) | | | | | | |
| | | 4859 | 5829 | 6715 | 7532 | 8294 |

Note:

- Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

PRIMARY CONDUCTORS AND FASTENINGS
 Conductor Installation
 Sagging Method

07 20 07 03

Sheet 9 of 12

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

795 SAC 15kV Spacer Cable – MAINTENANCE USE ONLY

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | |
|-------------------|------------------------------------|--------------------|------|------|------|------|
| | | R.S. | | | | |
| | | 100 | 150 | 200 | 250 | 300 |
| 0° | | 14 | 27 | 43 | 61 | 82 |
| 0° | 0.5" ice, 4 psf wind + k | 23 | 42 | 64 | 89 | 117 |
| 30° | | 15 | 29 | 46 | 65 | 85 |
| 32° | 0.5" ice | 23 | 42 | 64 | 88 | 115 |
| 32° | 0.5" ice, 2 psf wind | 23 | 42 | 64 | 89 | 116 |
| 60°F | | 17 | 31 | 48 | 68 | 89 |
| 60°F | 4 psf wind | 17 | 32 | 50 | 70 | 92 |
| 60°F | 6 psf wind | 18 | 34 | 52 | 72 | 95 |
| 90°F | | 18 | 34 | 51 | 71 | 93 |
| 120°F | | 20 | 36 | 54 | 74 | 96 |
| 167°F | | 23 | 39 | 59 | 79 | 102 |
| | | | | | | |
| | Heavy Loading Tension (Lbs) | 5324 | 6463 | 7493 | 8440 | 9320 |

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY CILCO – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions
 3/8" Copperweld Messenger
 1/0 15kV Spacer Cable – **MAINTENANCE USE ONLY**

DE Tension = 4,495 Lbs

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | | | | | | | | Tension Lbs |
|-------------------|----------------------------|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------|
| | | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | |
| -20 | | 5 | 6 | 8 | 9 | 11 | 12 | 14 | 16 | 18 | 20 | 22 | 2916 |
| 0 | | 6 | 7 | 8 | 10 | 12 | 13 | 15 | 17 | 19 | 21 | 23 | 2671 |
| 0° | 0.5" ice, 4 psf wind + k | 18 | 22 | 25 | 28 | 32 | 36 | 39 | 43 | 47 | 52 | 56 | 4495 |
| 30 | | 6 | 8 | 10 | 12 | 13 | 15 | 17 | 19 | 22 | 24 | 26 | 2326 |
| 32° | 0.5" ice | 18 | 21 | 24 | 27 | 31 | 34 | 38 | 41 | 45 | 49 | 53 | 3848 |
| 32° | 0.5" ice, 2 psf wind | 18 | 21 | 24 | 28 | 31 | 35 | 38 | 42 | 46 | 50 | 54 | 3921 |
| 40 | | 7 | 9 | 10 | 12 | 14 | 16 | 18 | 20 | 23 | 25 | 27 | 2218 |
| 50 | | 8 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 24 | 26 | 29 | 2114 |
| 60 | | 8 | 10 | 12 | 13 | 15 | 18 | 20 | 22 | 24 | 27 | 30 | 2015 |
| 60° F | 6 psf wind | 11 | 13 | 15 | 18 | 20 | 23 | 26 | 28 | 32 | 34 | 37 | 2377 |
| 70 | | 9 | 10 | 12 | 14 | 16 | 18 | 21 | 23 | 26 | 28 | 31 | 1921 |
| 80 | | 9 | 11 | 13 | 15 | 17 | 19 | 22 | 24 | 27 | 29 | 32 | 1831 |
| 90 | | 10 | 12 | 14 | 16 | 18 | 20 | 23 | 25 | 28 | 30 | 33 | 1747 |
| 100 | | 10 | 12 | 14 | 17 | 19 | 21 | 24 | 26 | 29 | 32 | 34 | 1667 |
| 120 | | 12 | 14 | 16 | 18 | 21 | 23 | 26 | 28 | 31 | 34 | 37 | 1523 |

3/8" Copperweld Messenger
 3/0 15kV Spacer Cable – **MAINTENANCE USE ONLY**

DE Tension = 4,677 Lbs

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | | | | | | | | Tension Lbs |
|-------------------|----------------------------|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------|
| | | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | |
| -20 | | 7 | 8 | 10 | 12 | 13 | 15 | 17 | 20 | 22 | 24 | 37 | 3019 |
| 0 | | 8 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 24 | 26 | 29 | 2793 |
| 0° | 0.5" ice, 4 psf wind + k | 20 | 23 | 26 | 30 | 34 | 37 | 42 | 46 | 50 | 54 | 59 | 4677 |
| 30 | | 9 | 10 | 12 | 14 | 16 | 19 | 21 | 24 | 26 | 29 | 32 | 2479 |
| 32° | 0.5" ice | 19 | 22 | 26 | 29 | 33 | 36 | 40 | 44 | 48 | 52 | 57 | 4057 |
| 32° | 0.5" ice, 2 psf wind | 19 | 23 | 26 | 29 | 33 | 37 | 41 | 45 | 49 | 53 | 57 | 4125 |
| 40 | | 9 | 11 | 13 | 15 | 17 | 20 | 22 | 25 | 27 | 30 | 33 | 2382 |
| 50 | | 10 | 12 | 14 | 16 | 18 | 20 | 23 | 25 | 28 | 31 | 34 | 2289 |
| 60 | | 10 | 12 | 14 | 16 | 19 | 21 | 24 | 26 | 29 | 32 | 35 | 2200 |
| 60° F | 6 psf wind | 13 | 15 | 18 | 20 | 23 | 26 | 28 | 31 | 35 | 38 | 41 | 2541 |
| 70 | | 11 | 13 | 15 | 17 | 19 | 22 | 25 | 27 | 30 | 33 | 36 | 2115 |
| 80 | | 11 | 13 | 15 | 18 | 20 | 23 | 26 | 28 | 31 | 34 | 37 | 2034 |
| 90 | | 12 | 14 | 16 | 19 | 21 | 24 | 26 | 29 | 32 | 35 | 38 | 1957 |
| 100 | | 12 | 15 | 17 | 19 | 22 | 25 | 27 | 30 | 33 | 36 | 39 | 1885 |
| 120 | | 13 | 16 | 19 | 21 | 24 | 27 | 29 | 32 | 35 | 39 | 42 | 1752 |

Note:

- Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY CILCO – This information is **FOR MAINTENANCE USE ONLY**

3/8" Copperweld Messenger
350 MCM 15kV Spacer Cable – MAINTENANCE USE ONLY

DE Tension = 5,072 Lbs

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | | | | | | | | Tension Lbs | |
|-------------------|----------------------------|--------------------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|----------------|--|
| | | | | | | | | R.S. | | | | | | |
| | | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | | |
| -20 | | 9 | 11 | 13 | 16 | 18 | 21 | 23 | 26 | 29 | 32 | 35 | 3212 | |
| 0 | | 10 | 12 | 15 | 17 | 19 | 22 | 25 | 27 | 30 | 34 | 37 | 3015 | |
| 0° | 0.5" ice, 4 psf wind + k | 22 | 25 | 29 | 33 | 37 | 41 | 46 | 50 | 55 | 60 | 64 | 5072 | |
| 30 | | 12 | 14 | 16 | 19 | 21 | 24 | 27 | 30 | 33 | 36 | 40 | 2743 | |
| 32° | 0.5" ice | 22 | 25 | 29 | 33 | 36 | 40 | 45 | 49 | 54 | 58 | 63 | 4483 | |
| 32° | 0.5" ice, 2 psf wind | 22 | 25 | 29 | 33 | 37 | 41 | 45 | 50 | 54 | 59 | 63 | 4547 | |
| 40 | | 12 | 14 | 17 | 19 | 22 | 25 | 28 | 31 | 34 | 37 | 41 | 2659 | |
| 50 | | 13 | 15 | 17 | 20 | 23 | 26 | 29 | 32 | 35 | 38 | 42 | 2578 | |
| 60 | | 13 | 15 | 18 | 21 | 23 | 26 | 29 | 33 | 36 | 39 | 43 | 2501 | |
| 60° F | 6 psf wind | 16 | 18 | 21 | 24 | 27 | 30 | 34 | 37 | 41 | 44 | 48 | 2876 | |
| 70 | | 14 | 16 | 19 | 21 | 24 | 27 | 30 | 33 | 37 | 40 | 44 | 2427 | |
| 80 | | 14 | 17 | 19 | 22 | 25 | 28 | 31 | 34 | 38 | 41 | 45 | 2356 | |
| 90 | | 15 | 17 | 20 | 23 | 26 | 29 | 32 | 35 | 39 | 42 | 46 | 2288 | |
| 100 | | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 40 | 43 | 47 | 2224 | |
| 120 | | 17 | 19 | 22 | 25 | 28 | 31 | 35 | 38 | 42 | 45 | 49 | 2104 | |

1/2" Copperweld Messenger
500 MCM 15kV Spacer Cable – MAINTENANCE USE ONLY

DE Tension = 6,710 Lbs

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | | | | Tension Lbs |
|-------------------|----------------------------|--------------------|-----|-----|-----|------|-----|-----|----------------|
| | | | | | | R.S. | | | |
| | | 110 | 120 | 130 | 140 | 150 | 160 | 170 | |
| -20 | | 10 | 12 | 14 | 16 | 18 | 20 | 23 | 4742 |
| 0 | | 11 | 13 | 15 | 17 | 19 | 22 | 24 | 4412 |
| 0° | 0.5" ice, 4 psf wind + k | 21 | 25 | 28 | 32 | 35 | 39 | 43 | 6710 |
| 30 | | 12 | 15 | 17 | 19 | 22 | 24 | 27 | 3958 |
| 32° | 0.5" ice | 22 | 25 | 28 | 32 | 35 | 39 | 43 | 5945 |
| 32° | 0.5" ice, 2 psf wind | 22 | 25 | 28 | 32 | 36 | 39 | 43 | 6012 |
| 40 | | 13 | 15 | 18 | 20 | 22 | 25 | 28 | 3818 |
| 50 | | 14 | 16 | 18 | 21 | 23 | 26 | 29 | 3685 |
| 60 | | 14 | 17 | 19 | 21 | 24 | 27 | 30 | 3557 |
| 60° F | 6 psf wind | 16 | 19 | 21 | 24 | 27 | 30 | 33 | 3950 |
| 70 | | 15 | 17 | 20 | 22 | 25 | 28 | 31 | 3436 |
| 80 | | 16 | 18 | 20 | 23 | 26 | 29 | 32 | 3320 |
| 90 | | 16 | 19 | 21 | 24 | 27 | 30 | 33 | 3211 |
| 100 | | 17 | 19 | 22 | 25 | 28 | 30 | 33 | 3107 |
| 120 | | 18 | 21 | 24 | 27 | 29 | 32 | 36 | 2916 |

Note:

- Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

PRIMARY CONDUCTORS AND FASTENINGS
 Conductor Installation
 Sagging Method

07 20 07 03
 Sheet 12 of 12

NOTE: The following conductors are installed in LEGACY CILCO – This information is **FOR MAINTENANCE USE ONLY**

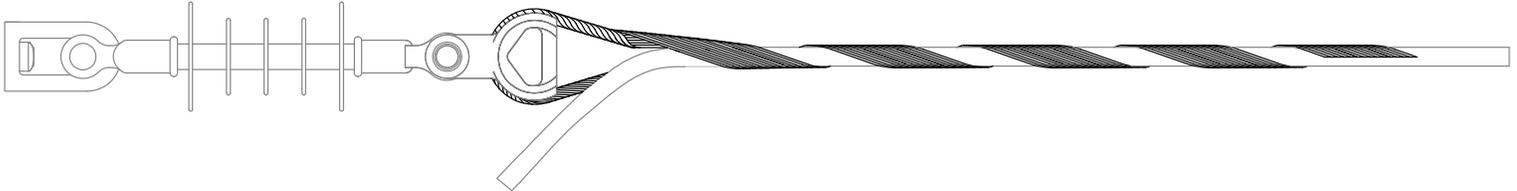
1/2" Copperweld Messenger
500 MCM 15kV Spacer Cable – MAINTENANCE USE ONLY

DE Tension = 7,907 Lbs

| Temp. Deg. F ↓ | Condition → Span (Ft) → | FINAL SAG (inches) | | | | | | Tension Lbs | |
|-------------------|----------------------------|--------------------|-----|-----|-------------|-----|-----|----------------|------|
| | | 170 | 180 | 190 | R.S. 200 | 210 | 220 | | 230 |
| -20 | | 21 | 23 | 26 | 28 | 31 | 34 | 37 | 5354 |
| 0 | | 22 | 25 | 27 | 30 | 33 | 36 | 39 | 5043 |
| 0° | 0.5" ice, 4 psf wind + k | 41 | 45 | 49 | 53 | 57 | 62 | 66 | 7907 |
| 30 | | 25 | 27 | 30 | 33 | 36 | 39 | 42 | 4613 |
| 32° | 0.5" ice | 41 | 45 | 49 | 53 | 57 | 61 | 65 | 7065 |
| 32° | 0.5" ice, 2 psf wind | 41 | 45 | 49 | 53 | 57 | 62 | 66 | 7147 |
| 40 | | 26 | 28 | 31 | 34 | 37 | 40 | 43 | 4479 |
| 50 | | 27 | 29 | 32 | 35 | 38 | 41 | 44 | 4351 |
| 60 | | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 4227 |
| 60° F | 6 psf wind | 31 | 34 | 37 | 40 | 44 | 47 | 51 | 4708 |
| 70 | | 28 | 31 | 34 | 37 | 40 | 43 | 47 | 4109 |
| 80 | | 29 | 32 | 35 | 38 | 41 | 45 | 48 | 3995 |
| 90 | | 30 | 33 | 36 | 39 | 42 | 46 | 49 | 3886 |
| 100 | | 31 | 34 | 37 | 40 | 44 | 47 | 50 | 3782 |
| 120 | | 33 | 36 | 39 | 42 | 46 | 49 | 53 | 3588 |

Note:

- Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

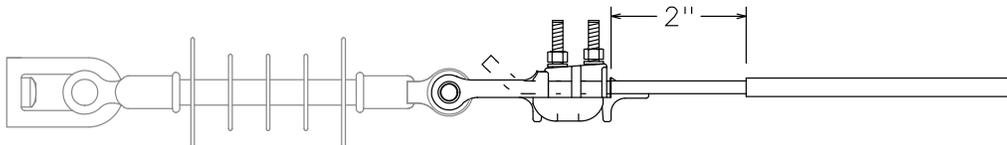


Preformed Type – Phase Conductors

| Std. / Stk. No. | Description | 07 20 11 00 | New / Maint | Legacy Co. |
|-----------------|----------------------------------|-------------|-------------|-------------------|
| 17 69 064 | Deadend, Preformed, 1/0 5kV | | M | IP |
| 23 78 433 | Deadend, Preformed, 1/0 15kV | | M | IP |
| 23 78 433 | Deadend, Preformed, 1/0 15kV | | M | CILCO |
| 17 69 061 | Deadend, Preformed, 350 MCM 5kV | | M | IP |
| 17 69 058 | Deadend, Preformed, 350 MCM 15kV | | M | CILCO |
| 17 69 060 | Deadend, Preformed, 477 MCM 5kV | | M | IP |
| 23 68 701 | Deadend, Preformed, 477 MCM 15kV | | N | IP & New Installs |
| 17 69 058 | Deadend, Preformed, 500 MCM 15kV | | M | CILCO |
| 17 69 058 | Deadend, Preformed, 795 MCM 5kV | | M | IP |
| 17 69 062 | Deadend, Preformed, 795 MCM 15kV | | M | IP |

Preformed Type – Messenger

| Std. / Stk. No. | Description | 07 20 11 00 | New / Maint | Legacy Co. |
|-----------------|-----------------------------------|-------------|-------------|--------------|
| 23 68 543 | Deadend, Preformed, 7#7 Alumoweld | | M | IP |
| 23 68 277 | Deadend, Preformed, 1/2" CW | | M | CILCO |
| 17 69 061 | Deadend, Preformed, 052 AWA | | N | New Installs |



Clamp Type – Phase Conductors – **LIMITED USE and MAINTENANCE ONLY**

| Std. / Stk. No. | Description | 07 20 11 00 | New / Maint | Legacy Co. |
|-----------------|----------------------------------|-------------|-------------|------------|
| 23 18 397 | Clamp, Deadend, 1/0 Al. 15kV | | M | CILCO |
| 23 18 397 | Clamp, Deadend, 3/0 Al. 15kV | | M | CILCO |
| 23 18 292 | Clamp, Deadend, 350 MCM Al. 15kV | | M | CILCO |
| 23 18 292 | Clamp, Deadend, 500 MCM Al. 15kV | | M | CILCO |

Clamp Type – Messenger – **LIMITED USE and MAINTENANCE ONLY**

| Std. / Stk. No. | Description | 07 20 11 00 | New / Maint | Legacy Co. |
|-----------------|-------------------------|-------------|-------------|------------|
| 23 18 394 | Clamp, Deadend, 3/8" CW | | M | CILCO |
| 23 18 395 | Clamp, Deadend, 1/2" CW | | M | CILCO |

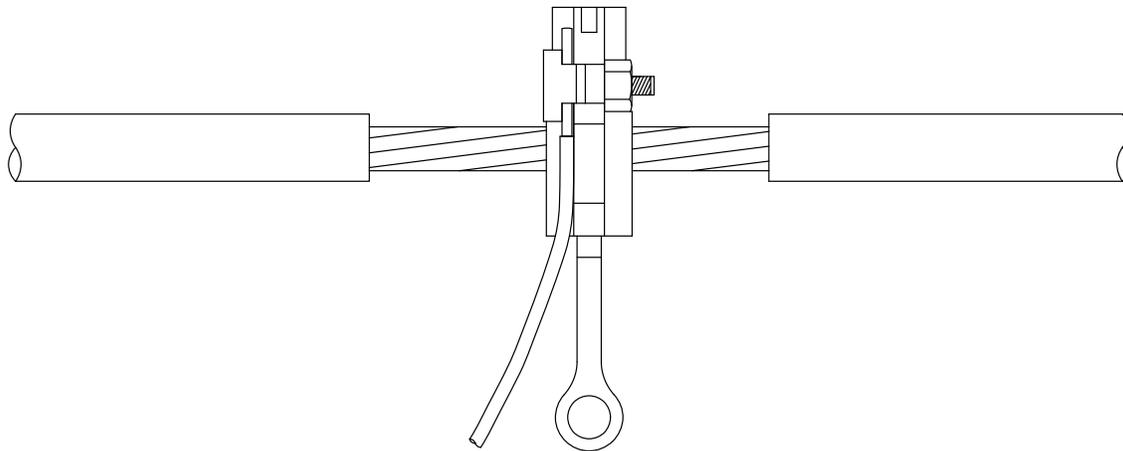
General

Hot line clamps shall be used to make connections on lines rated over 5000 volts phase to phase where the connection must be made "hot" or where it is likely that the connection will have to be disconnected and reconnected with some degree of frequency. **Avoid the use of hot line clamps where currents exceed 250 amps**

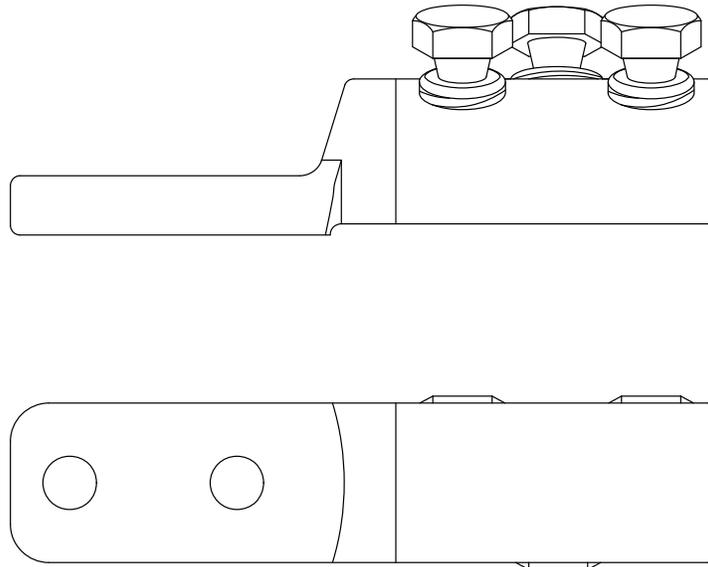
Aluminum hot line clamps shall be connected directly to unprotected aluminum line conductors of like material **when making no load taps**. This includes switches and lightning arresters.

INSTALLATION OF HOT LINE CLAMPS

- a. Use the proper size and type clamps as shown in the following tables.
- b. Apply corrosion resisting lubricant, 31 59 058 – BT.



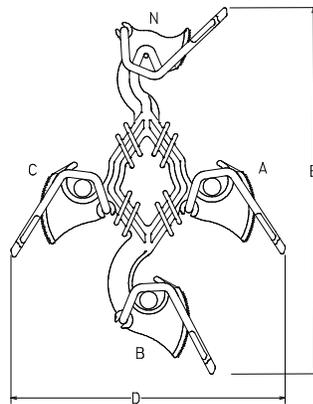
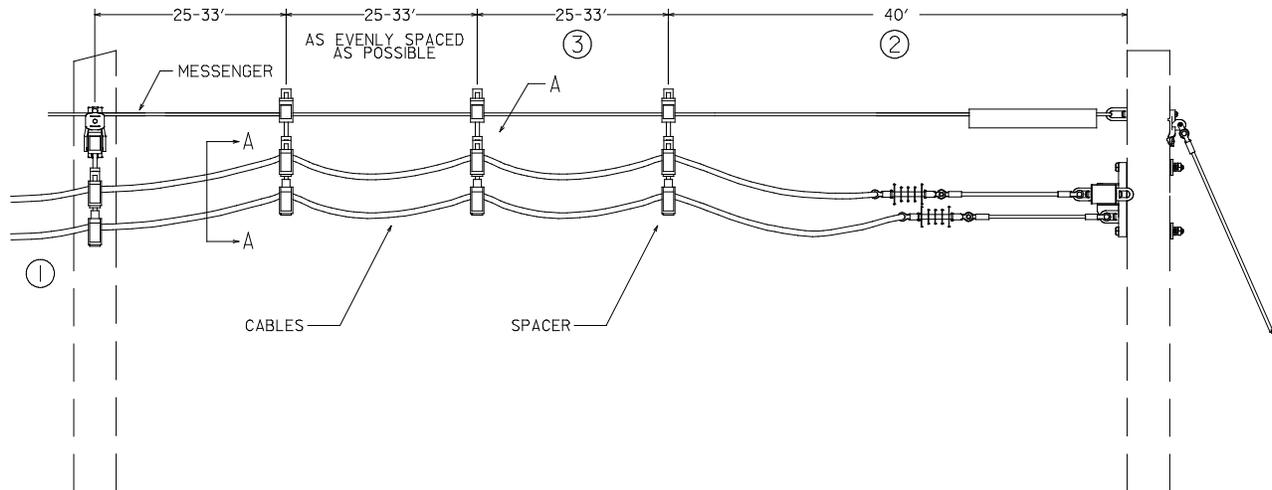
| Std. / Stk. No. | Description | 07 20 21 00 |
|-----------------|---|-------------|
| 17 62 088 | Clamp, Hot Line, 1/0 Al. – Spacer Cable | |
| 17 62 088 | Clamp, Hot Line, 3/0 Al. – Spacer Cable | |
| 17 62 088 | Clamp, Hot Line, 350 MCM Al. – Spacer Cable | |
| 17 62 088 | Clamp, Hot Line, 477 MCM Al. – Spacer Cable | |
| 17 62 112 | Clamp, Hot Line, 500 MCM Al. – Spacer Cable | |
| 17 62 112 | Clamp, Hot Line, 795 MCM Al. – Spacer Cable | |



| Std. / Stk. No. | Description | 07 20 30 00 |
|-----------------|---|-------------|
| 17 55 804 | Lug, Connecting, Shear Bolt, 350 MCM Al. 19 Str. – 5kV | |
| 17 55 804 | Lug, Connecting, Shear Bolt, 477 MCM Al. 19 Str. Round – 5kV | |
| 17 55 804 | Lug, Connecting, Shear Bolt, 350 MCM Al. 19 Str. – 15kV | |
| 17 55 804 | Lug, Connecting, Shear Bolt, 477 MCM Al. 19 Str. Round – 15kV | |
| 17 55 804 | Lug, Connecting, Shear Bolt, 477 MCM Al. 19 Str. Compact – 15kV | |
| 17 55 804 | Lug, Connecting, Shear Bolt, 500 MCM Al. 35 Str. – 15kV | |
| 17 55 804 | Lug, Connecting, Shear Bolt, 795 MCM Al. 37 Str. – 5kV | |
| 17 55 804 | Lug, Connecting, Shear Bolt, 795 MCM Al. 37 Str. – 15kV | |

Notes

1. For spacer cable conductor sizes 1/0 and 3/0, there are no lugs available. A PG clamp shall be used to connect a short poly covered copper lead wire to the spacer cable that could then be terminated into the device.



Detail A-A

| Dim. (in) | | Conductor Spacing (in) | | | Min. Leakage Distance (in) | Messenger Range | Cable Range (in) | Max. System Voltage (KV) | Short Circuit Rating (kA) | Weight (lbs) |
|-----------|--------|------------------------|----|----|----------------------------|-----------------|------------------|--------------------------|---------------------------|--------------|
| D | E | AN | AC | BC | | | | | | |
| 161/2 | 23 1/2 | 8 1/2 | 8 | 8 | 10 3/4 | .375-.750 | .438-2.00 | 15 | 13.5 | 2.5 |

| | | Std. / Stk. No. | Description | 07 20 45 01 | |
|--|---|-----------------|-----------------------------------|-------------|---|
| | A | 23 67 334 | Spacer, High Density Polyethylene | | 1 |

NOTES

1. When replacing an existing pole built to the old standard with spacers three foot on either side of the pole, remove these two spacers as long as the next spacer is less than 33 feet away on either side.
2. Install spacers about 40 ft. From dead-end structures.
3. Install spacers every 25-33 FT as evenly spaced as possible.

PRIMARY CONDUCTOR AND FASTENINGS
Spacer Cable Splices & Covering
For Messenger & Conductors

07 20 85 00

Sheet 1 of 4

General

Maintaining the proper conductor clearance is one of the most important steps to insuring reliable operation of spacer cable. This can be achieved either by separation or insulation. There must be 2 ft. of horizontal separation between any two exposed primary conductors or between exposed primary conductors and ground points. If this clearance cannot be achieved, the vertical spacing must revert back to that of bare wire conductor. For this reason, properly staggering the openings, covering openings, and installation of Line Duc (a covering to insulate the messenger) is vital for achieving the desired reliability. This proper staggering of openings is detailed in the construction standards for each configuration.

This standard will address the methods and materials for:

- a. Messenger Splices
- b. Installing Line Duc
- c. Conductor Splices & Coverings
 - Splice kits
 - Covering openings with tape
 - Covering taps with Line Duc

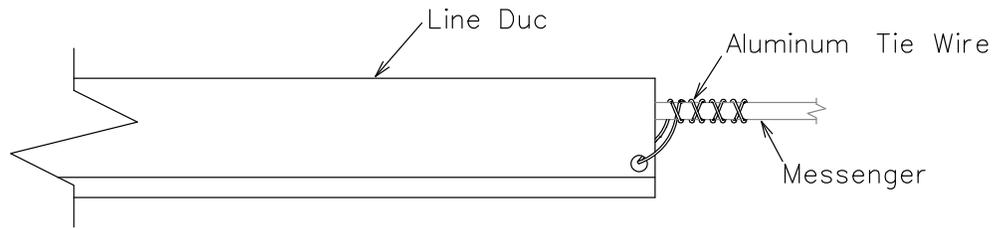
Messenger Splices

| Std. / Stk. No. | Description | 07 20 85 00 |
|-----------------|--|-------------|
| 17 63 300 | Splice, NM, 55 in. Long, Preformed, 7#6 AWA or 052 AWA | |
| 17 63 299 | Splice, NM, 38 in. Long, Preformed, 7#8 AWA or 252 AWA | |
| 17 60 582 | Connector, Splice, Automatic, 7#7 AWA | |
| 17 60 165 | Sleeve, Conductor, 3/8" Copperweld | |
| 17 60 235 | Sleeve, Conductor, 1/2" Copperweld | |

Once the messenger has been repaired, install a #2 copper jumper wire to restore full electrical conductivity.



Installing Line Duc



Hendrix Line Duc must be installed on the messenger above a tap, or any other open point, to avoid outages. All taps should be a minimum of 2'-0" horizontal separation from ground points, splices, spacers, brackets, etc. When installing multiple taps, they should be offset from each other by a minimum of 2'-0". Secure one end of the Line Duc with aluminum tie wire as shown in the above drawing.

Conductor Splices & Coverings

| Stk. No. | Conductor Size | Legacy Co. | Description | 07 20 85 00 |
|-----------|--|-------------------|---|-------------|
| 17 60 731 | 1/0 Al. 7 Str. | IP | Sleeve, Compression, 1/0 Spacer Cable | |
| 17 55 782 | | | Splice, Cold Shrink, 1/0 AWG – 3/0 AWG, Poly | |
| 17 60 462 | 1/0 Al. 7 Str. | CILCO | Sleeve, Compression, 1/0 Spacer Cable | |
| 17 55 782 | | | Splice, Cold Shrink, 1/0 AWG – 3/0 AWG, Poly | |
| 17 60 584 | 3/0 Al. 7 Str. | CILCO | Sleeve, Compression, 3/0 Spacer Cable | |
| 17 55 782 | | | Splice, Cold Shrink, 1/0 AWG – 3/0 AWG, Poly | |
| 17 60 209 | 350 MCM Al. 19 Str. | IP | Sleeve, Compression, 350 MCM Spacer Cable | |
| 17 55 783 | | | Splice, Cold Shrink, 4/0 AWG – 266.8 KCMIL | |
| 17 60 654 | 477 MCM Al. 19 Str.–Round | IP | Sleeve, Compression, 397.5 KCMIL – 500 KCMIL | |
| 17 55 791 | | | Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL | |
| 17 60 650 | 350 MCM Al. 19 Str. | CILCO | Sleeve, Compression, 350 KCMIL | |
| 17 55 791 | | | Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL | |
| 17 60 650 | 477 MCM Al. 19 Str.–Compact | New Installs | Sleeve, Compression, 477 MCM Compact Spacer Cable | |
| 17 55 791 | | | Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL | |
| 17 60 653 | 477 MCM Al. 19 Str.–Round to 477 MCM Al. 19 Str.–Compact | IP & New Installs | Sleeve, Compression, 477 Compact to 477 Round | |
| 17 55 791 | | | Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL | |
| 17 60 572 | 500 MCM Al. 35 Str. | CILCO | Sleeve, Compression, 500 MCM Spacer Cable | |
| 17 55 791 | | | Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL | |
| 17 60 694 | 795 MCM Al. 37 Str. | IP | Sleeve, Compression, 795 MCM Spacer Cable | |
| 17 55 784 | | | Splice, Cold Shrink, 795 MCM Spacer Cable | |

Covering openings with tape

Step 1

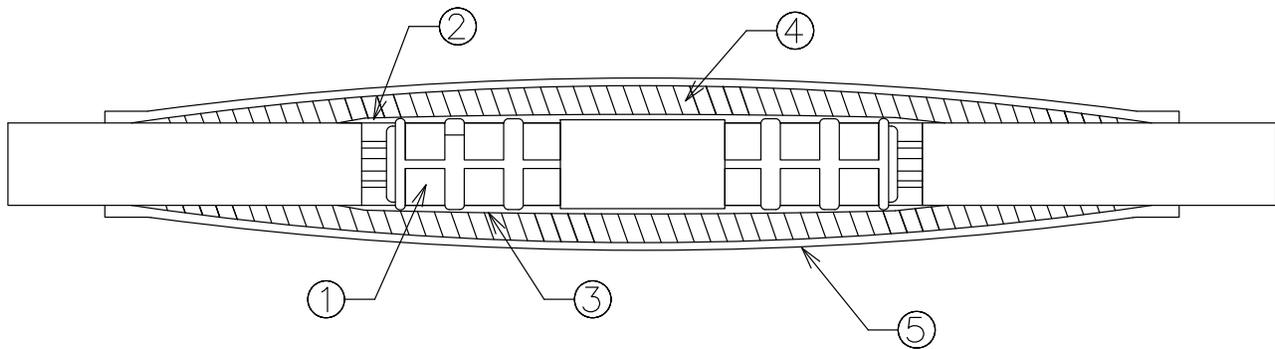
If the conductor has a semiconducting layer, Install one half-lapped layer of semiconducting tape, 25 53 076. This step is omitted if the conductor doesn't have a semiconducting layer.

Step 2

Install half-lapped layers of filler tape, 25 53 123, to match the thickness of the original conductor installation.

Step 3

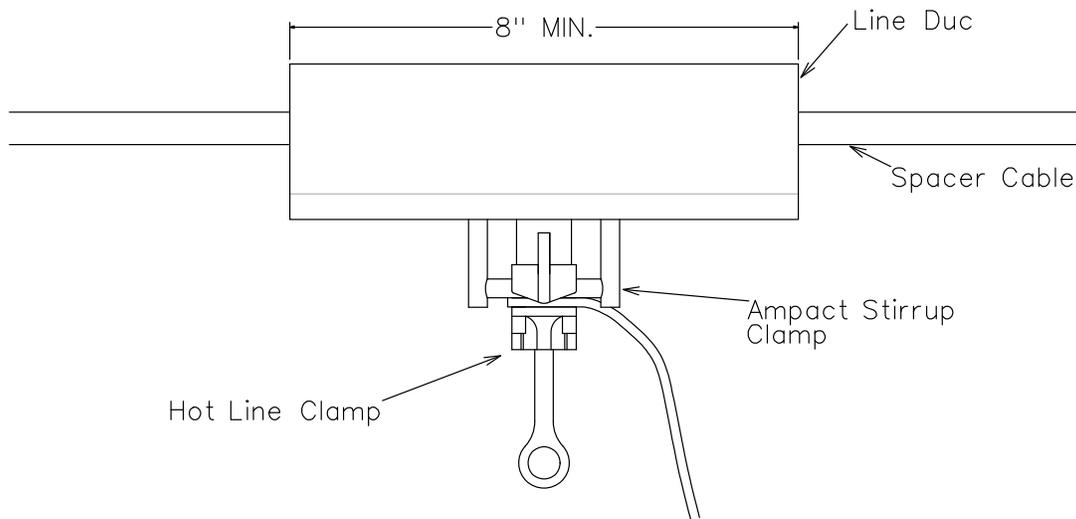
Install three half-lapped layers of tape, 25 53 077.



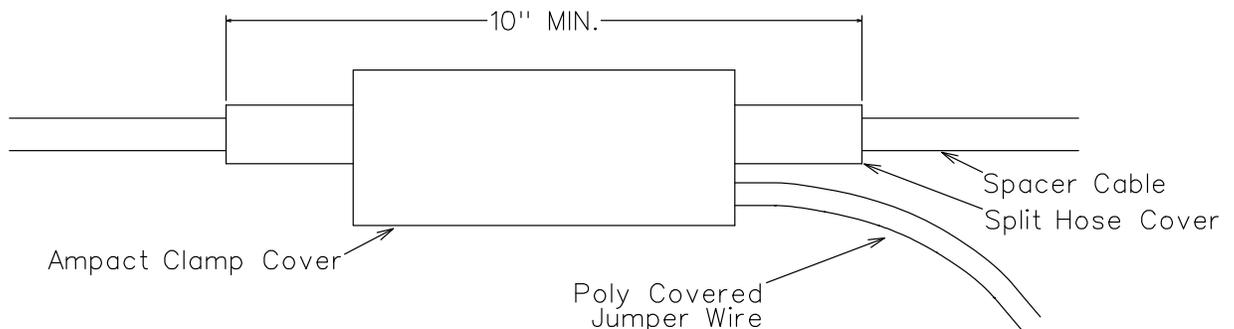
1. Partial Tension Compression Sleeve
2. Strips – 3M Insulating Mastic
3. Roll – 3M Semi-conducting Tape
4. 3M Rubber Mastic Tape
5. 3M Cold Shrink Silicone Splice (Length of tube is approximately 22“)

Covering taps with Line Duc

On poles where uncovered Ampact style stirrup clamps that do not have the required 2 feet separation are installed on spacer cable, Jumbo Line Duc (69 58 293) may be used to cover the stirrup clamp to reduce the possibility of phase to phase or phase to ground wildlife contact. This should be used as a maintenance practice only. Line Duc may need to be heated or stretched to fit cover the stirrup clamp. The Line Duc will NOT fit over the new style hot line clamps. If the pole is getting replaced, then the taps should be re-installed with the appropriate 2 feet spacing as identified in the standard.



On poles where uncovered Ampact style connectors are used to connect jumpers on spacer cable, an Ampact cover (stk# 40 79 742) and split hose (stk# 71 25 214) may be used to reduce the possibility of phase to phase or phase to ground wildlife contact. This should be used as a maintenance practice only. If the pole is getting replaced, then the jumpers should be re-installed with the appropriate and connectors with covers shall be used as identified in the standard.



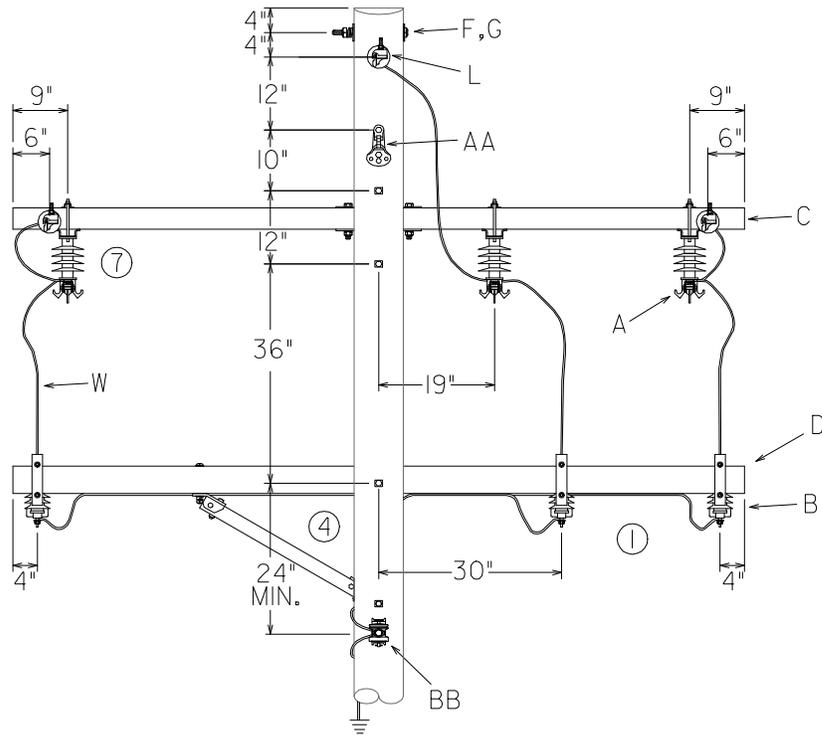
FUSES AND SWITCHES

Three Phase Sectionalizing – Spacer Cable to Open Wire

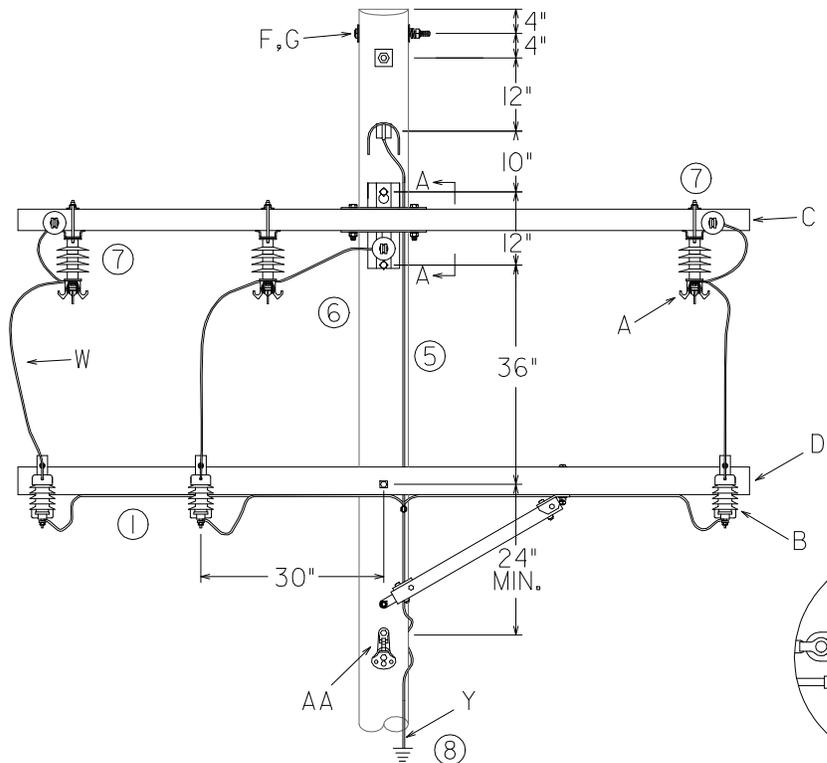
600 Amp – 4 or 12 kV

10 20 05 01

Sheet 1 of 4



OPEN WIRE SIDE



SPACER CABLE SIDE

Detail A-A

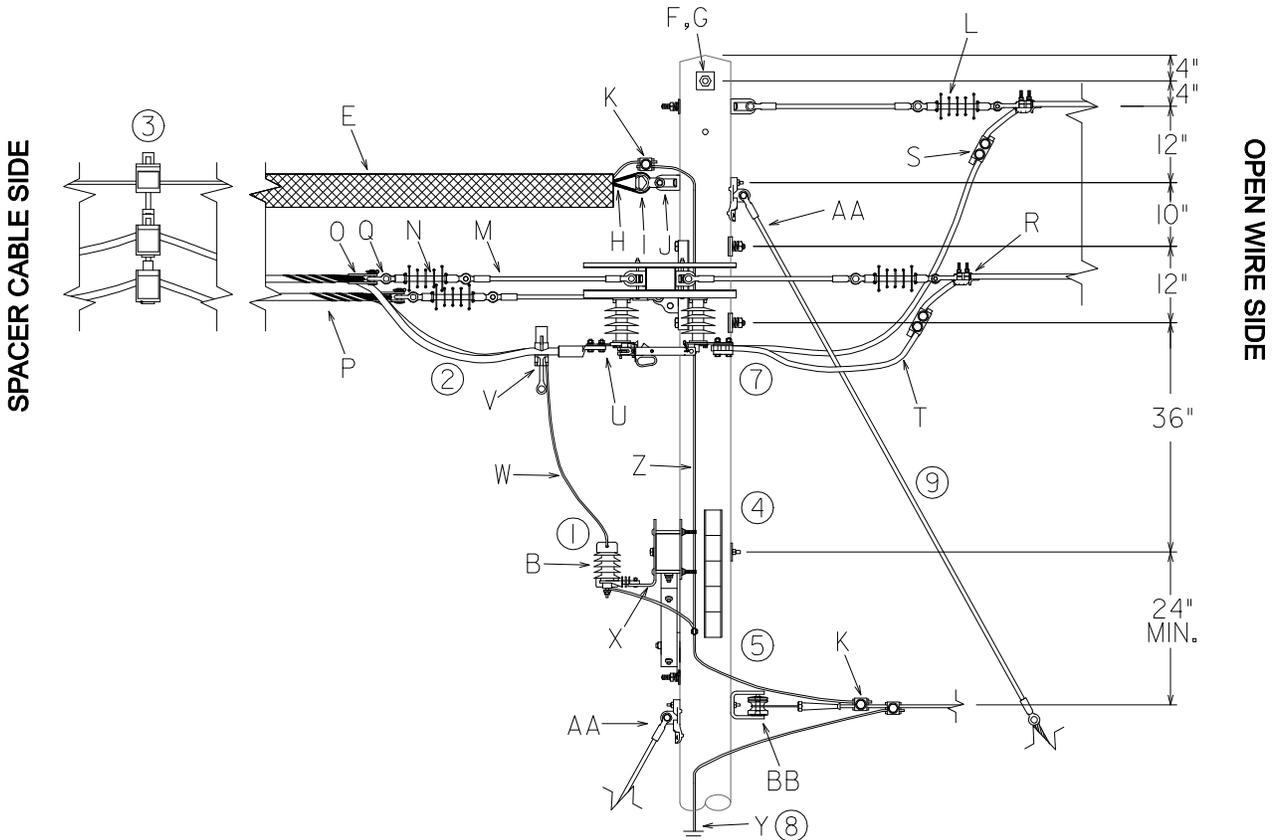
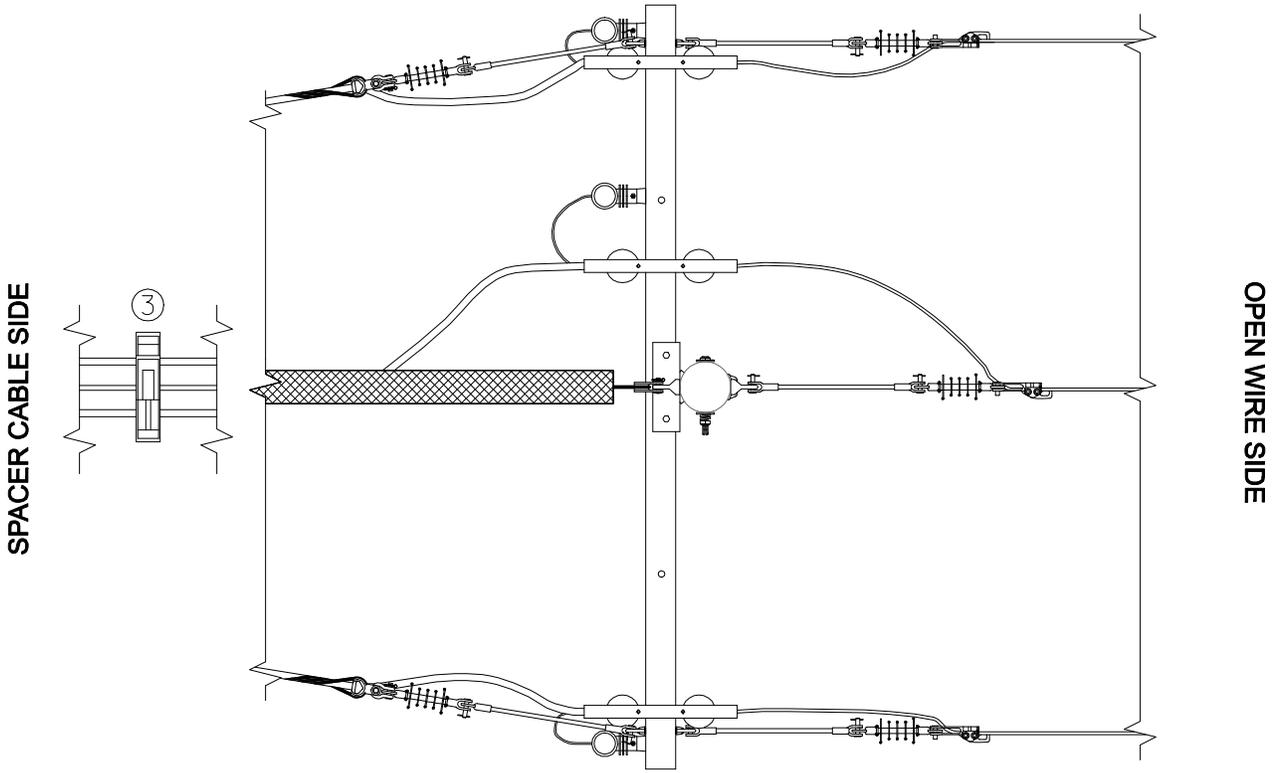
FUSES AND SWITCHES

Three Phase Sectionalizing – Spacer Cable to Open Wire

600 Amp – 4 or 12 kV

10 20 05 01

Sheet 2 of 4



FUSES AND SWITCHES
 Three Phase Sectionalizing – Spacer Cable to Open Wire
 600 Amp – 4 or 12 kV

10 20 05 01

Sheet 3 of 4

| | | Std. / Stk. No. | Description | 10 20 05 01 |
|----|----|------------------------|---|--------------------|
| 7 | A | 54 07 204 | Switch, Dis., 600A, 15kV | 3 |
| 1@ | B | 10 01 144 | Arrester, 10kV w/ Protective Cap | 3 |
| | | 10 01 133 | Arrester, 3kV w/ Protective Cap | 3 |
| | C | 04 00 41 04 | Crossarm, Deadend, F/G, 10' | 1 |
| | D | 04 00 20 03 | Crossarm, Sgl., Wood, 10', (use only 1/2 of V-Brace) | 1 |
| | E | 69 58 293 | Line Duc (Messenger Cover), Black, 8' Long (Each) | 1 |
| | F | 23 52 065 | Bolt, 5/8" x 12" | 1 |
| | G | 23 66 027 | Washer, Square, 2-1/4" | 2 |
| | H | 23 68 713 | Grip, Messenger/ Neutral, Preformed for 7#6 AW-052AWA | 1 |
| | I | 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | 1 |
| | J | 23 59 095 | Eyelet, NM, STD, 3/4", Galvanized Steel | 1 |
| | K | 17 51 137 | Clamp, PG – Messenger to Open Wire Neutral | 2 |
| | L | 06 12 30 01 | Deadend on Pole w/ FG Extension | 1 |
| 6 | M | 25 56 076 | Insulator, Strain, Fiberglass, 26" | 5 |
| | N | 25 06 052 | Insulator, Suspension, 15kV, Poly | 5 |
| | O | 23 58 122 | Clevis, Thimble, 7/8" opening, Galvanized Steel | 3 |
| @ | P | 17 69 063 | Grip, Conductor Deadend, 15kV, New 477 Spacer Cable | 3 |
| | | 17 69 ** | Size Grip per existing Spacer Cable Conductor | 3 |
| | Q | 23 68 181 | Shackle – Anchor, 9/16" | 3 |
| @ | R | DEC*W | Clamp, Deadend | 3 |
| @ | S | PG*W | Clamp, Parallel Groove (See 07 00 25 00) | 3 |
| | T | 18 51 052 | Wire, Poly, SD, 350 Cu. (Ft.) | 15 |
| 2 | U | 17 55 804 | Lug, Shear Bolt, 1/0 Through 795 Spacer Cable | 3 |
| @ | V | 17 62 088 | Clamp, Hot Line, 1/0 Through 477 Spacer Cable | 3 |
| | | 17 62 143 | Clamp, Hot Line, 795 Spacer Cable | 3 |
| | W | 18 51 021 | Wire, Poly #6 Cu., (Ft.) | 15 |
| | X | 17 58 054 | Bracket, Switch/Arrester Mounting | 3 |
| 8@ | Y | 12 00 10 ** | Grounding Unit, 7#10 Copperweld to Neutral | 1 |
| 5 | Z | 18 51 019 | Wire, #2 Cu. Poly Covered (Ft.) | 15 |
| 9@ | AA | 11 00 42 ** | Guying Unit w/ FG Strain Insulator & HD Guy Hook | |
| @ | BB | 03 01 01 ** | Neutral Configuration | |

NOTES

1. Install proper voltage arresters at this location. Where switches are normally open, install additional set of arresters on the Open-wire side of the arrester arm. See Dist. Std. **12 12 01 ****.
2. Extend spacer cable conductor with covering intact through the preform into the switch using shear bolt lugs.
3. Install the first spacer (23 67 334) about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
4. Switch number tag shall be installed here.
5. Extend #2 poly covered ground wire (18 51 019) from open wire neutral to the messenger. Route along the single switch side of the pole.
6. Install the center phase of the spacer cable with fiberglass Strain Insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.

FUSES AND SWITCHES
Three Phase Sectionalizing – Spacer Cable to Open Wire
600 Amp – 4 or 12 kV

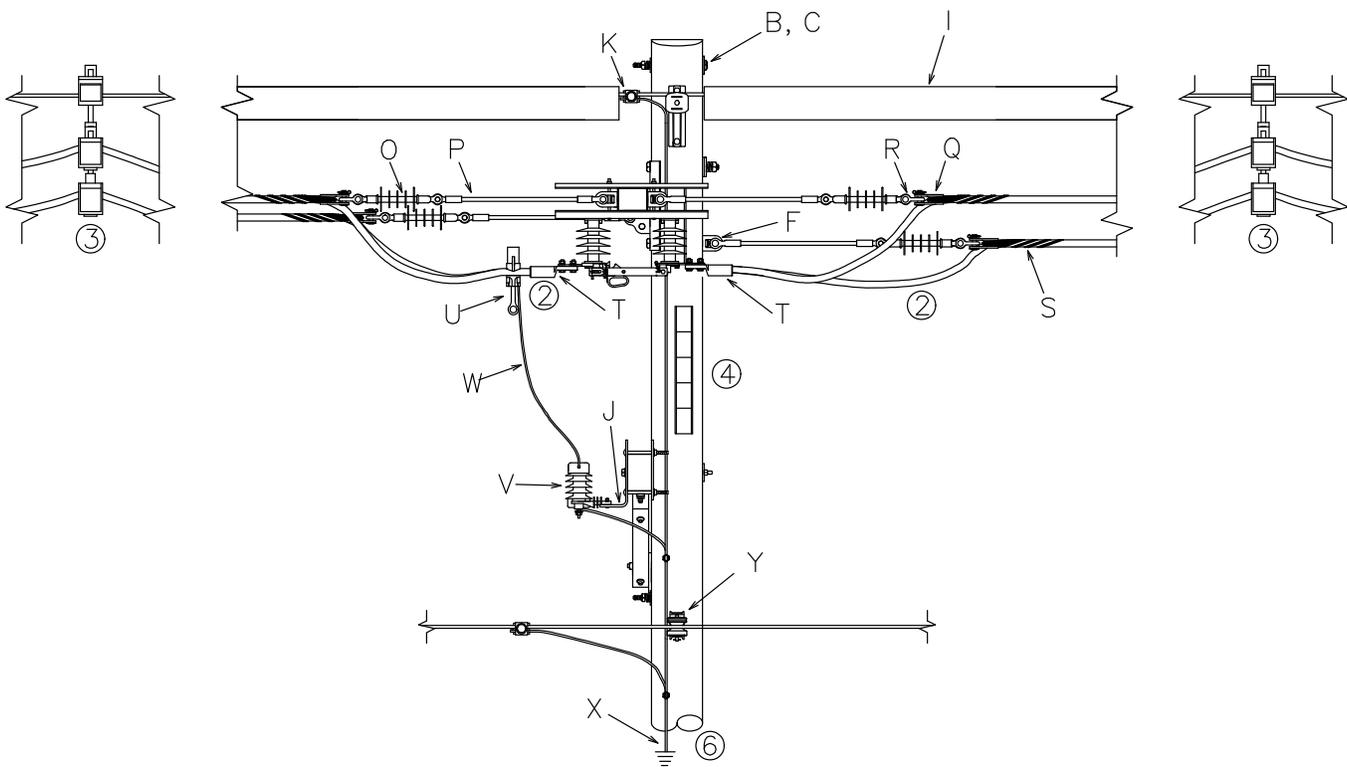
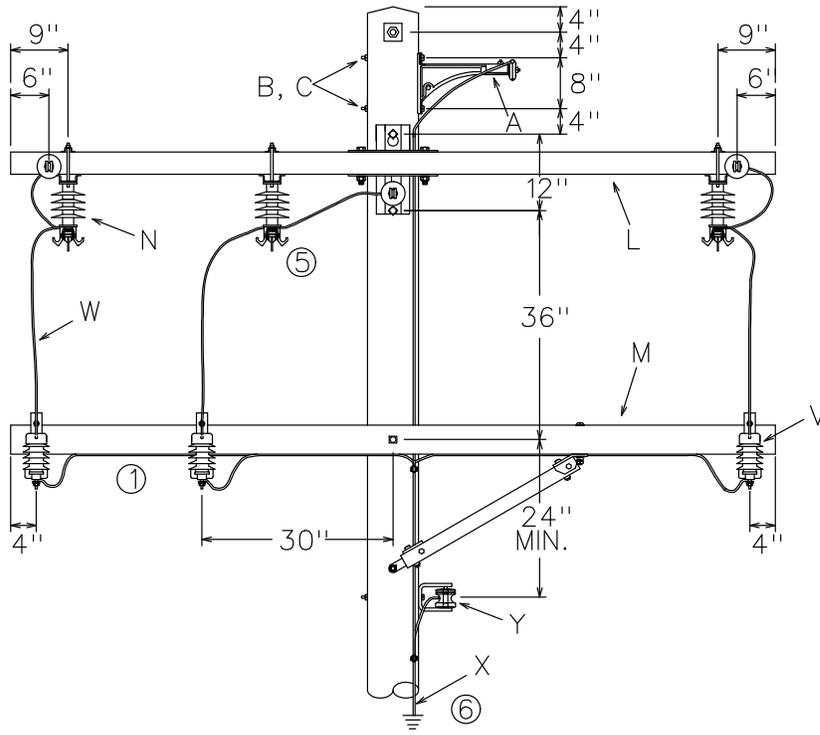
10 20 05 01

Sheet 4 of 4

7. Only install the two inside bolts on the switch and slide them as close to the crossarms as possible.
8. Use DCS **12 00 10 01** for ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.
9. Size anchor and guying for heavy loading deadend tension of spacer cable.

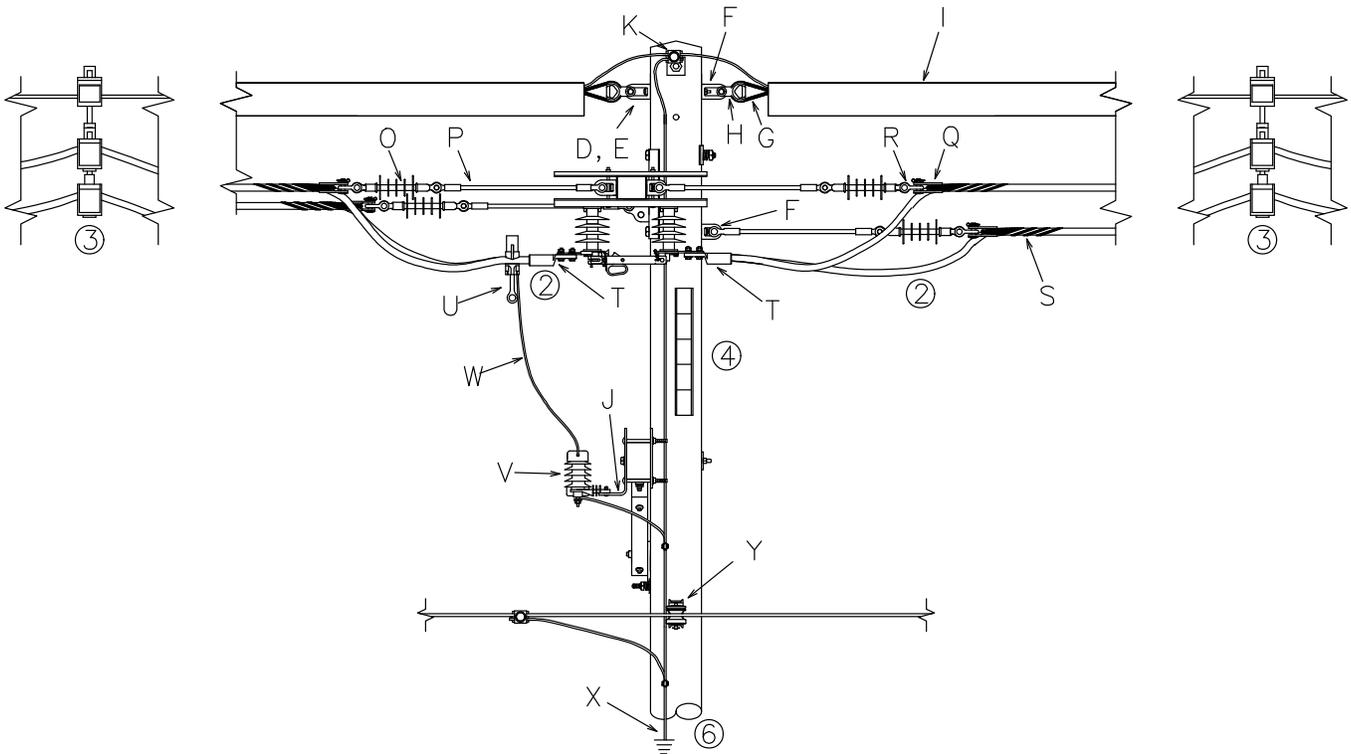
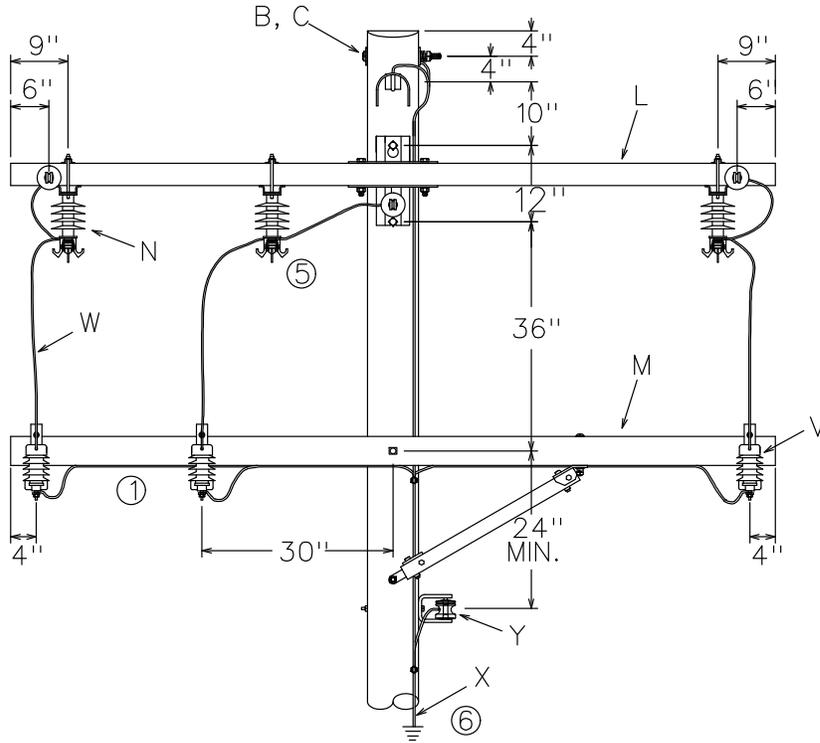


FUSES AND SWITCHES
 Three Phase Sectionalizing – Spacer Cable to Spacer Cable
 600 Amp – 4 or 12 kV



01 - TANGENT MESSENGER

FUSES AND SWITCHES
 Three Phase Sectionalizing – Spacer Cable to Spacer Cable
 600 Amp – 4 or 12 kV



02 - DEAD END MESSENGER

FUSES AND SWITCHES
 Three Phase Sectionalizing – Spacer Cable to Spacer Cable
 600 Amp – 4 or 12 kV

| | | Std. / Stk. No. | Description | 10 20 10 ** | 01 | 02 |
|----|---|------------------------|---|--------------------|-----------|-----------|
| | A | 23 56 075 | Bracket, Messenger | | 1 | |
| | B | 23 52 065 | Bolt, Machine, 5/8" x 12" (w/ nut) | | 3 | 1 |
| | C | 23 66 027 | Washer, Square 2-1/4" x 3/16" Thick | | 4 | 2 |
| | D | 23 59 095 | Eyelet, 3/4", Galvanized Steel | | | 1 |
| | E | 23 52 097 | Bolt, 3/4" x 12" | | | 1 |
| | F | 23 65 018 | Eyenuit, 3/4", Galvanized Steel | | 1 | 2 |
| | G | 23 68 713 | Grip, Messenger/ Neutral, Preformed – 052 AWA | | | 2 |
| | H | 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | | | 2 |
| | I | 69 58 293 | Line Duc (Messenger Cover), Black, 8' Long (Each) | | 2 | 2 |
| | J | 17 58 054 | Bracket, Switch/ Arrester Mounting | | 3 | 3 |
| | K | 17 51 137 | Connector, PG, Pole Ground to Messenger | | 1 | 1 |
| | L | 04 00 41 04 | Crossarm, Deadend, F/G, 10' | | 1 | 1 |
| | M | 04 00 20 03 | Crossarm, Sgl., Wood, 10', (use only 1/2 of V-Brace) | | 1 | 1 |
| 5 | N | 54 07 204 | Switch, Dis., 600A, 15kV | | 3 | 3 |
| | O | 25 06 052 | Insulator, Suspension, 15kV, Poly | | 6 | 6 |
| | P | 25 56 076 | Insulator, Strain, Fiberglass, 26", 15kV | | 6 | 6 |
| | Q | 23 58 122 | Clevis, Thimble, 7/8" opening, Galvanized Steel | | 6 | 6 |
| | R | 23 68 181 | Shackle – Anchor, 9/16" | | 6 | 6 |
| @ | S | 23 68 701 | Grip, Conductor Deadend, 15kV, New 477 Spacer Cable | | 6 | 6 |
| | | | Size Grip per Existing Spacer Cable Conductor (See 07 20 11 00) | | 6 | 6 |
| 2 | T | 17 55 804 | Lug, Shear Bolt, 350 Through 795 Spacer Cable | | 6 | 6 |
| @ | U | 17 62 088 | Clamp, Hotline, 1/0 Through 477 Spacer Cable | | 3 | 3 |
| | | 17 62 143 | Clamp, Hotline, 795 Spacer Cable | | 3 | 3 |
| 1@ | V | 10 01 144 | Arrester, 10kV w/ Protective Cap | | 3 | 3 |
| | | 10 01 133 | Arrester, 3kV w/ Protective Cap | | 3 | 3 |
| | W | 18 51 025 | Wire, #4 Cu. Poly Covered (Ft.) | | 15 | 15 |
| 6@ | X | 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 | 1 |
| @ | Y | 03 01 01 ** | Neutral Configuration | | | |

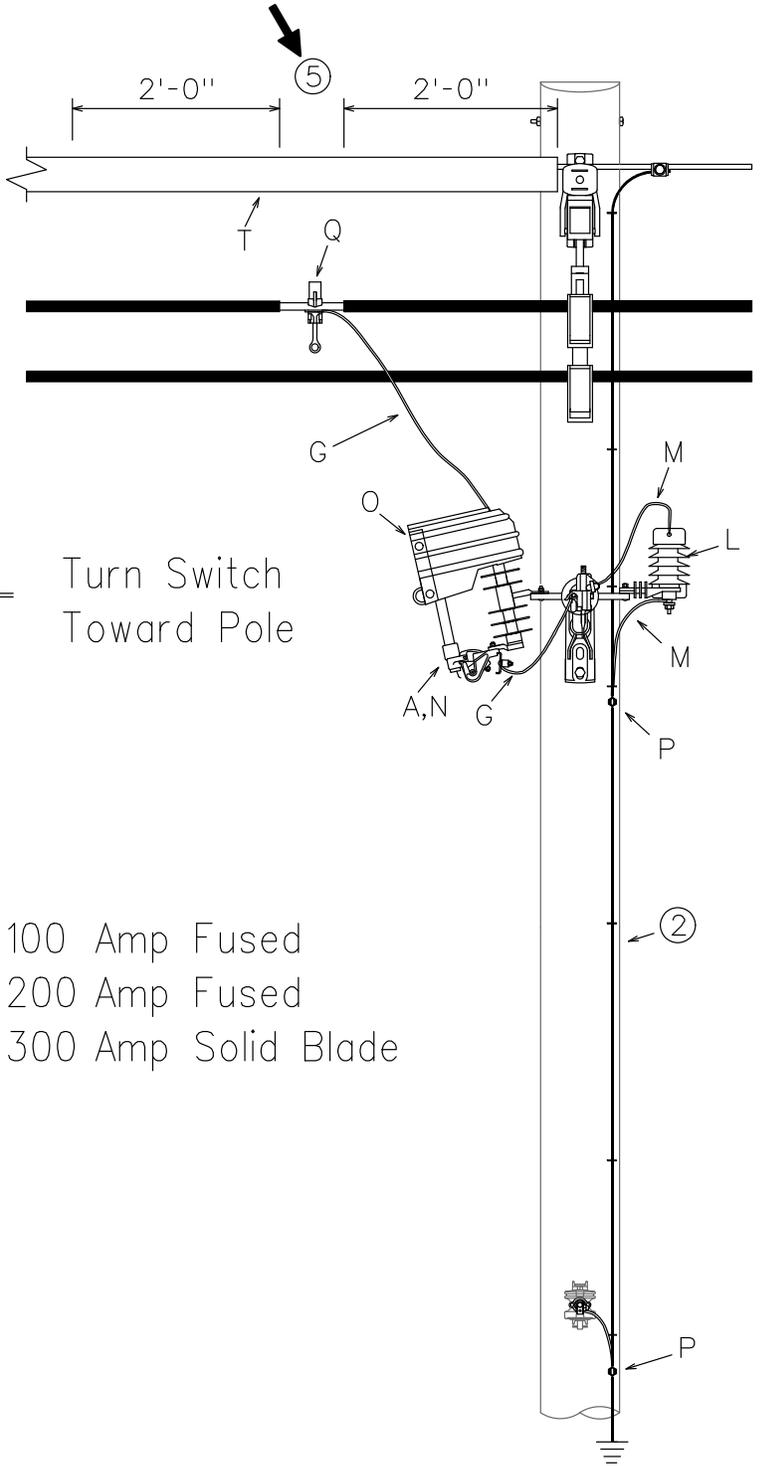
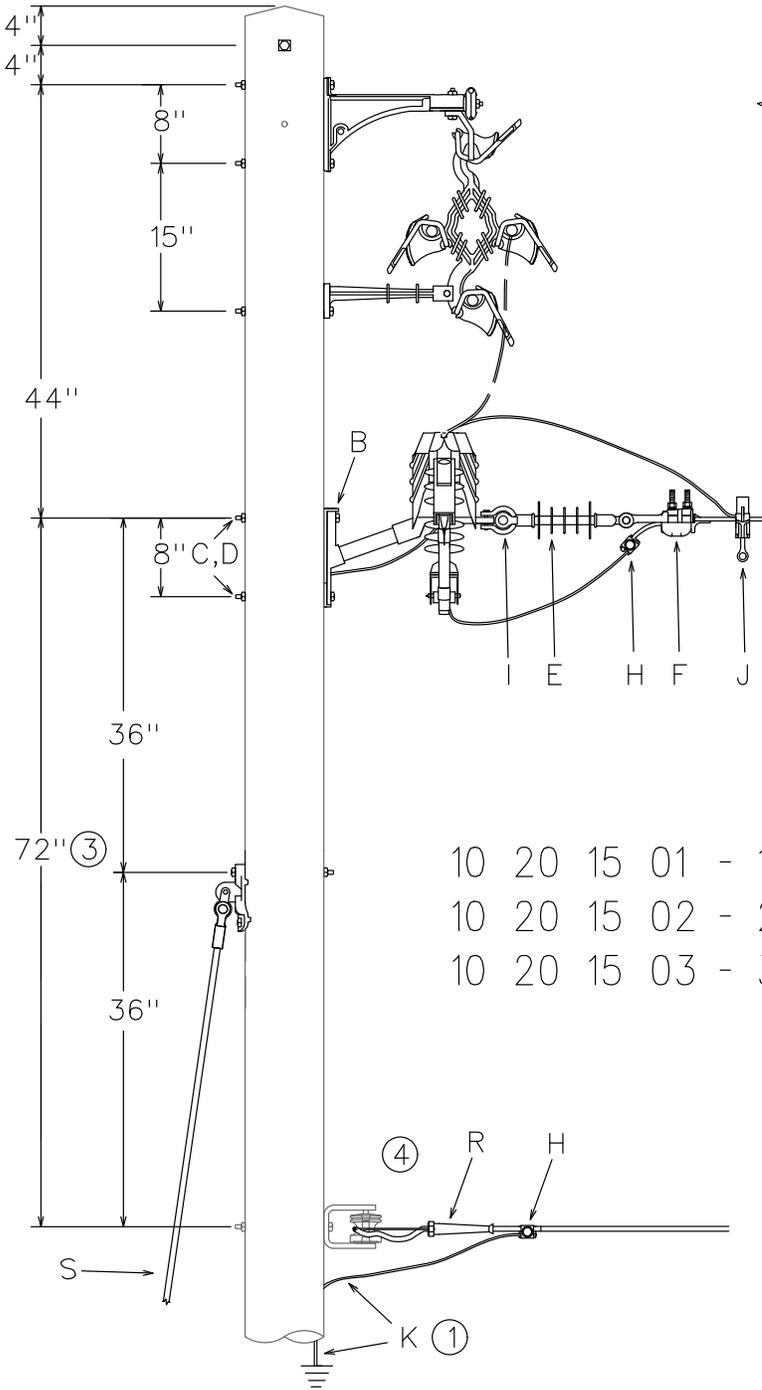
NOTES:

1. Install proper voltage arresters at this location. Where switches are normally open, install additional set of arresters on an adjacent pole for unprotected side of switches.
2. Extend spacer cable conductor with covering intact through the preform into the switch using compression lugs.
3. Install the first spacer (23 67 334) about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
4. Where required, switch number tag shall be installed here.
5. Only install the two inside bolts on the switch and slide them as close to the crossarm as possible.
6. Use DCS **12 00 10 01** for ground coil application on new poles installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.

FUSES AND SWITCHES
 Single Phase Tap From Spacer Cable
 100 to 300 Amp – 15 KV & Below

10 20 15 **

Sheet 1 of 2



- 10 20 15 01 - 100 Amp Fused
- 10 20 15 02 - 200 Amp Fused
- 10 20 15 03 - 300 Amp Solid Blade

FUSES AND SWITCHES
 Single Phase Tap From Spacer Cable
 100 to 300 Amp – 15 KV & Below

10 20 15 **
 Sheet 2 of 2

| | Std. /Stk. No. | Description | 10 20 15 ** | 01 | 02 | 03 |
|------|----------------|---|--|----|----|----|
| | A 54 07 208 | Switch, Fuse, 100A, 15 KV | | 1 | | |
| | 54 07 209 | Switch, Fuse, 200A, 15 KV | | | 1 | |
| | 54 07 210 | Switch, Solid Blade, 300A, 15 KV | | | | 1 |
| | B 23 56 063 | Bracket, Switch, Arrester, and Dead End | | 1 | 1 | 1 |
| | C 23 52 065 | Bolt, Mach., 5/8" x 12" | | 2 | 2 | 2 |
| | D 23 66 027 | Washer, Square, 5/8" | | 2 | 2 | 2 |
| | E 25 06 052 | Ins., Suspension, 15 KV | | 1 | 1 | 1 |
| @ | F DEC*W | Clamp, Deadend (See 07 00 11 00) | | 1 | 1 | 1 |
| @ | G PLW*W | Wire, Poly Covered (ft.) (See 07 00 80 00 & 07 00 01 03) | | 10 | 10 | 10 |
| @ | H PG* | Clamp, Parallel Groove or Split Bolt or Two Bolt. (See 07 00 25 00) | | 2 | 2 | 2 |
| | I 23 68 181 | Shackle, Deadend | | 1 | 1 | 1 |
| @ | J HLC*W | Clamp, Hot Line See 07 00 21 00 | | 1 | 1 | 1 |
| 1,2@ | K | 12 00 10 02 | 7#10 Pole Ground with Ground Rod | 1 | 1 | 1 |
| | | 12 00 10 03 | #2 Cu. Pole Ground with Ground Rod | 1 | 1 | 1 |
| @ | L | 10 01 144 | Arrester, 10 KV w/ Protective Cap | 1 | 1 | 1 |
| | | 10 01 133 | Arrester, 3 KV w/ Protective Cap | 1 | 1 | 1 |
| | M 18 51 021 | Wire, S.D., #6 Cu, Poly (ft.) | | 6 | 6 | 6 |
| | N | Link, Fused, (sized by Engineer) | | 1 | 1 | 1 |
| | O 23 17 411 | Cover, Cutout | | 1 | 1 | 1 |
| | P 17 54 373 | Connector, Split Bolt | | 2 | 2 | 2 |
| @ | Q | 17 62 088 | Clamp, Hotline, 1/0 through 477 Spacer Cable | 1 | 1 | 1 |
| | | 17 62 143 | Clamp, Hotline, 795 Spacer Cable | 1 | 1 | 1 |
| 4 @ | R | SDEA*W | Deadend, Automatic, Secondary. (See 08 01 10 00) | 1 | 1 | 1 |
| 3 @ | S | 11 00 ** ** | Guy Unit | 1 | 1 | 1 |
| | T | 69 58 293 | Line DUC, Messenger Cover, Black (Each) | 1 | 1 | 1 |

NOTES

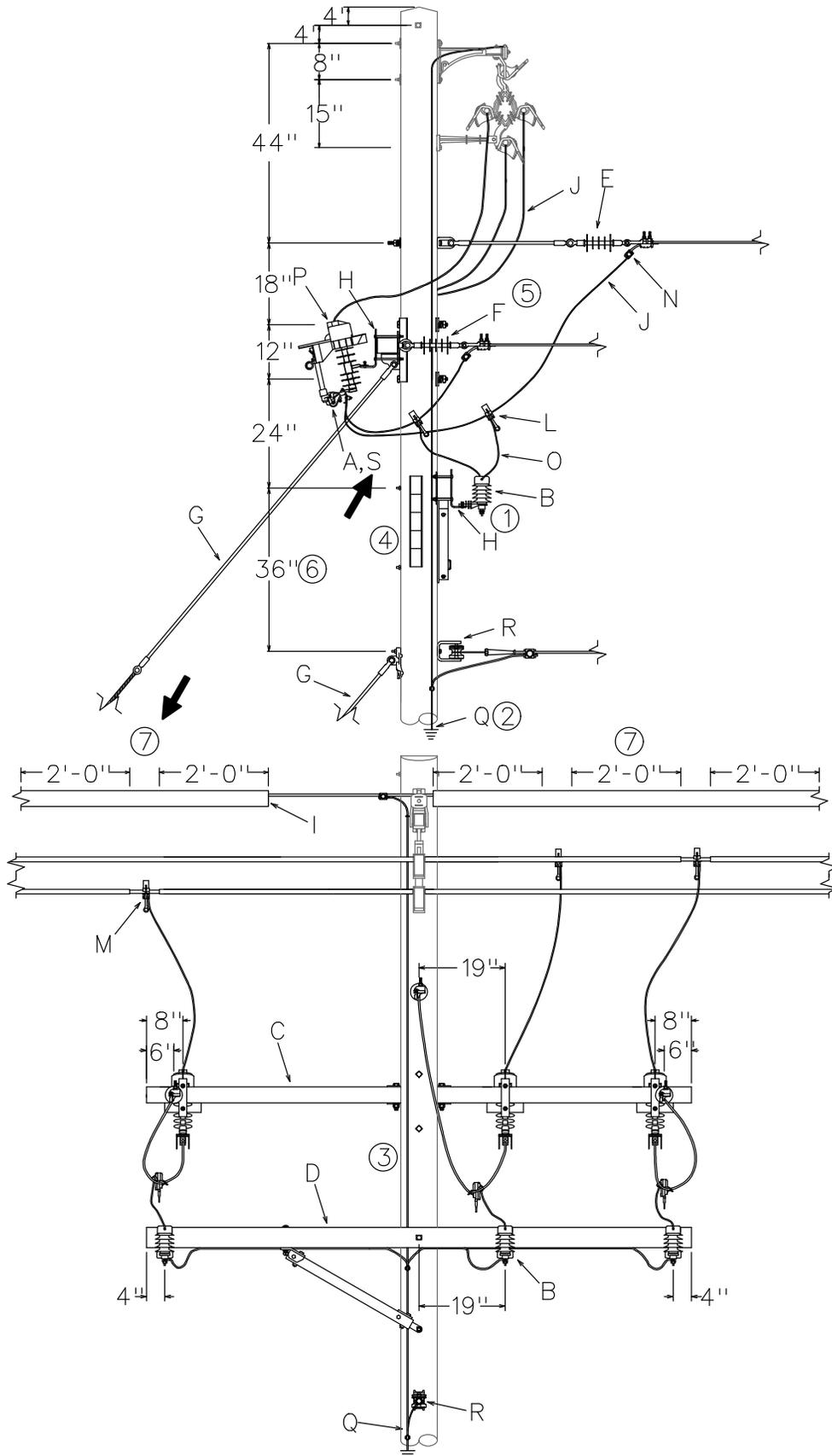
1. The pole ground is included with a new pole. Only needed when mounting switch on existing pole
2. The conductor between the messenger and open-wire tap neutral must be #2 copper if the messenger is the system neutral, i.e. there is no secondary neutral present
3. This distance may be reduced to 40 inches if approved by engineering. Center the guy attachment between the primary and neutral if this distance is reduced.
4. Use a primary dead end clamp for tensions greater than 1,500 pounds.
5. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

FUSES AND SWITCHES

15kV & Below – Spacer Cable – Two or Three Phase Tap
100 to 300 Amp

10 20 20 **

Sheet 1 of 2



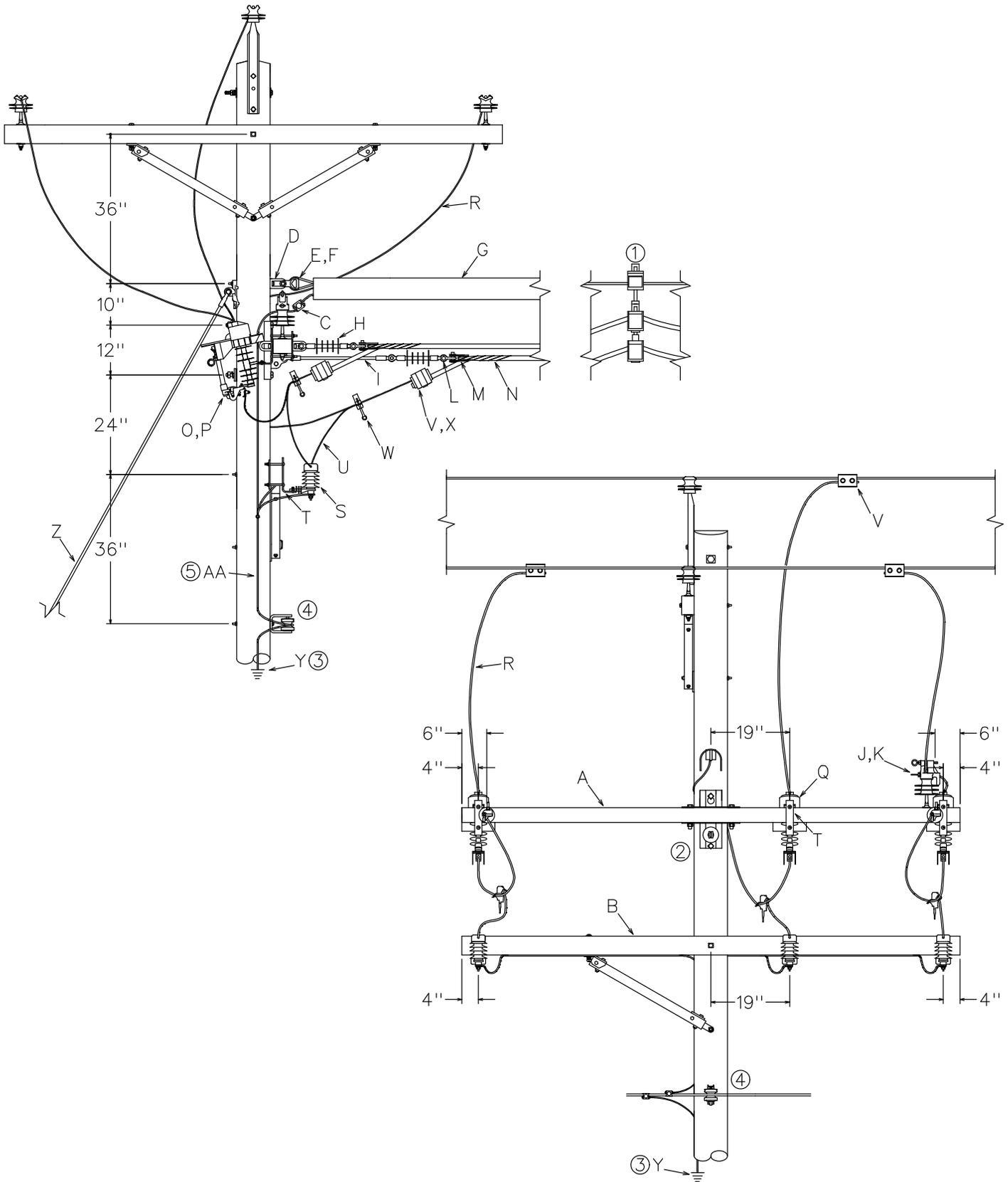
FUSES AND SWITCHES
 15kV & Below – Spacer Cable – Two or Three Phase Tap
 100 to 300 Amp

| | Std. / Stk. No. | Description | 10 20 20 ** | 2 Phase | | | 3 Phase | | |
|------|-----------------|-------------|--|---------|----|----|---------|----|----|
| | | | | 01 | 02 | 03 | 04 | 05 | 06 |
| @1 | A | 54 07 208 | Switch, Fused, 100A, 15kV | 2 | | | 3 | | |
| | | 54 07 209 | Switch, Fused, 200A, 15kV | | 2 | | | 3 | |
| | | 54 07 210 | Switch, Solid Blade, 300A, 15kV | | | 2 | | | 3 |
| @1 | B | 10 01 144 | Arrester, 10kV w/ Protective Cap | 2 | 2 | 2 | 3 | 3 | 3 |
| | | 10 01 133 | Arrester, 3kV w/ Protective Cap | 2 | 2 | 2 | 3 | 3 | 3 |
| | C | 04 00 41 04 | Crossarm, Deadend, FG 10' | 1 | 1 | 1 | 1 | 1 | 1 |
| | D | 04 00 20 03 | Crossarm, Sgl, Wood, 10' (use only 1/2 of V-brace) | 1 | 1 | 1 | 1 | 1 | 1 |
| | E | 06 12 30 01 | Deadend on pole with FG extension, 10' | | | | 1 | 1 | 1 |
| | F | 06 12 35 02 | Deadend on single arm | 1 | 1 | 1 | 1 | 1 | 1 |
| @ | G | 11 00 42 ** | Guying Unit w/ FG Strain Insulator and HD Guy Hook | | | | | | |
| | H | 17 58 054 | Bracket, Switch/Arrester Mounting | 4 | 4 | 4 | 6 | 6 | 6 |
| | I | 69 58 293 | Line Duc (Messenger Cover), Black. 8' Long (Each) | 2 | 2 | 2 | 2 | 2 | 2 |
| @ | J | PLW*W | Wire, Poly Covered, S.D. (ft) (DCS 07 00 80) | 20 | 20 | 20 | 30 | 30 | 30 |
| | L | 23 78 394 | Clamp, Hotline, #6 to 2/0 | 2 | 2 | 2 | 3 | 3 | 3 |
| @ | M | 17 62 088 | Clamp, Hotline, 1/0 through 477 Spacer Cable | 2 | 2 | 2 | 3 | 3 | 3 |
| | | 17 62 143 | Clamp, Hotline, 795 Spacer Cable | 2 | 2 | 2 | 3 | 3 | 3 |
| @ | N | PG* | Clamp, Parallel Groove (DCS 07 00 25 00) | 2 | 2 | 2 | 3 | 3 | 3 |
| | O | 18 51 021 | Wire, #6 CU., S.D. Covered (ft) | 6 | 6 | 6 | 9 | 9 | 9 |
| | P | 05 15 10 01 | Cover – Cutout | 2 | 2 | 2 | 3 | 3 | 3 |
| @2,3 | Q | 12 00 10 ** | #2 Copper Ground Unit | 1 | 1 | 1 | 1 | 1 | 1 |
| @ | R | 03 01 01 ** | Neutral Configuration | | | | | | |
| @ | S | | Link, Fused, (sized by Engineer) | 2 | 2 | | 3 | 3 | |

NOTES

1. Install proper voltage arresters at this location. Where switches are normally open, install additional set of arresters on the spacer cable side of the switch.
2. The pole ground is included with a new pole. Only needed when installing tap on an existing pole.
3. The ground wire between the messenger and open-wire tap neutral must be #2 copper if the messenger is the system neutral, i.e. there is no secondary neutral present.
4. Switch number tag shall be installed here.
5. The mirror of this configuration can be built with the dead-end arm and switches installed under the spacer cable and the open wire extending in the opposite direction than shown in the drawing.
6. This distance may be reduced to 24 inches if approved by engineering.
7. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

FUSES AND SWITCHES
 15 kV & Below – Spacer Cable
 Three Phase Tap From Open Wire 100 to 300 Amp



FUSES AND SWITCHES
15 kV & Below – Spacer Cable
Three Phase Tap From Open Wire 100 to 300 Amp

10 20 25 **
 Sheet 2 of 2

| | Std./Stk. No. | Description | 10 20 25 ** | 01 | 02 | 03 |
|-----|---------------|---|-------------|----|----|----|
| | A 04 00 41 04 | Deadend Assy, FG Arm, 10' | | 1 | 1 | 1 |
| | B 04 00 20 03 | Crossarm, Sgl, Wood, 10' (use only 1/2 of V-Brace) | | 1 | 1 | 1 |
| | C 17 51 137 | Connector, PG, Pole Ground to Messenger | | 1 | 1 | 1 |
| | D 23 59 095 | Eyelet, NM, STD, 3/4" | | 1 | 1 | 1 |
| | E 23 68 713 | Grip, Messenger/Neutral, Preformed for 7#6 – 052AWA | | 1 | 1 | 1 |
| | F 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | | 1 | 1 | 1 |
| | G 69 58 293 | Line Duc Cover – (Messenger Cover), Black. 8' Long (Each) | | 1 | 1 | 1 |
| | H 25 06 052 | Insulator, Suspension, 15kV, Poly | | 3 | 3 | 3 |
| | I 25 56 076 | Insulator, Guy Strain, Fiberglass 26", 15kV | | 1 | 1 | 1 |
| | J 25 05 143 | Insulator, Pin, 15kV, Vice-Top | | 1 | 1 | 1 |
| | K 23 62 028 | Pin, Insulator, Long Shank | | 1 | 1 | 1 |
| | L 23 68 181 | Shackle – Anchor, 9/16" | | 3 | 3 | 3 |
| | M 23 58 122 | Clevis, Thimble, 7/8" Opening, Galvanized Steel | | 3 | 3 | 3 |
| @ | N 23 68 701 | Grip, Conductor Deadend, 15kV, 477 Spacer Cable | | 3 | 3 | 3 |
| | | Size Grip per existing Spacer Cable Conductor (See 07 20 11 00) | | 3 | 3 | 3 |
| | O 54 07 208 | Switch, Fused, 100A | | 3 | | |
| | 54 07 209 | Switch, Fused, 200A | | | 3 | |
| | 54 07 210 | Switch, Solid Blade, 300A | | | | 3 |
| @ | P | Link, Fuse (Sized by Engineer) | | 3 | 3 | |
| | Q 23 17 411 | Cover, Cutout | | 3 | 3 | 3 |
| @ | R LW*W | Wire, Poly Covered, S.D. (ft.) (See 07 00 80 00) | | 30 | 30 | 30 |
| @ | S 10 01 144 | Arrester, 10kV w/ Protective Cap | | 3 | 3 | 3 |
| | 10 01 133 | Arrester, 3kV w/ Protective Cap | | 3 | 3 | 3 |
| | T 17 58 054 | Bracket, Switch/Arrester Mounting | | 6 | 6 | 6 |
| | U 18 51 021 | Wire, Poly #6 CU., (FT.) | | 15 | 15 | 15 |
| @ | V PG*W | Clamp, Parallel Groove (See 07 00 25 00) | | 3 | 3 | 3 |
| | HLC*W | Hot Line Clamp | | 3 | 3 | 3 |
| @ | W HLC*W | Hot Line Clamp | | 3 | 3 | 3 |
| | X 38 51 608 | Cover, Large, Vice Type Connectors | | 3 | 3 | 3 |
| @,3 | Y 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 | 1 | 1 |
| @ | Z 11 00 42 ** | Guying Unit with FG Strain Insulator & HD Guy Hook | | | | |
| 5 | AA 18 51 019 | Wire, #2 Cu. Poly Covered (Ft.) | | 15 | 15 | 15 |

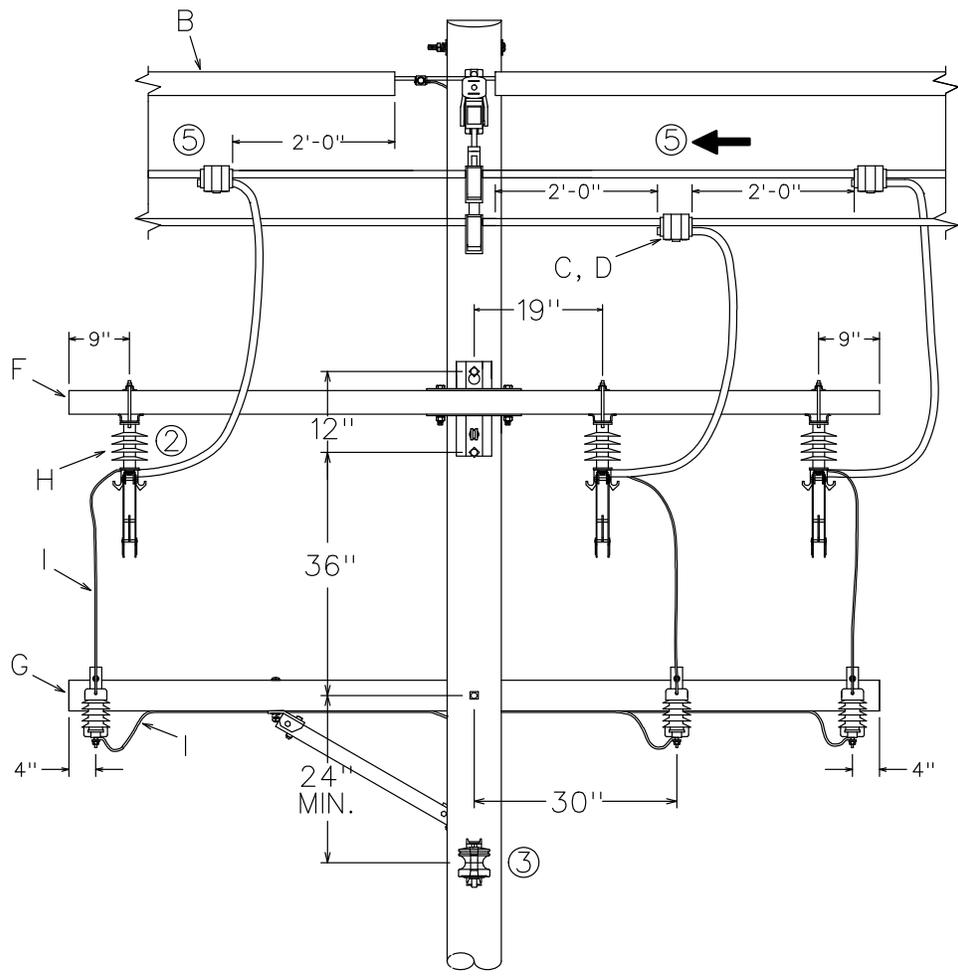
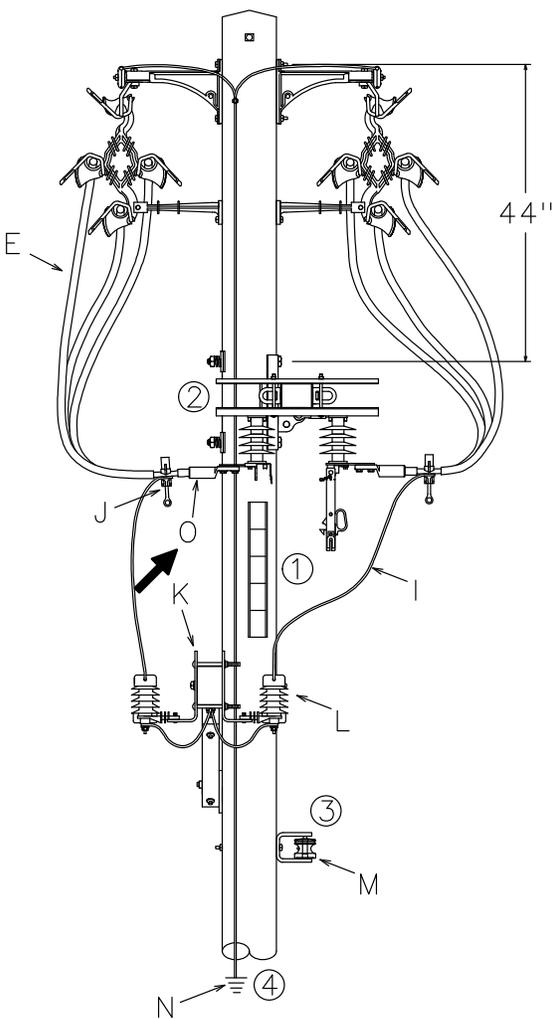
NOTES:

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS 07 20 01 01 for spacer installation between poles.
2. Install the center phase of the spacer cable with fiberglass Strain Insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.
3. Use DCS 12 00 10 01 ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Extend #2 poly covered ground wire (18 51 019) from open wire neutral to the messenger.

FUSES AND SWITCHES
 15kV & Below – Spacer Cable
 Double Circuit 600A Tie Switch

10 20 30 01

Sheet 1 of 2



FUSES AND SWITCHES
15kV & Below – Spacer Cable
Double Circuit 600A Tie Switch

10 20 30 01

Sheet 2 of 2

| | | Std./Stk. No. | Description | 10 20 30 01 | |
|---|---|----------------------|---|--------------------|----|
| @ | A | 03 20 02 01 | Double Circuit – Tangent – Back to Back Configuration | | |
| | B | 69 58 293 | Line Duc (Messenger Cover), Black, 8' Long (Each) | | 2 |
| @ | C | PG*W | Clamp, PG, Conductor to Conductor | | 6 |
| | D | 38 51 608 | Cover, Large, Vise Type Connectors | | 6 |
| | E | 18 51 052 | Wire, Poly, SD, 350 Cu. (Ft.) | | 36 |
| | F | 04 00 41 04 | Crossarm, Deadend, F/G, 10' | | 1 |
| | G | 04 00 20 03 | Crossarm, Sgl., Wood, 10', (use only 1/2" of V-Brace) | | 1 |
| 2 | H | 54 07 204 | Switch, Dis., 600A, 15kV | | 3 |
| | I | 18 51 021 | Wire, #6 Cu. Poly Covered (Ft.) | | 40 |
| @ | J | 17 62 088 | Clamp, Hotline, 1/0 Through 477 Spacer Cable | | 6 |
| | | 17 62 143 | Clamp, Hotline, 795 Spacer Cable | | 6 |
| | K | 23 56 088 | Bracket, Crossarm, CO/LA – Double | | 3 |
| @ | L | 10 01 144 | Arrester, 10kV w/ Protective Cap | | 6 |
| | | 10 01 133 | Arrester, 3kV w/ Protective Cap | | 6 |
| @ | M | 03 01 01 ** | Neutral Configuration | | |
| @ | N | 12 00 10 03 | Grounding Unit, #2 Cu. Pole Ground With Ground Rod | | 1 |
| | | 12 00 10 04 | Grounding Unit, #2 Cu. Pole Ground With Ground Coil | | 1 |
| | O | 17 55 804 | Lug, Shear Bolt, 350 Through 795 Spacer Cable | | 6 |

NOTES:

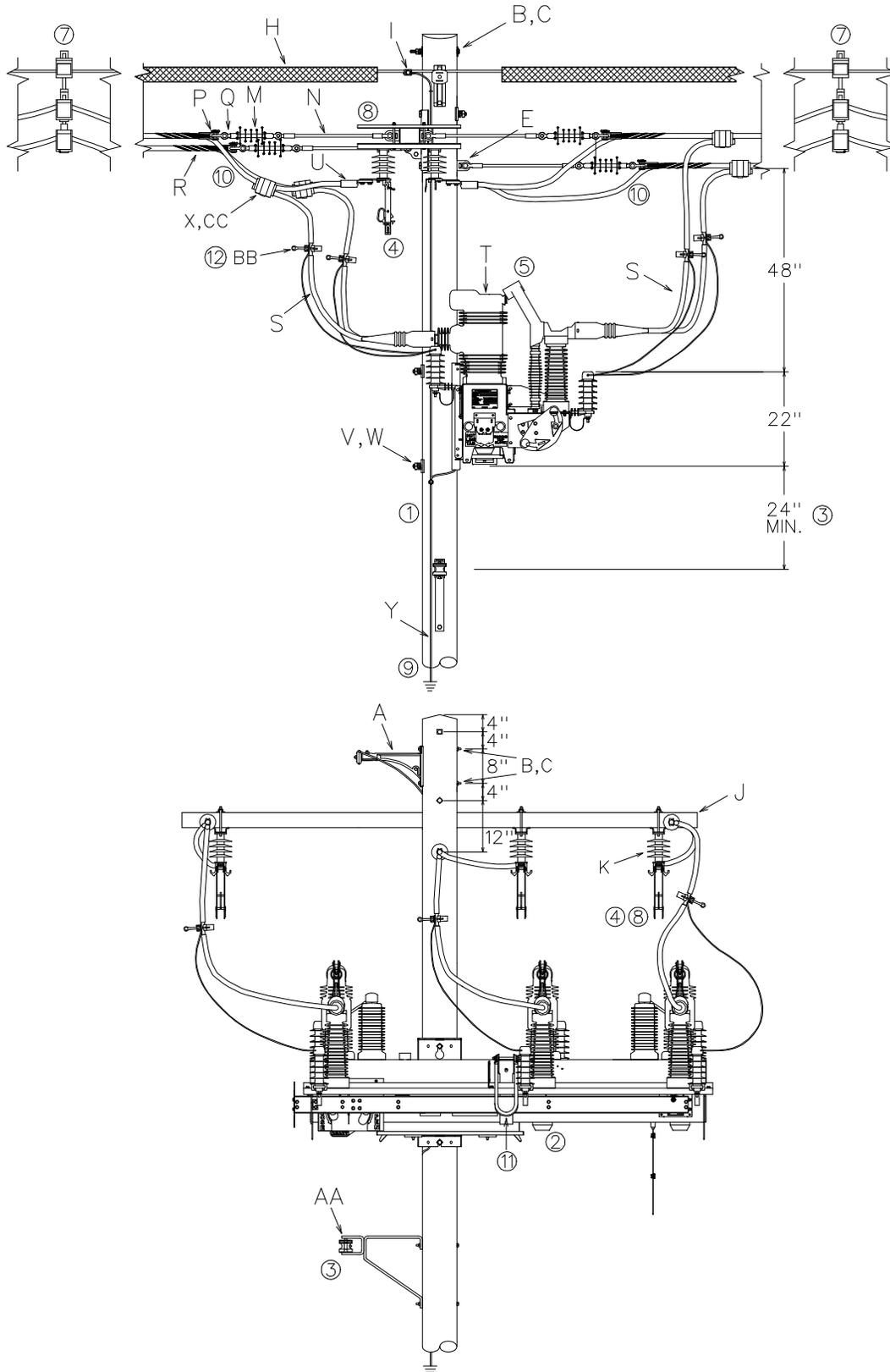
- Where required, switch number tag shall be installed here.
- Only install the two inside bolts on the switch and slide them as close to the crossarm as possible.
- Secondary location if present. Connect secondary neutral to pole ground.
- Use DCS **12 00 10 04** for ground coil application on new pole installation. Use DCS **12 00 10 03** for ground rod application on existing pole installation.
- Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

CONFIGURATIONS

Three Phase Recloser – Spacer Cable With Remote Control – 600 Amp – 15kV

10 20 33 **

Sheet 1 of 4



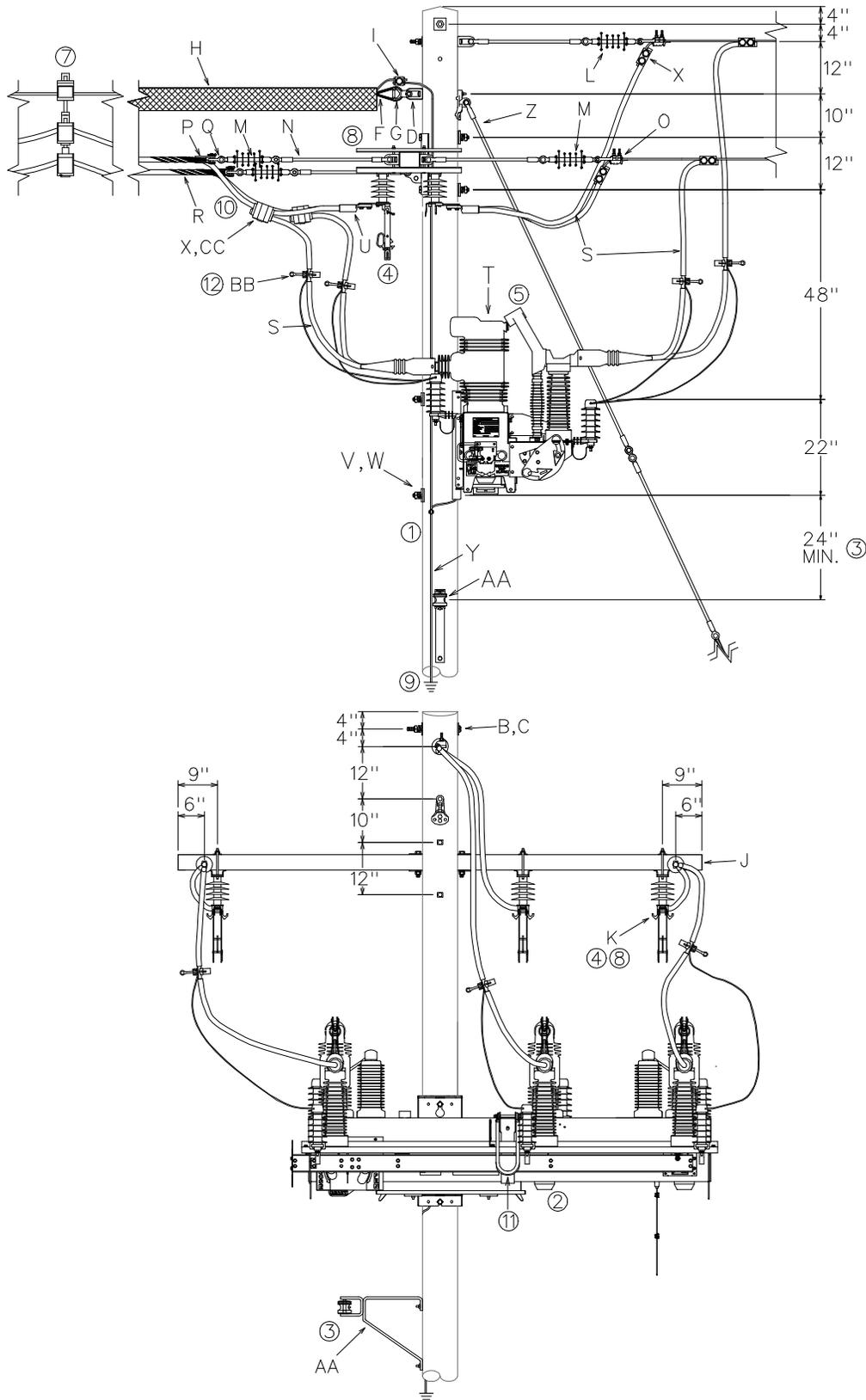
01 - SPACER CABLE TO SPACER CABLE

CONFIGURATIONS

Three Phase Recloser – Spacer Cable With Remote Control – 600 Amp – 15kV

10 20 33 **

Sheet 2 of 4



02 - SPACER CABLE TO OPEN WIRE

CONFIGURATIONS
 Three Phase Recloser – Spacer Cable
 With Remote Control – 600 Amp – 15kV

10 20 33 **
 Sheet 3 of 4

| | | Std. / Stk. No. | Description | 10 20 33 ** | 01 | 02 |
|-------|----|------------------------|--|--------------------|-----------|-----------|
| | A | 23 56 075 | Bracket, Messenger | | 1 | |
| | B | 23 52 065 | Bolt, Machine, 5/8" x 12" (w/ nut) | | 3 | 1 |
| | C | 23 66 027 | Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick | | 3 | 1 |
| | D | 23 59 095 | Eyelet, 3/4" Galvanized Steel | | | 1 |
| | E | 23 65 018 | Eyenuit, 3/4" Galvanized Steel | | 1 | |
| | F | 23 68 713 | Grip, Messenger/Neutral, Preformed 7#6 – 052 AWA | | | 2 |
| | G | 23 58 054 | Clevis, NM, Thimble, Galvanized Steel | | | 1 |
| | H | 69 58 293 | Line Duc (Messenger Cover), Black. 8' Long (Each) | | 2 | 1 |
| | I | 17 51 137 | Clamp, PG, Pole Ground to Messenger | | 1 | 1 |
| | J | 04 00 41 04 | Crossarm, Deadend, F/G, 10' | | 1 | 1 |
| 4,8 | K | 54 07 204 | Switch, Dis., 600A, 15kV | | 3 | 3 |
| | L | 06 12 30 01 | Deadend on Pole w/ FG Extension | | | 1 |
| | M | 25 06 052 | Insulator, Suspension, 15kV, Poly | | 6 | 5 |
| | N | 25 56 076 | Insulator, Strain, Fiberglass, 26", 15kV | | 6 | 5 |
| @ | O | DEC*W | Clamp, Deadend | | | 3 |
| | P | 23 58 122 | Clevis, Thimble, 7/8" Opening, Galvanized Steel | | 6 | 3 |
| | Q | 23 68 181 | Shackle – Anchor, 9/16" | | 6 | 3 |
| @ | R | 17 69 063 | Grip, Conductor Deadend, 15kV, New 477 Spacer Cable | | 6 | 3 |
| | | 17 69 *** | Size Grip per Existing Spacer Cable Conductor | | 6 | 3 |
| | S | 18 51 052 | Wire, Poly, SD, 350 Cu. (Ft.) | | 75 | 100 |
| 5,6 | T | 69 10 250 | Recloser, S&C Intellirupter, 15kV, 600A w/ Comm Module | | 1 | 1 |
| 10 | U | 17 55 804 | Lug, Shear Bolt, 1/0 Through 795 Spacer Cable | | 6 | 3 |
| | V | 23 52 219 | Bolt, Galv., 3/4" x 14" | | 2 | 2 |
| | W | 23 66 031 | Washer, NM, Curved, 3/4" | | 2 | 2 |
| @ | X | PG*W | Clamp, Parallel Groove (See 07 00 25 00) | | 6 | 9 |
| 1,9 @ | Y | 12 00 10 ** | Grounding Unit, #2 CU Poly Covered | | 1 | 1 |
| @ | Z | 11 00 42 ** | Guying Unit w/ FG Strain Insulator & HD Guy Hook | | | 1 |
| 3 @ | AA | 03 01 01 ** | Neutral Configuration | | 1 | 1 |
| 12 | BB | 23 78 183 | Clamp, Hot Line | | 6 | 6 |
| | CC | 38 51 608 | Cover | | 6 | 3 |

NOTES

- Intellirupter recloser frame must be connected to ground with #2 copper wire. Pole ground to neutral connection must be #2 copper wire.
- Tool to remove/install radio module and control is 46 01 645
- Install neutral/secondary using extension brackets. Install to the one phase side of the pole to allow access to the compartments on the bottom of the intellirupter. The neutral/ secondary may be dead-ended to the pole as long as they are mounted 36 inches below the bottom mounting bolt of the intellirupter.
- Switches are to open towards the climbing side of the pole.

**DISTRIBUTION
 CONSTRUCTION STANDARDS**



ENG: WYW
 REV. NO: NEW
 REV. DATE: 09/15/17

CONFIGURATIONS
Three Phase Recloser – Spacer Cable
With Remote Control – 600 Amp – 15kV

10 20 33 **

Sheet 4 of 4

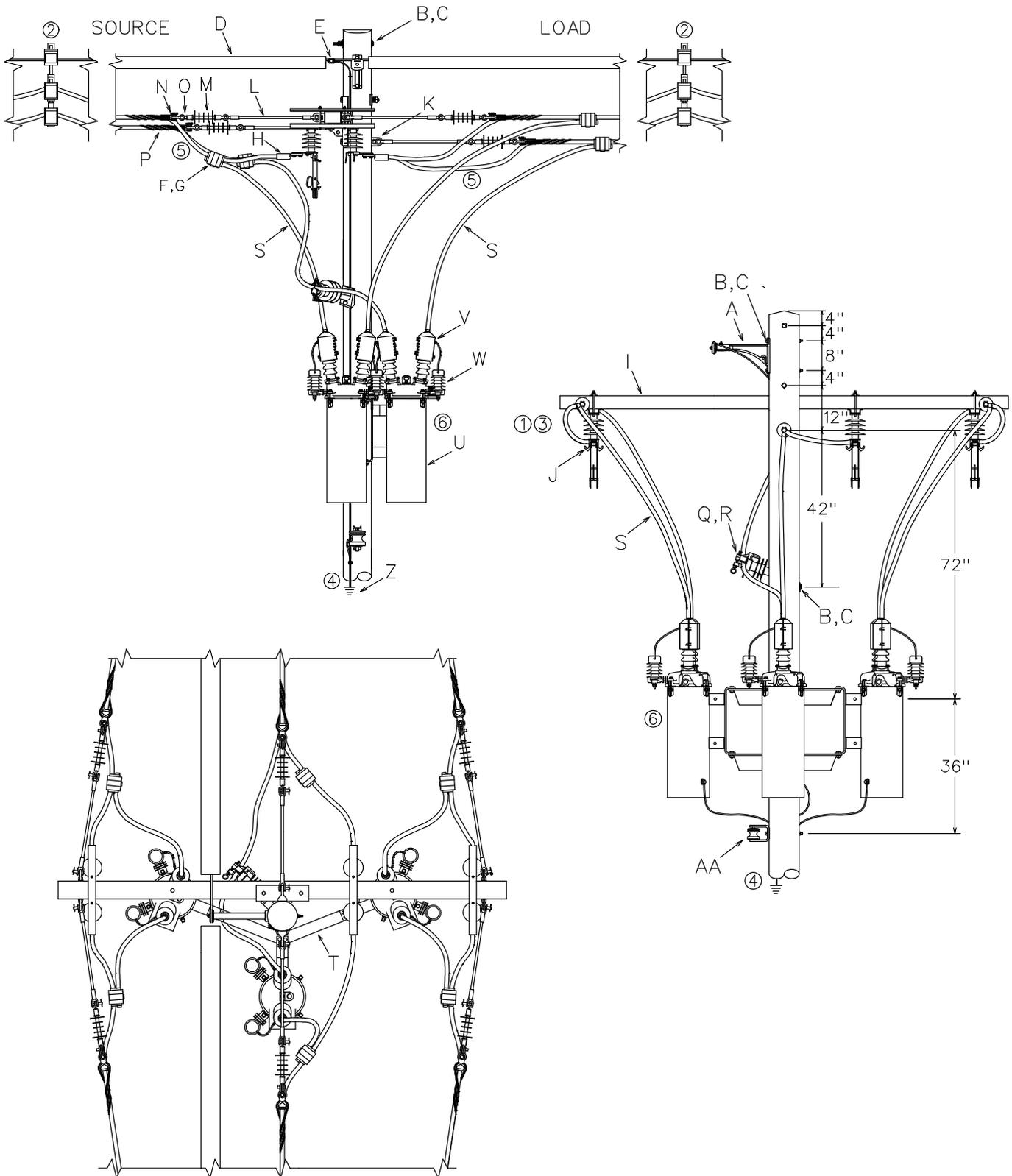
5. Integral disconnect switches on recloser shall be in the open position while connecting primary leads to the recloser.
6. Intellirupter Recloser weight is 1,010 lbs.
7. Install the first spacer (23 67 334) about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
8. Only install to two inside bolts on the switch and slide them as close to the crossarms as possible.
9. Use DCS **12 00 10 04** for ground coil application on the new pole installation. Use DCS **12 00 10 03** for ground rod application on existing pole installation.
10. Extend spacer cable conductor with covering intact through the preform into the switch using shear bolt lugs.
11. Fold lifting bracket down after lifting.
12. The lightning arresters shall be connected to the recloser leads with hot-line clamps installed a minimum of 36 inches away from the aluminum base of the intellirupter. The arrester wire is included with the intellirupter.

FUSES AND SWITCHES

Three Phase Recloser – Spacer Cable
280 Amp – 12kV

10 20 35 01

Sheet 1 of 2



FUSES AND SWITCHES

Three Phase Recloser – Spacer Cable 280 Amp – 12kV

10 20 35 01

Sheet 2 of 2

| | | Std./Stk. No. | Description | 10 20 35 01 | |
|-----|----|---------------|---|-------------|----|
| | A | 23 56 075 | Bracket, Messenger | | 1 |
| | B | 23 52 065 | Bolt, Machine, 5/8" x 12" (w/nut) | | 4 |
| | C | 23 66 027 | Washer, Square 2-1/4" x 2-1/4" x 3/16" Thick | | 4 |
| | D | 69 58 293 | Line Duc (Messenger Cover), Black. 8' Long (Each) | | 2 |
| | E | 17 51 137 | Connector, PG, Pole Ground to Messenger | | 1 |
| @ | F | PG*W | Clamp, Parallel Groove (See 07 00 25 00) | | 6 |
| | G | 38 51 608 | Cover | | 6 |
| | H | 17 55 804 | Lug, Shear Bolt, 350 Through 795 Spacer Cable | | 6 |
| | I | 04 00 41 04 | Crossarm, Deadend, F/G, 10' | | 1 |
| 1,3 | J | 54 07 204 | Switch, Dis., 600A, 15kV | | 3 |
| | K | 23 65 018 | Eyenuit, 3/4", Galvanized Steel | | 1 |
| | L | 25 56 076 | Insulator, Strain, Fiberglass, 26", 15kV | | 6 |
| | M | 25 06 052 | Insulator, Suspension, 15kV, Poly | | 6 |
| | N | 23 58 122 | Clevis, Thimble, 7/8" opening, Galvanized Steel | | 6 |
| | O | 23 68 181 | Shackle – Anchor, 9/16" | | 6 |
| @ | P | 23 68 701 | Grip, Conductor Deadend, 15kV, New 477 Spacer Cable | | 6 |
| | | | Size Grip per Existing Spacer Cable Conductor (See 07 20 11 00) | | 6 |
| | Q | 25 05 143 | Insulator, Vise-Top, 15kV | | 1 |
| | R | 23 12 122 | Bracket, FG, Standoff, LD, 10" | | 1 |
| | S | 18 51 024 | Wire, Poly, S.D., 1/0 Cu. (Ft.) | | 36 |
| | T | 23 17 209 | Mounting, NM, Recloser | | 1 |
| 6 | U | 69 10 143 | Recloser | | 3 |
| | V | 69 58 181 | Guard, Clam-Shell, Wildlife | | 6 |
| | W | 10 01 144 | Arrester, Lightning, 10kV | | 6 |
| | X | 23 52 219 | Bolt, Galv., 3/4" x 14" | | 2 |
| | Y | 23 66 031 | Washer, NM, Curved, 3/4" | | 2 |
| @,4 | Z | 12 00 10 ** | Grounding Unit, #2 CU Poly Covered | | 1 |
| @ | AA | 03 01 01 ** | Neutral Configuration | | |

NOTES:

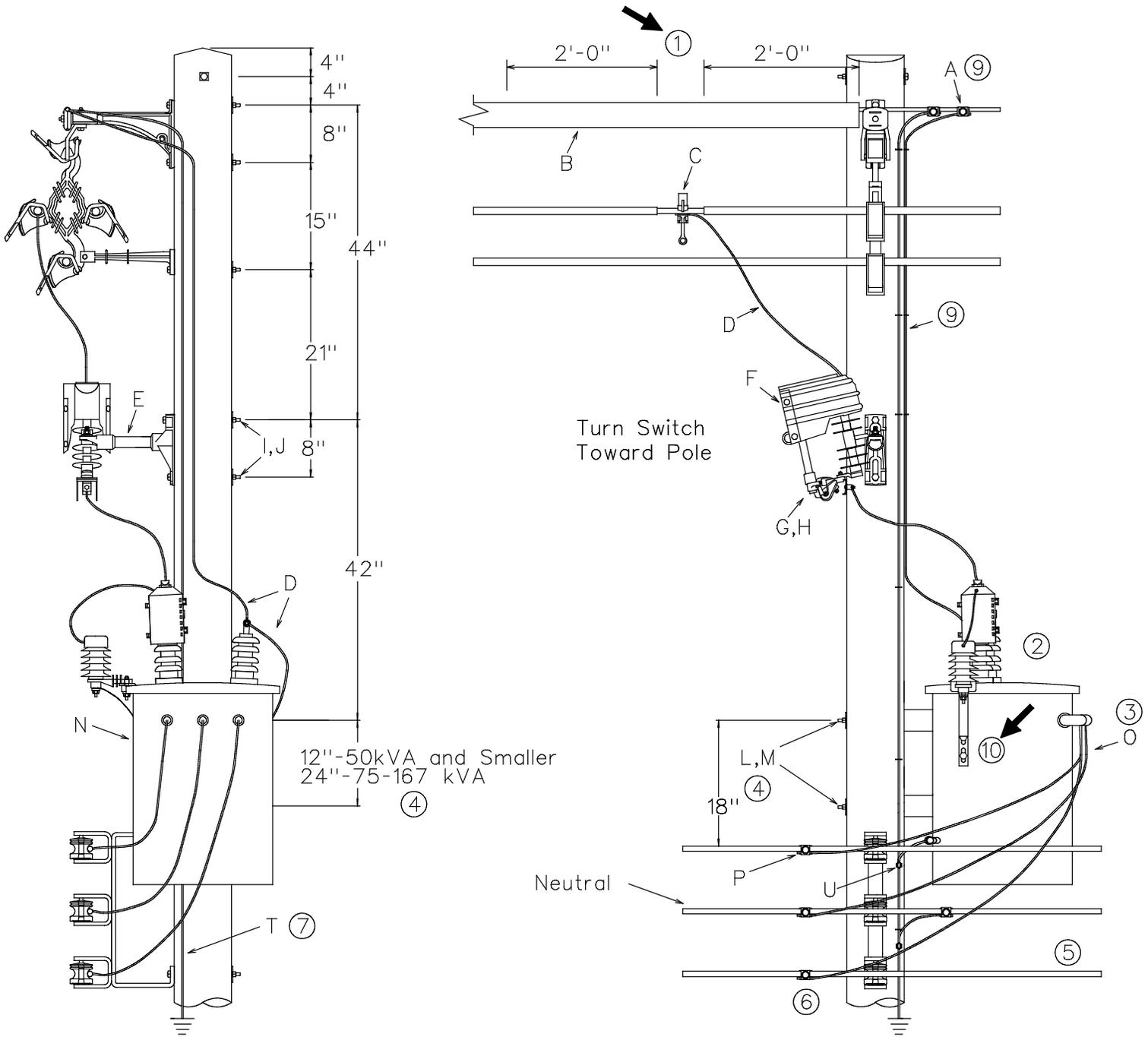
- Switches are to open toward the climbing side of the pole.
- Install the first spacer (23 67 334) about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
- Only install to two inside bolts on the switch and slide them as close to the crossarms as possible.
- Use DCS 12 00 10 04 for ground coil application on new pole installation. Use DCS 12 00 10 03 for ground rod application on existing pole installation.
- Extend spacer cable conductor with covering intact through the preform into the switch using shear bolt lugs.
- Reclosers should be turned in tank to position shown so all operating handles are accessible from the load side of the pole.

TRANSFORMERS

15kV & Below - Spacer Cable - Grounded Wye Primary
1 to 167kVA - Single Phase - Protected

13 20 00 01

Sheet 1 of 2



TRANSFORMERS

15kV & Below – Spacer Cable – Grounded Wye Primary
1 to 167kVA – Single Phase – Protected

13 20 00 01

Sheet 2 of 2

| | | Std. /Stk. No. | Description | 13 20 00 01 | |
|----|---|----------------|---|-------------|----|
| 9 | A | 17 51 137 | Connector, PG | | 1 |
| 1 | B | 69 58 293 | Line DUC (Messenger Cover), Black (Each) | | 1 |
| @ | C | 17 62 088 | Hot Line Clamp 1/0 through 477 Spacer Cable | | 1 |
| | | 17 62 143 | Hot Line Clamp 795 Spacer Cable | | 1 |
| | D | 18 51 025 | Wire, Trans. Riser #4, S.D. Poly Covered (FT.) | | 20 |
| | E | 23 06 127 | Bracket, Cutout, Single-Position | | 1 |
| | F | 23 17 411 | Cover, Cutout, 100 Amp | | 1 |
| 8 | G | 54 07 208 | Switch, Fused, 100 Amp | | 1 |
| @ | H | | Link, Fuse – See Single-Phase Trans. Table in 10 00 01 01 | | 1 |
| | I | 23 52 066 | Bolt, Machine, 5/8" x 14" (w/nut) | | 2 |
| | J | 23 66 027 | Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16" Thick | | 2 |
| T | L | 23 52 066 | Bolt, Machine, 5/8" x 14" (w/nut) (50kVA & Below) | | 2 |
| | | 23 52 219 | Bolt, Machine, 3/4" x 14" (w/nut) (75 & 167kVA) | | 2 |
| T | M | 23 66 027 | Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16" Thick (50kVA & Below) | | 2 |
| | | 23 66 031 | Washer, Square, 3/4", Curved (75 to 167kVA) | | 2 |
| @ | N | | Transformer – See 13 00 01 02 | | 1 |
| T | O | | Secondary Leads (FT.) (See 13 00 03 01) | | 12 |
| T | P | PG*W | Connector, Lead Wire Connections (See 07 00 25 00) | | 3 |
| @7 | T | 12 00 10 02 | 7#10 Grounding Unit With Ground Rod | | 1 |
| | U | 17 54 373 | Connector, Split Bolt | | 1 |

NOTES:

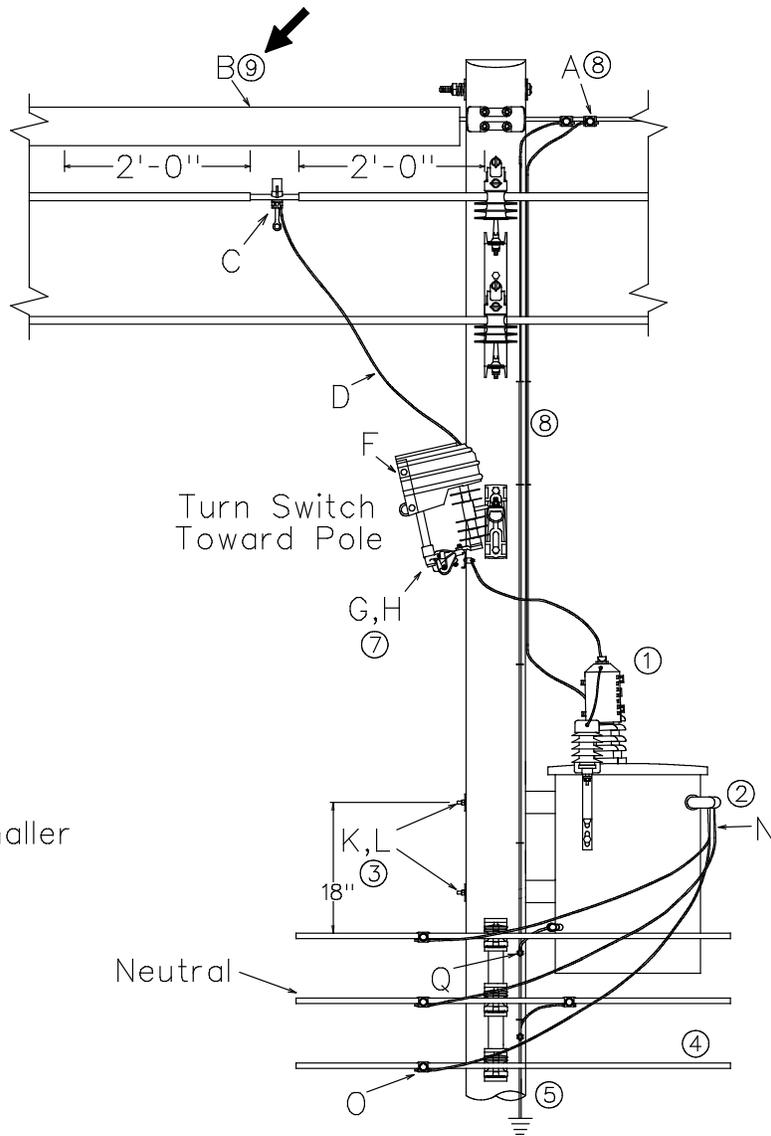
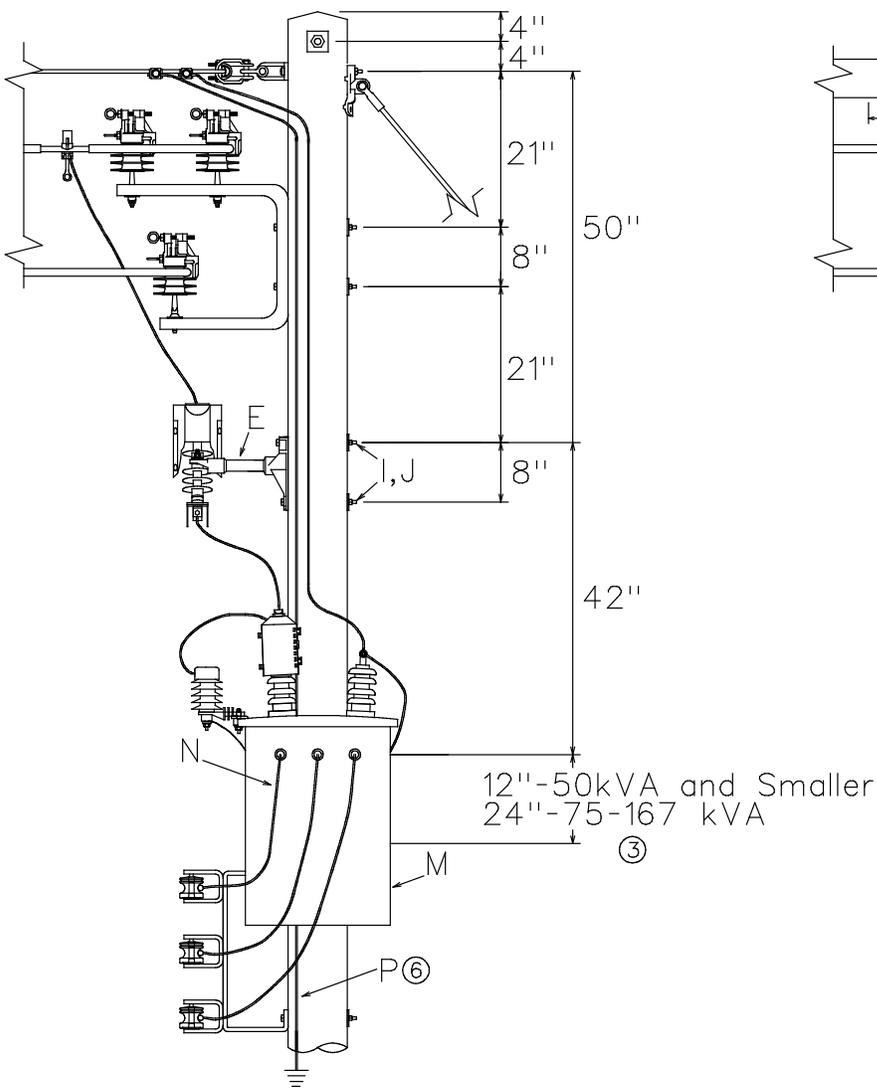
1. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.
2. Transformer may be received with the LA mounted beside either the H1 or H2 bushing. Both positions are acceptable. The arrester may be shifted to the most convenient side of tank.
3. See DCS 13 00 06 02 for 120/240 or 240/480V 3-wire. See DCS 13 00 06 03 for 240 or 120V 2-wire.
4. Measure the distance between the mounting slots and drill so that the transformer rests evenly on both bolts. This distance is approximately 12 inches for transformers 50kVA and below, and 24 inches for 75kVA and above. The secondary rack position does not change.
5. See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
6. If pole is NOT truck accessible, make secondary connections on the climbing side of the pole.
7. Install a pole ground if not already installed on pole.
8. If installing a CSP transformer, a fused switch shall be installed.
9. Note that the messenger also serves as the system neutral, so the transformer high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
10. If an existing transformer does not have the tapped lug holes for a tank mounted arrester, refer to DCS 12 12 05 **.W

CONFIGURATIONS

13 20 03 01

15kV & Below - Spacer Cable - Grounded Wye Primary
 1 to 167kVA - Single Phase - Protected - Angle Structure 7° - 60°

Sheet 1 of 2



CONFIGURATIONS

13 20 03 01

15kV & Below – Spacer Cable – Grounded Wye Primary
1 to 167kVA – Single Phase – Protected – Angle Structure 7° – 60°

Sheet 2 of 2

| | | Std. / Stk. No. | Description | 13 20 03 01 | 01 |
|----|---|-----------------|---|-------------|----|
| @ | A | 17 51 137 | Connector, PG | | 1 |
| | B | 69 58 293 | Line Duc (Messenger Cover), Black, 8' Long (Each) | | 1 |
| | C | 17 62 088 | Hot Line Clamp 1/0 through 477 Spacer Cable | | 1 |
| | | 17 62 143 | Hot Line Clamp 795 Spacer Cable | | 1 |
| | D | 18 51 025 | Wire, Trans. Riser #4, S.D. Poly Covered (Ft.) | | 20 |
| | E | 23 06 127 | Bracket, Cutout, Single-Position | | 1 |
| | F | 23 17 411 | Cover, Cutout, 100 Amp | | 1 |
| @ | G | 54 07 208 | Switch, Fused, 100 Amp | | 1 |
| | H | | Link, Fuse (See 10 00 01 01) | | 1 |
| | I | 23 52 066 | Bolt, Machine, 5/8" x 14" (w/ nut) | | 2 |
| T | J | 23 66 027 | Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16" Thick | | 2 |
| | K | 23 52 066 | Bolt, Machine, 5/8" x 14" (w/ nut) (50kVA & Below) | | 2 |
| | | 23 52 219 | Bolt, Machine, 3/4" x 14" (w/ nut) (75 to 167kVA) | | 2 |
| T | L | 23 66 027 | Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16" Thick (50kVA & Below) | | 2 |
| | | 23 66 031 | Washer, Square, 3/4", Curved (75 to 167kVA) | | 2 |
| | M | | Transformer – See 13 00 01 02 | | 1 |
| T | N | | Secondary Leads (FT.) (See 13 00 03 01) | | 12 |
| T | O | PG*W | Connector, Lead Wire Connections (See 07 00 25 00) | | 3 |
| @6 | P | 12 00 10 02 | 7#10 Grounding Unit With Ground Rod | | 1 |
| | Q | 17 54 373 | Connector, Split Bolt | | 1 |

NOTES

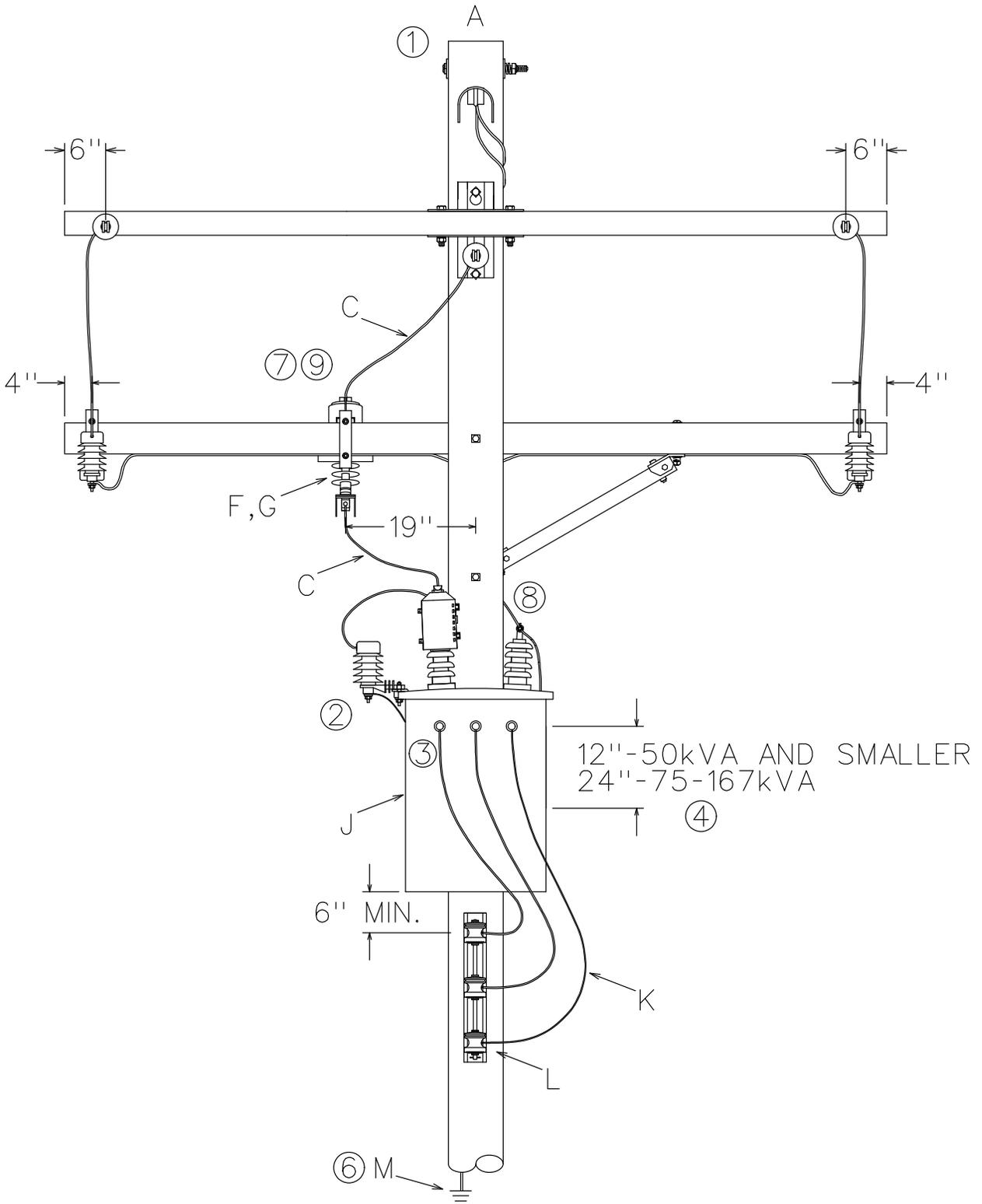
- Transformer may be received with the LA mounted beside either the H1 or H2 bushing. Both positions are acceptable. The arrester may be shifted to the most convenient side of tank.
- See DCS 13 00 06 02 for 120/240 or 240/480V 3-wire. See DCS 13 00 06 03 for 240 or 120V 2-wire.
- Measure the distance between the mounting slots and drill so that transformer rests evenly on both bolts. This distance is approximately 12 inches for transformers 50kVA and below, and 24 inches for 75kVA and above. The secondary rack position does not change.
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- If pole is NOT truck accessible, make secondary connections on the climbing side of the pole.
- Install a pole ground if not already installed on pole.
- If installing a CSP transformer, a fused switch shall be installed.
- Note that the messenger also serves as the system neutral, so the transformer high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
- Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.g

TRANSFORMERS

15kV & Below – Spacer Cable – 3 Phase Dead End Structure
1 to 167kVA – Single Phase – Protected

13 20 10 01

Sheet 1 of 3

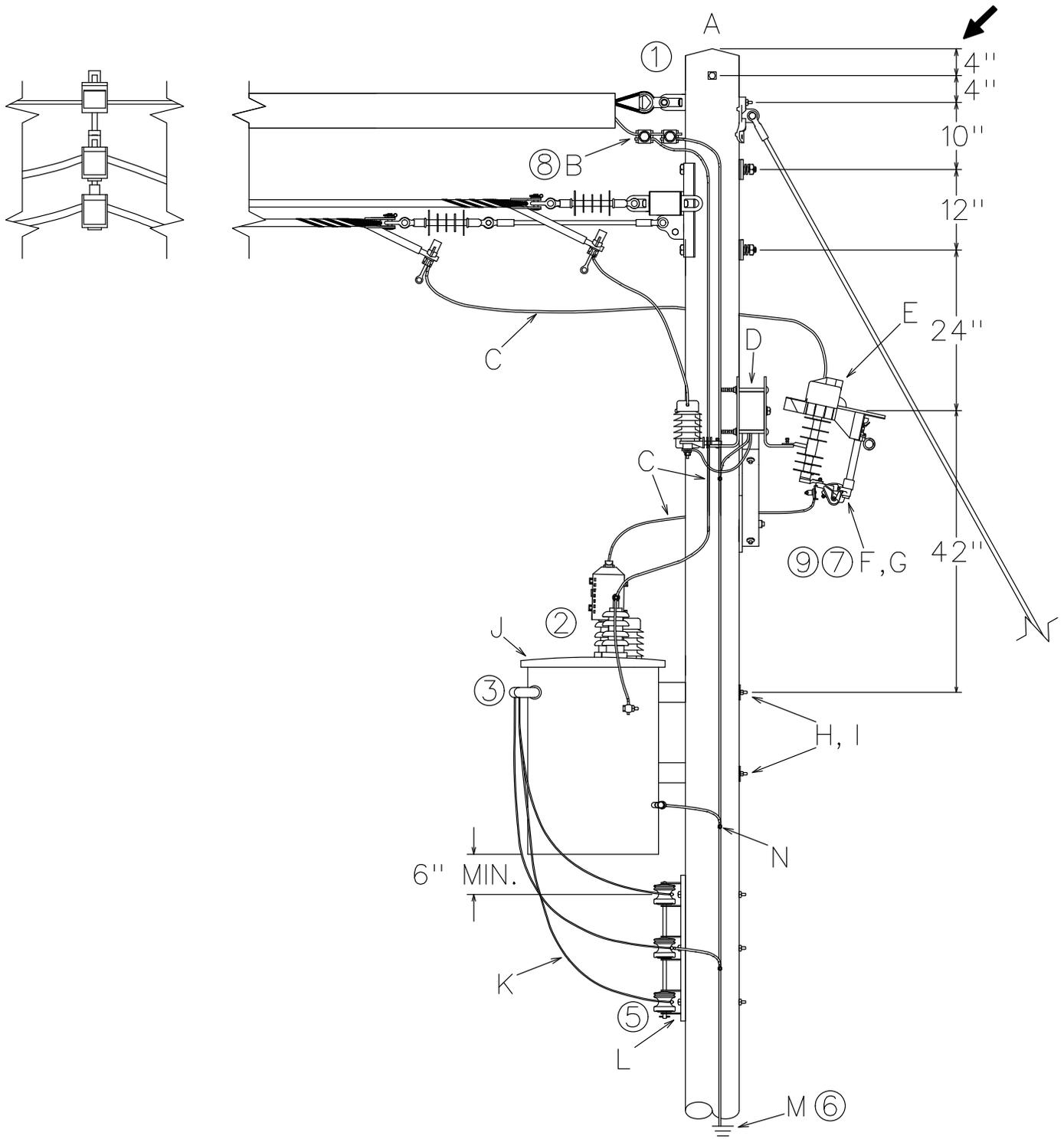


TRANSFORMERS

15kV & Below – Spacer Cable – 3 Phase Dead End Structure
1 to 167kVA – Single Phase – Protected

13 20 10 01

Sheet 2 of 3



TRANSFORMERS

13 20 10 01

15kV & Below – Spacer Cable – 3 Phase Dead End Structure
1 to 167kVA – Single Phase – Protected

Sheet 3 of 3

| | | Std./Stk. No. | Description | 13 20 10 01 |
|------|---|--------------------|--|-------------|
| @1 | A | 03 20 10 01 | 15kV & Below – Spacer Cable Single Circuit – Dead End Structure | |
| 8 | B | 17 51 137 | Connector, PG | 1 |
| | C | 18 51 025 | Wire, Trans. Riser #4, S.D. Poly Covered (Ft.) | 20 |
| | D | 17 58 054 | Bracket, Crossarm, Cutout | 1 |
| | E | 23 17 411 | Cover, Cutout, 100 Amp | 1 |
| 7, 9 | F | 54 07 208 | Switch, Fused, 100 Amp | 1 |
| @ | G | | Link, Fuse – See Single Phase Transformer Table in 10 00 01 01 | 1 |
| T | H | 23 52 066 | Bolt, Machine, 5/8" x 14" (w/ nut) (50kVA and Below) | 2 |
| | | 23 52 219 | Bolt, Machine, 3/4" x 14" (w/ nut) (75 to 167kVA) | 2 |
| T | I | 23 66 027 | Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16", Thick (50kVA and Below) | 2 |
| | | 23 66 031 | Washer, Square, 3/4", Curved (75 to 167kVA) | 2 |
| @ | J | | Transformer – See 13 00 01 02 | 1 |
| T | K | | Secondary Leads (FT.) (See 13 00 03 01) | 12 |
| T | L | PG*W | Connector, Lead Wire Connections (See 07 00 25 00) | 3 |
| @6 | M | 12 00 10 ** | 7#10 Grounding Unit | 1 |
| | N | 17 54 373 | Connector, Split Bolt | 1 |

NOTES:

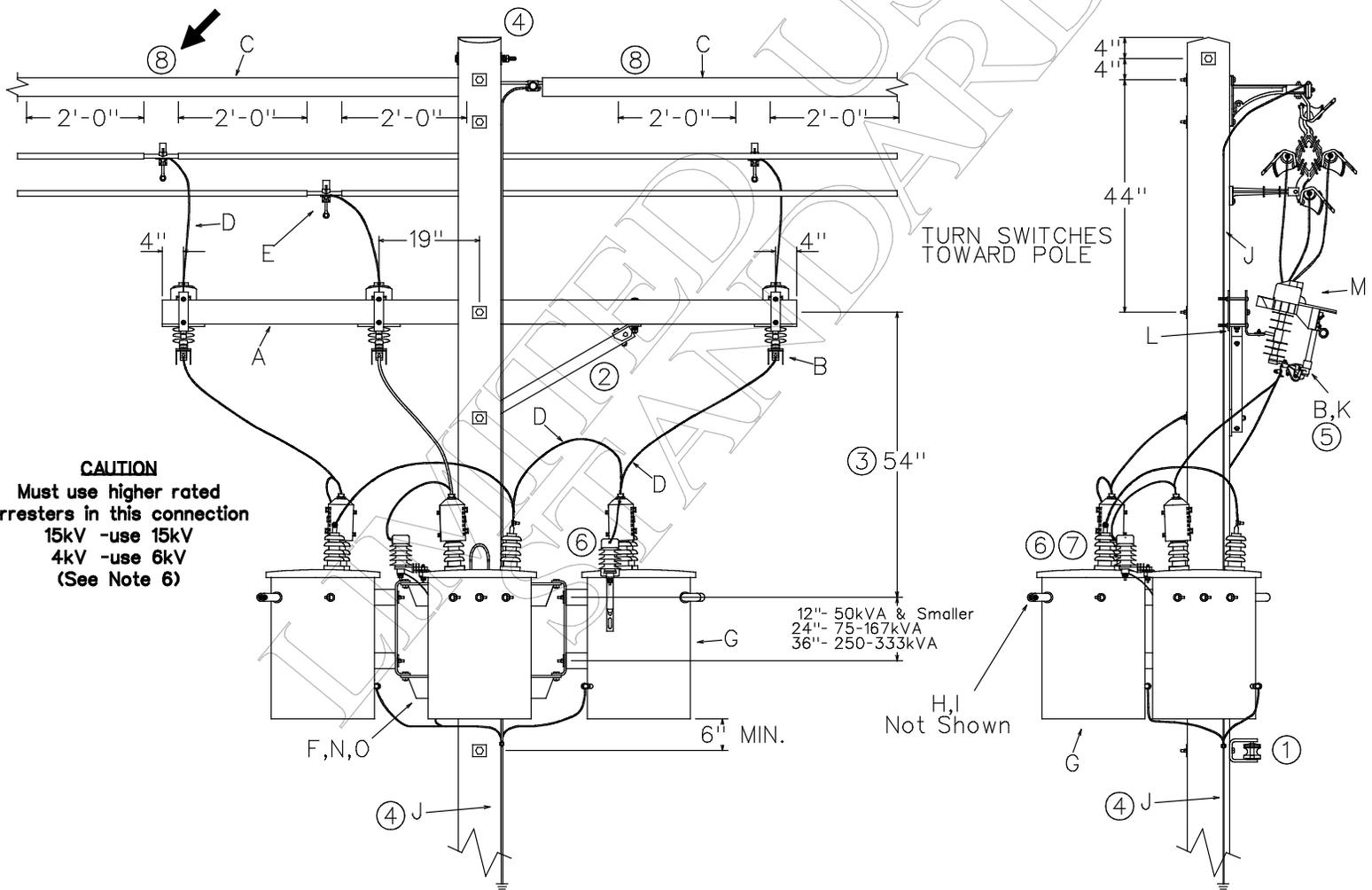
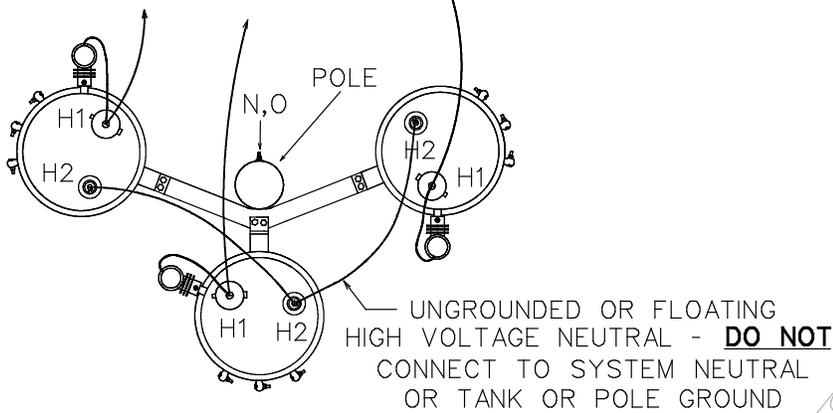
- Construct pole using **03 20 10 01**. Mount the equipment arm on the guyed side of the pole as shown and omit one lightning arrester and replace with a switch as specified in this standard. Only two lightning arresters are required on the crossarm for the unprotected phases. The tank mounted arrester will be used to protect the phase that is tapped for the transformer.
- Transformer may be received with the LA mounted beside either the bushing H1 or H2 bushing. Both positions are acceptable. The arrester may be shifted to the most convenient side of the tank.
- See DCS **13 00 06 02** for 120/240 or 240/480V 3-wire. See DCS **13 00 06 03** for 240 or 120V 2-wire.
- Measure the distance between the mounting slots and drill so that the transformer rests evenly on both bolts. This distance is approximately 12 inches for transformers 50kVA and below, and 24 inches for 75kVA and above. The secondary rack position does not change.
- See DCS **13 01 01 **** for secondary support and DCS **03 01 20 **** for secondary configurations.
- Use DCS **12 00 10 01** for ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.
- If installing a CSP transformer, a fused switch shall be installed.
- Note that the messenger also serves as the system neutral, so the transformer high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
- Switch may be mounted on any of the three positions on the LA arm depending on which phase is used.

TRANSFORMERS

15kV & Below - Spacer Cable - Three Single Phase
Transformers Ungrounded-Wye Primary - Delta Secondary

13 20 80 **
Sheet 1 of 2

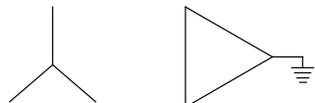
FLOATING WYE PRIMARY CONNECTION TO FUSED CUTOUTS



SEE DCS 13 00 07 04 FOR

SEE DCS 13 00 07 10 FOR

50kVA & Smaller - 13 20 80 01
75kVA - 167kVA - 13 20 80 02
250kVA- 333kVA- 13 20 80 03



DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: DG
REV. NO: 1
REV. DATE: 06/19/18

TRANSFORMERS
 15kV & Below - Spacer Cable - Three Single Phase
 Transformers Ungrounded-Wye Primary - Delta Secondary

13 20 80 **
 Sheet 2 of 2

| | | Std. / Stk. No. | Description | 13 20 80 ** | 01 | 02 | 03 |
|----|---|-----------------|--|-------------|----|----|----|
| 2 | A | 04 00 20 03 | Crossarm 10' w/ 60" V Brace | | 1 | 1 | 1 |
| 5 | B | 54 07 208 | Switch Fused 100A 15kV | | 3 | 3 | 3 |
| | C | 69 58 293 | Line DUC (Messenger Cover), Black (ea.) | | 2 | 2 | 2 |
| T | D | 18 51 025 | Primary Leads (ft.) (See 13 00 03 01) | | 40 | 40 | 40 |
| @ | E | 17 62 088 | Hot Line Clamp 1/0 through 477 Spacer Cable | | 3 | 3 | 3 |
| | | 17 62 143 | Hot Line Clamp 795 Spacer Cable | | 3 | 3 | 3 |
| | F | 23 17 209 | Mounting Unit, 3 Pos. Light (Up To Three 50 KVA Trans.) | | 1 | | |
| | | 23 17 202 | Mounting Unit, 3 Pos. Heavy (Three 75kVA to 167kVA Trans.) | | | 1 | |
| | | 23 17 354 | Mounting Unit, 3 Pos. Xtra Hvy (Three 250kVA to 333kVA Trans.) | | | | 1 |
| @ | G | | Transformer (See 13 00 01 02) | | 3 | 3 | 3 |
| T | H | | Secondary Leads (ft.) (See 13 00 03 01) | | | | |
| T | I | PG* | Connector, Lead Wire Connections (See 07 00 25 00) | | | | |
| @4 | J | 12 00 10 02 | Grounding Unit, 7#10 Copperweld With Ground Rod | | 1 | 1 | 1 |
| @ | K | | Link, Fuse - See Three-Phase Trans. Table in 10 00 01 01 | | 3 | 3 | 3 |
| | L | 17 58 054 | Bracket, Crossarm, Heavy Duty | | 3 | 3 | 3 |
| | M | 23 17 411 | Cover - Cutout, 100 Amp | | 3 | 3 | 3 |
| | N | 23 52 219 | Bolt, Mach., 3/4" x 14" | | 2 | 2 | |
| | O | 23 66 031 | Washer, Curved, 3/4" | | 2 | 2 | |

NOTES:

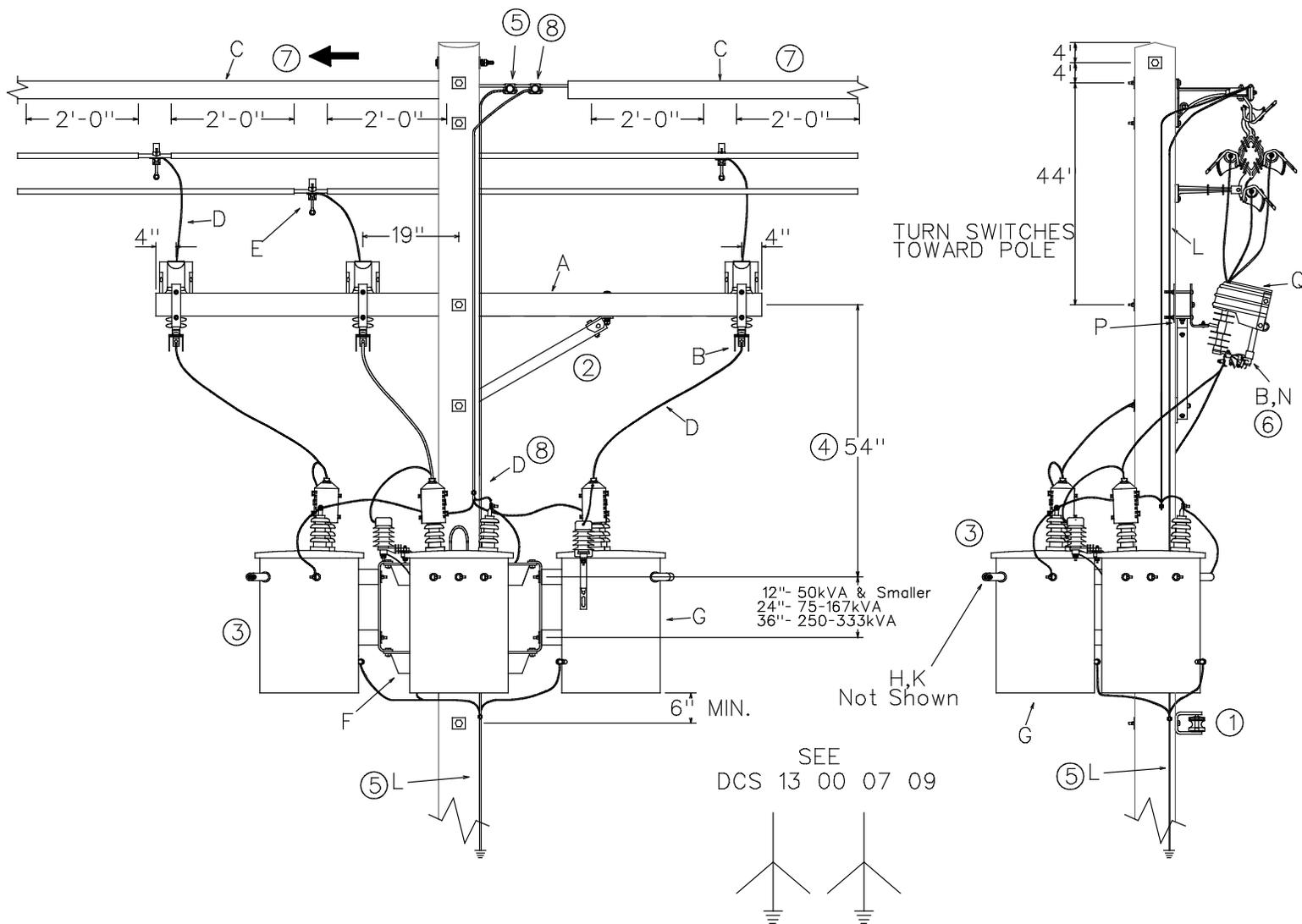
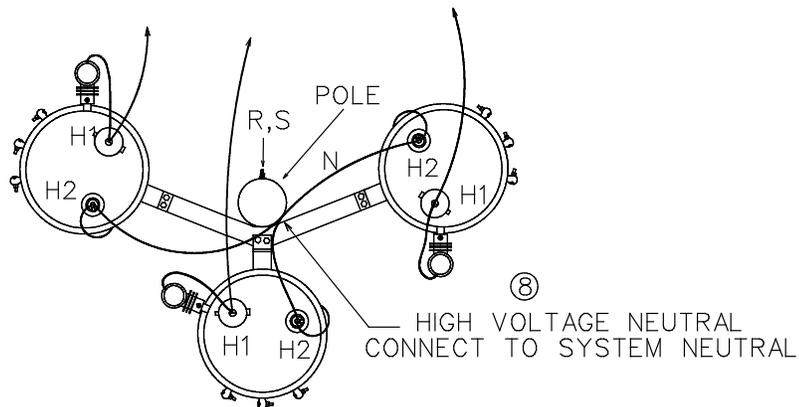
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- Use only one V Brace. Keep the extra brace for future use.
- This dimension may be reduced to 48" for installation on existing pole.
- All poles with spacer cable should be installed with a pole ground. Add a pole ground if not already installed. Pole ground shall extend up to the messenger which is the system neutral and attached on the single switch side of the pole.
- Substitute 200A fused switches stock #54 07 209 for transformer banks greater than 500kVA on 4kV circuits.
- For 7.2, 7.62, and 7.97kV transformers use 15kV arrester stock #10 01 188. For 2.4kV transformers use 6kV arrester stock #10 01 184.
- 2400/4160 Y Transformers may have sidewall or cover mounted HV bushings. If sidewall mounted bushings:
 - Build according to the DCS except use 2.5 kV primary lead wire per Table 2.2 of DCS 13 00 03 01 or
 - If pole is congested, 2.5 kV primary lead wire in conduit similar to DCS 13 04 54 01.
- Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.y

TRANSFORMERS

15kV & Below - Spacer Cable - Three Single Phase Transformers
 Grounded - Wye Primary/Grounded - Wye Secondary

13 20 81 **
 Sheet 1 of 2

GROUNDED WYE PRIMARY CONNECTION
 TO FUSED CUTOUTS AND COMMON NEUTRAL



50kVA & Smaller - 13 20 81 01
 75kVA - 167kVA - 13 20 81 02
 250kVA- 333kVA- 13 20 81 03

TRANSFORMERS

15kV & Below - Spacer Cable - Three Single Phase Transformers
Grounded - Wye Primary/Grounded - Wye Secondary

13 20 81 **
Sheet 2 of 2

| | | Std. / Stk. No. | Description | 13 20 81** | 01 | 02 | 03 |
|----|---|-----------------|--|------------|----|----|----|
| 2 | A | 04 00 20 03 | Crossarm 10' w/ 60" V Brace | | 1 | 1 | 1 |
| 6 | B | 54 07 208 | Switch Fused 100A 15kV | | 3 | 3 | 3 |
| | C | 69 58 293 | Line DUC (Messenger Cover), Black (ea.) | | 2 | 2 | 2 |
| T | D | 18 51 025 | Primary Leads (ft.) (See 13 00 03 01) | | 40 | 40 | 40 |
| @ | E | 17 62 088 | Hot Line Clamp 1/0 through 477 Spacer Cable | | 3 | 3 | 3 |
| | | 17 62 143 | Hot Line Clamp 795 Spacer Cable | | 3 | 3 | 3 |
| | F | 23 17 209 | Mounting Unit, 3 Pos. Light (Up To Three 50 KVA Trans.) | | 1 | | |
| | | 23 17 202 | Mounting Unit, 3 Pos. Heavy (Three 75kVA to 167kVA Trans.) | | | 1 | |
| | | 23 17 354 | Mounting Unit, 3 Pos. Xtra Hvy (Three 250kVA to 333kVA Trans.) | | | | 1 |
| @ | G | | Transformer (See 13 00 01 02) | | 3 | 3 | 3 |
| T | H | | Secondary Leads (ft.) (See 13 00 03 01) | | | | |
| T | K | PG* | Connector, Lead Wire Connections (See 07 00 25 00) | | | | |
| @5 | L | 12 00 10 02 | Grounding Unit | | 1 | 1 | 1 |
| @ | N | | Link, Fuse - See Three-Phase Trans. Table in 10 00 01 01 | | 3 | 3 | 3 |
| @3 | O | 16 01 301 | Tag, Banked Transformer | | 3 | 3 | 3 |
| | P | 17 58 054 | Bracket, Crossarm, Heavy Duty | | 3 | 3 | 3 |
| | Q | 23 17 411 | Cover - Cutout, 100 Amp | | 3 | 3 | 3 |
| | R | 23 52 219 | Bolt, Mach., 3/4" x 14" | | 2 | 2 | |
| | S | 23 66 031 | Washer, Curved, 3/4" | | 2 | 2 | |

NOTES:

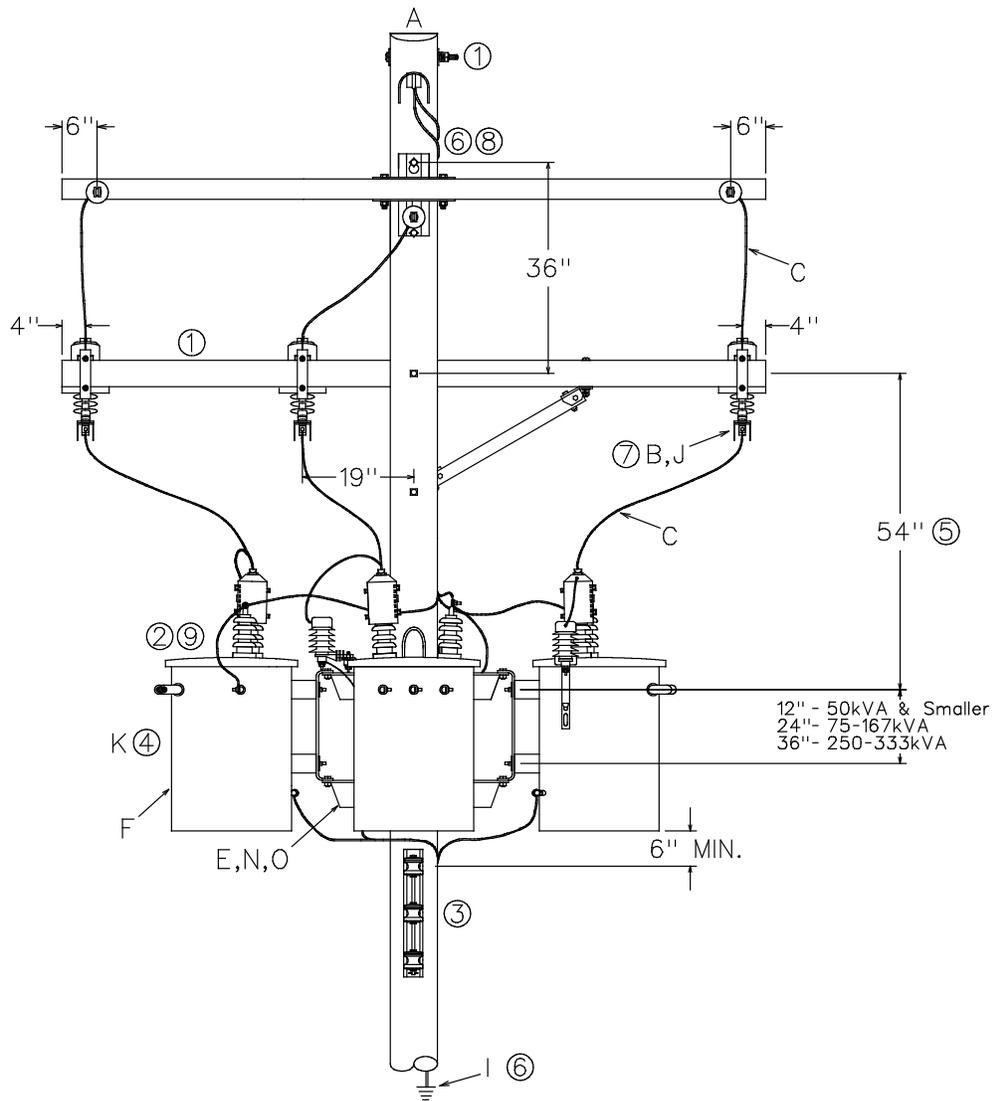
1. See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
2. Use only one V Brace. Keep the extra brace for future use.
3. Install tag "Banked Transformer, 120/208Y" stock #16 01 301 to identify transformers that have been rewired internally for 120/208Y service. The tag should be attached to the secondary bushing that is no longer connected internally. See DCS 13 00 07 09.
4. This dimension may be reduced to 48" for installation on existing pole.
5. All poles with spacer cable should be installed with a pole ground. Add a pole ground if not already installed. Pole ground shall extend up to the messenger which is the system neutral and attached on the single switch side of the pole.
6. Substitute 200A fused switches stock #54 07 209 for transformer banks greater than 500kVA on 4kV circuits.
7. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation..
8. Note that the messenger also serves as the system neutral, so the high voltage neutral must extend from the neutral bushings up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.y

TRANSFORMERS

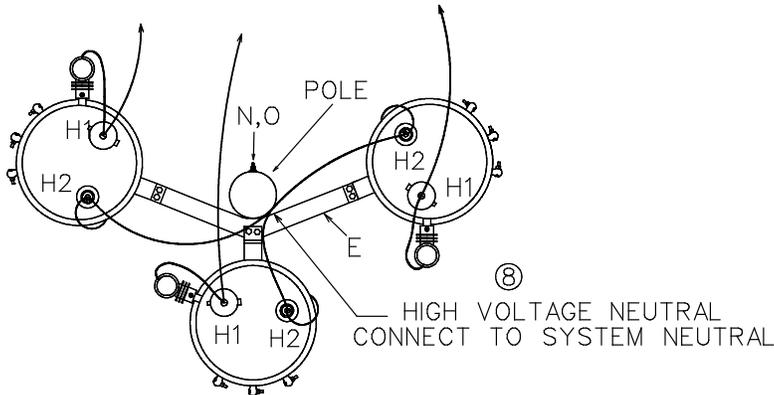
15 kV & Below - Spacer Cable - Dead End Structure Three Single Phase Transformers - Grounded Wye Primary

13 20 85 **

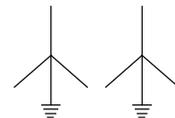
Sheet 1 of 3



GROUNDED WYE PRIMARY CONNECTION TO FUSED CUTOUTS AND COMMON NEUTRAL



SEE
DCS 13 00 07 09



50kVA & Smaller - 13 20 81 01
75kVA - 167kVA - 13 20 81 02
250kVA- 333kVA- 13 20 81 03

TRANSFORMERS
 15 kV & Below – Spacer Cable – Dead End Structure
 Three Single Phase Transformers – Grounded Wye Primary

13 20 85 **
 Sheet 3 of 3

| | | Std. / Stk. No. | Description | 13 20 85 ** | 01 | 02 | 03 |
|----|---|-----------------|---|-------------|----|----|----|
| @1 | A | 03 20 10 01 | 15kV & Below – Spacer Cable Single Circuit – Dead End Structure | | 1 | 1 | 1 |
| 7 | B | 54 07 208 | Switch, Fused, 100A 15kV | | 3 | 3 | 3 |
| T | C | 18 51 025 | Primary Leads (ft.) (See 13 00 03 01) | | 40 | 40 | 40 |
| @ | D | 17 62 088 | Hot Line Clamp 1/0 through 477 Spacer Cable | | 3 | 3 | 3 |
| | | 17 62 143 | Hot Line Clamp 795 Spacer Cable | | 3 | 3 | 3 |
| @ | E | 23 17 209 | Mounting Unit, 3 Pos. Light (Up To Three 50 KVA Trans.) | | 1 | | |
| | | 23 17 202 | Mounting Unit, 3 Pos. Heavy (Three 75kVA to 167kVA Trans.) | | | 1 | |
| | | 23 17 354 | Mounting Unit, 3 Pos. Xtra Hvy (Three 250kVA to 333kVA Trans.) | | | | 1 |
| @ | F | | Transformer (See 13 00 01 02) | | 3 | 3 | 3 |
| T | G | | Secondary Leads (ft.) (See 13 00 03 01) | | | | |
| T | H | PG*W | Connector, Lead Wire Connections (See 07 00 25 00) | | | | |
| @6 | I | 12 00 10 02 | Grounding Unit, 7#10 Copperweld With Ground Rod | | 1 | 1 | 1 |
| @ | J | | Link, Fuse, See Three Phase Trans. Table in 10 00 01 01 | | 3 | 3 | 3 |
| @4 | K | 16 01 301 | Tag, Banked Transformer | | 3 | 3 | 3 |
| @ | L | 17 58 054 | Bracket, Crossarm, Heavy Duty | | 3 | 3 | 3 |
| | M | 23 17 411 | Cover, Cutout, 100 Amp | | 3 | 3 | 3 |
| | N | 23 52 219 | Bolt, Mach., 3/4" x 14" | | 2 | 2 | |
| | O | 23 66 031 | Washer, Curved, 3/4" | | 2 | 2 | |

NOTES:

- Construct pole using 03 20 10 01. Mount the equipment arm on the guyed side of the pole as shown and omit the three lightning arresters and replace with switches as specified in this standard. The tank mounted arrester will be used to protect the phases that are tapped for the transformers.
- Transformer may be received with the LA mounted beside either the bushing H1 or H2 bushing. Both positions are acceptable. The arrester may be shifted to the most convenient side of the tank.
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- Install tag "Banked Transformer, 120/208Y" stock #16 01 301 to identify transformers that have been rewired internally for 120/208Y service. The tag should be attached to the secondary bushing that is no longer connected internally. See DCS 13 00 07 09.
- This dimension may be reduced to 48" for installation on existing pole.
- All poles with spacer cable should be installed with a pole ground. Add a pole ground if not already installed. Pole ground shall extend up to the messenger which is the system neutral and attached on the single switch side of the pole.
- Substitute 200A fused switches stock #54 07 209 for transformer banks greater than 500kVA on 4kV circuits.
- Note that the messenger also serves as the system neutral, so the high voltage neutral must extend from the neutral bushings up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
- 2400/4160 Y Transformers may have sidewall or cover mounted HV bushings. If sidewall mounted bushings:
 - Build according to the DCS except use 2.5 kV primary lead wire per Table 2.2 of DCS 13 00 03 01 or
 - If pole is congested, 2.5 kV primary lead wire in conduit similar to DCS 13 04 54 01.

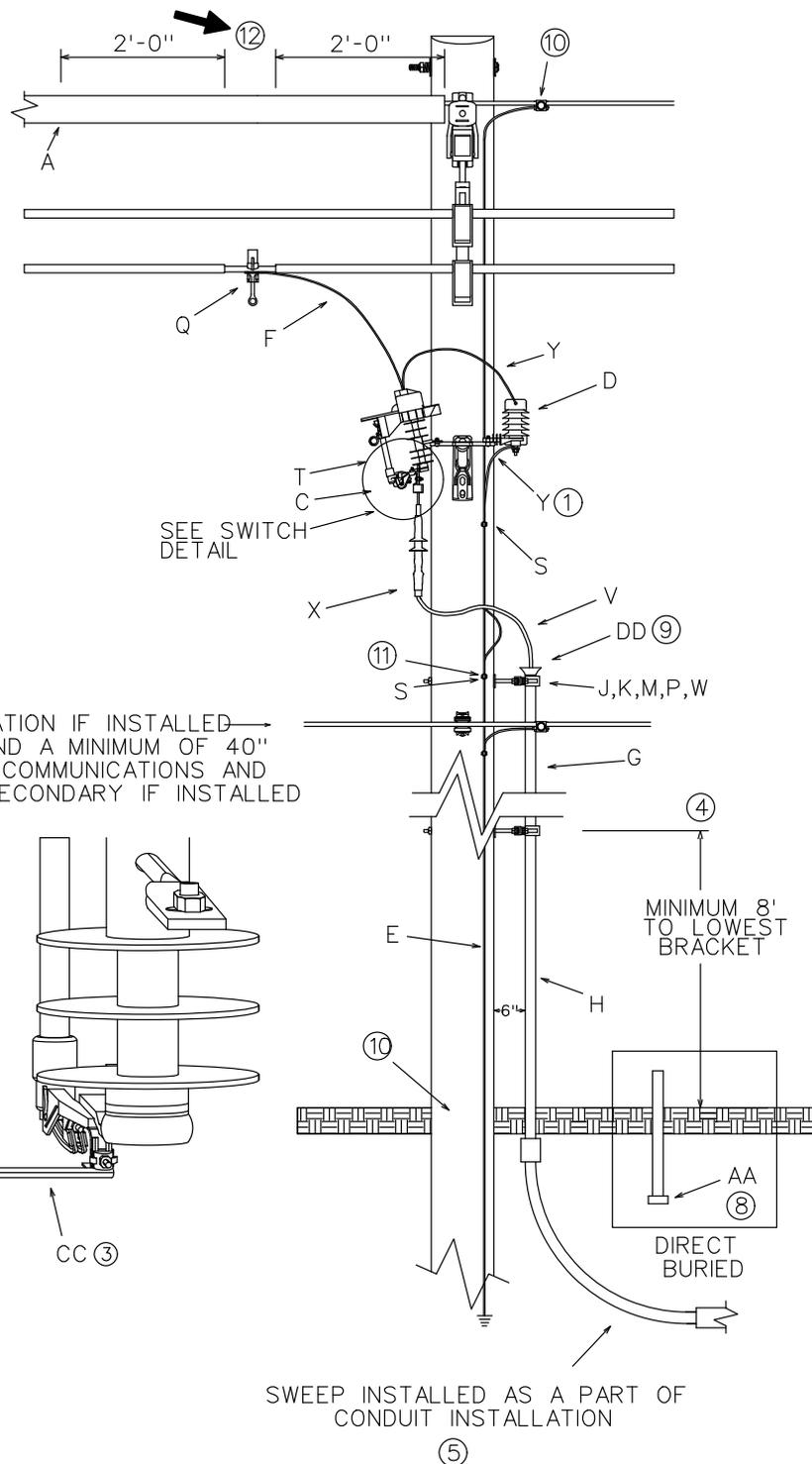
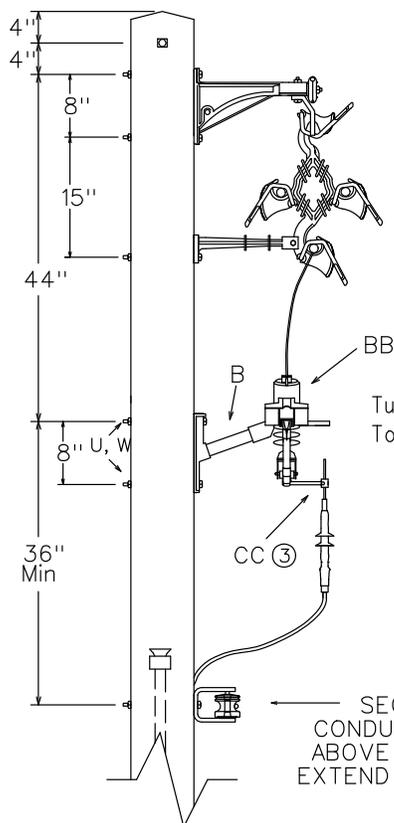
CABLE TERMINALS

15KV & Below – Spacer Cable

#2 through 4/0 Single Phase Riser

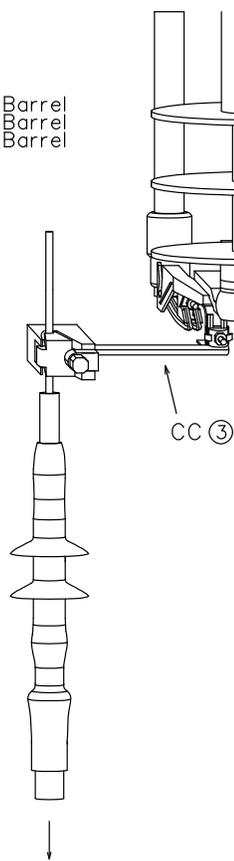
14 20 01 **

Sheet 1 of 3



- Use #4 Cu Line Lead w/ 100A Barrel
- Use #1/0 Cu Line Lead w/ 200A Barrel
- Use #1/0 Cu Line Lead w/ 300A Barrel

SWITCH DETAIL



- 14 20 01 01- #2 Direct Buried or In 2" Conduit/Duct
- 14 20 01 02- 4/0 Direct Buried or In 2" Conduit/Duct
- 14 20 01 03- #2 Direct Buried or In 3" Conduit/Duct
- 14 20 01 04- 4/0 Direct Buried or In 3" Conduit/Duct

CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Single Phase Riser

14 20 01 **

Sheet 2 of 3

| | | Std. / Stk. No. | Description | 01 | 02 | 03 | 04 |
|-----|----|------------------------|---|-----------|-----------|-----------|-----------|
| | A | 69 58 293 | Line DUC (Messenger Cover), Black, 8' long (Each) | 1 | 1 | 1 | 1 |
| | B | 23 56 063 | Bracket, Fiberglass, 3 Position Mounting | 1 | 1 | 1 | 1 |
| | C | 54 07 208 | Switch, Fuse, 100A, 15KV | 1 | 1 | 1 | 1 |
| 2@ | D | 10 01 129 | Arrester, Lightning, 9KV | 1 | 1 | 1 | 1 |
| | | 10 01 133 | Arrester, Lightning, 3KV | 1 | 1 | 1 | 1 |
| | | 10 01 146 | Arrester, Lightning, 10KV | 1 | 1 | 1 | 1 |
| 10@ | E | 12 00 10 03 | #2 Copper Ground Unit with ground rod | 1 | 1 | 1 | 1 |
| @ | F | 18 51 025 | Wire, Cu., #4 S.D. Covered | 10 | | 10 | |
| | | 18 51 024 | Wire, Cu., 1/0 S.D. Covered | | 10 | | 10 |
| 4@ | G | 12 01 280 | Conduit, Plastic, 2", SCH 40 | 20 | 20 | | |
| | | 12 01 279 | Conduit, Plastic, 3", SCH 40 | | | 20 | 20 |
| | H | 12 01 275 | Conduit, Plastic, 2", SCH 80 | 10 | 10 | | |
| | | 12 01 276 | Conduit, Plastic, 3", SCH 80 | | | 10 | 10 |
| 4@ | J | 23 06 086 | Bracket, Standoff 20" | 3 | 3 | 3 | 3 |
| | | 23 06 087 | Bracket, Standoff 12" | 3 | 3 | 3 | 3 |
| | K | 23 53 003 | Bolt, Double Arming 5/8' x 18" | 3 | 3 | 3 | 3 |
| | M | 23 67 190 | Strap, Conduit 2" | 3 | 3 | | |
| | | 23 67 182 | Strap, Conduit 3" | | | 3 | 3 |
| | P | 23 65 053 | Nut, Jam 5/8" | 3 | 3 | 3 | 3 |
| @ | Q | 17 62 088 | Hot Line Clamp, 1/0 through 477 Spacer Cable | 1 | 1 | 1 | 1 |
| | | 17 62 143 | Hot Line Clamp, 795 Spacer Cable | 1 | 1 | 1 | 1 |
| @ | S | 17 54 373 | Connector, Split Bolt, 2 AWA Stranded | 2 | 2 | 2 | 2 |
| | T | | Fuse Sized By Engineer | 1 | 1 | 1 | 1 |
| | U | 23 52 066 | Bolt, Mach., 5/8" x 14" | 2 | 2 | 2 | 2 |
| | V | 18 07 238 | Cable, 15 kv, #2 | 35 | | 35 | |
| | | 18 07 239 | Cable, 15 kv, 4/0 | | 35 | | 35 |
| | W | 23 66 027 | Washer, Square, 5/8" | 8 | 8 | 8 | 8 |
| | X | 42 34 59 01 | Termination, 15KV, #2 Al. | 1 | | 1 | |
| | | 42 34 59 03 | Termination, 15KV, 4/0 | | 1 | | 1 |
| | Y | 18 51 021 | Wire, #6 Cu., S.D. Covered (ft) | 6 | 6 | 6 | 6 |
| 8@ | AA | 12 53 017 | Shield, Duct, Cable | 1 | 1 | 1 | 1 |
| | BB | 23 17 411 | Cover, Cutout | 1 | 1 | 1 | 1 |
| 3 | CC | 17 55 828 | Stirrup – Grounding, 1/2" x 7" | 1 | 1 | 1 | 1 |
| 9 | DD | 40 83 491 | Coupling, Bell End, 2" | 1 | 1 | | |
| | | 12 51 008 | Coupling, Bell End, 3" | | | 1 | 1 |
| | | OP278 | Install Cable Up Pole | 1 | 1 | 1 | 1 |

NOTES

- Attached arrester ground lead to the pole ground keeping to lead as short as possible.
- On 13kv terminal poles use 10 kv lightning arrester, Stock Number 10-01-146.
- Insert a grounding stirrup into the bottom of the cutout for a grounding attachment point.
- See DCS **14 00 01 03** for standoff bracket placement and grounding requirements.

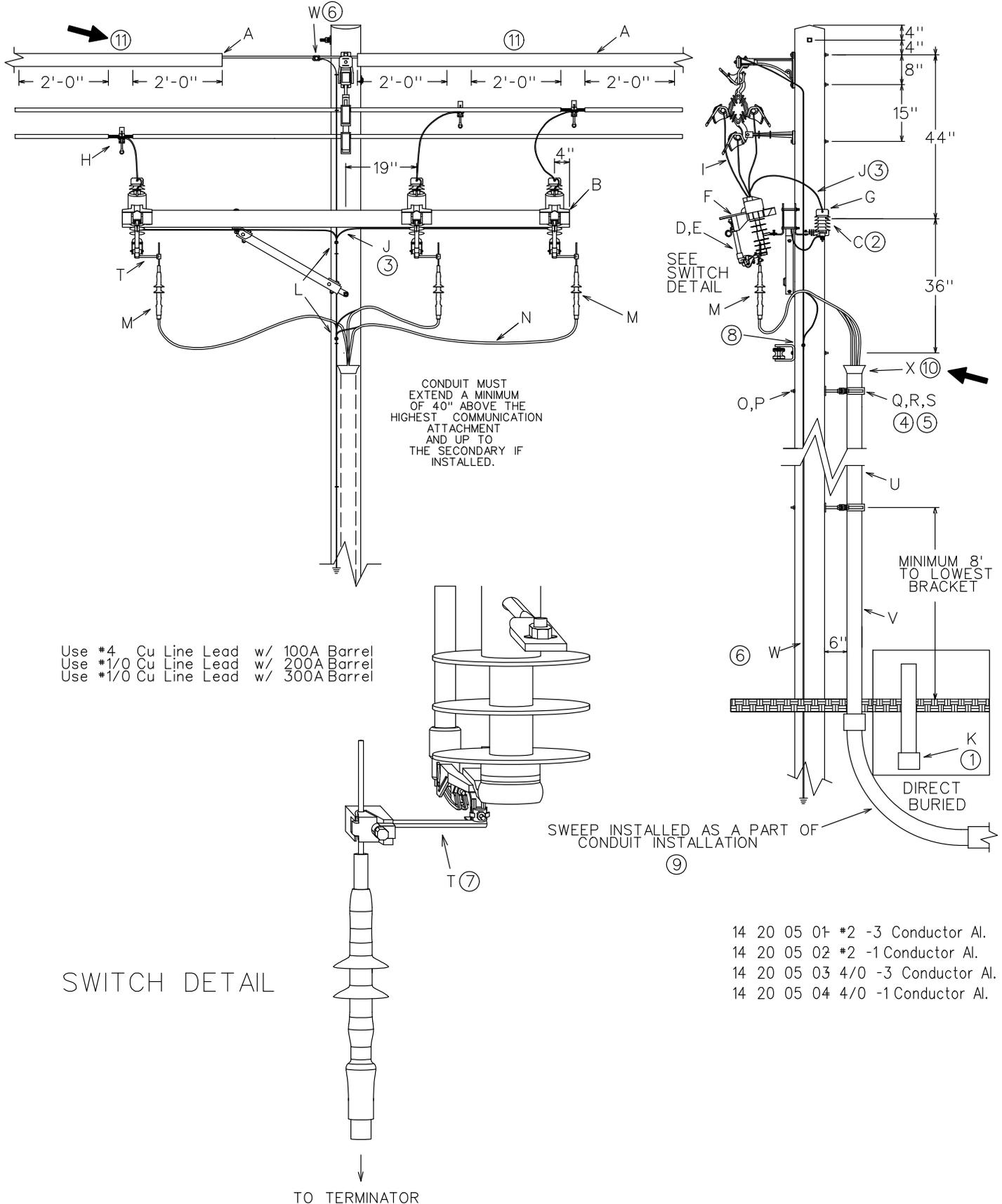
CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Single Phase Riser

14 20 01 **

Sheet 3 of 3

5. See DCS **59 40 41 01** for information on making PVC to HDPE Duct connection at the end of the sweep if HDPE Duct is used.
6. Some standoff brackets require that one of the nuts on the double arming bolt be replaced with a jam nut, stock number 23-65-053. The jam nut should then be inserted into the 5/8" slot on the standoff bracket. If the nut on the double arming bolt will fit into the 5/8" slot on the bracket - Do Not use the jam nut.
7. On the front of the 20" standoff bracket, the following conduits may be mounted: 4-2" conduits, 3-2 1/2" conduits, 3-3" conduits, 3-4" conduits, 2-5" conduits. Various combinations of conduits may also be mounted. On the front of the 12" standoff bracket, the following conduits may be mounted: 2-2" conduits, 2-2 1/2" conduits 1-3" & 1-2" conduits, 1-3" and 1-2 1/2" conduits, and 1-5" conduit.
8. To prevent damage to direct buried cables, install a cable shield (Stk# 12-53-017) at the conduit entry.
9. If water entering the duct becomes a problem, the top of the duct can be sealed with polyurethane expanding foam, stock number 31-53-082. Expanding foam requires a dispensing gun, stock number 85-20-073.
10. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the non – switch side of the pole. Use DCS **12 00 10 04** for ground coil application on new pole installation. Use **12 00 10 03** for ground rod on an existing pole.
11. Connect the metallic shields of the riser cable to the system neutral/ messenger by attaching to the #2 stranded copper pole ground that extends to the system neutral/messenger. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
12. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duct over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Three Phase Riser



CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Three Phase Riser

14 20 05 **

Sheet 2 of 3

| | | Std. / Stk. No. | Description | 01 | 02 | 03 | 04 |
|-----|---|------------------------|---|-----------|-----------|-----------|-----------|
| 1 | A | 69 58 293 | Line DUC (Messenger Cover), Black, 8' long (Each) | 2 | 2 | 2 | 2 |
| | B | 04 00 20 03 | Crossarm, Single, Wood, 10' (Use only 1/2 of V-brace) | 1 | 1 | 1 | 1 |
| 2 | C | 17 58 054 | Bracket, Arrester/Cutout Mounting | 6 | 6 | 6 | 6 |
| | D | 54 07 208 | Switch, Fuse, 100A, 15KV | 3 | 3 | 3 | 3 |
| @ | E | | Fuse Sized by Engineer | 3 | 3 | 3 | 3 |
| @ | F | 23 17 411 | Cover, Cutout | 3 | 3 | 3 | 3 |
| @ | G | 10 01 129 | Arrester, Lightning, 9KV | 3 | 3 | 3 | 3 |
| | | 10 01 133 | Arrester, Lightning, 3KV | 3 | 3 | 3 | 3 |
| | | 10 01 146 | Arrester, Lightning, 10KV | 3 | 3 | 3 | 3 |
| @ | H | 17 62 088 | Hot Line Clamp, 1/0 through 477 Spacer Cable | 3 | 3 | 3 | 3 |
| | | 17 62 143 | Hot Line Clamp, 795 Spacer Cable | 3 | 3 | 3 | 3 |
| @ | I | 18 51 025 | Wire, Cu., #4 S.D. Covered(ft) | 15 | | 15 | |
| | | 18 51 024 | Wire, Cu., 1/0 S.D. Covered(ft) | | 15 | | 15 |
| 3 | J | 18 51 021 | Wire, #6 Cu., S.D. Covered (ft) | 16 | 16 | 16 | 16 |
| 1@ | K | 12 53 017 | Shield, Duct Cable | 1 | 1 | 1 | 1 |
| | L | 17 54 373 | Connector, Split Bolt, 2AWA Stranded | 4 | 4 | 4 | 4 |
| | M | 42 34 59 01 | Termination, 15KV, #2 Al. | 3 | 3 | | |
| | | 42 34 59 03 | Termination, 15KV, 4/0 Al. | | | 3 | 3 |
| | N | 18 07 237 | Cable, 15KV, #2-3C Al. | 35 | | | |
| | | 18 07 238 | Cable, 15KV, #2-1C Al. | | 105 | | |
| | | 18 07 240 | Cable, 15KV, 4/0-3C Al. | | | 35 | |
| | | 18 07 239 | Cable, 15KV, 4/0-1C Al. | | | | 105 |
| | O | 23 53 003 | Bolt, Double Arming 5/8" x 18" | 3 | 3 | 3 | 3 |
| | P | 23 66 027 | Washer, Square, 5/8" | 6 | 6 | 6 | 6 |
| | Q | 23 65 053 | Nut, Jam 5/8" | 3 | 3 | 3 | 3 |
| 4,5 | R | 23 06 087 | Bracket, Standoff 12" | 3 | 3 | 3 | 3 |
| | S | 23 67 183 | Strap, Conduit 4" | 3 | 3 | 3 | 3 |
| 7 | T | 17 55 828 | Stirrup – Grounding, 1/2" x 7" | 3 | 3 | 3 | 3 |
| | U | 12 01 278 | Conduit, Plastic, 4", SCH 40 | 20 | 20 | 20 | 20 |
| | V | 12 01 273 | Conduit, Plastic, 4" SCH 80 | 10 | 10 | 10 | 10 |
| 6@ | W | 12 00 10 03 | #2 Copper Ground Unit with ground rod | 1 | 1 | 1 | 1 |
| 10 | X | 12 51 254 | Coupling, Bell End, 4" | 1 | 1 | 1 | 1 |
| | | OP279 | Install Cable Up Pole | 1 | 1 | 1 | 1 |

NOTES

- To prevent damage to direct buried cables, install a cable shield (stk# 12 53 017) at the conduit entry.
- Discard the backs of the brackets mounting them together with the cutout and arrester in the low position below the crossarm. Three double brackets stock number 23 56 088 may be substituted.
- Route the arrester ground leads under the crossarm to attached to the pole ground keeping them as short as possible. Connect the arrester primary leads under the cutout cover to the arrester and keep them as short as possible.
- Substitute the 20" standoff bracket, stock number 23 06 086 if a longer bracket is required.

CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Three Phase Riser

14 20 05 **

Sheet 3 of 3

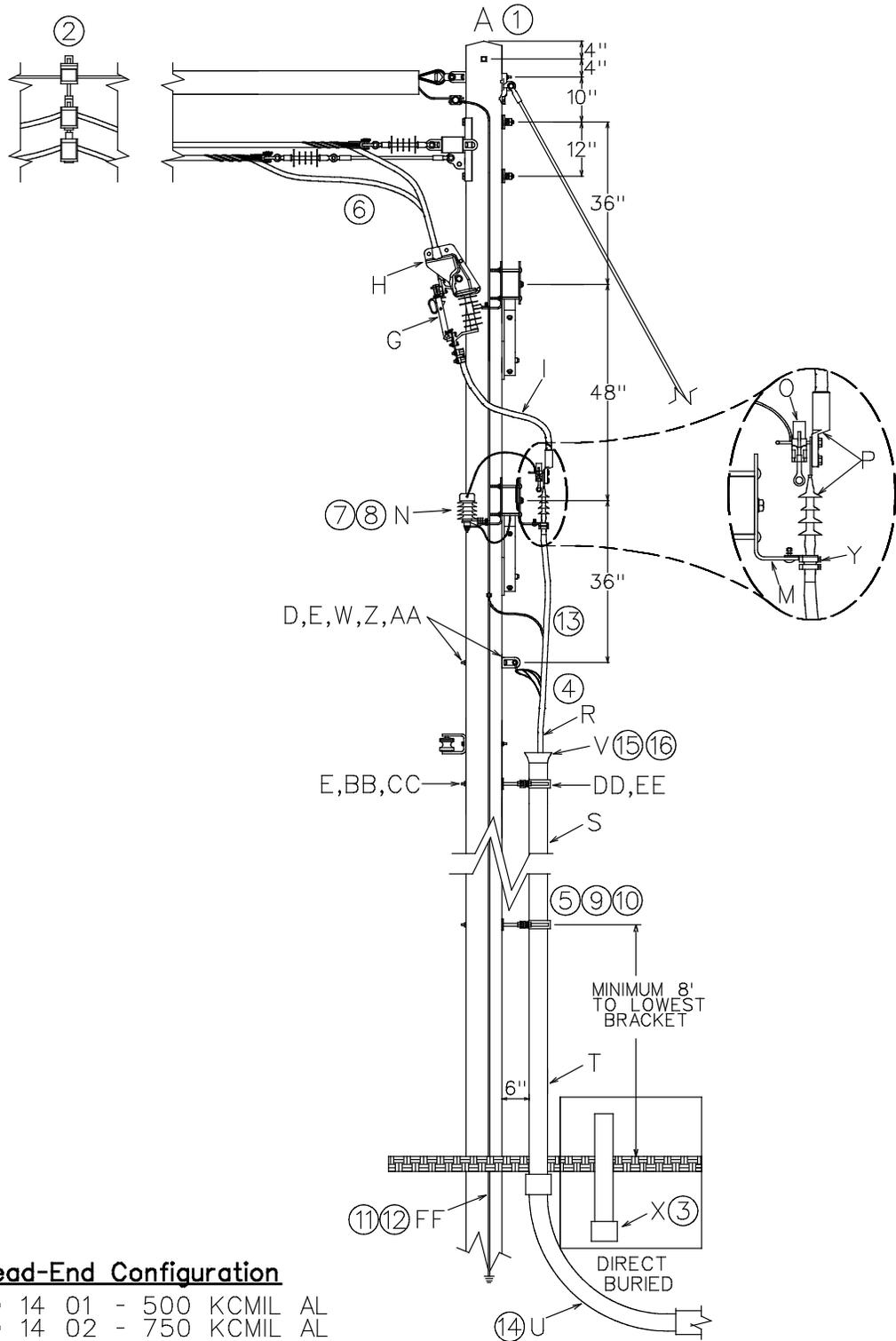
5. See DCS **14 00 01 03** for standoff bracket placement and grounding requirements.
6. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the single switch side of the pole.
7. Insert a grounding stirrup into the bottom of the cutout for a grounding attachment point.
8. Always connect the metallic shields of the riser cable to the system neutral/ messenger by attaching to the #2 stranded copper pole ground that extends to the system neutral/ messenger. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
9. See DCS **59 40 41 01** for information on making PVC to HDPE Duct connection at the end of the sweep if HDPE Duct is used.
10. If water entering the duct becomes a problem, the top of the duct can be sealed with polyurethane expanding foam, stock number 31-53-082. Expanding foam requires a dispensing gun, stock number 85-20-073.
11. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duct over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

CABLE TERMINALS

15kV & Below- Spacer Cable-Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil-750 kcmil

14 20 14 **

Sheet 1 of 5



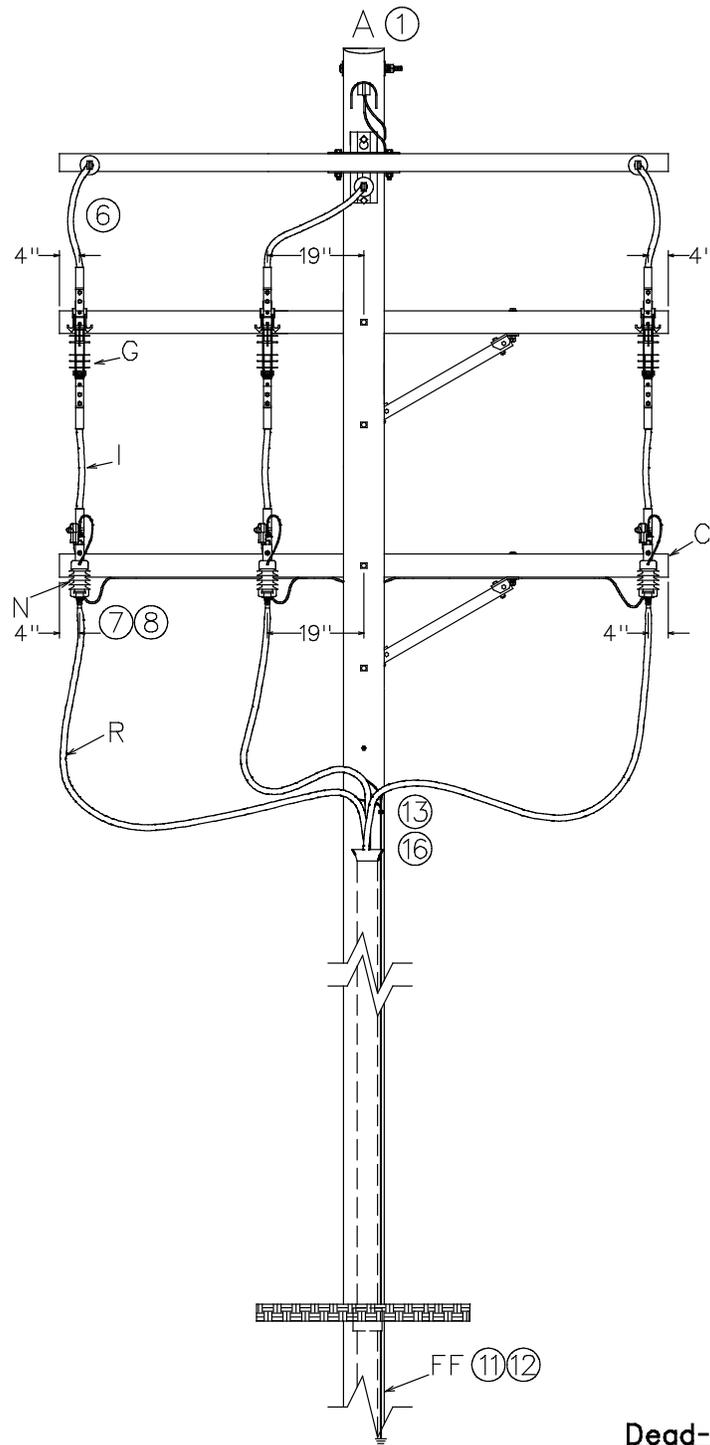
Dead-End Configuration

| | | | | | | | |
|----|----|----|----|---|-----|-------|----|
| 14 | 20 | 14 | 01 | - | 500 | KCMIL | AL |
| 14 | 20 | 14 | 02 | - | 750 | KCMIL | AL |
| 14 | 20 | 14 | 03 | - | 350 | KCMIL | CU |
| 14 | 20 | 14 | 04 | - | 750 | KCMIL | CU |

CABLE TERMINALS

15kV & Below- Spacer Cable-Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil-750 kcmil

14 20 14 **
Sheet 2 of 5



Dead-End Configuration

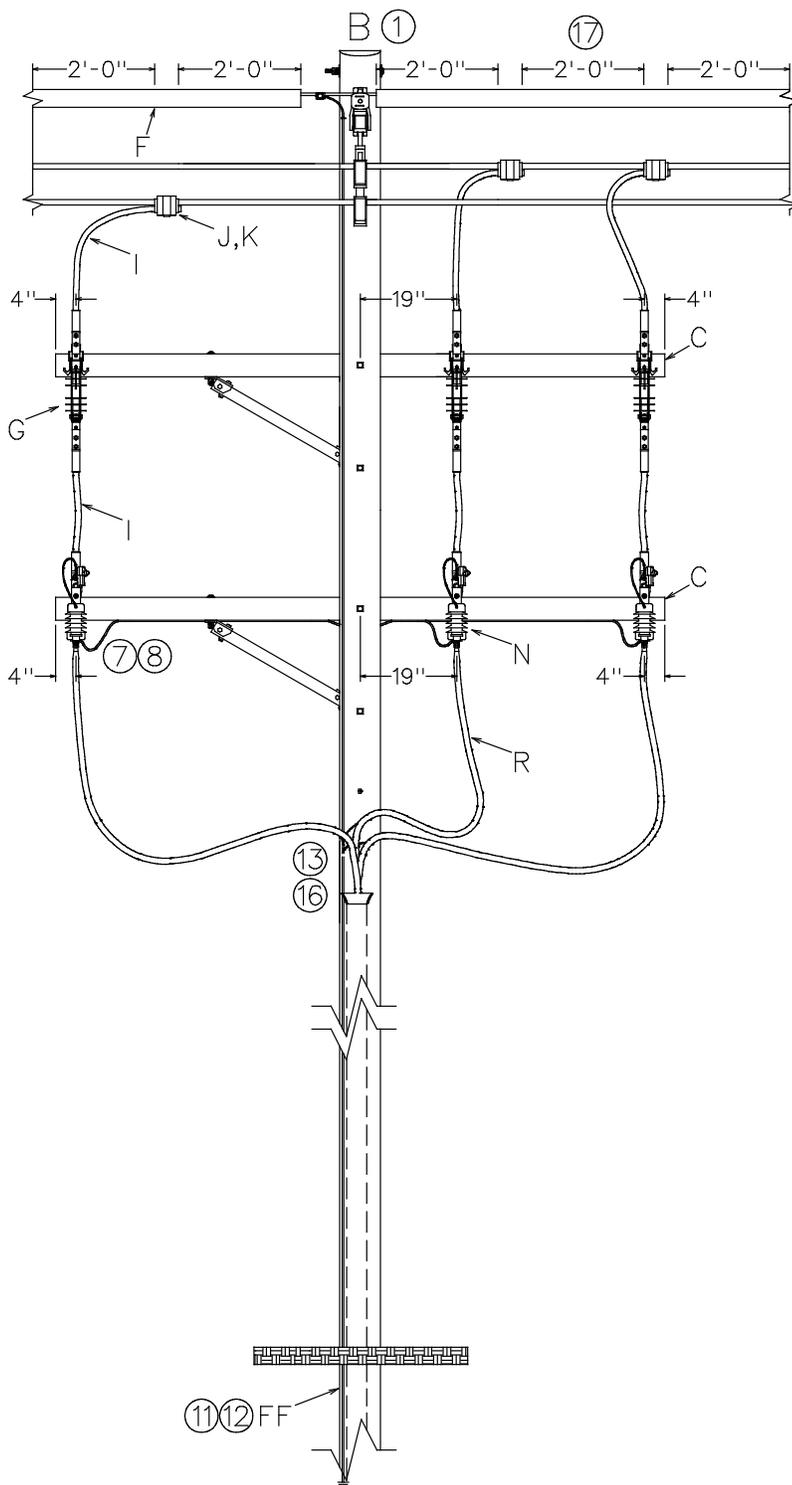
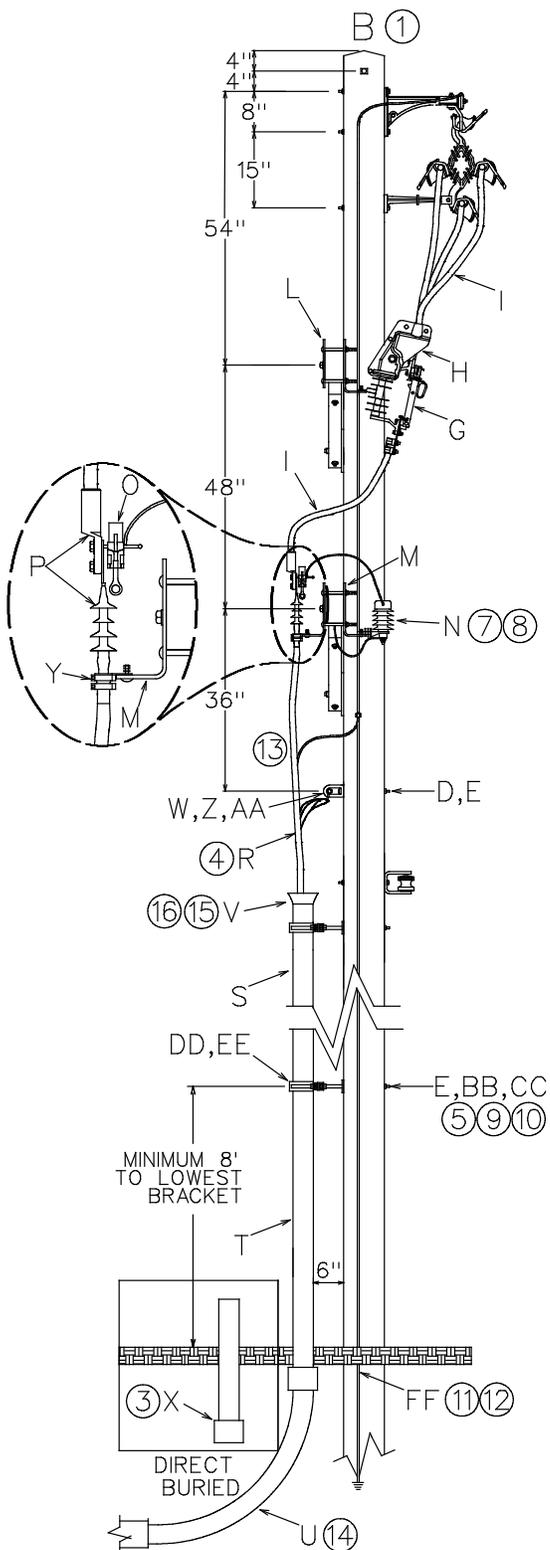
| | | | | | | | |
|----|----|----|----|---|-----|-------|----|
| 14 | 20 | 14 | 01 | - | 500 | KCMIL | AL |
| 14 | 20 | 14 | 02 | - | 750 | KCMIL | AL |
| 14 | 20 | 14 | 03 | - | 350 | KCMIL | CU |
| 14 | 20 | 14 | 04 | - | 750 | KCMIL | CU |

CABLE TERMINALS

15kV & Below- Spacer Cable-Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil-750 kcmil

14 20 14 **

Sheet 3 of 5



Tangent Configuration

| | | | | | | | |
|----|----|----|----|---|-----|-------|----|
| 14 | 20 | 14 | 05 | - | 500 | KCMIL | AL |
| 14 | 20 | 14 | 06 | - | 750 | KCMIL | AL |
| 14 | 20 | 14 | 07 | - | 350 | KCMIL | CU |
| 14 | 20 | 14 | 08 | - | 750 | KCMIL | CU |

CABLE TERMINALS

15kV & Below–Spacer Cable–Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil–750 kcmil

14 20 14 **

Sheet 4 of 5

| | | Std./Stk. No. | Description | 14 20 14 ** | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 |
|------|---|---------------|---|-------------|-----|----|----|----|-----|----|----|----|
| @1 | A | 03 20 10 01 | 15kV & Below–Spacer Cable Single Circuit–Dead End Structure | | 1 | 1 | 1 | 1 | | | | |
| @1 | B | 03 20 01 01 | 15kV & Below – Spacer Cable Single Circuit –Tangent Structure | | | | | | 1 | 1 | 1 | 1 |
| | C | 04 00 20 03 | Crossarm, Sgl., Wood, 10' (Use only 1/2" of VBrace) | | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| | D | 23 52 066 | Bolt, Mach., 5/8 x 14" | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | E | 23 66 027 | Washer, Square, 2-1/4" x 2-1/4" x 3/16" | | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| | F | 69 58 293 | Line Duc Cover-(Messenger Cover), Black, 8' Long(Ea) | | | | | | 2 | 2 | 2 | 2 |
| | G | 54 07 296 | Switch, Disc., 600A, Vertical, 15kV | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | H | 23 17 512 | Cover, Vertical Switch, 600 Amp | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | I | 18 51 052 | Wire, Cu. 350 S.D., Covered | | 15 | 15 | 15 | 15 | 35 | 35 | 35 | 35 |
| @ | J | PG*W | Clamp, Parallel Groove (See 07 00 25 00) | | | | | | 3 | 3 | 3 | 3 |
| | K | 38 51 608 | Cover, Large, Vice Type Connectors | | | | | | 3 | 3 | 3 | 3 |
| | L | 17 58 054 | Bracket, Switch, Arrester | | | | | | 3 | 3 | 3 | 3 |
| | M | 23 56 088 | Bracket, Switch, Arrester, Double | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| @7,8 | N | 10 01 133 | Arrester, Lighting, 3kV | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | 10 01 129 | Arrester, Lighting, 9kV | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | 10 01 146 | Arrester, Lighting, 10kV | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | O | 23 78 183 | Clamp, Hot Line, #6-400 kcmil, CU. | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| @ | P | 42 34 61 10 | Termination, 15kV, 500 kcmil AL. | | 3 | | | | 3 | | | |
| | | 42 34 61 04 | Termination, 15kV, 750 kcmil AL. | | | 3 | | | | 3 | | |
| | | 42 34 61 06 | Termination, 15kV, 350 kcmil CU. | | | | 3 | | | | 3 | |
| | | 42 34 61 02 | Termination, 15kV, 750 kcmil CU. | | | | | 3 | | | | 3 |
| | Q | 23 17 415 | Cover, Wildlife, 2" X 36 ft. Self-Fusing Tape | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | R | 18 07 261 | Cable, 500 kcmil AL. (3 Cables, 35' Ea.) | | 105 | | | | 105 | | | |
| | | 18 07 243 | Cable, 750 kcmil AL. | | | 35 | | | | 35 | | |
| | | 18 07 245 | Cable, 350 kcmil CU. | | | | 35 | | | | 35 | |
| | | 18 07 244 | Cable, 750 kcmil CU. | | | | | 35 | | | | 35 |
| 5 | S | 12 01 303 | Conduit, 5" Plastic, SCH. 40 | | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| 5 | T | 12 01 272 | Conduit, 5" Plastic, SCH. 80 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| @ | U | 12 51 206 | Bend, 5", 36" Radius | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | V | 12 51 233 | Coupling, Bell End, 5" | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | W | 23 65 012 | Nut, Eye, Oval, 5/8" | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| @3 | X | 12 53 017 | Shield, Duct Cable | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Y | 23 67 197 | Bracket, Cable Support, 500-750 kcmil | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

CABLE TERMINALS

15kV & Below–Spacer Cable–Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil–750 kcmil

14 20 14 **
Sheet 5 of 5

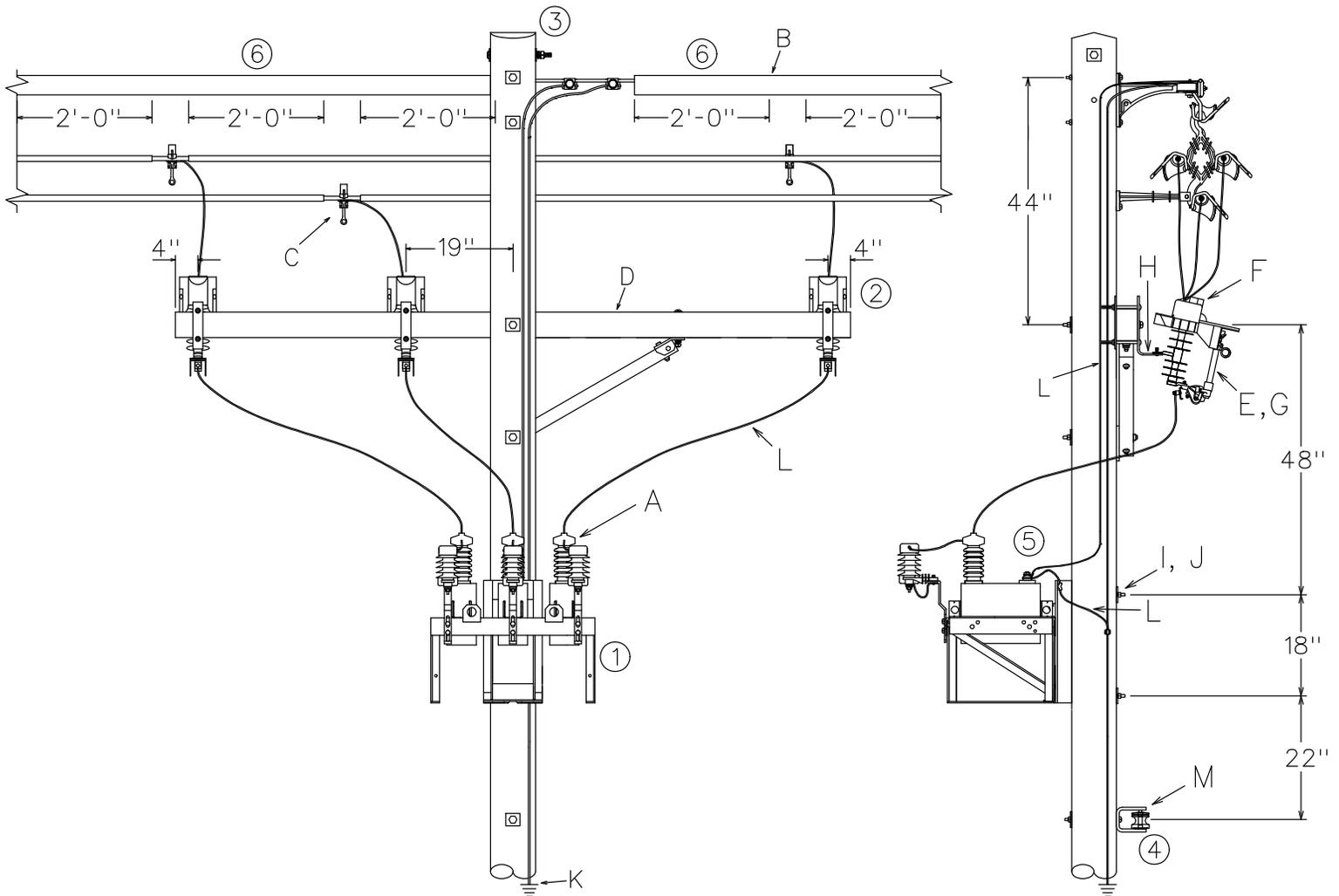
| | | | | | | | | | | | |
|--------|----|-------------|---------------------------------|---|---|---|---|---|---|---|---|
| 4 | Z | 23 17 245 | Grip, Cable Riser, 2"-2.5" Dia. | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | AA | 23 68 181 | Shackle – Anchor, 9/16" | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9,10 | BB | 23 53 003 | Bolt, Double Arming, 5/8"x18" | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | CC | 23 65 053 | Nut, Jam, 5/8" | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | DD | 23 67 184 | Strap, Conduit, 5" | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| @11,12 | EE | 23 06 087 | Bracket, Standoff, 12" | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | FF | 12 00 10 ** | Grounding Unit #2 Cu. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | OP277 | Install Cable Up Pole | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

NOTES:

1. Refer to DCS **03 20 10 01** for dead end material. Refer to DCS **03 20 01 01** for the tangent material.
2. Install the first spacer, stock # 23 67 334, about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
3. To prevent damage to direct buried cables, install a cable shield (stk# 12 53 017) at the conduit entry.
4. Wrap cable with friction tape prior to installation of cable grip.
5. For alternate construction, call for split conduit with steel guard.
6. Extend spacer cable conductor with covering intact through the preform into the switch.
7. On 13kV terminal poles, a 10kV arrester shall be used.
8. Route the arrester ground leads under the crossarm and attach to the pole ground keeping them as short as possible. Connect the arrester primary leads under the cutout cover to the arrester and keep them as short as possible.
9. Substitute the 20" standoff bracket, stock number 23 06 086 if a longer bracket is required.
10. See DCS **14 00 01 03** for standoff bracket placement and grounding requirements.
11. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the single switch side of the pole.
12. Use DCS **12 00 10 04** for ground coil application on new pole installation. Use DCS **12 00 10 03** for ground rod on existing pole.
13. Always connect the metallic shields of the riser cable to the system neutral/ messenger by attaching to the #2 stranded copper pole ground that extends to the system neutral/ messenger. Be aware that the bare and/or covered #7/10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
14. See DCS **59 40 41 01** for information on making PVC to HDPE Duct connection at the end of the sweep if HDPE duct is used.
15. If water entering the duct becomes a problem, the top of the duct can be sealed with polyurethane expanding foam, stock number 31 53 082. Expanding foam requires a dispensing gun, stock number 85 20 073.
16. Conduit must extend a minimum of 40" above the highest communication attachment and up to the secondary, if installed.
17. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.i

CAPACITORS AND REGULATORS
 Spacer Cable – Fixed Capacitor Installation
 2.4 – 13.8kV Three Phase

16 20 01 **
 Sheet 1 of 2



NOTES:

1. For wiring diagram, see Standard **16 00 05 00**.
2. Loadbreak tool, Stock No. 87 38 045 must be used to open switches.
3. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is a system neutral and attached on the single switch side of the pole.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Connect neutral ground to the bus of the neutral bushings of the capacitor and extend up the pole to the messenger / system neutral.
6. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger any-where the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

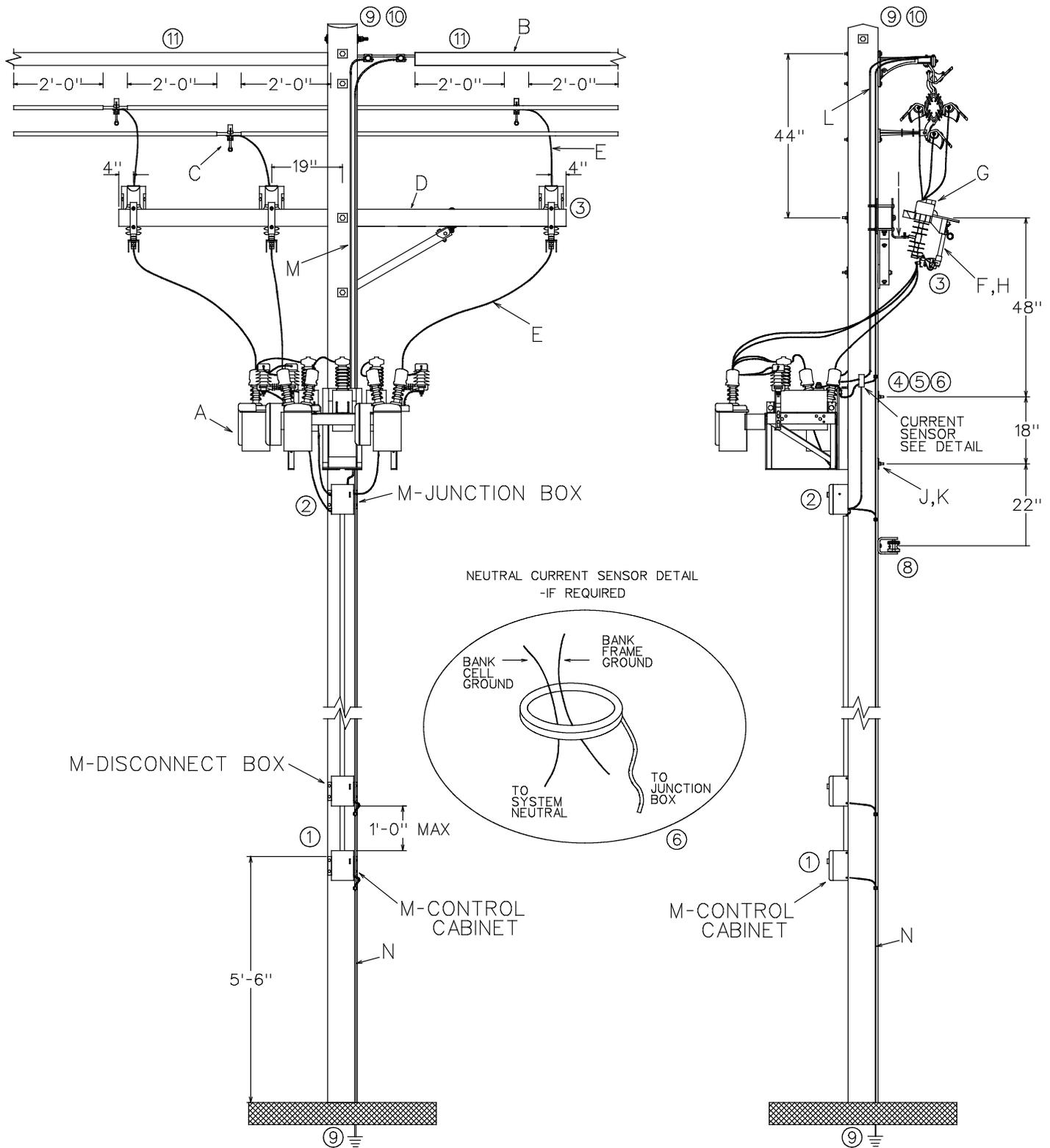
CAPACITORS AND REGULATORS
Spacer Cable – Fixed Capacitor Installation
2.4 – 13.8kV Three Phase

16 20 01 **

Sheet 2 of 2

| | Std./ Stk. No. | Description | 16 20 01 ** | | | | | | |
|------|-------------------|--------------------|---|----|------|----|--------|----|----|
| | | | 4kV | | 12kV | | 13.8kV | | |
| | | | 01 | 02 | 03 | 04 | 05 | 06 | |
| 1 | A | 69 11 055 | Cap, Fix, 300 KVAR, 4KV | 1 | | | | | |
| | | 69 11 057 | Cap, Fix, 600 KVAR, 4KV | | 1 | | | | |
| | | 69 11 061 | Cap, Fix, 300 KVAR, 12KV | | | 1 | | | |
| | | 69 11 062 | Cap, Fix, 600 KVAR, 12KV | | | | 1 | | |
| | | 69 11 073 | Cap, Fix, 300 KVAR, 13.8KV | | | | | 1 | |
| | | 69 11 072 | Cap, Fix, 600 KVAR, 13.8KV | | | | | | 1 |
| 6 | B | 69 58 293 | Line Duc (Messenger Cover), Black. 8' Long (Each) | 2 | 2 | 2 | 2 | 2 | 2 |
| @ | C | 17 62 088 | Clamp, Hot Line 1/0 Through 477 Spacer Cable | 3 | 3 | 3 | 3 | 3 | 3 |
| | | 17 62 143 | Clamp, Hot Line, 795 Spacer Cable | 3 | 3 | 3 | 3 | 3 | 3 |
| | D | 04 00 20 03 | Crossarm, Sgl., Wood, 10' (use only 1/2 of V-Brace) | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | E | 54 07 208 | Switch, Fuse, 100A, 15kV | 3 | 3 | 3 | 3 | 3 | 3 |
| | F | 05 15 10 01 | Cover – Cutout | 3 | 3 | 3 | 3 | 3 | 3 |
| | G | 20 53 088 | Link, Fuse, 40T | 3 | | | | | |
| | | 20 53 200 | Link, Fuse, 80T | | 3 | | | | |
| | | 20 53 085 | Link, Fuse, 15T | | | 3 | | | |
| | | 20 53 087 | Link, Fuse, 30T | | | | 3 | | |
| | | 20 53 084 | Link, Fuse, 12T | | | | | 3 | |
| | | 20 53 089 | Link, Fuse, 25T | | | | | | 3 |
| | H | 17 58 054 | Bracket, Switch, Arrester | 3 | 3 | 3 | 3 | 3 | 3 |
| | I | 23 52 219 | Bolt, Machine, 3/4" x 14" | 2 | 2 | 2 | 2 | 2 | 2 |
| | J | 23 66 031 | Washer, NM, Curved, 3/4" | 2 | 2 | 2 | 2 | 2 | 2 |
| @, 3 | K | 12 00 10 02 | Grounding Unit, 7#10 Copperweld With Ground Rod | 1 | 1 | 1 | 1 | 1 | 1 |
| 5 | L | 18 51 025 | Wire, #4 Cu. Poly | 34 | 34 | 34 | 34 | 34 | 34 |
| @, 4 | M | 03 01 01 ** | Neutral Configuration | | | | | | |

CAPACITORS AND REGULATORS
 15kV & Below - Spacer Cable - 300 kVAR to 1200 kVAR
 For Time, Temp., Voltage or Communicating Type Controls



CAPACITORS AND REGULATORS
 15kV & Below – Spacer Cable – 300 kVAR to 1200 kVAR
 For Time, Temp., Voltage or Communicating Type Controls

16 20 05 **
 Sheet 2 of 3

| | Std./ Stk. No. | Description | 16 20 05 ** | | | | | | | | |
|---------|-------------------|--------------------|---|----|------|----|----|--------|----|----|---|
| | | | 4kV | | 12kV | | | 13.8kV | | | |
| | | | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | |
| 7 | A | 69 11 031 | Cap, Switched, 300 kVAR, 4kV | 1 | | | | | | | |
| | | 69 11 036 | Cap, Switched, 600 kVAR, 4kV | | 1 | | | | | | |
| | | 69 11 019 | Cap, Switched, 300 kVAR, 12kV | | | 1 | | | | | |
| | | 69 11 032 | Cap, Switched, 600 kVAR, 12kV | | | | 1 | | | | |
| | | 69 11 058 | Cap, Switched, 1200 kVAR, 12kV | | | | | 1 | | | |
| | | 69 11 086 | Cap, Switched, 300 kVAR, 13.8kV | | | | | | 1 | | |
| | | 69 11 071 | Cap, Switched, 600 kVAR, 13.8kV | | | | | | | 1 | |
| | | 69 11 074 | Cap, Switched, 1200 kVAR, 13.8kV | | | | | | | | 1 |
| 11 | B | 69 58 293 | Line Duc (Messenger Cover), Black. 8' Long (Each) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| @ | C | 17 62 088 | Clamp, Hot Line 1/0 Through 477 Spacer Cable | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | | 17 62 143 | Clamp, Hot Line, 795 Spacer Cable | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | D | 04 00 20 03 | Crossarm, Sgl., Wood, 10' (use only 1/2 of V-Brace) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | E | 18 51 025 | Wire, #4 Cu. Poly | 24 | 24 | 24 | 24 | 24 | 24 | 24 | |
| | F | 54 07 208 | Switch, Fuse, 100A, 15kV | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | G | 05 15 10 01 | Cover – Cutout | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | H | 20 53 088 | Link, Fuse, 40T | 3 | | | | | | 3 | |
| | | 20 53 200 | Link, Fuse, 80T | | 3 | | | | | | |
| | | 20 53 085 | Link, Fuse, 15T | | | 3 | | | | | |
| | | 20 53 087 | Link, Fuse, 30T | | | | 3 | | | | |
| | | 20 53 090 | Link, Fuse, 65T | | | | | 3 | | | |
| | | 20 53 089 | Link, Fuse, 12T | | | | | | 3 | | |
| | | 20 53 084 | Link, Fuse, 25T | | | | | | | 3 | |
| | I | 17 58 054 | Bracket, Switch, Arrester | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | J | 23 52 219 | Bolt, Machine, 3/4" x 14" | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | K | 23 66 031 | Washer, NM, Curved, 3/4" | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | L | 18 51 019 | Wire, #2 Cu. Poly Covered (Ft.) | 15 | 15 | 15 | 15 | 15 | 15 | 15 | |
| @ 5,6,7 | M | 16 00 24 ** | Control, Capacitor | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| @ 9 | N | 12 00 10 ** | Grounding Unit, 7#10 Copperweld | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

NOTES:

1. Clearance from ground to the top of the control cabinet shall be 5'-6" from the ground, and the bottom of the disconnect box has to be installed 1'-0" max above the top of the control cabinet, but the next hand or foot hold shall be 8' or greater above the disconnect box.
2. The junction box shall be mounted either on the capacitor bank frame or 1' to 2' below the capacitor bank frame. Leads to the bank switches shall be secured to the frame of the bank with wire ties.
3. Loadbreak tool, Stock No. 87 38 045 must be used to open switches.
4. Connect neutral ground to the bus of the neutral bushings of the capacitor and extend up the pole to the messenger / system neutral.
5. For wiring diagram, see DCS **16 00 05 00**.

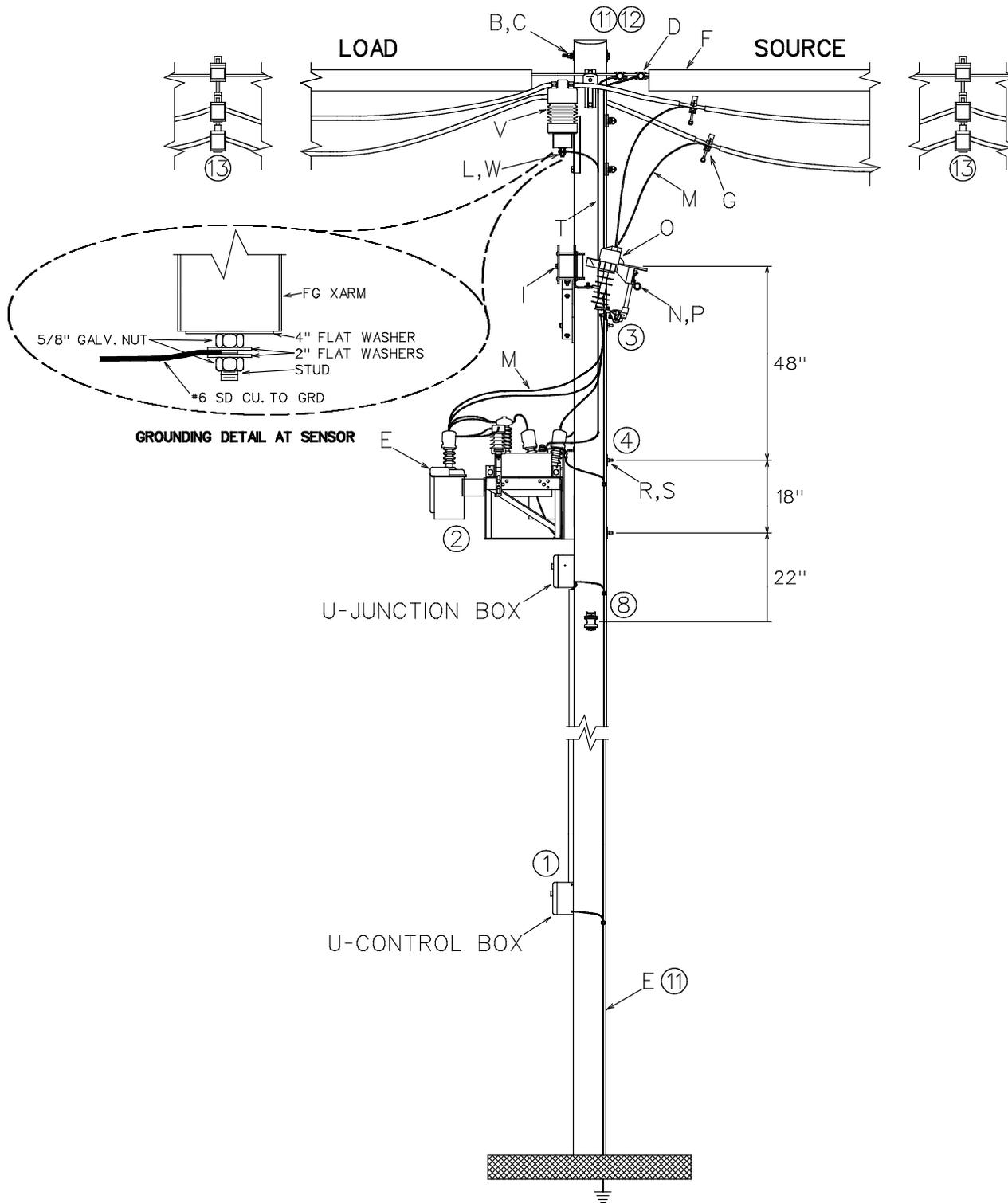
6. Neutral current sensor is not included on all models. Refer to DCS **16 00 24 **** for material and connection in the junction box. The neutral current sensor shall be mounted as shown on the drawing above. Both ground wires from the bank must pass through the center of the sensor. The sensor shall be located on the ground wires between the bank and their connection to the distribution system neutral (thereby capturing all of the ground current in the wires from the bank), and secured with a staple above and below to the ground wires passing through the sensor. (If a 1kVA transformer is installed on the bank, the two ground wires from the transformer must also pass through the neutral current sensor). Run sensor cable and terminate to the junction box.
7. Capacitor banks have a “C” order point, and have at least 16 weeks lead time.
8. Secondary location if present. Connect secondary neutral to pole ground.
9. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the single switch side of the pole.
10. Note that the messenger also serves as the system neutral, so the high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground using #2 poly covered ground wire (18 51 019). The capacitor neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
11. Stagger taps and other areas where the covering has been removed to provide a minimum 2’-0” horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2’-0” of horizontal separation.u

CAPACITORS AND REGULATORS

Switched Capacitor Installation 2.4-13.8kV Three Phase
Non-Communicating Current or VAR Type Controls

16 20 10 **

Sheet 1 of 4



CAPACITORS AND REGULATORS

Switched Capacitor Installation 2.4-13.8kV Three Phase Non-Communicating Current or VAR Type Controls

16 20 10 **

Sheet 3 of 4

| | | Std./ Stk. No. | Description | 16 20 10 ** | 4kV | | 12kV | | | 13.8kV | | | |
|-----------|-----------|----------------------------------|---|-------------|-----|----|------|----|----|--------|----|----|--|
| | | | | | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | |
| 5,7,10 | A | 23 56 075 | Bracket, Messenger | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | B | 23 52 065 | Bolt, Machine, 5/8" x 12" (w/ nut) | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | C | 23 66 027 | Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | |
| | D | 17 51 137 | Connector, PG, Pole Ground to Messenger | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | E | 69 11 031 | Cap, Switched, 300 kVAR, 4kV | | 1 | | | | | | | | |
| | | 69 11 036 | Cap, Switched, 600 kVAR, 4kV | | | 1 | | | | | | | |
| | | 69 11 019 | Cap, Switched, 300 kVAR, 12kV | | | | 1 | | | | | | |
| | | 69 11 032 | Cap, Switched, 600 kVAR, 12kV | | | | | 1 | | | | | |
| | | 69 11 058 | Cap, Switched, 1200 kVAR, 12kV | | | | | | 1 | | | | |
| | | 69 11 086 | Cap, Switched, 300 kVAR, 13.8kV | | | | | | | 1 | | | |
| 69 11 071 | | Cap, Switched, 600 kVAR, 13.8kV | | | | | | | | | 1 | | |
| | 69 11 074 | Cap, Switched, 1200 kVAR, 13.8kV | | | | | | | | | | 1 | |
| @ | F | 69 58 293 | Line Duc (Messenger Cover), Black. 8' Long (Each) | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | G | 17 62 088 | Clamp, Hot Line 1/0 Through 477 Spacer Cable | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | | 17 62 143 | Clamp, Hot Line, 795 Spacer Cable | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | H | 04 00 41 16 | Crossarm, Tangent, F/G, 10' | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | I | 04 00 20 03 | Crossarm, Sgl., Wood, 10' (use only 1/2 of V-Brace) | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | J | 25 05 143 | Insulator, Pin, 15kV, Vice-Top | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | K | 23 62 028 | Pin, Insulator, Long Shank | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | L | 23 66 132 | Washer, Flat, Sq., 4" x 4", with 13/16" hole | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | M | 18 51 025 | Wire, #4 Cu. Poly | | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | |
| 3 | N | 54 07 208 | Switch, Fuse, 100A, 15kV | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | O | 05 15 10 01 | Cover - Cutout | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| P | 20 53 088 | Link, Fuse, 40T | | 3 | | | | | | | | 3 | |
| | 20 53 200 | Link, Fuse, 80T | | | 3 | | | | | | | | |
| | 20 53 085 | Link, Fuse, 15T | | | | 3 | | | | | | | |
| | 20 53 087 | Link, Fuse, 30T | | | | | 3 | | | | | | |
| | 20 53 090 | Link, Fuse, 65T | | | | | | 3 | | | | | |
| | 20 53 084 | Link, Fuse, 12T | | | | | | | 3 | | | | |
| | 20 53 089 | Link, Fuse, 25T | | | | | | | | | 3 | | |
| | Q | 17 58 054 | Bracket, Switch, Arrester | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| | R | 23 52 219 | Bolt, Machine, 3/4" x 14" | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | S | 23 66 031 | Washer, NM, Curved, 3/4" | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| | T | 18 51 019 | Wire, #2 Cu. Poly Covered (Ft.) | | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | |
| @ | U | 16 00 20 01 | Control, Capacitor | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| 9 | V | 69 11 297 | Sensor, Current, 15kV w/o Control Cable | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | W | 23 64 034 | Stud, Insulator, Line Post, 5/8" x 7" | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| @,11 | X | 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

NOTES:

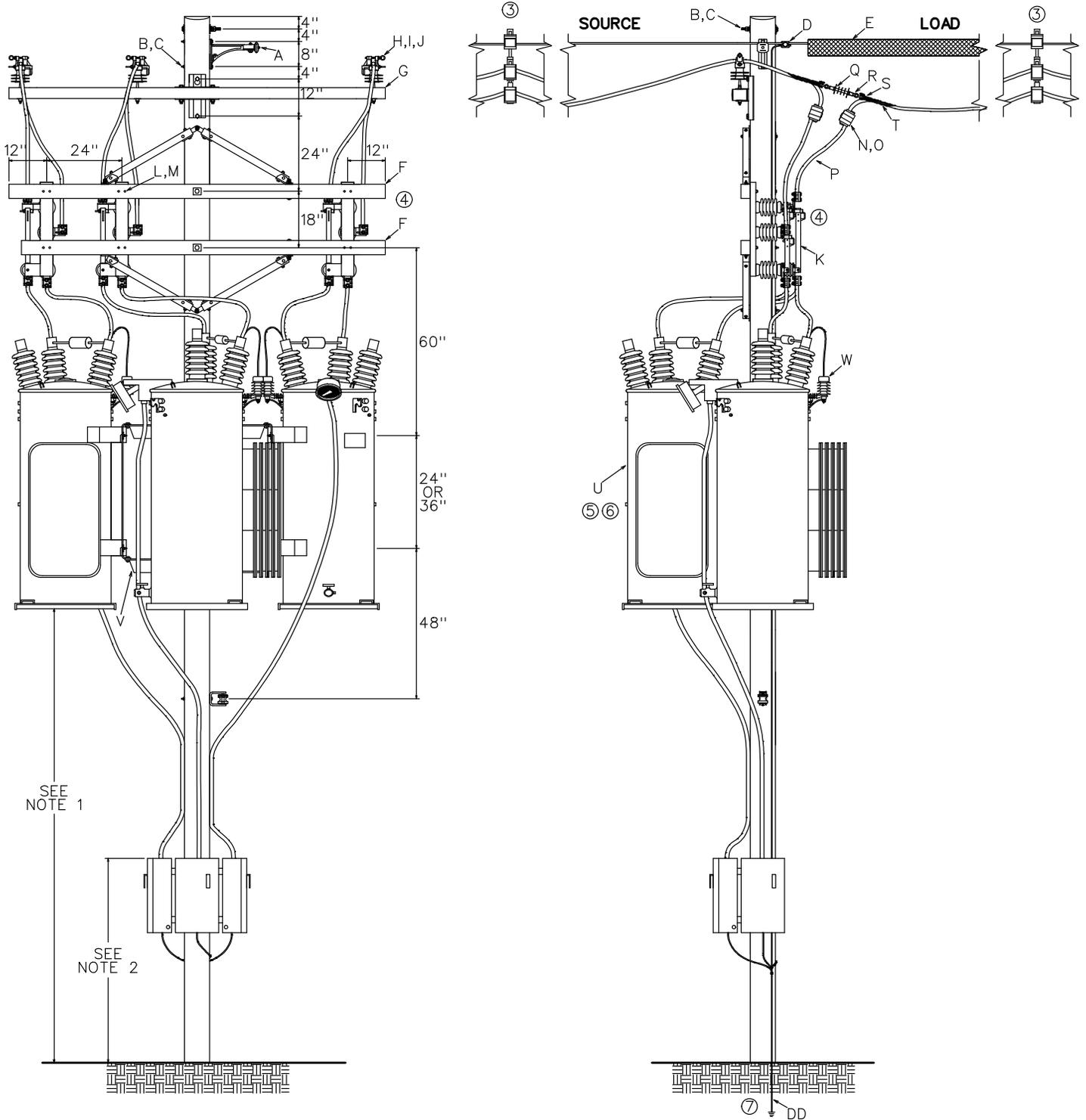
1. Minimum clearance from ground to the **top of the control cabinet** shall be minimum 5'6" from the ground, with the next hand or foot hold 8' or greater above the control cabinet.
2. The junction box shall be mounted either on the capacitor bank frame of 1' to 2' below the capacitor bank frame. Leads to the bank switches shall be secured to the frame of the bank with wire ties.
3. Loadbreak tool, Stock No. 87 38 045 must be used to operate switches
4. Connect neutral ground to the bus of the neutral bushings of the capacitor and extend up the pole to the messenger / system neutral.
5. For wiring diagram, see DCS **16 00 05 00**.
6. Current sensor is not included on all models. Refer to DCS **16 00 20 **** for material and wire connections in the Junction box.
7. Capacitor banks have a "C" order point, and have at least 16 weeks lead time.
8. Secondary location if present. Connect secondary neutral to pole ground.g
9. See grounding diagram for sensor. Low voltage wires from sensor should be connected in the junction box on the bank before the primary wire is energized on the sensor. However, if the primary on the sensor is energized, the sensor wires are safe to connect (low output current and voltage). Hand tie primary to sensor.
10. For VAR controlled banks, the source and load should be reversed from what is shown.
11. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the single switch side of the pole.
12. Note that the messenger also serves as the system neutral, so the high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground using #2 poly covered ground wire (18 51 019). The capacitor neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.

CAPACITORS AND REGULATORS

Regulator – Spacer Cable

Pole Mounted, Three Phase 4kV & 12kV

16 20 15 01
Sheet 1 of 4



CAPACITORS AND REGULATORS

Regulator – Spacer Cable
Pole Mounted, Three Phase 4kV & 12kV

16 20 15 01

Sheet 2 of 4

| Regulator-Line | Voltage | Amps | KVA | Weight (lbs) Per Unit | | |
|----------------|---------|------|-------|-----------------------|--------------|------|
| | | | | Siemens | Cooper/Eaton | GE |
| 69 09 078 | 2500 | 200 | 50 | | 1200 | 1230 |
| 69 09 125 | 2500 | 400 | 100 | 2064 | 2526 | 1830 |
| 69 09 126 | 2500 | 665 | 167 | 2410 | 2509 | 2100 |
| 69 09 005 | 7620 | 100 | 76.2 | 1431 | 1270 | 1430 |
| 69 09 007 | 7620 | 150 | 114.3 | 1902 | 1585 | 1902 |
| 69 09 006 | 7620 | 219 | 167 | 2100 | 1975 | 2100 |

| | Std./Stk. No. | Description | 16 20 15 01 | |
|----|-------------------------|---|-------------|----|
| | A 23 56 075 | Bracket, Messenger | | 1 |
| | B 23 52 065 | Bolt, Machine, 5/8" x 12" (w/ nut) | | 3 |
| | C 23 66 027 | Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick | | 4 |
| | D 17 51 137 | Connector, PG, Pole Ground to Messenger | | 1 |
| | E 69 58 293 | Line Duc (Messenger Cover), Black, 8' Long (Each) | | 1 |
| | F 04 00 20 03 | Crossarm, Sgl., Wood, 10' | | 2 |
| | G 04 00 41 16 | Crossarm, Tangent, F/G, 10' | | 1 |
| | H 25 05 143 | Insulator, Pin, 15kV, Vice-Top | | 3 |
| | I 23 62 028 | Pin, Insulator, Long Shank | | 3 |
| | J 23 66 132 | Washer, Flat, Sq., 4"x4", with 13/16" hole | | 3 |
| 4 | K 54 07 455 | Switch, By-Pass, 600A | | 3 |
| | L 23 52 038 | Bolt, Machine, 1/2" x 6" | | 12 |
| | M 23 66 118 | Washer, Square, 1/2" | | 15 |
| @ | N PG*W | Clamp, Parallel Groove (See 07 00 25 00) | | 6 |
| | O 38 51 608 | Cover, Large, Vice Type Connectors | | 6 |
| | P 18 51 052 | Wire, Poly, SD, 350 Cu. (Ft.) | | 60 |
| | Q 25 06 052 | Insulator, Suspension, 15kV, Poly | | 3 |
| | R 23 68 181 | Shackle – Anchor, 9/16" | | 6 |
| | S 23 58 122 | Clevis, Thimble, 7/8" opening, Galvanized Steel | | 6 |
| @ | T 17 69 063 | Grip, Conductor Deadend, 15kV, New 477 Spacer Cable | | 6 |
| | 17 69 *** | Size Grip per Existing Spacer Cable Conductor | | 6 |
| @5 | U Regulator (See Above) | Regulator | | 3 |
| | V 23 17 202 | Mounting Unit, 3 Position | | 1 |
| @ | W 10 01 133 | Arrester, 3kV w/ Protective Cap | | 6 |
| | 10 01 145 | Arrester, 10kV w/ Protective Cap | | 6 |

CAPACITORS AND REGULATORS
Regulator – Spacer Cable
Pole Mounted, Three Phase 4kV & 12kV

16 20 15 01
 Sheet 3 of 4

| | | Std./Stk. No. | Description | 16 20 15 01 | |
|----|----|----------------------|---|--------------------|----|
| @6 | X | 69 58 127 | Galv. Channel for Adapting some 219A Reg. from 36" to 24" Spacing | | 1 |
| | Y | 23 52 219 | Bolt, Mach., 3/4" x 14" | | 2 |
| | Z | 23 66 031 | Washer, Square, 3/4" | | 2 |
| | AA | 23 64 028 | Staple | | 48 |
| | BB | 23 52 309 | Bolt, Mach., 1/2" x 18" | | 6 |
| | CC | 17 54 005 | Connector, Split Bolt | | 7 |
| @7 | DD | 12 00 10 ** | Grounding Unit, 7#10 Copperweld | | 1 |

NOTES:

1. Minimum clearance from the ground to the **bottom of the regulator tank** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrians – 11 feet.
2. Minimum clearance from ground to the **top of the control cabinet** shall be minimum 5'6" from the ground, with the next hand or foot hold 8' or greater above the control cabinet. In addition, the minimum clearance from ground to the **bottom of the control cabinet** shall be:
 - Over shoulder of roadway – 15 feet.
 - In areas subject to vandalism – 15 feet.
 - Over walkways where unduly obstructing the walkway – 10 feet.
3. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See **07 20 01 01** for space installation between poles.
4. See by-pass switch details on Sheet 4, follow instructions for operating.
5. 7620V regulators can be applied at 2400V. However, the amperage limit remains the same, so the kVA rating will be lower. Also, in most cases, this will require moving a wire underneath the hand hole. Cover on the top of the regulator and changing a few parameters on the control.
6. Some 219A regulators may require an adapter plate (69 58 127) for mounting.
7. Use DCS **12 00 10 01** ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.

CAPACITORS AND REGULATORS
Regulator – Spacer Cable
Pole Mounted, Three Phase 4kV & 12kV

16 20 15 01
Sheet 4 of 4

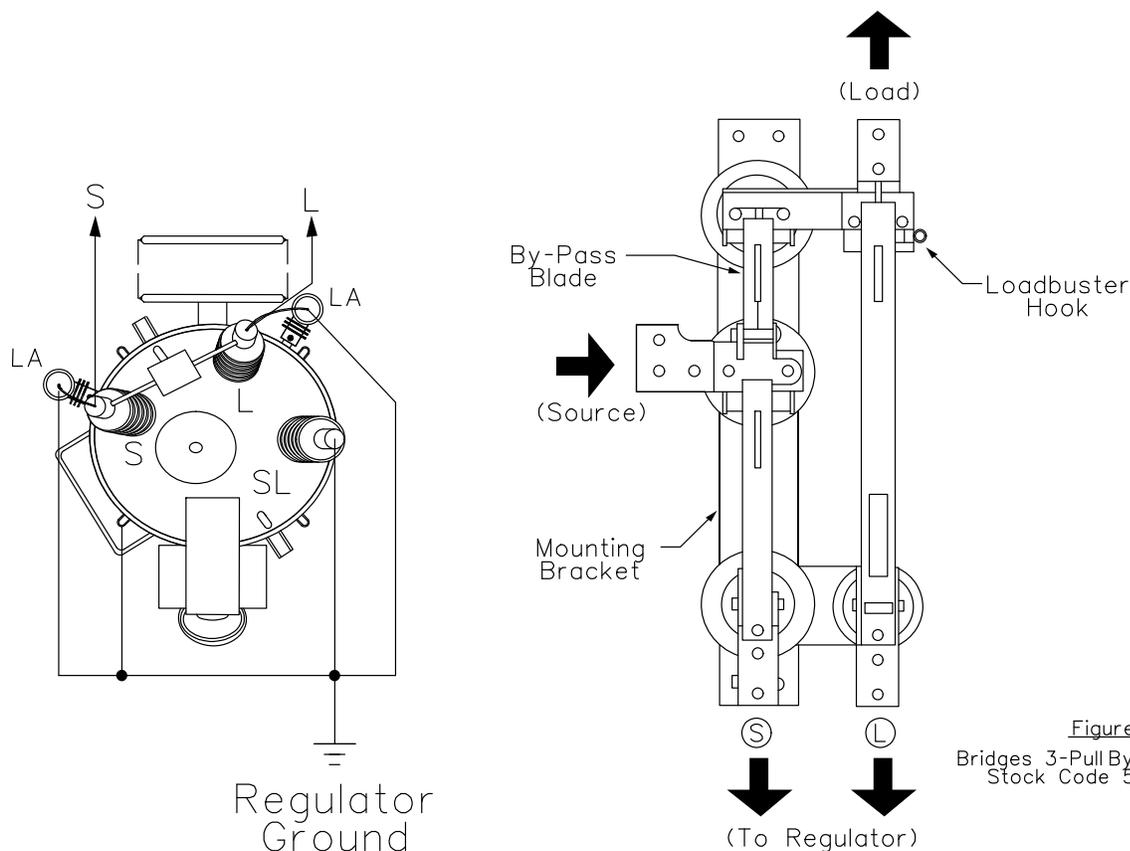


Figure 1
Bridges 3-Pull By-Pass Switch
Stock Code 54-07-455

REGULATOR WIRING SCHEMATIC

BY-PASS SWITCH DETAIL

TO BY-PASS REGULATOR

1. Set regulator on neutral position. (Follow appropriate procedures to verify regulator is on neutral.)
2. Close the short by-pass blade.
3. Use load-buster tool and open the load blade.
4. Open the source blade.

TO RE-ENERGIZE REGULATOR

1. With by-pass blade closed, set regulator on neutral position.
2. Close the source side blade only to test the regulator.
3. Close the source and load blades to the regulator.
4. Open the short by-pass blade to the regulator.
5. Place regulator in service.