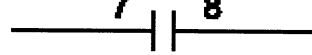
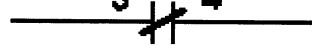


SYMBOL	DESCRIPTION
ONE LINE PROTECTION RELAYING AND ELEMENTARY DIAGRAMS-1	
 or 	DEVICE FUNCTION NUMBER INDICATED, SEE DEVICE TABLE
	CONTROL SWITCH TRIP
	CONTROL SWITCH CLOSE
43/CS	43-DEVICE FUNCTION NUMBER, SEE DEVICE TABLE
	VOLTMETER SWITCH
	AMMETER SWITCH
	INDICATING LAMP-SWITCHBOARD TYPE INDICATING LAMP LENS COLORS INDICATED AS FOLLOWS: A - AMBER R - RED B - BLUE W - WHITE G - GREEN
	VOLTMETER
	AMMETER
	WATTMETER
	FREQUENCY METER
	POWER FACTOR METER
	WATT-HOUR METER
	ELAPSED TIME METER
	TACHOMETER
	WATTS TRANSDUCER
	POWER FACTOR TRANSDUCER
	TIME DELAY
	RELAY COIL, DEVICE FUNCTION NUMBER PER ANSI 37.2 - AMERICAN STANDARD MANUAL AND AUTOMATIC STATION CONTROL, SUPERVISORY AND ASSOCIATED TELEMETRY EQUIPMENT
	
	NORMALLY OPEN CONTACT
	NORMALLY CLOSED CONTACT
	REMOTE DEVICE
	TEST SWITCH CURRENT ELEMENT
	TEST SWITCH POTENTIAL ELEMENT
	NEUTRAL CONNECTION
	DIODE
	INSTRUMENTATION CABLE, SHIELDED
	NEUTRAL GROUNDING RESISTOR
	PHASE SHIFTING TRANSFORMER

DEVICE TABLE	
ONE LINE PROTECTION RELAYING AND ELEMENTARY DIAGRAMS-2	
DEVICE FUNCTION NO.	DEVICE DESCRIPTION
21	IMPEDANCE/DISTANCE RELAY
25A	AUTOMATIC SYNCHRONIZER
25C	SYNCH CHECK RELAY
27	UNDERVOLTAGE RELAY
32	REVERSE POWER RELAY
40	GENERATOR LOSS OF EXCITATION RELAY
43CSE	AUTOMATIC POWER TRANSFER AND LOAD CONTROL MODE SEL. SWITCH
43CSX	MODE SEL. SWITCH
46	GENERATOR CURRENT UNBALANCE RELAY
49	THERMAL RELAY
50GS	INSTANTANEOUS OVERCURRENT DEVICE, GROUND SENSOR
50	INSTANTANEOUS OVERCURRENT DEVICE,
51	TIME OVERCURRENT RELAY
51G	TIME OVERCURRENT RELAY, GROUND FAULT
51V	TIME OVERCURRENT, VOLTAGE RESTRAINED
52	POWER CIRCUIT BREAKER
52CSX	POWER CIRCUIT BREAKER CONTROL SWITCH
59	OVERVOLTAGE RELAY
60	VOLTAGE OR CURRENT BALANCE RELAY
65A	ENGINE GOVERNOR, SPEED CONTROL
65A, MOP	ENGINE GOVERNOR, SPEED CONTROL MOTOR OPERATED POTENTIOMETER
65A, RL	ENGINE GOVERNOR, SPEED CONTROL RAISE/LOWER SWITCH
65B	ENGINE GOVERNOR, LOAD CONTROL
65B, MOP	ENGINE GOVERNOR, LOAD CONTROL MOTOR OPERATED POTENTIOMETER
65B, RL	ENGINE GOVERNOR, % LOAD RAISE/LOWER SWITCH
65E	AUTOMATIC POWER TRANSFER AND LOAD CONTROL, WOODWARD APTL
65F	AUTOMATIC GENERATOR LOADING CONTROL, WOODWARD AGLC
67	DIRECTIONAL TIME OVERCURRENT RELAY
74	ALARM RELAY
81O/U	FREQUENCY RELAY, OVER/UNDER
86	LOCKOUT RELAY
87	DIFFERENTIAL PROTECTIVE RELAY
90	VOLTAGE REGULATOR
90, MOP	ENGINE EXCITATION, POWER OPERATED POTENTIOMETER
90PF	ENGINE EXCITATION, POWER FACTOR CONTROL
90RL	ENGINE EXCITATION, RAISE/ LOWER SWITCH

X = DEVICE NUMBER, WHEN THERE ARE MULTIPLE UNITS

4

5

6

CIRCUIT AND RACEWAY

GENERAL CIRCUIT CONDUCTOR AND CONDUIT IDENTIFICATION

POWER CIRCUIT CALLOUTS				MULTICONDUCTOR POWER CABLE CIRCUIT CALLOUTS	
[P1]	[1/2" FLEX, 2#12, 1#12G]	[P24]	[1"C, 3#8, 3#14, 1#10G]	[PC1]	[3/4"C, 1 (3C#12, 1#12G) TYPE 2]
[P2]	[3/4"C, 2#12, 1#12G]	[P25]	[1"C, 3#8, 4#14, 1#10G]	[PC2]	[3/4"C, 1 (3C#10, 1#10G) TYPE 2]
[P3]	[3/4"C, 3#12, 1#12G]	[P26]	[1"C, 3#8, 5#14, 1#10G]	[PC3]	[1"C, 1 (3C#8, 1#10G) TYPE 2]
[P4]	[3/4"C, 4#12, 1#12G]	[P27]	[1"C, 2#8, 1#10G]	[PC4]	[1 1/4"C, 2 (3C#12, 1#12G) TYPE 2]
[P5]	[3/4"C, 5#12, 1#12G]	[P28]	[1"C, 3#8, 1#8G]	[PC5]	[1 1/2"C, 2 (3C#10, 1#10G) TYPE 2]
[P6]	[3/4"C, 6#12, 1#12G]	[P29]	[1"C, 3#8, 2#14, 1#8G]	[PC1A]	[3/4"C, 1 (2C#12, 1#12G) TYPE 2]
[P7]	[3/4"C, 7#12, 1#12G]	[P30]	[1"C, 3#8, 3#14, 1#8G]	[PC2A]	[3/4"C, 1 (2C#10, 1#10G) TYPE 2]
[P8]	[3/4"C, 8#12, 1#12G]	[P31]	[1"C, 3#8, 4#14, 1#8G]		
[P9]	[3/4"C, 3#12, 2#14, 1#12G]	[P32]	[1"C, 3#8, 5#14, 1#8G]		
[P10]	[3/4"C, 3#12, 3#14, 1#12G]	[P33]	[1"C, 3#4, 1#8G]		
[P11]	[3/4"C, 3#12, 4#14, 1#12G]	[P34]	[1 1/4"C, 3#4, 3#14, 1#8G]		
[P12]	[3/4"C, 3#12, 5#14, 1#12G]	[P35]	[1 1/4"C, 3#4, 5#14, 1#8G]		
[P13]	[3/4"C, 3#12, 6#14, 1#12G]	[P36]	[1 1/4"C, 3#3, 1#8G]		
[P14]	[3/4"C, 3#12, 7#14, 1#12G]	[P37]	[1 1/4"C, 3#3, 3#14, 1#8G]		
[P15]	[3/4"C, 2#10, 1#10G]	[P38]	[1 1/4"C, 3#2, 1#8G]		
[P16]	[3/4"C, 3#10, 1#10G]	[P39]	[1 1/4"C, 3#1, 1#8G]		
[P17]	[3/4"C, 3#10, 2#14, 1#10G]	[P40]	[1 1/2"C, 3#1, 3#14, 1#8G]		
[P18]	[3/4"C, 3#10, 3#14, 1#10G]	[P41]	[1 1/2"C, 3#2/0, 1#4G]		
[P19]	[3/4"C, 3#10, 4#14, 1#10G]	[P42]	[2"C, 3#3/0, 1#4G]		
[P20]	[3/4"C, 3#10, 5#14, 1#10G]	[P43]	[2"C, 3#4/0, 1#3G]		
[P21]	[1"C, 2#8, 1#10G]				
[P22]	[1"C, 3#8, 1#10G]				
[P23]	[1"C, 3#8, 2#14, 1#10G]				
ANALOG CIRCUIT CALLOUTS				EMPTY CONDUIT	
[A1]	[3/4"C, 1 TYPE 3]			[EC-1]	[3/4"C, WITH PULL STRING]
[A2]	[1"C, 2 TYPE 3]			[EC-2]	[1"C, WITH PULL STRING]
[A3]	[1"C, 3 TYPE 3]			[EC-3]	[1 1/4"C, WITH PULL STRING]
[A4]	[1"C, 4 TYPE 3]			[EC-4]	[1 1/2"C, WITH PULL STRING]
[A5]	[1 1/4"C, 5 TYPE 3]			[EC-5]	[2"C, WITH PULL STRING]
[A6]	[1 1/4"C, 6 TYPE 3]			[EC-6]	[3"C, WITH PULL STRING]
[A7]	[1 1/2"C, 7 TYPE 3]			[EC-7]	[4"C, WITH PULL STRING]
[A8]	[1 1/2"C, 8 TYPE 3]			[EC-8]	[5"C, WITH PULL STRING]
[A9]	[1 1/2"C, 9 TYPE 3]				
[A10]	[2"C, 10 TYPE 3]				
[A11]	[2"C, 11 TYPE 3]				
[A12]	[2"C, 12 TYPE 3]				
[A13]	[2"C, 13 TYPE 3]				
[A14]	[2"C, 14 TYPE 3]				
[A15]	[3/4"C, 1 TYPE 4]				
[A16]	[3/4"C, 2 TYPE 4]				
[A17]	[1"C, 3 TYPE 4]				
[A18]	[1 1/4"C, 4 TYPE 4]				
[A19]	[1 1/4"C, 5 TYPE 4]				
[A20]	[1 1/4"C, 6 TYPE 4]				
[A21]	[1 1/2"C, 7 TYPE 4]				
[A22]	[1 1/2"C, 8 TYPE 4]				
[A23]	[2"C, 9 TYPE 4]				
[A24]	[3/4"C, 1-4 pr. TYPE 5]				
[A25]	[1"C, 2-4 pr. TYPE 5]				
CONTROL CIRCUIT CALLOUTS				MULTICONDUCTOR CONTROL CABLE CIRCUIT CALLOUTS	
[C1]	[3/4"C, MSC]			[CC5]	[3/4"C, 1-5G TYPE 1]
[C2]	[3/4"C, 2#14, 1#14G]			[CC7]	[3/4"C, 1-7C TYPE 1]
[C3]	[3/4"C, 3#14, 1#14G]			[CC9]	[1"C, 1-9C TYPE 1]
[C4]	[3/4"C, 4#14, 1#14G]			[CC12]	[1"C, 1-12C TYPE 1]
[C5]	[3/4"C, 5#14, 1#14G]			[CC19]	[1 1/2"C, 1-19C TYPE 1]
[C6]	[3/4"C, 6#14, 1#14G]			[CC25]	[1 1/2"C, 1-25C TYPE 1]
[C7]	[3/4"C, 7#14, 1#14G]			[CC37]	[2"C, 1-37C TYPE 1]
[C8]	[3/4"C, 8#14, 1#14G]			[CCC1]	[1-7C #12 TYPE 1]
[C9]	[3/4"C, 9#14, 1#14G]				
[C10]	[3/4"C, 10#14, 1#14G]				
[C11]	[3/4"C, 11#14, 1#14G]				
[C12]	[3/4"C, 12#14, 1#14G]				
[C13]	[3/4"C, 13#14, 1#14G]				
[C14]	[3/4"C, 14#14, 1#14G]				
[C15]	[3/4"C, 15#14, 1#14G]				
[C16]	[3/4"C, 16#14, 1#14G]				
[C17]	[3/4"C, 17#14, 1#14G]				
[C18]	[3/4"C, 18#14, 1#14G]				
[C19]	[3/4"C, 19#14, 1#14G]				
[C20]	[1"C, 20#14, 1#14G]				
[C21]	[1"C, 21#14, 1#14G]				
[C22]	[1"C, 22#14, 1#14G]				
[C23]	[1"C, 23#14, 1#14G]				
[C24]	[1"C, 24#14, 1#14G]				
[C25]	[1"C, 25#14, 1#14G]				

- NOTES:**
- 1. FOR CABLE TYPES, SEE SPECIFICATIONS.**
 - 2. CONDUIT SIZES ARE BASE ON THE AREA OF THW CONDUCTORS.**
 - 3. SIZING OF CONDUCTORS #1AWG AND SMALLER BASED ON AMPACITIES AT 60 DEGREES C, SIZING OF CONDUCTORS #1/0AWG AND LARGER BASED ON AMPACITIES AT 75 DEGREES C.**
 - 4. WHERE CIRCUITS ARE UNDERGROUND, DIRECT BURIED OR CONCRETE ENCASED, MINIMUM CONDUIT SIZE SHALL BE 1".**
 - 5. FOR METRIC CONDUIT SIZES USE THE FOLLOWING CONVERSION:**

1/2" = 16 mm	1/4" = 35 mm
3/4" = 21 mm	1 1/2" = 41 mm
1" = 27 mm	2" = 53 mm

CH2MHILL.		ELECTRICAL CRYSTAL SPRING WATER TREATMENT PLANT CLEARWELL REPLACEMENT WESTERN VIRGINIA WATER AUTHORITY CITY OF ROANOKE, VIRGINIA		LEGEND AND SYMBOLS				RELIEF OF DOCUMENTS: THIS DOCUMENT, AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF CH2M HILL AND IS NOT TO BE USED, IN WHOLE OR IN PART, FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF CH2M HILL.	
VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING. 1" = 0' _____									
DATE		JUNE 2014							
PROJ		475481							
DWG		E-0003							
SHEET		26 of 37							