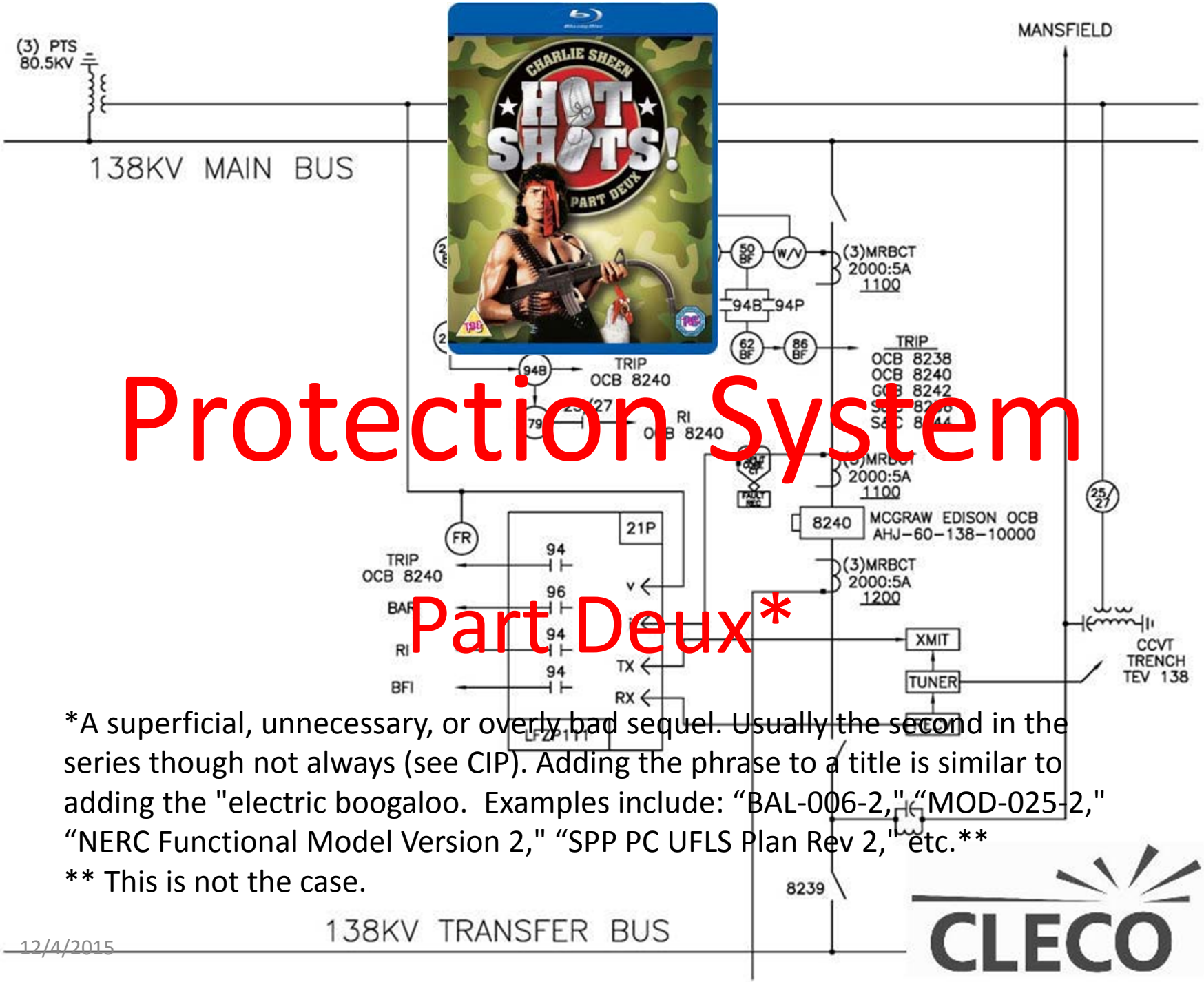
Protection System Part Deux*



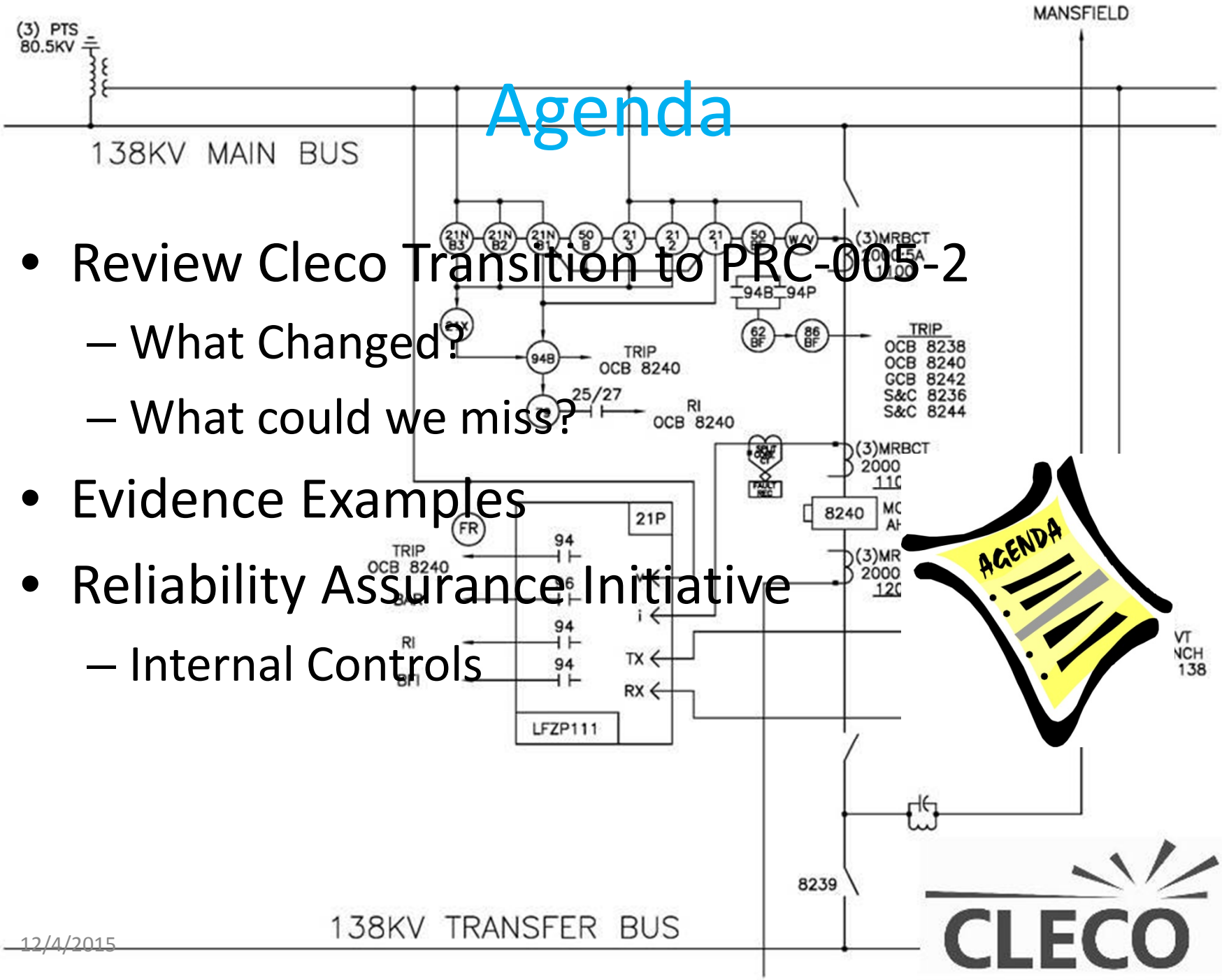
*A superficial, unnecessary, or overly bad sequel. Usually the second in the series though not always (see CIP). Adding the phrase to a title is similar to adding the "electric boogaloo. Examples include: “BAL-006-2," “MOD-025-2," “NERC Functional Model Version 2," “SPP PC UFLS Plan Rev 2," etc.**

** This is not the case.

CLECO

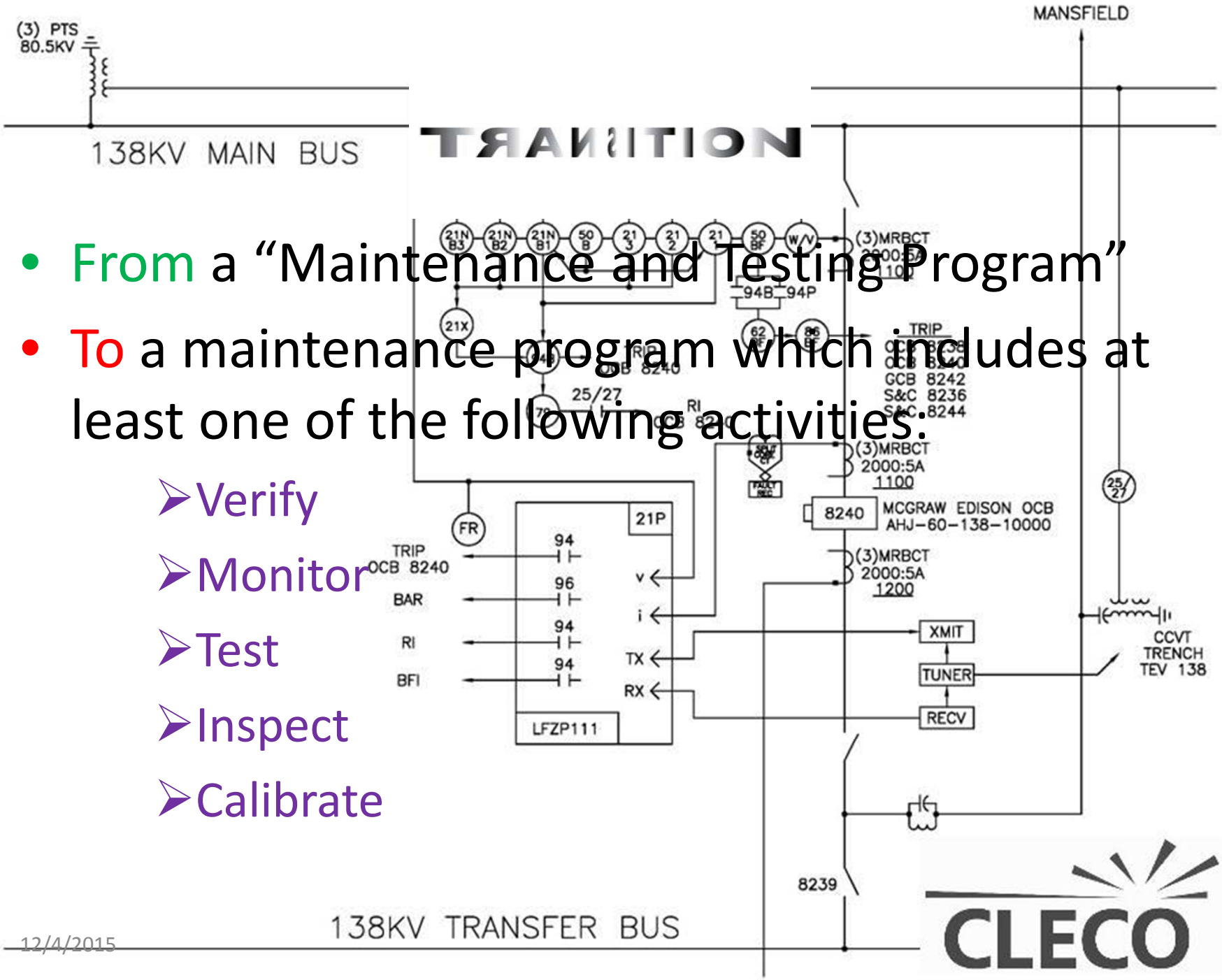
Agenda

- Review Cleco Transition to PRC-005-2
  - What Changed?
  - What could we miss?
- Evidence Examples
- Reliability Assurance Initiative
  - Internal Controls



TRANSITION

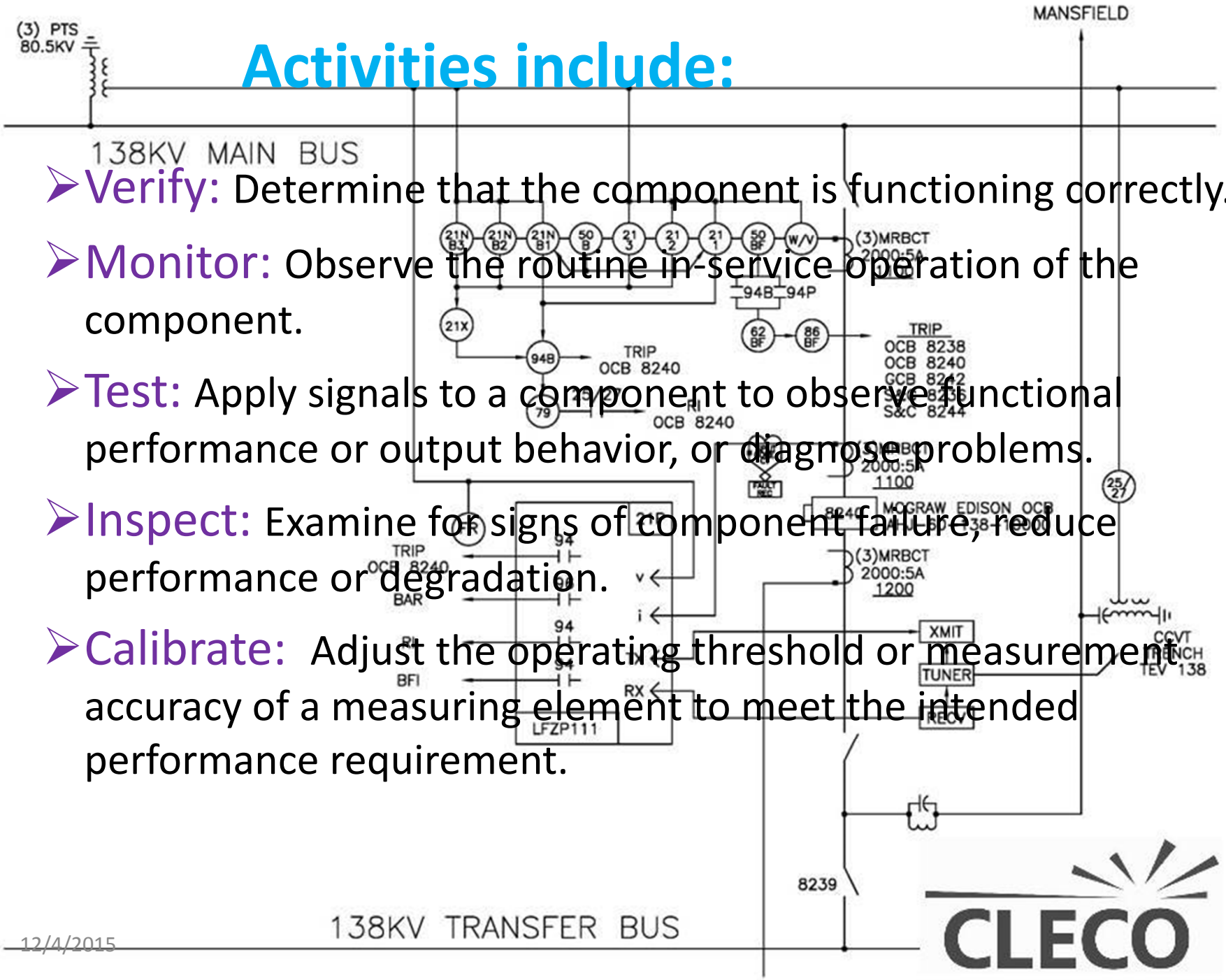
- From a “Maintenance and Testing Program”
- To a maintenance program which includes at least one of the following activities:
  - Verify
  - Monitor
  - Test
  - Inspect
  - Calibrate



CLECO

Activities include:

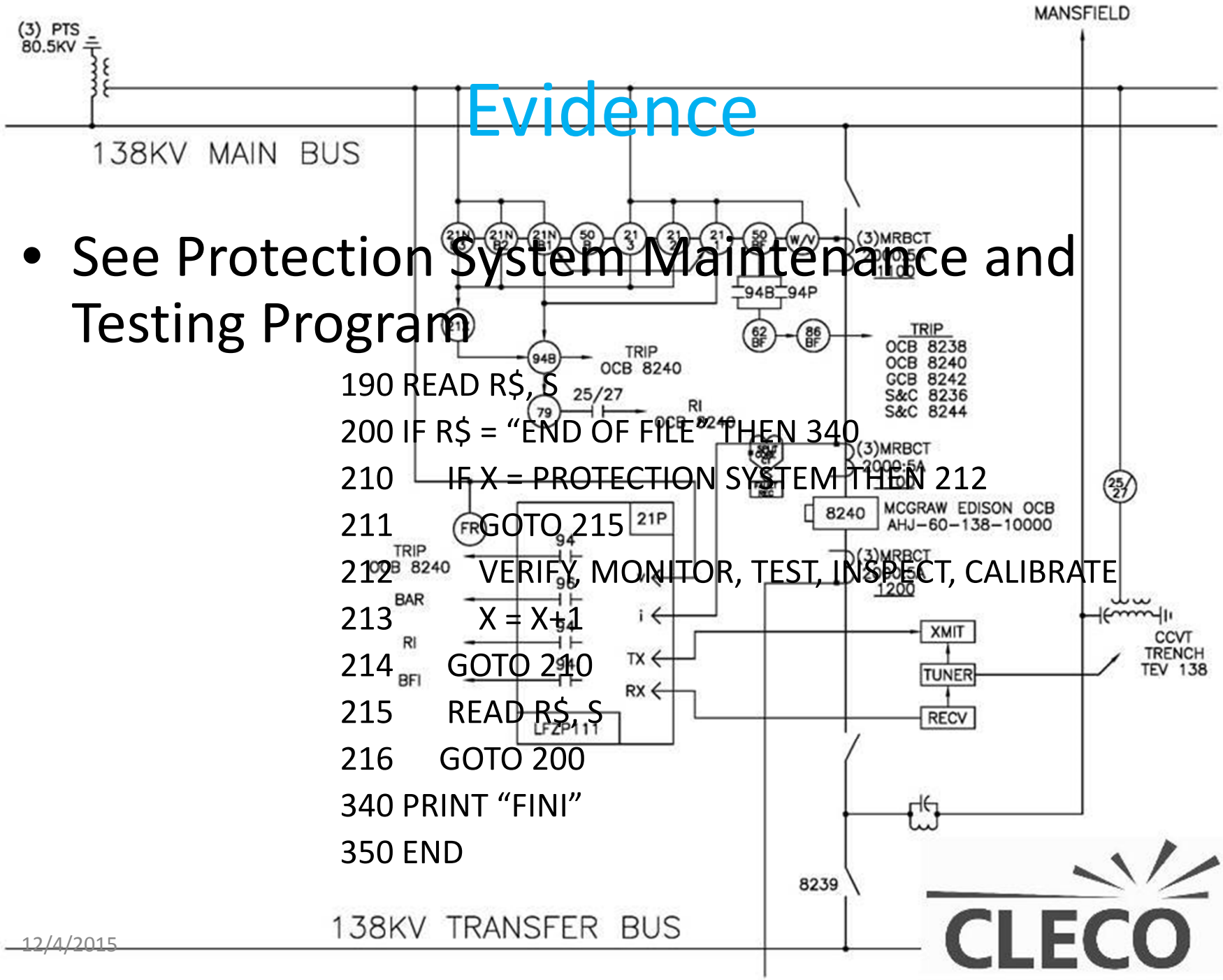
- **Verify:** Determine that the component is functioning correctly.
- **Monitor:** Observe the routine in-service operation of the component.
- **Test:** Apply signals to a component to observe functional performance or output behavior, or diagnose problems.
- **Inspect:** Examine for signs of component failure, reduce performance or degradation.
- **Calibrate:** Adjust the operating threshold or measurement accuracy of a measuring element to meet the intended performance requirement.



Evidence

- See Protection System Maintenance and Testing Program

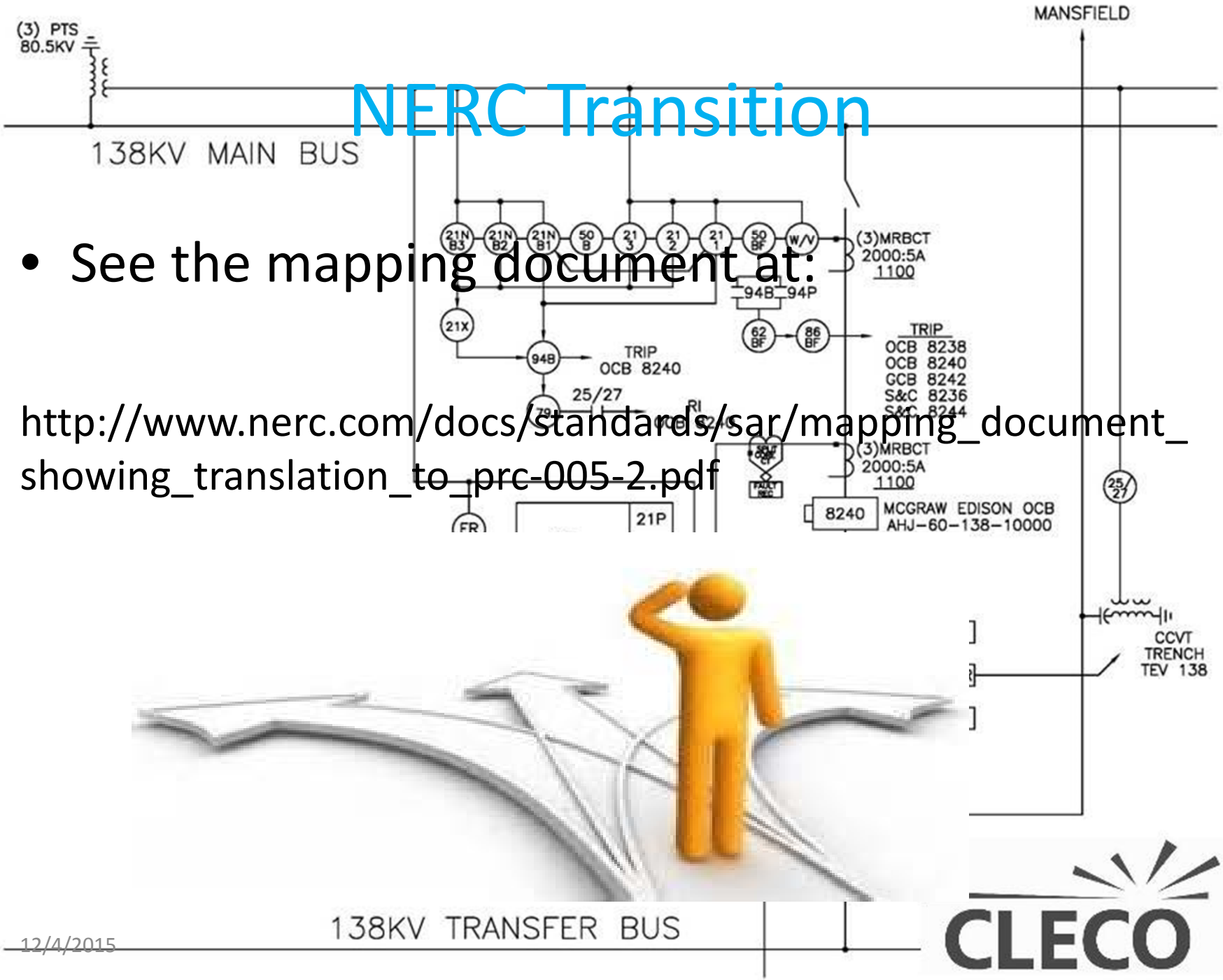
```
190 READ R$, S
200 IF R$ = "END OF FILE" THEN 340
210     IF X = PROTECTION SYSTEM THEN 212
211         GOTO 215
212         VERIFY, MONITOR, TEST, INSPECT, CALIBRATE
213         X = X+1
214     GOTO 210
215     READ R$, S
216     GOTO 200
340 PRINT "FINI"
350 END
```



NERC Transition

- See the mapping document at:

http://www.nerc.com/docs/standards/sar/mapping_document_showing_translation_to_prc-005-2.pdf



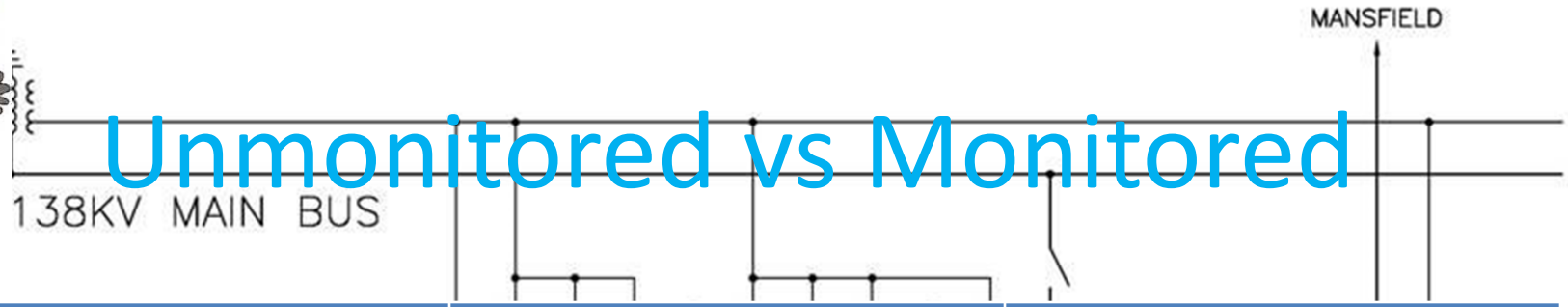
Cleco's Components

Version 1	Version 2
Batteries & Chargers	Batteries & Chargers
Current Transformers	Current Transformers
Potential Transformers	Potential Transformers
Carrier systems	Carrier systems
Wavetraps	Wavetraps
UF relays	UF relays
Protection Relays	Protection Relays
Special Protection Schemes	Remedial Action Systems
Protection Functional test (trip checks)	Protection Functional test (trip checks)
	UF Functional test
	Alarms or monitoring

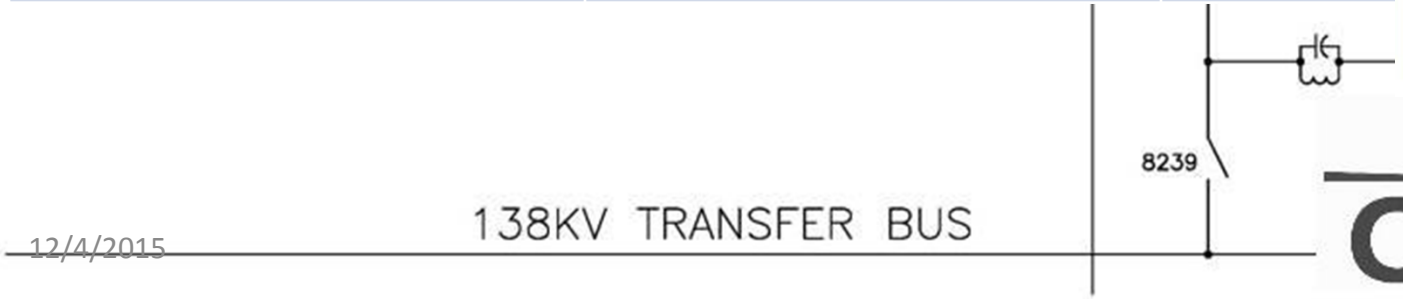
Cleco's Program

- Our Program is strictly "Time Based"

Unmonitored vs Monitored



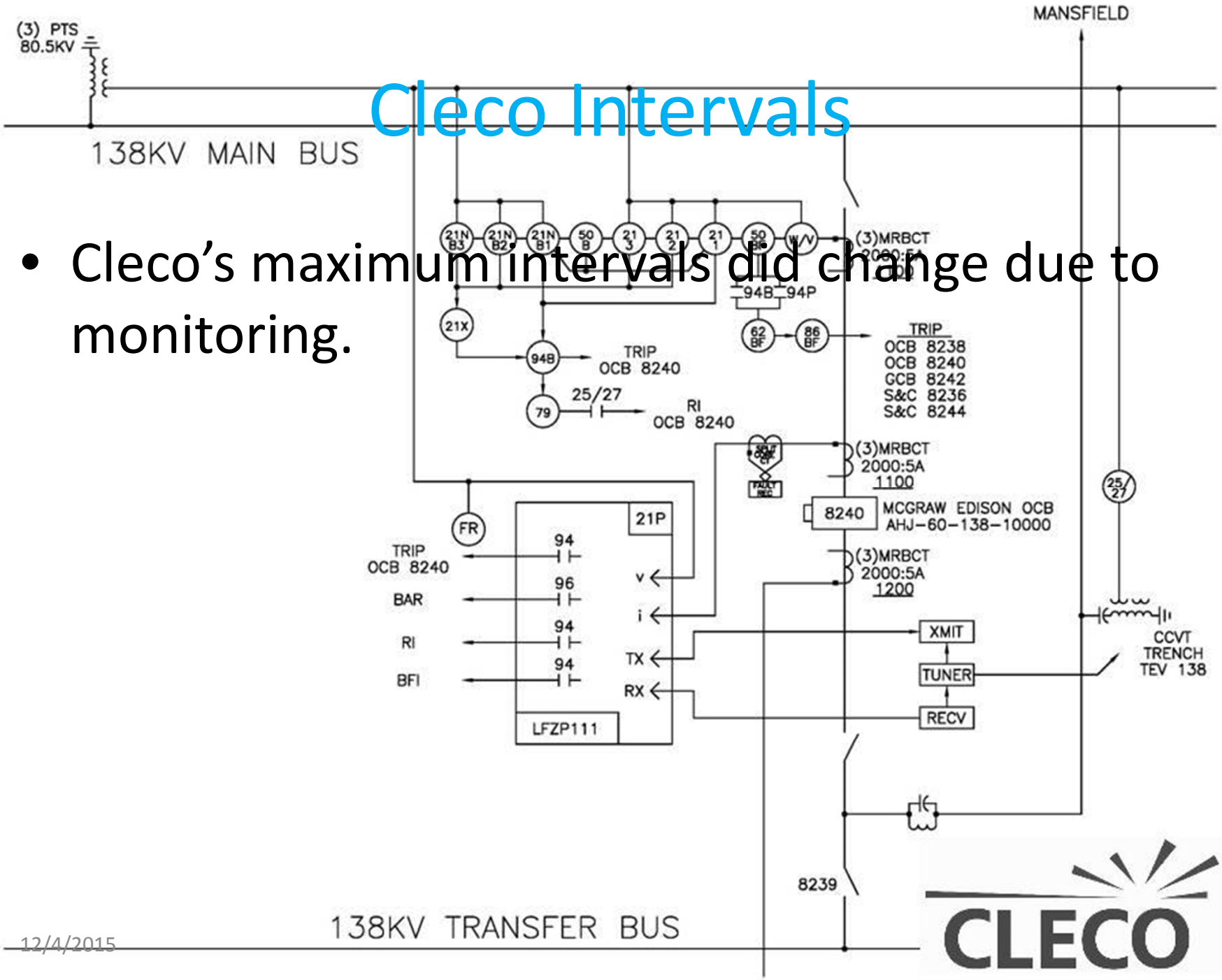
Component Attribute	Maximum Interval for Unmonitored	Maximum Interval for Monitored
Protective Relay	6 years	12 years
Communications system	4 months & 6 years	12 years
Voltage & current sensing devices	12 years	None
Protection System DC supply	4 months & 18 months	None
Control Circuitry	6 or 12 years	None
Alarm Path	12 years	None
UFLS/UVLS	6 years	12 years



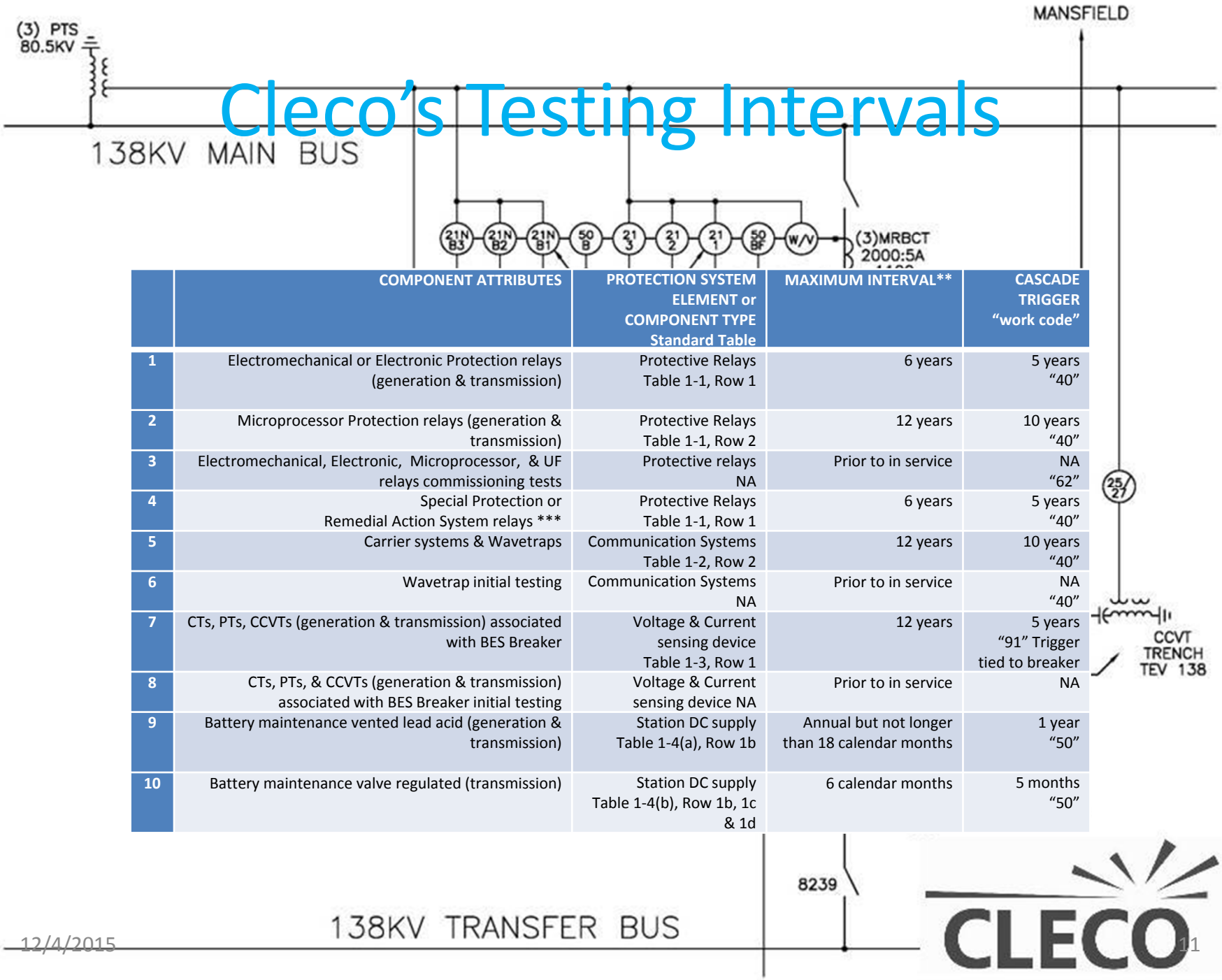
CLECO

Cleco Intervals

- Cleco's maximum intervals did change due to monitoring.

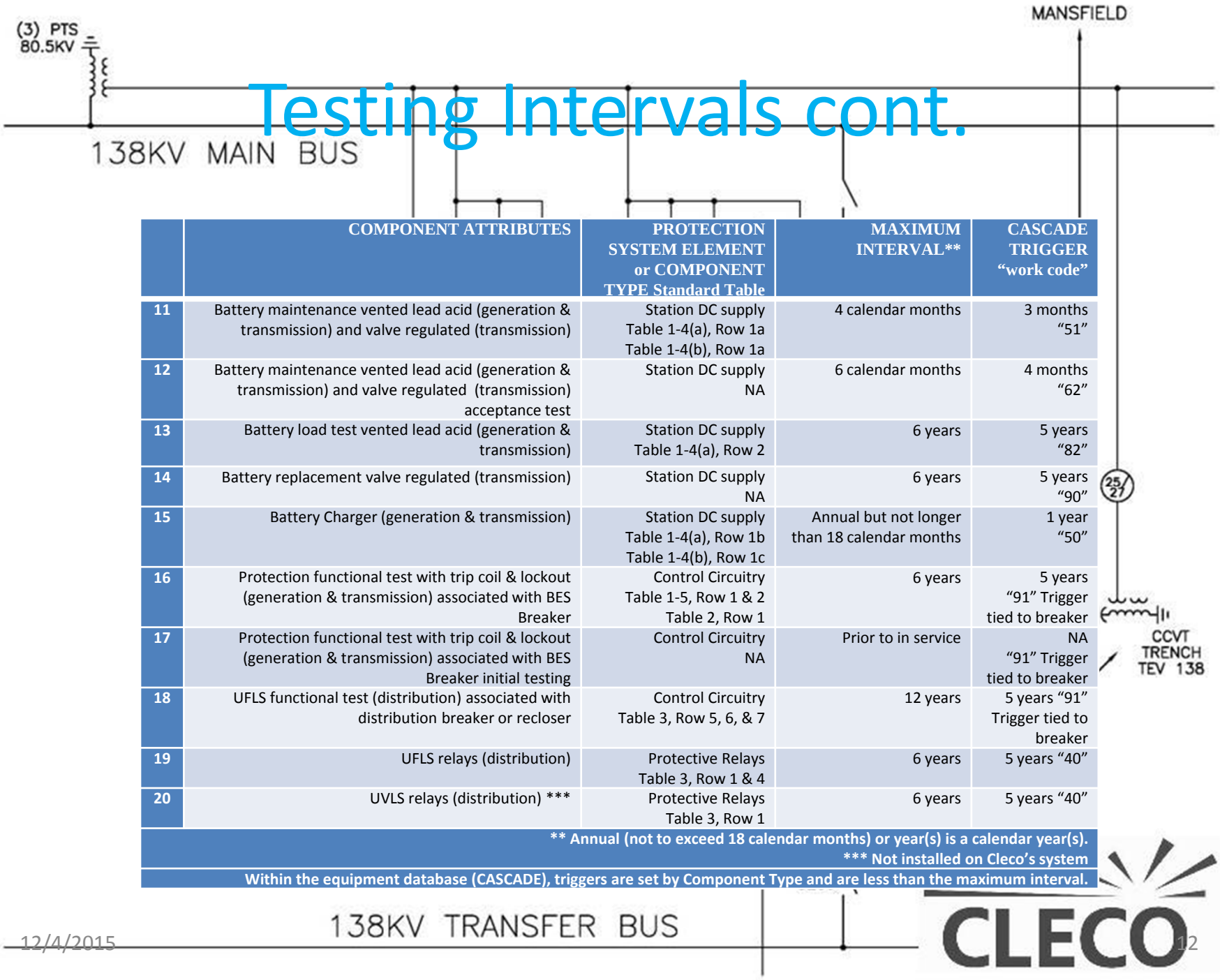


Cleco's Testing Intervals



	COMPONENT ATTRIBUTES	PROTECTION SYSTEM ELEMENT or COMPONENT TYPE Standard Table	MAXIMUM INTERVAL**	CASCADE TRIGGER "work code"
1	Electromechanical or Electronic Protection relays (generation & transmission)	Protective Relays Table 1-1, Row 1	6 years	5 years "40"
2	Microprocessor Protection relays (generation & transmission)	Protective Relays Table 1-1, Row 2	12 years	10 years "40"
3	Electromechanical, Electronic, Microprocessor, & UF relays commissioning tests	Protective relays NA	Prior to in service	NA "62"
4	Special Protection or Remedial Action System relays ***	Protective Relays Table 1-1, Row 1	6 years	5 years "40"
5	Carrier systems & Wavetraps	Communication Systems Table 1-2, Row 2	12 years	10 years "40"
6	Wavetrap initial testing	Communication Systems NA	Prior to in service	NA "40"
7	CTs, PTs, CCVTs (generation & transmission) associated with BES Breaker	Voltage & Current sensing device Table 1-3, Row 1	12 years	5 years "91" Trigger tied to breaker
8	CTs, PTs, & CCVTs (generation & transmission) associated with BES Breaker initial testing	Voltage & Current sensing device NA	Prior to in service	NA
9	Battery maintenance vented lead acid (generation & transmission)	Station DC supply Table 1-4(a), Row 1b	Annual but not longer than 18 calendar months	1 year "50"
10	Battery maintenance valve regulated (transmission)	Station DC supply Table 1-4(b), Row 1b, 1c & 1d	6 calendar months	5 months "50"

Testing Intervals cont.



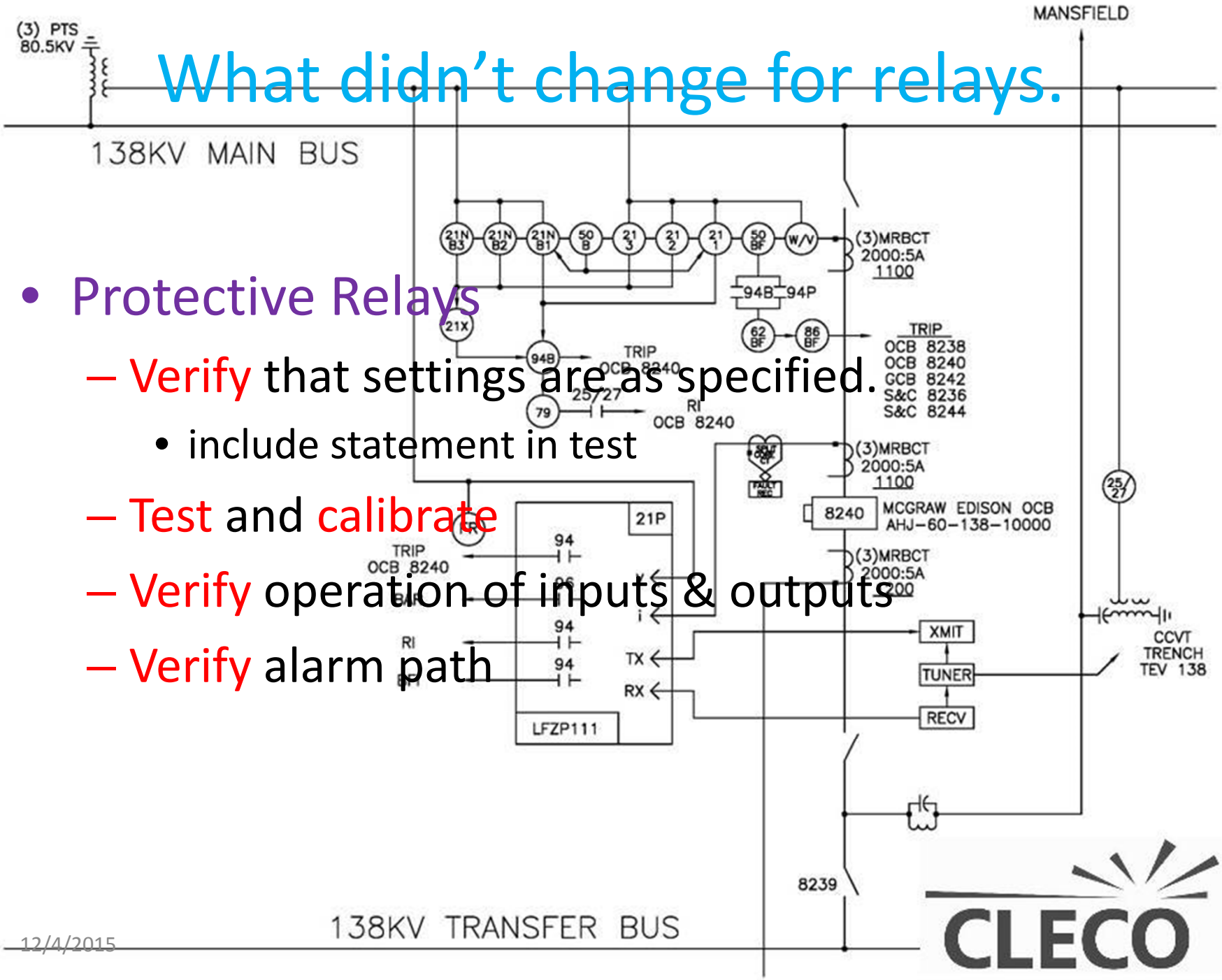
	COMPONENT ATTRIBUTES	PROTECTION SYSTEM ELEMENT or COMPONENT TYPE Standard Table	MAXIMUM INTERVAL**	CASCADE TRIGGER "work code"
11	Battery maintenance vented lead acid (generation & transmission) and valve regulated (transmission)	Station DC supply Table 1-4(a), Row 1a Table 1-4(b), Row 1a	4 calendar months	3 months "51"
12	Battery maintenance vented lead acid (generation & transmission) and valve regulated (transmission) acceptance test	Station DC supply NA	6 calendar months	4 months "62"
13	Battery load test vented lead acid (generation & transmission)	Station DC supply Table 1-4(a), Row 2	6 years	5 years "82"
14	Battery replacement valve regulated (transmission)	Station DC supply NA	6 years	5 years "90"
15	Battery Charger (generation & transmission)	Station DC supply Table 1-4(a), Row 1b Table 1-4(b), Row 1c	Annual but not longer than 18 calendar months	1 year "50"
16	Protection functional test with trip coil & lockout (generation & transmission) associated with BES Breaker	Control Circuitry Table 1-5, Row 1 & 2 Table 2, Row 1	6 years	5 years "91" Trigger tied to breaker
17	Protection functional test with trip coil & lockout (generation & transmission) associated with BES Breaker initial testing	Control Circuitry NA	Prior to in service	NA "91" Trigger tied to breaker
18	UFLS functional test (distribution) associated with distribution breaker or recloser	Control Circuitry Table 3, Row 5, 6, & 7	12 years	5 years "91" Trigger tied to breaker
19	UFLS relays (distribution)	Protective Relays Table 3, Row 1 & 4	6 years	5 years "40"
20	UVLS relays (distribution) ***	Protective Relays Table 3, Row 1	6 years	5 years "40"

** Annual (not to exceed 18 calendar months) or year(s) is a calendar year(s).
*** Not installed on Cleco's system

Within the equipment database (CASCADE), triggers are set by Component Type and are less than the maximum interval.

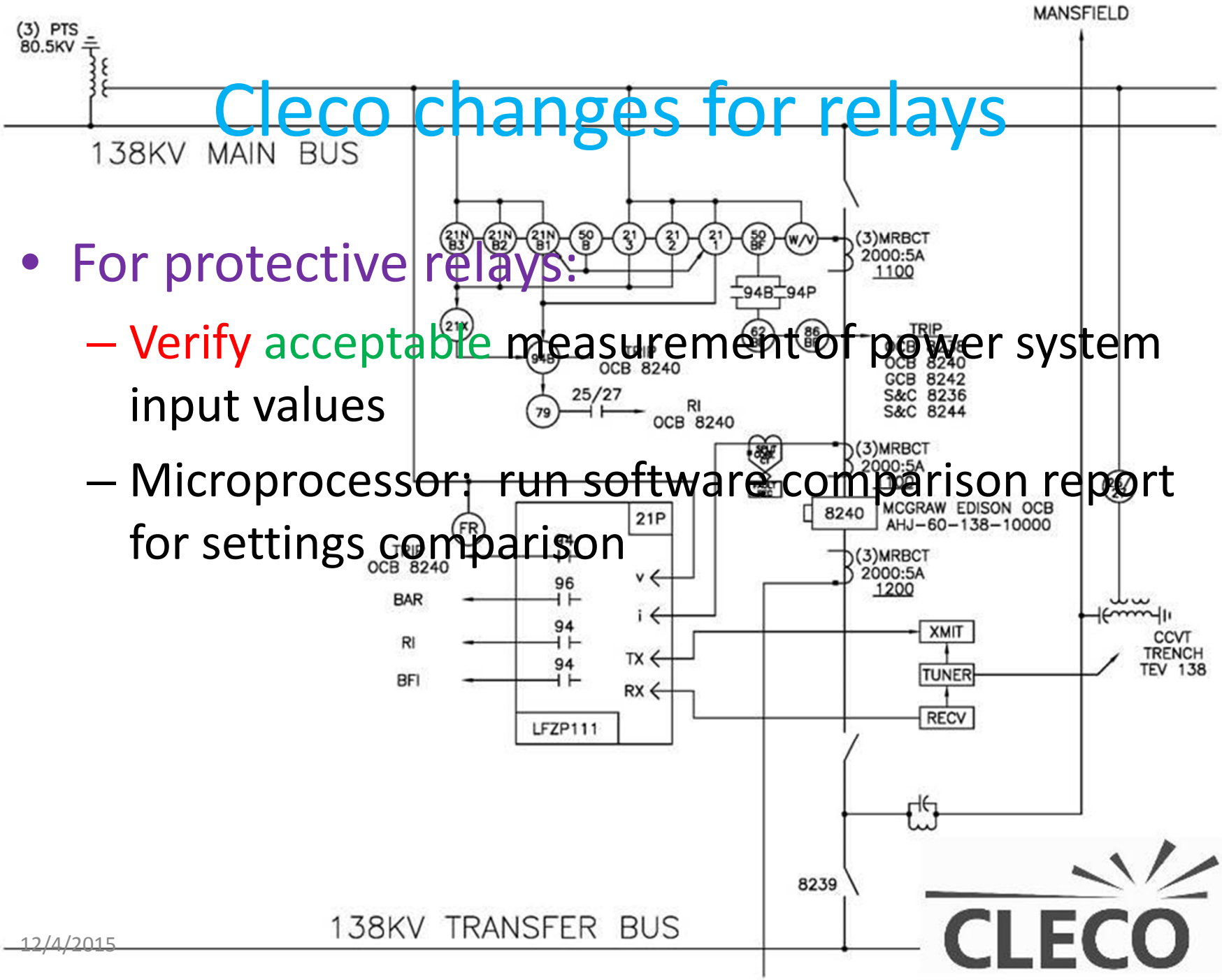
What didn't change for relays.

- Protective Relays
  - Verify that settings are as specified.
    - include statement in test
  - Test and calibrate
  - Verify operation of inputs & outputs
  - Verify alarm path

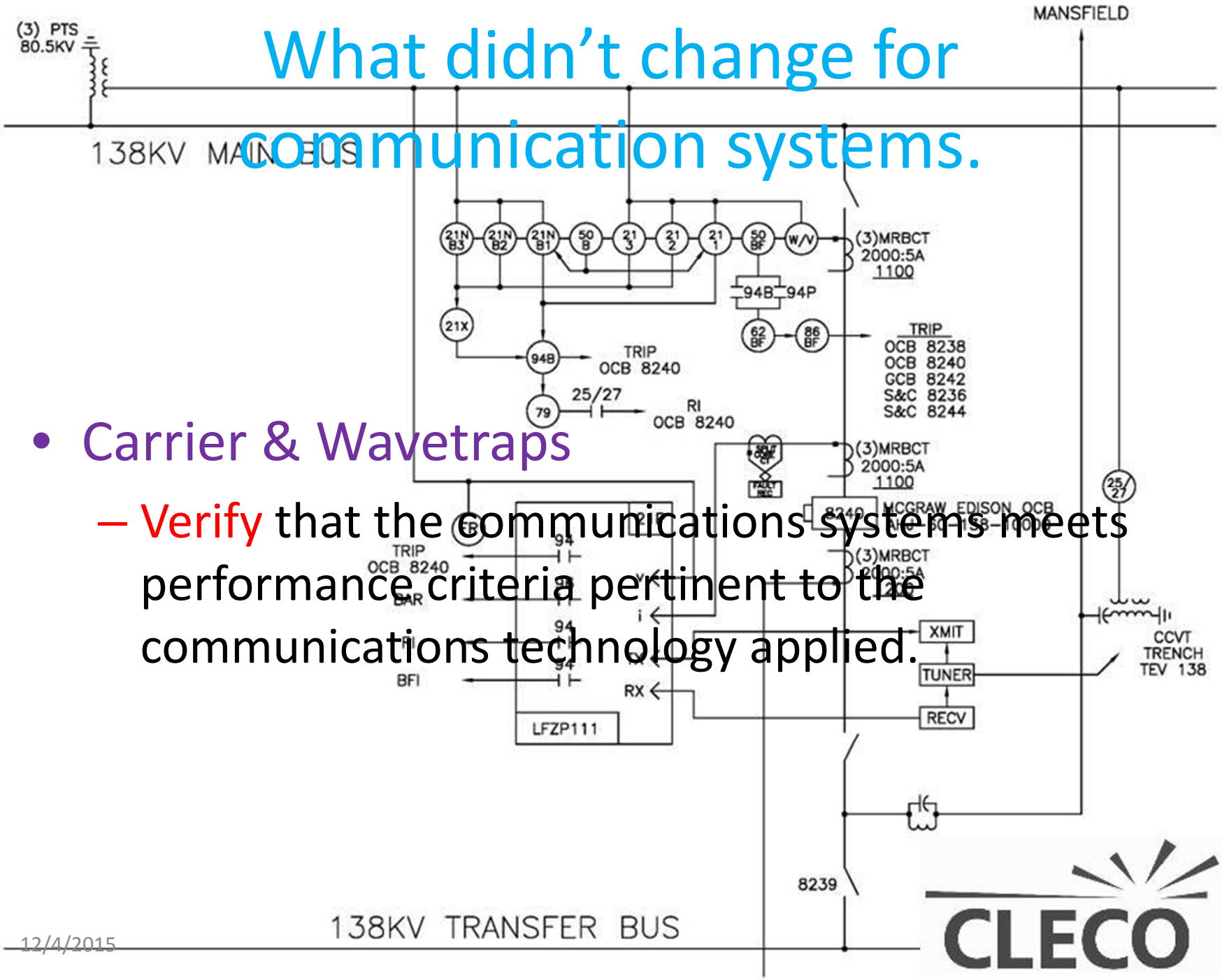


Cleco changes for relays

- For protective relays:
  - Verify acceptable measurement of power system input values
  - Microprocessor: run software comparison report for settings comparison



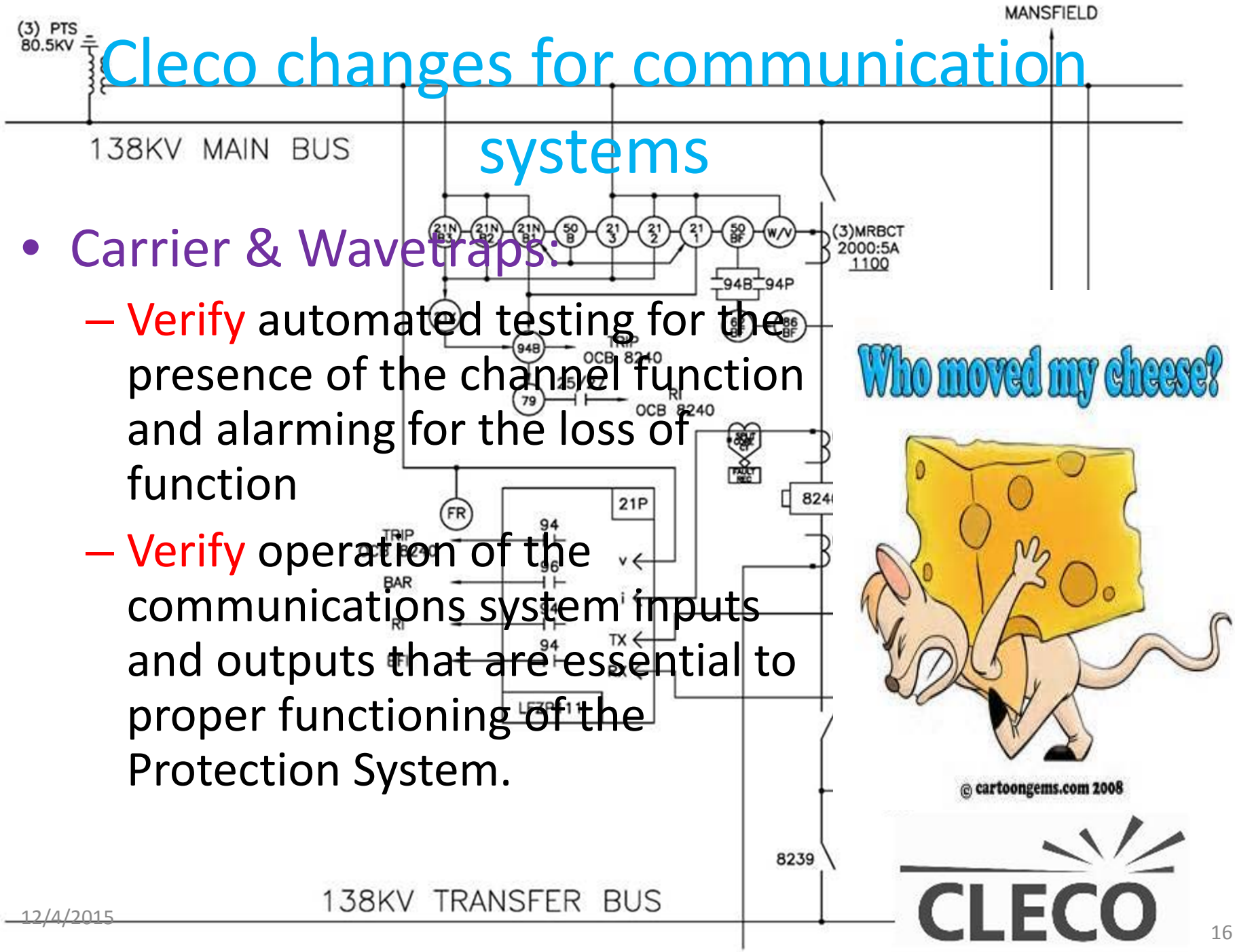
What didn't change for communication systems.



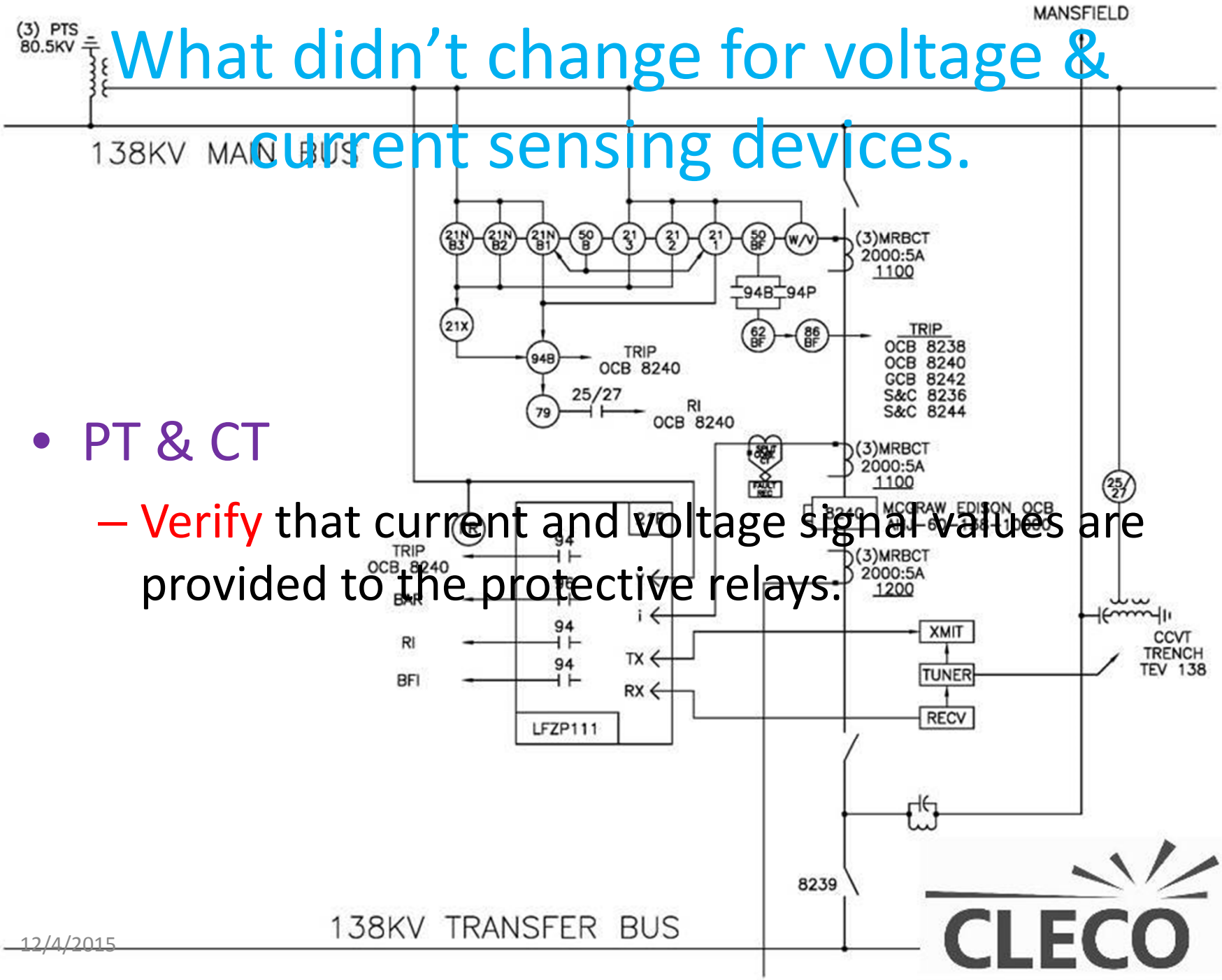
- Carrier & Wavetraps
  - Verify that the communications systems meets performance criteria pertinent to the communications technology applied.

Cleco changes for communication systems

- Carrier & Wavetraps:
  - Verify automated testing for the presence of the channel function and alarming for the loss of function
  - Verify operation of the communications system inputs and outputs that are essential to proper functioning of the Protection System.



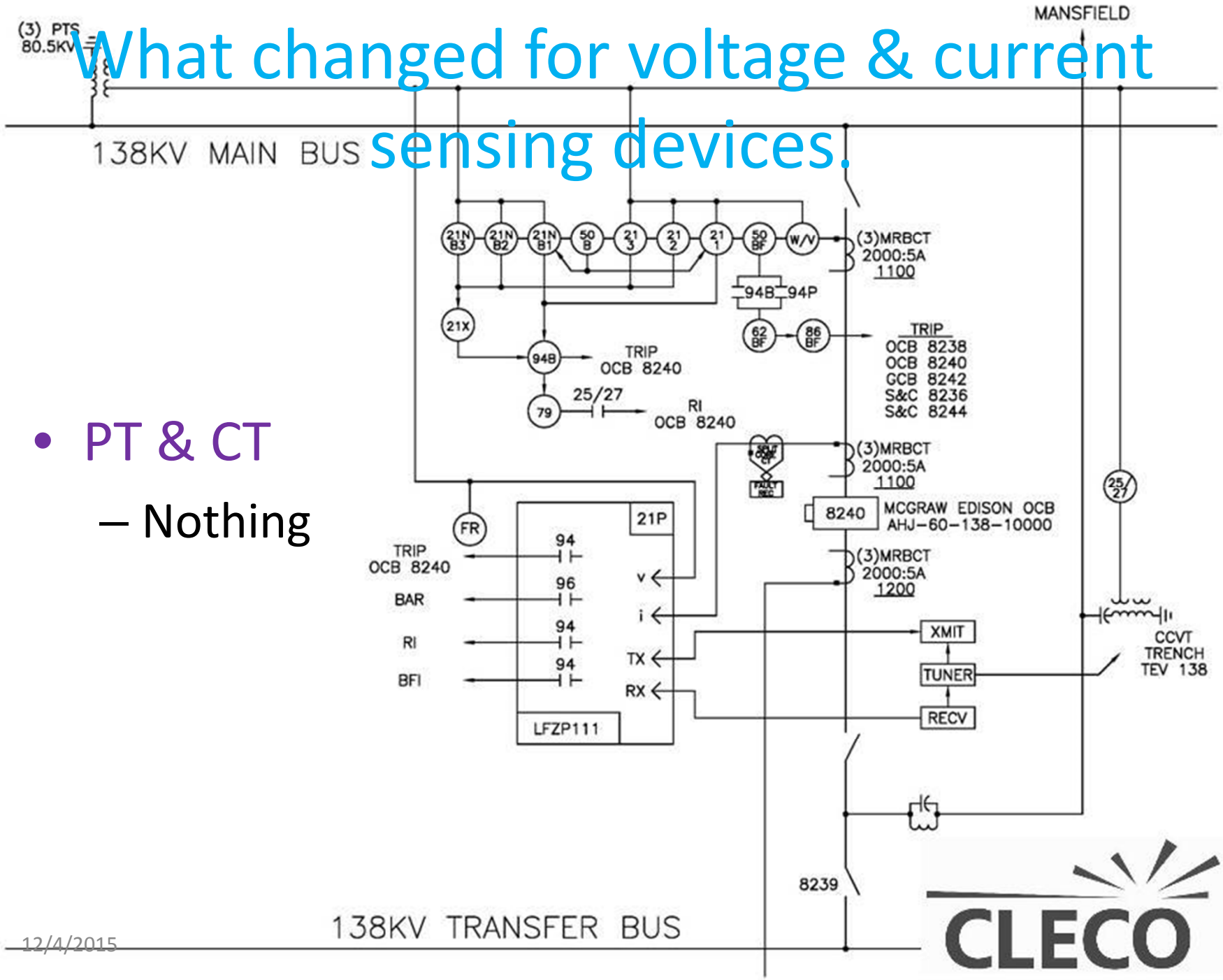
What didn't change for voltage & current sensing devices.



- PT & CT
  - Verify that current and voltage signal values are provided to the protective relays.

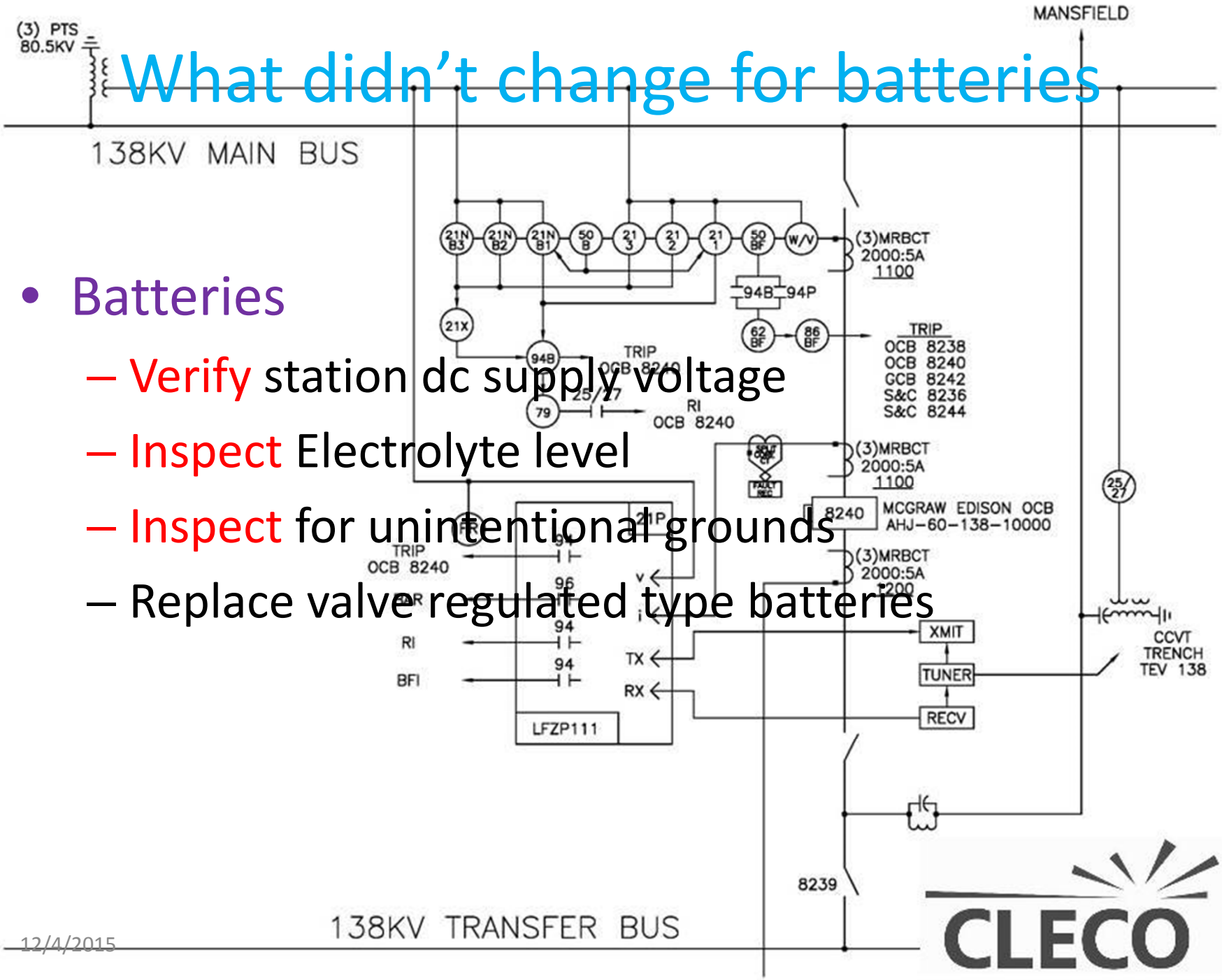
What changed for voltage & current sensing devices.

- PT & CT
  - Nothing



What didn't change for batteries

- Batteries
  - Verify station dc supply voltage
  - Inspect Electrolyte level
  - Inspect for unintentional grounds
  - Replace valve regulated type batteries



Cleco changes for batteries

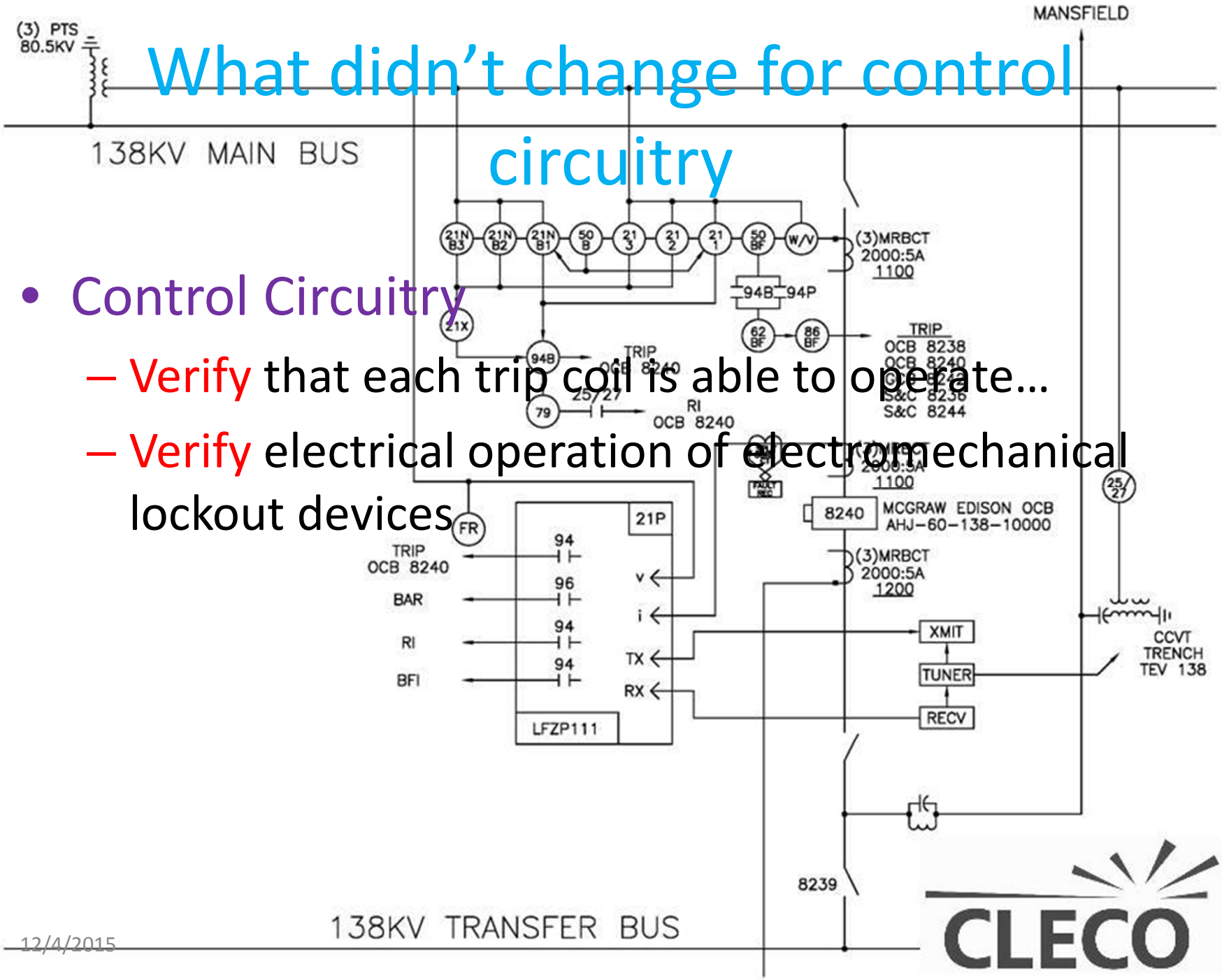
- Batteries vented lead acid:
  - Quarterly inspection now every 4 calendar months
  - Annual Inspection must be done within 18 calendar months
  - Inspect physical condition of the battery rack
  - Load test interval increased to 6 years

Cleco changes for batteries cont.

- Batteries valve regulated:
  - Quarterly inspection now every 4 calendar months
  - Inspect condition of all cells every 6 calendar months
  - Annual Inspection must be done within 18 calendar months
  - Inspect physical condition of the battery rack
  - Replace interval changed to 3 years

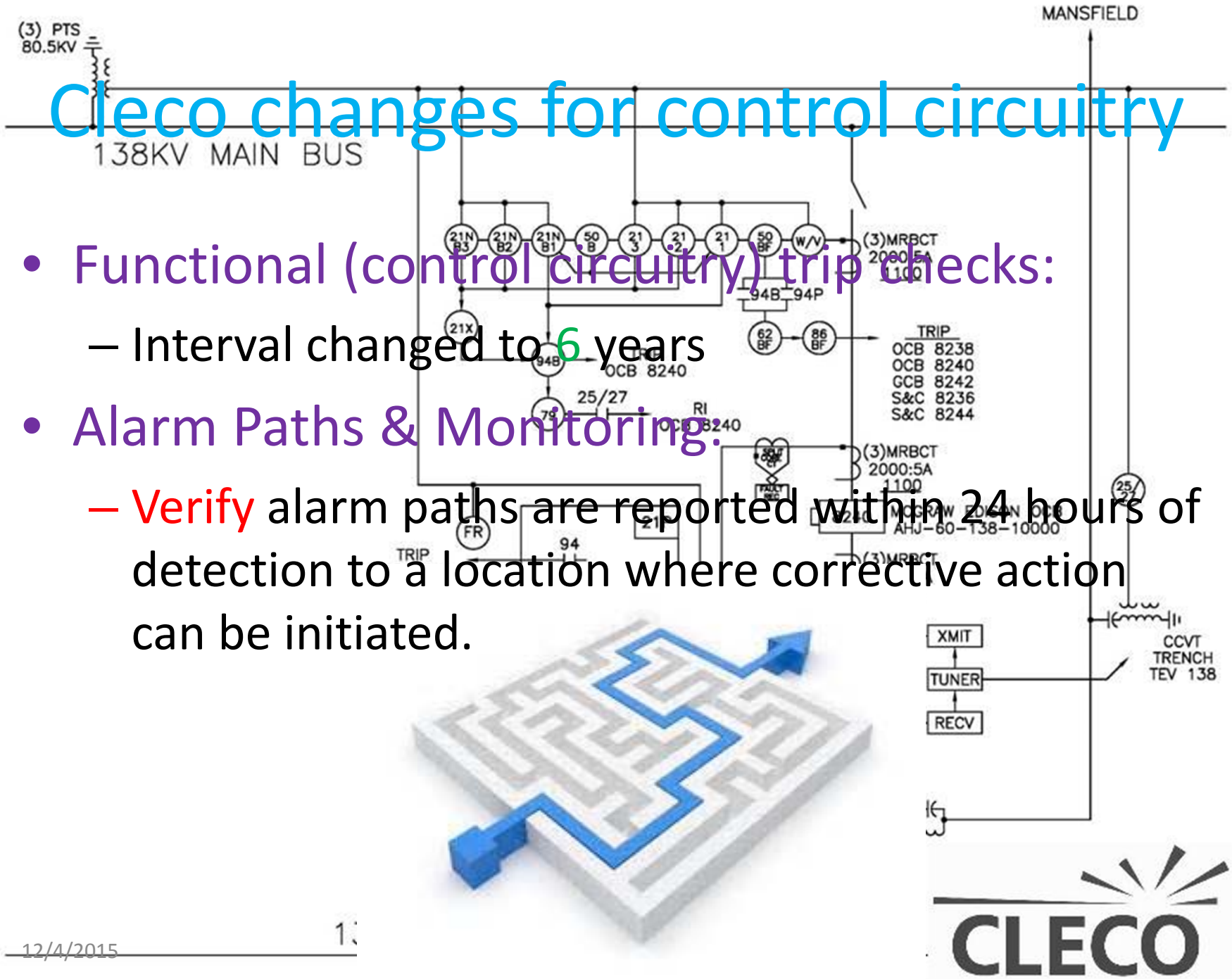
What didn't change for control circuitry

- Control Circuitry
  - Verify that each trip coil is able to operate…
  - Verify electrical operation of electromechanical lockout devices



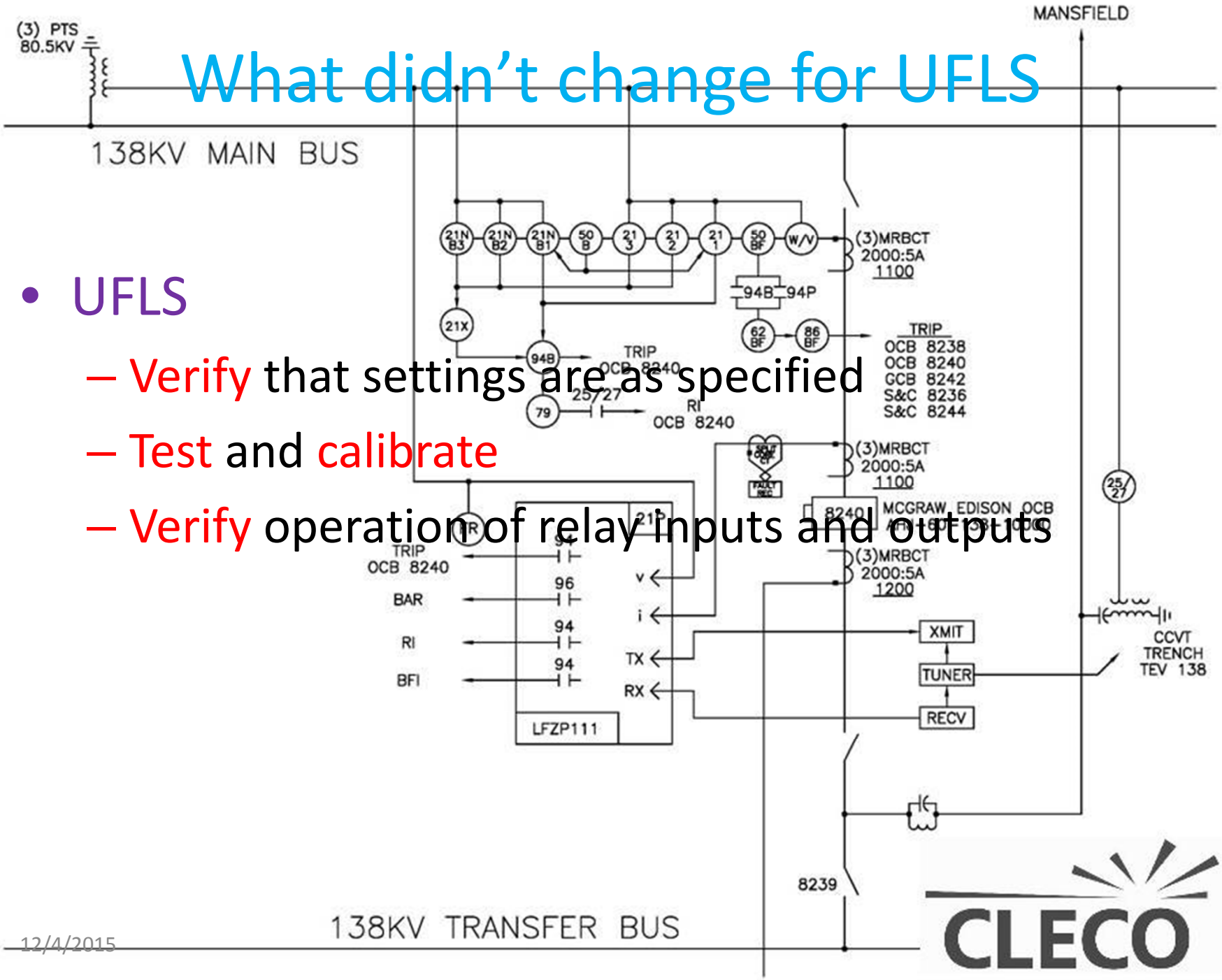
Cleco changes for control circuitry

- Functional (control circuitry) trip checks:
  - Interval changed to 6 years
- Alarm Paths & Monitoring:
  - Verify alarm paths are reported within 24 hours of detection to a location where corrective action can be initiated.



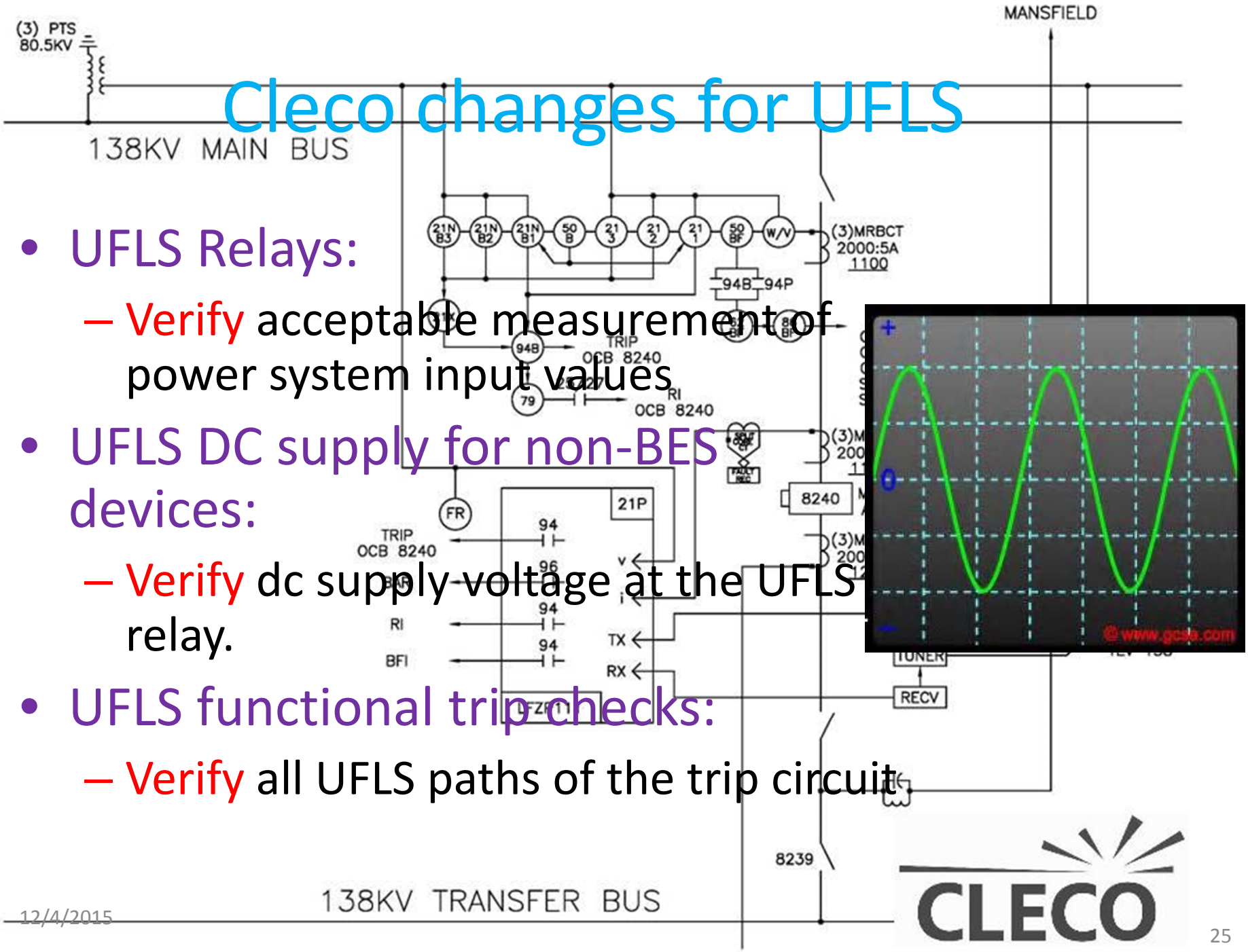
What didn't change for UFLS

- UFLS
  - Verify that settings are as specified
  - Test and calibrate
  - Verify operation of relay inputs and outputs



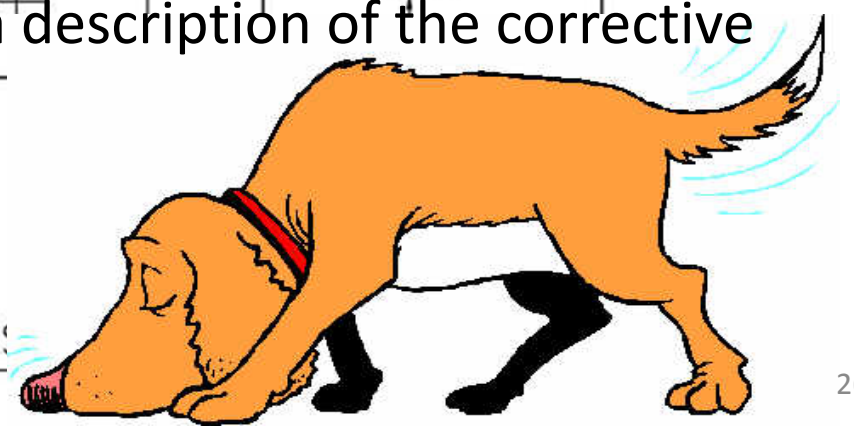
Cleco changes for UFLS

- UFLS Relays:
  - Verify acceptable measurement of power system input values
- UFLS DC supply for non-BES devices:
  - Verify dc supply voltage at the UFLS relay.
- UFLS functional trip checks:
  - Verify all UFLS paths of the trip circuit



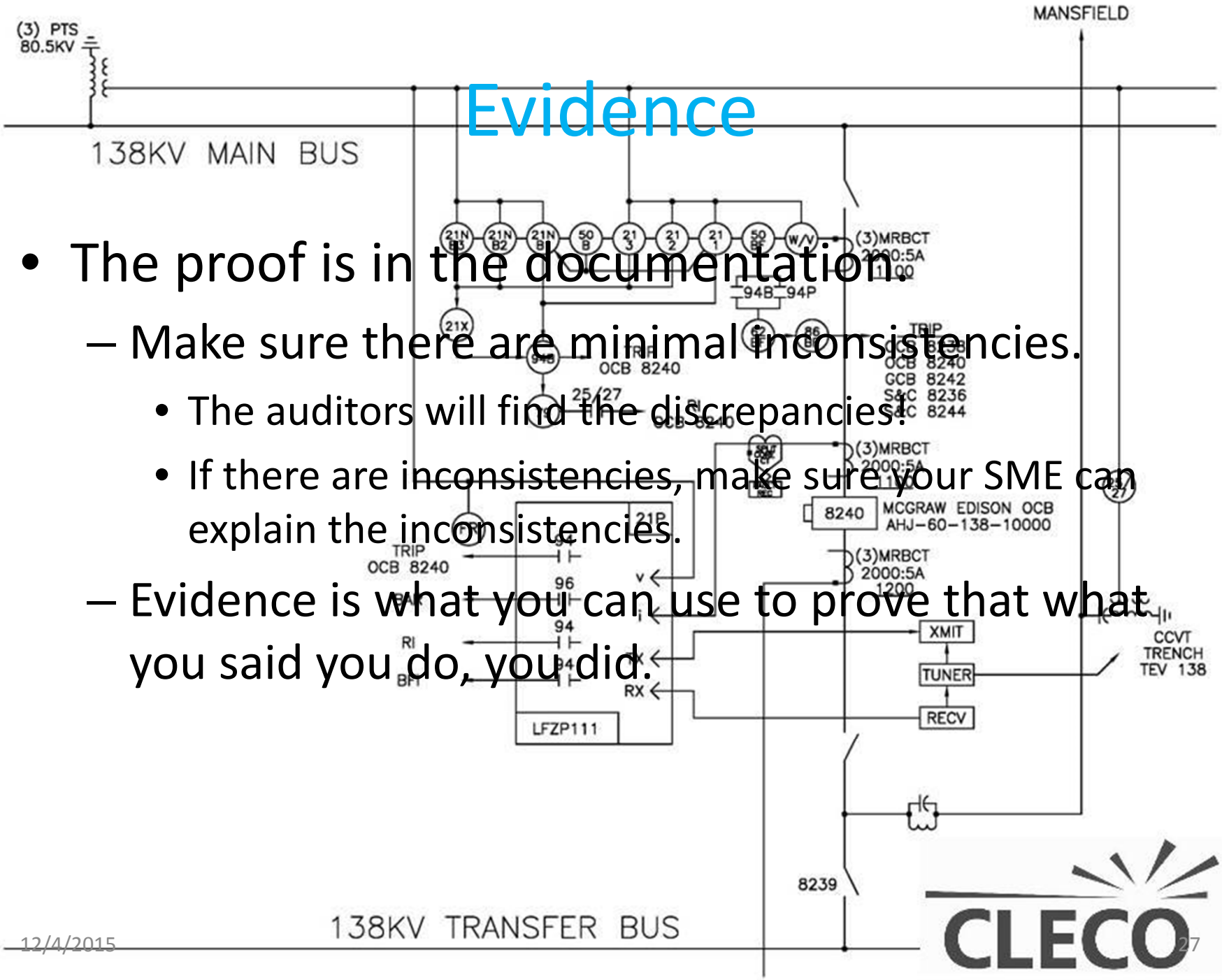
What could we miss!

- Unresolved Maintenance Issues:
  - A deficiency identified during a maintenance activity that causes the component to not meet the intended performance, cannot be corrected during the maintenance interval, and requires follow-up corrective action.
  - Cleco will document within the maintenance database the corrective action plan. Included will be a description of the problem, who was notified of the problem (System Operations, Generation Operations, or operating personnel at the plant), and a description of the corrective action to resolve the issue.

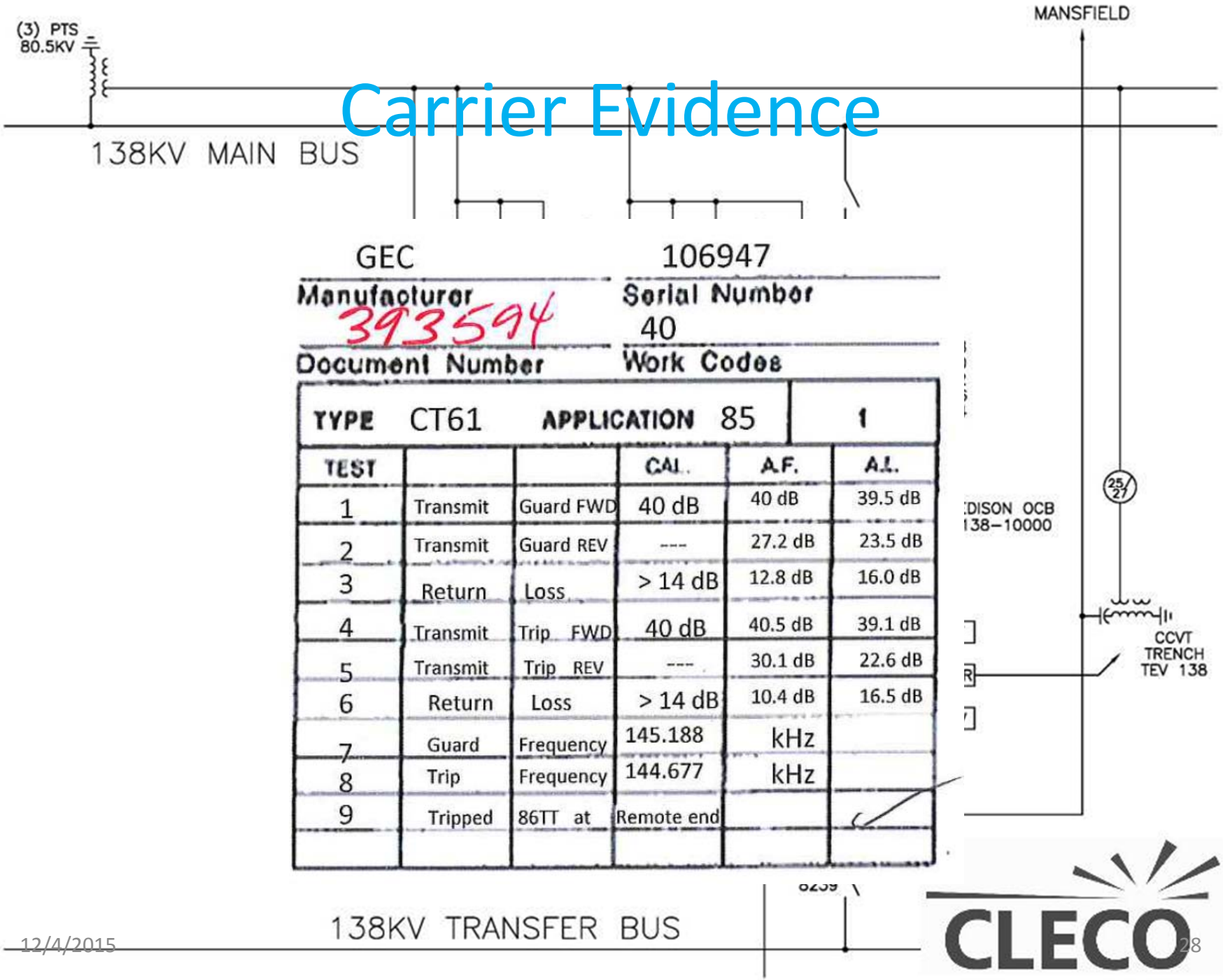


Evidence

- The proof is in the documentation.
  - Make sure there are minimal inconsistencies.
    - The auditors will find the discrepancies!
    - If there are inconsistencies, make sure your SME can explain the inconsistencies.
  - Evidence is what you can use to prove that what you said you do, you did.



Carrier Evidence



GEC — Manufacturer

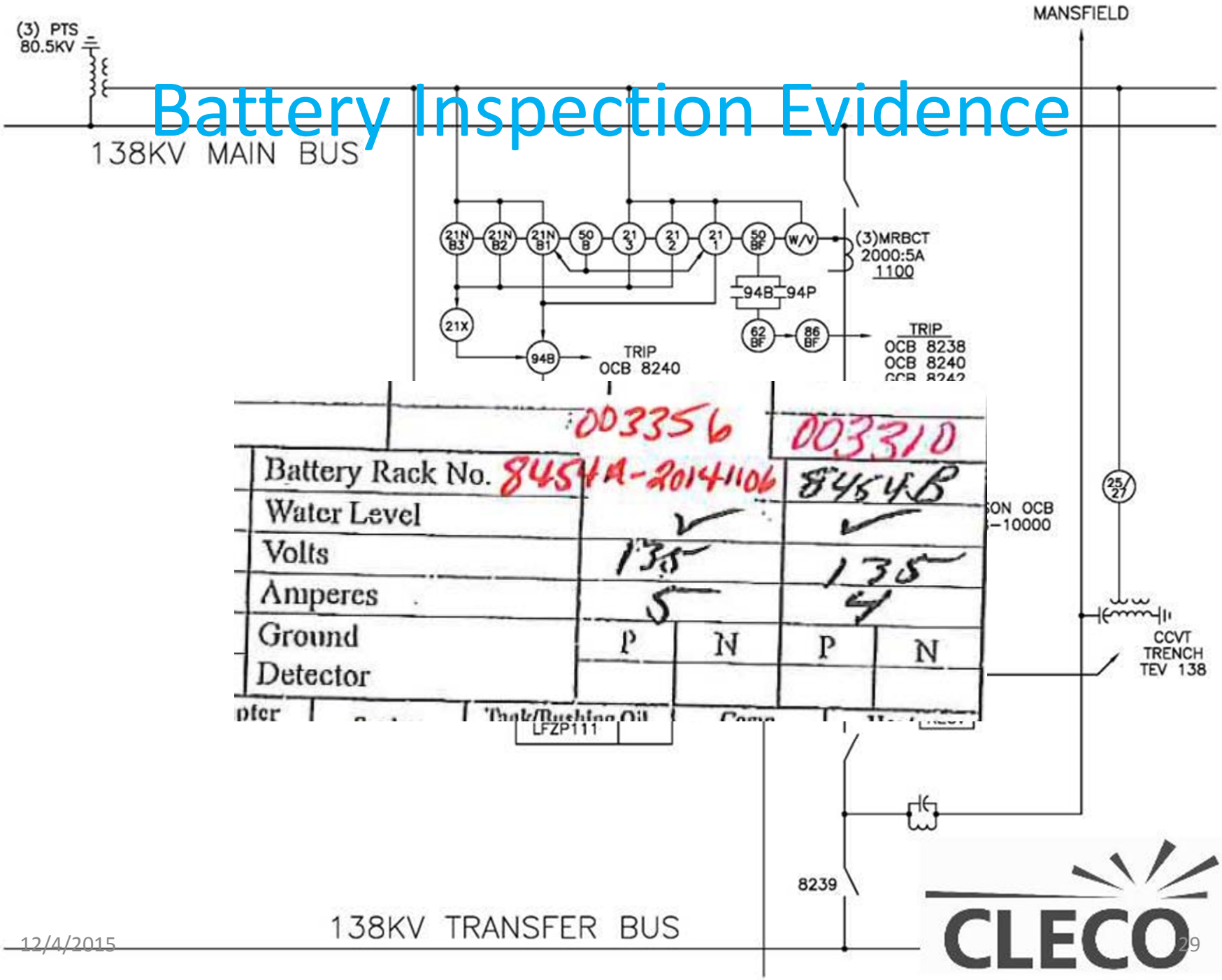
106947 — Serial Number

393594 — Document Number

40 — Work Codes

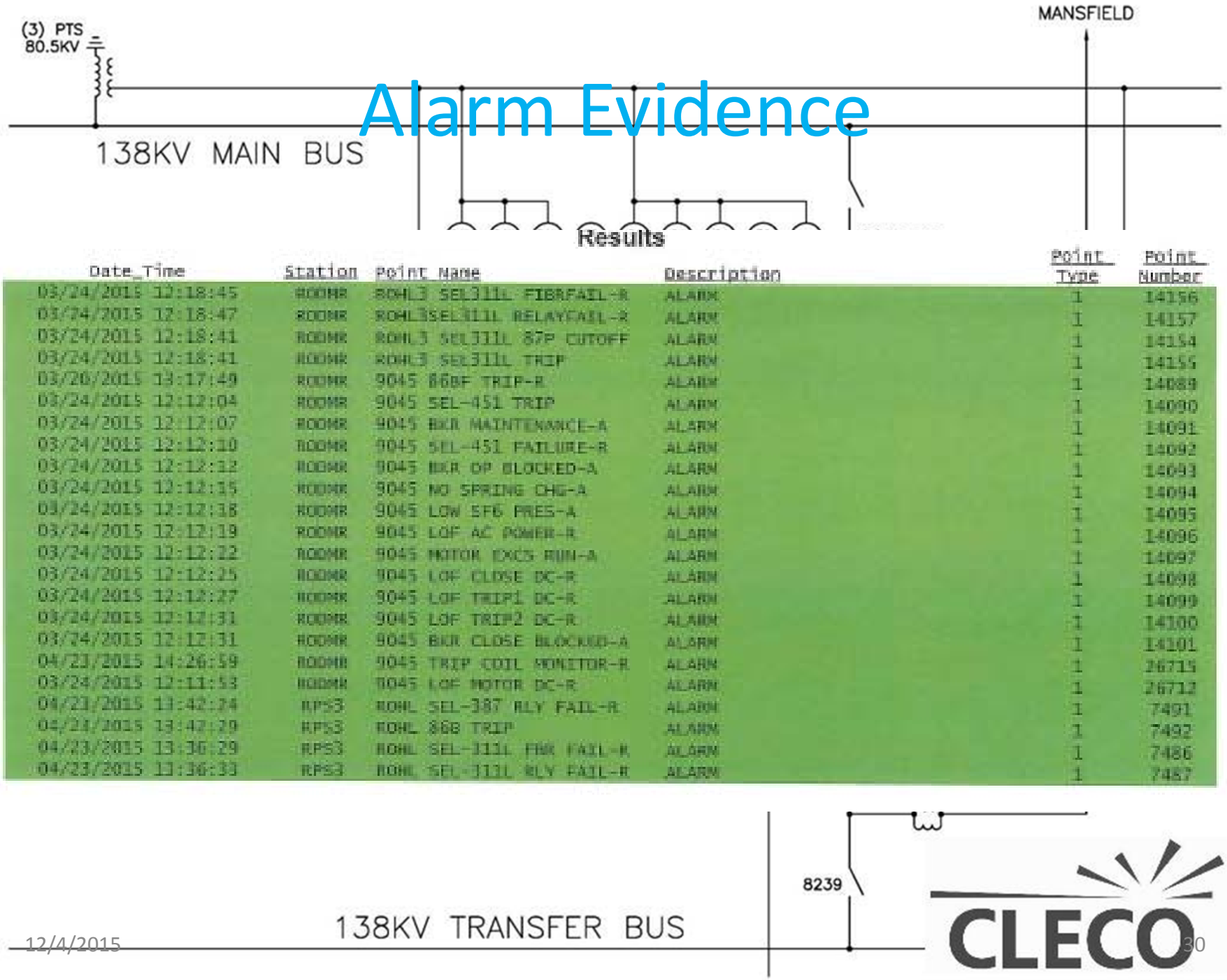
TYPE CT61	APPLICATION 85				1
TEST			CAL.	A.F.	A.L.
1	Transmit	Guard FWD	40 dB	40 dB	39.5 dB
2	Transmit	Guard REV	---	27.2 dB	23.5 dB
3	Return	Loss	> 14 dB	12.8 dB	16.0 dB
4	Transmit	Trip FWD	40 dB	40.5 dB	39.1 dB
5	Transmit	Trip REV	---	30.1 dB	22.6 dB
6	Return	Loss	> 14 dB	10.4 dB	16.5 dB
7	Guard	Frequency	145.188	kHz	
8	Trip	Frequency	144.677	kHz	
9	Tripped	86TT at	Remote end		

Battery Inspection Evidence



	003356		003310	
Battery Rack No.	8454A-20141106		8454B	
Water Level	✓		✓	
Volts	135		135	
Amperes	5		4	
Ground Detector	P	N	P	N

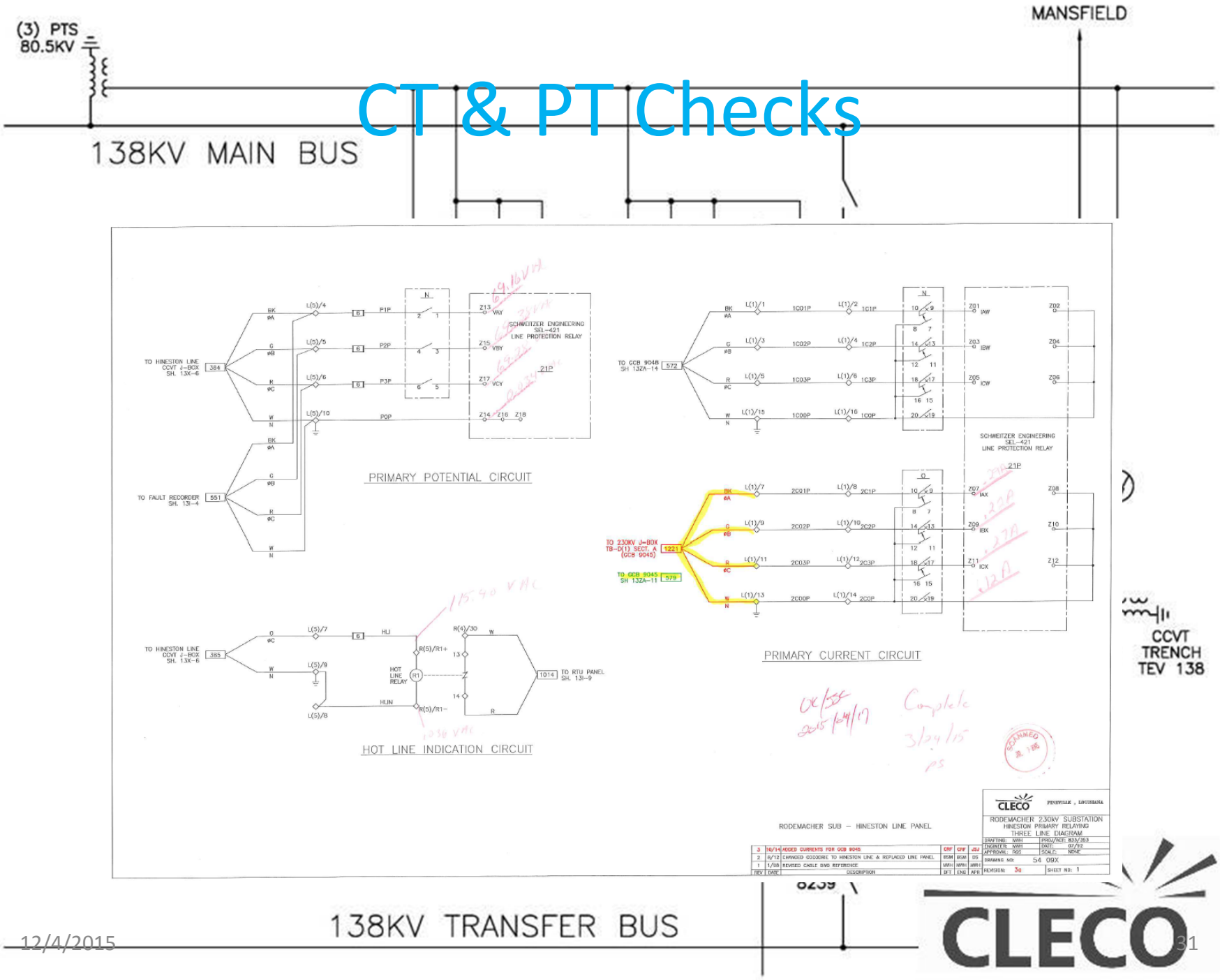
Alarm Evidence



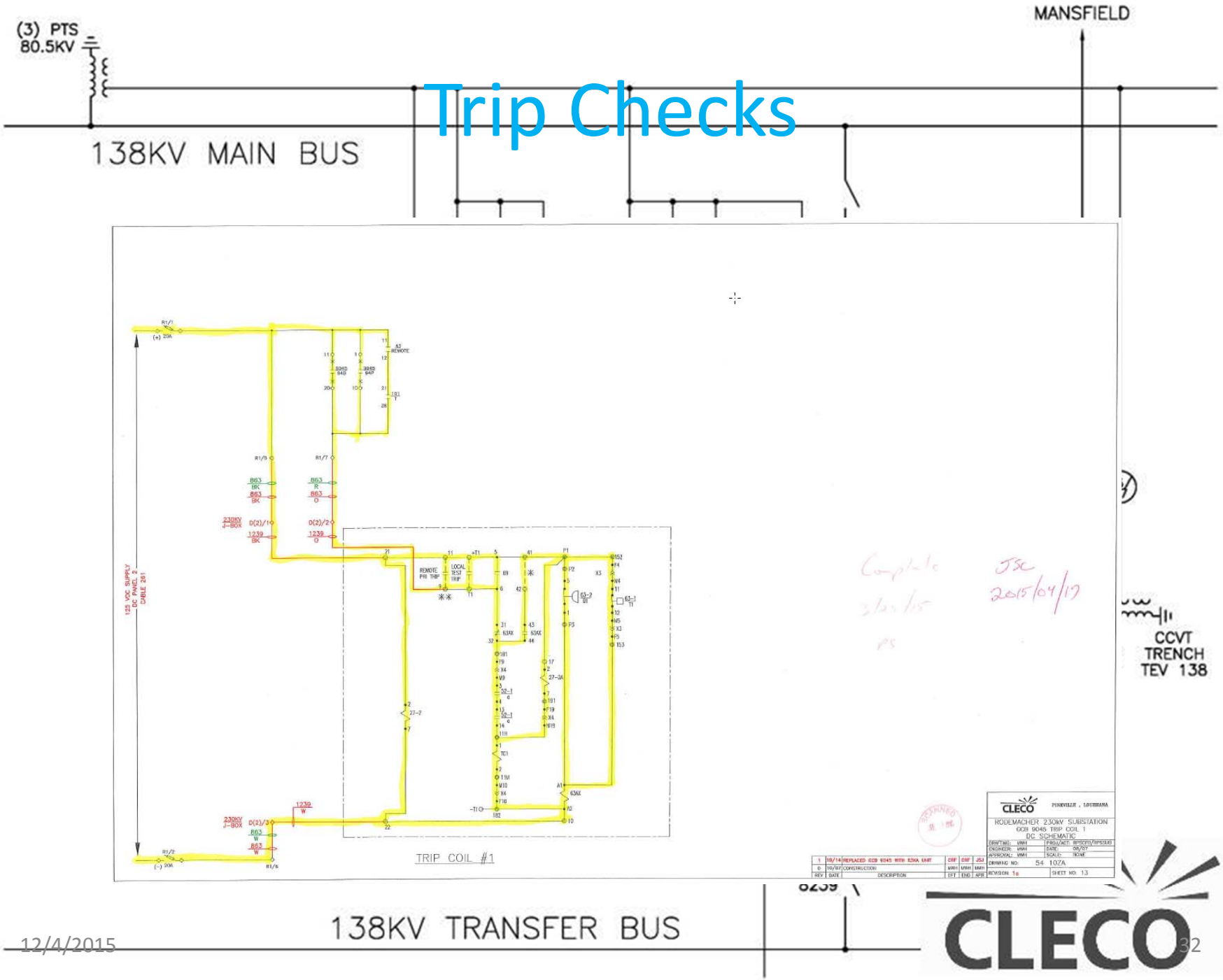
Results

Date_Time	Station	Point Name	Description	Point Type	Point Number
03/24/2015 12:18:45	ROOMR	ROHL3 SEL311L FIBRFAIL-R	ALARM	1	14156
03/24/2015 12:18:47	ROOMR	ROHL3SEL311L RELAYFAIL-R	ALARM	1	14157
03/24/2015 12:18:41	ROOMR	ROHL3 SEL311L 87P CUTOFF	ALARM	1	14154
03/24/2015 12:18:41	ROOMR	ROHL3 SEL311L TRIP	ALARM	1	14155
03/20/2015 13:17:49	ROOMR	9045 86BF TRIP-R	ALARM	1	14089
03/24/2015 12:12:04	ROOMR	9045 SEL-451 TRIP	ALARM	1	14090
03/24/2015 12:12:07	ROOMR	9045 BKR MAINTENANCE-A	ALARM	1	14091
03/24/2015 12:12:10	ROOMR	9045 SEL-451 FAILURE-R	ALARM	1	14092
03/24/2015 12:12:12	ROOMR	9045 BKR OP BLOCKED-A	ALARM	1	14093
03/24/2015 12:12:15	ROOMR	9045 NO SPRING CHG-A	ALARM	1	14094
03/24/2015 12:12:18	ROOMR	9045 LOW SF6 PRES-A	ALARM	1	14095
03/24/2015 12:12:19	ROOMR	9045 LOF AC POWER-R	ALARM	1	14096
03/24/2015 12:12:22	ROOMR	9045 MOTOR EXCS RUN-A	ALARM	1	14097
03/24/2015 12:12:25	ROOMR	9045 LOF CLOSE DC-R	ALARM	1	14098
03/24/2015 12:12:27	ROOMR	9045 LOF TRIP1 DC-R	ALARM	1	14099
03/24/2015 12:12:31	ROOMR	9045 LOF TRIP2 DC-R	ALARM	1	14100
03/24/2015 12:12:31	ROOMR	9045 BKR CLOSE BLOCKED-A	ALARM	1	14101
04/23/2015 14:26:59	ROOMR	9045 TRIP COIL MONITOR-R	ALARM	1	26715
03/24/2015 12:11:53	ROOMR	9045 LOF MOTOR DC-R	ALARM	1	26712
04/23/2015 13:42:24	RPS3	ROHL SEL-387 RLY FAIL-R	ALARM	1	7491
04/23/2015 13:42:29	RPS3	ROHL 86B TRIP	ALARM	1	7492
04/23/2015 13:36:29	RPS3	ROHL SEL-311L FWR FAIL-R	ALARM	1	7486
04/23/2015 13:36:33	RPS3	ROHL SEL-311L RLY FAIL-R	ALARM	1	7487

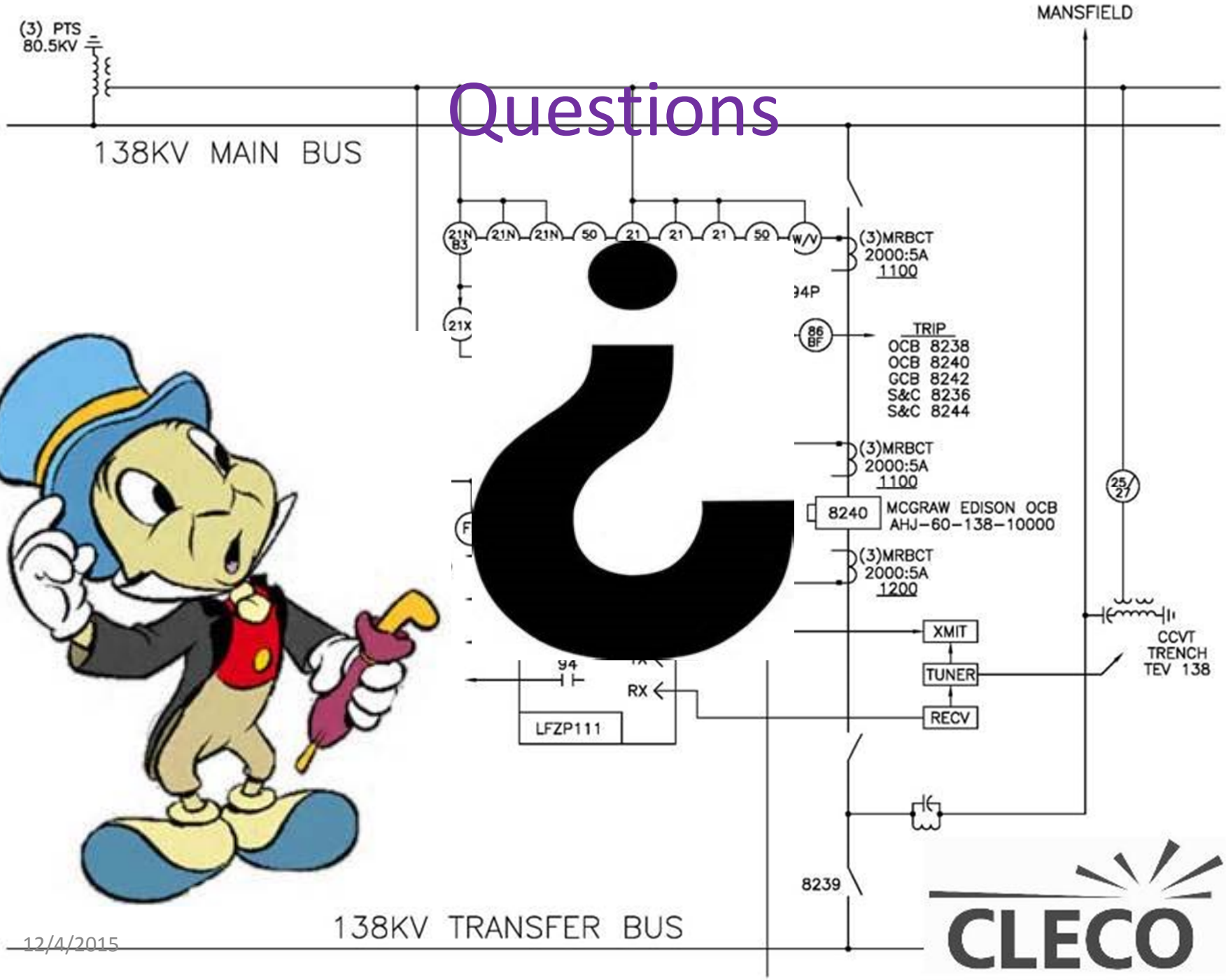
CT & PT Checks


(3) PTS
80.5KV
MANSFIELD
138KV MAIN BUS
PRIMARY POTENTIAL CIRCUIT
PRIMARY CURRENT CIRCUIT
HOT LINE INDICATION CIRCUIT
SCHWEITZER ENGINEERING
SEL-421
LINE PROTECTION RELAY
TO HINESTON LINE
CCVT J-BOX
SH. 13X-6
TO FAULT RECORDER
SH. 13I-4
TO GCB 9048
SH 13A-14
TO 230KV J-BOX
TB-D(1) SECT. A
(GCB 9045)
TO GCB 9045
SH 13A-11
TO HINESTON LINE
CCVT J-BOX
SH. 13X-6
HOT
LINE
RELAY
TO RTU PANEL
SH. 13I-9
CCVT
TRENCH
TEV 138
RODEMACHER SUB – HINESTON LINE PANEL
CLECO
PINEVILLE, LOUISIANA
RODEMACHER 230KV SUBSTATION
HINESTON PRIMARY RELAYING
THREE LINE DIAGRAM
DRAWING NO: 54 09X
SHEET NO: 1
138KV TRANSFER BUS

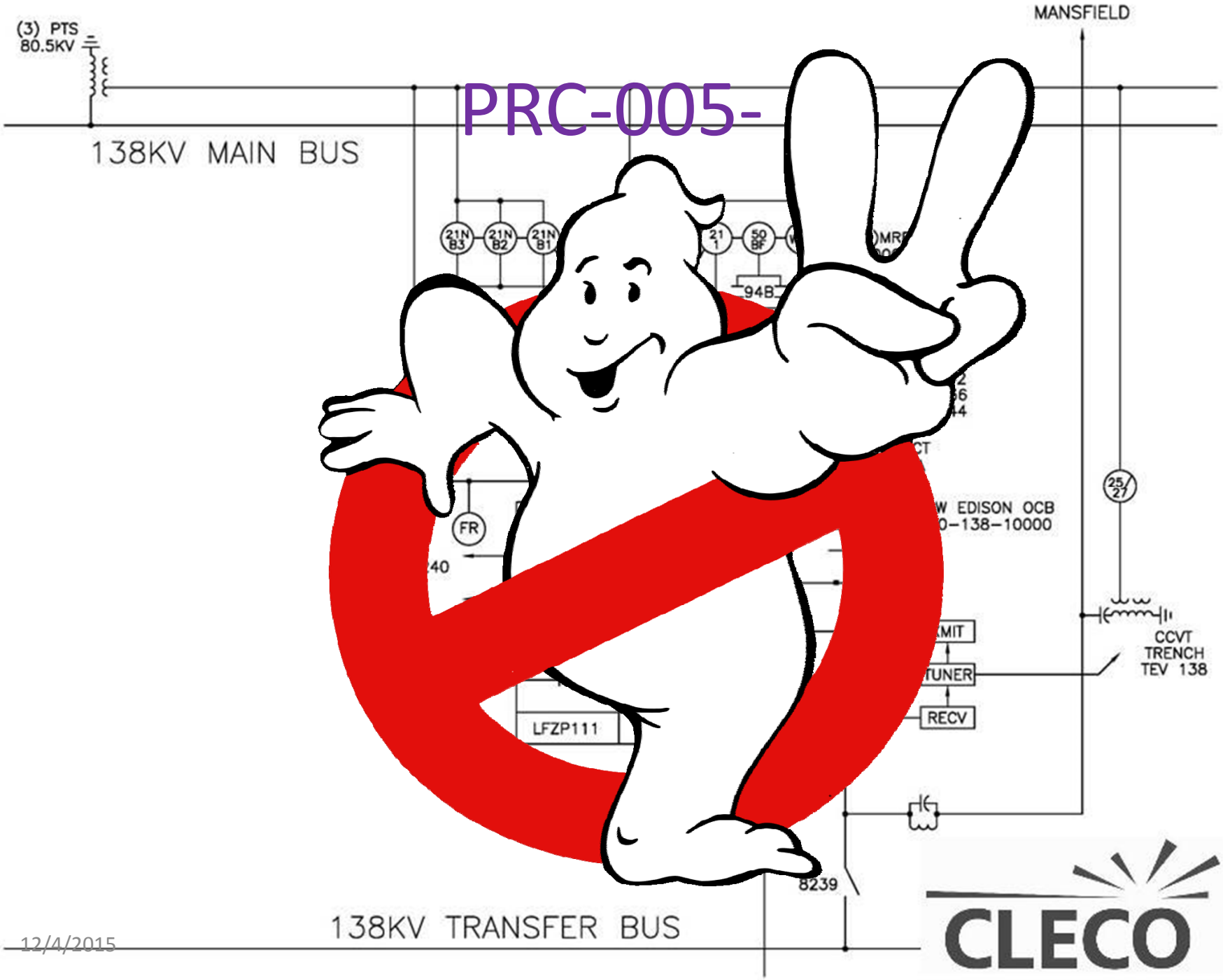
Trip Checks


(3) PTS
80.5KV
MANSFIELD
138KV MAIN BUS
CCVT
TRENCH
TEV 138
TRIP COIL #1
CLECO
PINEVILLE, LOUISIANA
RODEMACHER 230kV SUBSTATION
GCB 9045 TRIP COIL 1
DC SCHEMATIC
138KV TRANSFER BUS

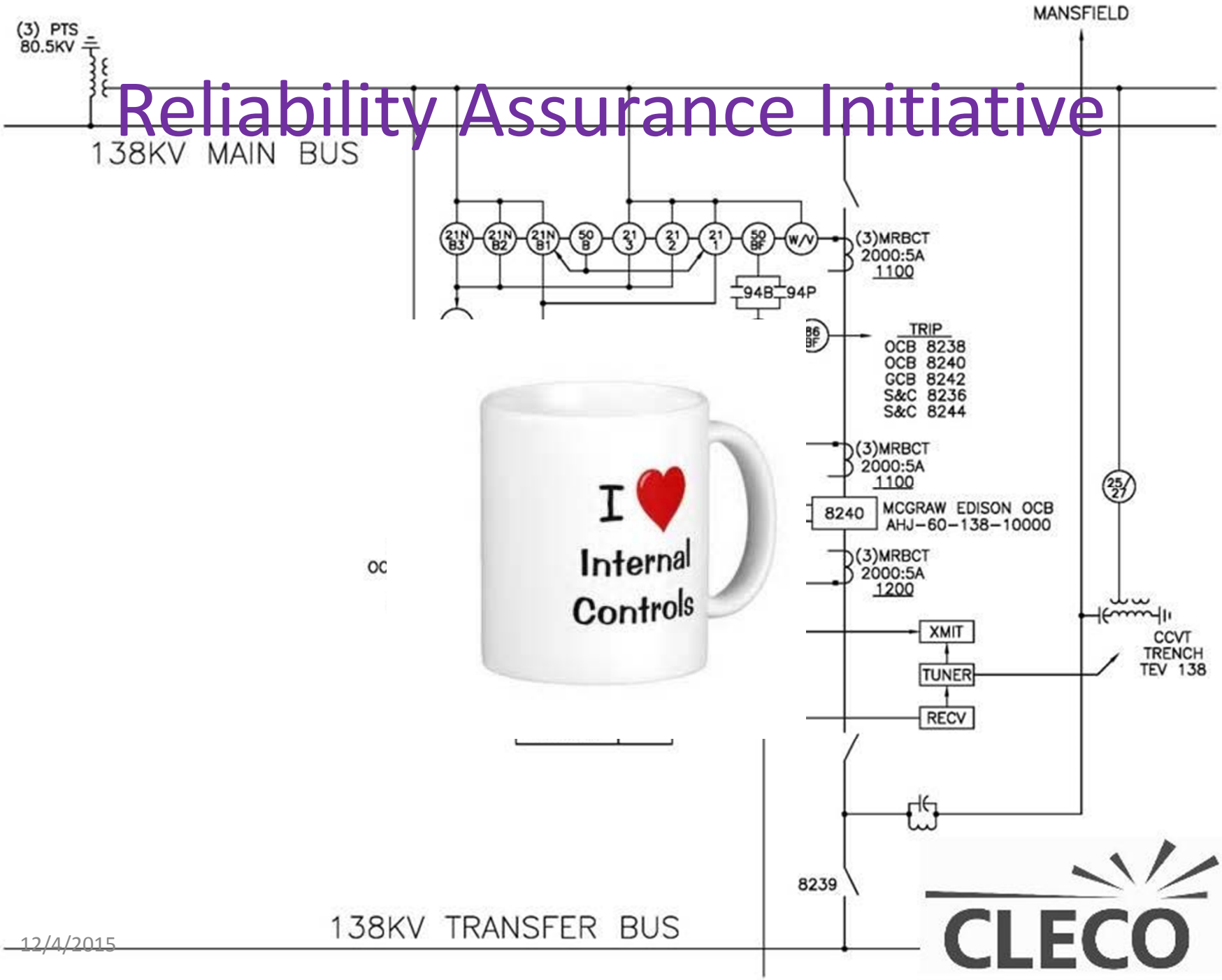
Questions


(3) PTS
80.5KV
MANSFIELD
138KV MAIN BUS
21N
B3
21N
21N
50
21
21
21
50
W/V
(3)MRBCT
2000:5A
1100
94P
21X
86
BF
TRIP
OCB 8238
OCB 8240
GCB 8242
S&C 8236
S&C 8244
(3)MRBCT
2000:5A
1100
25/
27
8240
MCGRAW EDISON OCB
AHJ-60-138-10000
(3)MRBCT
2000:5A
1200
XMIT
TUNER
RECV
CCVT
TRENCH
TEV 138
94
RX
LFZP111
8239
138KV TRANSFER BUS

PRC-005-

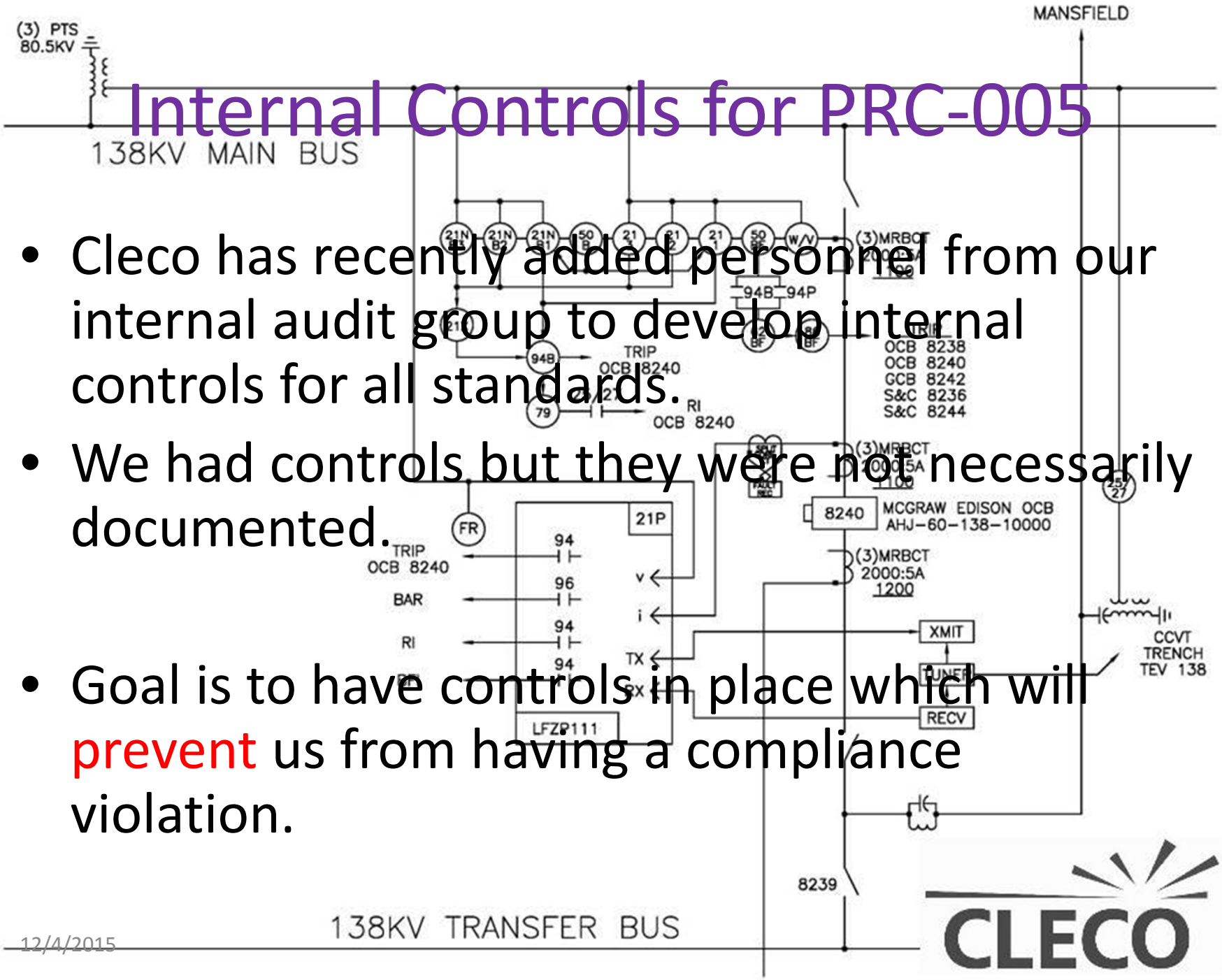

(3) PTS
80.5KV
MANSFIELD
138KV MAIN BUS
21N B3
21N B2
21N B1
21 1
50 BF
94B
FR
W EDISON OCB
0-138-10000
25/27
CCVT
TRENCH
TEV 138
TUNER
RECV
LFZP111
8239
138KV TRANSFER BUS

Reliability Assurance Initiative



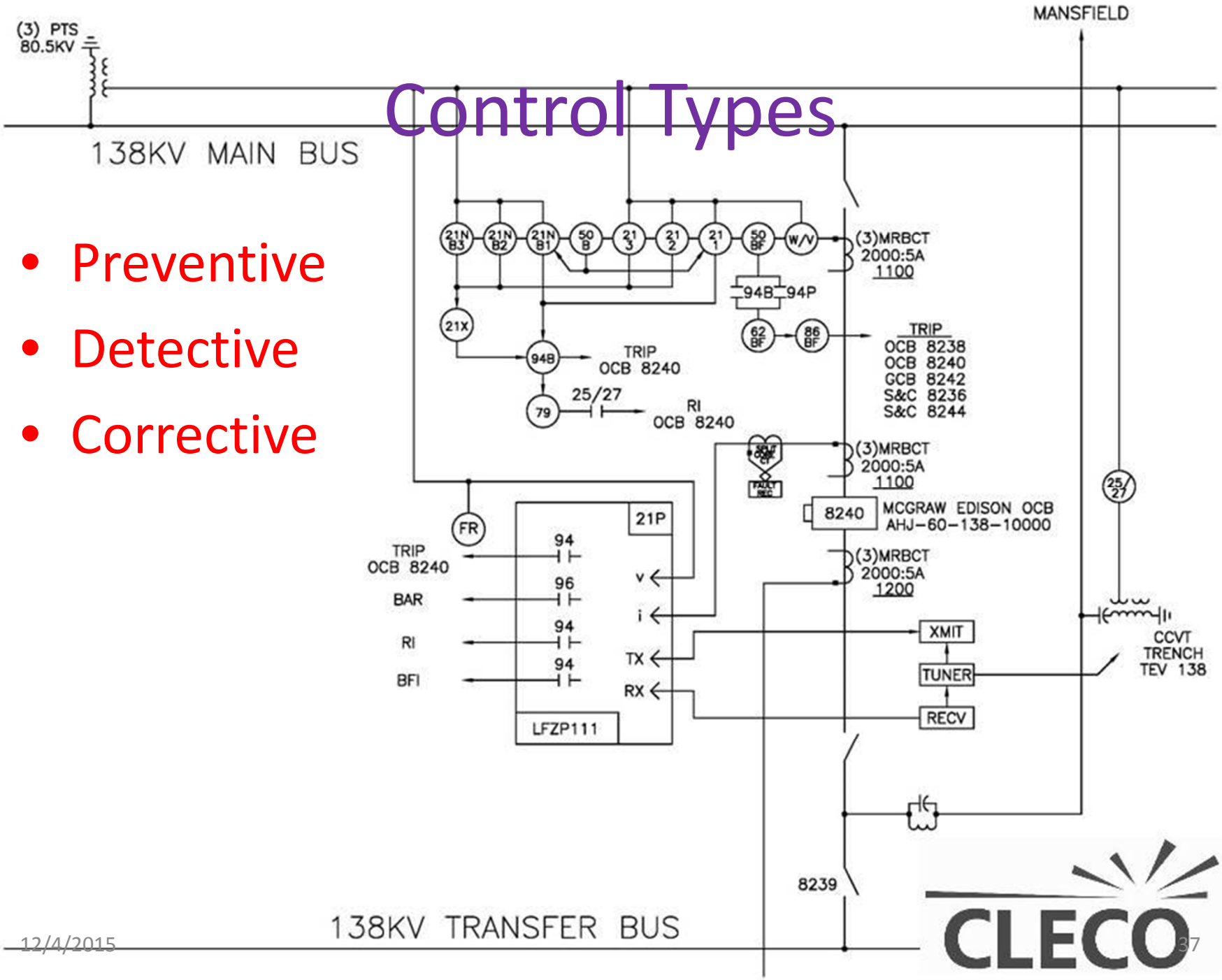
Internal Controls for PRC-005

- Cleco has recently added personnel from our internal audit group to develop internal controls for all standards.
- We had controls but they were not necessarily documented.
- Goal is to have controls in place which will prevent us from having a compliance violation.



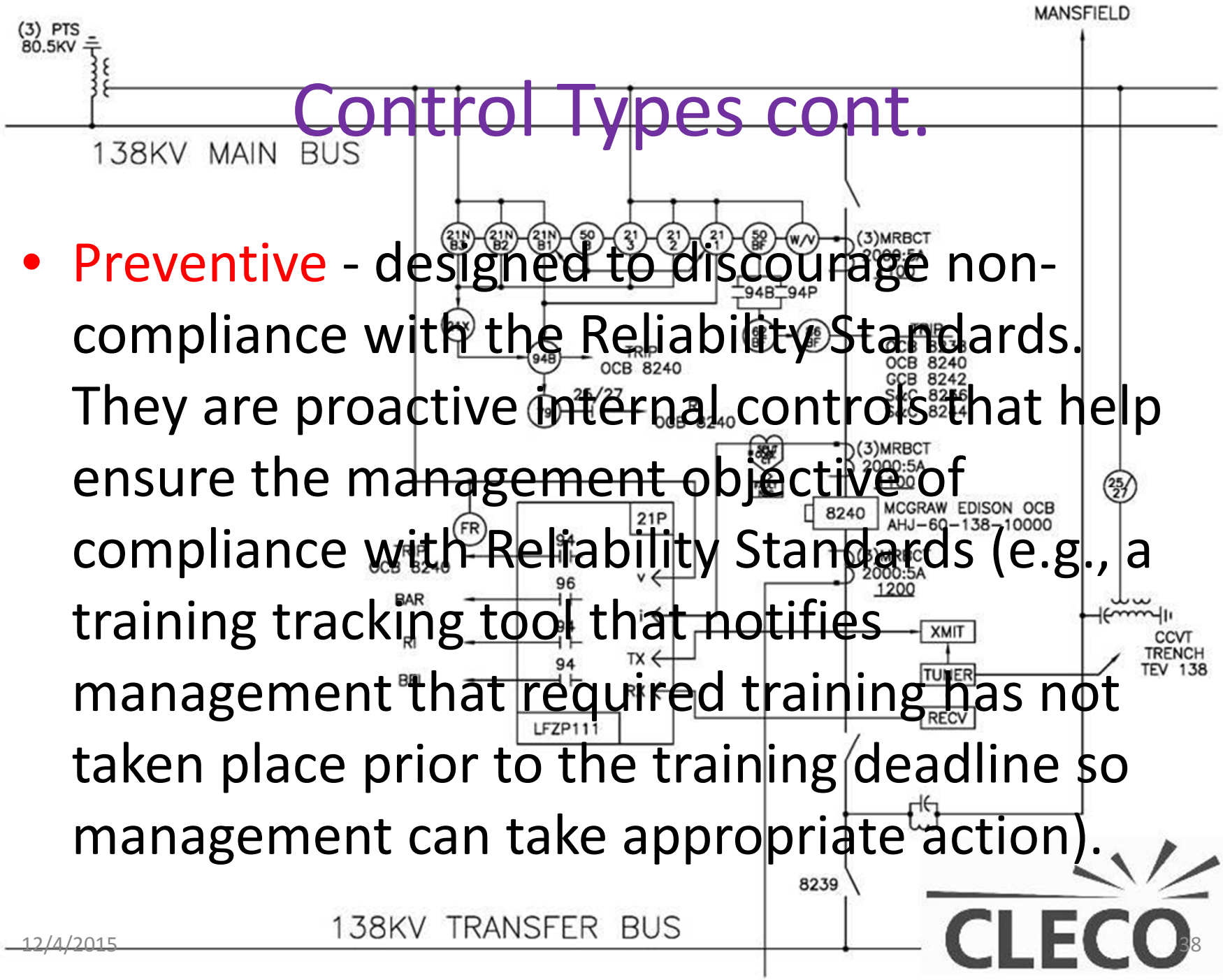
Control Types

- Preventive
- Detective
- Corrective



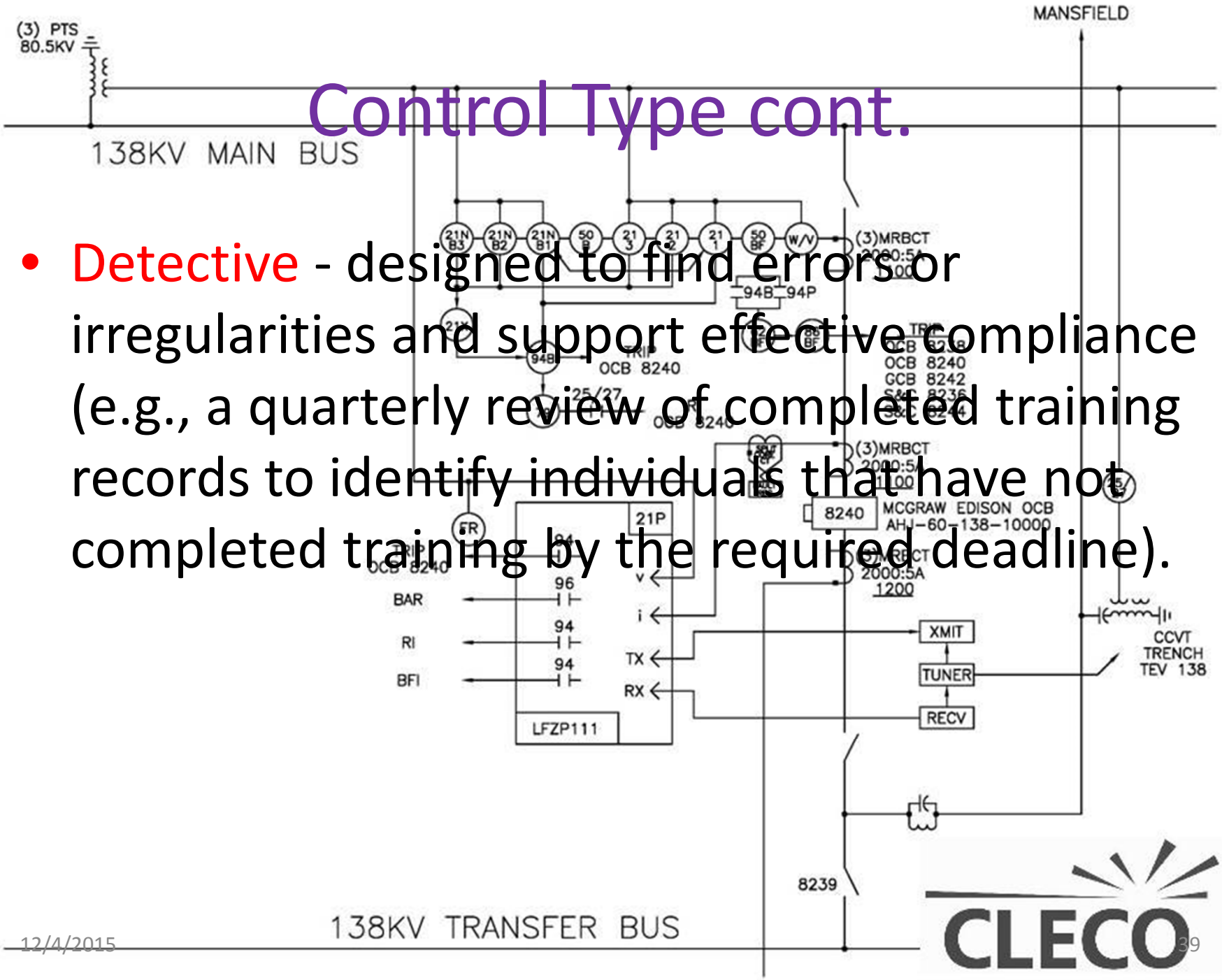
Control Types cont.

- Preventive - designed to discourage non-compliance with the Reliability Standards. They are proactive internal controls that help ensure the management objective of compliance with Reliability Standards (e.g., a training tracking tool that notifies management that required training has not taken place prior to the training deadline so management can take appropriate action).



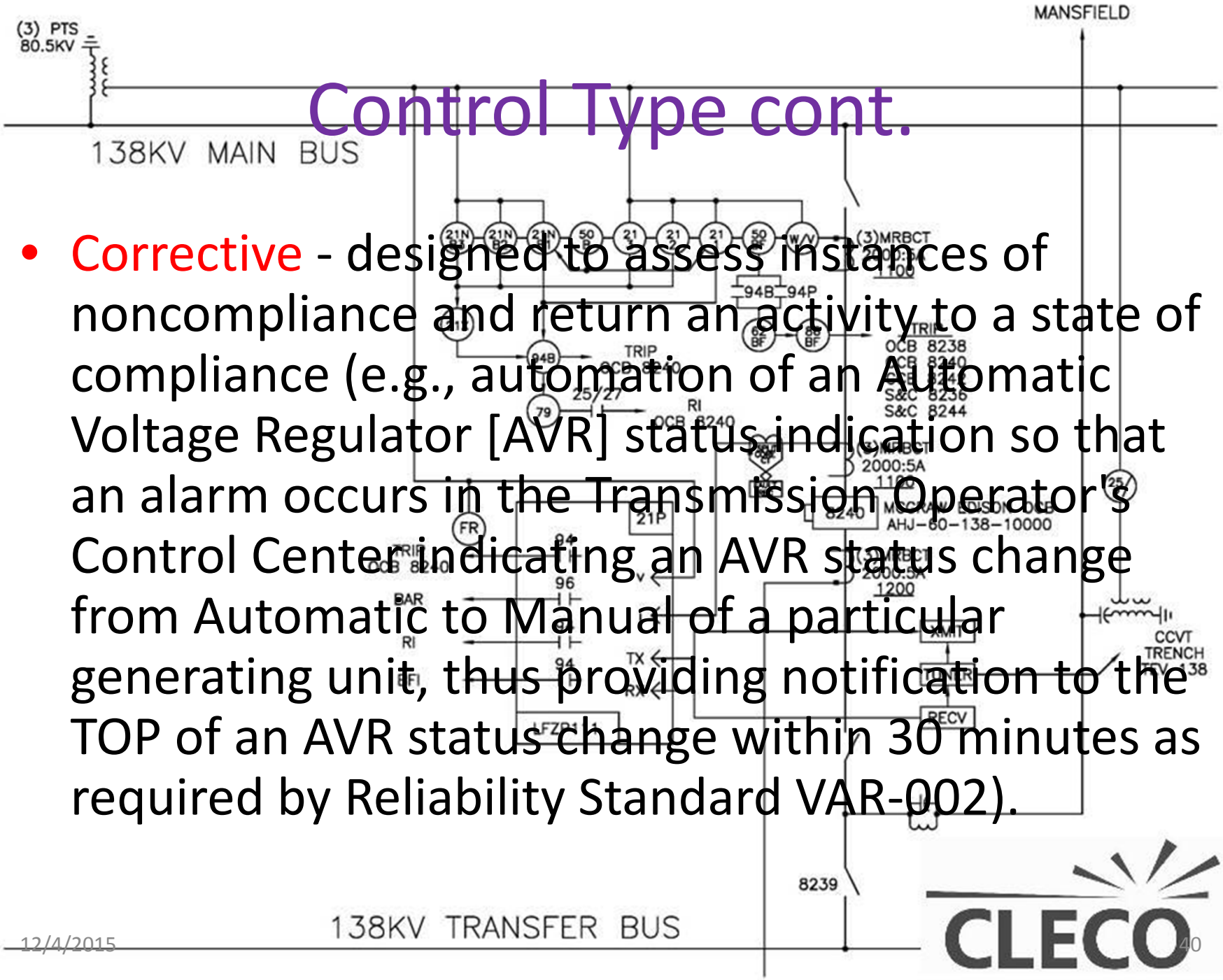
Control Type cont.

- Detective - designed to find errors or irregularities and support effective compliance (e.g., a quarterly review of completed training records to identify individuals that have not completed training by the required deadline).



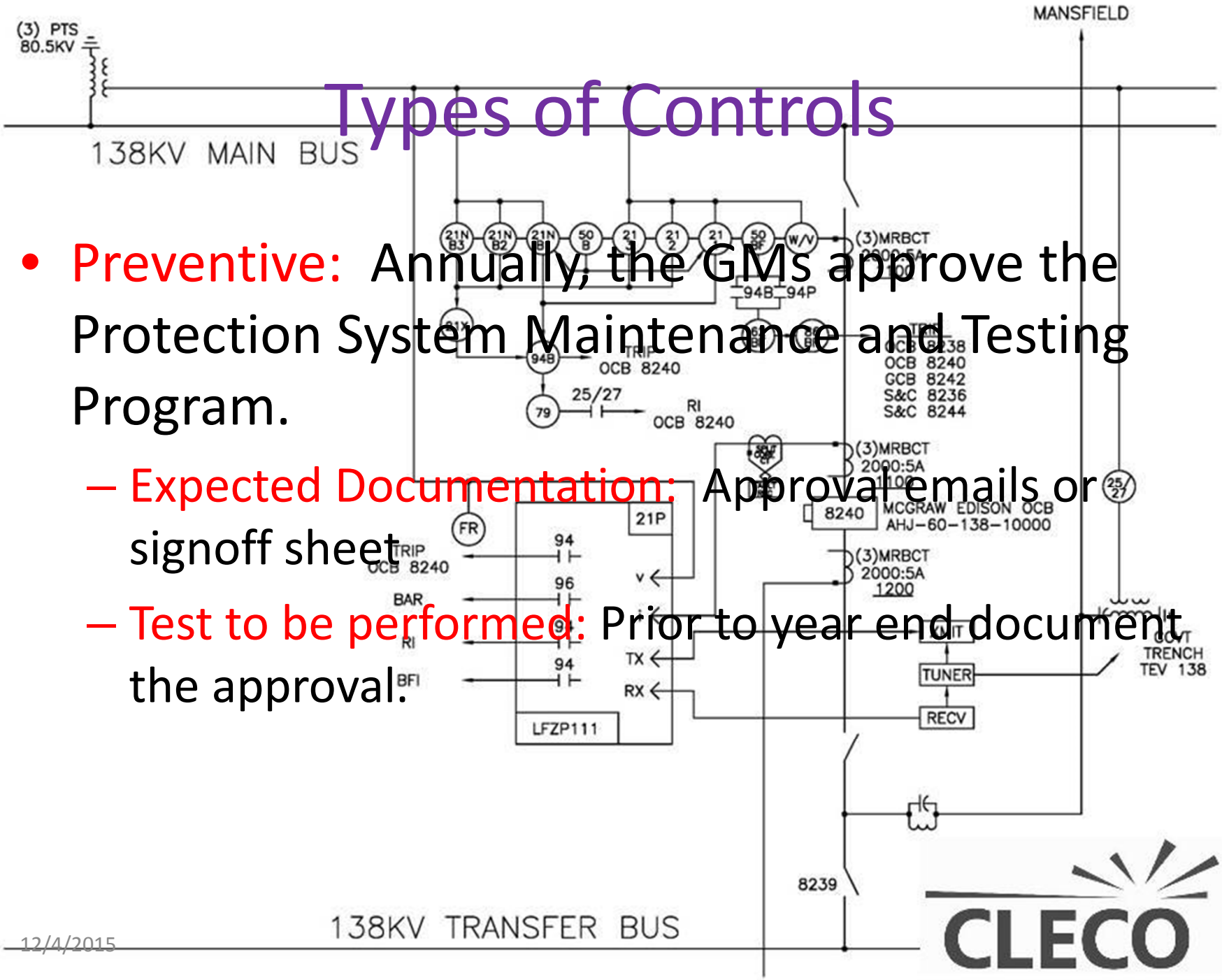
Control Type cont.

- Corrective - designed to assess instances of noncompliance and return an activity to a state of compliance (e.g., automation of an Automatic Voltage Regulator [AVR] status indication so that an alarm occurs in the Transmission Operator's Control Center indicating an AVR status change from Automatic to Manual of a particular generating unit, thus providing notification to the TOP of an AVR status change within 30 minutes as required by Reliability Standard VAR-002).



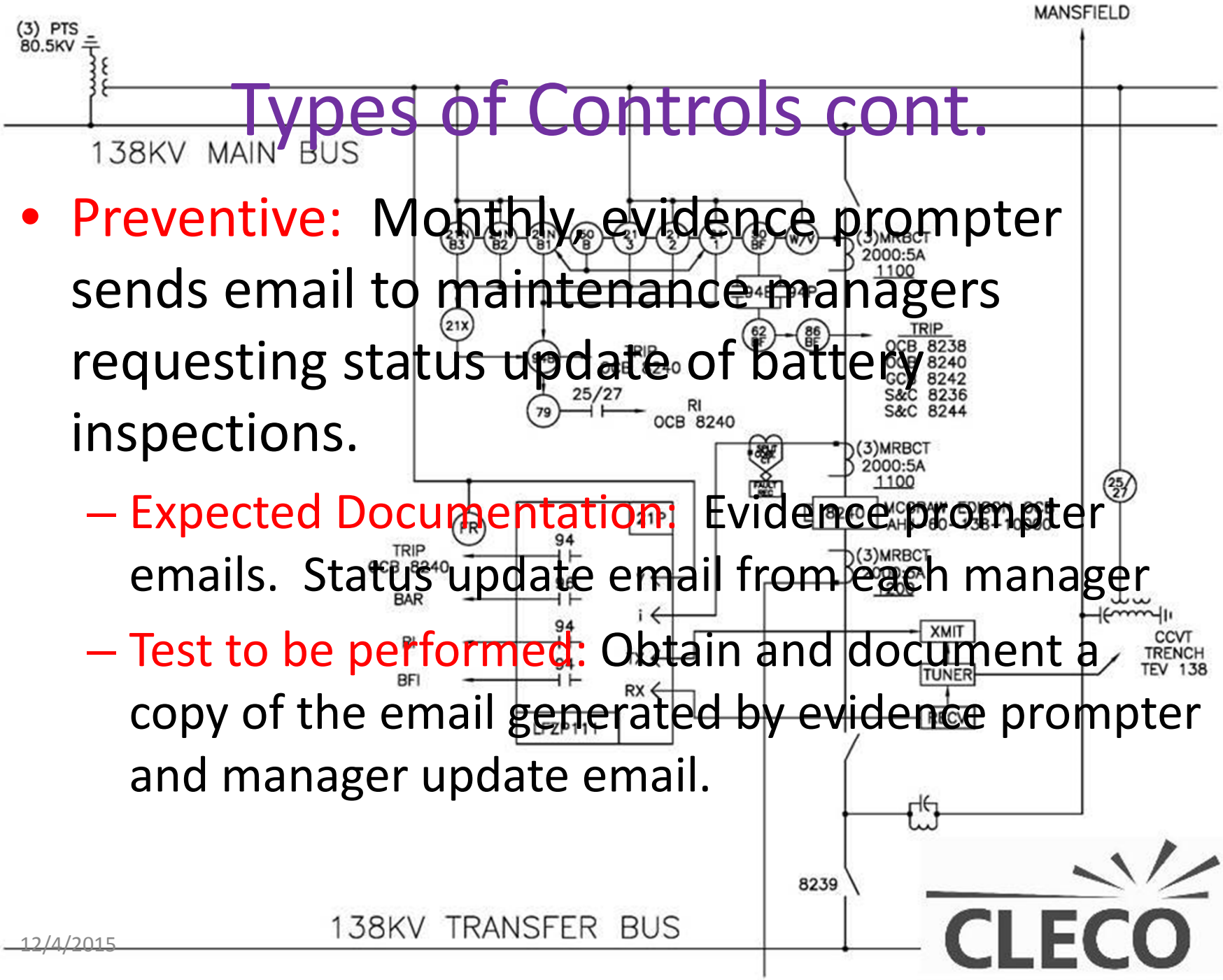
Types of Controls

- Preventive: Annually, the GMs approve the Protection System Maintenance and Testing Program.
  - Expected Documentation: Approval emails or signoff sheet
  - Test to be performed: Prior to year end document the approval.



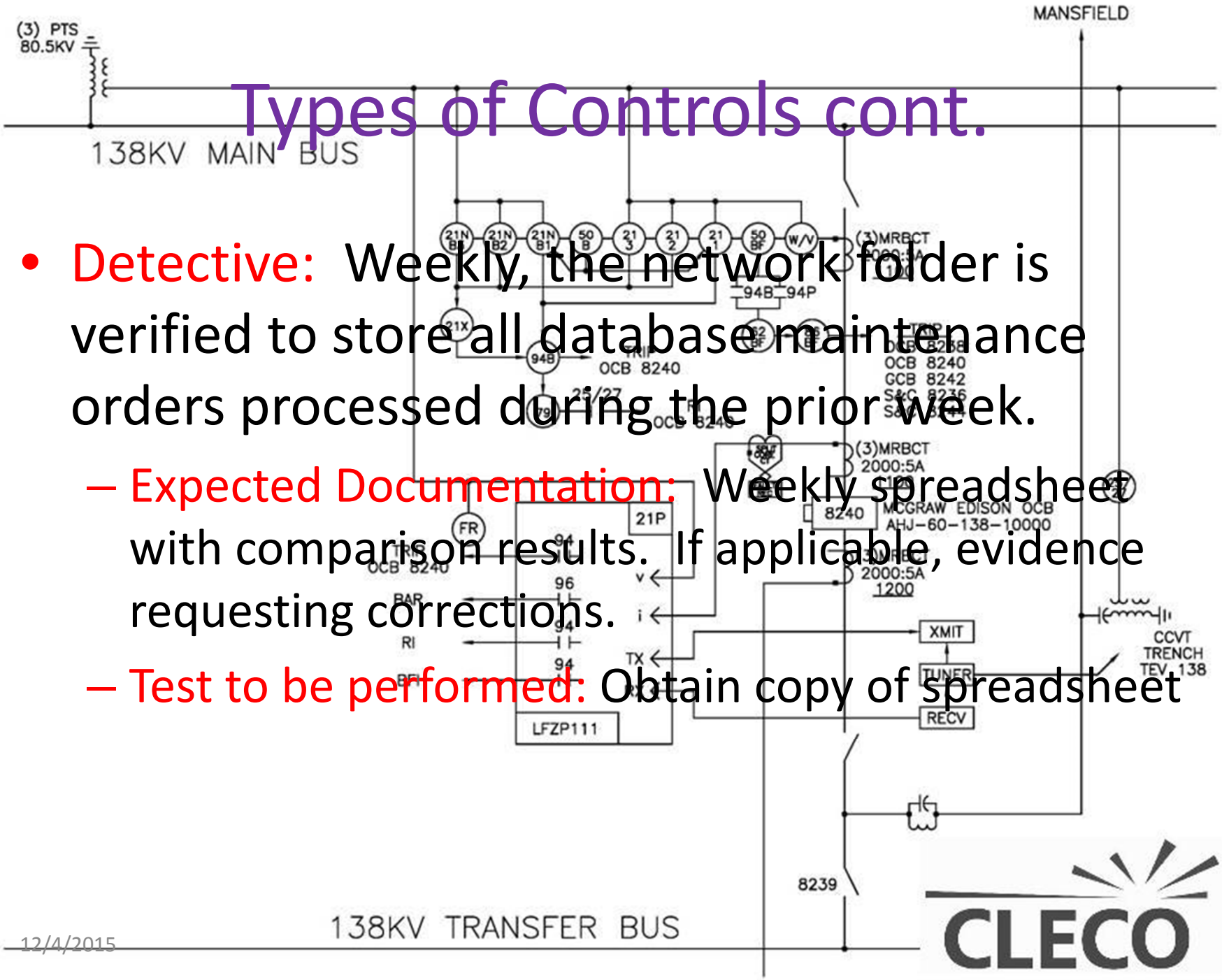
Types of Controls cont.

- Preventive: Monthly evidence prompter sends email to maintenance managers requesting status update of battery inspections.
  - Expected Documentation: Evidence prompter emails. Status update email from each manager
  - Test to be performed: Obtain and document a copy of the email generated by evidence prompter and manager update email.



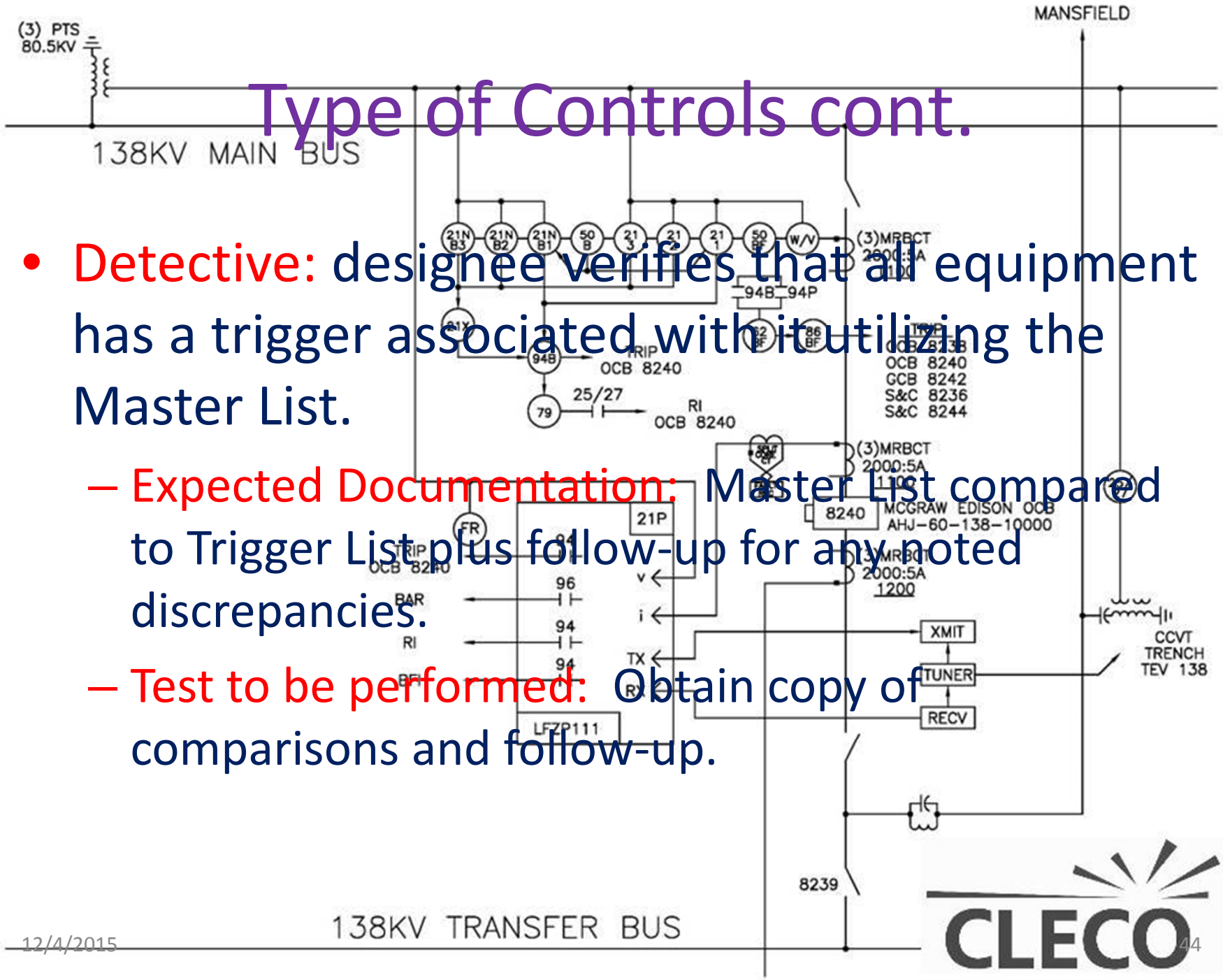
Types of Controls cont.

- Detective: Weekly, the network folder is verified to store all database maintenance orders processed during the prior week.
  - Expected Documentation: Weekly spreadsheet with comparison results. If applicable, evidence requesting corrections.
  - Test to be performed: Obtain copy of spreadsheet



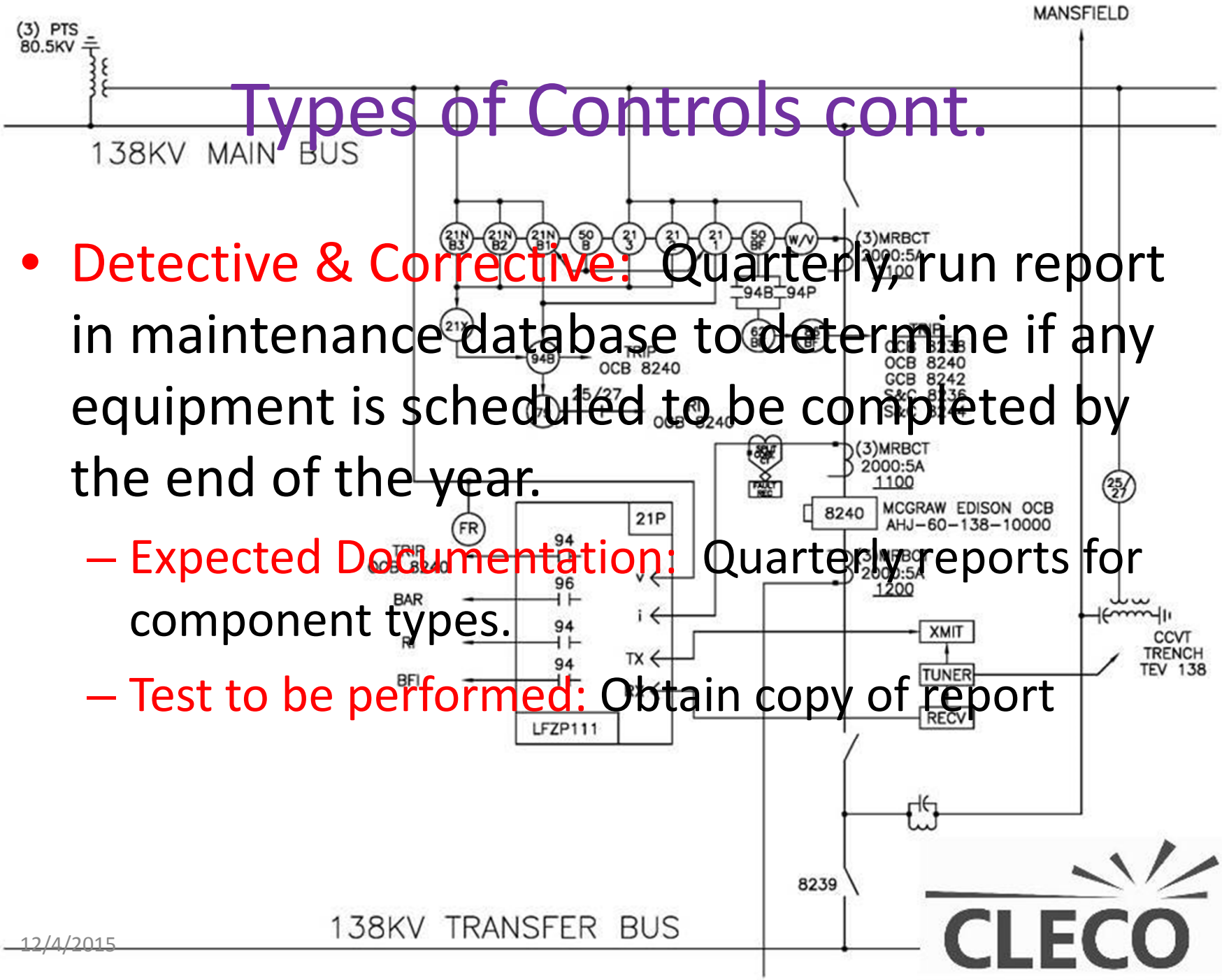
Type of Controls cont.

- Detective: designee verifies that all equipment has a trigger associated with it utilizing the Master List.
  - Expected Documentation: Master List compared to Trigger List plus follow-up for any noted discrepancies.
  - Test to be performed: Obtain copy of comparisons and follow-up.



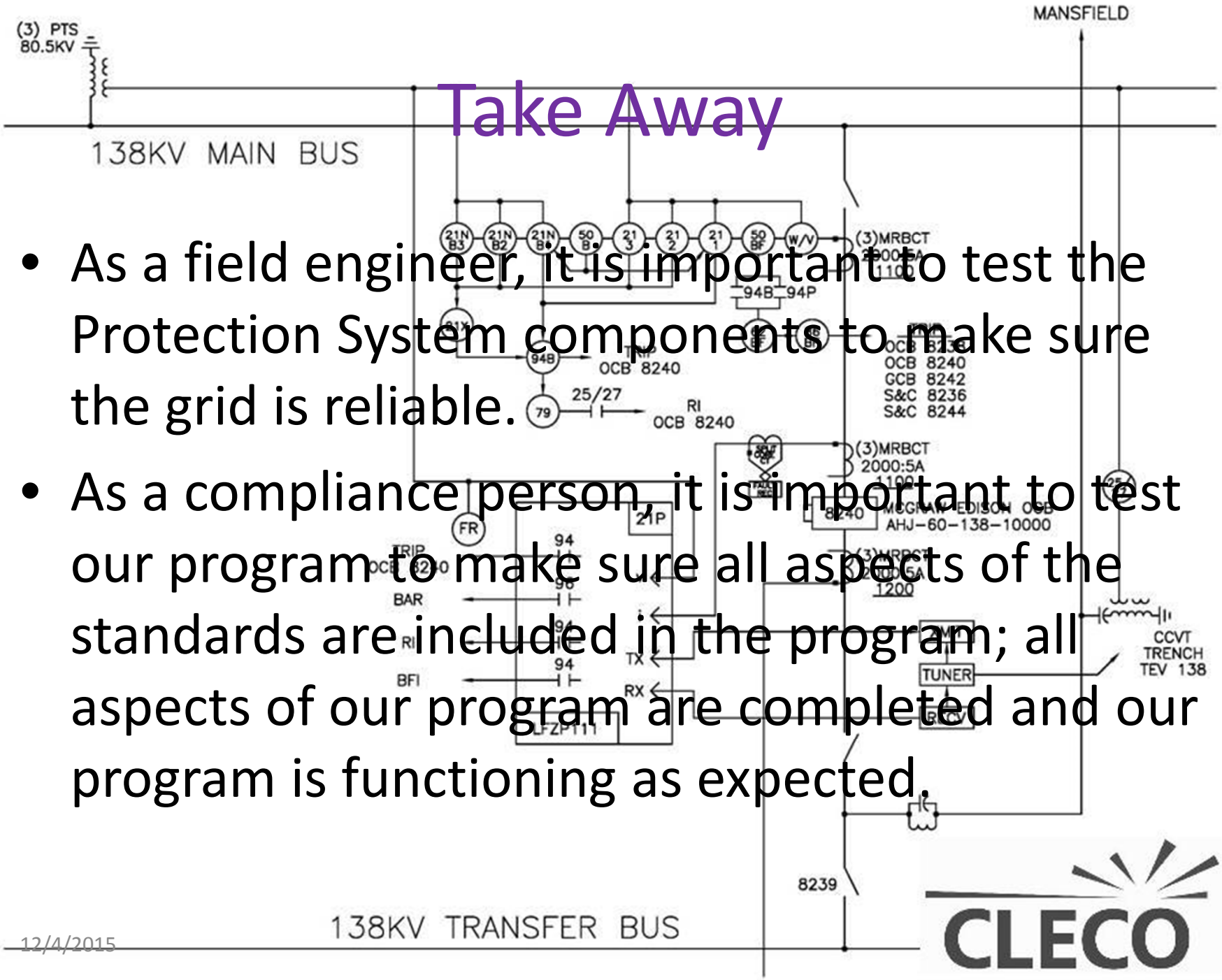
Types of Controls cont.

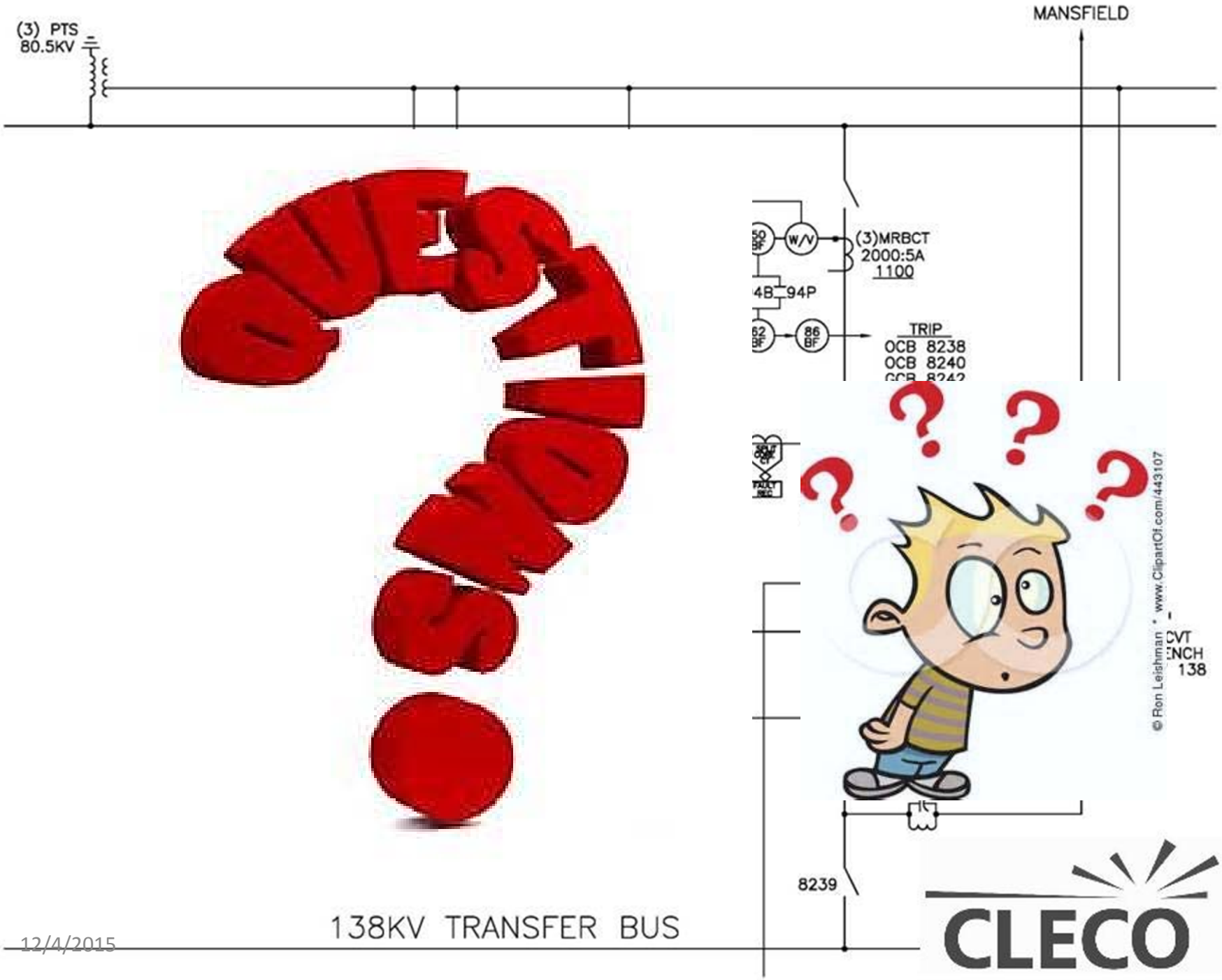
- Detective & Corrective: Quarterly, run report in maintenance database to determine if any equipment is scheduled to be completed by the end of the year.
  - Expected Documentation: Quarterly reports for component types.
  - Test to be performed: Obtain copy of report



Take Away

- As a field engineer, it is important to test the Protection System components to make sure the grid is reliable.
- As a compliance person, it is important to test our program to make sure all aspects of the standards are included in the program; all aspects of our program are completed and our program is functioning as expected.

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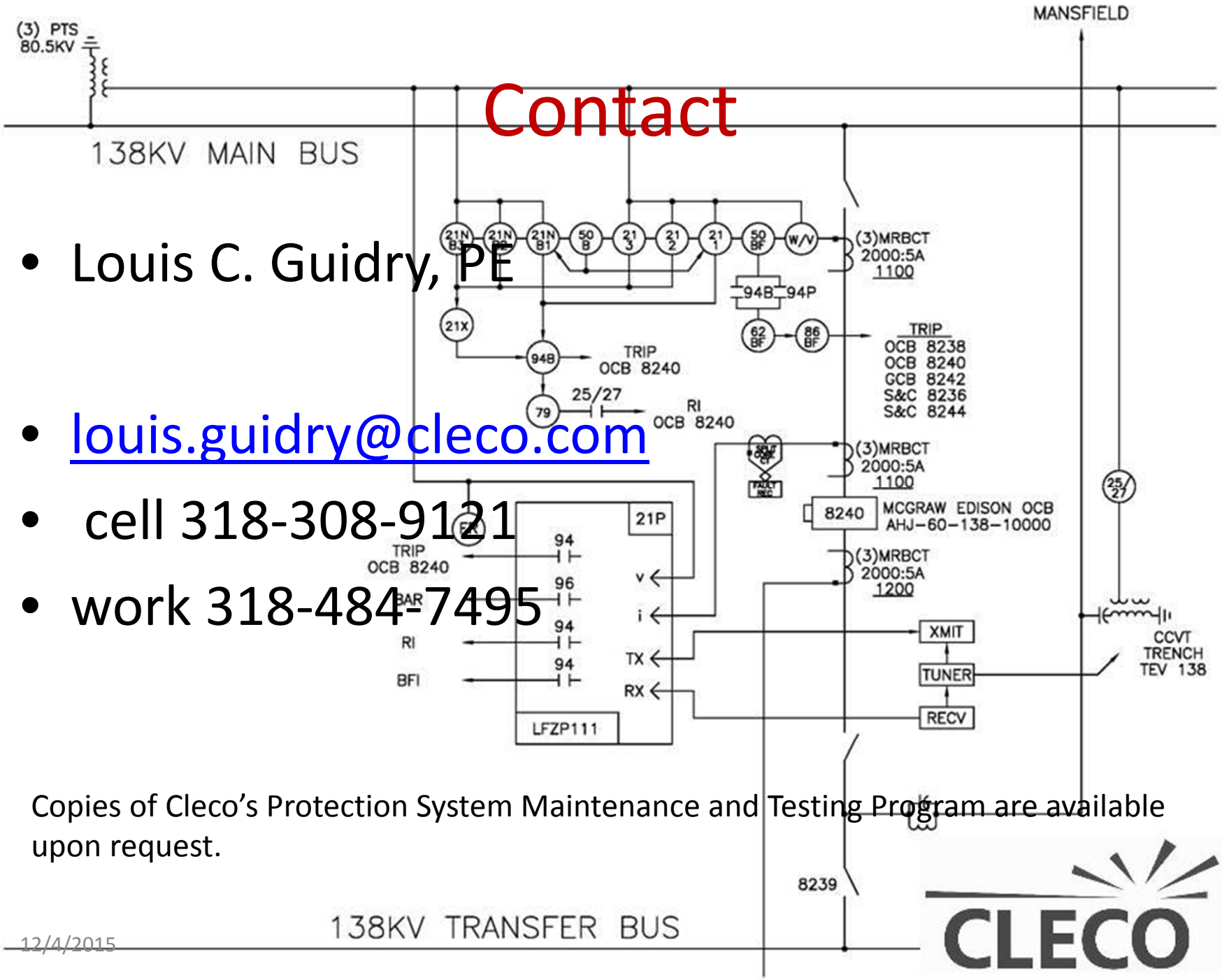

Copies of Cleco's Protection System Maintenance and Testing Program are available upon request.