**Tour Report – 220KV Flagship Substation, Hinjewadi Date – 16-06-2025**

**Purpose:** Testing of 220KV/22KV Power transformer

**Duration:** 13-06-2025 (1 day)

**Persons Involved:** Mr. Sushant Kamble (R&D), Mr. Girish Soman(R&D), Mr. Angad Chauhan(R&D), Mr. Parikshith K S(R&D)

**Instruments Details:** TTRM302, TRM25+ with OLTC

**Customer:** 220KV FLAGSHIP SUB STATION MSETCL, Hinjewadi, Maharashtra

**Details:**

13-06-2025

Left the Aundh R&D Office at 10AM and reached the flagship substation at around 11AM.

After reaching the substation we got the overview of the substation from Sushant Kamble Sir, the topics covered in this overview are

1. **LA (Lightning Arrestors)** -. A lightning arrester protects electrical systems by safely diverting high-voltage surges caused by lightning strikes to the ground. When a surge occurs, the arrester provides a low-resistance path to earth, preventing the excess voltage from damaging connected equipment
2. **Isolators** - an Isolator is a form of mechanical switch used to isolate a particular section of an electrical circuit from the power source. This component ensures the circuit is completely de-energized as a safety precaution during maintenance hours.
3. **Circuit Breakers** - is tasked with isolating sections of the substation when faults or abnormal conditions are detected. This isolation prevents potential damage to transformers, cables, and other critical infrastructure, maintaining the integrity and improving the safety of the sub-station. There are different types of circuit breakers, but in this sub-station there was Air Circuit breaker which uses air as a medium to extinguish the arc.
4. **Power Transformer** – These transformers transfer electricity over varying voltage levels. There are 2 main functions of this step-down and step-up.

The electricity generated in the power plants are of high current and low voltages so to reduce the losses the voltage is increased and the current is reduced, for this a Step-Up transformer is used and a step-down power transformer transforms electricity into low-voltage electricity to make it safer for use in homes, industries.

After the site overview and before starting any tests, we earthed the device as this is an important safety precaution after this, we conducted AC and DC tests on the transformer, the AC tests performed using **TTRM302** by Girish Soman are as followed.

1. Transformer Turns Ratio Test
2. Magnetic Balance Test of the Transformer

**Transformer Turns Ratio Test -** test used to measure the turns ratio of the transformer. Turns ratio is defined as ratio of number of turns in the primary winding to the number of turns in the secondary winding of a transformer. For this test a low-voltage AC signal is applied to the HV side of the transformer. The resulting voltage on the LV side is measured. The measured ratio is compared to the transformer nameplate ratio.

We conducted this test for 3 different voltages i.e. 10V, 40V, 100V and on different taps i.e. Taps – 1, 5, 9, 17 and the results were acceptable and were within an error percentage range of +/- 0.3%.

**Magnetic Balance Test on the Transformer –** Normally the Magnetic Balance Test is conducted to those transformers which has a Neutral line present i.e. any one of the sides should be Star configuration, the transformer we visited has Star-Star configuration and an AC voltage is applied to one phase of transformer with respect to the neutral (e.g., between the R phase and neutral). The voltages on the remaining two phases (Y and B) are then measured individually with respect to neutral.

The sum of the measured voltages from these two phases should approximately equal the applied voltage. This process is repeated by applying the same voltage to the Y and B phases one at a time, while measuring the remaining phase voltages in each case.

If, in all three cases, the sum of the measured voltages is close to the applied voltage, it indicates that the core the transformer is balanced and there are no shorted turns or core issues.

If the transformer is Delta-Delta then the voltage is applied to any 2 phases Ex: R – Y and is voltage is measured in Y – B and B – R. But this is a bit complex compared to Star-Star as there is not neutral line.

After the AC tests, we conducted DC tests on the transformer using **TRM25+** **with OLTC** kit and the tests are:

1. WRT - Winding resistance test
2. ATWRT - All taps winding resistance test
3. Demagnetization

**Winding resistance test –** This is a test conducted on transformers to check the integrity of the windings of the transformer. This test involves applying DC current to each winding and measuring the voltage drop across it, using these and Ohm’s law (R = V/I) the resistance is calculated, if the windings are shorted or there is a break in the winding then the resistance will be more than the resistance given by the manufacturer indicating a possible problem in the winding. This test was conducted successfully by Sushant Kamble sir and the results were within the acceptable range.

**All taps winding resistance test –** This test is an extension of the Winding resistance test. In this test the resistance on all the taps is calculated in this transformer there were 17 Taps and the resistance of all these taps were calculated using the TRM25+ instrument and a graph of the same was plotted. The results were within the acceptable range.

The On-Load Tap Changer (OLTC) Test is a specialized diagnostic procedure used to evaluate the condition and performance of the tap changer in a transformer when the transformer is in load condition. OLTCs allow transformers to adjust their turns ratio without interrupting the load.

**Demagnetization Test –**After all the DC tests and after the removal of the DC supply the coils will be charged, so for future tests the coils should be demagnetized this is done by sending AC Current to the coil that slowly demagnetizes the coil and making it safe for future tests and working of transformer.

**Nameplate of the Power Transformer:**

