Genius Engineering & Service Co., Ltd.

ELECTRICAL SERVICE "TRUST OUR EXPERIENCE"

KNOWLEDGE SHARING

GT GENERATOR (GT21) TRIPPED BY VOLT PER HZ

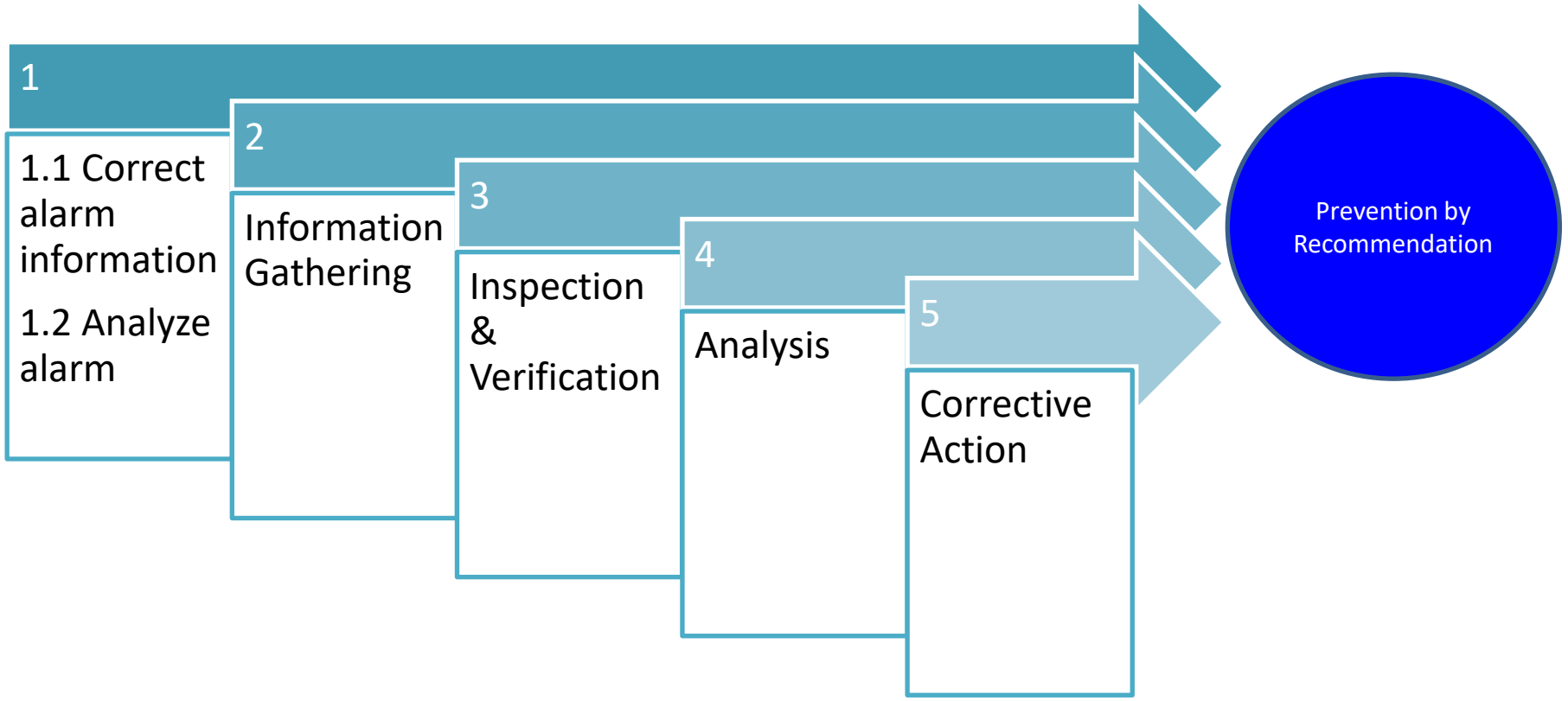
ROOT CAUSE ANALYSIS (RCA) REPORT

Shared by: Kongsit

Rev.1: 01 SEPT 2018

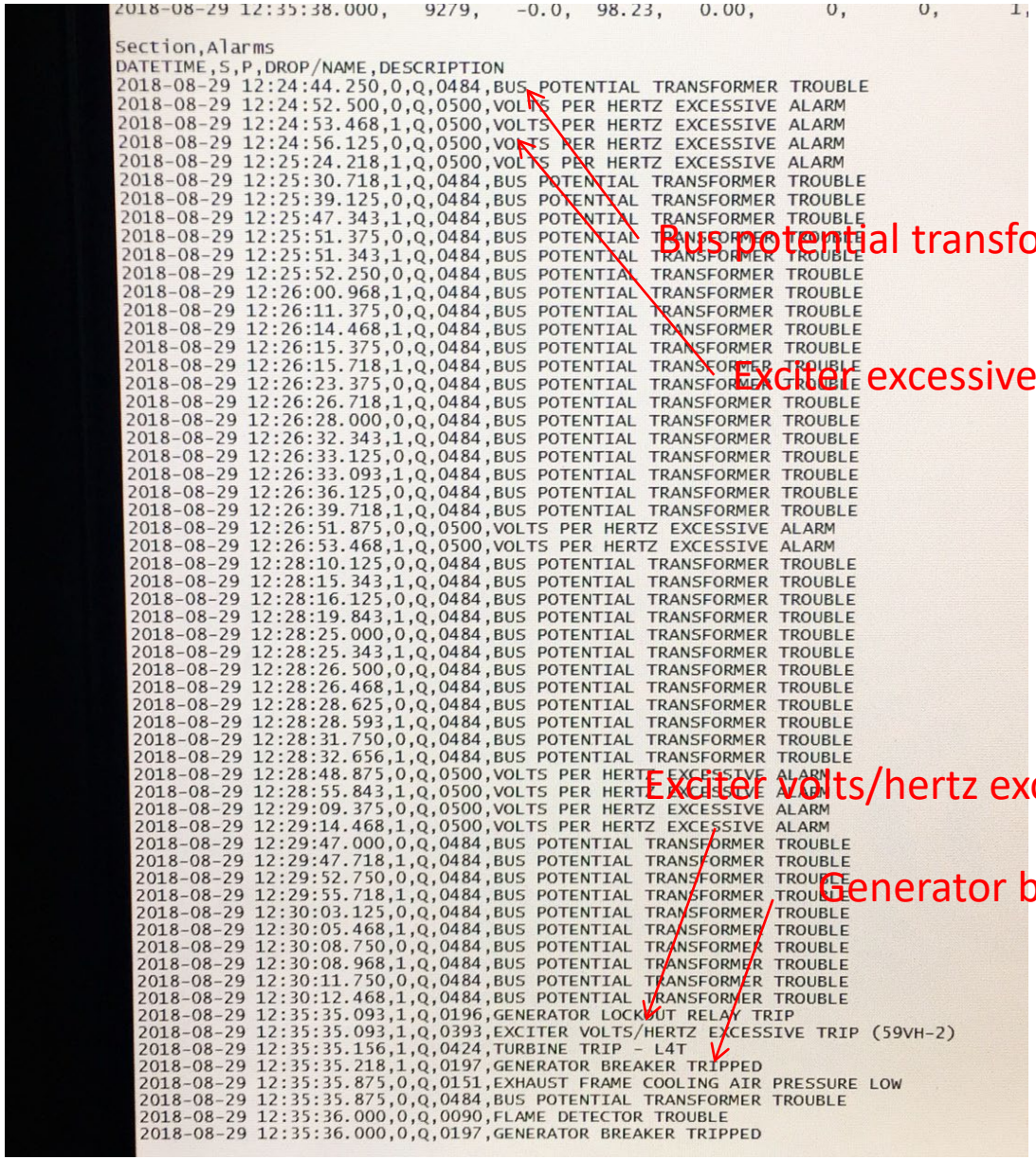
ALARM LIST

Root Cause Analysis Process



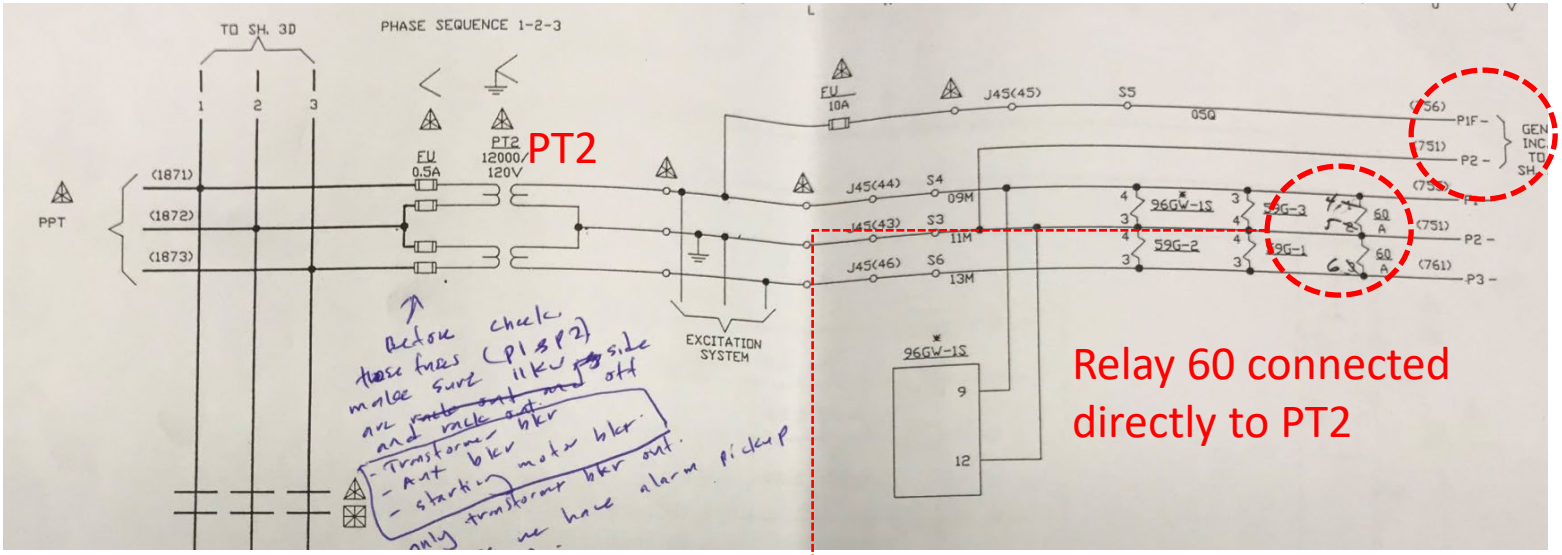
ALARM LIST

Alarm on Mark V HMI



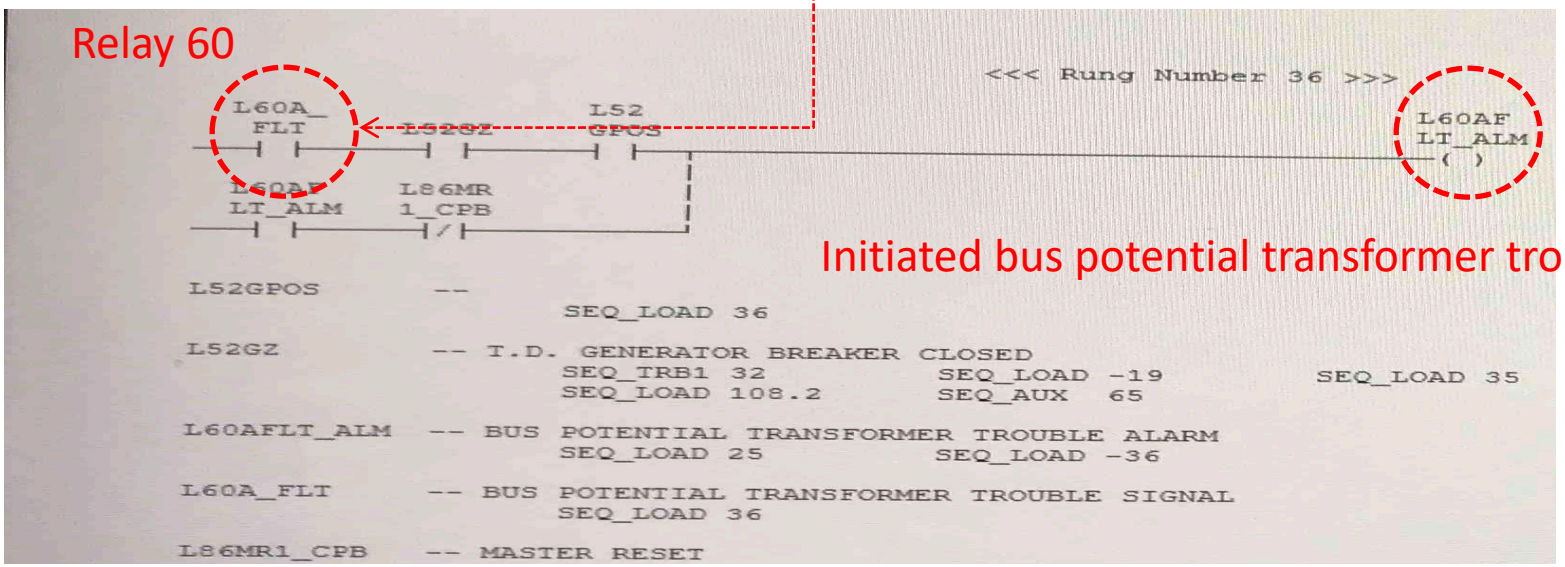
ALARM Analysis

Electrical Diagram

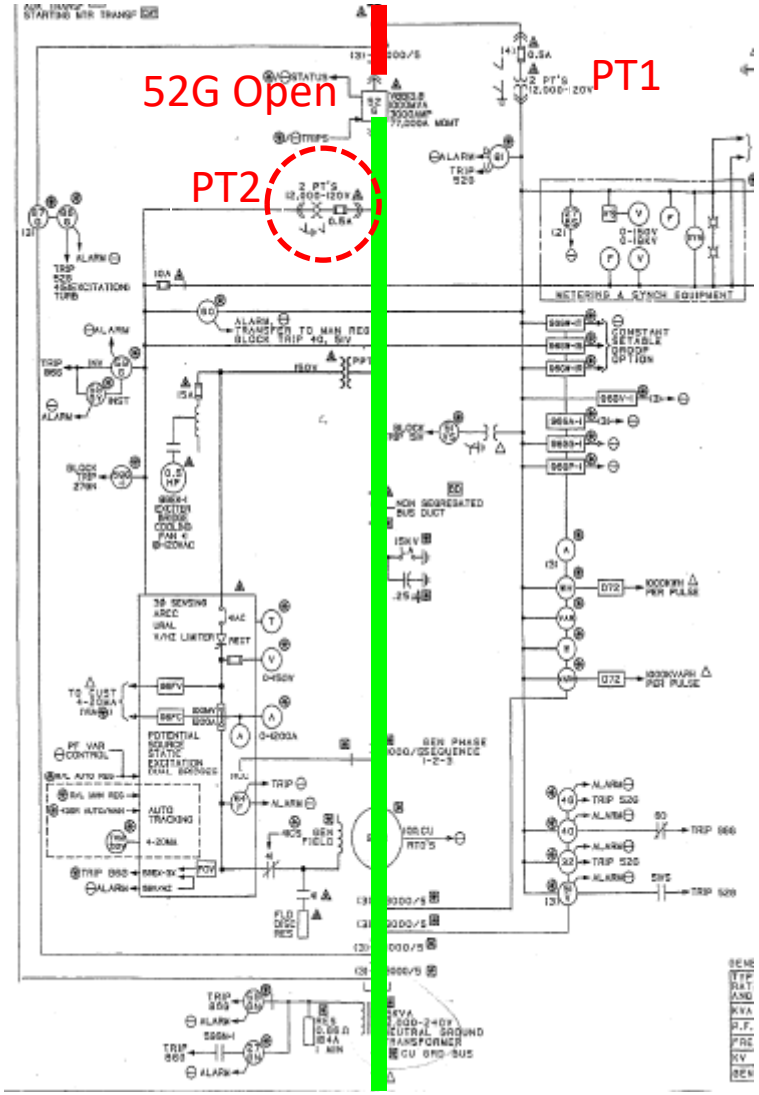


Voltage feedback signal to Excitation System

Logic in Mark V



Status After UNIT Tripped

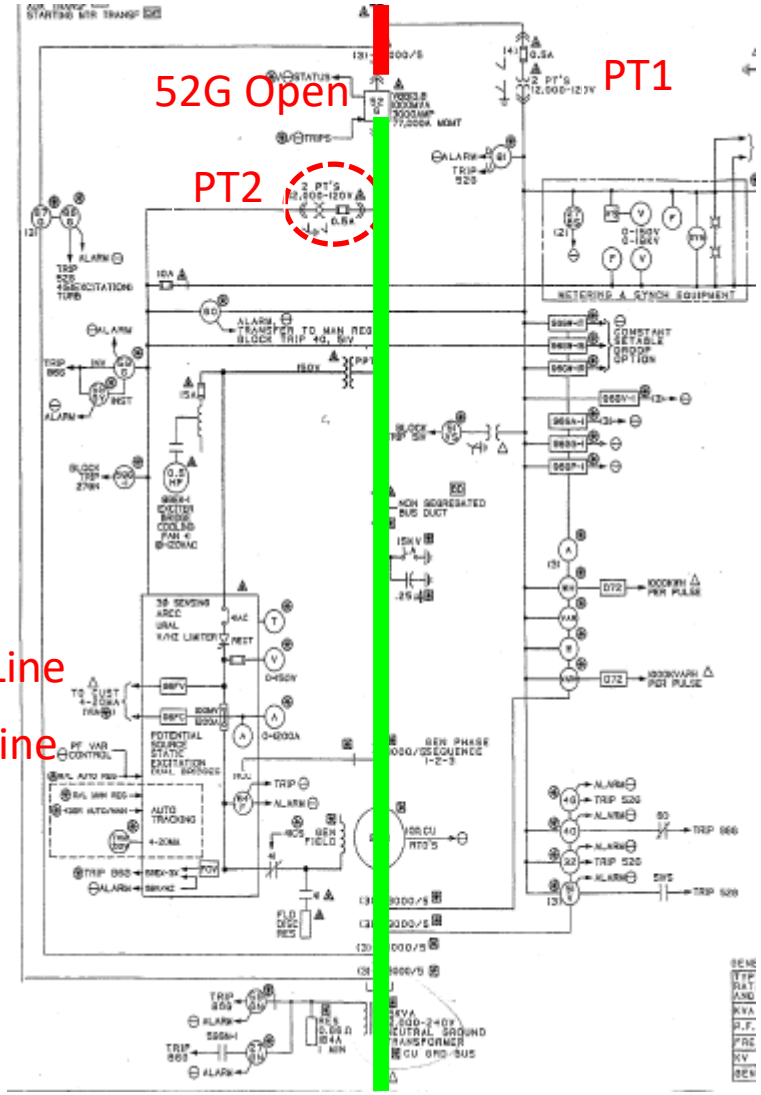


Live Line

Off Line

Note - Potential Transformer: PT

Information Gathering

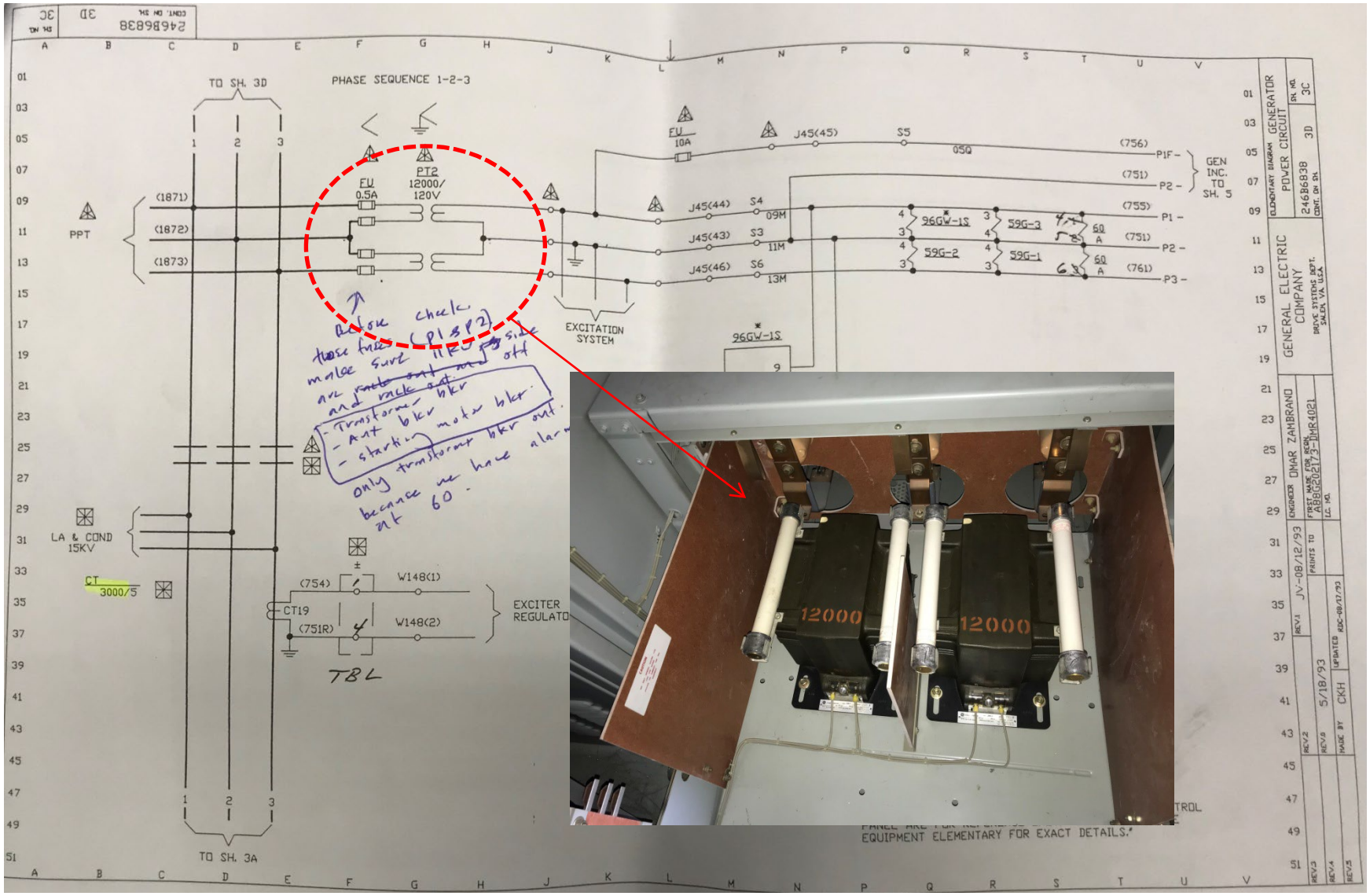


If PT2 fail cause Relay 60 operated then initiated alarm “Bus potential transformer trouble alarm”. And PT2 also send voltage feedback signal to Excitation System if no voltage appear on Excitation System means it don’t see the actual voltage. So it will generate more field current to rotor filed winding to try to increase generator voltage then cause excessive volt per hertz alarm.

This lead to investigate PT2.

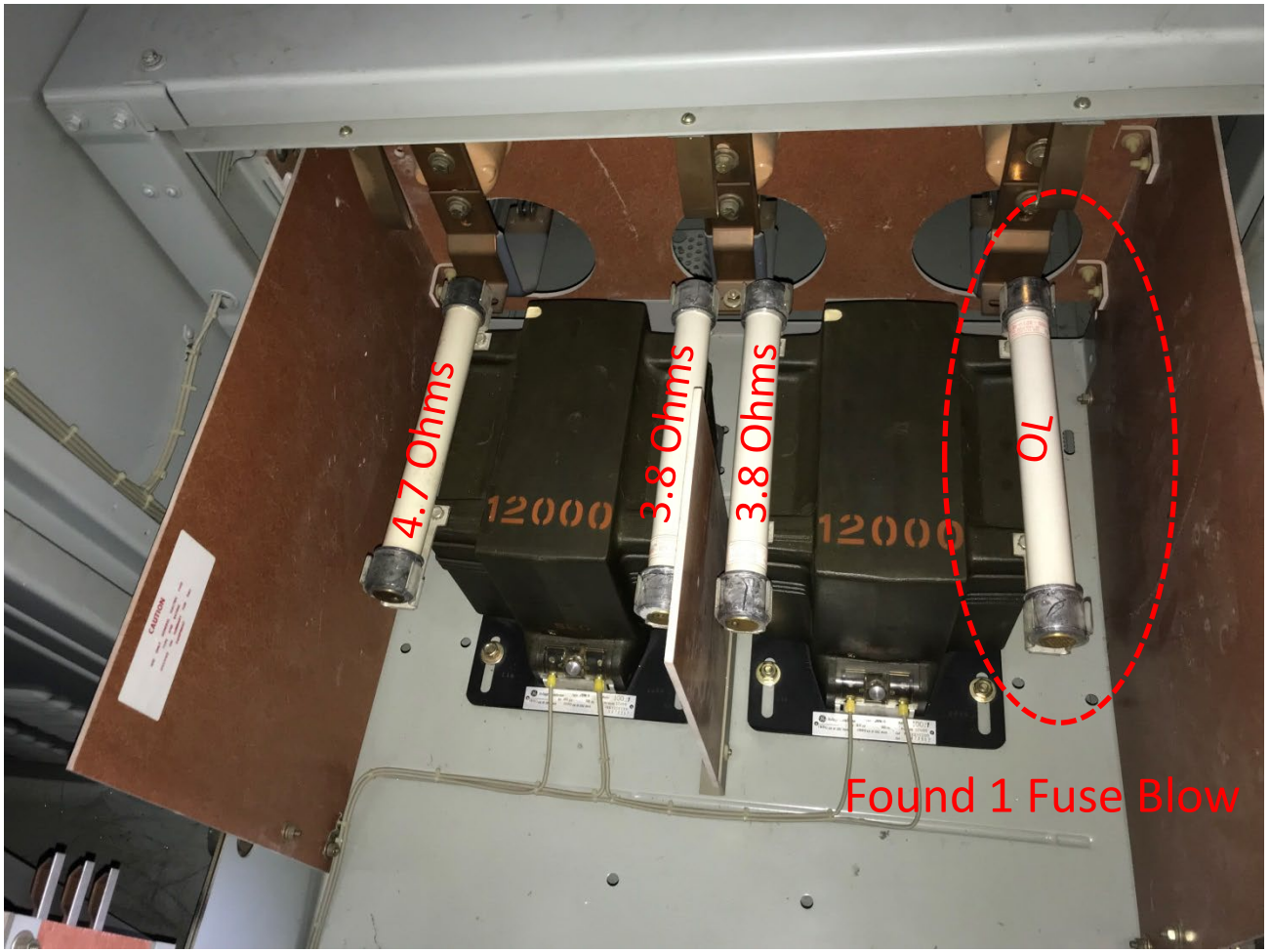
<u>Note</u> – Volt per Hertz is overfluxing protection used to prevent generator stator core damage from heat due to high flux.

PT2 Inspection & Verification



PT2 Inspection & Verification

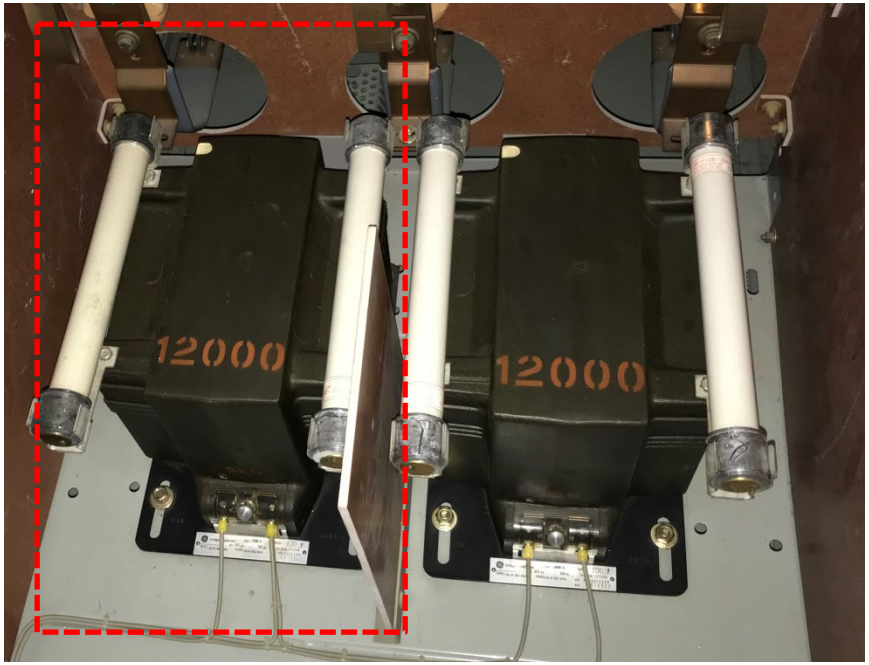
Fuse resistance measurement & record



PT2 Inspection & Verification

PT2 verification by electrical test

PT2 Specification
HV: 12000V
LV: 120V
Ratio: 100

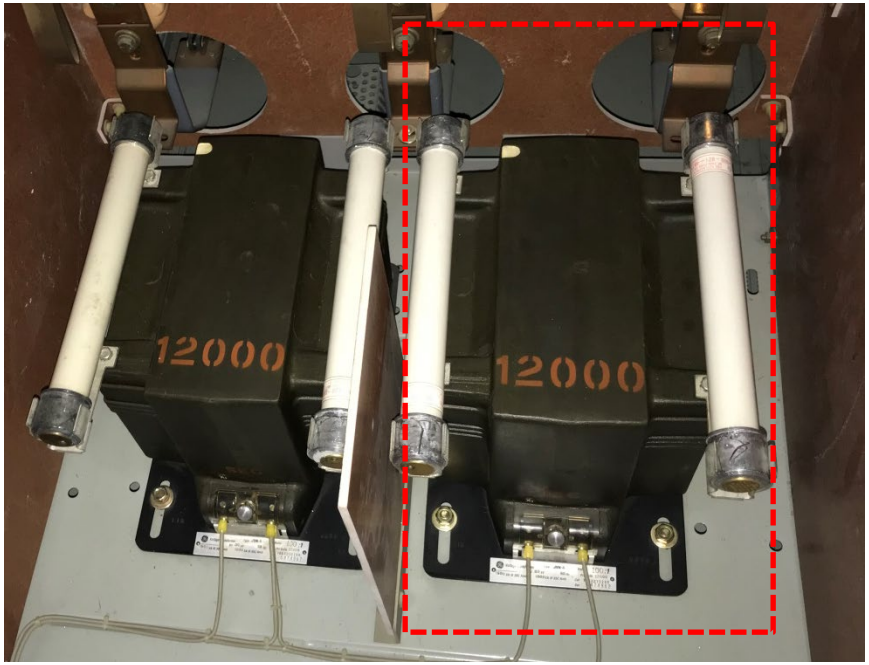


Left Side PT2		
ELECTRICAL TEST	**RESULT**	**EVALUATION**
DC Winding Resistance Test	HV: 893 Ω LV:151.5 mΩ	Passed
Ratio Test	99.756	Passed
Insulation Resistance (IR) Test	919 GΩ	Passed

PT2 Inspection & Verification

PT2 verification by electrical test

PT2 Specification
HV: 12000V
LV: 120V
Ratio: 100



Right Side PT2		
ELECTRICAL TEST	**RESULT**	**EVALUATION**
DC Winding Resistance Test	HV: 895.5 Ω LV:151.89 mΩ	Passed
Ratio Test	99.734	Passed
Insulation Resistance (IR) Test	583 GΩ	Passed

PT1 Inspection & Verification

Fuse resistance measurement & record

PT1 Inspection & Verification

As agreed with DES, PT1 also need to be verified by electrical test

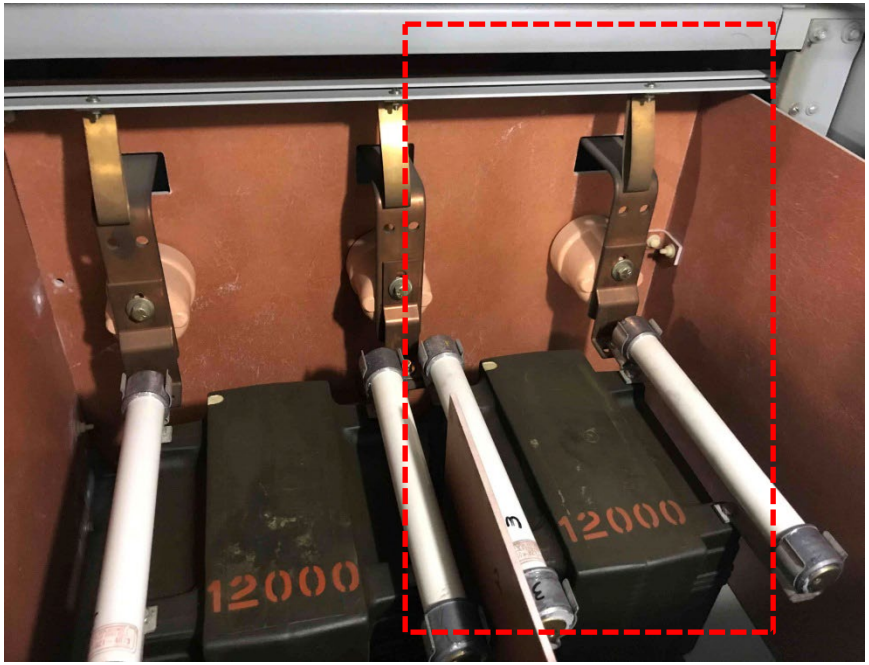
PT1 Specification
HV: 12000V
LV: 120V
Ratio: 100

Left Side PT1		
ELECTRICAL TEST	**RESULT**	**EVALUATION**
DC Winding Resistance Test	HV: 912.1 Ω LV:154.4 mΩ	Passed
Ratio Test	99.765	Passed
Insulation Resistance (IR) Test	171 GΩ	Passed

PT1 Inspection & Verification

As agreed with DES, PT1 also need to be verified by electrical test

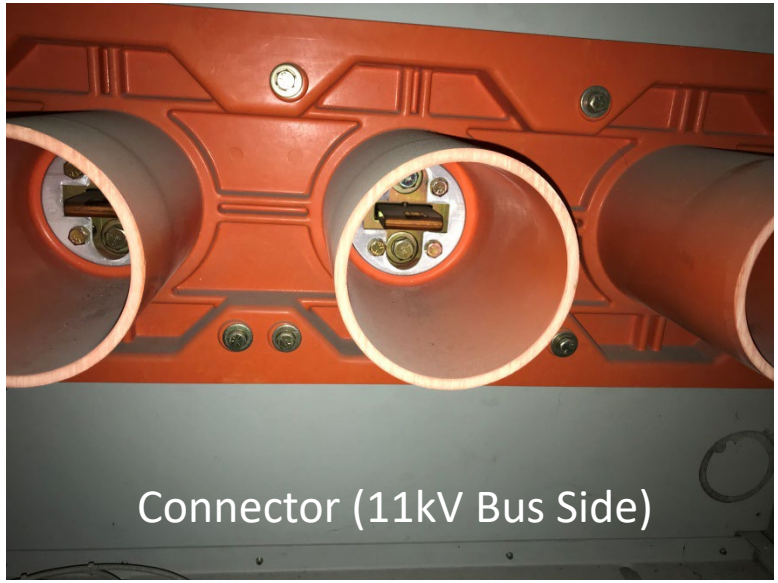
PT1 Specification
HV: 12000V
LV: 120V
Ratio: 100



Right Side PT1		
ELECTRICAL TEST	**RESULT**	**EVALUATION**
DC Winding Resistance Test	HV: 909.5 Ω LV:154.4 mΩ	Passed
Ratio Test	99.738	Passed
Insulation Resistance (IR) Test	1720 GΩ	Passed

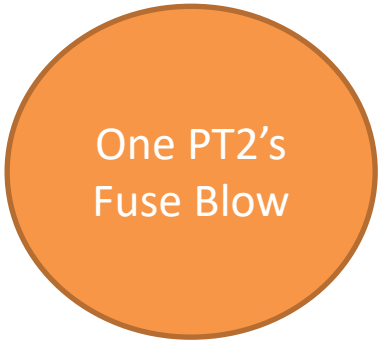
PT2 & PT1 Visual Inspection & Cleaning

PT2



PT1

Root Cause Analysis

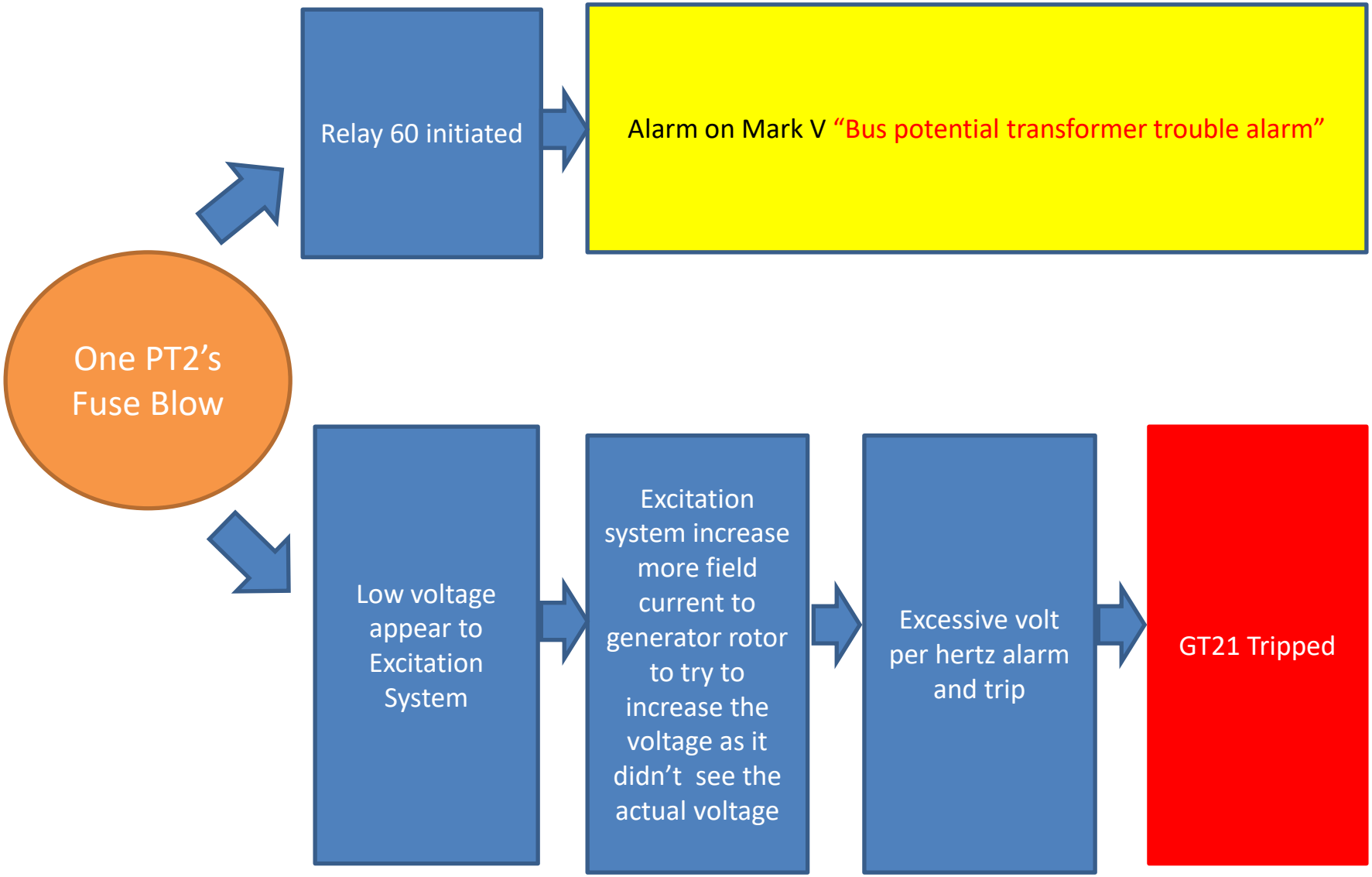


Possible Root Cause

- Defect of fuse itself
- Load of fuse shorted, in this case load of fuse is PT2 which we have verified that the PT2 still be Okay by electrical test

Therefore, we conclude that the root cause of the problem come from blow fuse.

Root Cause Analysis



Corrective Action

From the investigation, we found abnormality only fuse blow of PT2 which is in the circuit that lead occurring of all the alarm and then cause GT21 tripped.

Two Fuses has been replaced (Blow one and the another one that has quite high resistance compare to the perfect good one).

The PT2 itself has been verified by electrical test. It is satisfy all the test results are in acceptance criterial.

Moreover, PT1 has also been verified by electrical test. It is satisfy all the test results are in acceptance criterial.

As we don’t have trend of voltage of GT21 before unit tripped, therefore during the start up the generator voltage should be monitored and recorded.

Recommendation

- The fuse of PT1 and PT2 should be routine inspected, measured and recorded the resistance. We found 1 fuse of PT2 was high resistance (4.7Ohms) compare to other 2 good fuses (3.8 Ohms) this can lead fuse to be hot then blow. Such fuse shall be replaced.

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