REVISED		BY	CK'D	APPR.
3				
2	12/2/15	KATIGBAK	BURLISON	ADCOCK
1	4/2/14	KATIGBAK	GUINN	ADCOCK
0	11/16/10	CECCONI	GUINN	ELKINS

SECTION 7 - CAPACITORS AND REGULATORS

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
		X	

REVISED		BY	CK'D	APPR.
3				
2				
1	11/10/11	CECCONI	BURLISON	ELKINS
0	11/16/10	CECCONI	GUINN	ELKINS

STANDARD PROCEDURES BULLETIN

CAPACITORS ARE ONE OF THE MOST EXPENSIVE ITEMS OF EQUIPMENT USED ON A DISTRIBUTION SYSTEM. CARE SHOULD BE TAKEN IN HANDLING AND STORING; THEY SHOULD NEVER BE LIFTED OR MOVED BY TAKING HOLD OF BUSHING OR LEADS. DO NOT LEAVE CAPACITORS SITTING ON THE GROUND OR WITH TANKS IN CONTACT WITH A MOIST SURFACE THAT MAY CAUSE CORROSION OR RUSTING OF THE METAL.

BEFORE CAPACITORS ARE INSTALLED, A THOROUGH EXAMINATION SHOULD BE MADE. IF ANY INJURY IS EVIDENT (BROKEN BUSHINGS, LEAKS, ETC.), THE CAPACITORS SHALL BE RETURNED TO THE WAREHOUSE. A CAPACITOR IS A DEVICE CAPABLE OF STORING AN ELECTRIC CHARGE; THEREFORE, EXTREME CARE SHOULD BE EXERCISED DURING HANDLING, TESTING AND SHIPPING.

PRIOR TO WORKING ON CAPACITORS, THE CAPACITOR SHALL BE DISCONNECTED FROM THE ENERGIZING SOURCE, SHORT-CIRCUITED, AND GROUNDED. INSTALL A MINIMUM SIZE OF NO. 18 COPPER ACROSS TERMINALS AND GROUND BEFORE SHIPPING. LEAVE GROUND WIRE ATTACHED ACROSS TERMINALS AFTER TESTING IN THE LAB OR SHOP FOR FUTURE HANDLING. THE CAPACITOR CONTAINS AN INTERNAL (BLEEDER) RESISTOR FOR DISCHARGING THE LINE VOLTAGE TO 50V AFTER 5 MINUTES. THIS INTERNAL RESISTOR SHALL NOT BE DEPENDED UPON TO DISCHARGE CAPACITORS.

CAPACITOR BANKS PRESENTLY BEING PURCHASED FOR USE ON THE CAROLINAS DISTRIBUTION SYSTEM ARE IN-LINE RACK MOUNTED USING ALL FILM, NON-PCB, 2-BUSHING, SINGLE-PHASE CAPACITOR UNITS. NEW CAPACITOR BANKS COME WITH WILDLIFE PROTECTION, POTENTIAL TRANSFORMER AND LIGHTNING ARRESTERS PRE-INSTALLED.

DISTRIBUTION CONSTRUCTION CREWS SHALL INSTALL ALL CAPACITOR BANKS ACCORDING TO THE SPECIFICATIONS CONTAINED HEREIN.

3				
2				
1				
0	7/11/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

CAPACITORS - INTRODUCTION

Progress Energy

CAR

DWG. 07.00-05

SINGLE-PHASE INSTALLATION

USE THE SAME SIZE LISTED IN THE THREE-PHASE TABLE BELOW UNLESS TAP LINE FUSE IS 50KS (80K) OR SMALLER. WHERE THE TAP LINE FUSE IS A KS (MS) FUSE, USE THE SAME SIZE K FUSE ON THE SINGLE-PHASE CAPACITOR BANK DOWN TO A MINIMUM SIZE OF 30K.

THREE-PHASE INSTALLATION

THREE-PHASE BANK CAPACITY	KVAR PER PHASE	FUSE LINK SIZE		
		12 KV	23 KV	34.5 KV
1200 KVAR OR SMALLER	400	65K	50K	30K
1800 KVAR	600	NOT USED	65K	-
2400 KVAR	800	NOT USED	100K	-

FUSE LINKS
AVAILABLE FROM GENERAL WAREHOUSE

FUSE SIZE (AMPS)	KS/MS	K
30	-	21124904
50	-	21125109
65	-	21125208
100	-	21125505

NOTES:

1. DO NOT FUSE NEUTRAL.
2. GROUND TANKS OR CAPACITOR UNITS AND BANK FRAME ON ALL INSTALLATIONS.
3. WHEN A CAPACITOR BANK IS DISCONNECTED FROM THE LINE, BE SURE TO DISCHARGE ALL CAPACITORS BEFORE HANDLING. DO NOT REMOVE SHORTING CONDUCTOR UNTIL JUST PRIOR TO RE-ENERGIZING CAPACITORS.
4. ALL CAPACITORS RETURNED TO SYSTEM MATERIAL REPAIR SHOP IN GARNER MUST HAVE SHORTING CONDUCTOR INSTALLED BETWEEN TERMINALS. USE MINIMUM WIRE SIZE OF #18 COPPER.
5. DO NOT INSTALL CAPACITOR BANKS WHERE AVAILABLE PHASE-TO-GROUND FAULT CURRENT EXCEEDS 6000 AMPERES SYMMETRICAL. CONSULT DISTRIBUTION STANDARDS FOR SPECIAL CASES.
6. ENERGIZE BANK ONLY IF FUSED WITH THE PROPER SIZE AND TYPE FUSES.
7. CONSULT REGION SYSTEM ENGINEER REGARDING FUSING IF BANKS ARE INSTALLED BEYOND SINGLE-PHASE RECLOSERS RATED AT LESS THAN 100 AMPS CONTINUOUS.

REVISED		BY	CK'D	APPR.
3				
2	2/14/12	HOFFMAN	BURLISON	ELKINS
1	7/21/11	HOFFMAN	BURLISON	ELKINS
0	7/11/10	GUINN	GUINN	ELKINS

PRIMARY CAPACITOR FUSING

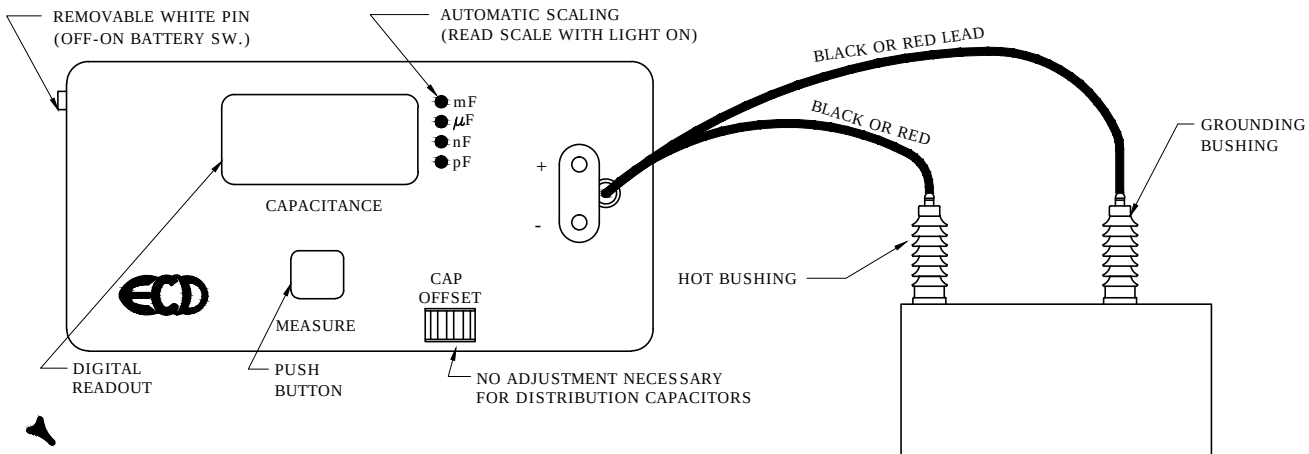
Progress Energy

CAR

DWG. 07.00-15

ECD MODEL 100 CAPACITANCE METER

(NOT TO SCALE)



PRIMARY VOLTAGE/SHUNT CAPACITOR VALUES							
UNIT RATED VOLTAGE	UNIT RATED KVAR	ACCEPTABLE RANGE OF PHASE CURRENT AND UNIT CAPACITANCE					
		ALL UNITS		UNITS MANUFACTURED BEFORE 2002		UNITS MANUFACTURED IN 2002 OR LATER	
		LOW CURRENT (AMPS)	LOW CAPACITANCE (μF)	HIGH AMPS	HIGH (μF)	HIGH AMPS	HIGH (μF)
7200	100	13.9	5.12	16.0	5.89	15.3	5.52
7200	200	27.8	10.20	35.1	11.73	30.6	11.22
7200	400	55.6	20.47	63.9	23.54	61.1	22.47
13200	100	7.6	1.50	8.7	1.73	8.3	1.65
13200	200	15.2	3.00	17.4	3.46	16.7	3.30
13200	400	30.3	6.02	34.9	6.92	33.3	6.62
19900	200	10.1	1.33	11.6	1.53	11.1	1.46

* CURRENT VALUES ARE CALCULATED BASED ON NAMEPLATE RATED VOLTAGE. IF TWO UNITS ARE PARALLELED ON A PHASE, THE PHASE CURRENT WILL BE 2X UNIT CURRENT.

READING	SIGNIFICANCE
IN RANGE	UNIT OK
BELOW RANGE	REPLACE
ABOVE RANGE	REPLACE
PF	REPLACE
0.0 μF - 0.0 pF	REPLACE

$$\text{RATED CAPACITANCE} = \frac{\text{VAR}}{377 \times (\text{RATED VOLTAGE})^2}$$

$$\text{EXAMPLE: } \frac{100{,}000 \text{ VAR}}{377 \times (13{,}200\text{V})^2} = 1.5\mu\text{F}$$

PROCEDURE FOR TESTING CAPACITORS:

1. DE-ENERGIZE CAPACITOR BANK AND WAIT 5 MINUTES FOR CAPACITORS TO DISCHARGE DOWN TO 50 VOLTS. BLEED OFF REMAINING CHARGE WITH SHORTING CONDUCTOR BEFORE HANDLING.
2. IF CAPACITORS ARE IN PARALLEL, DISCONNECT WIRES SO THAT EACH CAPACITOR CAN BE MEASURED SEPARATELY.
3. REMOVE WHITE PIN FROM METER. REPLACE THIS PIN WHEN TESTS ARE COMPLETE. IF USING FLUKE OR OTHER MULTIMETER, SWITCH TO CAPACITANCE MEASUREMENT TO TAKE READINGS.
4. CONNECT ONE LEAD TO HOT BUSHING AND ONE LEAD TO GROUNDING BUSHING OR GROUNDING STUD. BE SURE TO CLEAN BUSHING TERMINALS.
5. PRESS BUTTON AND TAKE READING.
6. COMPARE READING WITH PRIMARY VOLTAGE SHUNT CAPACITOR VALUES TO DETERMINE CONDITION OF UNITS. REPLACE ANY UNIT THAT DOES NOT FALL WITHIN THE ACCEPTED RANGE AND RETURN TO SYSTEM MATERIAL REPAIR SHOP IN GARNER FOR FURTHER ELECTRICAL TESTING.
7. REPLACE AND RETURN ANY UNIT WITH BULGED CANS, LEAKS, CRACKED BUSHINGS, ETC.
8. ALL CAPACITORS RETURNED TO SYSTEM MATERIAL REPAIR SHOP MUST HAVE SHORTING CONDUCTOR INSTALLED BETWEEN TERMINALS.

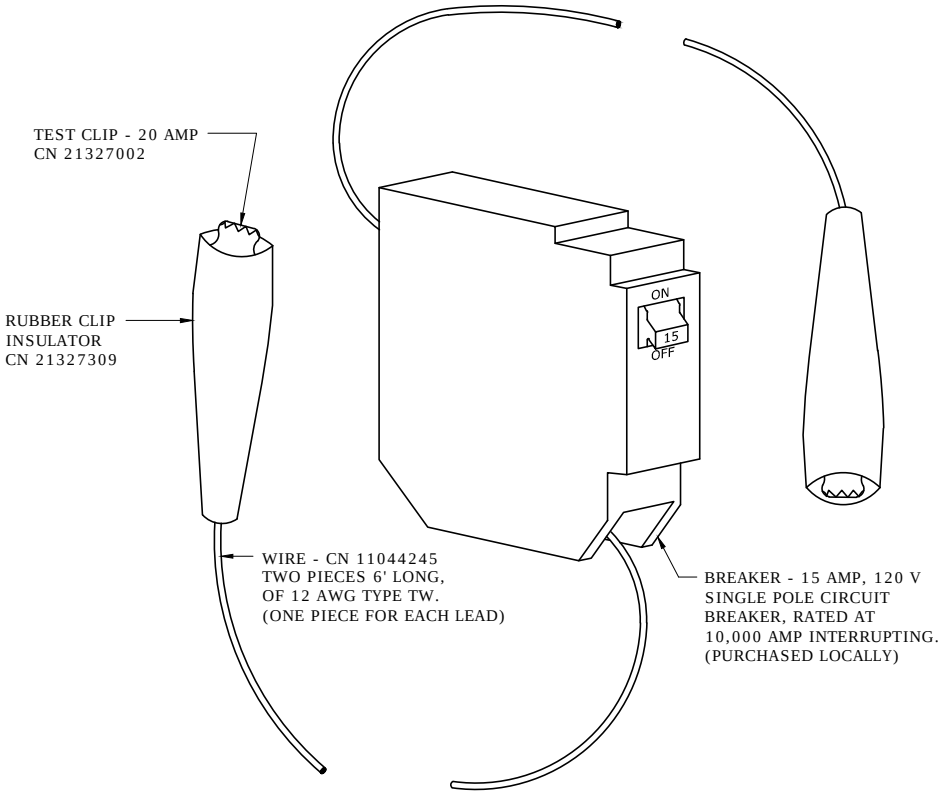
REVISED		BY	CK'D	APPR.
3				
2				
1	3/1/13	SIMMONS	GUINN	ADCOCK
0	4/12/10	GUINN	GUINN	ELKINS

TESTING CAPACITOR UNITS USING A CAPACITANCE METER

Duke Energy®

CAR

DWG. 07.00-30

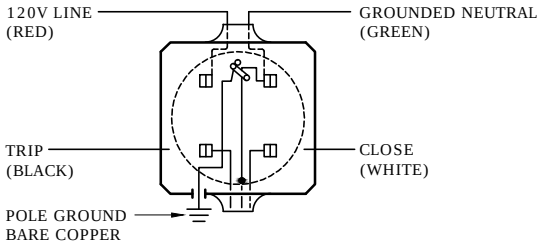


USE:

TO MANUALLY OPERATE SWITCHES ON CAPACITOR BANKS REMOVE CONTROL FROM BASE AND CONNECT INSULATED CLIPS FROM 120 VOLT LUG TO EITHER THE "OPEN" OR "CLOSE" LUG. SWITCH 15 AMP BREAKER TO THE "ON" POSITION. THE CIRCUIT BREAKER IS A SAFETY PRECAUTION- IF THERE IS A SHORT IN A SWITCH OR IN THE CONTROL CABLE THE CIRCUIT BREAKER WILL TRIP OUT.

NOTES:

1. DO NOT USE THIS DEVICE WITHOUT WEARING RUBBER GLOVES.



3				
2				
1				
0	9/20/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

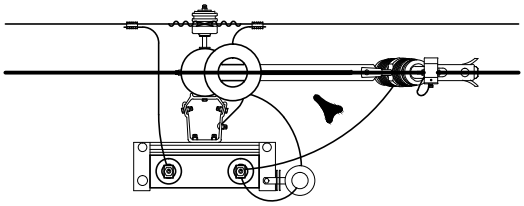
CAPACITOR SWITCH

CONTROL CIRCUIT FIELD TESTER

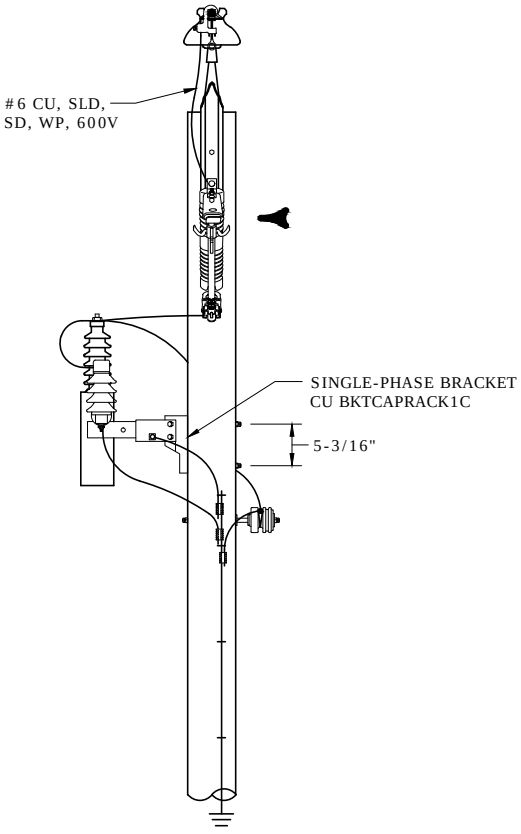
Progress Energy

CAR

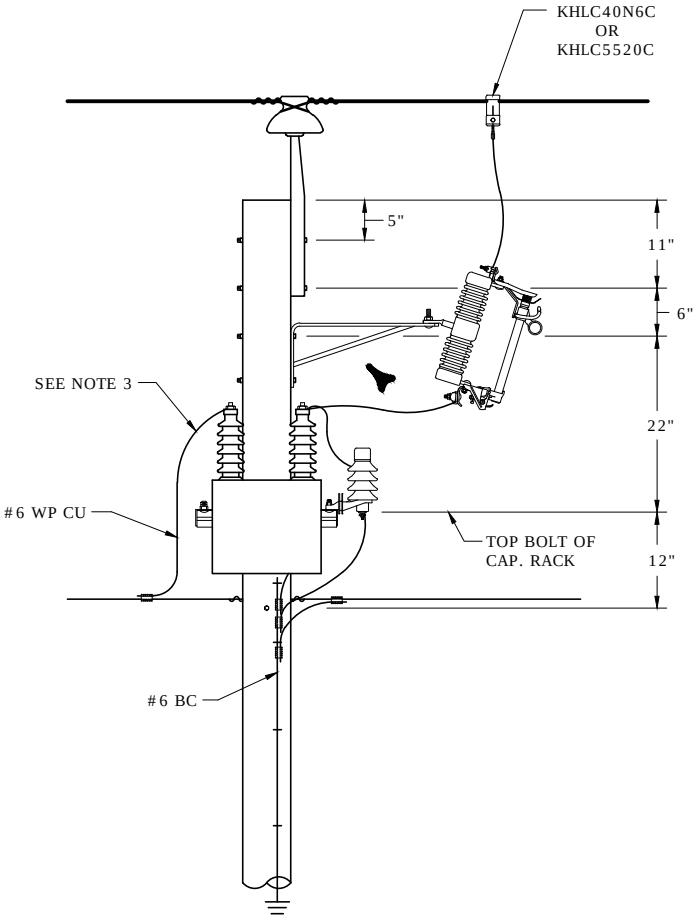
DWG. 07.01-20



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. INSTALL CAPACITOR ON EXISTING POLE.
2. CAPACITOR MOUNTING FRAME TO BE GROUNDED.
3. SEE SECTION 01.01 FOR REQUIRED GROUNDING.
4. SEE DWG. 07.00-15 FOR FUSING INFORMATION.

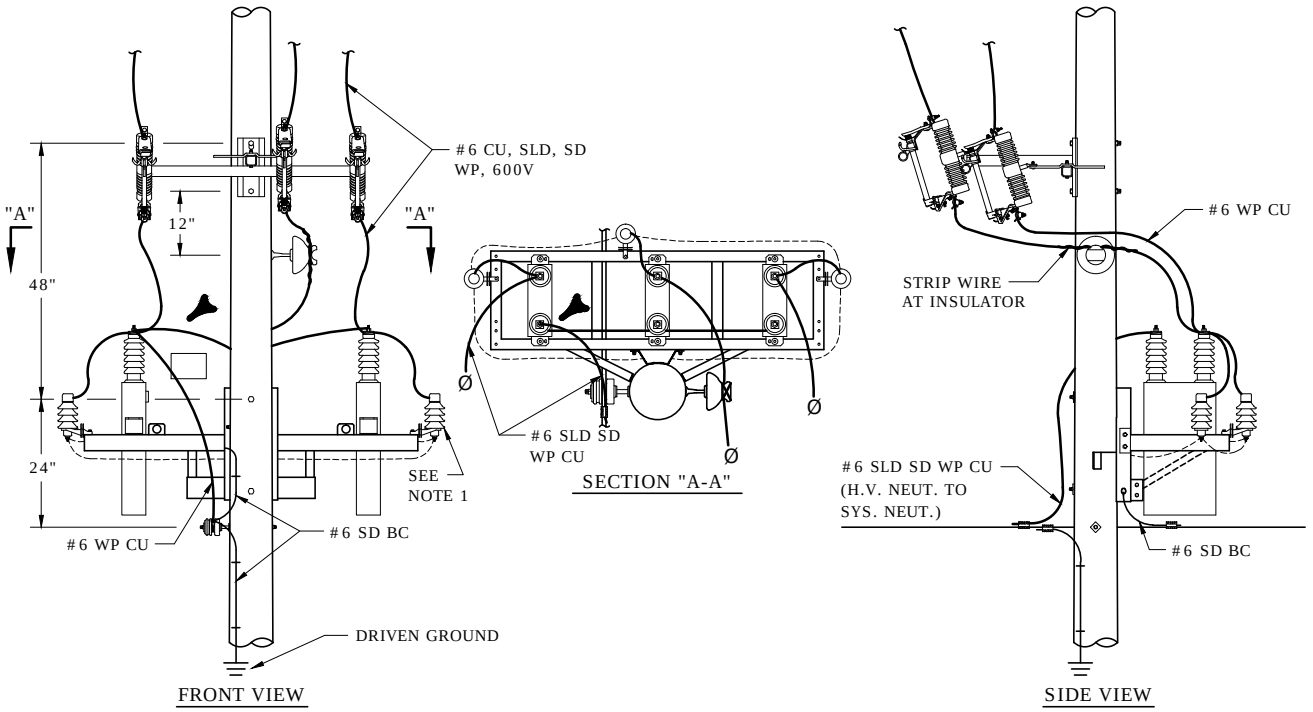
REVISED	BY	CK'D	APPR.
4 5/10/13	GUINN	GUINN	ADCOCK
3 11/30/12	GUINN	GUINN	ADCOCK
2 2/14/12	HOFFMAN	BURLISON	ELKINS
0 7/11/10	GUINN	GUINN	ELKINS

CAPACITOR - FIXED
SINGLE-PHASE

DUKE ENERGY.

CAR

DWG. 07.02-05



BILL OF MATERIALS				
MACRO UNIT	DESCRIPTION	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
C1200FX23CM	CAP BANK MU 1200KVAR FIXED 23KV	CAP1200FX23C	1	OVERHEAD CAPACITOR 1200 KVAR FIXED 23KV
		TFUSE27CO100C	3	TRANS/CAP FUSE 27KV CUTOUT 100AMP
		BKTCOLATRISTLC	1	BKT FOR CUTOUT AND ARRESTER, TRIPLE MOUNT, STEEL
		PINSCREW6C	1	INSULATOR PIN SCREW 6" X 1" HEAD
		IPIN23C	1	INSULATOR PIN 23KV
C300FX12CM	CAP BANK MU 300KVAR FIXED 12.47KV			
C300FX23CM	CAP BANK MU 300KVAR FIXED 23KV			
C600FX12CM	CAP BANK MU 600KVAR FIXED 12.47KV			
C600FX23CM	CAP BANK MU 600KVAR FIXED 23KV			

NOTES:

1. ARRESTERS COME PRE-INSTALLED ON NEW CAPACITOR BANKS. ARRESTERS SHALL BE INSTALLED ON THE RACK FOR CAPACITOR BANKS THAT ARE RELOCATED THAT DID NOT HAVE PRE-INSTALLED ARRESTERS.
2. SEE DWG. 07.02-20 FOR CAPACITOR BANK GROUNDING DETAIL.
3. BANKS IN DLC AREAS HAVE BLOCKING UNIT INSTALLED BETWEEN THE SYSTEM NEUTRAL AND THE BANK NEUTRAL.
4. ALL HIGH VOLTAGE WIRING IS TO BE #6 SOLID SOFT DRAWN, WEATHERPROOF COPPER. STRIP WIRE AT INSULATOR.
5. SEE DWG 07.02-25 FOR WIRING OF FIXED BANK.
6. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

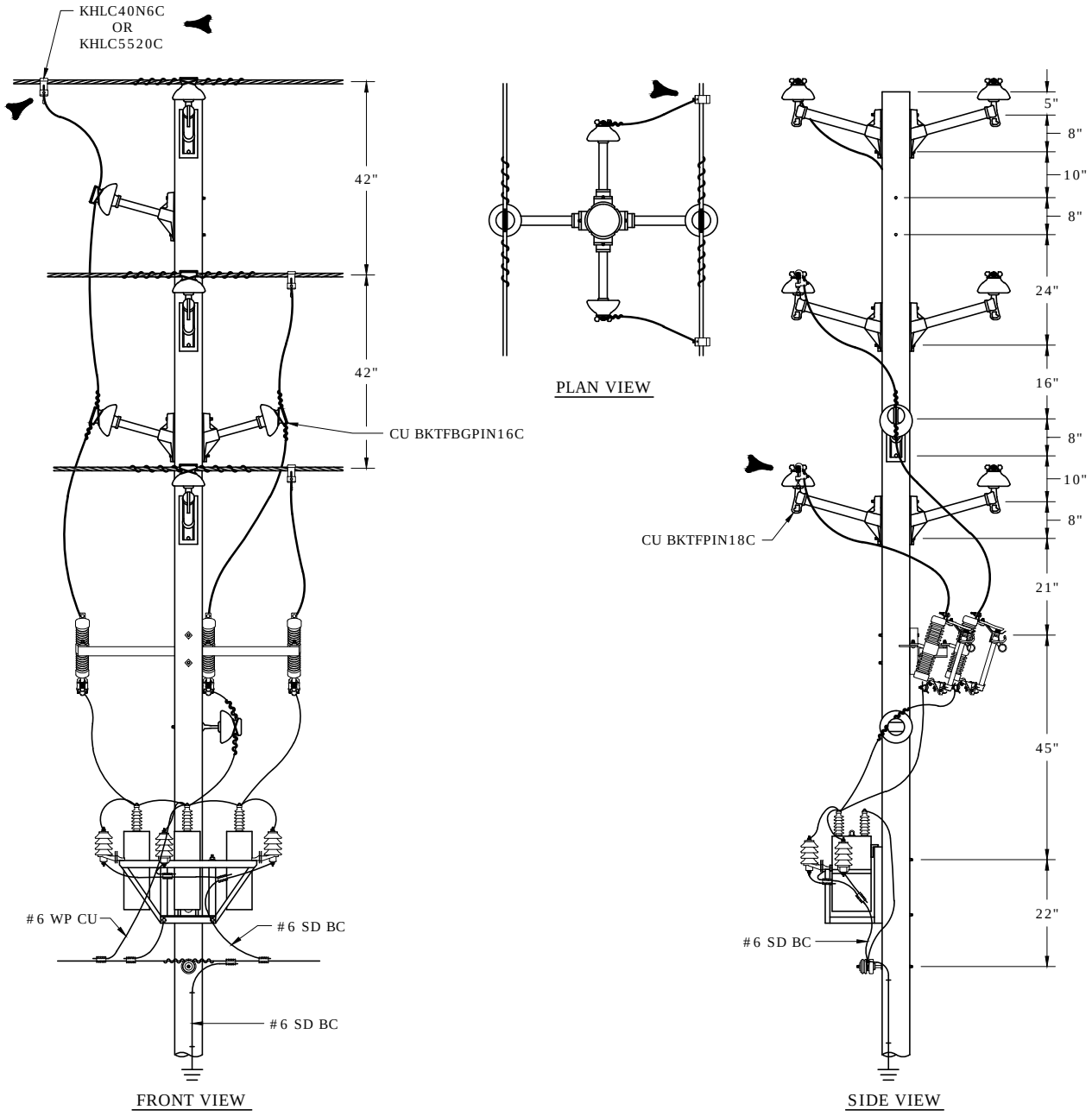
REVISED		BY	CK'D	APPR.
3				
2	2/14/12	HOFFMAN	BURLISON	ELKINS
1	4/20/11	HOFFMAN	BURLISON	ELKINS
0	4/16/10	GUINN	GUINN	ELKINS

FIXED CAPACITOR BANK, 12KV OR 23KV

Progress Energy

CAR

DWG. 07.02-10



NOTES:

1. STRIP WIRE WHERE IT IS TIED TO JUMPER POST.
2. PRIMARY JUMPERS BELOW THE CUTOUTS SHOULD BE WPC TO REDUCE DAMAGE CAUSED BY ANIMAL CONTACT
3. SEE DWG. 07.02-20 FOR GROUNDING DETAILS. SEE SECTION 01.01 FOR REQUIRED EQUIPMENT-TO-EARTH GROUND.
4. USE HAND TIES ON JUMPER SUPPORT INSULATORS. SEE DWG. 03.04-07.
5. PREFERRED CONSTRUCTION IS TO HAVE THE SAME PHASE CONDUCTORS ON THE SAME LEVEL. THIS IMPROVES THE STRUCTURE BIL.

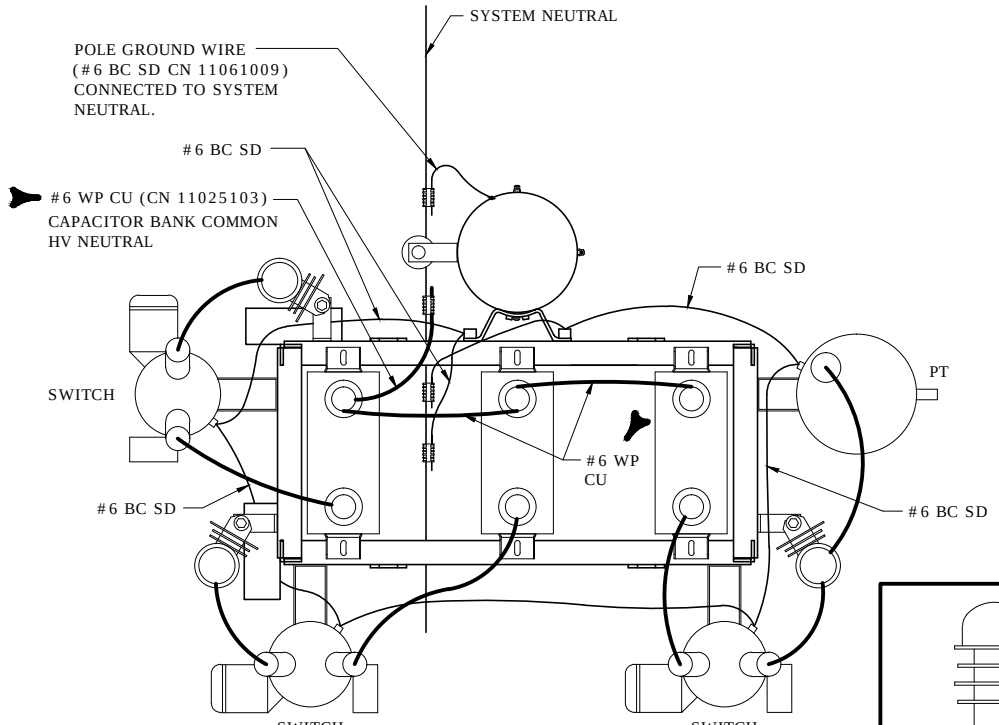
REVISED	BY	CK'D	APPR.
3			
2	8/31/11	BURLISON	BURLISON	ELKINS
1	4/20/11	HOFFMAN	BURLISON	ELKINS
O	4/12/10	GUINN	GUINN	ELKINS

CAPACITOR BANK ON A DOUBLE CIRCUIT POLE - CONFIGURATION DRAWING

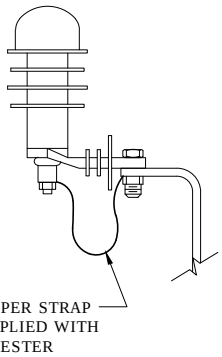
Progress Energy

CAR

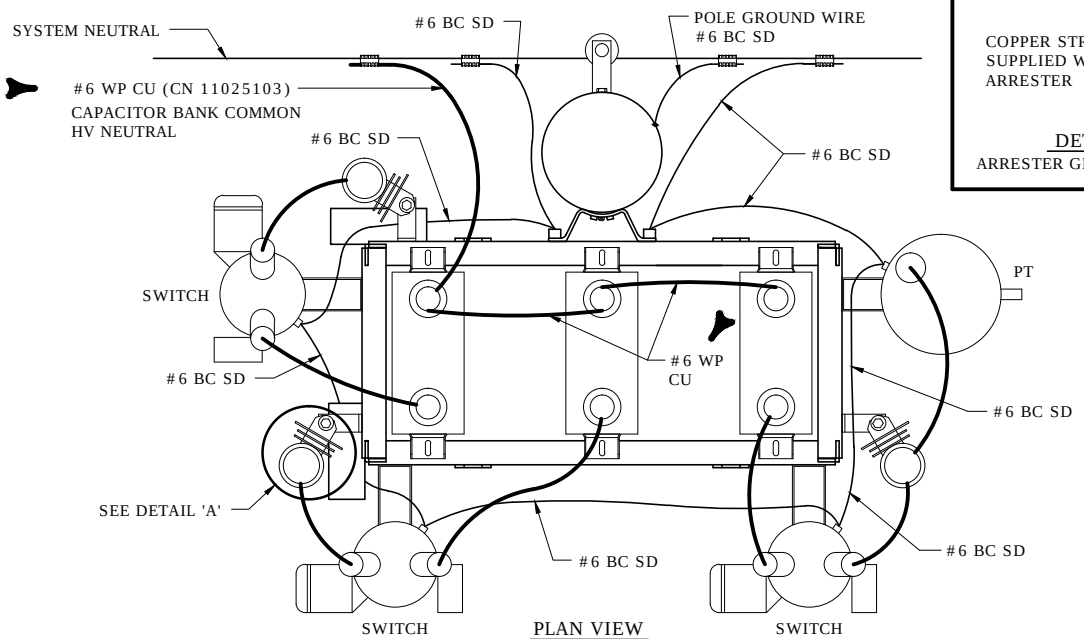
DWG. 07.02-17



PLAN VIEW
HORIZONTAL CONSTRUCTION



DETAIL 'A'
ARRESTER GROUNDING STRAP



PLAN VIEW
VERTICAL CONSTRUCTION

NOTES:

1. SEE SECTION 01.01 FOR REQUIRED EQUIPMENT-TO-EARTH GROUNDING.
2. BANK ORIENTATION IS TO BE PARALLEL TO THE LINE ON VERTICAL CONSTRUCTION AND PERPENDICULAR TO THE LINE ON HORIZONTAL OR TRIANGULAR CONSTRUCTION.
3. WHEN MAINTAINING EXISTING BANKS WITH BARE COPPER, REPLACE WITH #6 WP CU.

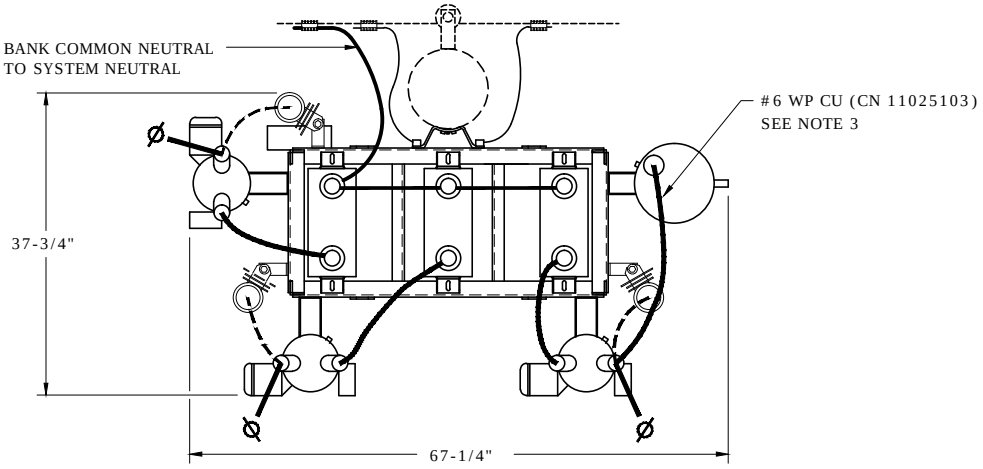
3				
2				
1	4/20/11	HOFFMAN	BURLISON	ELKINS
0	4/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

CAPACITOR BANK
GROUNDING WIRING

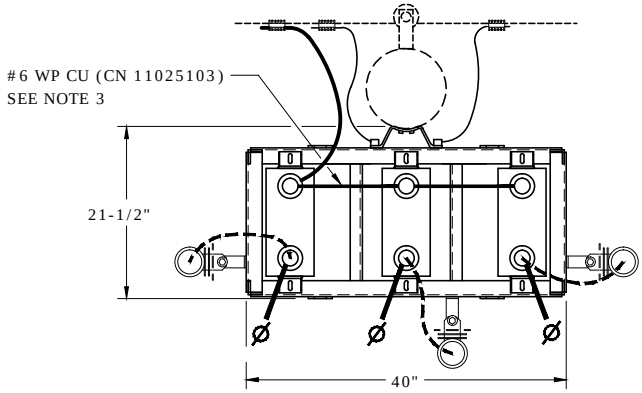
Progress Energy

CAR

DWG.
07.02-20



OIL SWITCHED BANKS



FIXED BANKS

NOTES:

1. ALL BANK HIGH VOLTAGE WIRING TO BE #6 SOLID SD WP CU.
2. BANK ORIENTATION IS TO BE PARALLEL TO THE LINE ON VERTICAL CONSTRUCTION AND PERPENDICULAR TO THE LINE FOR HORIZONTAL OR TRIANGULAR CONSTRUCTION.
3. INSULATED TUBING FOR ANIMAL PROTECTION IS SUPPLIED ON NEW BANKS.

3				
2				
1				
0	2/14/12	HOFFMAN	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

CAPACITOR RACK

HIGH VOLTAGE WIRING

Progress Energy

CAR

DWG. 07.02-25

POWER LINE CARRIER USED ON THE DISTRIBUTION SYSTEM IS CALLED DISTRIBUTION LINE CARRIER (DLC). DLC IS USED TO COMMUNICATE WITH CAPACITOR BANKS IN SOME AREAS. TO PREVENT THE COMMUNICATIONS SIGNAL FROM BEING DRAINED OFF TO GROUND, A CAPACITOR BLOCKING UNIT NEEDS TO BE INSTALLED BETWEEN THE CAPACITOR BANK NEUTRAL AND SYSTEM GROUND OF EACH WYE-CONNECTED CAPACITOR BANK WHERE DLC EXISTS. DLC EXISTS AT SOME SUBSTATIONS IN THE EASTERN, NORTHERN, AND SOUTHERN REGIONS IN ADDITION TO MUCH OF WESTERN REGION.

DLC IS BEING DECOMMISSIONED IN ALL AREAS AS WE MOVE TO CELLULAR COMMUNICATIONS TO CAPACITOR BANKS. ALL BLOCKING UNITS WILL BE REMOVED.

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	CAPBLOCKC	1	22062509	1	CAPACITOR BLOCKING UNIT

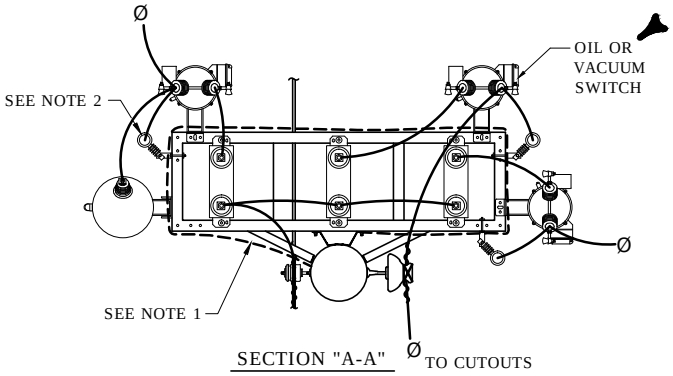
REVISED	BY	CK'D	APPR.
3				
2				
1				
0	7/11/10	GUINN	GUINN	ELKINS

CAPACITOR BLOCKING UNITS
IN DLC AREAS (FRO)

Progress Energy

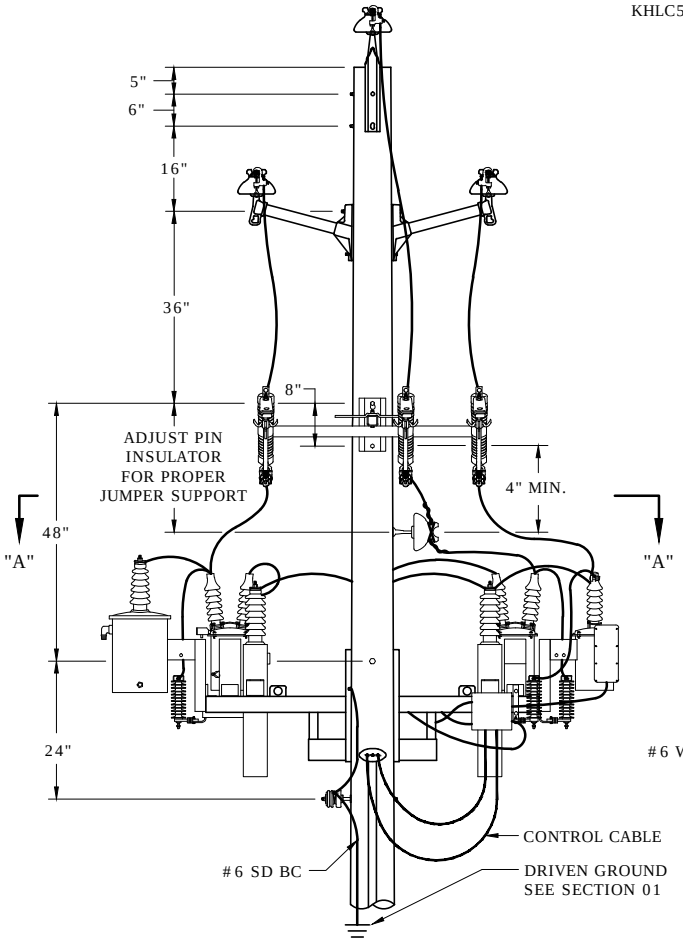
CAR

DWG. 07.03-17

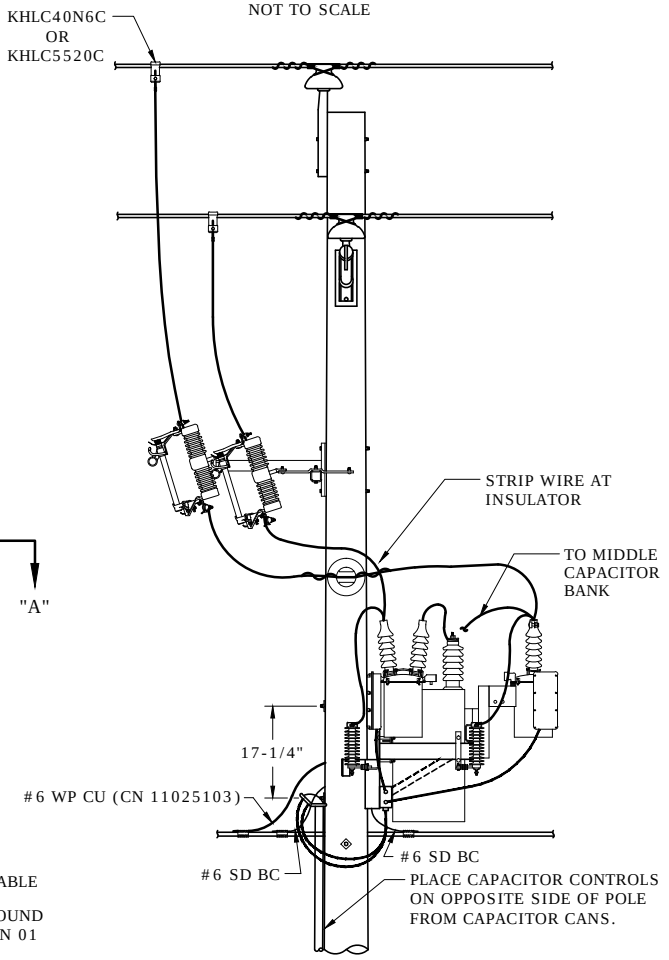


SECTION "A-A"

NOT TO SCALE



FRONT VIEW



SIDE VIEW

PT NOT SHOWN FOR CLARITY

NOTES:

1. SEE DWG. 07.02-20 FOR CAPACITOR BANK GROUNDING. USE DEEP DRIVEN GROUNDS INSTALLED PER SECTION 01.

2. CAPACITOR BANK COMES WITH ARRESTERS MOUNTED NEAR EQUIPMENT TO BE PROTECTED FROM THE FACTORY. IF INSTALLING AN EXISTING CAPACITOR BANK THAT DOES NOT HAVE ARRESTERS MOUNTED ON THE FRAME, INSTALL THEM AS SHOWN IN SECTION A-A OF THIS DRAWING AND ON DWG. 07.02-20.

3. SEE DWG. 07.03-20B FOR BILL OF MATERIALS.

4. CAPACITOR BANK LOCATION SHOWN ABOVE IS CONSIDERED STANDARD BUT CAN BE MODIFIED DUE TO EXTENUATING CIRCUMSTANCES (I.E., SEVERE CHANGE IN GRADE, BETTER/SAFER OPERATION OF SWITCHES, ETC.). ROAD AND FIELD SIDE LOCATION OF CAPACITOR BANK IS ACCEPTABLE BASED ON EXTENUATING CIRCUMSTANCES. FUSED CUTOUTS ARE TO BE LOCATED ON THE OPPOSITE SIDE OF THE POLE FROM THE CAPACITOR BANK.

REVISED	BY	CK'D	APPR.
4	4/24/15	SIMMONS	BURLISON	ADCOCK
3	2/14/12	HOFFMAN	BURLISON	ELKINS
2	8/31/11	BURLISON	BURLISON	ELKINS
0	7/11/10	GUINN	GUINN	ELKINS

TWO BUSHING SWITCHED CAPACITOR BANK

WYE CONNECTED

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	

07.03-20A

BILL OF MATERIALS				
MACRO UNIT	DESCRIPTION	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
C1200SW12CM	CAP BANK MU 1200KVAR SWITCHED 12.47KV	CAP1200SW23C	1	OVERHEAD CAPACITOR 1200 KVAR SWITCHED 23KV
		CCNTRLMAT4JC	1	CAP CONTROL ASSEMBLY WITH 4 JAW SOCKET
		TFUSE27CO100C	3	TRANS/CAP FUSE 27KV CUTOUT 100AMP
		BKTCOLATRISTLC	1	BKT FOR CUTOUT AND ARRESTER, TRIPLE MOUNT, STEEL
		PINSCREW6C	1	INSULATOR PIN SCREW 6" X 1" HEAD
		IPIN23C	1	INSULATOR PIN 23KV
C1200SW23CM	CAP BANK MU 1200KVAR SWITCHED 23KV			
C600SW12CM	CAP BANK MU 600KVAR SWITCHED 12.47KV			
C600SW23CM	CAP BANK MU 600KVAR SWITCHED 23KV			
C600SW35CM	CAP BANK MU 600KVAR SWITCHED 34.5KV			

NOTES:

1. SEE DWG. 07.03-20A FOR DESIGN SPECIFICATIONS.
2. USE #6 CU WP SD (CN 11025103) FOR ALL GROUNDING AND PRIMARY CONDUCTOR CONNECTIONS.

REVISED		BY	CK'D	APPR.
3				
2	1/30/14	KATIGBAK	GUINN	ADCOCK
1	4/21/11	HOFFMAN	BURLISON	ELKINS
0	4/22/10	GUINN	GUINN	ELKINS

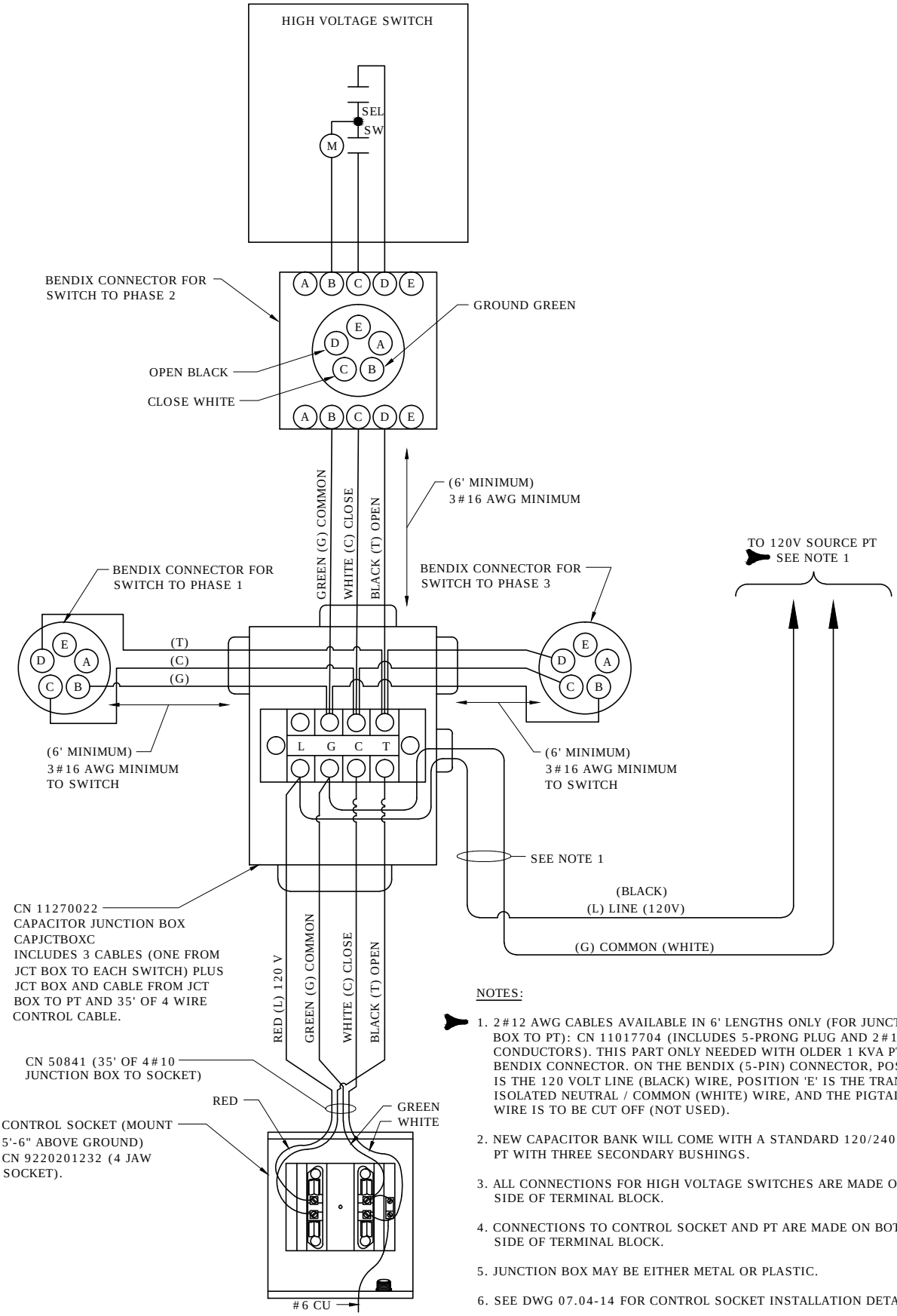
TWO BUSHING SWITCHED CAPACITOR BANK

WYE CONNECTED

DUKE ENERGY.

CAR

DWG. 07.03-20B



NOTES:

1. 2#12 AWG CABLES AVAILABLE IN 6' LENGTHS ONLY (FOR JUNCTION BOX TO PT): CN 11017704 (INCLUDES 5-PRONG PLUG AND 2#12 AWG CONDUCTORS). THIS PART ONLY NEEDED WITH OLDER 1 KVA PT WITH BENDIX CONNECTOR. ON THE BENDIX (5-PIN) CONNECTOR, POSITION 'A IS THE 120 VOLT LINE (BLACK) WIRE, POSITION 'E' IS THE TRANSFORMER ISOLATED NEUTRAL / COMMON (WHITE) WIRE, AND THE PIGTAIL (GREEN) WIRE IS TO BE CUT OFF (NOT USED).
2. NEW CAPACITOR BANK WILL COME WITH A STANDARD 120/240 VOLT PT WITH THREE SECONDARY BUSHINGS.
3. ALL CONNECTIONS FOR HIGH VOLTAGE SWITCHES ARE MADE ON TOP SIDE OF TERMINAL BLOCK.
4. CONNECTIONS TO CONTROL SOCKET AND PT ARE MADE ON BOTTOM SIDE OF TERMINAL BLOCK.
5. JUNCTION BOX MAY BE EITHER METAL OR PLASTIC.
6. SEE DWG 07.04-14 FOR CONTROL SOCKET INSTALLATION DETAIL.

3				
2				
1	2/7/13	SIMMONS	GUINN	ADCOCK
0	9/24/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

JUNCTION BOX - CAPACITOR BANK

Duke Energy

CAR

DWG. 07.03-40

LEGEND

1. LCD READOUT
2. REMOTE/LOCAL BUTTON
3. MANUAL TRIP BUTTON
4. MANUAL CLOSE BUTTON
5. POWER INDICATOR
6. 10 AMP FUSE
7. USB PORT FOR LAPTOP
8. CONTROLLER RESET BUTTON

BILL OF MATERIALS

CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
1	CCNTCELC	1	9220191066	1	CONTROL, CAPACITOR, AUTOMATED, 2-WAY, CELLULAR COMM.

NOTES:

1. SEE DWG. 07.04-12B FOR MANUAL OPERATION INSTRUCTIONS.

3					
2					
1					
0	10/26/10	GUINN	GUINN	ELKINS	
REVISED		BY	CK'D	APPR.	

CANNON 2-WAY CAPACITOR CONTROL

Progress Energy

CAR

DWG. 07.04-12A

MANUAL OPERATION:

- TO PUT THE CBC IN THE LOCAL MODE, PRESS THE LOCAL/REMOTE BUTTON ON THE BLUE KEYPAD LOCATED ON THE TOP LEFT OF THE CONTROL PANEL. AT THIS TIME, THE LED LOCATED TO THE LEFT OF " LOCAL" SHOULD BE LIT.

- TO RETURN THE CBC TO THE REMOTE/AUTOMATIC MODE, PRESS THE " LOCAL/REMOTE" BUTTON. AT THIS TIME, THE LED SHOULD GO OFF.

- TO CLOSE THE CAPACITOR BANK, PLACE THE CBC IN LOCAL MODE AND PRESS THE BLUE " CLOSE" BUTTON. THE "CLOSE" LIGHT WILL BLINK FAST FOR 30 SECONDS AND THEN THE CAPACITOR BANK WILL CLOSE AND THE "CLOSE" LIGHT WILL STOP BLINKING AND BE SOLID.

- A RECLOSE OPERATON IS DEFINED AS A " CLOSE" IMMEDIATELY AFTER A TRIP. THE CONTROL WILL NOT RECLOSE FOR 5 MINUTES.

- AFTER A TRIP OPERATION, THE " TRIP" LIGHT WILL BLINK FAST FOR 30 SECONDS WHILE VOLTAGE IS APPLIED TO THE SWITCHES, THEN BLINK SLOW FOR 5 MINUTES WHICH IS A VISUAL INDICATION THAT THE CONTROL IS IN THE 5 MINUTE RECLOSE DELAY PERIOD.

IF THE CBC IS LEFT IN LOCAL MODE FOR ANY REASON, PLEASE CONTACT THE DCC TO REPORT CAPACITOR BANK IS IN LOCAL MODE AND TAG IT. DCC WILL UPDATE THE BANK STATUS IN THE APPROPRIATE SYSTEMS.

ALL CANNON 7000 CONTROLLERS MUST BE PROGRAMMED BY DISTRIBUTION STANDARDS PROVISIONING SHOP PERSONNEL AND HAVE COMMUNICATIONS COMPONENT ACTIVATED, BEFORE INSTALLATION. RETURN ALL REMOVED CANNON 7000 CONTROLLERS TO THE DISTRIBUTION STANDARDS LAB AT THE EIC. CONTACT DCC FOR ANY QUESTIONS RELATIVE TO THIS CONTROL.

NOTES:

1. SEE DWG. 07.04-12A FOR CONTROL DETAILS AND BILL OF MATERIALS.

3				
2				
1				
0	4/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

CANNON 2-WAY CAPACITOR CONTROL

Progress Energy

CAR

DWG. 07.04-12B

BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	CCNTC8GXVZC	1	9220276739	1	CONTROL, CAPACITOR BANK, CBC-8000, SIERRA GX450
1	CCNTC8C	1	9220274968	1	CONTROL, CAPACITOR BANK, SOCKET MOUNTED, ETHERNET INTERF

NOTES:

1. REMOVE CONTROL FUSE BEFORE INSTALLING OR REMOVING CAPACITOR CONTROL.

2. SEE DWG. 07.04-13B FOR MANUAL OPERATION INSTRUCTIONS.

3				
2				
1				
0	12/2/15	BURLISON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

EATON CBC-8000 2-WAY CAPACITOR CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	

07.04-13A

CONTROLLER SUPPLIED WITH 4G ANTENNA (EITHER TWO DIVERSITY OR ONE CENTER MOUNT - MIMO)

CONTROL MUST BE SECURELY GROUNDED TO SYSTEM GROUND THROUGH THE USE OF THE GROUND LUG ON THE BOTTOM OF THE CONTROL ENCLOSURE. FAILURE TO GROUND THE CASE CAN CAUSE DAMAGE TO THE UNIT.

MANUAL OPERATION:

1. TO PUT THE CBC-8000 IN THE MANUAL MODE, PRESS THE GRAY "MANUAL" BUTTON ON THE BOTTOM SECTIONS OF THE CONTROL PANEL. THE LED IN THE UPPER LEFT CORNER OF THE GRAY "MANUAL" BUTTON SHOULD ILLUMINATE RED. THE LED IN THE UPPER LEFT CORNERS OF THE "REMOTE" AND "AUTO" GRAY BUTTONS SHOULD NOT BE LIT RED.

2. TO RETURN THE CBC-8000 TO THE REMOTE MODE, PRESS THE GRAY "REMOTE" BUTTON ON THE BOTTOM SECTIONS OF THE CONTROL PANEL. THE LED IN THE UPPER LEFT CORNER OF THE GRAY "REMOTE" BUTTON SHOULD ILLUMINATE RED. THE LED IN THE UPPER LEFT CORNERS OF THE "MANUAL" AND "AUTO" GRAY BUTTONS SHOULD NOT BE LIT RED.

3. TO MANUALLY CLOSE THE CAPACITOR BANK, PLACE THE CBC-8000 IN THE MANUAL MODE AND PRESS THE RED "CLOSE" BUTTON. AT THIS TIME, THE LED IN THE UPPER LEFT CORNER OF THE RED CLOSE BUTTON WILL BEGIN FLASHING. THE CAPACITOR BANK WILL MOVE TO THE CLOSE POSITION IN 60 SECONDS, OR 5 MINUTES ON A RECLOSE. AFTER THE CAPACITOR BANK CLOSES, THE LED LIGHT IN THE UPPER LEFT CORNER OF THE RED CLOSE BUTTON WILL REMAIN ILLUMINATED.

4. TO MANUALLY OPEN THE CAPACITOR BANK, PLACE THE CBC-8000 IN THE MANUAL MODE AND PRESS THE GREEN "TRIP" BUTTON. THE LED LIGHT IN THE UPPER LEFT CORNER OF THE "TRIP" BUTTON WILL ILLUMINATE.

IF THE CBC-8000 IS LEFT IN THE "MANUAL" OR "AUTO" MODE FOR ANY REASON, PLEASE CONTACT THE DCC TO REPORT REASON.

ALL EATON CBC-8000 CONTROLLERS MUST BE PROGRAMMED BY METER DEPARTMENT PERSONNEL BEFORE INSTALLATION, AND HAVE COMMUNICATIONS COMPONENT ACTIVATED. RETURN ALL REMOVED EATON CBC-8000 CONTROLLERS TO THE METER SHOP. REFER TO METER SHOP FOR ANY QUESTIONS RELATIVE TO THIS TYPE OF CAPACITOR CONTROL.

NOTES:

1. SEE DWG. 07.04-13A FOR CONTROL DETAILS AND BILL OF MATERIALS.

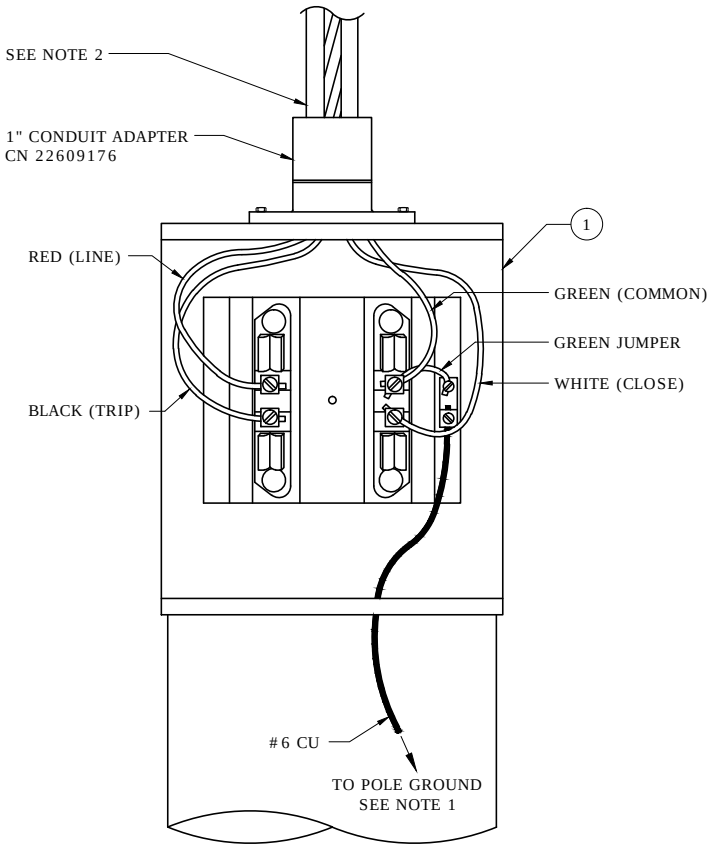
3				
2				
1				
0	12/2/15	BURLISON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

EATON CBC-8000 2-WAY CAPACITOR CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	

07.04-13B



BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
1	CCNTRLMAT4JC	1	10311900	45	SCREW, LAG, 1/4 IN X 2 IN, STEEL, LAG, HX, 1/4 X 2", GALV 1/4-INC
			11061009	3	WIRE, TIE, #6, SOLID SOFT DRAWN BARE COPPER, TIE, 6-SLD, CU, SO
			11195005	1	CONNECTOR, COMPRESSION, #6 SLD - #4 SLD, CU PARALLEL TYPE COPPER
			21004601	25	CONDUIT, PVC, 1" X 10', SCH 40 GRAY
			22609176	1	ADAPTER, PVC, SOCXMNPT, 1", PVC, TERM 1-INCH PVC MALE TERMINAL
			9220201232	1	SOCKET, METER, 1/2 TO 5/8 IN, STD HUB ON TOP, CAPACITOR CONT

NOTES:

1. CONNECT TO POLE GROUND USING CRIMP TYPE CONNECTOR.

2. 1 INCH CONDUIT, COUPLING AND CONTROL CABLE IS INCLUDED IN CAPACITOR BANK COMPATIBLE UNIT.

REVISED		BY	CK'D	APPR.
3				
2				
1	6/16/11	HOFFMAN	BURLISON	ELKINS
0	7/11/10	GUINN	GUINN	ELKINS

SOCKET MOUNTING AND WIRING SCHEME

SOCKET MOUNT TYPE CONTROLS

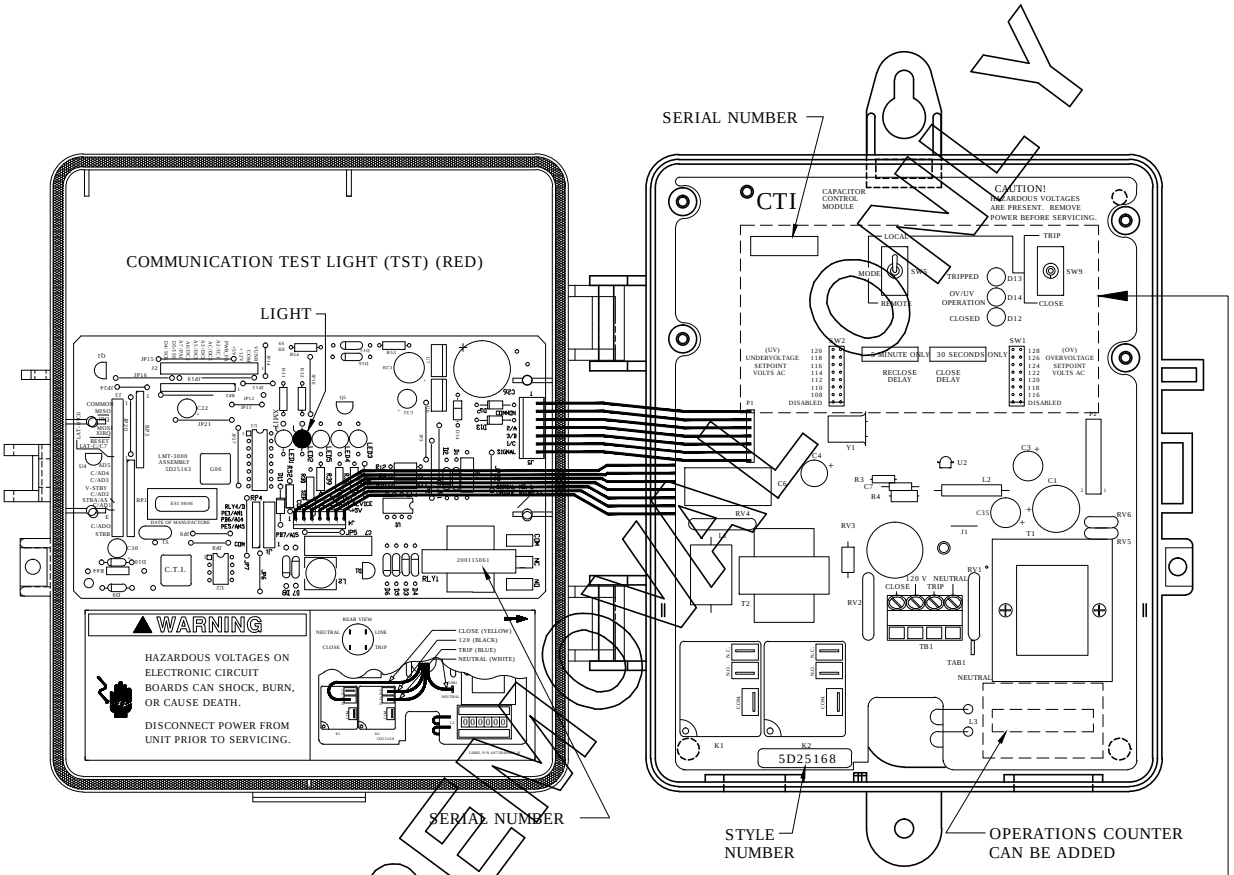
Progress Energy

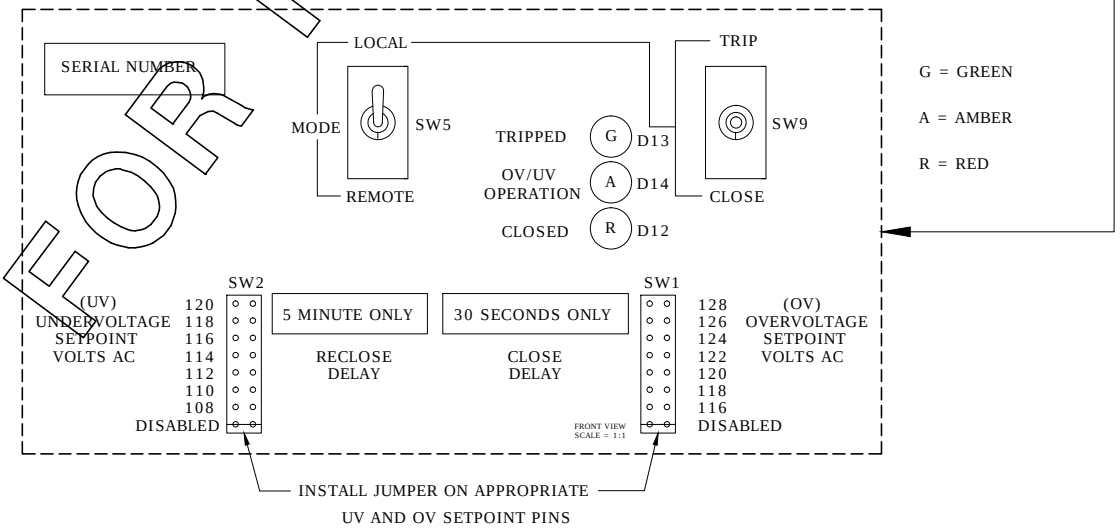
CAR

DWG. 07.04-14

DLC CAPACITOR BANK CONTROLLER

CU CCNTDLCC
CN 11210804



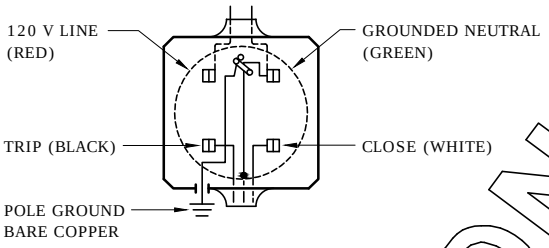


3					DLC CAPACITOR BANK CONTROLLER WITH HIGH AND LOW VOLTAGE OVERRIDE (FRO)
2					
1					
0	7/11/10	GUINN	GUINN	ELKINS	
REVISED		BY	CK'D	APPR.	

Progress Energy

CAR

DWG. 07.05-10



DLC OR CELLULAR CONTROLS

NOTES:

1. THE NORMAL MODE OF OPERATION OF THIS CAPACITOR CONTROLLER IS BY THE CENTRALIZED CAPACITOR CONTROL COMPUTER VIA (DLC) POWER LINE CARRIER OR VIA PAGING. FOR NORMAL OPERATION, THE LOCAL/REMOTE SWITCH (SW5) MUST BE IN THE REMOTE POSITION.

2. FOR MANUAL OPERATION OF THE CAPACITOR BANK, SET THE "LOCAL/REMOTE" SWITCH (SW5) TO LOCAL AND SET THE TRIP/NEUTRAL /CLOSE TOGGLE SWITCH (SW9) TO THE DESIRED STATUS POSITION ("CLOSE" OR "TRIP"). AFTER A "TRIP" OR "CLOSE", THE SWITCH SW5 ALWAYS SPRINGS BACK TO THE NEUTRAL POSITION.

   THE PRESET TIME DELAYS SHOWN BELOW ARE ALWAYS IN EFFECT:

   A. CLOSE DELAY - 30 SECONDS
   B. RECLOSE DELAY - 5 MINUTES (INITIATED IMMEDIATELY AFTER TRIP)

3. THIS COMMUNICATING RECEIVER CAN DIRECTLY REPLACE ANY TIME OR VOLTAGE CONTROL IN THE SAME 4-PRONG METER BASE. THE 6-PRONG METER BASE OF ANY CURRENT. VAR. OR POWER FACTOR CONTROL MUST BE RECONNECTED TO 4-PRONG CONFIGURATION TO ALLOW REPLACEMENT BY THIS COMMUNICATING CONTROLLER.

4. THE OVER-VOLTAGE (OV) AND THE UNDER-VOLTAGE (UV) OVERRIDES ARE SET MANUALLY BY INSTALLING A BLUE JUMPER ON THE DESIRED SET OF PINS. A HORIZONTAL JUMPER WILL GIVE AN OV/UV AT THE VOLTAGE NUMBER JUMPERED. TWO HORIZONTAL JUMPERS ADJACENT (ABOVE AND BELOW) AT 126 VOLTS AND 128 VOLTS PRODUCES AN OVERVOLTAGE LIMIT OF 127 VOLTS AS THE SET-POINT.

3				
2				
1				
O	7/11/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

DLC/PAGING CAPACITOR CONTROLLER (FRO)

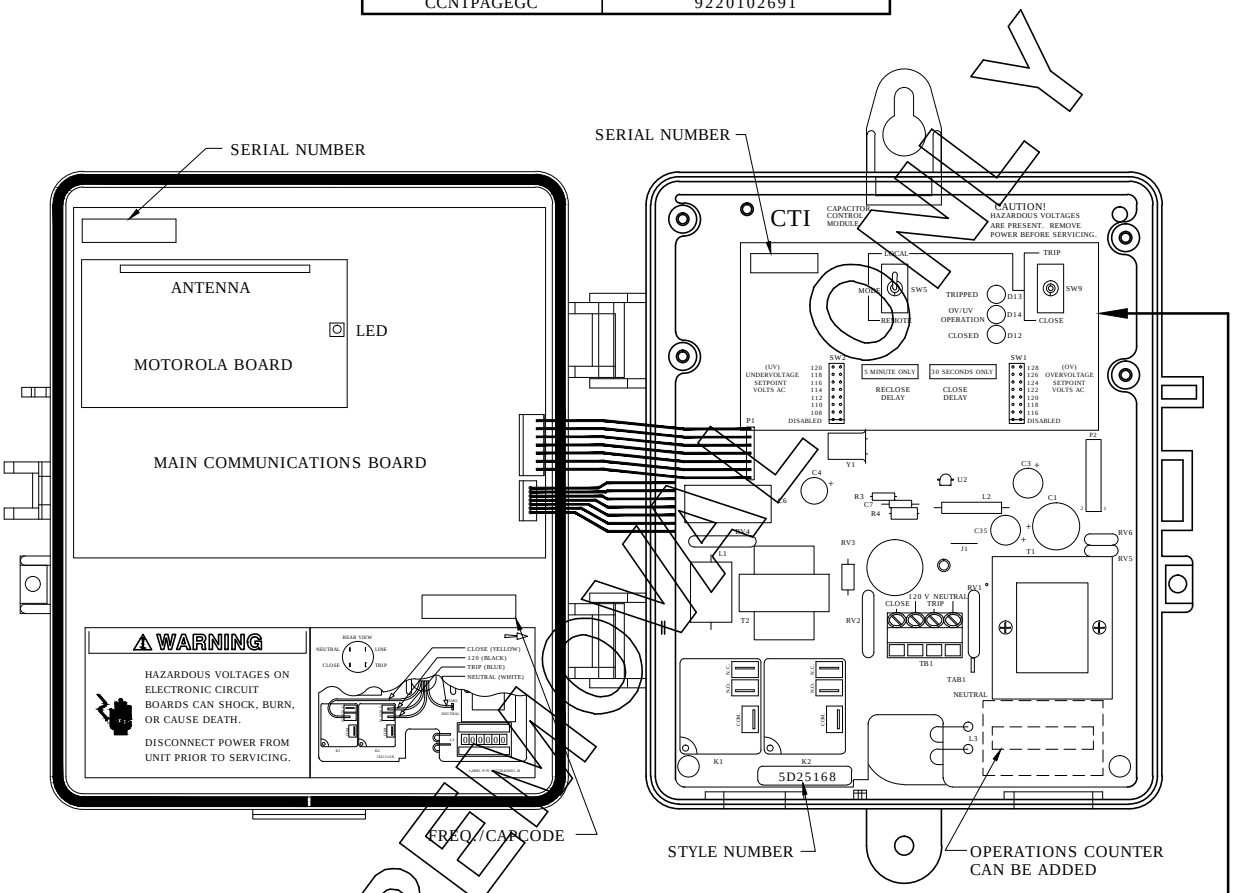
Progress Energy

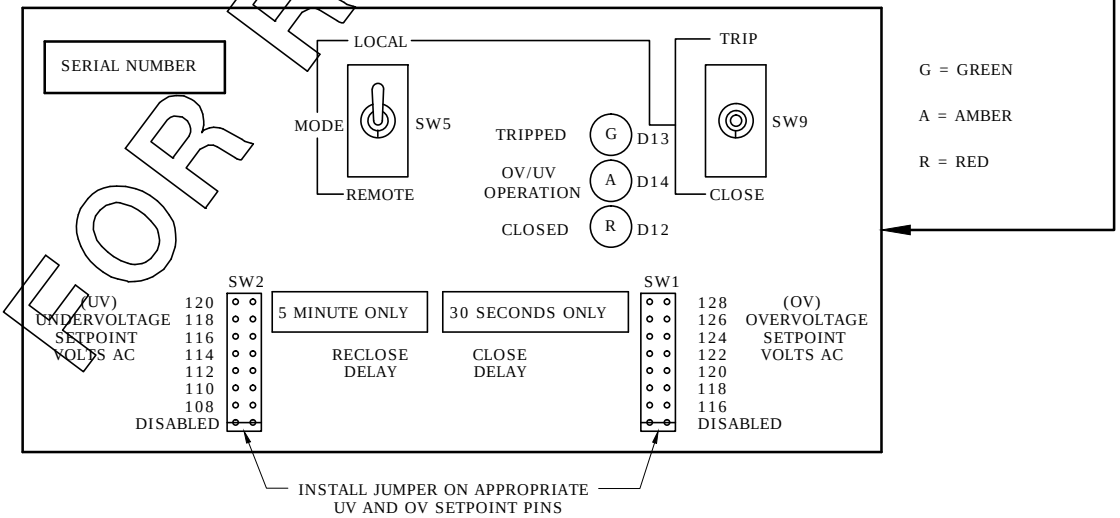
CAR

DWG. 07.05-15

PAGING CAPACITOR BANK CONTROLLER
WITH HIGH AND LOW VOLTAGE OVERRIDE

COMPATIBLE UNIT CONTROL	CATALOG NUMBER
CCNTPAGEGC	9220102691





NOTES:

1. UV/OV SAMPLES FOR 4 MINUTES BEFORE INITIATING SWITCHING.

2. SEE DWG. 07.02-30 IF AN EXTERNAL ANTENNA IS NEEDED.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 — 7/11/10	GUINN	GUINN	ELKINS

PAGING CAPACITOR BANK CONTROLLER
WITH HIGH AND LOW VOLTAGE OVERRIDE (FRO)

Progress Energy

CAR

DWG. 07.05-20

CATALOG NO./ COMP. UNIT	RATED VOLTS	VOLTS (KV) SET	KVA RATED	AMPS @10%	AMPS @5%	A-65°C @5% ***	MOUNTING	BASE MOUNTING DIMENSIONS*	WEIGHT (LBS)	MAX HEIGHT
12990008**	14.4	13.2 OR 7.2	72	50	80	90	POLE/PLATFORM	20" X 20"	1800	75"
12990404 REG100A13C	14.4	13.2 OR 7.2	144	100	160	179	POLE/PLATFORM	26" X 26"	2390	78"
12990701 REG200A14C	14.4	13.2 OR 7.2	288	200	320	358	PLATFORM	32" X 25"	3135	84"
9220170135 REG300A13C	14.4	13.2 OR 7.2	432	300	480	538	PLATFORM/STAND	35" X 29"	4810	105"

* BASE MOUNTING HOLE DIMENSIONS VARY BY VENDOR

** NO LONGER PURCHASED

*** THE A-65C @ 5% RATING IS A CONTINUOUS AMPERE RATING BASED ON THE REGULATION BEING LIMITED TO ±5%.
CONSULT WITH DISTRIBUTION STANDARDS FOR MAXIMUM AMPERE RATINGS WHEN REGULATION IS LIMITED TO SOME OTHER VALUE.

NOTES:

1. ALL OPTIONS INCLUDE REVERSE POWER FLOW, VOLTAGE REDUCTION, VOLTAGE LIMIT AND METERING.
2. 14.4 REGULATORS MAY BE USED ON 13.2 OR 7.2KV TAP. THEY COME SET FROM THE FACTORY FOR USE ON 13.2KV TAP. GARNER REPAIR SHOP MUST CONVERT THEM FOR USE ON 7.2 SYSTEM.
3. CN 9220170135 (CU REG300A13C) REQUIRES A CENTER STUB IF MOUNTED ON A PLATFORM.
4. SEE DWG. 12.07-01 FOR STAINLESS STEEL REGULATORS. THESE UNITS ARE ONLY TO BE USED IN DESIGNATED COASTAL AREAS.
5. ANY WORK ORDER FOR INSTALLATION, MAINTENANCE, REPLACEMENT, OR REMOVAL OF A REGULATOR(S) SHOULD INCLUDE THE CU SITEEVALC TO ENSURE THE I&C TECHNICIAN COORDINATES CHANGES WITH THE DISTRIBUTION CONTROL CENTER.

REVISED		BY	CK'D	APPR.
3				
2	2/1/13	SIMMONS	GUINN	ADCOCK
1	2/13/12	SIMMONS	BURLISON	ELKINS
0	7/11/10	SIMMONS	GUINN	ELKINS

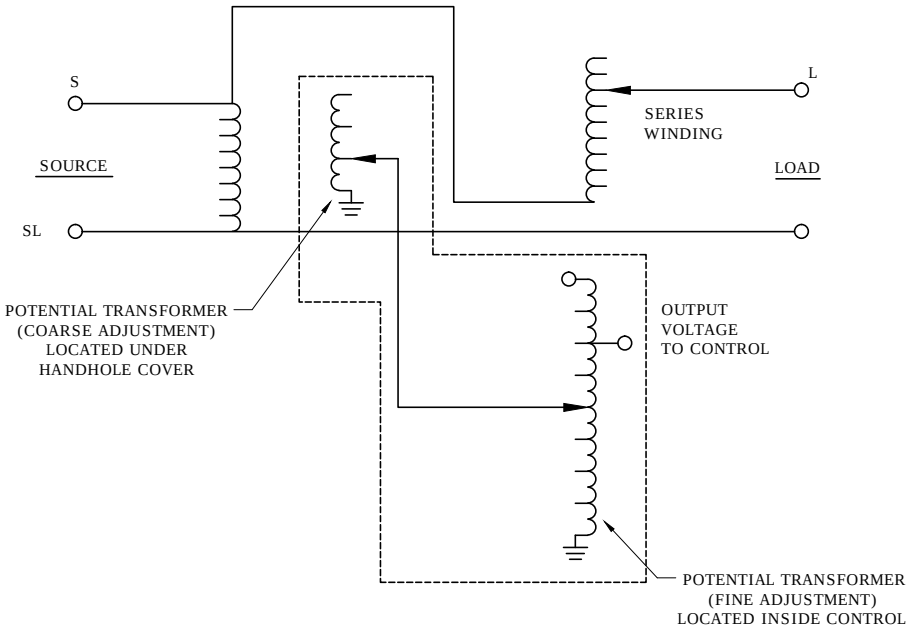
REGULATOR DESCRIPTION

Duke Energy®

CAR

DWG. 07.10-05

TYPICAL VOLTAGE REGULATOR CIRCUIT



THE VOLTAGE SUPPLY REQUIREMENTS OF THE TYPICAL VOLTAGE REGULATOR ARE MET THROUGH THE USE OF POTENTIAL TRANSFORMERS. THESE TRANSFORMERS, LIKE THOSE USED IN METERING APPLICATIONS, ARE USED TO RAISE OR LOWER PRIMARY LINE VOLTAGE TO USABLE LEVELS. IN THIS CASE, THE USABLE LEVEL IS 120 VAC AND IS USED TO SUPPLY THE TAP-CHANGING MOTOR AND THE REGULATOR CONTROL PANEL.

PROGRESS ENERGY USES DISTRIBUTION SYSTEM VOLTAGES OF 13.2 KV OR 13.8 KV Ø-G AND 7.2 KV Ø-G. SINCE INDUSTRY STANDARD VOLTAGES FOR REGULATORS ARE 14.4 KV Ø-G AND 7.62 KV Ø-G, SOME ADJUSTMENT OF THE POTENTIAL TRANSFORMERS IS NECESSARY FOR CORRECT OPERATION ON OUR SYSTEM.

THIS VOLTAGE ADJUSTMENT TAKES PLACE ON TWO LEVELS: 1) A COARSE ADJUSTMENT AND 2) A FINE ADJUSTMENT. THE COARSE ADJUSTMENT IS SET AT 120:1 FOR 14.4 KV CLASS REGULATORS AND 60:1 FOR 7.62 CLASS REGULATORS. THE COARSE ADJUSTMENT IS FOUND INSIDE THE REGULATOR TANK USUALLY JUST UNDER THE HANDHOLE COVER. USE OF THE COARSE ADJUSTMENT POTENTIAL TRANSFORMER ALONE RESULTS IN AN OUTPUT VOLTAGE OF 110 VOLTS ON 13.2 KV LINES AND 120 VOLTS ON 7.2 KV LINES.

SINCE THE OUTPUT VOLTAGE IS ONLY 110V ON 13.2 KV LINES, SOME FINE ADJUSTMENT IS NECESSARY. IN THIS EXAMPLE, THE INPUT LEAD OF THE FINE ADJUSTMENT TRANSFORMER MUST BE MOVED TO A TAP CLOSER TO GROUND TO RAISE THE TOTAL VOLTAGE SUPPLYING THE CONTROL TO 120 VAC. THE FINE ADJUSTMENT POTENTIAL TRANSFORMER IS LOCATED INSIDE THE CONTROL BOX. INSTEAD OF HAVING FINE ADJUSTMENT POINTS, NEWER REGULATORS CAN HAVE ADJUSTMENTS MADE INSIDE CONTROL SOFTWARE AND NOT REQUIRE FINE ADJUSTMENT POINT.

THE CORRECT CONNECTIONS AT VARIOUS PRIMARY VOLTAGES FOR BOTH POTENTIAL TRANSFORMERS CAN BE FOUND ON THE NAMEPLATE OF THE REGULATOR. AN EXAMPLE OF REGULATOR NAMEPLATE DATA BEING USED TO MAKE COARSE AND FINE VOLTAGE ADJUSTMENTS CAN BE FOUND ON DWG. 07.30-05B. THESE CONNECTIONS MUST BE CHECKED BEFORE A REGULATOR IS PLACED INTO SERVICE. FURTHER INFORMATION CAN BE FOUND IN THE USER'S MANUAL AND SPECIFICATION DRAWINGS LOCATED INSIDE THE REGULATOR CONTROL.

REFERENCE DWG. 07.10-05 FOR PRESET VOLTAGE RATING (VOLTS(KV) SET). ANY OTHER VOLTAGE SETTING MUST BE ARRANGED THROUGH THE GARNER REPAIR SHOP.

3				
2				
1				
0	7/11/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VOLTAGE REQUIREMENTS FOR
DISTRIBUTION REGULATORS

Progress Energy

CAR

DWG. 07.10-10

PROCEDURE TO DETERMINE WHEN REGULATOR TAP-CHANGER IS ON-NEUTRAL POSITION

PURPOSE:

TO PROVIDE OPERATING PROCEDURES FOR PROGRESS ENERGY DISTRIBUTION OPERATIONS PERSONNEL WHEN BYPASSING REGULATORS.

GENERAL:

IF REGULATORS ARE NOT IN THE NEUTRAL POSITION WHEN BYPASSED, THEY WILL FREQUENTLY FAIL AS A RESULT OF HIGH CIRCULATING CURRENTS INSIDE THE REGULATOR. THESE CIRCULATING CURRENTS ARE CAUSED BY A SHORT-CIRCUITING OF THE SERIES WINDING, AND ARE NOT DETECTED BY DISTRIBUTION LINE PROTECTIVE EQUIPMENT UNTIL THE FAULT CURRENT HAS DAMAGED THE REGULATOR.

TO BYPASS A REGULATOR, THE REGULATOR TAP-CHANGER MUST FIRST BE PLACED IN THE NEUTRAL POSITION. IF A LINEMAN PROCEEDS TO CLOSE THE BYPASS SWITCH WITH THE TAP-CHANGER AT SOME POSITION OTHER THAN NEUTRAL, PART OR ALL OF THE SERIES WINDING WILL BE SHORT-CIRCUITED. CIRCULATING CURRENTS CAN RANGE FROM 10,000 TO 30,000 AMPS.

SET REGULATOR TO NEUTRAL POSITION:

THERE ARE SEVERAL METHODS OF DETERMINING THE NEUTRAL POSITION. LISTED ARE FIVE METHODS; USE AS MANY METHODS AS NEEDED TO ASSURE REGULATOR IS ON NEUTRAL (2 OR MORE).

1. POSITION INDICATOR - THE POSITION INDICATOR IS MECHANICALLY DRIVEN BY THE TAP CHANGER. IT REGISTERS ALL 32 STEPS AND NEUTRAL. THIS IS THE MOST RELIABLE METHOD BUT IS NOT FOOLPROOF.
   A. CHECK THE POSITION INDICATOR'S SETTING.
   B. TURN REGULATOR "AUTO- OFF- RAISE/LOWER" CONTROL SWITCH TO THE DESIRED POSITION FOR RAISING OR LOWERING THE REGULATOR SETTING.
   C. RAISE OR LOWER THE REGULATOR SETTING TO REACH "NEUTRAL" INDICATION.

2. NEUTRAL INDICATOR LIGHT - THE LIGHT IS ACTIVATED BY A SWITCH ON THE TAP CHANGER WHICH CLOSES THE LIGHT CIRCUIT WHEN THE NEUTRAL POSITION IS REACHED. CHECK THE NEUTRAL INDICATOR LIGHT TO ENSURE IT IS "ON" WHEN THE REGULATOR POSITION INDICATOR POINTS TO NEUTRAL POSITION.

3. "HASTINGS REGULATOR NEUTRAL DETECTOR (RND) ON APPROVED HOT STICK". - THE HASTINGS RND, CATALOG NUMBER 6709-1, MUST BE USED IN CONJUNCTION WITH AN INSULATED HOT STICK. THE RND PROBES MUST BE PLACED BETWEEN ONLY THE SOURCE AND LOAD CONDUCTORS OF THE REGULATOR, IN A POSITION AWAY FROM ANY GROUND POTENTIAL. THE NEUTRAL POSITION WILL BE THE POSITION IN WHICH THE LOWEST RND READING IS OBTAINED. RND TESTING PROCEDURES ARE INSIDE THE RND CASE.

4. PD 50 PHASING VOLTMETER
   A. SELECT 2KV ON SELECTOR SWITCH ON METER PROBE.
   B. TAKE READING BETWEEN "S" AND "L" BUSHING USING PD 50 ATTACHED TO APPROPRIATE LENGTH STICK. READING LESS THAN 5 VOLTS CAN BE CONSIDERED IN THE NEUTRAL POSITION. IF READING GREATER THAN 5 VOLTS, STEP IN EITHER DIRECTION AND RECHECK WITH PD 50. IF LESS THAN 5 VOLT READING IS NOT OBTAINABLE, CONTACT DCC AND DE-ENERGIZE LINE AT AN UPSTREAM DEVICE.

   ADDITIONAL INFORMATION REGARDING PD 50 OPERATIONS CAN BE FOUND IN THE OPERATIONS QUICK REFERENCE MANUAL.

5. MANUAL STEPPING OF REGULATOR FROM MAXIMUM RAISE OR LOWER POSITION TO NEUTRAL (LEAST PREFERRED METHOD):
   A. SHOULD THE NEUTRAL INDICATOR LIGHT FAIL TO GIVE AN INDICATION AND ONLY ONE NEUTRAL INDICATION IS DETERMINED, THEN CHECK THE REGULATED VOLTAGE ON THE PANEL TO ASSIST IN DETERMINING IF THE REGULATOR CAN BE RAISED TO FULL RAISE POSITION WITHOUT RISKING A VOLTAGE LEVEL ABOVE THE REGULATED LIMIT, OR IF THE REGULATOR CAN BE LOWERED TO THE LOWEST POSITION WITHOUT RISKING A VOLTAGE LEVEL BELOW THE REGULATED LIMIT.
   B. THE NEUTRAL POSITION CAN BE FOUND BY MANUALLY STEPPING THE REGULATOR FROM MAXIMUM LOWER OR MAXIMUM RAISE POSITION AND COUNTING ALL THE STEPS. THE NUMBER OF STEPS REQUIRED TO REACH NEUTRAL WILL VARY DEPENDING ON WHAT THE REGULATION IS SET TO ON THE TAP-CHANGER HEAD:
      1. ±10% REGULATION WILL REQUIRE 16 STEPS TO REACH NEUTRAL.
      2. ±8.75% REGULATION WILL REQUIRE 14 STEPS TO REACH NEUTRAL.
      3. ±7.5% REGULATION WILL REQUIRE 12 STEPS TO REACH NEUTRAL.
      4. ±6.25% REGULATION WILL REQUIRE 10 STEPS TO REACH NEUTRAL.
      5. ±5% REGULATION WILL REQUIRE 8 STEPS TO REACH NEUTRAL.

REVISED		BY	CK'D	APPR.
3				
2				
1	7/15/11	SIMMONS	BURLISON	ELKINS
0	10/14/10	SIMMONS	GUINN	ELKINS

VOLTAGE REGULATOR BYPASSING

DETERMINATION OF TAP-CHANGER ON-NEUTRAL

Progress Energy

PGN

DWG. 07.10-15A

PROCEDURE TO ENERGIZE SINGLE-PHASE DISTRIBUTION LINE VOLTAGE REGULATOR(S)

1. CALL DCC AND NOTIFY OF PLANNED WORK TO ENERGIZE REGULATOR. PROVIDE FEEDER NAME AND LOCID NUMBER AT THE SITE.

2. PRE-JOB BRIEFING SHALL INCLUDE THE WARNING THAT SOURCE AND LOAD DISCONNECTS FOR REGULATOR SHALL NEVER BE BOTH CLOSED UNLESS REGULATOR IS IN NEUTRAL POSITION AND VERIFIED TO BE IN NEUTRAL BY TWO METHODS AS DESCRIBED IN DISTRIBUTION SPECIFICATIONS.

3. PLACE HOT LINE TAG ON NEAREST SOURCE SIDE DEVICE IN ACCORDANCE WITH STANDARD PROCEDURE. IF WORKING OFF-SYSTEM (I.E. T/D JOB) COORDINATE HOT LINE TAG WITH APPROPRIATE OFF-SYSTEM OPERATIONS PERSONNEL.

4. REGULATOR SHOULD BE INSTALLED WITH BYPASS DISCONNECT CLOSED AND SOURCE AND LOAD DISCONNECTS OPEN AND ALL PERMANENT JUMPERS INSTALLED (PREFERRED CONSTRUCTION). IF A TEMPORARY JUMPER HAS BEEN INSTALLED AROUND THE INLINE DEAD-END, THE SOURCE AND LOAD DISCONNECTS SHALL BE VERIFIED TO BE OPEN. CLOSE BYPASS DISCONNECT AND REMOVE THE TEMPORARY JUMPER.

5. VERIFY THAT REGULATOR IS IN NEUTRAL POSITION. IF NOT, CLOSE SOURCE DISCONNECT AND SWITCH THE REGULATOR CONTROL TO MANUAL POSITION AND OPERATE REGULATOR TO NEUTRAL POSITION. VERIFY NEUTRAL POSITION BY TWO METHODS IN ACCORDANCE WITH DISTRIBUTION SPECIFICATIONS. WHEN NEUTRAL POSITION IS VERIFIED TURN CONTROL TO OFF POSITION AND REMOVE ALL CONTROL FUSES .

6. PERSON IN CHARGE SHALL VERIFY THAT BYPASS DISCONNECT IS CLOSED, SOURCE DISCONNECT IS CLOSED, LOAD DISCONNECT IS OPEN, REGULATOR IS ON NEUTRAL POSITION, CONTROL IS OFF, AND ALL CONTROL FUSES ARE REMOVED. PERSON IN CHARGE SHALL EXAMINE THE WORK ZONE AND STOP ANY ACTIVITY THAT MAY BE DISTRACTING TO THE PERSON IN CHARGE OR THE PERSON WHO WILL CLOSE THE LOAD DISCONNECT. PERSON IN CHARGE WILL THEN AUTHORIZE THAT LOAD SIDE DISCONNECT BE CLOSED.

7. CLOSE LOAD SIDE DISCONNECT. VERIFY THAT BYPASS, SOURCE AND LOAD DISCONNECTS ARE ALL CLOSED, AND OPEN BYPASS DISCONNECT.

8. INSTALL ALL CONTROL FUSES . SWITCH CONTROL TO AUTO POSITION.

9. REPEAT PROCESS IF MULTIPLE REGULATORS ARE INSTALLED, SUCH AS A THREE PHASE BANK.

10. REMOVE HOT LINE TAG.

11. NOTIFY DCC THAT WORK IS COMPLETE, AND REGULATOR IS IN SERVICE.

12. NOTIFY LOCAL ENGINEER THAT REGULATOR IS IN SERVICE.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	9/5/14	GUINN	GUINN	ADCOCK
0	4/1/10	GUINN	GUINN	ELKINS

VOLTAGE REGULATOR BYPASSING

ENERGIZING PROCEDURE

DEC	DEM	DEP	DEF
		X	X

07.10-15B

PROCEDURE TO DE-ENERGIZE SINGLE-PHASE DISTRIBUTION LINE VOLTAGE REGULATOR(S)

1. CALL DCC AND NOTIFY OF PLANNED WORK TO DE-ENERGIZE REGULATOR. PROVIDE FEEDER NAME AND LOCID NUMBER AT THE SITE.

2 PRE-JOB BRIEFING SHALL INCLUDE THE WARNING THAT BYPASS DISCONNECT SHALL NEVER BE CLOSED UNLESS REGULATOR IS IN NEUTRAL POSITION AND VERIFIED TO BE IN NEUTRAL BY TWO METHODS AS DESCRIBED IN DISTRIBUTION SPECIFICATIONS. CONTROL MUST ALSO BE IN THE OFF POSITION WITH ALL CONTROL FUSES REMOVED.

3. A HOT LINE TAG NORMALLY IS NOT REQUIRED TO DE-ENERGIZE A LINE REGULATOR. HOWEVER, PERSON IN CHARGE MAY DECIDE TO PLACE ONE IF DEEMED NECESSARY. PLACE HOT LINE TAG ON NEAREST SOURCE SIDE DEVICE IN ACCORDANCE WITH STANDARD PROCEDURE. IF WORKING OFF-SYSTEM (I.E. T/D JOB) COORDINATE HOT LINE TAG WITH APPROPRIATE OFF-SYSTEM OPERATIONS PERSONNEL.

4. VERIFY THAT SOURCE AND LOAD DISCONNECTS ARE CLOSED AND BYPASS DISCONNECT IS OPEN.

5. SWITCH THE REGULATOR CONTROL TO MANUAL POSITION AND OPERATE REGULATOR TO NEUTRAL POSITION. VERIFY NEUTRAL POSITION BY TWO METHODS IN ACCORDANCE WITH DISTRIBUTION SPECIFICATIONS. WHEN NEUTRAL POSITION IS VERIFIED TURN CONTROL TO OFF POSITION AND REMOVE ALL CONTROL FUSES.

6. PERSON IN CHARGE SHALL VERIFY THAT SOURCE AND LOAD DISCONNECTS ARE CLOSED, BYPASS SWITCH IS OPEN, REGULATOR IS ON NEUTRAL POSITION, CONTROL IS OFF, AND ALL CONTROL FUSES ARE REMOVED. PERSON IN CHARGE SHALL EXAMINE THE WORK ZONE AND STOP ANY ACTIVITY THAT MAY BE DISTRACTING TO THE PERSON IN CHARGE OR THE PERSON WHO WILL CLOSE THE BY-PASS DISCONNECT. PERSON IN CHARGE WILL THEN AUTHORIZE THAT BY-PASS DISCONNECT BE CLOSED.

7. CLOSE BYPASS DISCONNECT. VERIFY THAT BYPASS, SOURCE AND LOAD DISCONNECTS ARE ALL CLOSED. OPEN LOAD DISCONNECT. OPEN SOURCE DISCONNECT.

8. INSTALL ALL CONTROL FUSES.

9. REPEAT PROCESS IF MULTIPLE REGULATORS ARE INSTALLED, SUCH AS A THREE-PHASE BANK.

10. REMOVE HOT LINE TAG IF ONE WAS PLACED.

11. NOTIFY DCC THAT WORK IS COMPLETE AND REGULATOR IS OUT OF SERVICE.

3				
2				
1				
0	4/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VOLTAGE REGULATOR BYPASSING

DE-ENERGIZING PROCEDURE

Progress Energy

PGN

DWG. 07.10-15C

PROCEDURE TO DE-ENERGIZE SINGLE-PHASE DISTRIBUTION LINE VOLTAGE REGULATOR

THAT IS NOT OPERATING AND IS OFF-NEUTRAL POSITION

1. (PEC ONLY) NOTIFY DISTRIBUTION I & C GRID TECH THAT A REGULATOR IS STUCK OFF-NEUTRAL AND SHOULD BE REPAIRED. IF POSSIBLE, DISTRIBUTION GRID TECH SHOULD PERFORM THIS PROCEDURE. IF FAILS, GO TO STEP 2.

2. DISTRIBUTION PERSONNEL TO CALL DCC AND NOTIFY OF PLANNED WORK TO DE-ENERGIZE A REGULATOR STUCK OFF NEUTRAL. PROVIDE FEEDER NAME AND LOCID NUMBER AT THE SITE.

3. PRE-JOB BRIEFING SHALL INCLUDE THE WARNING THAT BYPASS DISCONNECT FOR REGULATOR SHALL NEVER BE CLOSED UNLESS REGULATOR IS DE-ENERGIZED OR IN NEUTRAL POSITION AND VERIFIED TO BE IN NEUTRAL BY TWO METHODS AS DESCRIBED IN DISTRIBUTION SPECIFICATIONS.

4. PLACE HOT LINE TAG ON NEAREST SOURCE SIDE DEVICE IN ACCORDANCE WITH STANDARD PROCEDURE. IF WORKING OFF-SYSTEM (I. E. T/D JOB) COORDINATE HOT LINE TAG WITH APPROPRIATE OFF-SYSTEM OPERATIONS PERSONNEL.

5. IF POSSIBLE, MAKE REPAIR TO REGULATOR SO THAT IT CAN BE STEPPED TO NEUTRAL POSITION AND IF ADDITIONAL MAINTENANCE IS REQUIRED WHICH REQUIRES THE REGULATOR TO BE REMOVED FROM SERVICE FOLLOW STANDARD PROCEDURE FOR REMOVING A REGULATOR FROM SERVICE.

6. IF REGULATOR CAN NOT BE STEPPED TO NEUTRAL THE REGULATOR WILL HAVE TO BE DE-ENERGIZED TO REMOVE FROM SERVICE.

7. REGULATOR MUST BE DROPPED BY NEAREST SOURCE-SIDE LOAD BREAK DEVICE. IF THERE IS NO NEARBY LOADBREAK SINGLE-PHASE (PREFERRED) OR THREE-PHASE SWITCH THAT CAN BE OPENED TO CLEAR THE REGULATOR THEN A LINE CREW SHOULD BE ARRANGED TO INSTALL A SINGLE-PHASE LOAD BREAK SWITCH ON THE NEAREST SOURCE-SIDE POLE TO THE REGULATOR. NORMALLY, THE CIRCUIT BREAKER SHOULD NOT BE OPENED TO CLEAR A SINGLE-PHASE REGULATOR STUCK OFF NEUTRAL.

8. OPEN THE NEAREST SOURCE SIDE LOAD BREAK SWITCH. OPEN THE SOURCE AND LOAD-SIDE DISCONNECTS FOR THE REGULATOR AND CLOSE THE BYPASS DISCONNECT. CLOSE THE NEAREST SOURCE SIDE LOAD BREAK SWITCH.

9. REMOVE HOT LINE TAG IF ONE WAS PLACED.

10. NOTIFY DCC THAT WORK IS COMPLETE AND REGULATOR IS OUT OF SERVICE.

3				
2				
1				
0	10/26/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

VOLTAGE REGULATOR BYPASSING

OFF-NEUTRAL POSITION PROCEDURE

Progress Energy

PGN

DWG. 07.10-15D

PROCEDURE TO BYPASS LINE REGULATORS FROM A DEAD LINE

IF IT IS NECESSARY TO BYPASS LINE REGULATORS FROM A DEAD LINE IN ORDER TO BACK FEED A CIRCUIT, THE REGULATORS SHALL BE BYPASSED AS FOLLOWS:

STEPS REQUIRED TO BYPASS REGULATORS FROM SERVICE:

1. OPEN LOAD SIDE DISCONNECT.

2. CLOSE BYPASS DISCONNECT.

3. LEAVE SOURCE SIDE DISCONNECT IN CLOSE POSITION.

STEPS REQUIRED TO RETURN REGULATORS TO SERVICE AFTER LINE IS ENERGIZED:

1. VERIFY THAT REGULATOR IS IN NEUTRAL POSITION. IF NOT, SWITCH THE REGULATOR CONTROL TO MANUAL POSITION AND OPERATE REGULATOR TO NEUTRAL POSITION. VERIFY NEUTRAL POSITION BY TWO METHODS IN ACCORDANCE WITH DISTRIBUTION SPECIFICATIONS. WHEN NEUTRAL POSITION IS VERIFIED TURN CONTROL TO OFF POSITION AND REMOVE ALL CONTROL FUSES .

2. CLOSE LOAD SIDE DISCONNECTS.

3. OPEN BYPASS DISCONNECTS.

4. INSTALL ALL CONTROL FUSES . SWITCH CONTROL TO AUTO POSITION.

3				
2				
1				
0	9/7/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VOLTAGE REGULATOR BYPASSING

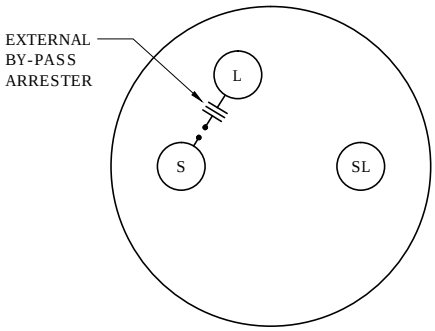
LINE REGULATORS FROM A DEAD LINE

Progress Energy

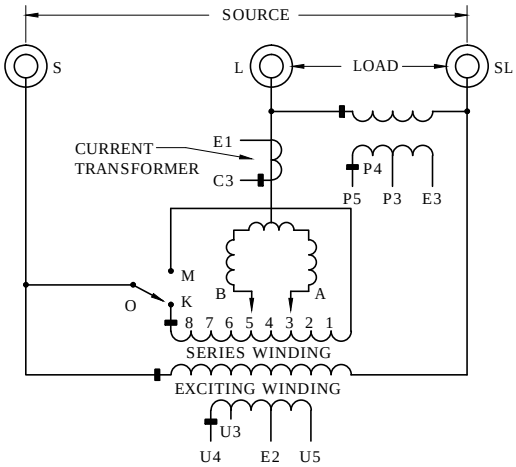
PGN

DWG. 07.10-15E

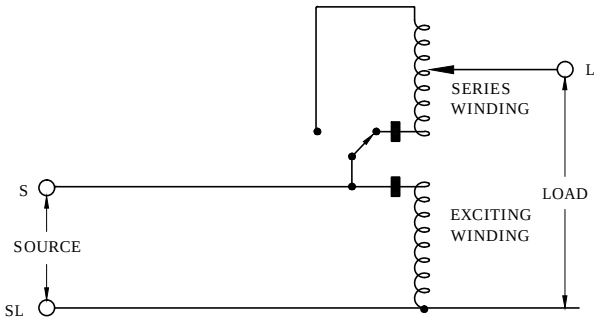
STRAIGHT DESIGN UNIT



TOP VIEW

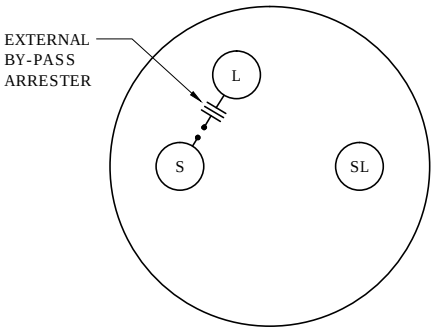


EXAMPLE NAMEPLATE
SCHEMATIC DIAGRAM

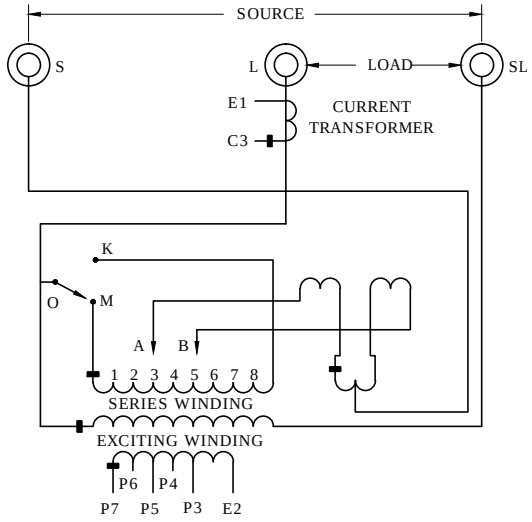


SCHEMATIC DIAGRAM REDRAWN FOR CLARITY
(SEE NOTE 1)

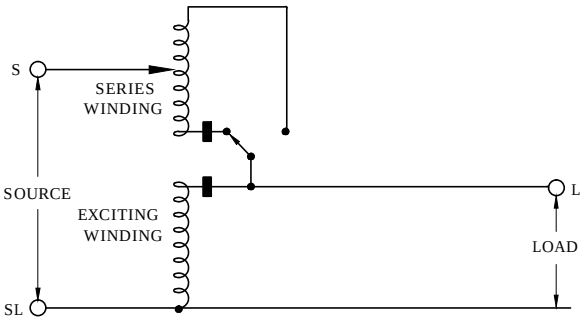
INVERTED DESIGN UNIT



TOP VIEW



EXAMPLE NAMEPLATE
SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM REDRAWN FOR CLARITY
(SEE NOTE 2)

NOTES:

1. A STRAIGHT DESIGN REGULATOR IS ONE IN WHICH THE SOURCE (S) BUSHING IS CONNECTED TO THE EXCITING WINDING AND THE LOAD (L) BUSHING IS CONNECTED TO THE TAP CHANGER MECHANISM ON THE SERIES WINDING TO RAISE AND LOWER THE LOAD VOLTAGE.

2. AN INVERTED DESIGN REGULATOR IS ONE IN WHICH THE LOAD (L) BUSHING IS CONNECTED TO THE EXCITING WINDING AND THE SOURCE (S) BUSHING IS CONNECTED TO THE TAP CHANGER MECHANISM ON THE SERIES WINDING TO RAISE AND LOWER THE LOAD VOLTAGE.

3. THE SL BUSHING IS THE GROUNDED NEUTRAL CONNECTION POINT.

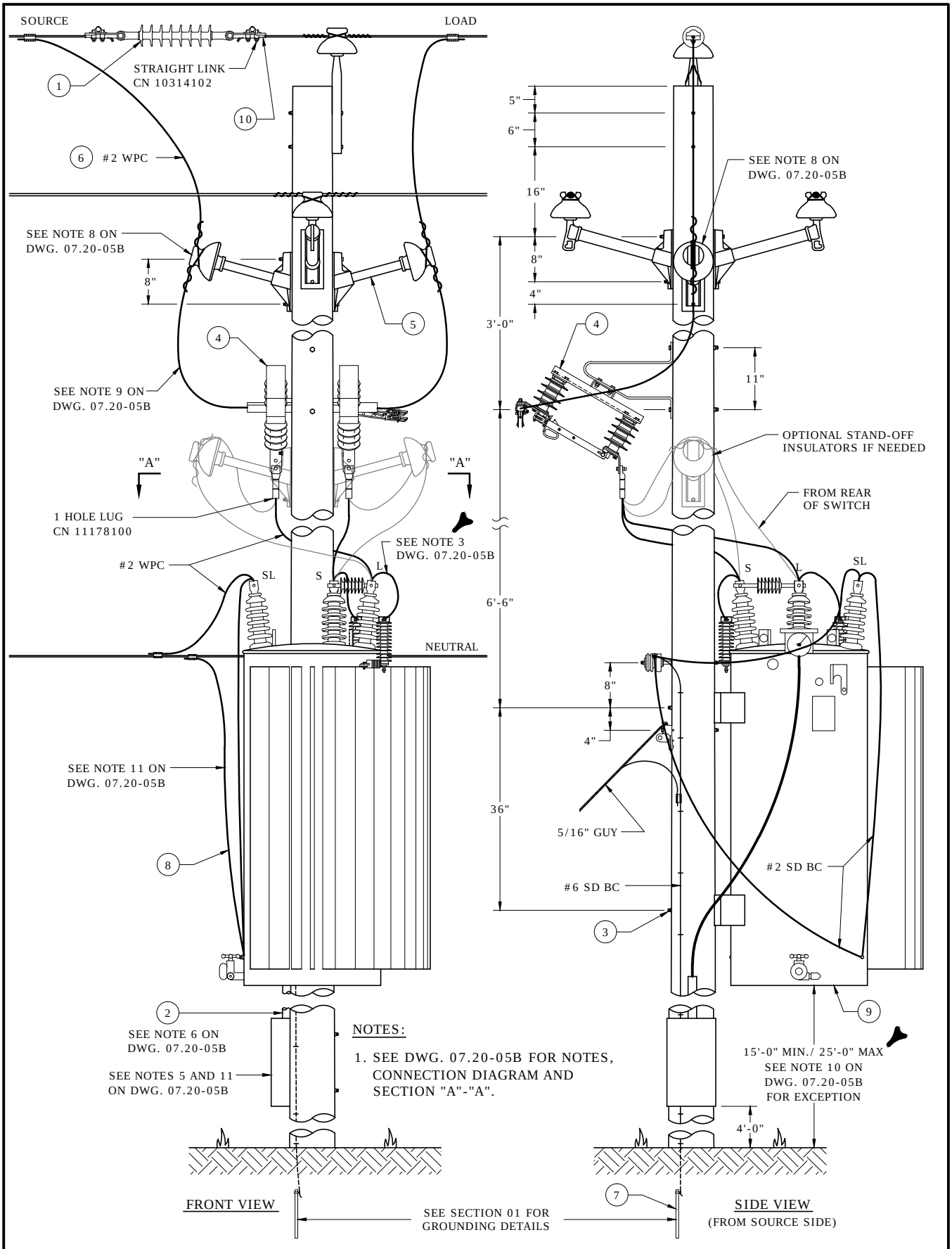
3				
2				
1				
0	4/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

STRAIGHT AND INVERTED REGULATOR DESIGNS

Progress Energy

PGN

DWG. 07.10-20



NOTES:

1. SEE DWG. 07.20-05B FOR NOTES, CONNECTION DIAGRAM AND SECTION "A"-"A".

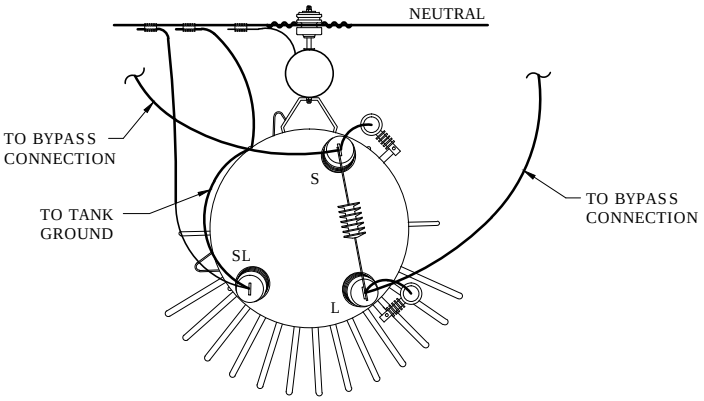
REVISED	BY	CK'D	APPR.
3 — 3/24/14	SIMMONS	GUINN	ADCOCK
2 — 9/12/11	SIMMONS	BURLISON	ELKINS
1 — 6/14/11	SIMMONS	BURLISON	ELKINS
0 — 7/11/10	SIMMONS	GUINN	ELKINS

SINGLE-PHASE POLE MOUNTED REGULATOR INSTALLATION 50-100 AMP

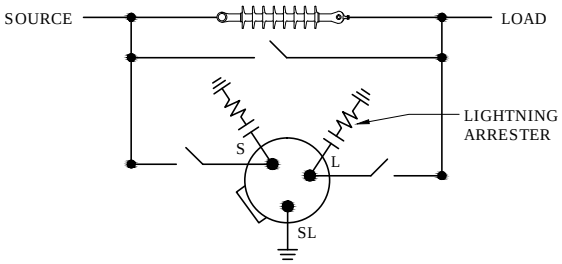
DUKE ENERGY.

CAR

DWG. 07.20-05A



SECTION "A"-"A"



CONNECTION DIAGRAM

BILL OF MATERIALS

MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
RG1P100A13POCM	REGULATOR MU 1PH 100A 13.2KV MILD POLE MOUNTED	1	IDES25PC	1	INSULATOR DEADEND/SUSPENSION 25KV POLYMER
		2	CRIS1UGPVC20C	1	CONDUIT 1 PC (10FT) RISER UGUARD PVC 2.0" DIA.
		3	TOAMALGC	1	TFMR OH 75-167 - HANG & MAKEUP PER XFMR
		4	SW256BYPC	1	SWITCH OH 25 KV 600 A 3-BLADED DISC BYP NL BRK
		5	BKTFBGPIN16C	2	INSULATOR BRACKET FIBERGLASS PIN 16" X 1" HEAD
			IPIN23C	2	INSULATOR PIN 23KV
		6	JUMPN2CCUC	6	JUMPER/RISER #2 COVERED CU
		7	GAR4C	1	4 - 5 FT GROUND RODS
		8	GOWE2C	2	#2 BARE COPPER GROUND WIRE
		9	REG100A13C	1	REGULATOR 100 AMP 13.2 KV 144 KVA
		10	DECLMP10AAC	2	DEADEND CLAMP 1/0 AAAC
RG1P100A193POCM	REGULATOR MU 1PH 100A 19.9KV304L SS POLE MOUNTED				
RG1P100A723POCM	REGULATOR MU 1PH 100A 19.9KV304L SS POLE MOUNTED				

NOTES:

1. A SIDE GUY IS REQUIRED TO KEEP POLE FROM LEANING. IF POLE CANNOT BE GUYED, USE CLASS 3 POLE THAT IS 5' TALLER THAN NECESSARY AND BURY 4' FEET DEEPER. USE POLESET (CU PFSTRAIGHTKITC) AS NEEDED IN POORER SOILS.
2. LIGHTNING ARRESTERS ARE TO BE LOCATED ON SOURCE AND LOAD BUSHINGS ON REGULATOR.
3. ALL BYPASS JUMPERS TO BE INSULATED. JUMPER SIZE TO AND FROM THE REGULATOR TO BE #2 WPC FOR 100 AMP REGULATORS. CONNECTORS USED ON INSULATED WIRE TO BE SEALED BY APPLYING AQUA SEAL AND WRAPPING WITH ELECTRICAL TAPE TO PREVENT WATER INTRUSION. FOR #2 WPC, USE 1-HOLE LUG (CN 11178100) TO CONNECT TO THE TOP AND BOTTOM OF THE BYPASS SWITCH.
4. CAUTION! WHEN IT IS NECESSARY TO BYPASS THE REGULATOR, SEE DWGS. 07.10-15A, 07.10-15B, 07.10-15C, 07.10-15D AND 07.10-15E.
5. REGULATOR CONTROL SHALL BE LOCATED ON THE SIDE OF THE POLE SO THE DRAGHAND INDICATOR ON THE TOP OF THE REGULATOR CAN BE SEEN WHILE OPERATING THE CONTROL.
6. ONE SECTION OF U-GUARD SHALL BE INSTALLED SO THAT IT COVERS THE CONTROL CABLE INTO THE TOP OF THE CONTROL CABINET UNLESS CONTROL CABLE IS ALREADY IN FLEXIBLE CONDUIT. USE GALVANIZED CONDUIT STRAP (CN 30637805) TO ATTACH FLEX CONDUIT TO POLE EVERY 3 FEET.
7. SEE DWG. 07.20-05A FOR DESIGN SPECIFICATIONS.
8. THE 23KV INSULATORS (CU IPIN23C) ON BULL HORNS (CU BKTFBGPIN16C) ARE REQUIRED TO MAINTAIN CLEARANCE BETWEEN PHASES WHEN REGULATOR IS INSTALLED ON TOP PHASE OF A THREE-PHASE LINE.
9. SOURCE BUSHING ON REGULATOR SHOULD ALWAYS BE CONNECTED TO PRIMARY SOURCE. BYPASS SOURCE AND LOAD LEADS MAY BE CROSSED, MAINTAIN 12" CLEARANCE BETWEEN LEADS.
10. CLEARANCE OF REGULATOR ABOVE GROUND REQUIREMENT IS 15', UNLESS JOINT USERS EXIST. IF JOINT USE EXISTS ON THE POLE, THE HEIGHT OF THE REGULATOR MUST BE INCREASED TO ALLOW FOR JOINT USERS TO ATTACH TO THE POLE SUCH THAT THEY HAVE ADEQUATE GROUND CLEARANCE UNDER THE REGULATOR AND IN ADJACENT SPANS (JOINT USERS NEED 15.5'). CLEARANCE FROM THE HIGHEST JOINT USE ATTACHMENT TO THE BOTTOM OF THE REGULATOR IS 2.5' (IF COMMUNICATIONS MESSENGER IS BONDED TO THE NEUTRAL) SO MINIMUM HEIGHT OF THE REGULATOR FOR A LINE WITH A SINGLE JOINT USER IS 18.0'. INCREASE SPACING AS NEEDED TO ALLOW FOR MULTIPLE JOINT USERS AND SAG IN ADJACENT SPANS, UP TO 25' MAX. IF JOINT USERS CAN NOT GET ADEQUATE CLEARANCE WITH 25' HEIGHT OF REGULATOR, SELECT ANOTHER LOCATION FOR THE REGULATOR.
11. GROUND CONTROL BOX WITH #6 SD BC. REGULATOR GROUND TO CONSIST OF #2 SD BC RUN FROM SL BUSHING TO REGULATOR TANK GROUND, THEN TO NEUTRAL.

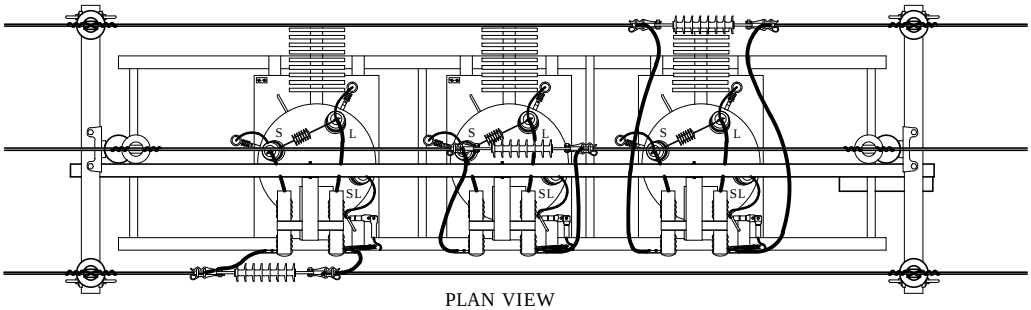
DUKE ENERGY.

REVISED	BY	CK'D	APPR.
4 12/1/14	SIMMONS	GUINN	ADCOCK
3 3/24/14	SIMMONS	GUINN	ADCOCK
2 7/12/11	SIMMONS	BURLISON	ELKINS
0 7/11/10	SIMMONS	GUINN	ELKINS

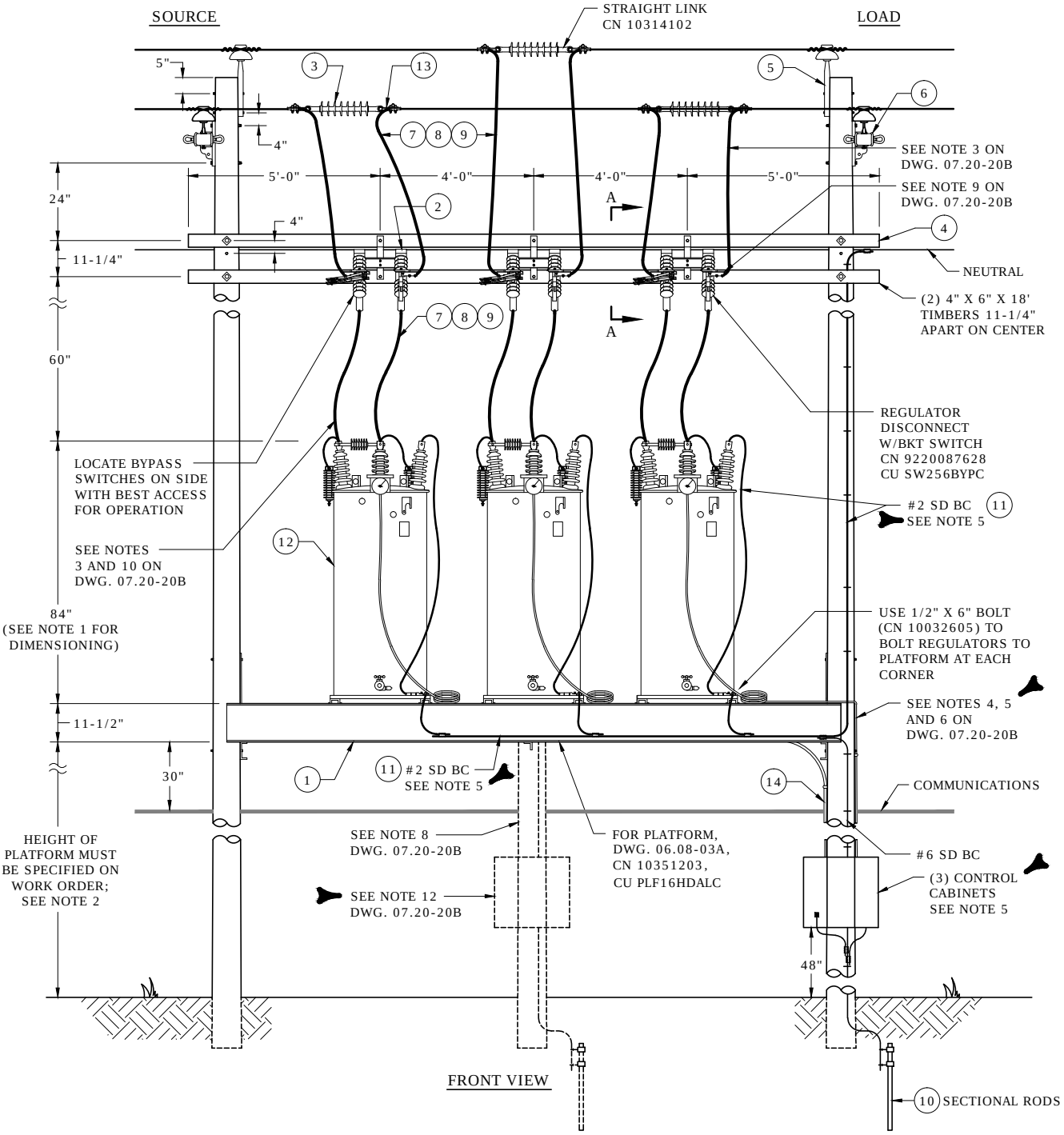
SINGLE-PHASE POLE MOUNTED REGULATOR INSTALLATION 50-100 AMP

DEC	DEM	DEP	DEF
		X	

07.20-05B



PLAN VIEW



FRONT VIEW

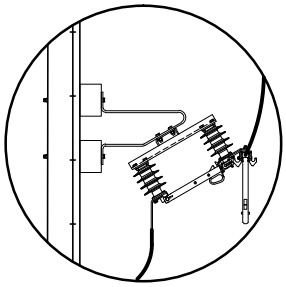
4	2/15/13	SIMMONS	GUINN	ADCOCK
3	7/27/12	GUINN	GUINN	ELKINS
2	11/10/11	GUINN	BURLISON	ELKINS
0	10/14/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

100, 200 AND 300 AMP REGULATOR PLATFORMS

Duke Energy®

CAR

DWG. 07.20-20A



SECTION 'A-A'
BYPASS SWITCH
WITH BRACKET

POLE CLASS TABLE FOR REGULATOR PLATFORMS									
POLE HEIGHT **	REGULATOR SIZE (AMPS)								
	100			200			300*		
	PLATFORM HEIGHT								
	15'	16'-20'	21'-25'	15'	16'-20'	21'-25'	15'	16'-20'	21'-25'
45	4	3	NA	4	3	NA	4/4 *	3/4 *	NA
50	3	3	2	3	3	2	3/4 *	3/4 *	2/3 *
55	NA	3	2	NA	3	2	NA	3/4 *	2/3 *

* ALL 300 AMP REGULATOR BANKS MUST HAVE A 3 POLE PLATFORM. IN THE CHART, THE FIRST NUMBER REFERS TO THE OUTSIDE POLE CLASS WHILE THE SECOND NUMBER REFERS TO THE CENTER STUB CLASS (EX. 3/4 REQUIRES CLASS 3 OUTSIDE POLES AND A CLASS 4 CENTER STUB).

** BURIAL DEPTH SHALL BE 10% OF THE POLE LENGTH PLUS 4 FT. FOR ALL PLATFORMS

NOTES:

1. INCREASE SPACING TO 105" FOR 300 AMP REGULATORS OR 19.9 KV REGULATORS.

2. CLEARANCE OF PLATFORM ABOVE GROUND REQUIREMENT IS 15', UNLESS JOINT USERS EXIST. HEIGHT OF PLATFORM MUST BE INCREASED TO ALLOW FOR JOINT USERS TO ATTACH TO THE POLES SO THEY HAVE ADEQUATE GROUND CLEARANCE UNDER THE PLATFORM AND IN ADJACENT SPANS (JOINT USERS NEED 15.5'). CLEARANCE FROM THE HIGHEST JOINT USE ATTACHMENT TO BOTTOM OF PLATFORM IS 2.5' (IF COMMUNICATIONS MESSENGER IS BONDED TO THE NEUTRAL) SO MINIMUM HEIGHT OF PLATFORM FOR A LINE WITH A SINGLE JOINT USER IS 18.0'. INCREASE SPACING AS NEEDED TO ALLOW FOR MULTIPLE JOINT USERS AND SAG IN ADJACENT SPANS, UP TO 25' MAX. IF JOINT USERS CAN NOT GET ADEQUATE CLEARANCE WITH 25' HEIGHT OF PLATFORM, SELECT ANOTHER LOCATION FOR THE PLATFORM.

3. ALL BYPASS JUMPERS TO BE INSULATED. SIZE JUMPERS TO AND FROM BYPASS SWITCHES AS FOLLOWS:

   #2 WPC FOR ALL BYPASS LEADS ON 100 AMP REGULATORS. CONNECTORS USED ON INSULATED WIRE TO BE SEALED BY APPLYING AQUA SEAL AND WRAPPING WITH ELECTRICAL TAPE TO PREVENT WATER INTRUSION.
   500 AL FROM BYPASS TO PRIMARY FOR 200 AND 300 AMP REGULATORS
   350 AL FROM BYPASS TO REGULATOR ON 200 AMP *
   500 AL FROM BYPASS TO REGULATOR ON 300 AMP *

   WHEN CONNECTING 350 OR 500 AL TO CLAMP TYPE REGULATOR BUSHINGS, TERMINATE CONDUCTOR WITH STEM CONNECTORS (SEE DWG. 06.03-04).

4. ONE 10 FOOT SECTION OF 2" U-GUARD (CU CRIS1UGPVC20C) SHALL BE INSTALLED TO COMPLETELY COVER CONTROL CABLE AT CONTROL CABINET UNLESS CONTROL CABLE IS ALREADY IN FLEXIBLE CONDUIT. USE GALVANIZED CONDUIT STRAP (CN 30637706) TO ATTACH FLEX CONDUIT TO POLE EVERY 3 FEET.

5. GROUND CONTROL BOXES AND PLATFORM WITH #6 SD BC. GROUND PLATFORM WITH COPPER GROUNDING LUG. REGULATOR GROUND TO CONSIST OF #2 SD BC RUN FROM EACH SL BUSHING TO REGULATOR TANK GROUND, THEN TO NEUTRAL.

6. MOUNT PLATFORM WITH 3/4" BOLTS (2 PER SIDE - TOTAL OF 4). SEE SECTION 06 FOR PLATFORM DETAILS.

7. CAUTION! WHEN IT IS NECESSARY TO BYPASS, BE SURE THE REGULATOR IS IN THE NEUTRAL POSITION AND TURNED OFF. SEE DWGS. 07.10-15A, 07.10-15B, 07.10-15C, 07.10-15D AND 07.10-15E FOR OPERATING PROCEDURES TO BYPASS REGULATOR.

8. SEE DWG. 07.10-05 FOR REGULATOR WEIGHTS, MOUNTING DIMENSIONS AND SAFETY REQUIREMENTS. 300 AMP REGULATOR BANKS REQUIRE CENTER STUB (CU PLFCPALC) UNDER PLATFORM. SEE DWGS. 02.02-03C AND 02.02-03D FOR POLE SIZE AND EMBEDMENT REQUIREMENTS.

9. USE 4-HOLE COMPRESSION TERMINAL (CN 9220205914) FOR CONNECTING TO TOP OF BYPASS SWITCH WITH 500MCM CONDUCTOR. FOR #2 WP, USE 1-HOLE LUG (CN 11178100). SEE DWG. 23.02-05 FOR AVAILABLE TERMINALS TO CONNECT TO BOTTOM OF BYPASS SWITCH (ALL CONDUCTOR SIZES) OR TOP OF BYPASS SWITCH WITH #2 WPC.

10. SOURCE BUSHING ON REGULATOR SHOULD ALWAYS BE CONNECTED TO PRIMARY SOURCE. BYPASS SOURCE AND LOAD LEADS MAY BE CROSSED, MAINTAIN MINIMUM 12" CLEARANCE BETWEEN LEADS.

11. SEE DWG. 07.20-20A FOR DESIGN SPECIFICATIONS.

12. WHEN CENTER STUB IS USED, MOUNT CONTROLS ON CENTER STUB AND INSTALL GROUND RODS AT CENTER STUB INSTEAD OF END POLE.

REVISED		BY	CK'D	APPR.
6	3/24/14	SIMMONS	GUINN	ADCOCK
5	2/15/13	SIMMONS	GUINN	ADCOCK
4	8/3/12	WOJNAROWSKI	GUINN	ELKINS
0	10/14/10	SIMMONS	GUINN	ELKINS

100, 200 AND 300 AMP REGULATOR PLATFORMS

DUKE ENERGY.

CAR

DWG. 07.20-20B

BILL OF MATERIALS

MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
RG3P100A133PCM	REGULATOR MU 3PH 100A 13.2KV MILD 3PH PLATFORM	1	PLF16HDALC	1	STRUCTURE PLATFORM 16 FT HEAVY DUTY ALUMINUM
		2	SW256BYPC	3	SWITCH OH 25 KV 600 A 3-BLADED DISC BYP NLB
		3	IDES25PC	3	INSULATOR DEADEND/SUSPENSION 25KV POLYMER
		4	ARMS18WC	2	XARM SINGLE 4"X6"X18' PENTA WOOD FOR REG. PLATFORM
		5	PINPTP20C	2	INSULATOR PIN POLE TOP PIN 20" STEEL
			IPIN23C	2	INSULATOR PIN 23KV
		6	ARMSDE72FC	2	CROSSARM SINGLE, FIBERGLASS, 72"
			IPIN23C	4	INSULATOR PIN 23KV
			PINCARMS586C	4	PIN, SHDR, 6" X 5/8 X 6-1/2", STEEL
		7	WOP350XLPAACC	70	350 KCM POLYETHYLENE AAC 37STR RUTGERS
		8	WOP500XLPAACC	70	500 KCM POLYETHYLENE AAC 37STR EMORY
		9	JUMPN2CCUC	18	JUMPER/RISER #2 COVERED CU
		10	GAR4C	1	4 - 5 FT GROUND RODS
		11	GOCWE2C	2	#2 BARE COPPER GROUND WIRE
		12	REG100A13C	3	REGULATOR 100 AMP 13.2 KV 144 KVA
		13	DECLMP10AAC	6	DEADEND CLAMP 1/0 AAAC
		14	CRIS1UGPVC20C	1	CONDUIT 1 PC (10FT) RISER UGUARD PVC 2.0" DIA.
RG3P200A133PCM	REGULATOR MU 3PH 200A 13.2KVMILD 3PH PLATFORM				
RG3P201A1933PCM	REGULATOR MU 3PH201A 19.9KV304L SS 3PH PLATFORM				
RG3P300A133PCM	REGULATOR MU 3PH 300A 13.2KVMILD 3PH PLATFORM				
RG3P100A1933PCM	REGULATOR MU 3PH 100A 19.9KV304L SS 3PH PLATFORM				
RG3P100A7233PCM	REGULATOR MU 3PH 100A 7.2KV304L SS 3PH PLATFORM				
RG3P219A7233PCM	REGULATOR MU 3PH 219A 7.2KV304L SS 3PH PLATFORM				
RG3P100A723PCM	REGULATOR MU 3PH 100A 7.2KVMILD 3PH PLATFORM				
RG3P200A723PCM	REGULATOR MU 3PH 200A 7.2KVMILD 3PH PLATFORM				
RG3P300A723PCM	REGULATOR MU 3PH 300A 7.2KVMILD 3PH PLATFORM				

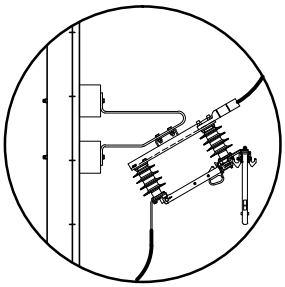
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2	5/14/14	GUINN	GUINN	ADCOCK
1	7/27/12	GUINN	GUINN	ELKINS
0	11/10/11	GUINN	BURLISON	ELKINS

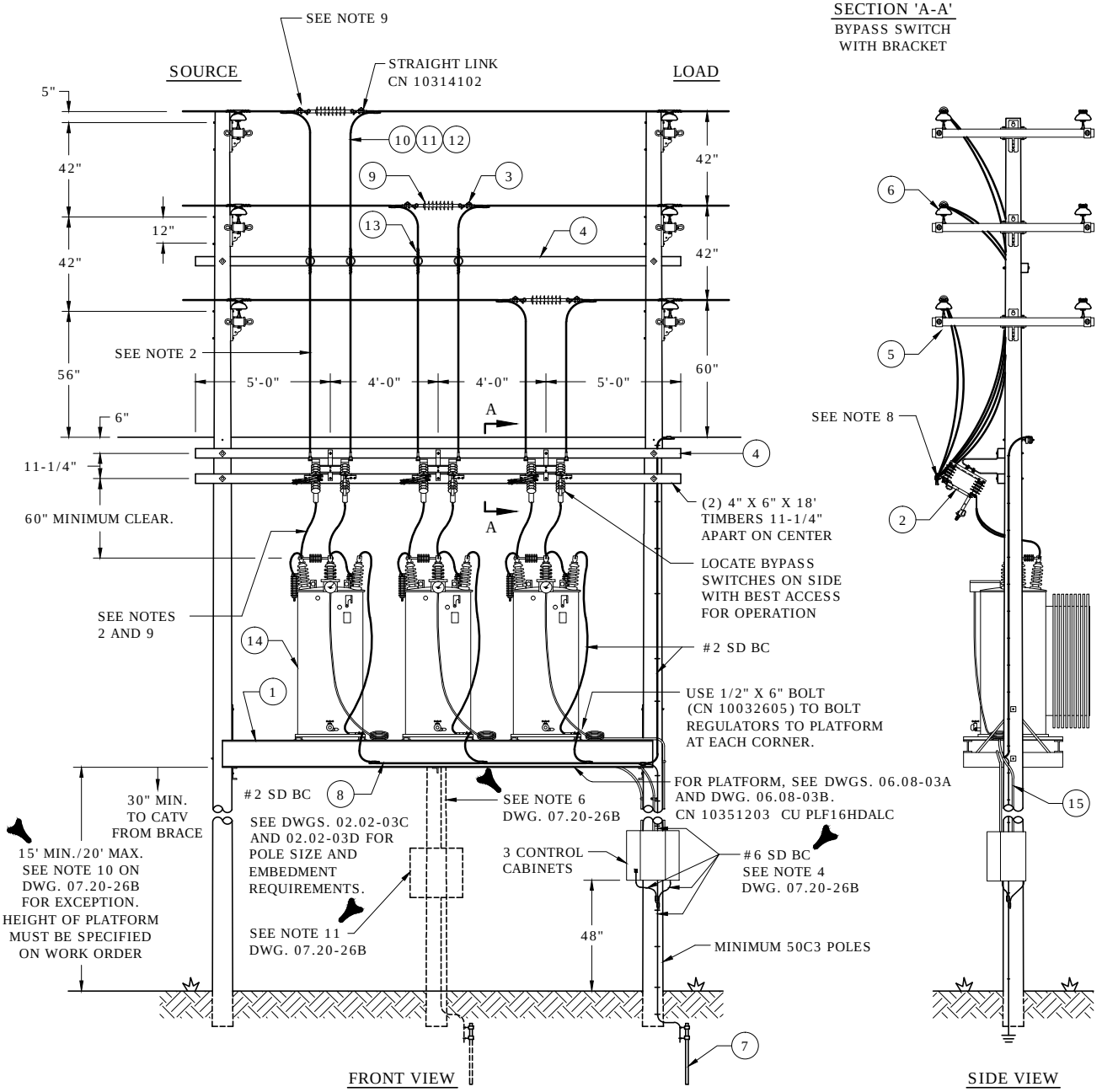
100, 200 AND 300 AMP REGULATOR PLATFORMS

DEC	DEM	DEP	DEF
		X	

07.20-20C



SECTION 'A-A'
BYPASS SWITCH
WITH BRACKET



NOTES:

1. SEE DWG. 07.20-26B FOR NOTES AND BILL OF MATERIALS.

REVISED	BY	CK'D	APPR.
3 3/24/14	SIMMONS	GUINN	ADCOCK
2 7/19/12	GUINN	GUINN	ELKINS
1 6/10/11	SIMMONS	BURLISON	ELKINS
0 10/13/10	SIMMONS	GUINN	ELKINS

DOUBLE CIRCUIT REGULATOR PLATFORM

DUKE ENERGY.

CAR

DWG. 07.20-26A

BILL OF MATERIALS					
MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
-	-	1	PLF16HDALC	1	STRUCTURE PLATFORM 16 FT HEAVY DUTY ALUMINUM
		2	SW256BYPC	3	SWITCH OH 25 KV 600 A 3-BLADED DISC BYP NL BRK
		3	DECLMP10AAC	6	DEADEND CLAMP 1/0 AAAC
		4	ARMS18WC	2	CROSSARM SINGLE 4"X6"X18' PENTA WOOD FOR REG. PLATFORM
		5	ARMSDE72FC	6	CROSSARM SINGLE 60" STEEL
		6	IPIN23C	12	INSULATOR PIN 23 KV
			PINCARMS586C	12	INSULATOR PIN POLE TOP PIN 20" STEEL
		7	GAR4C	1	4 - 5 FT GROUND RODS
		8	GOWE2C	2	#2 BARE COPPER GROUND WIRE
		9	IDES25PC	3	INSULATOR DEADEND/SUSPENSION 25KV POLYMER
		10	JUMPN2CCUC	18	JUMPER/RISER #2 COVERED CU
		11	WOP350XLPAACC	70	350 KCM POLYETHYLENE AAC 37STR RUTGERS
		12	WOP500XLPAACC	70	500 KCM POLYETHYLENE AAC 37STR EMORY
		13	PINSCREW6C	4	PIN SCREW, LAG, 1/2" X 3"
			IPIN23C	4	INSULATOR PIN 23KV
		14	REG_C	3	REGULATOR (SEE DWG. 07.10-05 FOR AVAIL. CU'S)
		15	CRIS1UGPVC20C	1	CONDUIT 1 PC (10 FT) RISER UGUARD PVC 2.0" DIA.

NOTES:

1. SEE DWG. 07.20-26A FOR DESIGN SPECIFICATIONS.
2. ALL BYPASS JUMPERS TO BE INSULATED. SIZE JUMPERS TO AND FROM BYPASS SWITCHES AS FOLLOWS:

   #2 WPC FOR ALL BYPASS LEADS ON 100 AMP REGULATORS. CONNECTORS USED ON INSULATED WIRE TO BE SEALED BY APPLYING AQUA SEAL AND WRAPPING WITH ELECTRICAL TAPE TO PREVENT WATER INTRUSION.
   500 AL FROM BYPASS TO PRIMARY FOR 200 AND 300 AMP REGULATORS.
   350 AL FROM BYPASS TO REGULATOR ON 200 AMP REGULATORS.
   500 AL FROM BYPASS TO REGULATOR ON 30O AMP REGULATORS.

   WHEN CONNECTING 350 OR 500 AL TO CLAMP TYPE REGULATOR BUSHINGS, TERMINATE CONDUCTOR WITH STEM CONNECTORS (SEE DWG. 06.03-04).
3. ONE 10 FOOT SECTION OF 2" U-GUARD (CU CRIS1UGPVC20C) SHALL BE INSTALLED TO COMPLETELY COVER CONTROL CABLE AT CONTROL CABINET UNLESS CONTROL CABLE IS ALREADY IN FLEXIBLE CONDUIT. USE GALVANIZED CONDUIT STRAP (CN 30637805) TO ATTACH FLEX CONDUIT TO POLE EVERY 3 FEET.
4. GROUND CONTROL BOXES AND PLATFORM WITH #6 SD BC. REGULATOR GROUND TO CONSIST OF #2 SD BC RUN FROM EACH SL BUSHING TO REGULATOR TANK GROUND, THEN TO NEUTRAL LOOP.
5. CAUTION! WHEN IT IS NECESSARY TO BYPASS, BE SURE THE REGULATOR IS IN THE NEUTRAL POSITION AND IS TURNED OFF. SEE DWGS. 07.10-15A, 07.10-15B, 07.10-15C, 07.10-15D AND 07.10-15E FOR OPERATING PROCEDURES TO BYPASS REGULATOR.
6. SEE DWG. 07.10-05 FOR REGULATOR WEIGHTS, MOUNTING DIMENSIONS AND SAFETY REQUIREMENTS. 300 AMP REGULATOR BANKS REQUIRE CENTER STUB (CU PLFCPALC) UNDER PLATFORM. SEE DWGS. 02.02-03C AND 02.02-03D FOR POLE SIZE AND EMBEDMENT REQUIREMENTS.
7. MOUNT PLATFORM WITH 3/4" BOLTS (2 PER SIDE - TOTAL OF 4). SEE SECTION 06 FOR PLATFORM DETAILS.
8. USE 4-HOLE COMPRESSION TERMINAL (CN 9220205914) FOR CONNECTING TO TOP OF BYPASS SWITCH WITH 500MCM CONDUCTOR. FOR #2 WP, USE 1-HOLE LUG (CN 11178100). SEE DWG. 23.02-05 FOR AVAILABLE TERMINALS TO CONNECT TO BOTTOM OF BYPASS SWITCH (ALL CONDUCTOR SIZES) OR TOP OF BYPASS SWITCH WITH #2 WPC.
9. SOURCE BUSHING ON REGULATOR SHOULD ALWAYS BE CONNECTED TO PRIMARY SOURCE. BYPASS SOURCE AND LOAD LEADS MAY BE CROSSED, MAINTAIN MINIMUM 12" CLEARANCE BETWEEN LEADS.
10. CLEARANCE OF PLATFORM ABOVE GROUND REQUIREMENT IS 15', UNLESS JOINT USERS EXIST. HEIGHT OF PLATFORM MUST BE INCREASED TO ALLOW FOR JOINT USERS TO ATTACH TO THE POLES SO THEY HAVE ADEQUATE GROUND CLEARANCE UNDER THE PLATFORM AND IN ADJACENT SPANS (JOINT USERS NEED 15.5'). CLEARANCE FROM THE HIGHEST JOINT USE ATTACHMENT TO BOTTOM OF PLATFORM IS 2.5' (IF COMMUNICATIONS MESSENGER IS BONDED TO THE NEUTRAL) SO MINIMUM HEIGHT OF PLATFORM FOR A LINE WITH A SINGLE JOINT USER IS 18.0'. INCREASE SPACING AS NEEDED TO ALLOW FOR MULTIPLE JOINT USERS AND SAG IN ADJACENT SPANS, UP TO 25' MAX. IF JOINT USERS CAN NOT GET ADEQUATE CLEARANCE WITH 25' HEIGHT OF PLATFORM, SELECT ANOTHER LOCATION FOR THE PLATFORM.
11. WHEN CENTER STUB IS USED, MOUNT CONTROLS ON CENTER STUB AND INSTALL GROUND RODS AT CENTER STUB INSTEAD OF END POLE.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
5	5/2/14	GUINN	GUINN	ADCOCK
4	3/24/14	SIMMONS	GUINN	ADCOCK
3	7/19/12	GUINN	GUINN	ELKINS
0	10/14/10	SIMMONS	GUINN	ELKINS

DOUBLE CIRCUIT REGULATOR PLATFORM

DEC	DEM	DEP	DEF
		X	

07.20-26B

FEATURES:

- MICROCONTROLLER-BASED LTC TRANSFORMER AND REGULATOR CONTROL PROVIDES RELIABLE OPERATION AND EXPANDED CAPABILITIES.
- TWO ACTIVE SERIAL COMMUNICATIONS PORTS, THROUGH RS-232, RS-485, OR FIBER OPTICS
- FIELD-UPDATABLE PROGRAMMING
- REVERSE POWER DETECTION/ OPERATION
- DEMAND METERING
- TIME/ DATE STAMPING OF MAXIMUM/ MINIMUM SYSTEM CONDITIONS
- DATA LOGGING OF METERED PARAMETERS
- SELF-TEST ALARM AND USER-PROGRAMMABLE ALARM
- LINE OVERCURRENT TAPCHANGE INHIBIT
- LDC WITH R & X OR Z-COMPENSATION
- DEFINITE OR INVERSE TIME DELAY
- VOLTAGE LIMITS WITH AUTOMATIC RUNBACK, TAP POSITION LIMITS
- SEE BECKWITH INSTALLATION/OPERATION MANUAL FOR FUNCTIONS TO STEP THROUGH MENU

3				
2				
1				
0	7/11/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

BECKWITH M-2001B MOD 467

REGULATOR CONTROL

Progress Energy

CAR

DWG. 07.30-20

BILL OF MATERIALS		
ITEM NO.	CATALOG NUMBER	DESCRIPTION
1	9220178899	UVR-1 IS A REPLACEMENT CONTROL FOR ALL SINGLE-PHASE REGULATORS MOUNTING RAIL AND WIRING HARNESS ARE SEPARATE
2	9220098520	RAIL AND WIRING HARNESS FOR SIEMENS PANEL REPLACEMENT
3	9220098521	RAIL AND WIRING HARNESS FOR COOPER / McGRAW REPLACEMENT
4	9220104591	WIRING HARNESS TO REPLACE GE SM-3 PANEL
5	9220103752	FIBER OPTIC CARD TO INSTALL IN EARLY VERSION UVR-1 THAT DID NOT INCLUDE FIBER OPTIC PORT
6	9220103755	304L STAINLESS STEEL REPLACEMENT CABINET FOR ICMI CONTROL
7	9220191749	PLAIN / MILD STEEL REPLACEMENT CABINET FOR ICMI CONTROL

UVR-1 RETROFIT KITS	
COMPATIBLE UNIT	DESCRIPTION
REGCNUVR1FRC45C	REG CNTL ICMI UVR-1 W/FIBER PORT REPLACE KIT COOPER CL4 CL5
REGCNUVR1FRC6C	REG CNTL ICMI UVR-1 W/FIBER PORT REPLACE KIT COOPER CL6
REGCNUVR1FRSIEC	REG CNTL ICMI UVR-1 W/FIBER PORT REPLACE KIT SIEMENS
REGCNUVR1FRSM3C	REG CNTL ICMI UVR-1 W/FIBER PORT REPLACE KIT GE SM-3

NOTES:

1. REPLACEMENT 2 AMP (TYPE ABC) FUSE FOR THE UVR-1 PANEL IS CN 9220229396.
2. REPLACEMENT 6 AMP (TYPE MDA) FUSE FOR THE UVR-1 PANEL IS CN 9220229395.

REVISED		BY	CK'D	APPR.
3				
2				
1	9/12/11	SIMMONS	BURLISON	ELKINS
0	7/11/10	SIMMONS	GUINN	ELKINS

ICMI UVR-1 UNIVERSAL SINGLE-PHASE REGULATOR CONTROL

Progress Energy

CAR

DWG. 07.30-35

NOTES:

1. VACUUM SWITCHES ARE NO LONGER USED ON NEW CAPACITOR BANKS. THE STANDARD SWITCH IN AN OIL SWITCH.

2. VACUUM SWITCHES MUST BE SECURED DURING TRANSPORTATION, AND CAREFULLY HANDLED. THE VACUUM SWITCH BUSHING CAN BE BROKEN EASILY.

3. VACUUM SWITCHES ARE TO BE MOUNTED ON THE CAPACITOR RACK AT THE SAME LOCATION AND WITH THE SAME MOUNTING BRACKETS AS PREVIOUS OIL SWITCHES. THE LOWER (HIGH VOLTAGE) CONNECTION MUST BE ORIENTED AND CONNECTED TO THE CAPACITOR UNIT(S). THE TOP H.V. VACUUM SWITCH TERMINAL SHOULD BE CONNECTED TO THE PRIMARY LINE. ORIENT VACUUM SWITCH TO EASE INSTALLATION AND TO OBTAIN BEST CLEARANCES BETWEEN LIVE PARTS.

4. WHEN INSTALLING VACUUM SWITCHES, DO NOT APPLY EXCESSIVE TORQUE ON HIGH VOLTAGE TERMINALS. THIS COULD DAMAGE THE VACUUM BOTTLE AND RESULT IN LOST VACUUM AND A DEFECTIVE SWITCH. IF A TERMINAL LUG IS LOOSE OR HAS A CRACK BETWEEN THE TERMINAL LUG AND THE BUSHING HOUSING, THE VACUUM SWITCH MUST NOT BE INSTALLED, BUT RED TAGGED AS DEFECTIVE AND SENT BACK TO THE GENERAL WAREHOUSE.

5. THE JOSLYN VACUUM SWITCH IS SOLENOID OPERATED, WHILE THE COOPER OR MAYSTEEL SWITCH IS MOTOR OPERATED. ALTHOUGH THESE SWITCHES HAVE DIFFERENT OPERATING MECHANISMS, THEY CAN BE USED IN THE SAME CAPACITOR BANK, AND WILL PROVIDE ACCEPTABLE OPERATION.

6. IF A SWITCH FAILS IN A 25KV CAPACITOR BACK, IT CAN BE REPLACED WITH AN OIL SWITCH. SOLENOID OPERATED SWITCH.

3				
2				
1				
0	7/11/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

NOTES FOR SINGLE-PHASE
25KV CAPACITOR VACUUM SWITCH (FMO)

Progress Energy

CAR

DWG. 07.01-12

STANDARD PROCEDURES BULLETIN

PURPOSE:

TO PROVIDE PROCEDURES FOR INSTALLING, OPERATING AND TROUBLESHOOTING THE VACUUM SWITCH.

INSTALLATION PROCEDURE:

1. MOUNT THE VACUUM SWITCH ON THE CAPACITOR RACK MOUNTING BRACKETS AT THE SAME LOCATION AS THE OIL SWITCH. THE ASSEMBLY CAN BE ROTATED ON THE HOUSING OF THE SINGLE POLE DESIGN TO ACHIEVE DESIRED ORIENTATION OF THE TERMINALS AND CONTROL CABLE RECEPTACLE. BE SURE TO TIGHTEN THE RETAINER BOLTS AFTER ROTATING.

2. PLACE VACUUM SWITCH IN THE OPEN POSITION BY OBTAINING A 120 VOLT SOURCE TO OPERATE THE SWITCH.

3. CONNECT TERMINAL B AND D OF THE 120 VOLT PIGTAIL SOURCE PLUG TO THE VACUUM SWITCH BENDIX CONNECTOR TO OPEN THE SWITCH. SEE DWG. 07.03-40.

4. CONNECT #6 BC GROUND IN GROUNDING LUG LOCATED ON THE VACUUM SWITCH MOUNTING HANGER.

5. CONNECT CONTROL CABLE TO BENDIX CONNECTOR ON VACUUM SWITCH.

6. ENSURE ALL CONNECTIONS ARE PROPERLY TIGHTENED.

NOTE: MIXING VACUUM SWITCHES WITH OIL SWITCHES AND SOLENOID OPERATED WITH MOTOR OPERATED SWITCHES ON THE SAME CAPACITOR BANK IS ACCEPTABLE. MAKE SURE CONNECTIONS ARE CORRECT FOR THE APPLIED VOLTAGE.

OPERATING PROCEDURE:

1. PRIOR TO ENERGIZING CAPACITOR BANK, ENSURE ALL SWITCHES ARE IN THE OPEN POSITION AND ALL LEADS AND GROUNDS ARE CONNECTED IN ACCORDANCE WITH DWG. 07.02-20.

2. PLACE CAPACITOR CONTROL AUTO/MANUAL SWITCH IN MANUAL POSITION.

3. CLOSE ALL THREE CUTOUTS.

4. PLACE CAPACITOR CONTROL AUTO/MANUAL SWITCH IN AUTO POSITION.

5. CHECK TO ENSURE ALL SWITCHES ARE IN THE OPEN OR CLOSED POSITION.

6. DOCUMENT CAPACITOR BANK OPERATION ON THE CAPACITOR BANK RECORD CARD, LOCATED INSIDE THE DOOR OF THE CAPACITOR CONTROL.

TROUBLESHOOTING PROCEDURE:

1. CHECK CAPACITOR BANK AND ASSOCIATED EQUIPMENT FOR:

   -OVERHEATING CONDITIONS.
   -DAMAGED BUSHINGS, VACUUM SWITCHES, POTENTIAL TRANSFORMER, CUTOUTS, BLOCKING UNITS, AND UNIT CONTROLS.
   -IMPROPER CONNECTIONS AND EQUIPMENT GROUNDS.
   -PHYSICAL CONDITION OF THE BANK.
   -SWOLLEN, BULGED OR LEAKING UNITS, BROKEN OR FLASHED BUSHINGS, BROKEN OR FLASHED LIGHTNING ARRESTERS
   -BLOWN PRIMARY FUSE, FOREIGN OBJECTS AND PROPER CLEARANCE.

2. VERIFY PROPER OPERATION AND SETTING OF THE CAPACITOR CONTROL BY COMPARING SETTING AGAINST CAPACITOR CONTROL RECORD CARD LOCATED INSIDE THE DOOR OF THE CAPACITOR CONTROL.

3. VERIFY ALL SWITCHES ARE OPERATING PROPERLY BY USING AN EXTERNAL 120 VOLT SOURCE AND CONNECTING AN APPROVED PIGTAIL PLUG TO TERMINALS B AND D TO OPEN VACUUM SWITCH B AND C TO CLOSE THE VACUUM SWITCH.

NOTES:

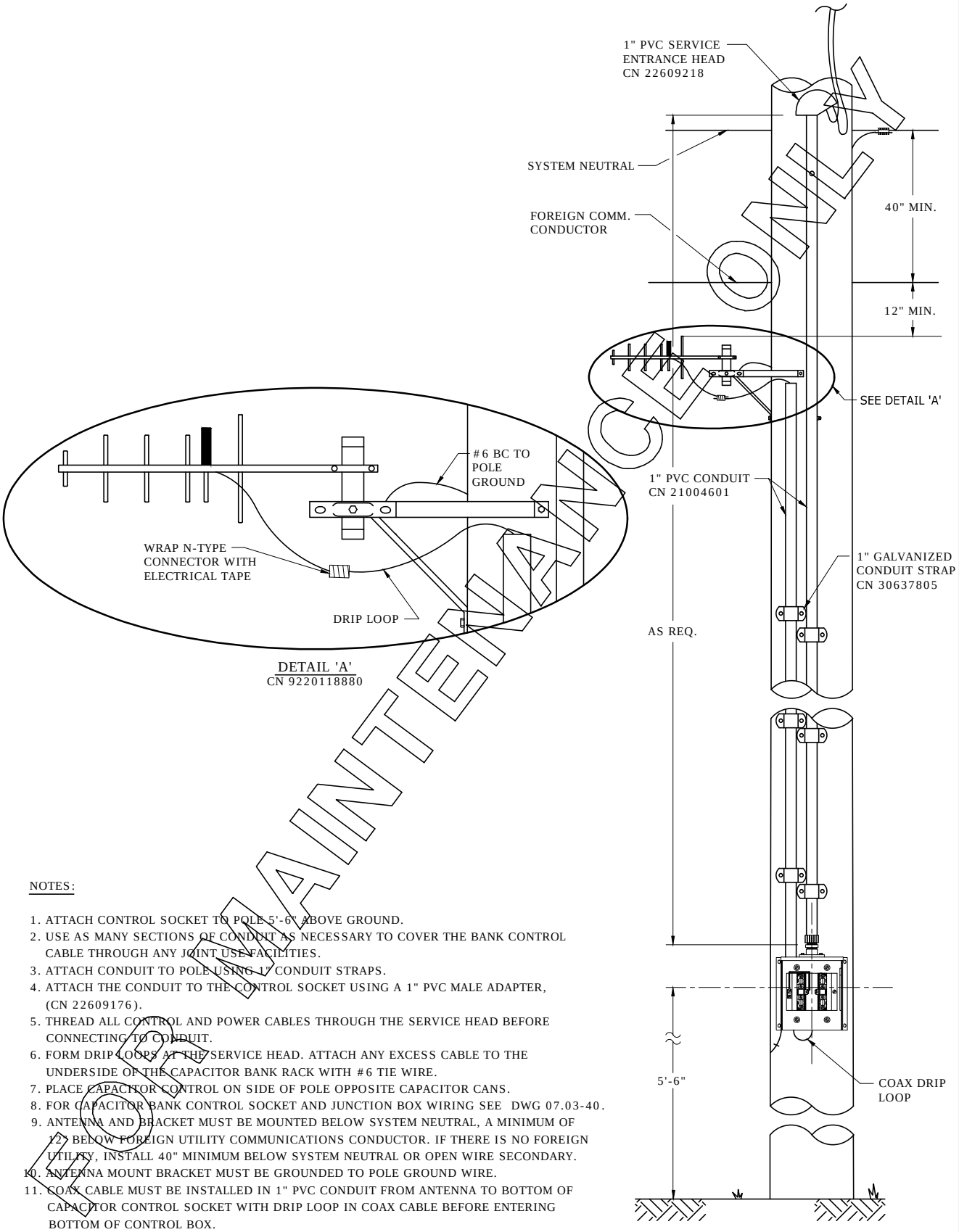
SWITCHED CAPACITOR BANKS MUST NEVER BE ENERGIZED OR DE-ENERGIZED WITH THE VACUUM SWITCHES IN THE CLOSED POSITION. SHOULD A CAPACITOR CONTROL FAIL TO OPEN THE VACUUM SWITCHES, REMOVE THE CONTROL FROM THE CONTROL BASE AND INSTALL THE CAPACITOR CONTROL SWITCH FIELD TESTER AS SHOWN IN DWG. 07.01-20 TO OPEN THE VACUUM SWITCHES.

3				
2				
1				
0	7/11/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

OPERATING AND TROUBLESHOOTING
CAPACITOR VACUUM SWITCH (FMO)

Progress Energy

CAR DWG. 07.01-14



DETAIL 'A'
CN 9220118880

NOTES:

1. ATTACH CONTROL SOCKET TO POLE 5'-6" ABOVE GROUND.
2. USE AS MANY SECTIONS OF CONDUIT AS NECESSARY TO COVER THE BANK CONTROL CABLE THROUGH ANY JOINT USE FACILITIES.
3. ATTACH CONDUIT TO POLE USING 1" CONDUIT STRAPS.
4. ATTACH THE CONDUIT TO THE CONTROL SOCKET USING A 1" PVC MALE ADAPTER, (CN 22609176).
5. THREAD ALL CONTROL AND POWER CABLES THROUGH THE SERVICE HEAD BEFORE CONNECTING TO CONDUIT.
6. FORM DRIP LOOPS AT THE SERVICE HEAD. ATTACH ANY EXCESS CABLE TO THE UNDERSIDE OF THE CAPACITOR BANK RACK WITH #6 TIE WIRE.
7. PLACE CAPACITOR CONTROL ON SIDE OF POLE OPPOSITE CAPACITOR CANS.
8. FOR CAPACITOR BANK CONTROL SOCKET AND JUNCTION BOX WIRING SEE DWG 07.03-40.
9. ANTENNA AND BRACKET MUST BE MOUNTED BELOW SYSTEM NEUTRAL, A MINIMUM OF 12" BELOW FOREIGN UTILITY COMMUNICATIONS CONDUCTOR. IF THERE IS NO FOREIGN UTILITY, INSTALL 40" MINIMUM BELOW SYSTEM NEUTRAL OR OPEN WIRE SECONDARY.
10. ANTENNA MOUNT BRACKET MUST BE GROUNDED TO POLE GROUND WIRE.
11. COAX CABLE MUST BE INSTALLED IN 1" PVC CONDUIT FROM ANTENNA TO BOTTOM OF CAPACITOR CONTROL SOCKET WITH DRIP LOOP IN COAX CABLE BEFORE ENTERING BOTTOM OF CONTROL BOX.

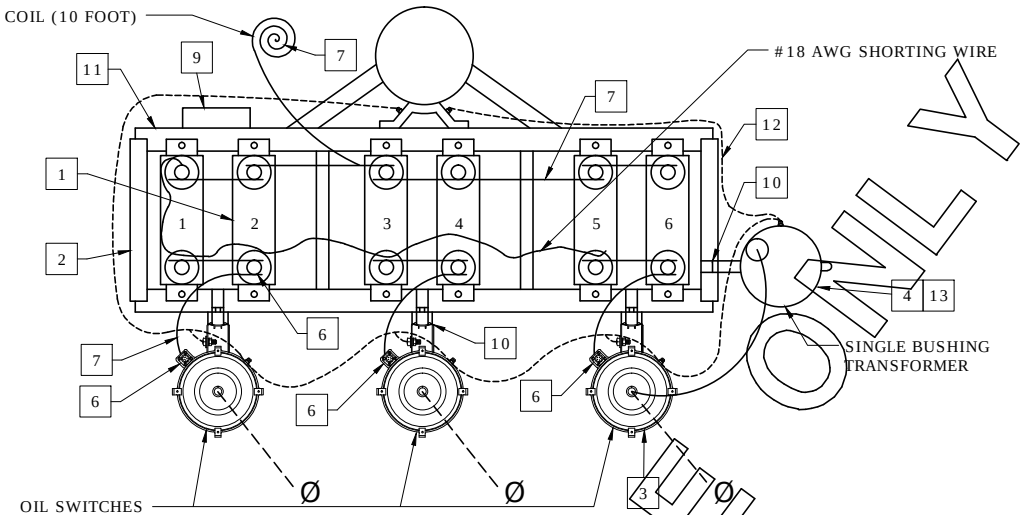
3				
2				
1				
0	4/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

CAPACITOR BANK CONTROL SOCKET INSTALLATION AND OPTIONAL PAGING ANTENNA (FMO)

Progress Energy

CAR

DWG. 07.02-30



CAPACITOR BANK LAYOUT

NOT TO SCALE

BILL OF MATERIALS

CU/CN ITEM NO.	CATALOG NUMBER	DESCRIPTION
1	22061808	CAPACITOR, 100KVAR, 13.2KV, 1Ø
	22062004	CAPACITOR, 200KVAR, 13.2KV, 1Ø
	007381	CAPACITOR, 400KVAR, 13.2KV, 1Ø
	22060602	CAPACITOR, 100KVAR, 7.2KV, 1Ø
	22060800	CAPACITOR, 200KVAR, 7.2KV, 1Ø
	9220066686	CAPACITOR, 400KVAR, 7.2KV, 1Ø
2	20315503	RACK, MTG., CAP, UN, 6-1 Ø, AL
3	9220151414	SWITCH, OIL, 1Ø, 90A, 20KV (FOR 12, 23 OR 34.5 BANK)
4	12810206	TSFMR, POT, 1.O KVA, 1 BUSHING, 13.2KV
	050782	TSFMR, POT, 1.O KVA, 1 BUSHING, 7.2KV
5	21132105	PROTECTIVE CAP, PLC, CAPACITOR
6	9220103215	PLC BOOTS FOR COOPER VAC-SW
	21132006	CAP, PRO, OIL-SW, CAP, PLC
7	11025202	#4-SOLID CU,SD, WP, 600V
8	31051006	TUBING, INS, PRO, CU, #4, SLD (IF NEEDED)
9	11270022	BOX, JUNCTION, CAP, DIST. (KIT)
10	12912226	BRACKET, SW, OIL, CAP, 1Ø
11	12912306	BRACKET, MTG, LARGE-RACK MT-OIL SW OR PT
12	11061009	#6 BC SD WIRE (QUANTITY SHOWN IN FEET)
13	10300507	TRANSFORMER SQUIRREL GUARD
14	22071005	CAPACITOR BANK, 600KVAR, 12KV, SW
15	22070205	CAPACITOR BANK, 600KVAR, 12KV, FIXED
16	9220066694	CAPACITOR BANK, 1200KVAR, 12KV, SW
17	22071401	CAPACITOR BANK, 1200KVAR, 23KV, SW
18	22071807	CAPACITOR BANK, 1200KVAR, 23KV, FIXED
19	22071500	CAPACITOR BANK, 1800KVAR, 23KV, SW

NOTES:

1. THIS IS A SAMPLE LAYOUT OF A 6 UNIT CAPACITOR BANK.
2. ALL EQUIPMENT ON THE CAPACITOR BANK MUST HAVE A LOOPED GROUNDING SYSTEM. THE RACK IS PART OF THE LOOP.
3. THE CONSTRUCTION CREW IS TO RUN 2 #6 BC GROUND WIRES - ONE FROM EACH CAPACITOR BANK POLE HANGER GROUNDING LUG TO THE SYSTEM NEUTRAL AND #6 BC FROM THE SYSTEM NEUTRAL TO THE POLE GROUND AT THE BASE OF THE POLE. THE HIGH VOLTAGE NEUTRAL WIRE (10' COILED) IS TO BE #4, SD, WP, CU. SEE DWGS. 07.02-20 AND 07.02-25.

3				
2				
1				
0	6/11/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

CAPACITOR BANK MATERIALS (FMO)

Progress Energy

CAR

DWG. 07.02-35