Date: 11/06/2023

Reference Report n°: ASTEC- 014-2023

Project name: AMEC Foxhound Solar

Site Address: Clover, Virginia

Transformer:
Serial number: 1050387107
Rating: 53 / 70.5 / 88 MVA
HV: 230000 GrdY/ 132791 V – 34500GrdY/ 19919 V
Internal Order: 150-1900212-2-2

INTERNAL INSPECTION AFTER FALIURE REPORT.

Customer report as follow:

On the morning of 10/9/23 it was discovered that the main power transformer was not on line. At the time the transformer was energized but had not been loaded down yet. Solar circuits are not yet ready to backfeed so feeder breakers were isolated and loto'ed. Upon investigation it was found that there was a trip indication on the primary and backup relay. It was also noted that there was a standing trip on the lockout relay. NO physical damage was noted to any insulators, bushing or surge arresters. Further investigation found that both the primary and backup relay did see fault current at the time of the event. The primary relay utilizes CT's from the high side breaker and the backup relay utilizes CT's on the H bushings of the transformer. At this time it was also discovered the the sudden pressure relay had activated and energized the seal in relay 63SR-2. There were no other system abnormalties noted at the time of the fault on the transformer.

After receive the previous report WEG transformer trip to site in order to investigate this report.

October 24, 2023:

WEG technician and contractor arrive on site to investigate the reported issue. The unit is de energized and a visual inspection to the transformer is performed, with the following findings:

- Oil level OK
- Temperatures OK
- LTC position 6L
- No visual leaks or oil traces over the tank or floor
- No signs from over pressure valves activation

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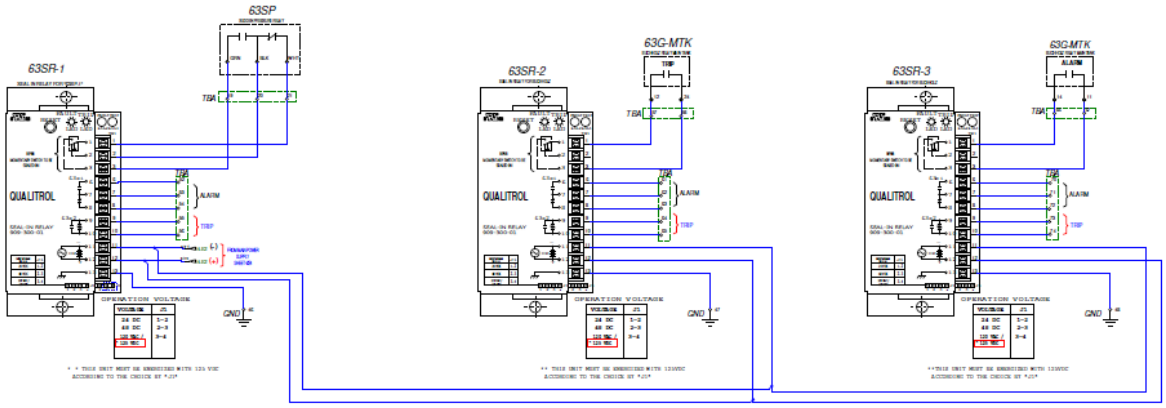
It should be noted that when reviewing the electrical diagrams, the seal relay 63SR-2 is connected to the trip of the Main Buchholz Relay (63G-MTK) and its alarm is connected to 63SR-3, and the sudden overpressure valve (63SP) is connected to relay 63SR-1, according to the following diagram:



That said, the relay that tripped was the 63SR-2, which means the event that caused the the unit to be off-line was detected by the main Buchholz relay.

Preliminary test before internal inspecion.

Core Megger test is performed, with 173330 M ohms results.

Disconnection of the transformer is carried out.

Ratio Tests (TTR) are performed on the transformer, mantaining the LTC in the position 6L.

TTR Results:

PHASE A: 6.4195
PHASE B: 6.4195
PHASE C: 6.4195

Winding resitance

- LOW VOLTAGE (X)

o X1-X0: 17.33 mΩ
o X2-X0: 17.34 mΩ
o X3-X0: 17.38 mΩ

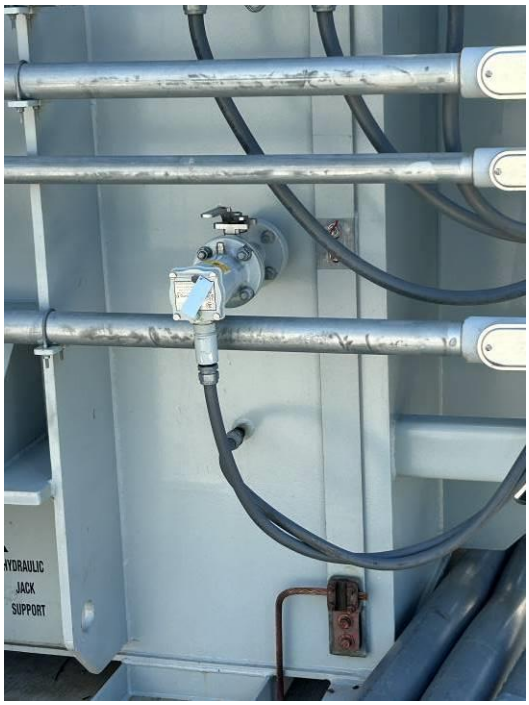
• HIGH VOLTAGE (H) POSITION 6L

o H1-H0: 1.032 Ω
o H2-H0: 1.029 Ω
o H3-H0: 1.028 Ω

The results obtained are in accordance to the values registered at the Factory Acceptance Testing (FAT).

Pictures of the Internal Inspection


LOCAL
REMOTE
ABB
LOWER
ABB
LOWER
A started hand operation must be completed.
25 turns for each operation.
LOWER
RAISE


HYDRAULIC
JACK
SUPPORT

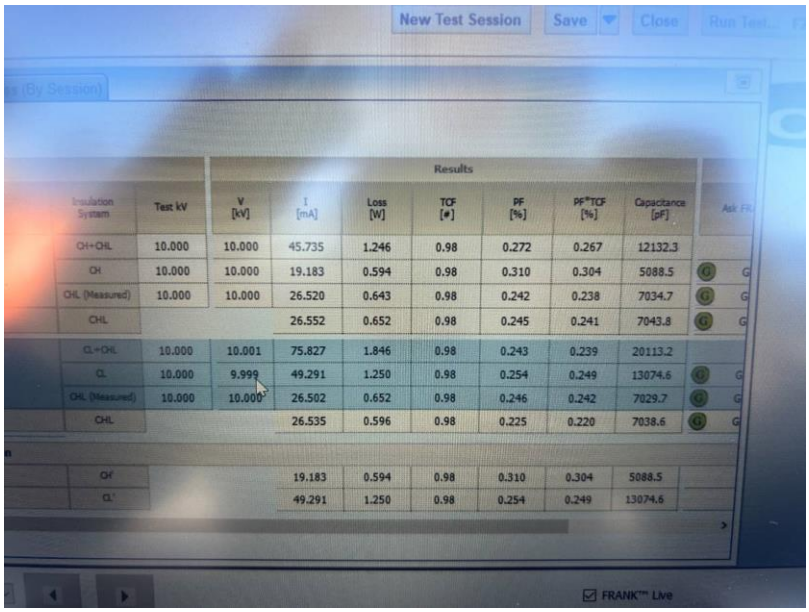
October 25, 2023:

WEG and Contractor return site in order to continue with the investigation. Prelimirary testing are concluded.

Hitachi (Load tap changer supplier) has also been on site to inspect its product.

- Excitation current tests.
    - H1-H0: 15.795 mA
    - H2-H0: 11.235 mA
    - H3-H0: 33.939 mA

- Power factor

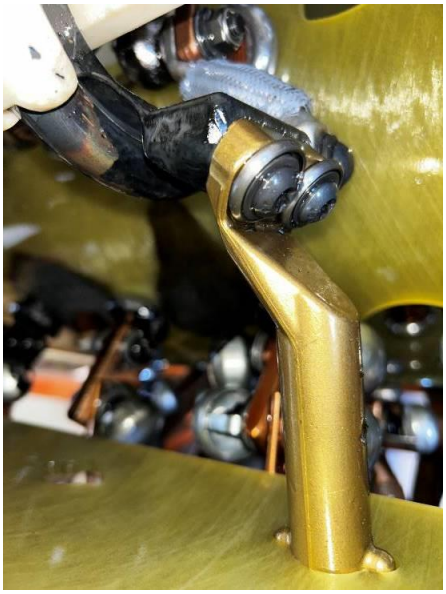


- DGA sample was take from main tank and LTC tank

The transformer was drain, Internal inspection to Un Load tap changer

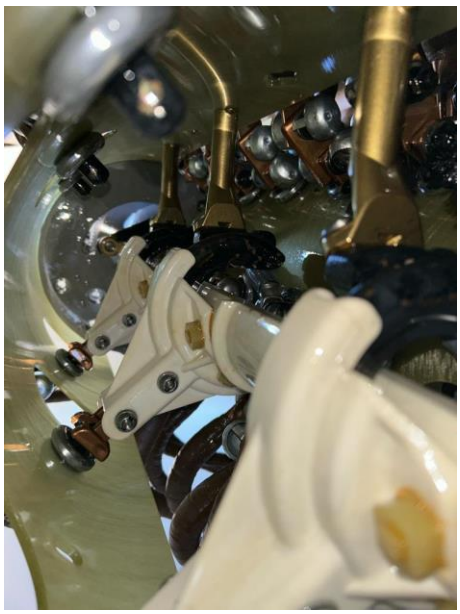
- WEG personnel, support Hitachi personnel to carry out the internal inspection

- The first comment today from the technician comments that the Selector was damaged and will need to be replaced, the Hitachi technician will send the evidence today to his specialist in Sweden.



October 25, 2023:

WEG, Contractor and Hitachi visit site in order to continue with the investigation.



Test to the unit was perform in order to have the compleate information from the unit. WEG and Hitachi informa to repari is not possible in site so the unit have to return to factory for repairs.

Conclusions:

According to the observed during site visit and results of the testing obtained, please consider:

1. Electrical Tests performed are mostly considered acceptable, as they match the results obtained at the Factory Acceptance Test. Such results mean that the event that occurred on site did not affected the coils of the transformer.

2. For the Excitation Current test, it was noted an elevated value on Phase C, if compared to the other phases. What is causing this value is uncertain at this point, but it is plausible to assume that the result can be affected by the problem at the LTC.

3. It is observed a damage at the LTC, between terminals 7 and 16. As previously mentioned at this report, it is plausible to consider that the damages at the unit are restricted to the LTC.

4. Based on the evaluation of the damages, Hitachi indicates the LTC cannot be repaired. The replacement of this equipment is a complex operation to be performed on site. Based on that, it is stated that the transformer must return to WEG facilities, in Mexico, so this activity can be properly performed.

5. At this point, it is not possible to discuss about possible root causes to this event. A forensic analysis to the transformer is needed to understand possible causes and corrective actions.

Best regards.

Eduardo Cercal Bender.
Engineering Manager WEG Mexico.

Jorge Ortiz Marin
Head of Technical Assistance WEG Mexico.