

TABLE OF CONTENTS**Capacitor Bank Wiring Diagrams**

SINGLE PHASE, FIXED 2.4, 7.2, & 7.96 KV 16-00-02-00

THREE PHASE, SWITCHED AND FIXED 2.4 – 14.4KV 16-00-05-00

Controls and Wiring Diagrams

TIME, TEMP, VOLTAGE, NON-COMMUNICATING FOR 2.4 – 34.5KV BANKS 16-00-18-**

CURRENT OR VAR, NON-COMMUNICATING FOR 2.4 – 34.5 KV BANKS 16-00-20-**

TIME, TEMP, VOLTAGE, COMMUNICATING FOR 2.4 – 34.5 KV BANKS 16-00-24-**

TIME, TEMP, VOLTAGE, COMMUNICATING FOR 2.4 – 34.5 KV BANKS 16-00-26-**

Fixed Capacitor Installations

2.4, 7.2 & 7.96KV SINGLE PHASE 16-15-01-**

2.4 – 14.4KV THREE PHASE 16-15-02-**

Switched Capacitor Installations

2.4 – 14.4KV FOR TIME, TEMP, VOLTAGE, COMMUNICATING CONTROLS 16-15-03-**

2.4 – 14.4KV FOR CURRENT CONTROLS, NON-COMMUNICATING CONTROLS 16-15-04-**

INSTALLATION OF 1KVA TRANSFORMER ON CAPACITOR BANK 16-15-05-01

SWITCHED CAPACITOR INSTALLATION 2.4-13.8KV THREE PHASE NON-COMMUNICATING CURRENT OR VAR
TYPE CONTROLS 16-20-01-**15KV & BELOW – SPACERCABLE – 300KVAR to 1200KVAR, FOR TIME, TEMP., VOLTAGE OR COMMUNICATING
TYPE CONTROLS 16-20-05-**SWITCHED CAPACITOR INSTALLATION 2.4-13.8KV THREE PHASE NON-COMMUNICATING CURRENT OR VAR
TYPE CONTROLS 16-20-10-**

REGULATOR – SPACER CABLE POLE MOUNTED, THREE PHASE 4KV & 12 KV 16-20-15-01

34.5KV FOR MULTI FUNCTION CONTROLS 16-34-02-**

Regulators

POLE MOUNTED, SINGLE PHASE 4 & 12KV 16-80-01-**

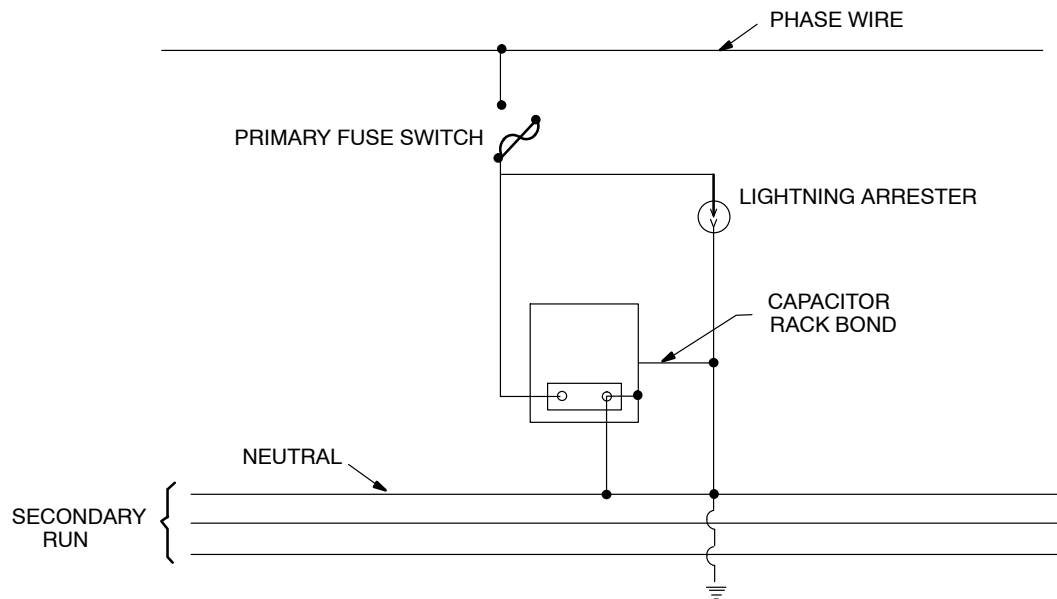
PLATFORM MOUNTED, THREE PHASE 4 & 12KV 16-80-02-**

POLE MOUNTED, THREE PHASE 4KV & 12KV 16-80-03-01

CAPACITORS AND REGULATORS
Capacitor Bank Wiring Diagram
Single Phase, Fixed 2.4, 7.2, and 7.96kV

16 00 02 00

Sheet 1 of 1

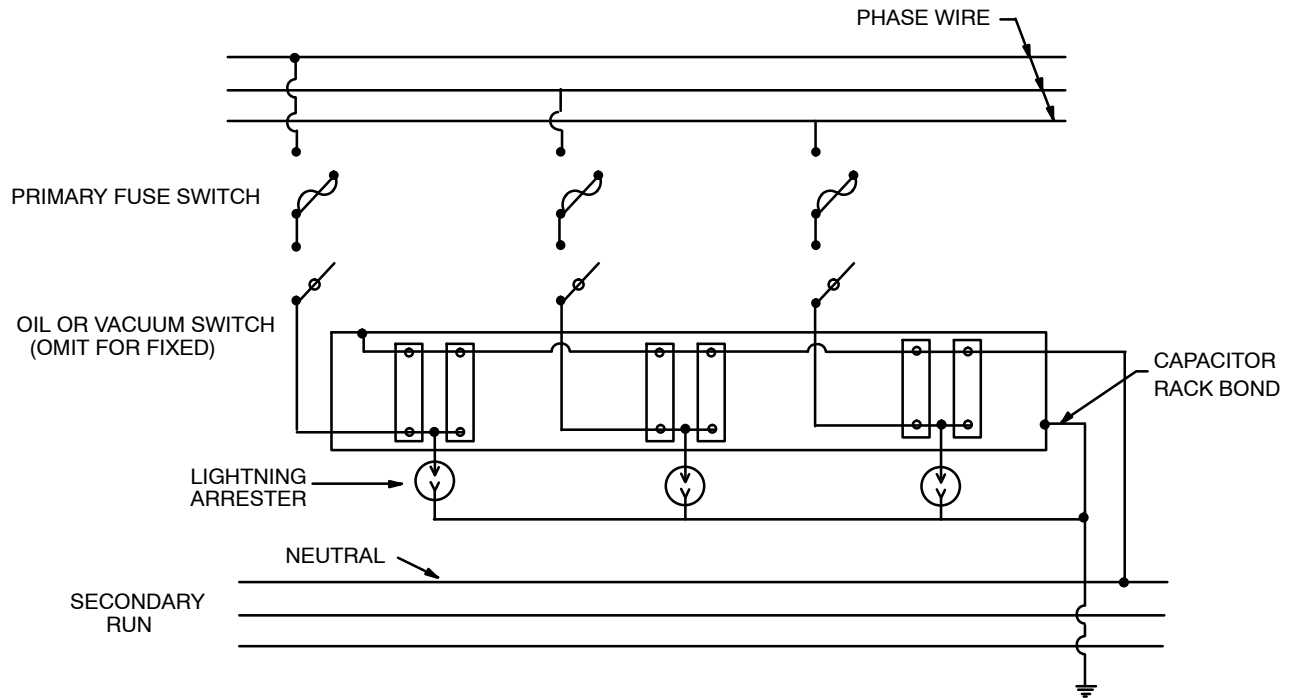


CAPACITORS AND REGULATORS
Capacitor Bank Wiring Diagram
Three Phase, Switched and Fixed – 2.4 – 14.4 kV

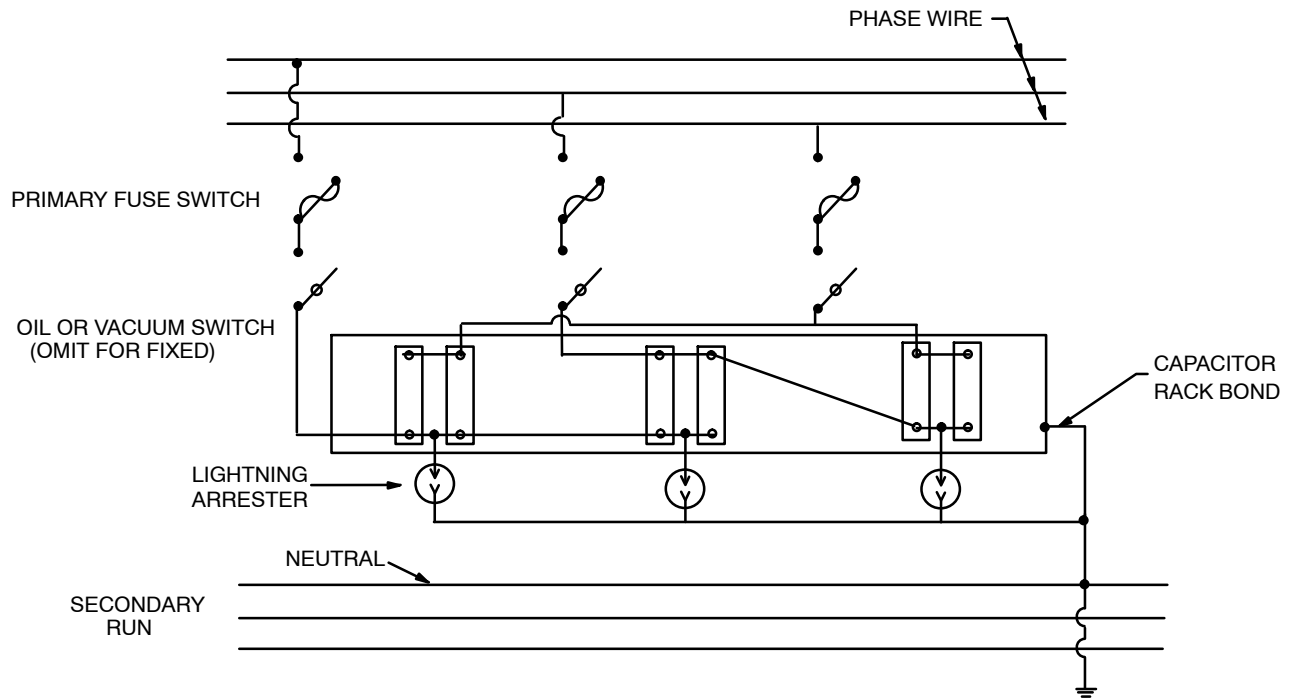
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Sheet 1 of 1

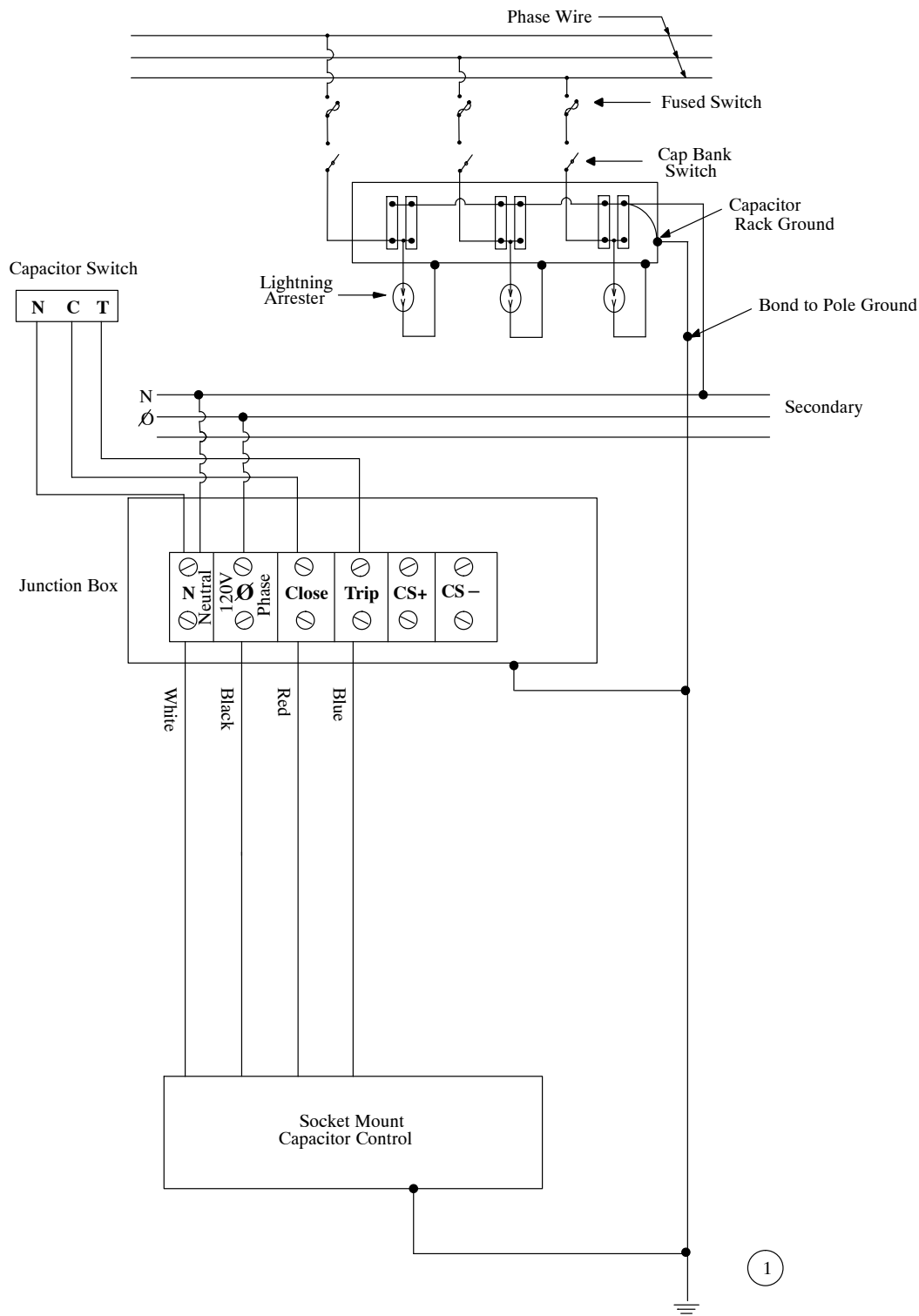
Wye Connected



Delta Connected



Control and Wiring– Non Communicating
Time, Temp and Voltage for 14.4kV Systems and Below



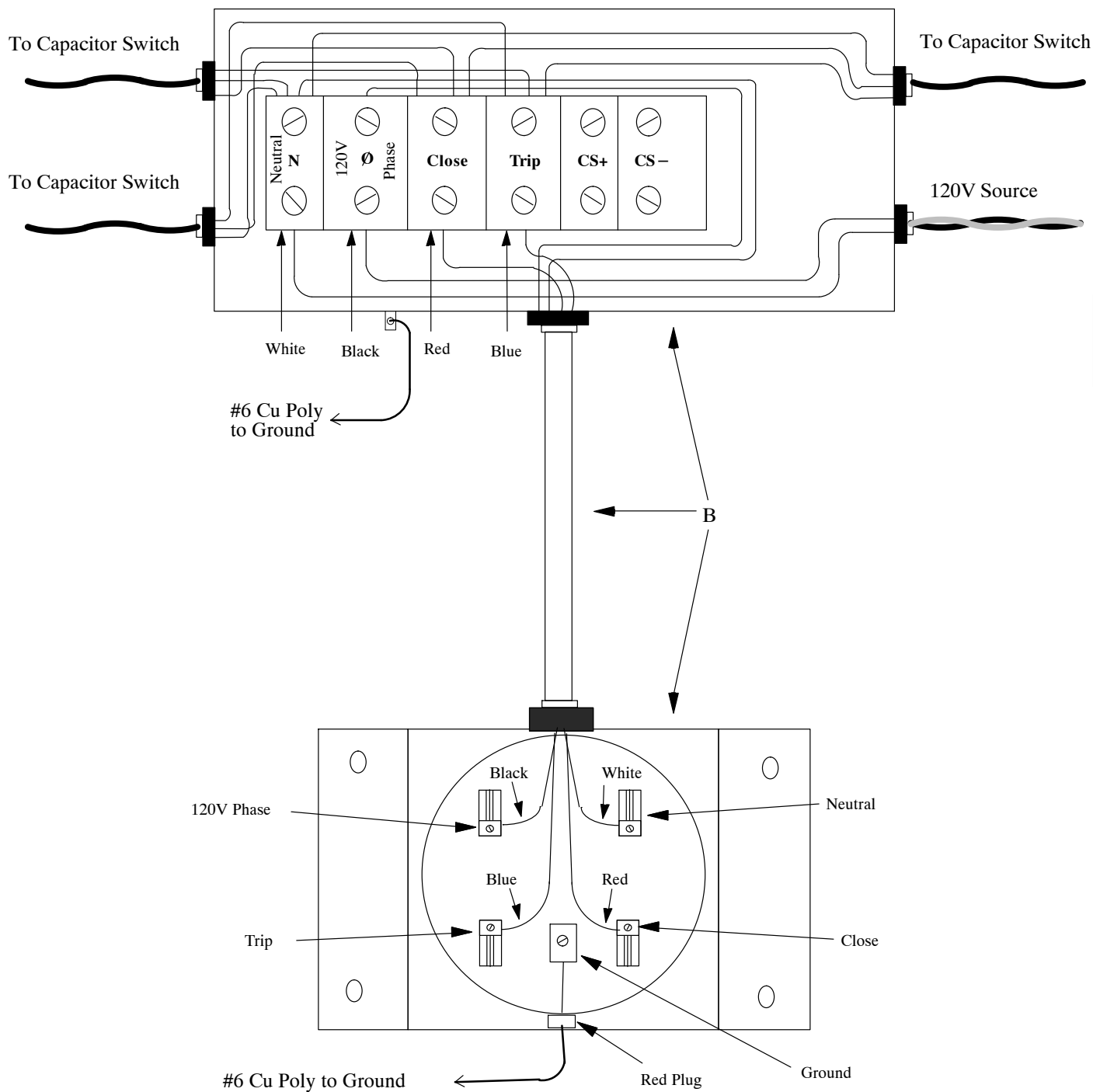
CAPACITORS AND REGULATORS

16 00 18 01

Control and Wiring – Non Communicating

Sheet 2 of 3

Time, Temp and Voltage for 14.4kV Systems and Below



CAPACITORS AND REGULATORS

16 00 18 01

Control and Wiring– Non Communicating

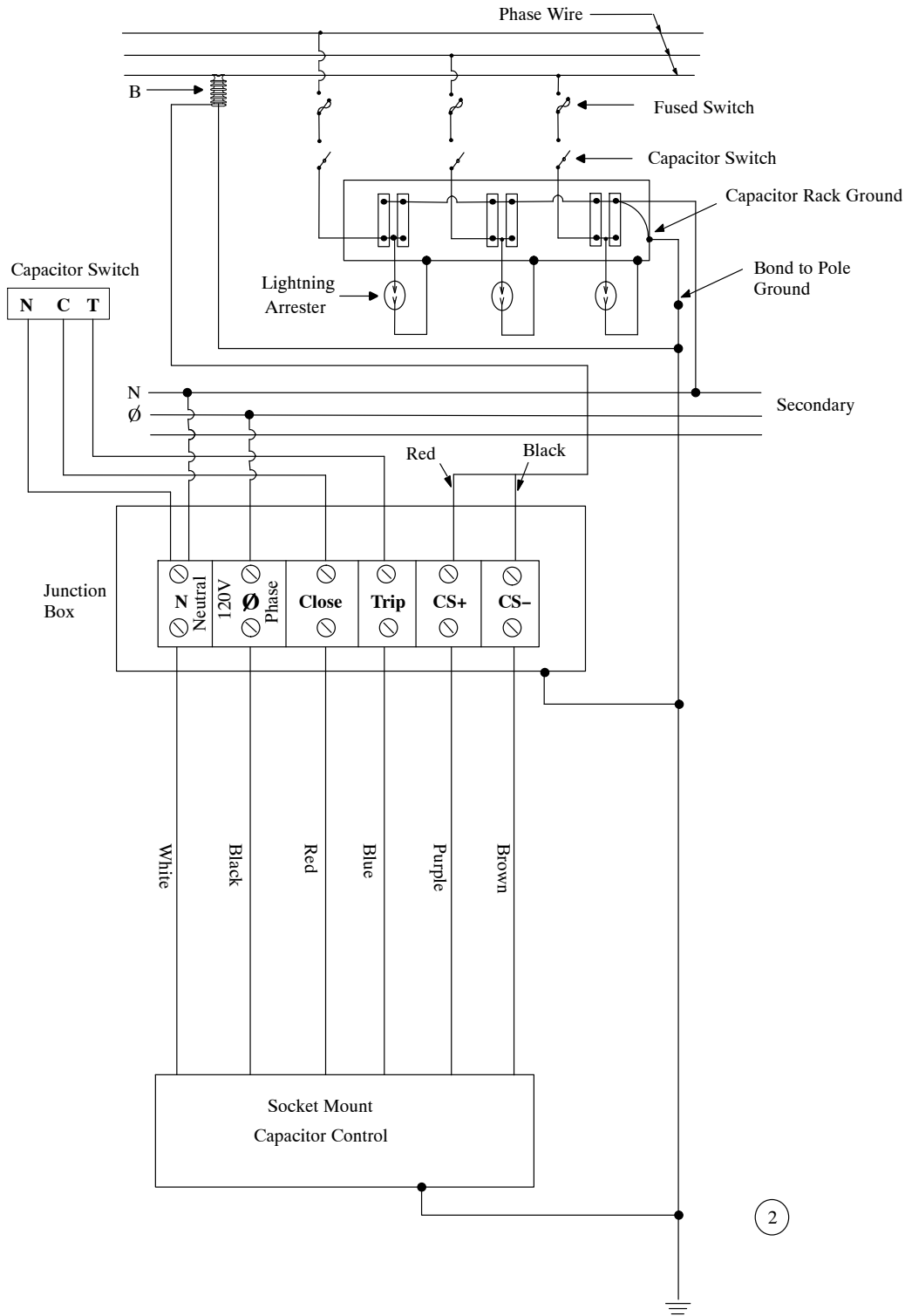
Sheet 3 of 3

Time, Temp and Voltage for 14.4kV Systems and Below

		Stnd. / Stk. No.	Description	16 00 18	01
A	69 11 311	Control, Time, Temp, Volt – S&C Intellicap			1
B	54 17 510	Junction/Socket Meter, 4 Jaw, Pre – wired with 25' Liquidtight Conduit			1
C	17 54 003	Connector, Split Bolt			4

NOTES:

1. The junction box, meter socket, capacitor rack and capacitor control shall be bonded to the pole ground.
2. See DCS 16 15 04 ** for capacitor bank installation.



➔ Control and Wiring – Non Communicating
Time, Temp, Voltage and VAR for 14.4kV and Below Systems

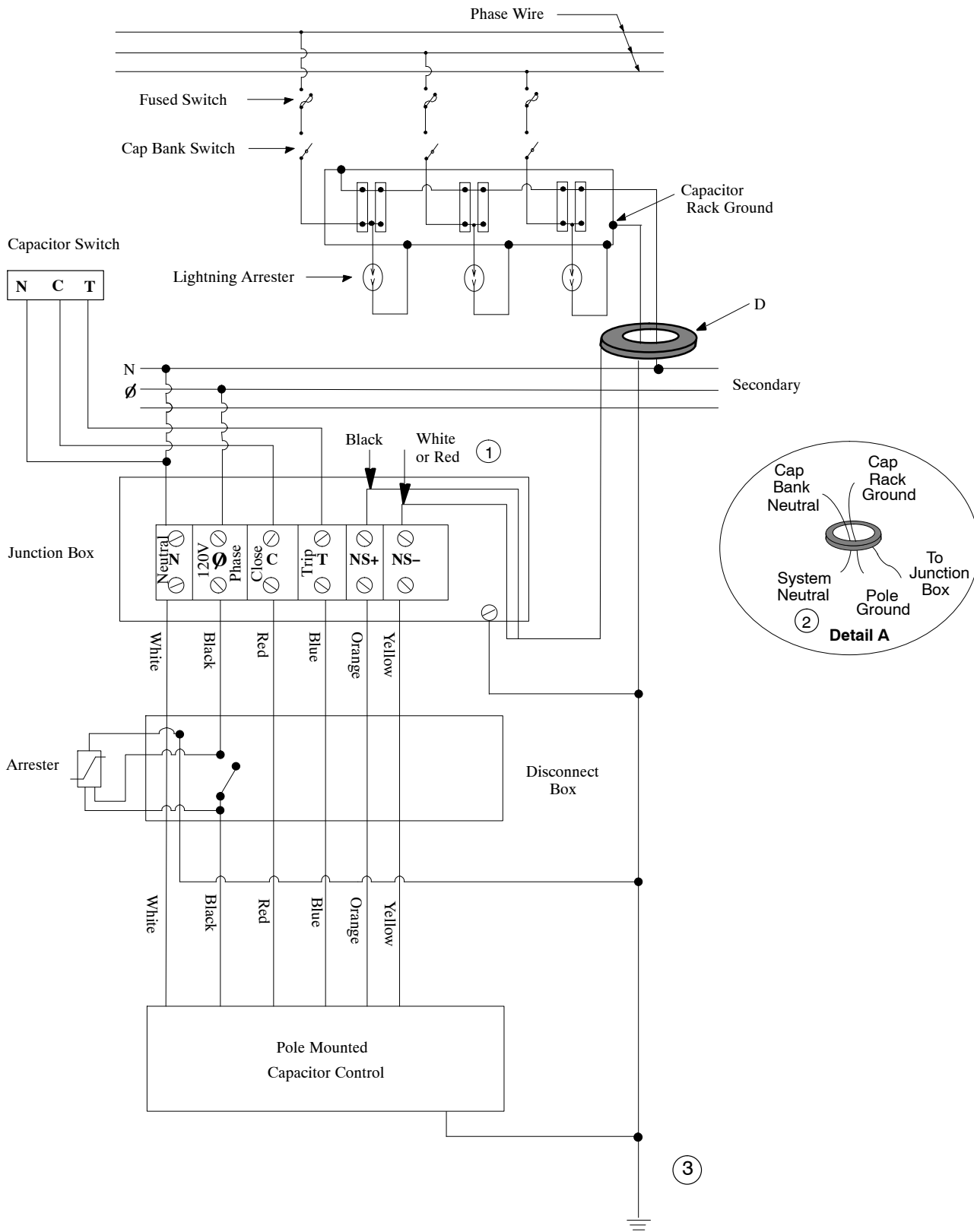
Sheet 2 of 3



		Std. / Stk. No.	Description	16 00 20	01
A	69 11 215	Control, Current or VAR – S&C Intellicap			1
B	69 11 297	Sensor, Current, Line Post Type, 15 kV			1
C	23 64 034	Stud, 5/8" X 7"			1
F	17 54 003	Connector, Split Bolt			5
H	54 17 511	Junction Box/Meter Socket 6-Jaw, Pre-wired with 25' Liquidtight Cable			1

NOTES:

1. Contact Standards Engineer for the replacement line post current sensor cable.
2. The junction box, meter socket, capacitor rack, capacitor control, and current sensor must be bonded to pole ground.
3. See DCS 16 15 04 ** for capacitor bank installation.

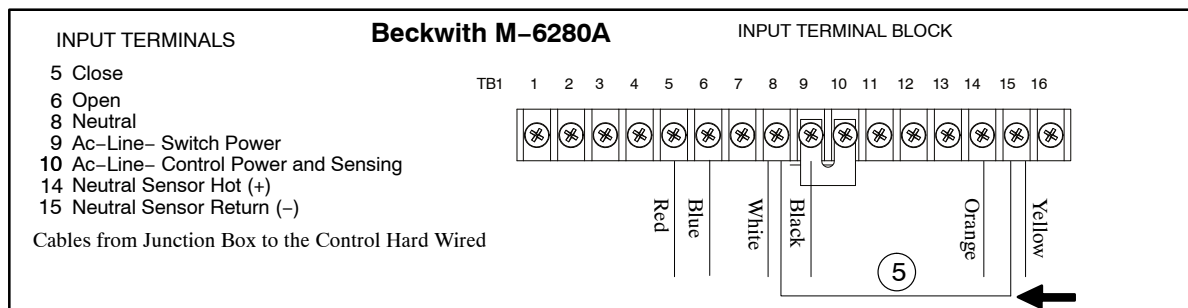
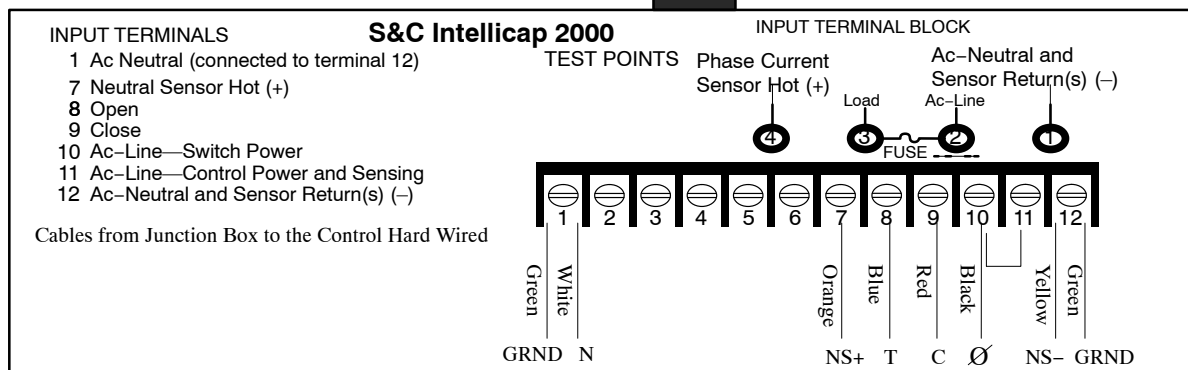
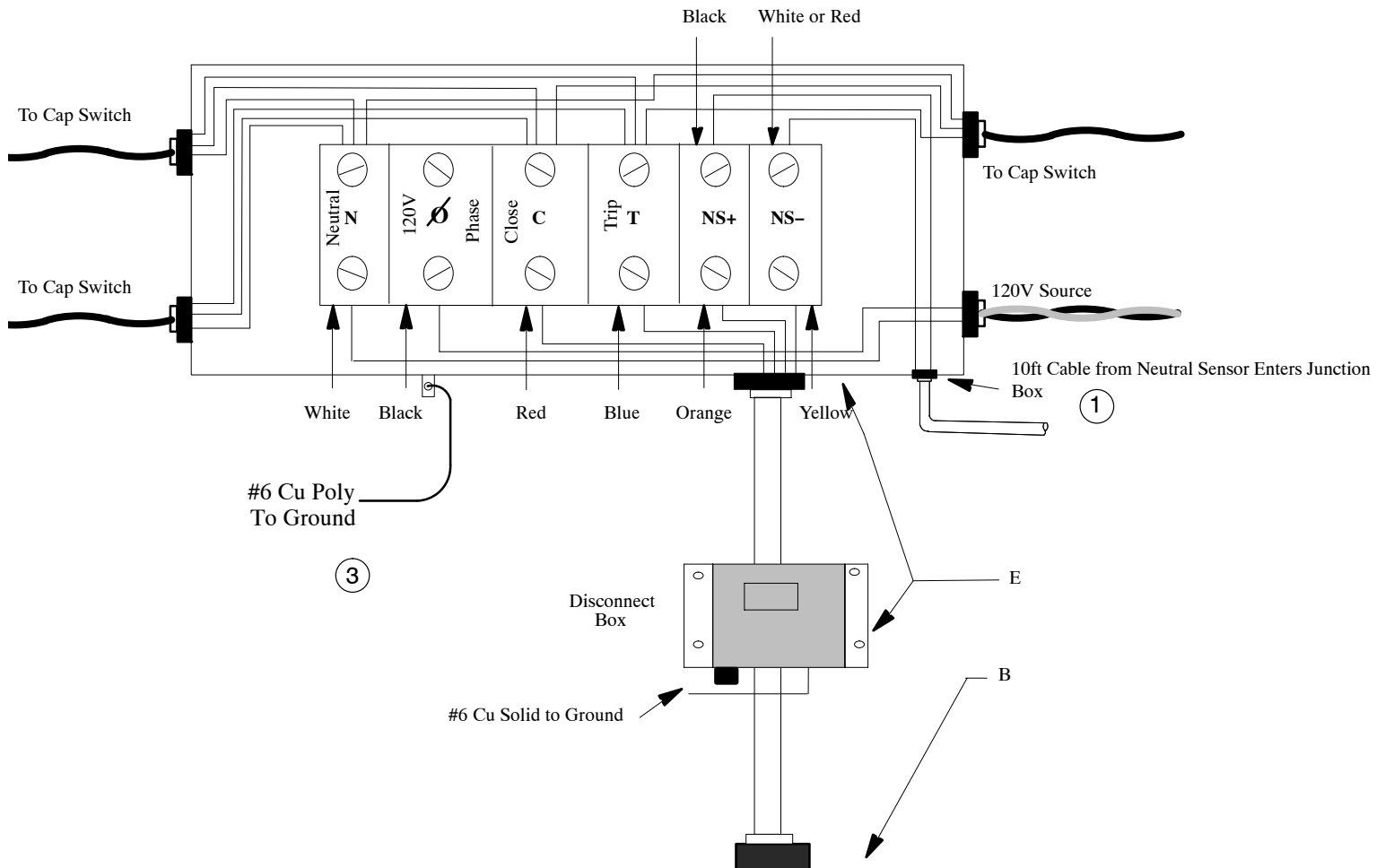


CAPACITORS AND REGULATORS

Control and Wiring – Communicating

Time, Temp and Voltage for 34.5kV Systems and Below

16 00 24 **
Sheet 2 of 3



CAPACITORS AND REGULATORS
Control and Wiring – Communicating
Time, Temp and Voltage for 34.5kV Systems and Below

16 00 24 **
Sheet 3 of 3

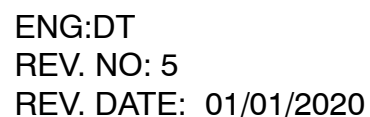
16 00 24 01 Time, Temp, Voltage sensing for 34 kV and below with Beckwith controller
16 00 24 02 Time, Temp, Voltage sensing for 34 kV and below with S&C Intellicap 2000 controller

		Std. / Stk. No.	Description	16 00 24	01	02
@6	B	69 11 306	Control, Communicating, Time, Temp, Volt – S&C Intellicap 2000			1
		69 11 307	Control, Communicating, Time, Temp, Volt – Beckwith	1		
	D	69 11 305	Neutral Current Sensor – S&C Intellicap Plus, with 10' cable W/O Connector			1
		69 11 304	Neutral Current Sensor – Beckwith, with 10' cable W/O Connector	1		
	E	54 17 498	Junction Box (6-terminal)/Disconnect Box, Pre-wired with 35' Liquidtight Cable	1		1
	L	17 54 003	Connector, Split Bolt	4		4
	M	69 59 001	Communications Kit, Coax and Antenna (VO only)	1		1
	N	69 59 003	GE Orbit ECR Cell Modem (VO only)	1		1
		16 08 298	GE Orbit ECR Cell Modem	1		1
	O	16 16 078	Low Profile Omnidirectional Antenna	1		1
@6	P	16 16 181	Coax. Cable, 2 ft jumper with SMA (male) to N (male)	1		1

NOTES:

- Neutral current sensor output can reach 40V if sensor wires are not terminated when current is present on wires routed through sensor.** Terminate the **neutral sensor wires** in the junction box. The **black** neutral sensor wire connects to the **NS+** terminal and the **white or red** neutral sensor wire connects to the **NS-** terminal.
- See Detail A.** The neutral current sensor shall be mounted below the bank. **Only the capacitor rack ground wire and the cap bank neutral wire from the bank should pass through the center of the sensor.** The sensor shall be located on the wires between the capacitor rack and their connections to pole ground and the distribution system neutral (thereby capturing all of the neutral current in the wires from the bank), and secured with a staple above and below to the wires passing through the sensor. If a 1kVA transformer is installed on the cap bank frame, the neutral and ground wires from the transformer must also pass through the neutral current sensor. If transformer is mounted on pole, the transformer neutral and ground wires do not need to be routed through sensor unless it's ground connection is made between sensor and cap bank frame. The sensor cable should be routed to the junction box.
- The junction box, disconnect box, capacitor rack and capacitor control shall be connected to pole ground.
- See DCS 16 15 03 ** for capacitor bank installation.
- Illinois uses 69 59 001 and 69 59 003 for VO only. Missouri and Illinois uses 16 08 298, 16 16 078 and 16 16 181 if SCADA control is needed (not for Illinois VO).
- For VO circuits, 120 V controller supply shall be no more than 1 span away from a lightly loaded transformer.

16 00 26 **
Sheet 1 of 3

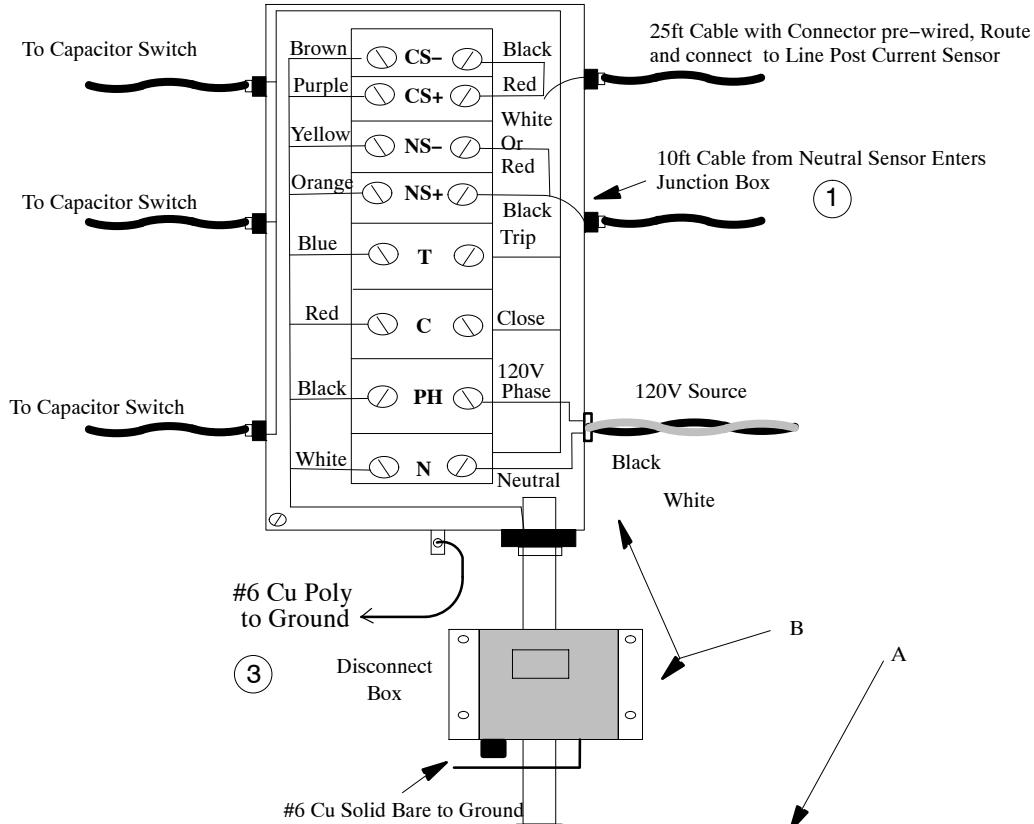


CAPACITORS AND REGULATORS

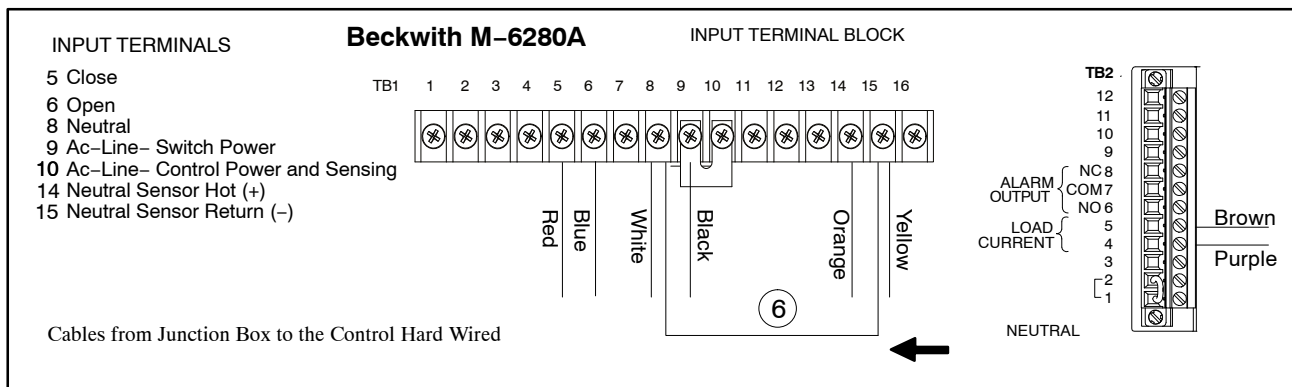
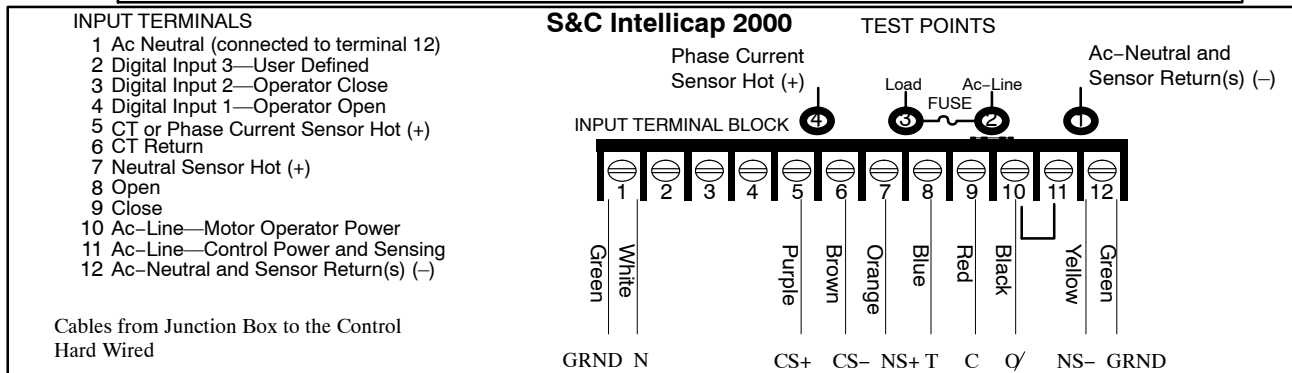
Control and Wiring – Communicating

Time, Temp, Voltage and VAR for 34.5kV Systems and Below

16 00 26 **
Sheet 2 of 3



Terminal Strip Configuration—For Wall or Pole Mounting Bracket



CAPACITORS AND REGULATORS

Control and Wiring – Communicating

Time, Temp, Voltage and VAR for 34.5kV Systems and Below

16 00 26 **
Sheet 3 of 3

16 00 26 01	Current and VAR Sensing for 15kV and below with S&C Intellicap 2000 controller
16 00 26 02	Current and VAR Sensing for 34kV with S&C Intellicap 2000 controller
16 00 26 03	Current and VAR Sensing for 15kV and below with Beckwith controller
16 00 26 04	Current and VAR Sensing for 34kV with Beckwith controller

		Std. / Stk. No.	Description	16 00 26 **	01	02	03	04
@7	A	69 11 201	Control, Time, Temp, Volt, Current or VAR – S&C Intellicap 2000		1	1	0	0
		69 11 316	Control, Time, Temp, Volt, Current or VAR – Beckwith		0	0	1	1
	B	54 17 512	Junction Box (8–terminal) and Disconnect Box, Pre-wired with 35' Liquid-tight Conduit		1	1	1	1
	C	69 11 305	Sensor, Neutral Current with 10' Cable– S&C		1	1	0	0
		69 11 304	Sensor, Neutral Current with 10' Cable– Beckwith		0	0	1	1
	D	69 11 297	Sensor, Current, Line Post Type, 15kV		1	0	1	0
		69 11 202	Sensor, Current, Line Post Type, 35kV		0	1	0	1
	E	23 64 034	Stud, 5/8" x 7"		1	1	1	1
	F	21 75 008	Washer, Flat, 5/8"		2	2	2	2
	N	17 54 003	Connector, Split Bolt		5	5	5	5
	S	18 51 021	Wire, #6 Cu., S.D. Poly Covered		7	7	7	7
	T	69 59 001	Communications Kit, Coax and Antenna (VO only)		1	1	1	1
	U	69 59 003	GE Orbit ECR Cell modem (VO only)		1	1	1	1
		16 08 298	GE Orbit ECR Cell Modem		1	1	1	1
	V	16 16 078	Low Profile Omnidirectional Antenna		1	1	1	1
	W	16 16 181	Coax Cable, 2 ft jumper with SMA (male) to N (male)		1	1	1	1

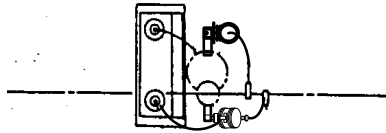
NOTES:

- Neutral current sensor output can reach 40V if sensor wires are not terminated when current is present on wires routed through sensor.** Terminate the **neutral sensor wires** in the junction box. The **black** neutral sensor wire connects to the **NS+** terminal and the **white or red** neutral sensor wire connects to the **NS–** terminal.
- See Detail A.** The neutral current sensor shall be mounted below the bank. Only the capacitor rack ground wire and the cap bank neutral wire from the bank should pass through the center of the sensor. The sensor shall be located on the wires between the capacitor rack and their connections to pole ground and the distribution system neutral (thereby capturing all of the neutral current in the wires from the bank), and secured with a staple above and below to the wires passing through the sensor. If a 1kVA transformer is installed on the cap bank frame, the neutral and ground wires from the transformer must also pass through the neutral current sensor. If transformer is mounted on pole, the transformer neutral and ground wires do not need to be routed through sensor unless it's ground connection is made between sensor and cap bank frame. The sensor cable should be routed to the junction box.
- The junction box, disconnect box, capacitor rack, capacitor control, and current sensor must be bonded to pole ground.
- Contact Standards Engineer for the replacement line post current sensor cable.
- See DCS 16 15 03 ** for capacitor bank installation.
- For Beckwith controllers, connect jumper wire from TB1–8 to TB1–15 when neutral sensor is used. When neutral current sensor is not used, connect jumper wire from TB2–4 to the ground stud to the right of TB–1.
- Illinois uses 69 59 001 and 69 59 003 for VO only. Missouri and Illinois uses 16 08 298, 16 16 078 and 16 16 181 if SCADA control is needed (not for Illinois VO).
- For VO circuits, 120 V controller supply shall be no more than 1 span away from a lightly loaded transformer.

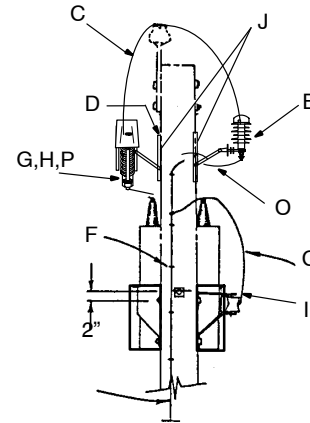
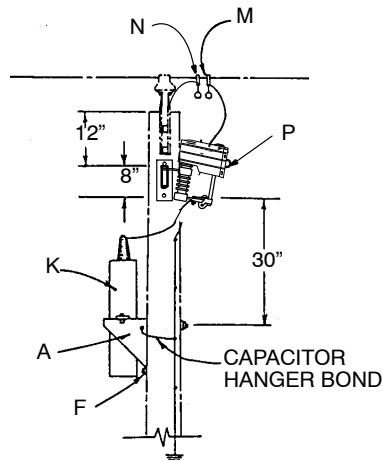
**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:DT
REV. NO: 5
REV. DATE: 01/01/2020



	<u>2.4kV</u>	<u>7.2kV</u>	<u>7.96kV</u>
50KVAR	01	03	
100KVAR	02	04	05



NOTES:

- Minimum clearance from the ground to the **bottom of the capacitor rack** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
- Connect wires to terminal strips in the junction box and capacitor control according to the color code chart in the schematic. Wiring colors may vary, and connect in junction box by its function (trip, close, 120V, neutral)
- Capacitor bank locations should be bucket truck accessible. If an exception is made and they are not, the control cable may be placed in conduit on standoff brackets if necessary. See DCS 14 02 02 ** for material.

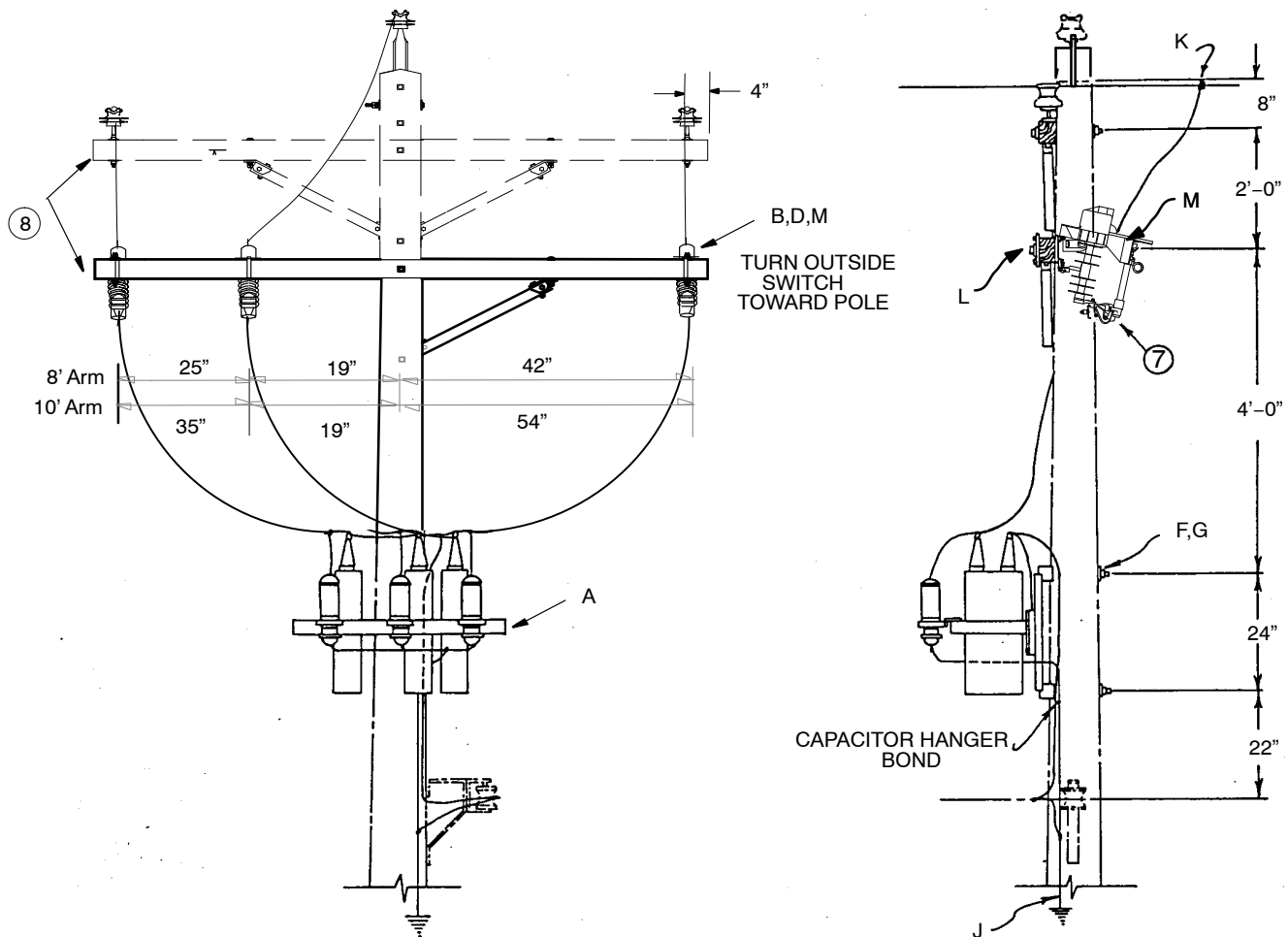
CAPACITORS AND REGULATORS

Fixed Capacitor Installation
One Phase 2.4, 7.2, & 7.96 kV

16 15 01 **

Sheet 2 of 2

		Std. / Stk. No.	Description	16 15 01 **	01	02	03	04	05
7@ @ @	A	69 11 002	Capacitor, Hanger		1	1	1	1	1
	B	10 01 133	Arrester, Lightning, 3kV		1	1			
		10 01 144	Arrester, Lightning, 10kV				1	1	1
	C	18 51 025	#4 Wire, Riser, Poly Covered		10	10	10	10	10
	D	23 52 065	5/8" x 12" Machine Bolt		3	3	3	3	3
	E	23 66 027	Washer, Galv, 11/16" Square		3	3	3	3	3
	F	23 60 011	5/8" x 5" Lag Screw		1	1	1	1	1
	G	54 07 208	Switch, Fuse 100A, 15kV		1	1	1	1	1
	H	20 53 089	Link, Fuse 25T		1				
		20 53 097	Link, Fuse 50K			1			
		20 53 084	Link, Fuse 12T				1		
		20 53 085	Link, Fuse 15T					1	1
	I	06 01 01 03	Clevis Extension Bracket		1	1	1	1	1
	J	23 06 127	Bracket, Switch, Fiberglass		2	2	2	2	2
	K	69 11 030	Cap, 2.4kV, 50 KVAR		1				
		69 11 044	Cap. 2.4kV, 100KVAR			1			
		69 11 029	Cap. 7.2 kV, 50 KVAR				1		
		69 11 043	Cap. 7.2kV, 100 KVAR					1	
		69 11 069	Cap. 7.96 kV, 100 KVAR						1
	L	12 00 10 02	Grounding Unit – Ground Rod		1	1	1	1	1
		12 00 10 01	Grounding Unit – Ground Coil		1	1	1	1	1
	M	HLC*W	Clamp, Hot Line		1	1	1	1	1
	N	PG*	Clamp, Parallel Groove See Std. 07 00 25 00		1	1	1	1	1
		HLC*W	Clamp, Hot Line		1	1	1	1	1
	O	18 51 021	Wire, Cu, #6 SD., Poly Covered		2	2	2	2	2
	P	05 15 10 01	Cover – Cutout		1	1	1	1	1



CAPACITORS AND REGULATORS

Fixed Capacitor Installation

2.4 – 14.4kV Three Phase

16 15 02 **

Sheet 2 of 2

	Std. / Stk. No.	Description	16 15 02 **	4kV		12kV		13.8kV		14.4kV	
				01	02	03	04	05	06	07	08
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		
	69 11 085	Cap Fix 300 kVAR 14.4kV								1	
	69 11 083	Cap Fix 600 kVAR 14.4kV									1
B	54 07 208	Switch, Fuse 100A, 15kV		3	3	3	3	3	3	3	3
C	18 51 025	Wire, #4 Riser		24	24	24	24	24	24	24	24
D	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 53 089	Link, Fuse 25T							3		3
	20 53 084	Link, Fuse 12T						3		3	
E	23 60 007	Screw, Lag 1/2" x 4"		2	2	2	2	2	2	2	2
F	23 52 095	Bolt, Mach. 3/4" x 10"		2	2	2	2	2	2	2	2
G	23 66 031	Washer, Curved 3/4"		2	2	2	2	2	2	2	2
H	04 00 20 02	Crossarm w/Brace, 8'		1	1	1	1	1	1	1	1
	04 00 20 03	Crossarm w/Brace, 10'		1	1	1	1	1	1	1	1
J	12 00 10 02	Grounding Unit – Ground Rod		1	1	1	1	1	1	1	1
	12 00 10 01	Grounding Unit – Ground Coil		1	1	1	1	1	1	1	1
K	PG*	Clamp, Parallel Groove – See 07 00 25 00		3	3	3	3	3	3	3	3
	HLC*W	Clamp, Hot Line		3	3	3	3	3	3	3	3
L	17 58 054	Bracket, Switch, Arrester		3	3	3	3	3	3	3	3

NOTES:

- Minimum clearance from the ground to the **bottom of the capacitor rack** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
- Connect wires to terminal strips in the junction box and capacitor control according to the color code chart in the schematic. Wiring colors may vary, Connect in junction box by its function (trip, close, 120V, neutral)
- Capacitor bank locations should be bucket truck accessible. If an exception is made and they are not, the control cable may be placed in conduit on standoff brackets if necessary. See DCS 14 02 02 ** for material.
- Loadbreak tool, Stock No. 87 38 045, must be used to operate switches.
- Ameren IL must use 2 – 10" crossarms.

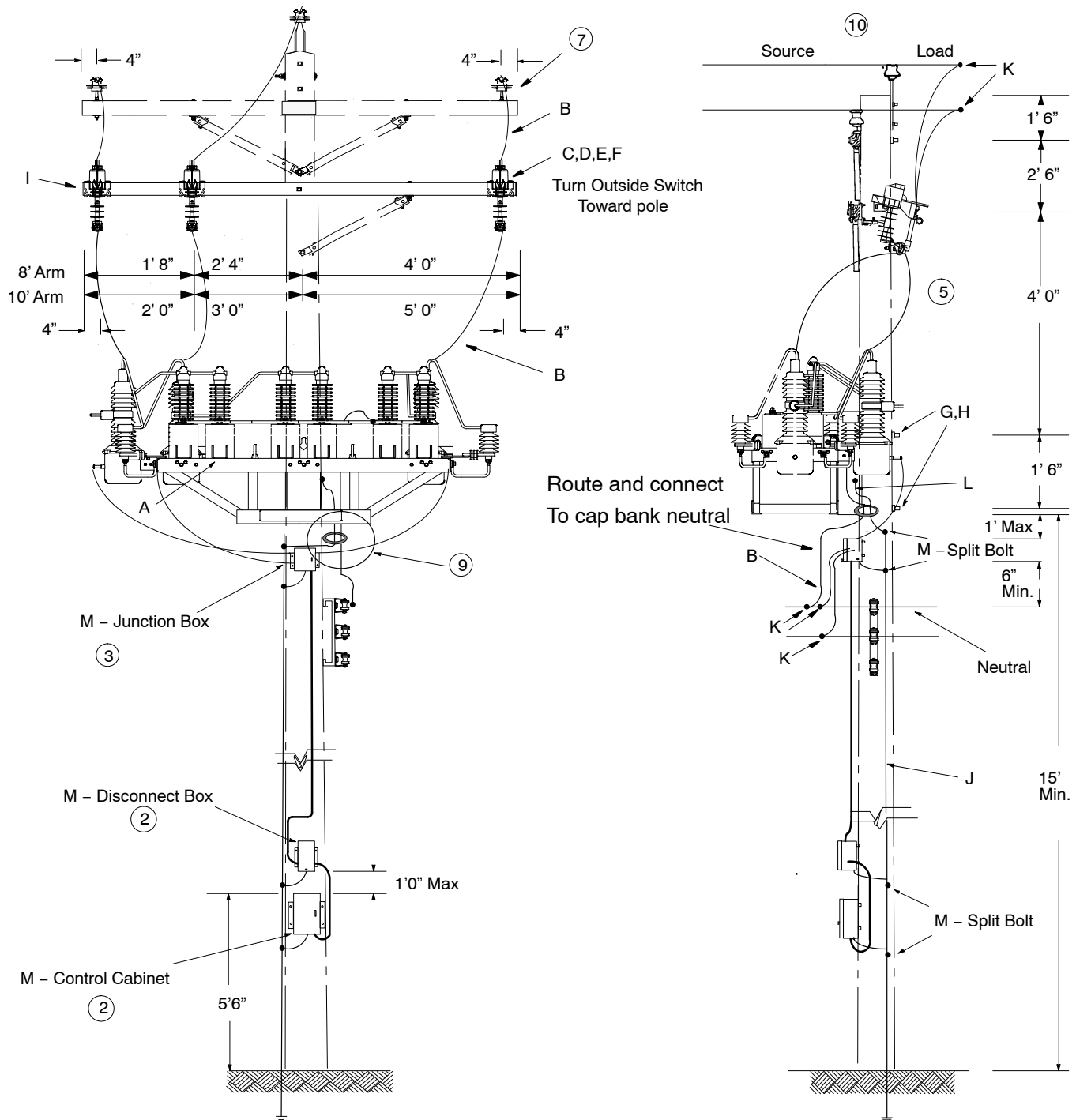
CAPACITORS AND REGULATORS

Switched Capacitor Installation – Communicating

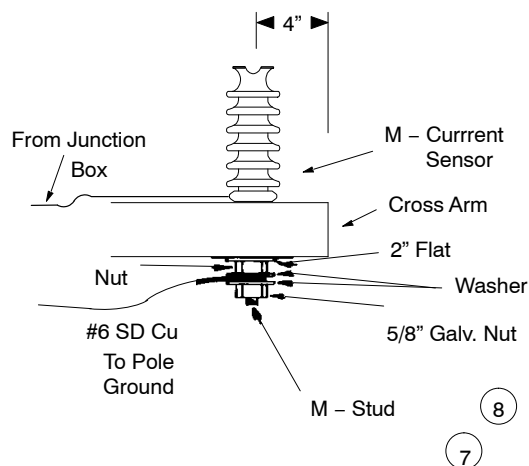
For 14.4 kV Systems and Below

16 15 03 **

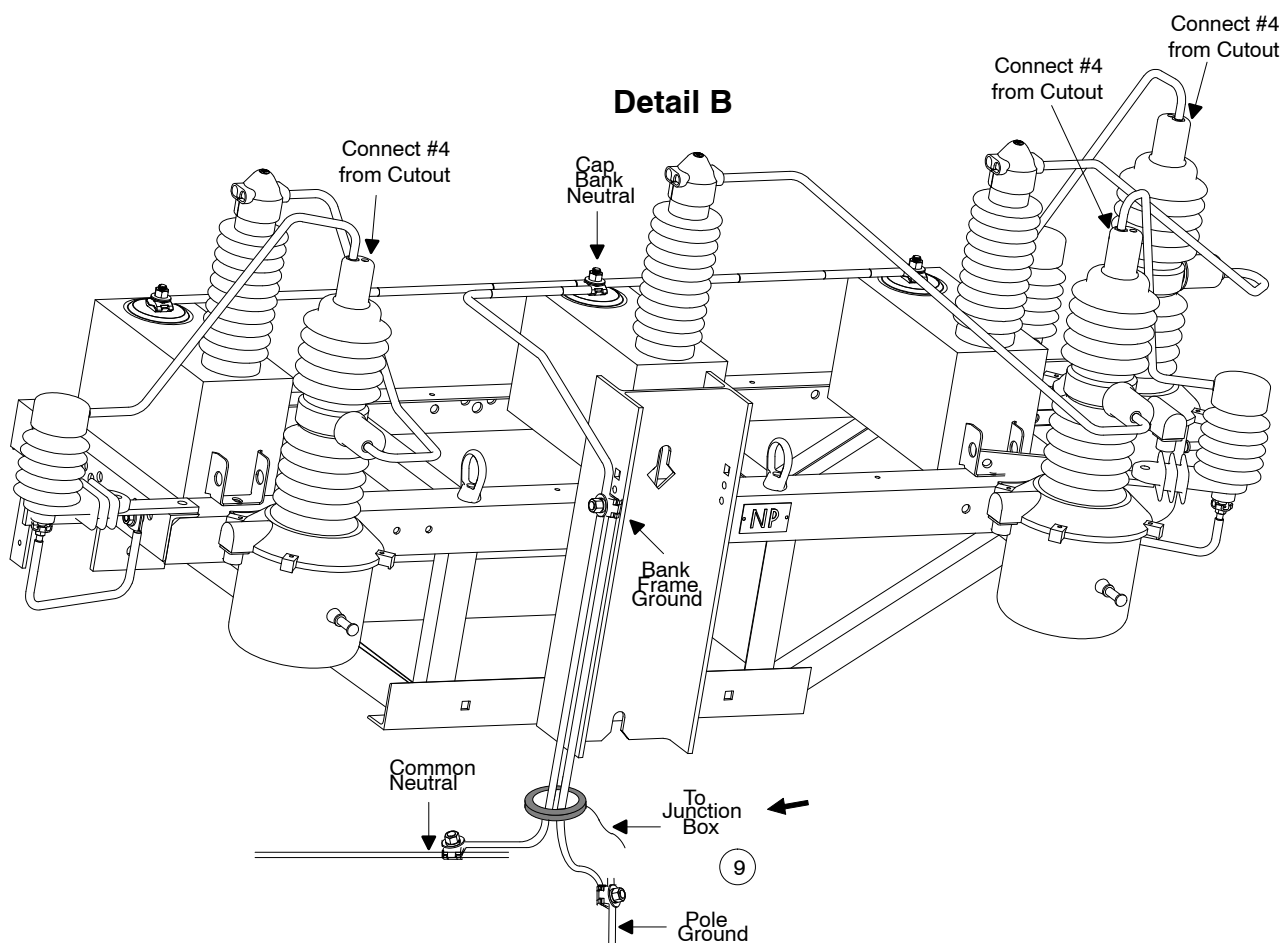
Sheet 1 of 4



Detail A



Detail B



CAPACITORS AND REGULATORS
Switched Capacitor Installation – Communicating
For 14.4 kV Systems and Below

16 15 03 **

Sheet 3 of 4

	Std. / Stk. No.	Description	16 15 03 **	4kV		12kV			13.8kV			13.2kV		14.4kV	
				01	02	03	04	05	06	07	08	11	12	09	10
A	69 11 031	Cap. Sw. 300 kVAR 4kV		1											
	69 11 036	Cap. Sw. 600 kVAR 4kV			1										
	69 11 019	Cap. Sw. 300 kVAR 12kV				1									
	69 11 032	Cap. Sw. 600 kVAR 12kV					1								
	69 11 058	Cap. Sw. 1200 kVAR 12kV						1							
	69 11 086	Cap. Sw. 300 kVAR 13.8kV							1						
	69 11 071	Cap. Sw. 600kVAR 13.8kV								1					
	69 11 074	Cap. Sw. 1200kVAR 13.8kV									1				
	69 11 084	Cap. Sw. 300 kVAR 14.4kV												1	
	69 11 077	Cap. Sw. 600kVAR 14.4kV													1
	69 11 226	Cap. Sw. 600 kVAR 13.2kV										1			
	69 11 225	Cap. Sw. 1200 kVAR 13.2kV											1		
B	18 51 025	Wire, #4 Cu Poly,Riser		24	24	24	24	24	24	24	24	24	24	24	24
C	54 07 208	Switch, Fuse, 100A, 15kV		3	3	3	3	3	3	3	3	3	3	3	3
D	17 58 054	Bracket, Switch, Arrester		3	3	3	3	3	3	3	3	3	3	3	3
E	05 15 10 01	Cover – Cutout		3	3	3	3	3	3	3	3	3	3	3	3
F	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					3			
	20 53 090	Link, Fuse 65T						3					3		
	20 53 084	Link, Fuse 12T							3					3	
	20 53 089	Link, Fuse 25T								3					3
G	23 52 095	Bolt, Mach. 3/4" x 10"		2	2	2	2	2	2	2	2	2	2	2	2
H	23 66 031	Washer, Curved 3/4"		2	2	2	2	2	2	2	2	2	2	2	2
@	I 04 00 20 02	Crossarm, w/ Brace 8'		1	1	1	1	1	1	1	1	1	1	1	1
	04 00 20 03	Crossarm, w/ Brace 10'		1	1	1	1	1	1	1	1	1	1	1	1
@6	J 12 00 10 01	Grounding Unit – Ground Coil		1	1	1	1	1	1	1	1	1	1	1	1
	12 00 10 02	Grounding Unit – Ground Rod		1	1	1	1	1	1	1	1	1	1	1	1
@	K PG*	Clamp, Parallel Groove See 07 00 25 00		6	6	6	6	6	6	6	6	6	6	6	6
	HLC*W	Clamp, Hot Line		3	3	3	3	3	3	3	3	3	3	3	3
L	18 51 021	Wire, Cu, #6 S.D., Poly Covered		10	10	10	10	10	10	10	10	10	10	10	10
@	M 16 00 24 **	Control, Capacitor, Time, Temp Volt-age		1	1	1	1	1	1	1	1	1	1	1	1
	16 00 26 **	Control, Capacitor, Current or VAR		1	1	1	1	1	1	1	1	1	1	1	1

NOTES:

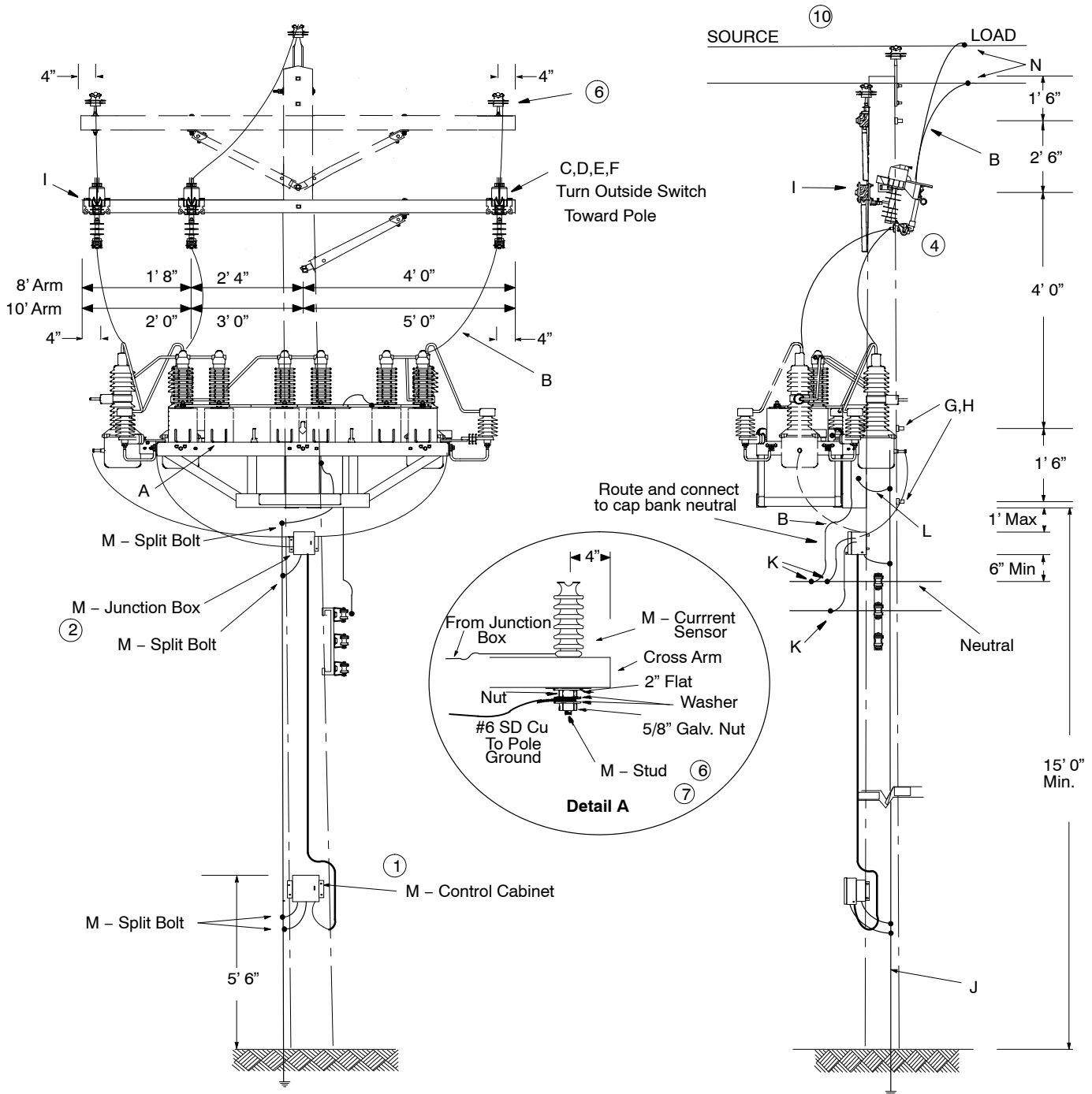
- 1..Minimum clearance from the ground to the **bottom of the capacitor rack** shall be 15 feet.
- 2..Clearance from the ground to the **top of the control cabinet** should be 5' 6" from the ground. The bottom of disconnect box shall be installed 1' max above the top of control cabinet. The next hand or foot hold shall be 8' or greater above the top of the disconnect box.
- 3..The top of the junction box shall be mounted a maximum of 1' below the capacitor bank frame. Leads to the capacitor switches shall be secured to the frame of the bank with wire ties. The junction box/meter socket kit includes 35' of pre-wired liquid-tight conduit. The liquid-tight must be stapled every 2'. Excess liquid-tight shall be coiled and secured to the pole between the junction box and the disconnect box.
- 4..For capacitor bank wiring diagram, refer to DCS 16 00 05 00. For capacitor control wiring diagram with current sensor, refer to DCS 16 00 26 **. For capacitor control wiring diagram without current sensor, refer to DCS 16 00 24 **.
- 5..Loadbreak tool, Stock No. 83 38 028, must be used to open cutout switches. Capacitor bank oil/vacuum switches should be primary method used to operate bank.
- 6..With new pole installation, refer to DCS 12 00 10 01 with ground coil.
- 7..For installations with a current sensor, the current sensor will be installed in place of an insulator, the current sensor stud shall be bonded to pole ground and the sensor cable shall be secured with a staple, refer to **detail A**.
- 8..Low voltage wires from line post current 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).
- 9..**Neutral current sensor output can reach 40V if sensor wires are not terminated when current is present on wires routed through sensor.** Neutral current sensors are not required on all cap banks. (ie. delta wired banks) For material and connection in the junction box; for installations without current sensor refer to DCS 16 00 24 **, with current sensor refer to DCS 16 00 26 **. The neutral current sensor, if equipped, shall be mounted between the bank and the connections between system neutral and pole ground and secured with a staple above and below to the ground wires passing through the sensor. The wire between the capacitor bank neutral and system neutral and the capacitor bank frame ground wire must pass through the center of the sensor (thereby capturing all of the ground current in the wires from the bank). If a 1kVA transformer is installed on the cap bank frame, the ground and neutral wires from the transformer must also pass through the neutral current sensor. If transformer is mounted on pole, the transformer neutral and ground wires do not need to be routed through sensor unless it's ground connection is made between sensor and cap bank frame. Run sensor cable and terminate to the junction box. **See Detail B.**
- 10..Capacitor control settings or SCADA may require source and load to be reversed from configuration shown for current or VAR controlled schemes.
- 11..The junction box, disconnect box, capacitor rack, capacitor control, and current sensor, if equipped, must be connected to pole ground.
- 12..If a 120V voltage source for the controller is not available from the circuit the capacitor bank is being installed on, refer to DCS 16 15 05 01 for 1 kVA transformer installation.

CAPACITORS AND REGULATORS

Switched Capacitor Installation– Non Communicating

14.4 kV Systems and Below

16 15 04 **
Sheet 1 of 3



CAPACITORS AND REGULATORS
Switched Capacitor Installation– Non Communicating
14.4 kV Systems and Below

16 15 04 **
Sheet 2 of 3

	Std. / Stk. No.	Description	16 15 04 **	4kV		12kV			13.2kV		13.8kV			14.4kV	
				01	02	03	04	05	11	12	06	07	08	09	10
A	69 11 031	Cap. Sw. 300 kVAR 4kV		1											
	69 11 036	Cap. Sw. 600 kVAR 4kV			1										
	69 11 019	Cap. Sw. 300 kVAR 12kV				1									
	69 11 032	Cap. Sw. 600 kVAR 12kV					1								
	69 11 058	Cap. Sw.1200 kVAR 12kV						1							
	69 11 086	Cap. Sw. 300 kVAR 13.8kV									1				
	69 11 071	Cap. Sw. 600 kVAR 13.8kV										1			
	69 11 074	Cap. Sw.1200 kVAR 13.8kV											1		
	69 11 084	Cap. Sw. 300 kVAR 14.4kV												1	
	69 11 077	Cap. Sw. 600 kVAR 14.4kV													1
	69 11 226	Cap. Sw. 600 kVAR 13.2kV							1						
	69 11 225	CAP. Sw.1200 kVAR 13.2kV								1					
B	18 51 025	Wire, #4 Riser, Poly Covered		24	24	24	24	24	24	24	24	24	24	24	24
C	54 07 208	Switch, Fuse 100A, 15kV		3	3	3	3	3	3	3	3	3	3	3	3
D	17 58 054	Bracket, Switch		3	3	3	3	3	3	3	3	3	3	3	3
E	05 15 10 01	Cover, Cutout		3	3	3	3	3	3	3	3	3	3	3	3
F	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		3						
	20 53 090	Link, Fuse 65T						3		3					
	20 53 084	Link, Fuse 12T									3			3	
	20 53 089	Link, Fuse 25T										3			3
G	23 52 095	Bolt, Mach., 3/4" x 10"		2	2	2	2	2	2	2	2	2	2	2	2
H	23 66 031	Washer, Curved 3/4"		2	2	2	2	2	2	2	2	2	2	2	2
I	04 00 20 02	Crossarm, w / Brace 8'		1	1	1	1	1	1	1	1	1	1	1	1
	04 00 20 03	Crossarm, w / Brace 10'		1	1	1	1	1	1	1	1	1	1	1	1
J	12 00 10 02	Grounding Unit – Ground Rod		1	1	1	1	1	1	1	1	1	1	1	1
	12 00 10 01	Grounding Unit – Ground Coil		1	1	1	1	1	1	1	1	1	1	1	1
K	PG*	Clamp, Parallel Groove (See 07 00 25 00)		3	3	3	3	3	3	3	3	3	3	3	3
L	18 51 021	Wire, Cu., #6 S.D., Ploy Covered		25	25	25	25	25	25	25	25	25	25	25	25
M	16 00 20 01	Control, Capacitor, Current or Var for Non –Comm		1	1	1	1	1	1	1	1	1	1	1	1
	16 00 18 01	Control, Capacitor, Time, Temp or Voltage for Non– Comm		1	1	1	1	1	1	1	1	1	1	1	1
N	PG*	Clamp, Parallel Groove (See 07 00 25 00)		3	3	3	3	3	3	3	3	3	3	3	3
	HLC*W	Clamp, Hot Line – DCS 07 00 21 00		3	3	3	3	3	3	3	3	3	3	3	3

NOTES:

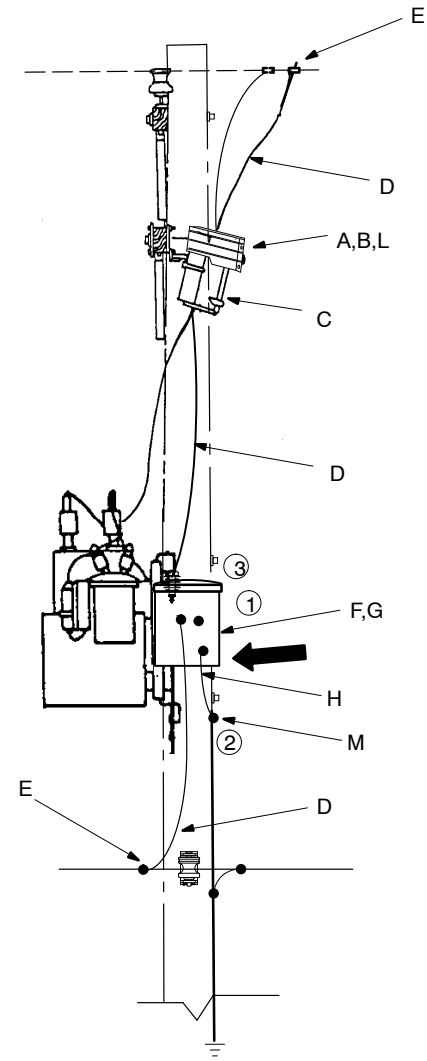
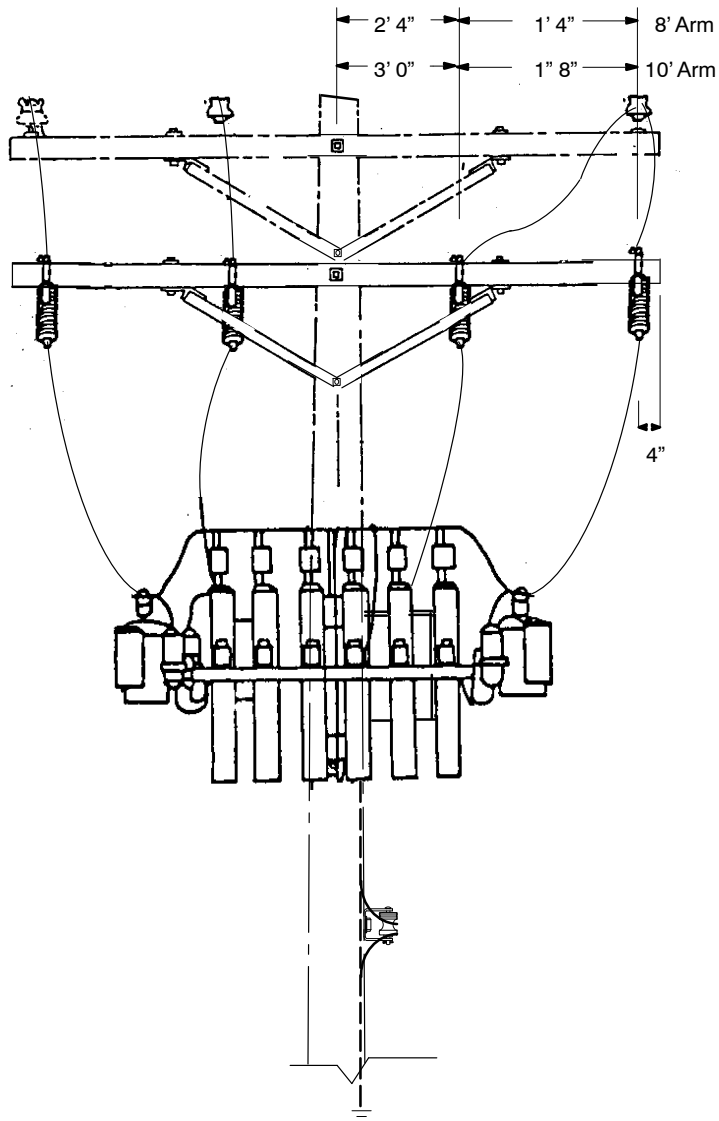
1. Clearance from ground to the **top of the control cabinet** shall be 5' 6" from the ground. The next hand or foot hold shall be 8' or greater above the control cabinet.
2. The top of the junction box shall be mounted a maximum 1' below the capacitor bank frame. Leads to the capacitor switches shall be secured to the frame of the bank with wire ties. The junction box/meter socket kit includes 25' of pre-wired liquid-tight conduit. The liquid-tight must be stapled every 2'. Excess liquid-tight shall be coiled and secured to the pole between the junction box and the control cabinet.
3. For capacitor bank wiring diagram, refer to DCS 16 00 05 00. For capacitor control wiring diagram with current sensor, refer to DCS 16 00 20 01. For capacitor control wiring diagram without current sensor, refer to DCS 16 00 18 01.
4. Loadbreak tool, Stock No. 83 38 028, must be used to operate switches. Capacitor bank oil/vacuum switches should be primary method used to operate bank.
5. With new pole installation, refer to DCS 12 00 10 01 with ground coil.
6. For installations with current sensors, the current sensor will be installed in place of an insulator, the current sensor stud shall be bonded to pole ground and the sensor cable shall be secured with a staple, refer to **detail A**.
7. 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).
8. The capacitor control, meter socket, junction box, capacitor rack and current sensor, if equipped, shall be bonded to pole ground.
9. If a 120V voltage source for the controller is not available from the circuit the capacitor bank is being installed on, refer to DCS 16 15 05 01 for 1 kVA transformer installation.
10. When equipped with a line post current sensor, settings may require the source and load to be reverse from what is shown. VAR controlled schemes normally require the current sensor to be on the source side of the bank (as shown) while current controlled schemes normally require the current sensor to be on the load side of the bank.

CAPACITORS AND REGULATORS

Installation of 1kVA Transformer On Capacitor Bank

16 15 05 01

Sheet 1 of 2



CAPACITORS AND REGULATORS
Installation of 1kVA Transformer
On Capacitor Bank

16 15 05 01

Sheet 2 of 2

		Std. / Stk. No.	Description	16 15 05	01
@ @	A	54 07 208	Switch, Fuse, 100A, 15kV		1
	B	17 58 054	Bracket, Switch, Arrester		1
	C	20 53 197	Link, Fuse, ¾ Amp type X		1
	D	18 51 025	Wire, #4 Riser (ft)		16
	E	PG*	Clamp, Parallel Groove see 07 00 25 00		2
	F	MK0001F	Transformer, 7200V, 1kVA		1
		SK0001F	Transformer, 7620V, 1kVA		1
	G	23 52 049	Bolt, Mach., 5/8"x2"		2
	H	18 52 019	Wire, #6 CU., Bare, SD, (ft)		6
	K	40 59 156	Tie, Nylon, Black		3
	L	05 15 10 01	Cover, Cutout		1
	M	17 54 003	Connector, Split Bolt		1

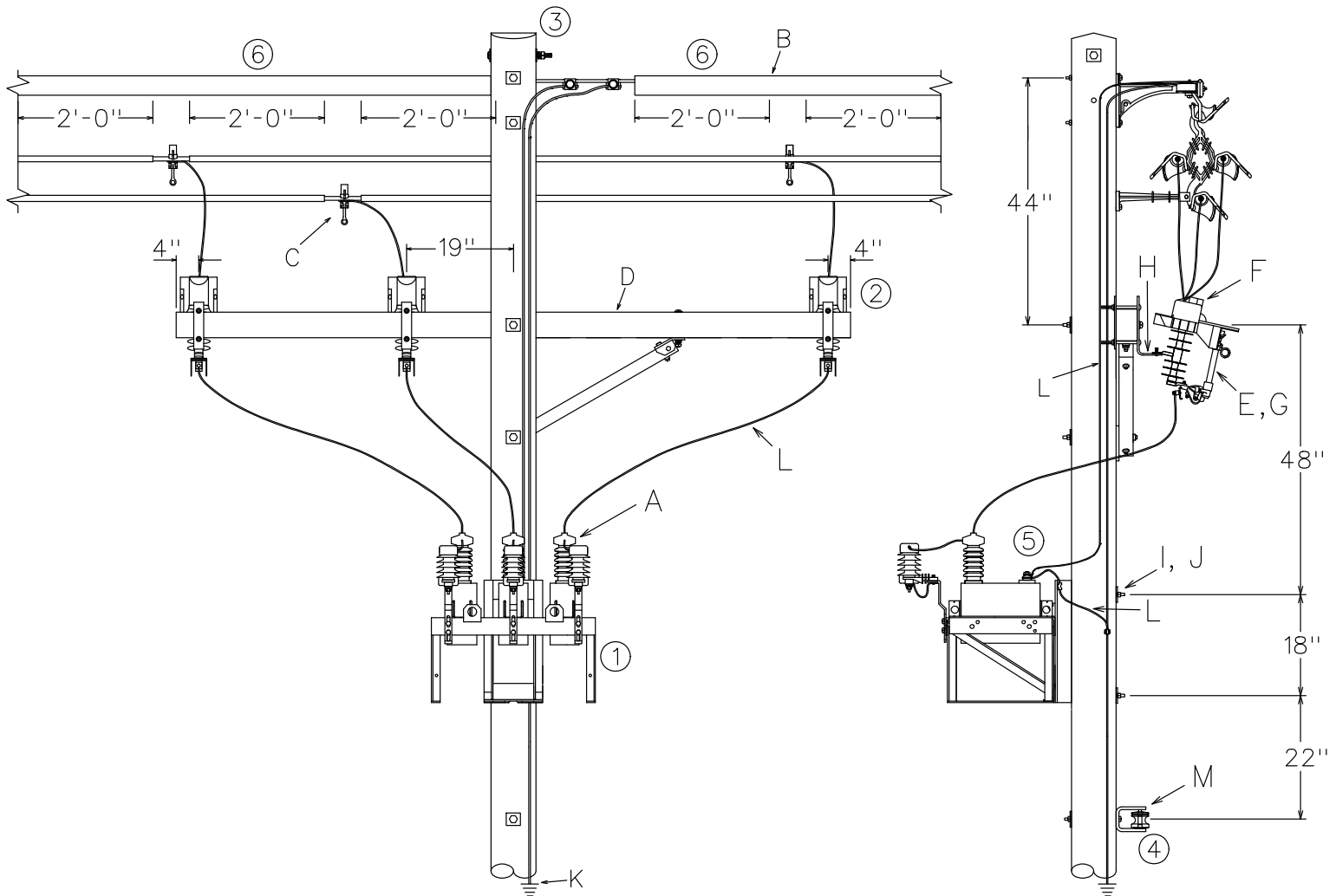
NOTES:

1. Typical mounting location is shown. Transformer may be mounted in other positions where mounting holes are provided..
2. The transformer shall have two ground connections; one ground connection should be between the transformer ground and pole ground and one should be between X2 and the system neutral. The transformer shall have a ground strap between X2 and transformer ground. The capacitor bank shall have a ground between the capacitor rack and pole ground, the capacitor bank neutral should connect to the system neutral.
3. 120V wiring goes from transformer to junction box mounted on pole below bank. Connect to transformer secondary bushing with minimum conductor size of #6 copper. Secure wire to frame of capacitor bank.

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 anywhere 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

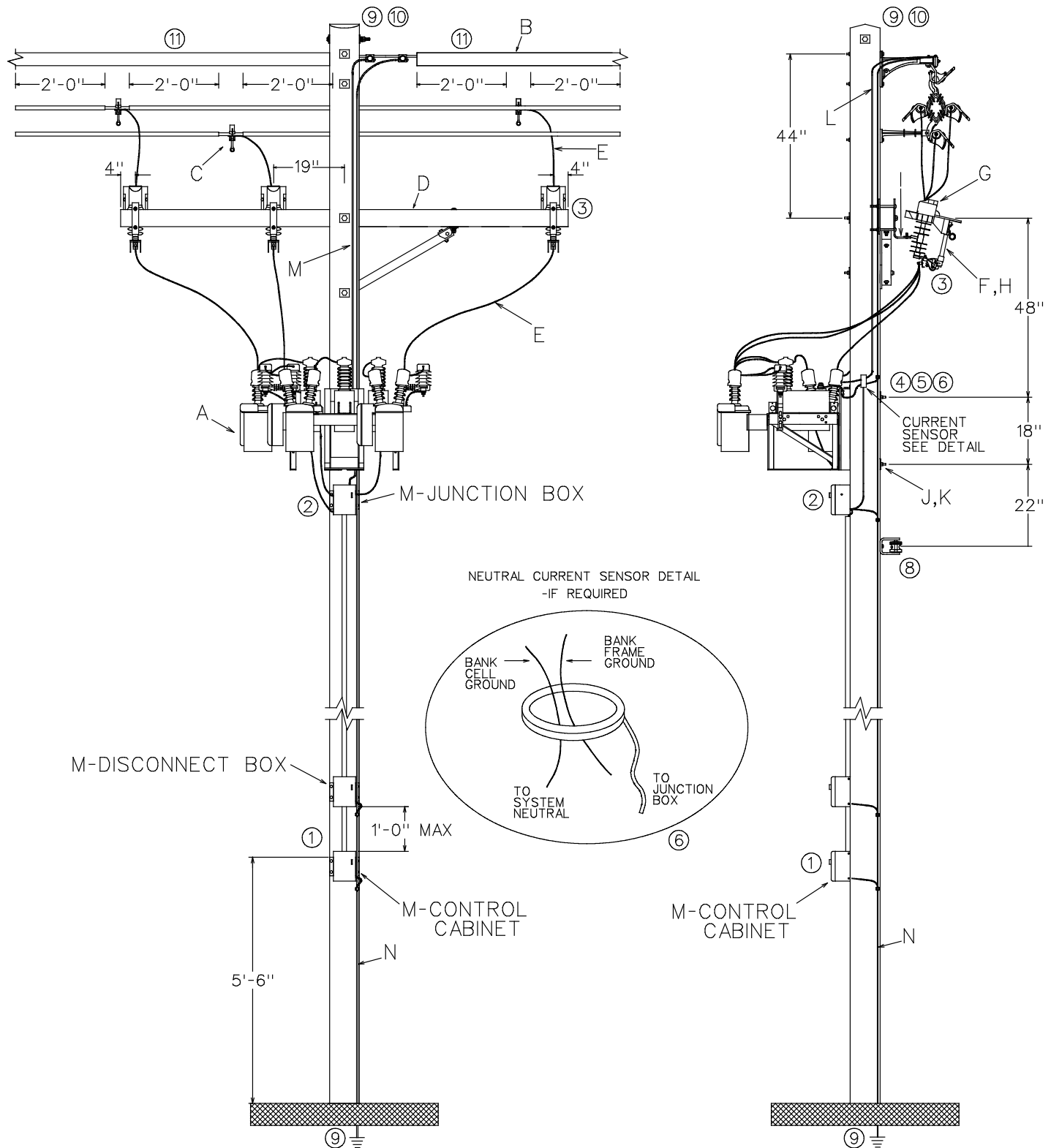
		Std./ Stk. No.	Description	16 20 01 **		4kV		12kV		13.8kV	
						01	02	03	04	05	06
1	A	69 11 055	Cap, Fix, 300 KVAR, 4KV			1					
		69 11 057	Cap, Fix, 600 KVAR, 4KV				1				
		69 11 061	Cap, Fix, 300 KVAR, 12KV					1			
		69 11 062	Cap, Fix, 600 KVAR, 12KV						1		
		69 11 073	Cap, Fix, 300 KVAR, 13.8KV							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

16 20 05 **

Sheet 1 of 3



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	2
@	C	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
	D	04 00 20 03	Crossarm, Sgl., Wood, 10' (use only ½ of V-Brace)		1	1	1	1	1	1	1	1
	E	18 51 025	Wire, #4 Cu. Poly		24	24	24	24	24	24	24	24
	F	54 07 208	Switch, Fuse, 100A, 15kV		3	3	3	3	3	3	3	3
	G	05 15 10 01	Cover – Cutout		3	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	3
	J	23 52 219	Bolt, Machine, 3/4" x 14"		2	2	2	2	2	2	2	2
	K	23 66 031	Washer, NM, Curved, 3/4"		2	2	2	2	2	2	2	2
	L	18 51 019	Wire, #2 Cu. Poly Covered (Ft.)		15	15	15	15	15	15	15	15
@ 5,6,7	M	16 00 24 **	Control, Capacitor		1	1	1	1	1	1	1	1
@ 9	N	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	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.

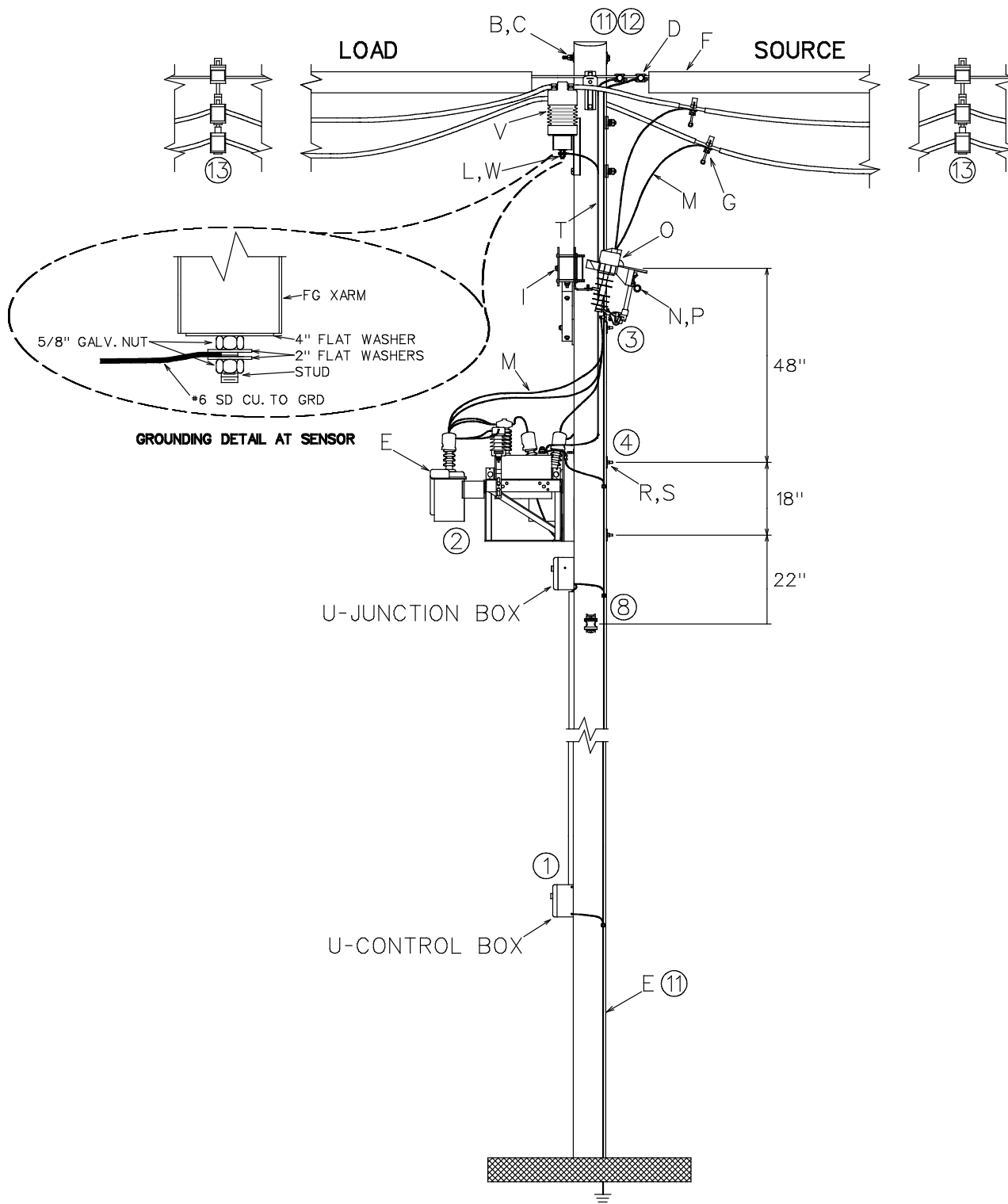
6. Neutral current sensor is not included on all models. Refer to DCS 16 00 24 ** for material and connection in the junction box. The neutral current sensor shall be mounted as shown on the drawing above. Both ground wires from the bank must pass through the center of the sensor. The sensor shall be 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.

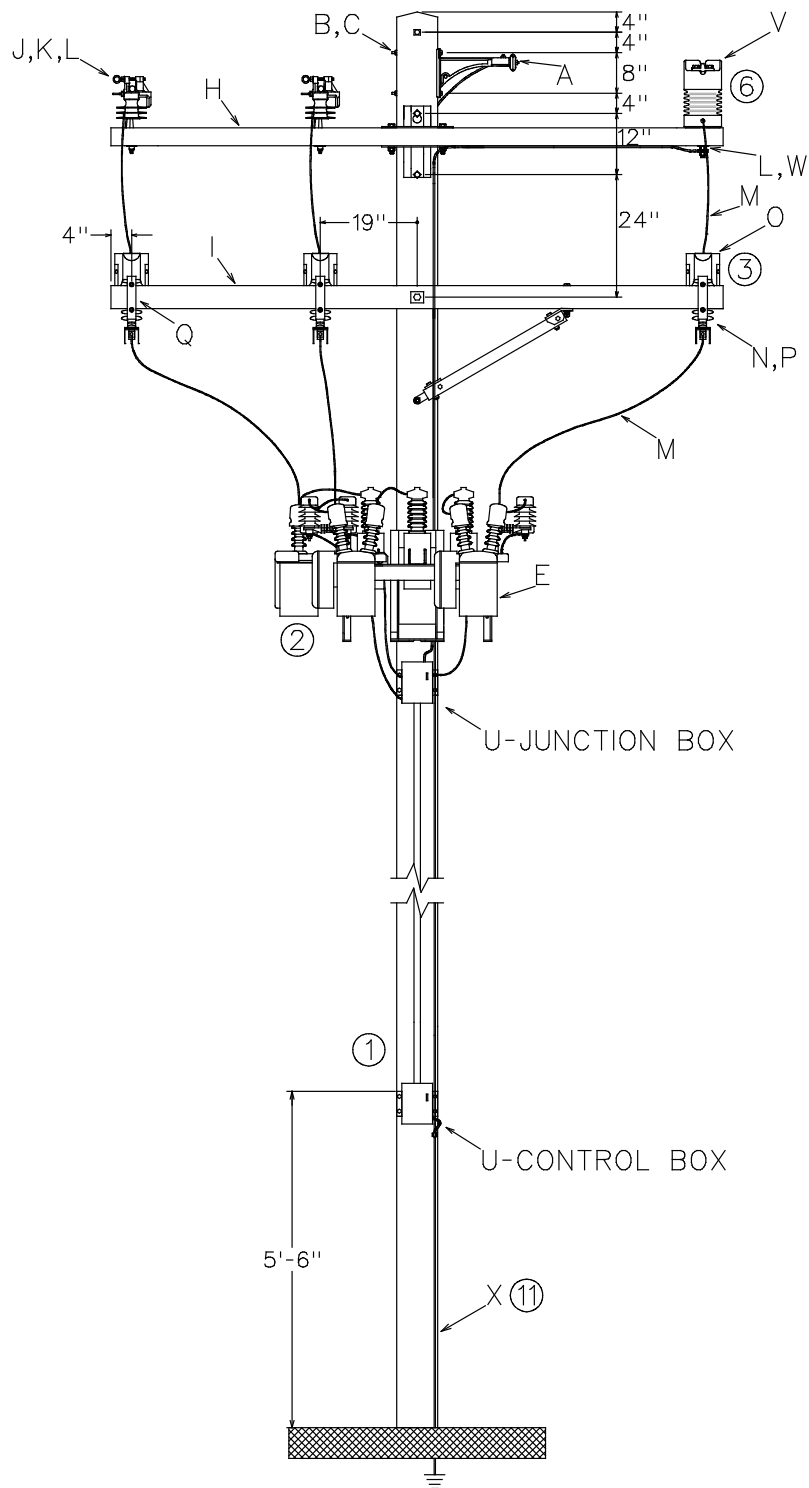
CAPACITORS AND REGULATORS

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
	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
9	U	16 00 20 01	Control, Capacitor		1	1	1	1	1	1	1	1
	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

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: JWC
REV. NO: 1
REV. DATE: 07/02/18

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.
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.

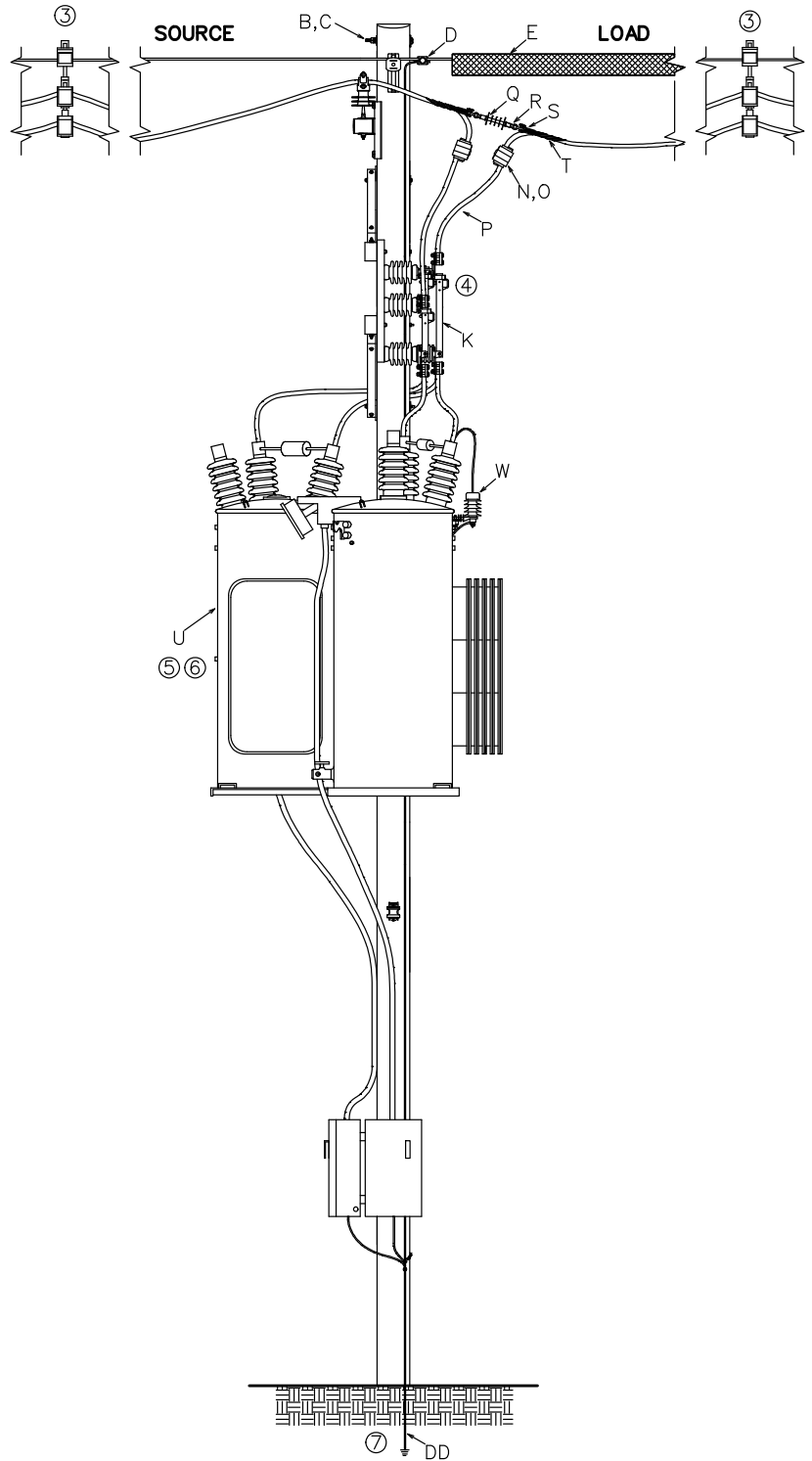
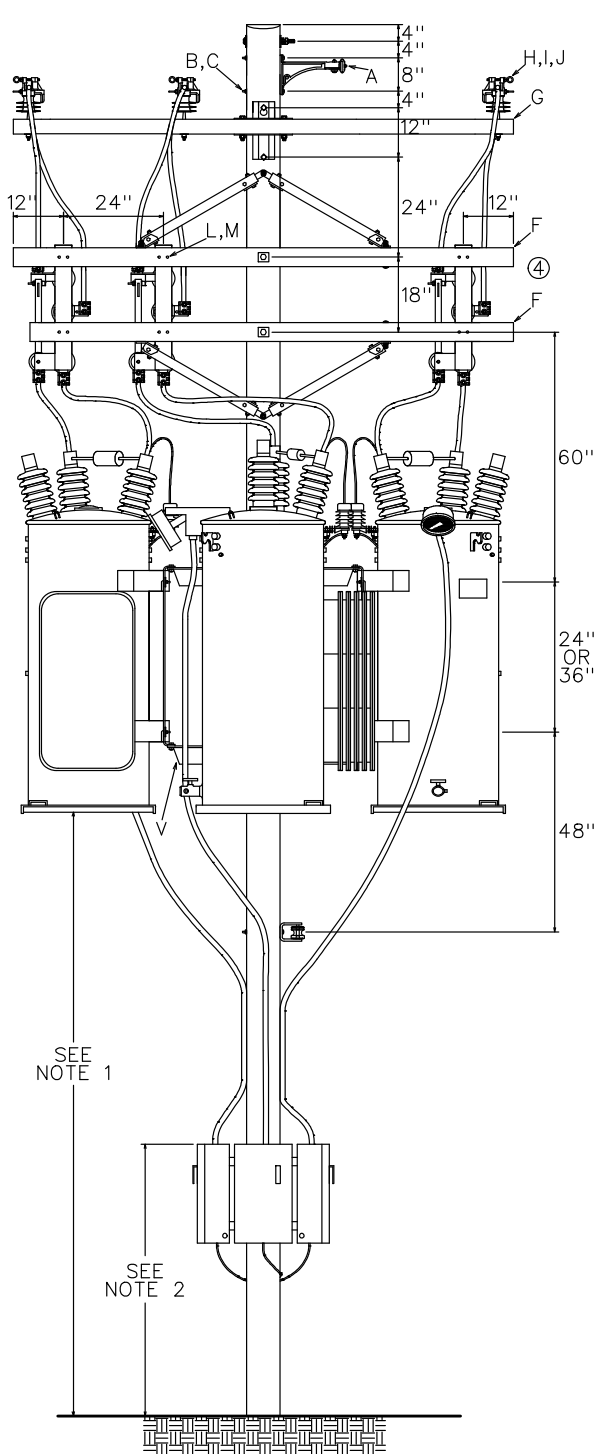
CAPACITORS AND REGULATORS

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:

- 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.
- 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.
- 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.
- See by-pass switch details on Sheet 4, follow instructions for operating.
- 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.
- Some 219A regulators may require an adapter plate (69 58 127) for mounting.
- 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

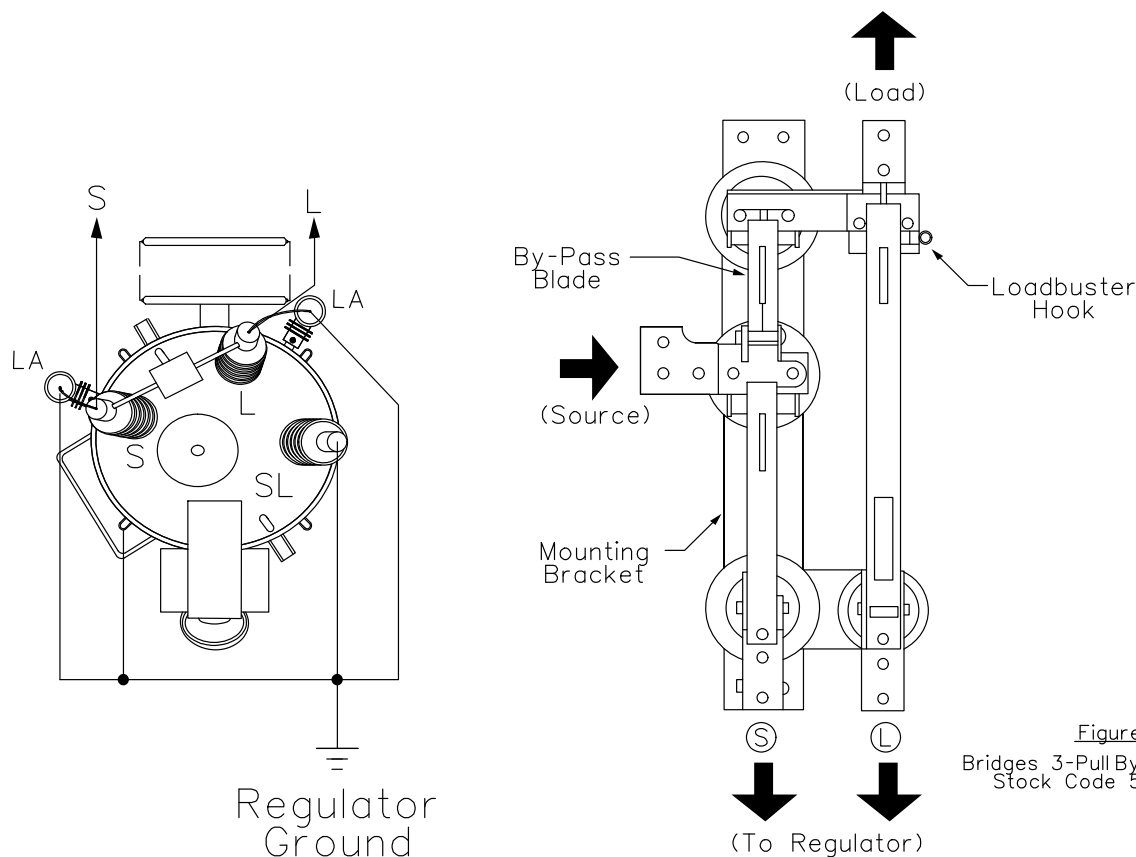


Figure 1
Bridges 3-Pull By-Pass Switch
Stock Code 54-07-455

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.

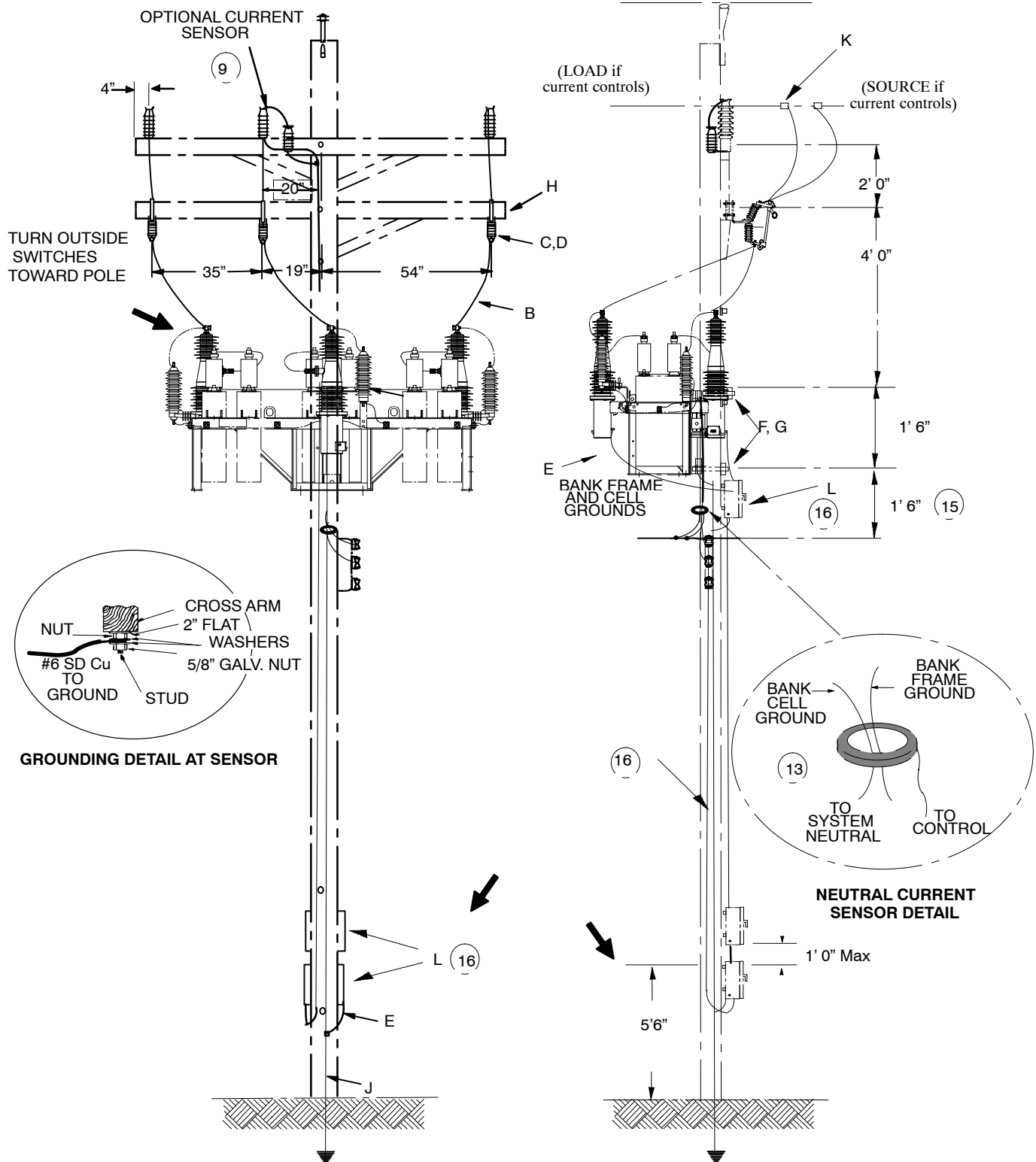
CAPACITORS AND REGULATORS

Switched Capacitor Installation

2400 or 4500 kVAR Banks – 34.5 kV

16 34 02 **

Sheet 1 of 3

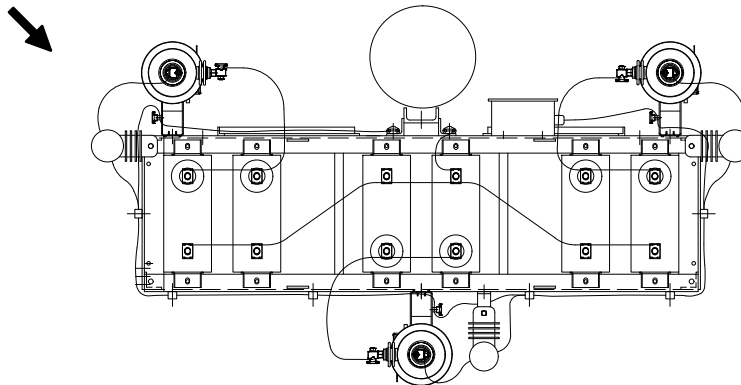


CAPACITORS AND REGULATORS
Switched Capacitor Installation
2400 or 4500 kVAR Banks – 34.5 kV

16 34 02 **

Sheet 2 of 3

34kV Capacitor Bank Top View



2400kVAR 16 34 02 02

4500kVAR 16 34 02 04

		Std./Stk. No.	Description	16 34 02 **	02	04
2.	A	69 11 302	Capacitor, Switched, 2400 kVAR		1	
		69 11 301	Capacitor, Switched, 4500 kVAR			1
1.	B	18 52 025	Wire, #4 Cu, Poly Covered		25	25
	C	54 06 052	Switch, Fused, SMD-20, 34kV		3	3
	D	20 04 343	Refill, Fuse, SMU 50K		3	
		20 04 355	Refill, Fuse, SMU 80E Slow			3
	E	18 51 021	Wire, Cu, #6 S.D., Poly Covered		20	20
	F	23 52 095	Bolt, Mach. 3/4" x 10"		2	2
	G	23 66 031	Washer, Curved, 3/4"		2	2
	H	04 00 20 03	X-Arm, 10'		1	1
3@	J	12 00 10 02	Grounding Unit – Ground Rod		1	1
		12 00 10 01	Grounding Unit – Ground Coil		1	1
@	K	PG*	Clamp, Parallel Groove – See 07 00 25 00		3	3
		HLC*W	Clamp, Hot Line – See 07 00 21 00		3	3
7.@	L	16 00 26 **	Control, multi function with NCS input		1	1

NOTES:

1. Minimum clearance from the ground to the **bottom of the capacitor rack** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
2. Clearance from ground to the **top of the control cabinet** shall be 5' 6" from the ground, and the bottom of disconnect box has to be installed 1' max above the top of control cabinet, but the next hand or foot hold shall be 8' or greater above the disconnect box.
3. 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.
4. Minimum clearance from ground to the top 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
5. Ameren IL must use 2–10' crossarms.
6. For wiring diagram, refer to DCS 16 00 05 00.
7. Loadbreak tool, Stock #87 38 045, must be used to operate switches.
8. With new pole installation, use Standard 12 10 00 01 with ground coil.
9. Neutral current sensor is not included on all models. See Standard 16 00 26 ** for material. The neutral current sensor should be secured with a staple above and below to the ground wires passing through the sensor.
10. Refer to DCS 10 00 01 01 for fusing selection.
11. Capacitor banks have a "C" order point.
12. With new pole installations, use DCS 12 10 00 01 with ground coil.
13. Wire from bank ground and cell ground must both pass through center of sensor before connecting to neutral or ground bus.
14. Connect bank ground(s) to static lead and distribution system neutral if present.
15. The minimum distance from the capacitor bank frame to the secondary line conductor is 1' 6". If underbuild on pole, bank lower mounting bolt must be 24" or more above the underbuild line conductor.
16. Refer to DCS 16 00 26 ** for control, neutral current sensor, cables, U-Guard and optional current sensor. Control requires 120V.

CAPACITORS AND REGULATORS

Regulator

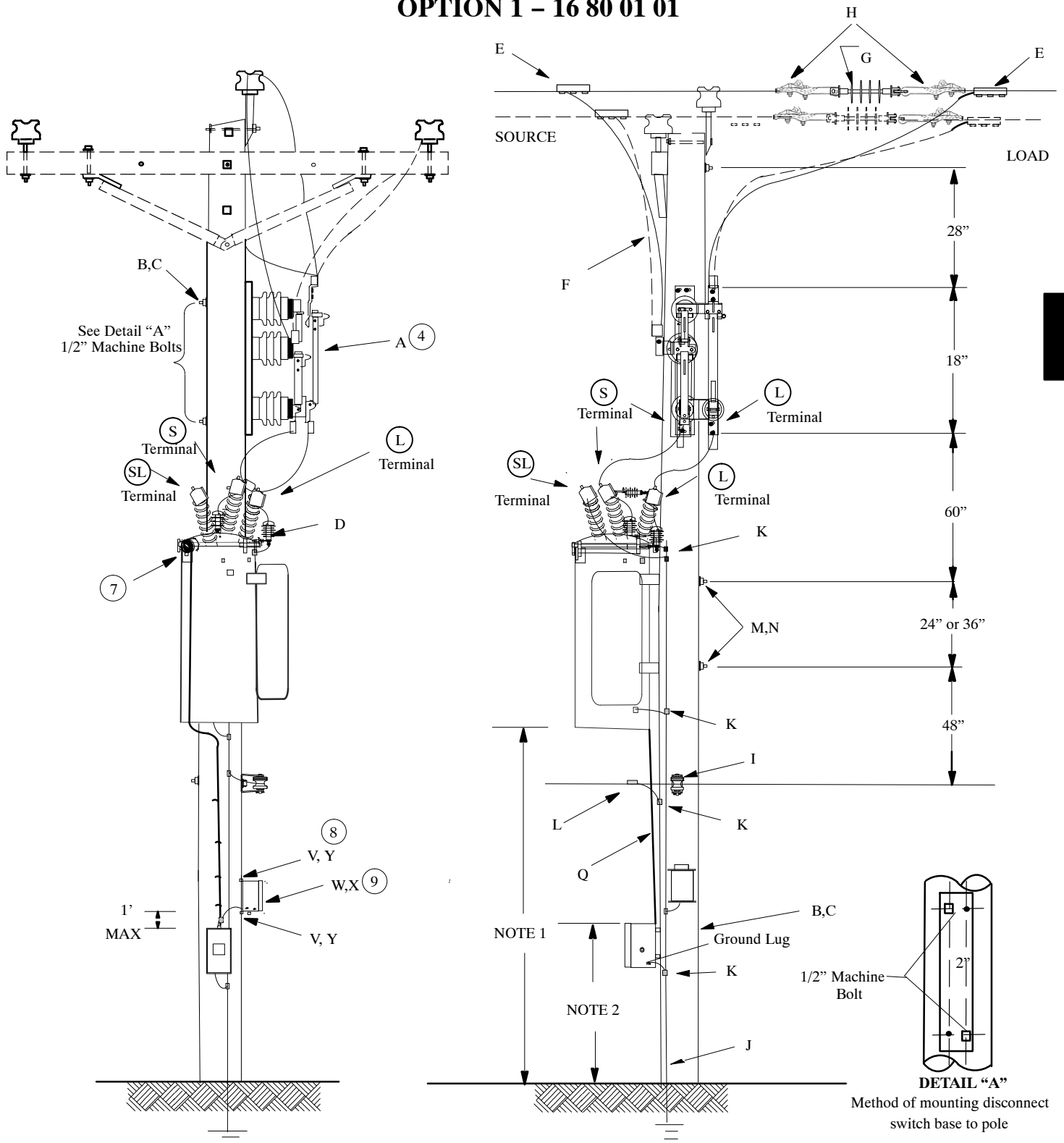
Pole Mounted Single Phase, 4 & 12kV

16 80 01**

Sheet 1 of 5

Use Option 1 or 2 that places the switch in the most favorable position to operate (road side if no other preference).

OPTION 1 - 16 80 01 01



CAPACITORS AND REGULATORS

Regulator

Pole Mounted Single Phase, 4 & 12kV

16 80 01**

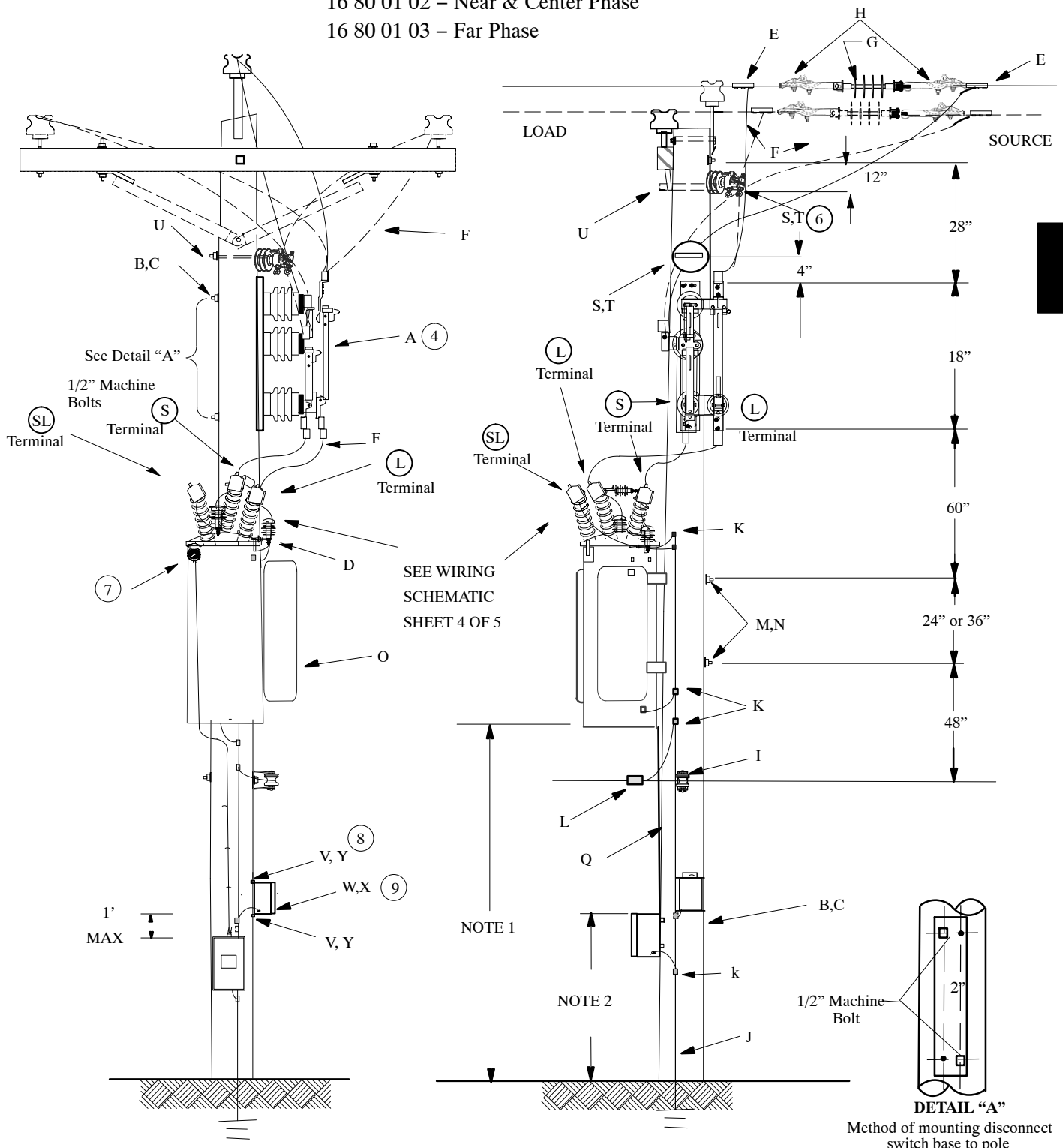
Sheet 2 of 5

Use Option 1 or 2 that places the switch in the most favorable position to operate (road side if no other preference).

OPTION 2

16 80 01 02 – Near & Center Phase

16 80 01 03 – Far Phase



CAPACITORS AND REGULATORS
Regulator
Pole Mounted Single Phase, 4 & 12kV

16 80 01**

Sheet 3 of 5

Regulator

Stock Number – Regulator Line	Voltage	Amps	kVA	Weigh in lbs.		
				Siemens	Cooper	GE
69 09 078	2500	200	50		1200	1230
69 09 125	2500	400	100	2064	2526	1830
69 09 126	2500	668	167	2410	2509	2100
69 09 005	7620	100	76.2	1431	1270	1280
69 09 007	7620	150	114.3	1902	1585	1600
69 09 006	7620	219	167	2100	1975	1900

		Std. / Stk. No.	Description	16 80 01	01	02	03
@	A	54 07 455	Switch, By-Pass, 600A		1	1	1
	B	23 52 309	Bolt, Mach., 1/2" x 16"		4	4	4
	C	23 66 118	Washer, Square, 1/2"		4	4	4
	D	10 01 145	Arrester, Lightning, 10kV Duty Cycle, 8.4kV MCOV with L-Shaped Bracket		2	2	2
		10 01 122	Arrester, Lightning, 3kV Duty Cycle, 2.55kV MCOV with L-Shaped Bracket		2	2	2
@	E	PG*	Clamp, Parallel Grove (See Std. 07 00 25 00)		2	2	2
@	F	LW*W	Wire, Poly, S.D. (ft.), DCS 07 00 01 01		50	50	50
@	G	25 06 052	Insulator, Susp. 15kV		1	1	1
	H	DEC*W	Clamp, Deadend, DCS 07 00 11 00		2	2	2
	I	06 01 01 **	Secondary Clevis		1	1	1
	J	12 00 10 01	Grounding Unit, 7#10CW, Ground Coil		1	1	1
		12 00 10 02	Grounding Unit, 7#10CW, Ground Rod		1	1	1
@	K	17 54 005	Connector, Split Bolt		4	4	4
	L	17 51 032	Clamp, Parallel Grove		1	1	1
	M	23 52 219	Bolt, Mach, 3/4" x14"		2	2	2
	N	23 66 031	Washer, Square, 3/4"		2	2	2
	O	Regulator (see above)	Regulator		1	1	1
6	Q	23 64 001	Staple – Ground Wire, Serrated Cu Clad		16	16	16
	S	25 05 143	Vice Top Insulator 15kV			1	2
	T	23 62 128	Adaptor Pin 1"			1	2
	U	23 52 065	Bolts 5/8" 12"			1	2
	V	62 51 563	Bracket, H Bar (VO only)		2	2	2
@9	W	69 59 004	Kit, Communications, (VO only)		1	1	1
@9	X	69 59 003	Radio, GE Orbitz, ECR, Single Port (VO only)		1	1	1
@9	Y	23 52 068	Bolt, mach., 5 /8" x 16"		2	2	2

CAPACITORS AND REGULATORS
Regulator
Pole Mounted Single Phase, 4 & 12kV

16 80 01**

Sheet 4 of 5

NOTES:

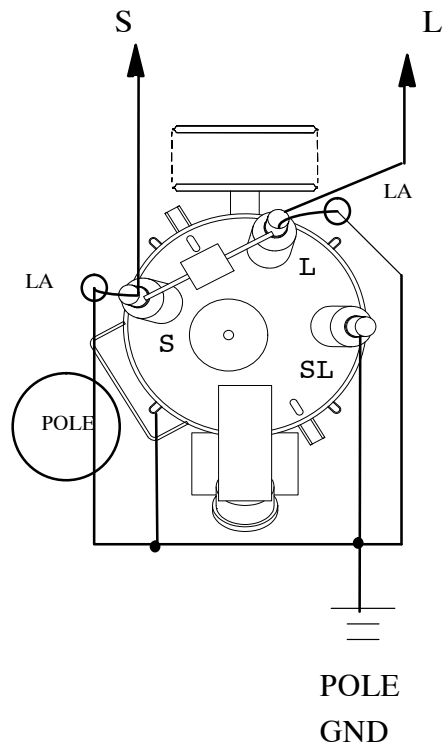
1. Minimum clearance from the ground to the **bottom of the regulator tank** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
2. Clearance from ground to the **top of the control cabinet** shall be 5' 6" from the ground unless additional clearance is needed for locations described in note 3. The next hand or foot hold shall be 8' or greater above the control cabinet.
3. Clearance from ground to the top of the control cabinet may be increased to the clearance provided for locations listed below:
 - Over shoulder of roadway – 15 feet
 - In areas subject to vandalism – 15 feet
 - Over walkways where unduly obstructing the walkway – 10 feet
4. See By-Pass Switch details below. 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. Install a vice top insulator to train the wire from the right side of the switch to the far phase.
7. Tap Change Position Indicator needs to be located at street side.
8. For Illinois VO only. If required, the communications box shall be mounted to the pole by bolting an H bar bracket to the pole with a 5/8" bolt for the top and bottom of the cabinet. 3/8" bolts shall be used to mount the cabinet to the T slot of the H bar. The maximum vertical separation between regulator control cabinet and communication box shall be 12". The communications box shall be bonded to pole ground.
9. Items V, W, X and Y are only for Illinois VO project.

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.
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.
5. Place regulator in service.



REGULATOR WIRING SCHEMATIC

BY-PASS SWITCH DETAILS

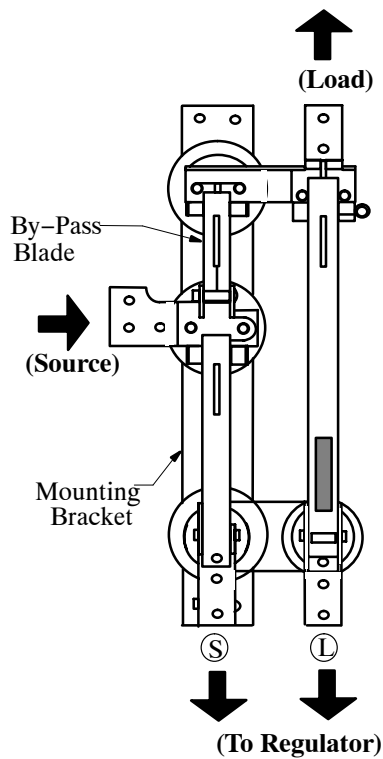


Figure 1
 Bridges 3-Pull By-Pass Switch
 Stock Code 54-07-455

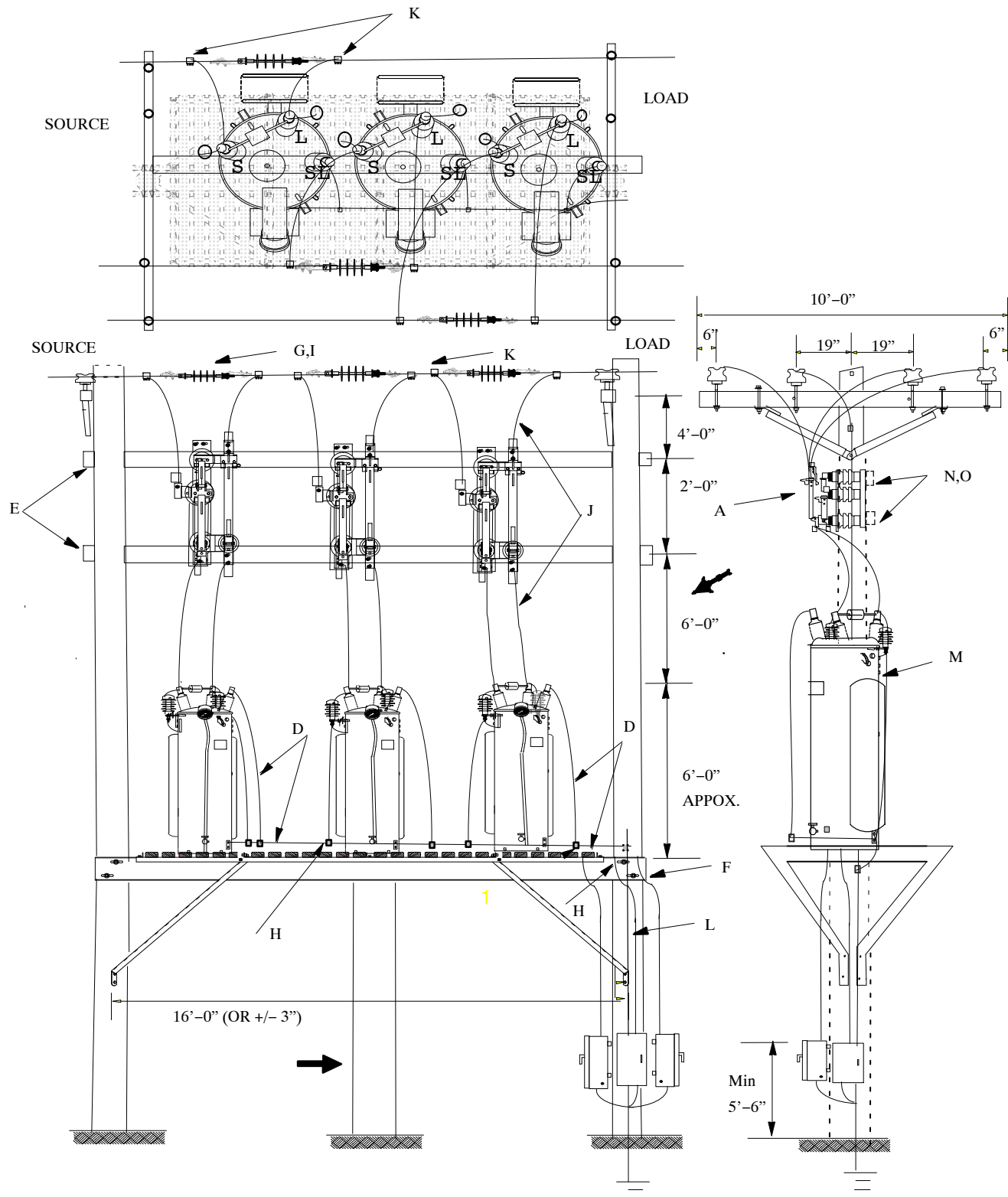
CAPACITORS AND REGULATORS

Regulator – Line

Platform Mounted, Three Phase 4kV & 12kV

16 80 02 **

Sheet 1 of 4



CAPACITORS AND REGULATORS
Regulator – Line
Platform Mounted, Three Phase 4kV & 12kV

16 80 02 **
Sheet 2 of 4

Stock No.	Voltage	Amps	kVA	Weight in lbs.		
				Siemens	Cooper	GE
69 09 006	7620	219	167	2100	1975	1900
69 09 091	7620	328	250	2985	2750	2620
69 09 127	7620	438	333	3950	3252	2980

		Std. / Stk. No.	Description	16 80 02 **	01	02	03
@	A	54 07 455	Switch, By-Pass, 600A.		3	3	3
	C	HLC*W	Clamp, Hot Line		6	6	6
	D	18 51 025	Wire, S.D., #4 Cu., Poly (Ft.)		30	30	30
	E	41 01 152	Cross Arm, 21'		2	2	2
	F	23 17 107	Platform		1	1	1
	G	25 06 052	Insulator, Suspension		3	3	3
@	H	17 54 005	Connector, Split Bolt, #2 Sol thru #6 Sol		3	3	3
	I	DEC*W	Clamp, Deadend		6	6	6
	J	LW*W	Wire, Ploy Covered (Ft., DCS 07 00 80 00)		50	50	50
	K	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		6	6	6
	L	12 00 10 01	Grounding Unit		2	2	2
	M	69 09 006	Regulator, 219A		3		
@		69 09 091	Regulator, 328A			3	
		69 09 127	Regulator, 438A				3
	N	23 52 309	Bolt, Machine, 1/2" x 16"		6	6	6
	O	23 66 118	Washer, Square, 1/2"		12	12	12
	P	10 01 145	Arrester, 10kV 8.4kV MCOV L-Bracket		3	3	3
		10 01 122	Arrester, 3kV 2.55kV MCOV L-Bracket		3	3	3

NOTES:

1. Install the regulator on the side of pole for easier access to the indicator.
2. Minimum clearance from the ground to the bottom of the regulator tank shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
3. Minimum clearance from ground to the top of the Control cabinet shall be:
 - Minimum 5'6" from the ground, but the next hand or foot hold is 8' or greater above the control cabinet.
4. Exception to Note 2, 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
5. See by-pass switch details below. Follow instructions for operating.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:WYW
REV. NO: 10
REV. DATE: 02/03/17

-
6. 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.

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. 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.
5. Place regulator in service.



BY-PASS SWITCH DETAILS

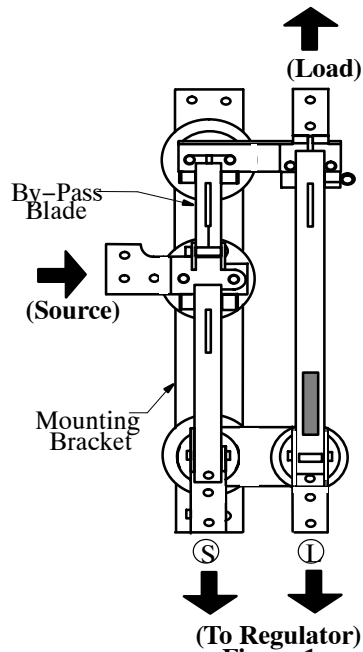
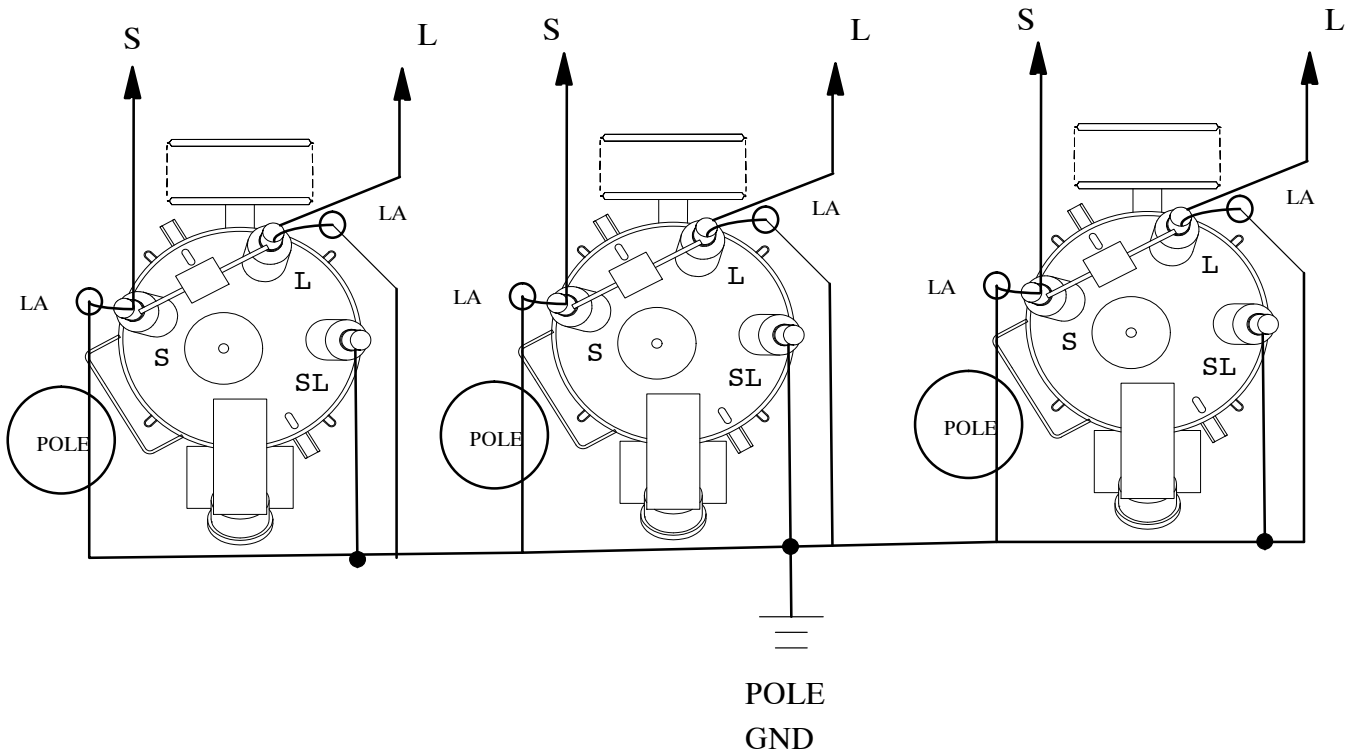
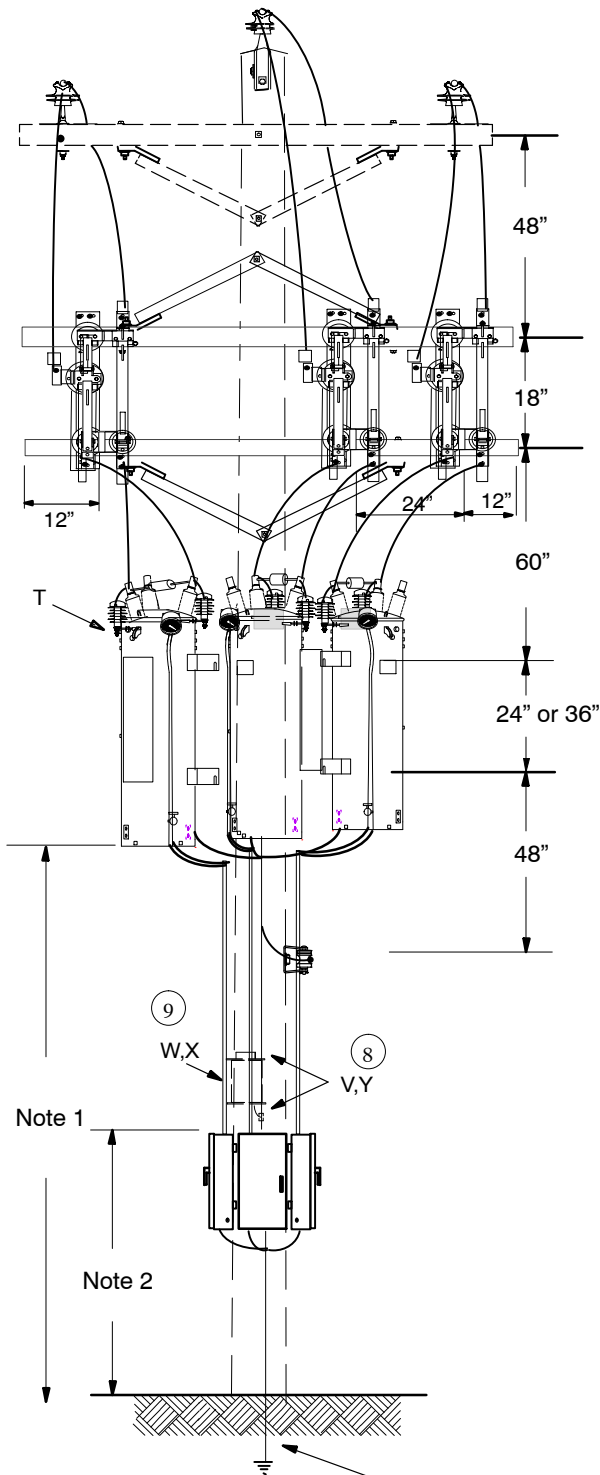


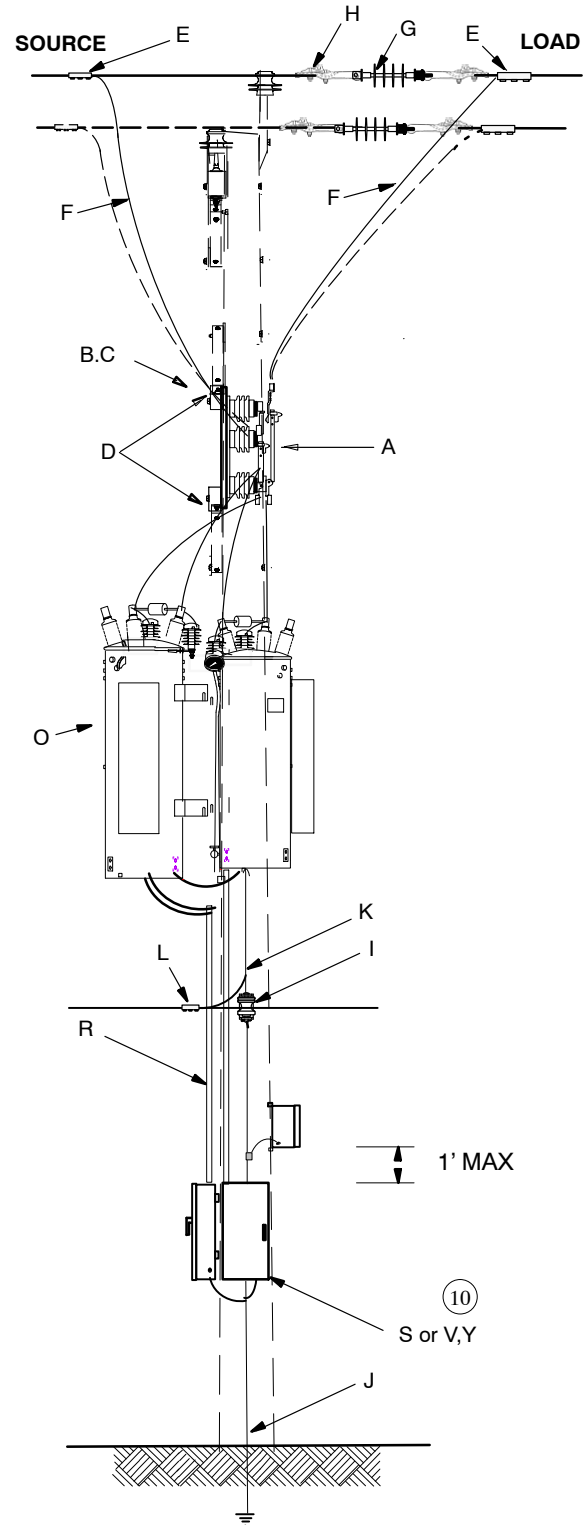
Figure 1
Bridges 3-Pull By-Pass Switch
Stock Code 54-07-455



REGULATOR WIRING SCHEMATIC



Grounding, DCS 12 00 10 01



CAPACITORS AND REGULATORS

Regulator

Pole Mounted, Three Phase 4 & 12kV

16 80 03 01

Sheet 2 of 5

Regulator-Line	Voltage	Amps	KVA	Weight (lbs) Per Unit		
				Siemens	Cooper	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	1431
69 09 007	7620	150	114.3	1902	1585	1902
69 09 006	7620	219	167	2100	1975	2100

	Std. / Stk. No.	Description	16 80 03 01
	A 54 07 455	Switch, By-Pass, 600 A.	3
	B 23 52 038	Bolt, Mach, 1/2" x 6"	12
	C 23 66 118	Washer, Square, 1/2"	15
	D 04 00 20 03	Crossarm, w/ Brace 10'	2
@	E PG*	Clamp, Parallel Grove, DSC 07 00 25 00	6
@	F LW*W	Wire, Poly, S.D. (ft.), DSC 07 00 01 01	150
	G 25 06 052	Insulator, Susp. 15kV	3
@	H DEC*W	Clamp, Deadend, DSC 07 00 17 00	6
@	I 06 01 01 **	Clevis, Secondary	1
7@	J 12 00 10 02	Grounding Unit – Ground Rod	1
	12 00 10 01	Grounding Unit – Ground Coil	1
	K 17 54 005	Connector, Split Bolt	7
	L 17 51 032	Clamp, Parallel Groove	1
	M 23 52 219	Bolt, Mach, 3/4" x 14"	2
	N 23 66 031	Washer, Square, 3/4"	2
5@	O Regulator (See Above)	Regulator	3
	P 23 17 202	Bracket, Cluster, Reg. and Trans.	1
	R 23 64 028	Staple	48
@	S 23 52 309	Bolt, Mach, 1/2" x 18"	6
@	T 10 01 133	Arrester, Lightning, 3kV Duty Cycle, 2.55kV MCOV with L-Shape Bracket	6
	10 01 145	Arrester, Lightning, 10kV duty Cycle, 8.4kV MCOV with L-Shape Bracket	6
6@	U 69 58 127	Adapter, Mounting Plate 36" to 24" Lug Spacing	1
8,10 @	V 62 51 563	Bracket, H Bar	8
@	W 69 59 004	Kit, Communications, (VO only)	1
@	X 69 59 002	Radio, GE Orbitz, MCR, 4 Port (VO only)	1
8,10 @	Y 23 52 068	Bolt, Mach., 5 /8" x 16"	8

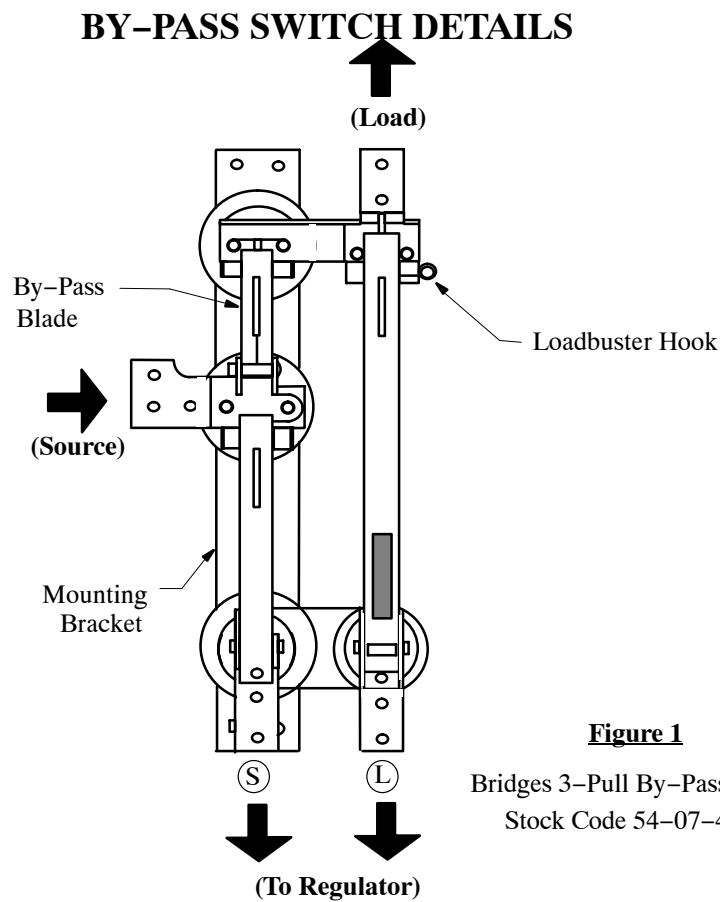
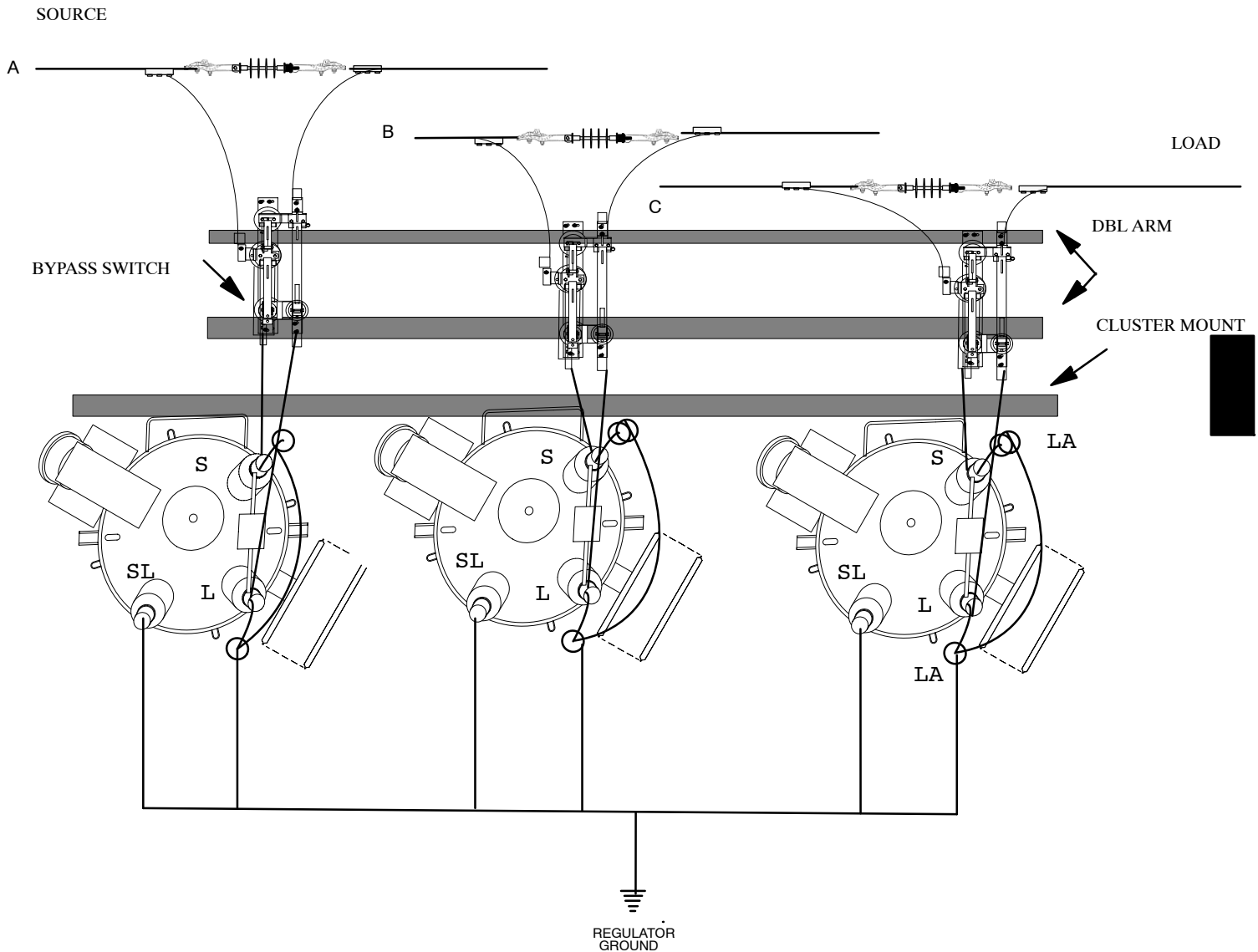


Figure 1
Bridges 3-Pull By-Pass Switch
Stock Code 54-07-455



REGULATOR WIRING SCHEMATIC

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 pedestrian only – 11 feet.
2. Clearance from ground to the **top of the control cabinet** shall be 5' 6" from the ground unless additional clearance is needed for locations described in note 3. The next hand or foot hold shall be 8' or greater above the control cabinet.
3. Clearance from ground to the top of the control cabinet may be increased to the clearance provided for locations listed below:
 - Over shoulder of roadway – 15 feet
 - In areas subject to vandalism – 15 feet
 - Over walkways where unduly obstructing the walkway – 10 feet
4. See by-pass switch details below, 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 regularor and changing a few parameters on the control.
6. Some 219A regulators may require an adapter plate (69 58 127) for mounting.
7. Existing pole installations, DCS 12 10 00 02 – ground rod.
8. For Illinois VO only. If required, the communications box shall be mounted to the pole by bolting an H bar bracket to the pole with a 5/8" bolt for the top and bottom of the cabinet. 3/8" bolts shall be used to mount the cabinet to the T slot of the H bar, two 5/8" bolts and two H bars are required. The maximum vertical separation between regulator control cabinet and communication box shall be 12". The communications box shall be bonded to pole ground.
9. Items W and X are only for Illinois VO project.
10. For installations without enough space to mount control cabinets directly to pole with 1/2" bolts, control cabinet may be mounted to the pole by bolting an H bar bracket to the pole with a 5/8" bolt for the top and bottom of the cabinet. 3/8" bolts would then be used to mount the cabinet to the T slot of the H bar. A total of six 5/8" bolts and six H bars would be required.

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. Place regulator in service.

NOTES