

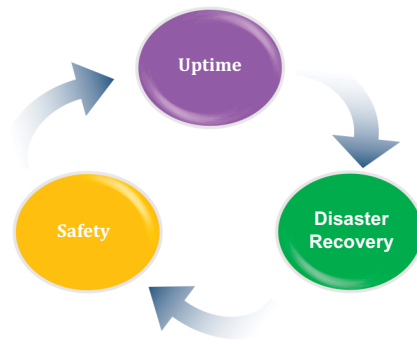
AUMSRI

ASSET UPTIME MANAGEMENT &
SPECIALIZED REFURBISHMENT OF INFRASTRUCTURE

Diagnostic Services for Steady Power Flow



**SUBSTATION HEALTH ASSESSMENT (SSHA)
IN ONLINE CONDITION “NO SHUTDOWN REQUIRED”**



Substation Health Assessment in online condition

“No Shutdown Required”

| Sl.No. | Activity | Description |
|--------|---|--|
| 01 | Third Harmonics Leakage Current measurement of LA / SA | Measurement of 3rd Harmonics Leakage Current, Measuring temperature and observing ultra sound noise emitted from all Lightning / Surge Arresters in the substation. |
| 02 | Earthing evaluation. | Soil Resistivity, Resistance of Earth Pit, Continuity Test |
| 03 | Corona Scanning of each Insulator string | Detection of Corona in substation at various places such as Insulator Strings, Bushings, Hardware joints, Circuit Breaker etc |
| 04 | Hotspot Detection: Scanning of all joints on all equipment | Inspection of all Hard work & Terminal Connectors to Identify Hot Spots in the substation |
| 05 | Ultrasound Inspection | inspection of all possible abnormality in Insulator Strings, Switchyard equipment and Control Panels |
| 06 | LID - Leaky Insulator Detection | Detection of all weak insulated string by measuring structure Leakage Current and Detection of partial discharge bearing string from ground. |
| 07 | Power Quality | Measurement of Power Factor, frequency and Total Harmonic Distortion of Voltage, Current, Power, check as per IEC Standard. |
| 08 | Visual Inspection of all equipment, Switchyard, Control Room and Safety measures. | General inspection of service substation i.e. proper installation of supporting equipment like corona ring, nuts, bolts, etc. keeping in view the safety, Health & cleanliness |
| 09 | Transformer Health Analysis | Analysis of the health of the transformer based on the historical test data provided by the utility. |
| 10 | SF6 gas Leak Detection | SF6 gas Leak Detection on various components like circuit breaker & GIS Substation |
| 11 | Testing of purity, Dew point and SO2 in SF6 gas of Circuit breaker | SF6 gas analysis of circuit Breaker & GIS Substation |
| 12 | DGA of Transformer Oil | Onsite measurement of all diagnostic gases plus moisture for all size Transformers, Tap Changer Tanks, Oil filled Circuit Breakers, Instrument Transformers |
| 13 | Partial Discharge Detection | TEV, Acoustics, High frequency and total body leakage current data collection from Assets of Transformer, CT, PT, CVT and analysis |

1. Third Harmonics Leakage Current measurement of LA / SA

The Primary Function of a Surge Arrester is to absorb high energy generated by Lightning or Switching Surges; and hence to protect the equipment in substation. Surge Arresters are exposed to stresses such as the normal operating voltage, temporary Over Voltages, switching over voltage, lightning Over Voltages and external pollution. The magnitude of Over Voltage could be 1.5 to 4 times of the normal operating voltage. If Surge Arrester is not healthy, it will fail to protect the equipment it is connected to in the severe Over Voltage condition.

Surge Arrester drives a small amount of current under continuous operating voltage known as leakage current. This leakage current can increase over the period of time due to stresses the Surge Arrester undergo.

Measuring the Third Harmonic Resistive Leakage Current gives us fair idea of aging or weakness of the Surge Arrester. Also the weak surge arresters generate a little amount of heat. Like any other equipment even a faulty or weak surge arrester produce ultra sound noise. Hence all these parameters must be captured periodically to avoid sudden failure / blasting and outage.

While carrying out the Surge Arrester inspection, following points are inspected and noted down.

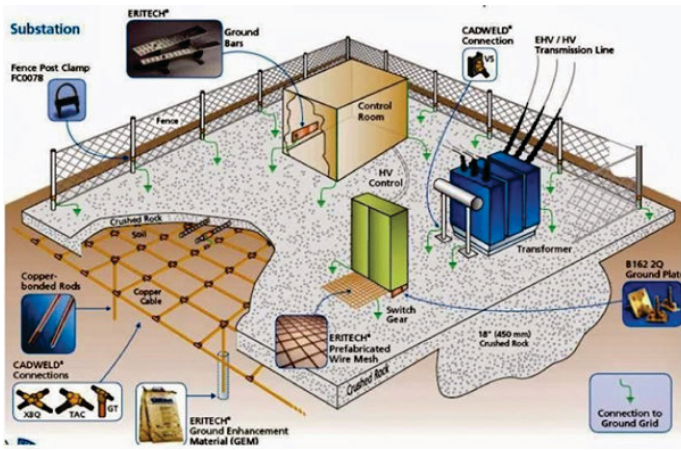
SA No., Make, Year Installed, Surge Counter, Ammeter Reading, Bay name, Phase sequence RMS current, 3rd Harmonic Resistive Leakage Current, Temperature of LA and Ambient Temperature is recorded for each Surge Arrester and report is submitted. Also the Ultrasound noise is observed if any.



2. Earthing System:

The basic objective of good earthing is to ensure the safety of life and property from shock and fire. Lightning, Surges or Unintentional contact between an energized electric conductor and the metal frame or structure that encloses it or an insulation failure in electrical equipment etc., can cause dangerously high voltages in the electrical distribution system. Under such circumstances, Grounding provides an alternative low impedance path and thereby minimizes damages. A good and an efficient Earth ensures that all parts of apparatus other than the live parts shall be at earth potential or very close to zero.

Earth Resistance & Soil Resistivity changes seasonally. Hence the Earth Pit Resistance should to be checked once in a year and remedial action to be taken.



Earth Mat beneath the substation soil sometimes get corroded and broken over the period of the time. This reduces the overall effect of the good earthing. Hence it is important to check the continuity of the Earth Mat periodically.

We cover followings during the Earthing System Health Check

1. Soil Resistivity
2. Individual Earth Pit Resistance check
3. Earth Mat continuity check

3. Corona Scanning of each Insulator string

Corona, the partial discharge is formed due to ionization of air where electric field exceeds a critical value and it produces ozone and Nitrogen oxide which are corrosive chemicals. During high humidity this oxide creates Nitric Acid which is very corrosive and works like slow poison for the system. Corona damages the area around it and also creates radio interference. It emits UV rays and makes audio noise. Insulators and conductor get damaged due to Corona.

Corona on the insulator is very dangerous because the Nitric Acid which is created during high humidity starts damaging the insulator. Unless the intensity of corona is very high it cannot be seen with naked eyes. Early detection of corona and the subsequent preventive action will help to maintain the required uptime.

Corona on the Insulator can be removed by cleaning the insulators thoroughly. Corona detection can also be done before and after cleaning of insulator as quality check.

Ultra High sensitive Daytime Corona Camera is used to capture corona even during broad day light.



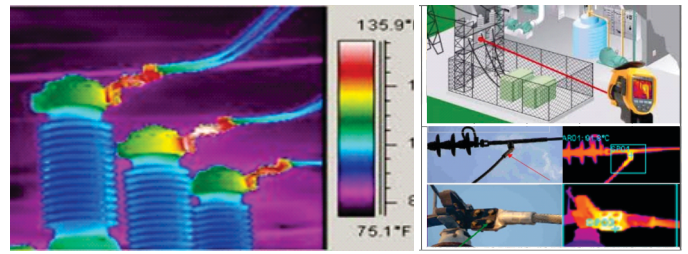
4. Hotspot Detection: Scanning of all joints on all equipment

The main reason for developing hot spots in the system is loose joints. This happens due to poor workmanship, constant vibration or wear & tear of material.

Hotspots are dangerous for the system and must be attended immediately to avoid breakdowns.

A loose joint causes more resistance to the current flow and hence get heated up. With the rising temperature the spot becomes hotspot and if not attended reaches to a breakdown point.

Hot spot is not visible to naked eyes unless it becomes too hot. We Taurus Powertronics provide Hot Spot detection service using latest IR Thermovision camera.



As seen in above pictures Thermovision Scanning is done for all joints in the substation and both digital and thermal images are provided in the report for easy mapping and comparison. Name of the feeder / Bay, Side, Phase, equipment name are clearly mentioned in the report for easy identification of the joints, so that remedial action can be taken without any confusion.

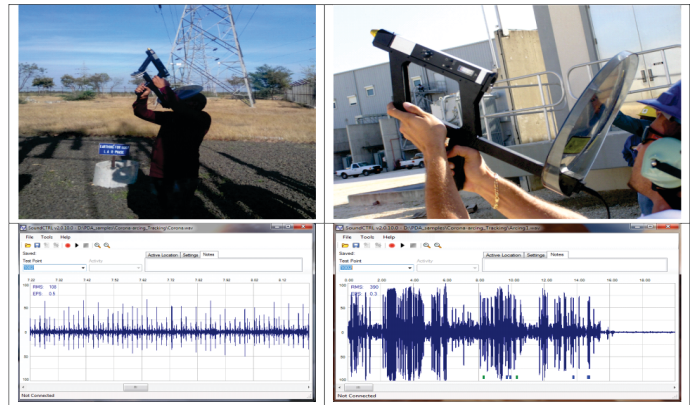
5. Ultrasound Inspection

Ultrasound Inspection is latest technology to find out abnormalities in various equipments in substation including Insulator Strings. A damaged or defective insulator produces high frequency noise which is not audible to human ear.

The ultrasound devise we use is capable of capturing any noise which has frequency more than 20,000 Htz.

This is one of the fastest and easiest way to detect any possible fault in different equipment and in Insulator string as well.

Panel boards in Control Room are also checked without opening them using Ultrasound equipment.



6. Leakage Current Measurement

Ideally there shouldn't be any leakage of current from any of the equipment in the substation. But generally, we find some leakage due to Deteriorated Insulation, pollution, improper connections etc. If this leakage is too high, it could be proved disastrous for the equipment, substation and also for human life.

The leakage current must be checked periodically for all the Metal Support Structures including the gantries in the substation.

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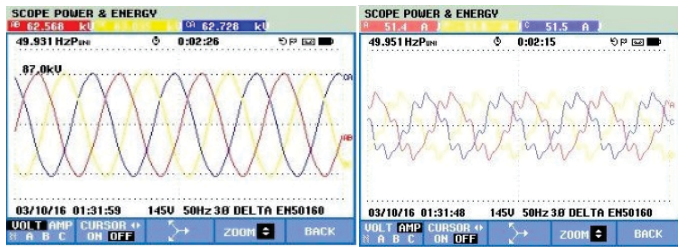


7. Power Quality Analysis

The quality of the power is GOOD, if the power factor as close as to 1 and the voltage & Current have a smooth curve.

The quality of the Voltage is mainly depended on Generation and the quality of current is depended on the Load. Total harmonics distortion (THD) effects heating in transformers, capacitors, motors, and generators, disoperation of electronic equipment, incorrect readings on meters, disoperation of protective relays, and communication interference.

Hence it becomes important to check the Quality of the Power regularly and improve it to the optimum. Taurus Powertronics uses the most advanced tool to check the quality of the power which gives the minute details and measures the distortions accurately.



Votage waveform

Current waveform

8. Visual Inspection of all equipment, Switchyard, Control Room and Safety measures.

General inspection of substation keeping in view the safety, Health & cleanliness

9. Transformer Health Analysis

Analysis of the health of the transformer based on the historical test data provided by the utility.

Under the guidance of expert data captured at substation for transformer testing will be analysed and analysis will be done with respective report.

10. Gas Leakage Detection

Search and location of gas leaks, Using advanced micro thermal conductivity sensor for fast, effective detection. Robust and reliable, repeatable readings of the detected gas. The instrument's LCD display, LED indicator and audible sounder clearly indicate the leak present.

11. Testing of purity, Dew point and SO2 in SF6 gas of Circuit breaker

SF6 gas analysis of circuit Breaker & GIS Substation

12. DGA of Transformer Oil

Onsite measurement of all diagnostic gases plus moisture for all size Transformers, Tap Changer Tanks, Oil filled Circuit Breakers, Instrument Transformers

13. Partial Discharge Detection

Using portable on-line PD detection unit for condition-based maintenance and substation access safety.

To reduce the down time screen for partial discharge

Partial Discharge

As per IEC 60270, Partial discharge is a localised electrical discharge that only partially bridges the insulation between conductors and which can/cannot occur adjacent to a conductor. PDs normally develop in air gaps or on insulation surfaces, due to defects in the insulation system. Because PDs are correlated to insulation ageing, they are the cause and effect of insulation degradation.

Innovative Technology of insight to address detection of PD

14. Executive Summary

Executive summary of the entire test will be prepared under the leadership of experienced team head.

All the data captured during inspection of the assets of substation will be carefully studied and assessed by the team.

Detail report will be generated with fact reading which will be excellent data to improve the performance of the network.

Our recommendation will also be the part of report.

All this health assessment will be carried out in online condition no shutdown is required

*** With additional cost Corrosion, Erosion & Rebuild of structure services available**



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