



**SERVICE OFFERINGS
FOR
POWER SYSTEM STUDY
&
CONDITION MONITORING
FOR
STATIC EQUIPMENT**

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POWER SYSTEM STUDY:

DATA COLLECTION AND NETWORK MODELLING

The studies shall follow after collecting the complete data required for the study. The list of minimum data required for the above studies will be attached for your perusal. These data shall be verified and validated by customer.

After data collection, network shall be modeled along with individual equipment data in NEPLAN[®] software. The electrical network shall be modelled up to 0.415kV secondary side breaker of distribution transformer by lumping loads at 0.415 kV level.

LOAD FLOW STUDY

Purpose: The load flow gives us the steady state of the entire system - voltages, real & reactive power generated / absorbed and losses. Load Flow solution helps to ensure that the power system is designed to satisfy its operating criteria. Load Flow study is used to determine the following,

- Component and circuit loadings
- Optimum operating modes for normal conditions
- System response to abnormal conditions, such as outages of lines or transformers
- Evaluate the effectiveness of new solutions to solve present deficiencies and meet future system requirements
- Transformer Tap settings
- Generator exciter/regulator voltage set points
- Performance of system under different emergency conditions.
- Size and Location of capacitors

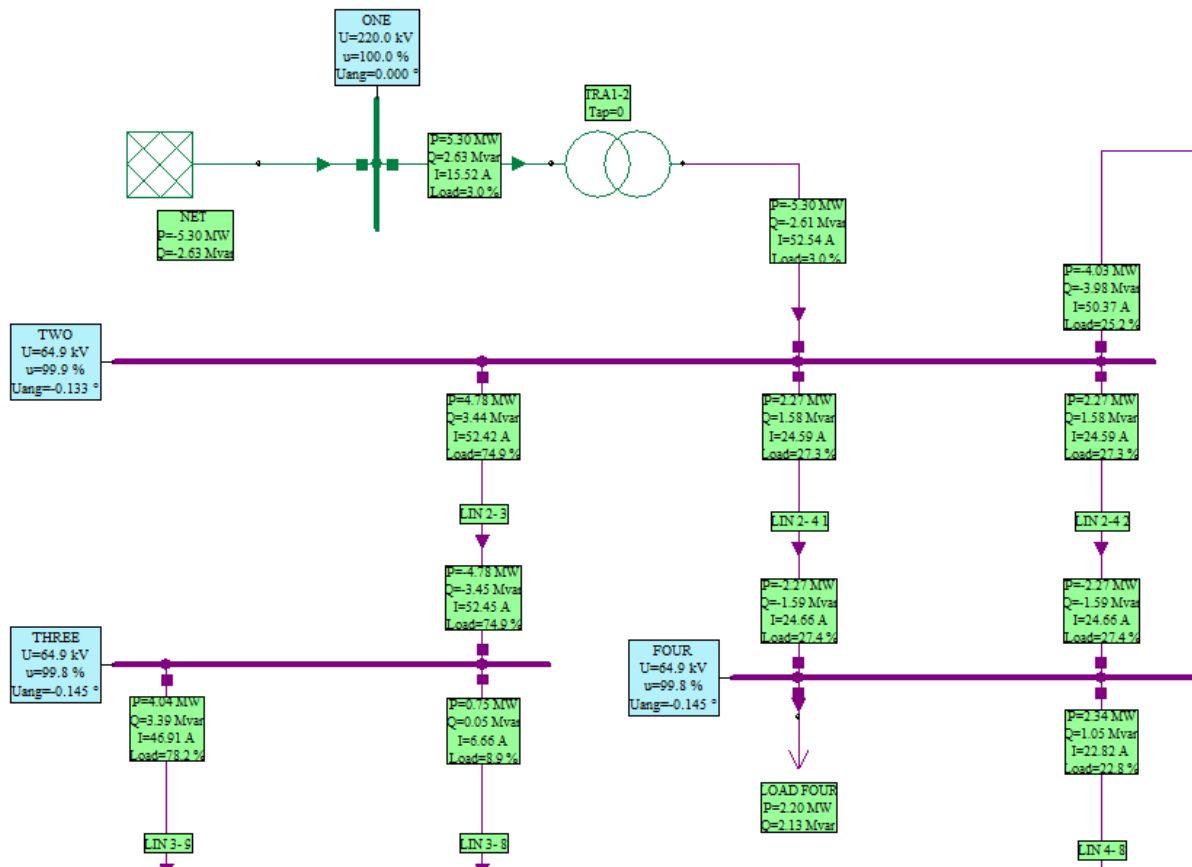
The load flow model is also the basis for several other types of studies such as stability and harmonic studies. The load flow model supplies the network data and an initial steady-state condition for these studies.

Study Methodology: Base load flow study shall be conducted for steady state operating condition of network and various operating or contingency conditions of the network to evaluate the steady state performance of power system. Critical or severe contingencies shall be considered for network redundancy checks as follows after mutual agreement with customer.

- I. Outage of Generator
- II. Outage of Transformers
- III. Outage of Major Loads
- IV. Optimization of Transformer Tap Positions

Methodology: The base load flow shall be conducted in NEPLAN[®] software and validated by customer. Case studies shall be created after discussing and understanding the operation philosophy and requirements with customer. Complete power flow diagrams highlighting limit violations (V/I) i.e. over voltages, under voltages, overloading etc. (if any) with proper remedial solutions shall be indicated along with the data considered.

Customer shall review and validate the power flow diagrams within 3 days from the date of submission of base case power flow solution. Based on the comments / suggestions the base load flow case shall be revised. These load flow results shall be frozen for further studies and analysis. A typical SLD generated on the software showing base load flow conditions will be as below.



SHORT CIRCUIT ANALYSIS

Purpose: Short circuit analysis is performed to know following things while designing and running the system

- Adequacy of Interrupting Equipment
- Protective Device Settings
- System Design
- Short-time current rating

Study Methodology:

Short circuit study shall be conducted for the normal operating conditions of the breaker, for peak and off-peak load condition and various generating conditions to evaluate the increased fault levels and bus voltages in accordance with IEC 60909-2001, for both 3-phase faults and 1-phase to ground faults. The normal operating position of the breakers shall be defined mutually with customer. The maximum fault level at various switchboards of the system (as per battery limits) shall be calculated for checking the adequacy of the switchgear capabilities with respect to the calculated fault level. The calculated fault levels shall also be used for protection co-ordination of P/F and E/F relays.

REACTIVE POWER COMPENSATION STUDY & PLANNING

Purpose: To decide optimum level of reactive power compensation and capacitor placement.

Study Methodology: Reactive Power flow in the network under base & peak load condition shall be studied and optimum capacitor rating (if required) shall be decided to achieve the desired power factor.

Optimum location for capacitor placement shall then be decided to locally compensate the reactive power requirement as far as possible.

With the decided capacitor rating, the system shall then be analysed for its impact. The voltage profile of the network with the capacitor bank shall be studied. Any voltage violations shall be highlighted with recommendations to bring them within permissible limits.

Depending on the frequency of reactive power demand variation, type of compensation – Static or dynamic shall be decided.

HARMONIC MEASUREMENT AND ANALYSIS

Purpose: With the advance of power semiconductor technology, the power electronic devices are widely used in industry to improve the manufacturing processes and system efficiency. These devices are likely to introduce the distorted current in the power system, which may not only increase power losses of electrical facilities, but also cause malfunction of communication devices. Besides, the harmonic resonance may also cause serious problem such as over voltage in the power system. Therefore, harmonic analysis is carried out for the system to check harmonic level and decide mitigation methods.

Study Methodology: As per standard IEEE 519 (1992), computer simulations are usually required for complex networks in order to perform following analysis -

- Frequency scans for system response
- Response to multiple harmonic sources
- Multiphase, unbalanced system solutions

Harmonics shall be measured at various locations (in mutual discussion with customer) with suspected harmonic sources. Harmonic currents obtained in data collection phase shall be modelled as current sources at the particular bus where the considered non-linear load is connected / measurement is taken. The Total Harmonic Distortion (THD_i & THD_v) at various buses shall be determined. Frequency / impedance scanning shall be carried out to check resonant frequency. Quality of power shall be evaluated as per IEEE519. Filter shall be recommended and ratings (including resonance frequency, MVAR compensation) to limit these distortions below standard limits wherever required.

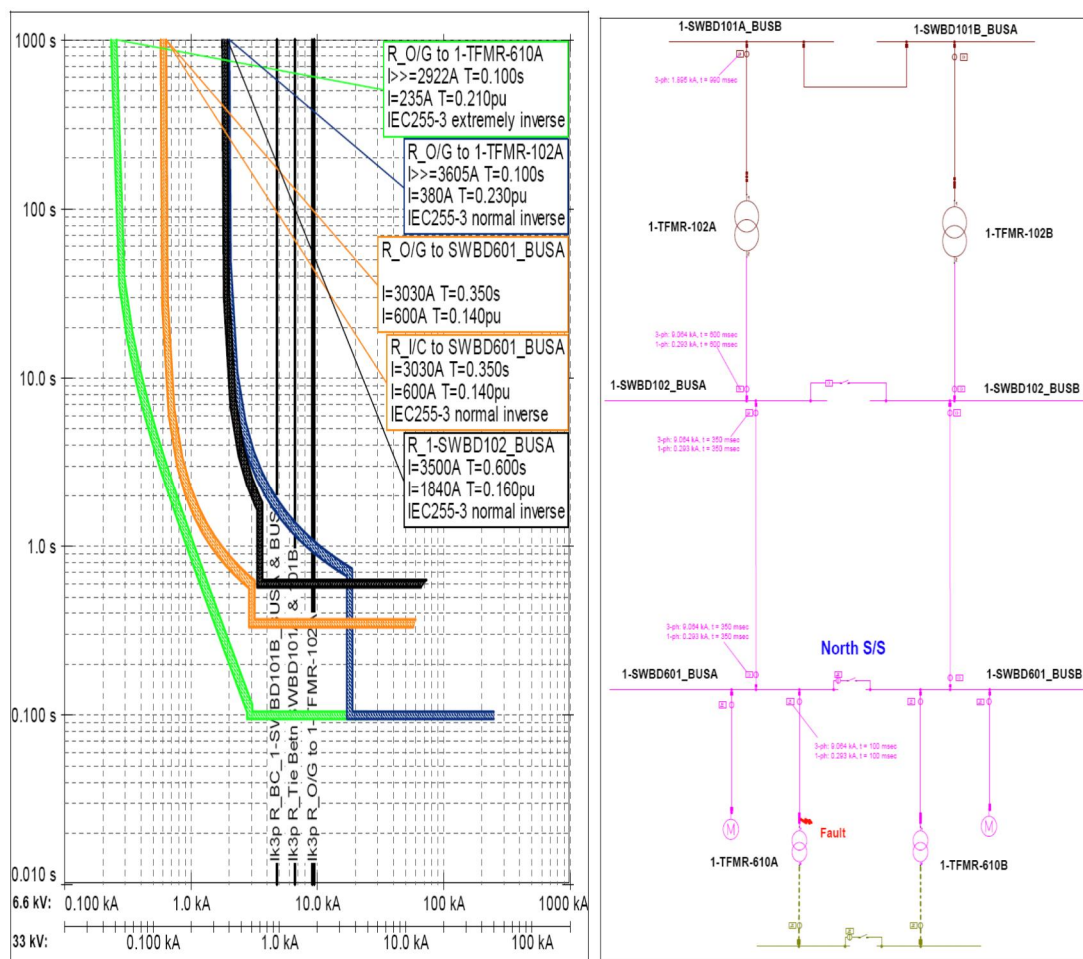
RELAY COORDINATION STUDY

Purpose: Relay Coordination study is carried out to ensure reliability of operation, selectivity at maximum fault level, sensitivity at minimum fault level and speed of isolation of the faulty section so that there is minimum impact on healthy network.

Study Methodology: The existing over current & earth fault protection scheme shall be reviewed Proper margins shall be kept for back up relays to avoid mal-operation. Study shall be carried out for system under scope as per battery limits.

It is observed that in Industrial systems, sometimes grading of protection is not possible due to limitation of time intervals of similar fault currents, however to ensure only selective tripping on fault, proper blocking schemes or dedicated unit protections shall be recommended.

The relay schematic diagram, relay details, existing settings and CT/PT data shall be provided by customer. The existing settings of the over current and earth fault relays of the system shall be reviewed and any modifications required shall be suggested. Relay Coordination charts shall be submitted along with proposed settings. A typical relay coordination chart is as below.



REVIEW OF UNIT PROTECTION / INDIVIDUAL MACHINE PROTECTION SETTINGS

Purpose: For proper islanding and protection coordination, the individual machine protection also needs to be reviewed.

Study methodology: The individual equipment protection settings provided by manufacturers of generator, Power transformers and HT motors shall be reviewed. Recommendations shall be made after review of these settings to ensure isolation for any abnormal (faulty) conditions that may occur. The settings recommended by the equipment manufacturer shall be provided by customer. Adequacy of existing protection system shall be studied and recommendations shall be made to overcome them, if required.

MOTOR STARTING ANALYSIS

Purpose: High starting currents while starting motors cause voltage dips in the system. The voltage drop during starting of one motor may cause large motor acceleration time or failure to accelerate or may also affect other running motors nearby. Motor Starting analysis is carried out to simulate the effect of motor acceleration.

Study Methodology: Motor starting dynamics for large HT motors (maximum 3 motors mutually decided with customer) shall be conducted. In this study the impact of starting large induction motors (at 100% and 80% voltage) on the system behaviour will be analysed. The voltage dips, current, speed and torque at various time interval from starting to full load speed shall be studied to decide the best motor starting method. The starting characteristic of the motors shall be provided by customer.

RECOMMENDATIONS

We shall submit draft report with recommendations to improve system performance, ensure switchgear adequacy, to avoid mal-operation of protective relays and other improvement areas encountered during study. Report will include the outcome of the results of above studies with the network information, assumptions, result, graphical analysis and recommendations.

Final report shall be submitted on receipt of comments on draft report. We shall also give presentation of the report at your office at the time of submission and finalization. Detailed engineering is not considered in study scope. However, we shall provide functional specifications of equipment recommended along with final report.

CONDITION MONITORING FOR TRANSFORMERS:

Following Basic Testing are carried out for Power Transformers

- **Capacitance & Tan Delta Testing**
- **SFRA (Sweep Frequency Response Analysis)**
- **Excitation Current Measurement**
- **Turns Ratio/Voltage Ratio Measurement**
- **Magnetic Balance Test**
- **Leakage Reactance Measurement**
- **Winding Resistance Measurement**
- **IR & PI Measurement**
- **Oil Testing (Furan, 1886, DGA)**

CAPACITANCE & TAN DELTA TEST

Capacitance Test:

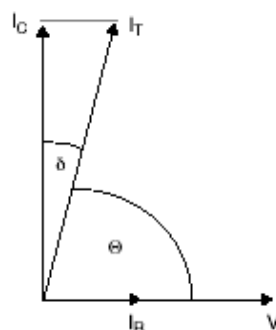
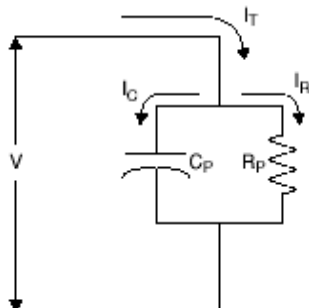
The electrical equipment considered in this guide is very much like a simple capacitor. Both contain a dielectric material (insulation) between two electrodes (conductors). The capacitance is dependent on the characteristics of the dielectric material, and on the physical configuration of the electrodes. In electrical apparatus, if the insulating material characteristics or the conductor configurations change, a difference in the measure capacitance will occur. These changes are caused by deterioration of the insulation, contamination, or physical damage.

Power factor and dissipation factor (Tan Delta Test):

The dielectric loss in an insulation system is the power dissipated by the insulation when subjected to an applied alternating voltage. All electrical insulation in power apparatus has a measurable quantity of dielectric loss, regardless of condition. Good insulation usually has a very low loss. A high loss may indicate problems in the insulation structure.

Normal aging of an insulating material will cause dielectric loss to increase. Contamination of insulation by moisture or chemical substances may cause losses to be higher than normal. Physical damage from electrical stress or other outside forces also affects the level of losses.

Loss factor is a dimensionless ratio expressed in percent which gives an indication of the condition of insulation. It is measured in terms of dissipation factor ($\tan \delta$) or power factor. When an ac voltage is applied to insulation, current flow occurs in the insulation (see figure). The total current has two components, one resistive and the other capacitive, which can be measured separately. Very simply, dissipation factor is the ratio of resistive current to capacitive current, and power factor is the ratio of current to total current flowing through insulation. For most applications involving power apparatus insulation, both quantities are very similar.



V = Applied voltage

I_T = Total current

I_R = Resistive current

I_C = Capacitive current

Dissipation factor = $\tan \delta = I_R/I_C$

Tan delta = $\cos \Theta = I_R/I_T$

A dielectric loss-testing program provides several important benefits. Initial tests on new equipment as it arrives from the manufacturer determine the presence of manufacturing defects or shipping damage, and also provide benchmark test values for future comparison.

Periodic tests performed during the service life of the equipment can indicate that the insulation is either aging normally or deteriorating rapidly. Diagnostic tests on suspect or failed equipment may disclose the location of a fault, or the reason for failure. Dielectric loss tests provide greatest benefit when performed periodically as part of a complete maintenance program.

Values obtained at the time of the original tests are used as benchmarks to determine the amount of insulation deterioration on subsequent tests. Tan delta is best compared to these benchmark values when performing field tests. However, it is also possible to determine a degree of insulation conditions by comparing test results to other similar equipments.

This test can be applied to monitor the condition of equipments like Current transformer, Capacitor voltage transformers, Power transformers, HV Cables, Rotating machines.

Conditions: - Transformer should be fully isolated.

Testing Equipment: Doble make M4100 Insulation Analyzer

Time taken:

2 hours (for winding), 0.5 hour (per bushing)

SWEEP FREQUENCY RESPONSE ANALYSIS (SFRA)

Sweep Frequency Response Analysis (SFRA) is a tool that can give an indication of core or winding movement in Transformers. This is done by performing a measurement, albeit a simple one, looking at how well a transformer winding transmits a low voltage signal that varies in frequency. Just how well a transformer does this is related to its impedance, the capacitive and inductive elements of which are intimately related to the physical construction of the transformer. Changes in frequency response as measured by SFRA techniques may indicate a physical change inside the transformer, the cause of which then needs to be identified and investigated.

Purpose: To detect winding movement of Transformer:

- Due to large electromagnetic forces from fault currents
- Winding Shrinkage causing release of clamping pressure
- Transformer Relocations or Shipping of transformer.

Conditions: Transformer should be fully isolated.

Testing Equipment: Doble make M5300 Sweep Frequency Response Analyzer.

Time taken:

4 hours (2-winding transformer) and 6 hours (Auto-transformers and 3-winding transformer)

EXCITATION CURRENT MEASUREMENT

The magnetising current is that current which flows in the primary winding when the primary voltage is applied with the secondary unloaded. It's the necessary current that satisfies the excitation condition as determined by the fundamental transformer equation. This current is related (with a reasonably good approximation) to the transformer equivalent primary inductance value and the applied primary voltage and given source frequency.

Magnetising current flows into the primary irrespective of transformer load conditions. The primary and secondary load components of magnetic flux are notionally in balance (by virtue of primary to secondary load ampere-turns balance) but the primary current always has a magnetising component which adds to the primary load current component. Since there is usually a phase displacement between the load and magnetising components, the effective primary current is determined by the complex number addition of the two primary components - not by a simple algebraic addition.

Purpose: To check the excitation current trend, this is helpful in locating core and winding faults. The single-phase exciting-current test is very useful in locating problems such as defects in the magnetic core structure, shifting of the windings, failures in the turn-to-turn insulation, or problems in the tap changing devices. These conditions result in a change in the effective reluctance of the magnetic circuit, which affects the current required to force a given flux through the core.

Conditions: All loads should be disconnected and the transformer should be de-energized.

Testing Equipment: Doble make M4100 Insulation Analyzer.

Time taken: 2 Hours

VOLTAGE\TURNS RATIO MEASUREMENT

The turns ratio of a transformer is defined as the number of turns on its secondary divided by the number of turns on its primary. The voltage ratio of an ideal transformer is directly related to the turns ratio:

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

The current ratio of an ideal transformer is inversely related to the turns ratio:

$$\frac{I_p}{I_s} = \frac{N_s}{N_p}$$

Where V_s = secondary voltage, I_s = secondary current, V_p = primary voltage, I_p = primary current, N_s = number of turns in the secondary winding and N_p = number of turns in the primary winding.

The turns ratio of a transformer therefore defines the transformer as stepup or step-down. A step-up transformer is one whose secondary voltage is greater than its primary voltage and a transformer that steps up voltage will step-down current. A step-down transformer is one whose secondary voltage is lower than its primary voltage and a transformer that steps down voltage will step-up current.

Purpose:. To determine the turns ratio of transformers to identify any abnormality in tap changers/ shorted or open turns etc

Conditions: Transformer should be fully isolated.

Testing Equipment: Doble make M4100 Insulation Analyzer.

Time taken: Hours

MAGNETIC BALANCE TEST

The Magnetic Balance test is conducted on Transformers to identify inter turn faults and magnetic imbalance. The magnetic balance test is usually done on the star side of a transformer. The Magnetic balance test is only an indicative test for the transformer. Its results are not absolute. It needs to be used in conjunction with other tests.

This test is conducted only in three phase transformers to check the imbalance in the magnetic circuit

Purpose:. To check the condition of core

Conditions: Transformer should be fully isolated.

Testing Equipment: Test board, Cables and Multimeter

Time taken: 1 Hour

LEAKAGE REACTANCE MEASUREMENTS

When the windings or the core of the transformer degrades, the leakage flux pathway changes. The changes reduce the efficiency of the transformer and may lead to eventual failure. Leakage reactance modules are used to detect deviations in transformers so they can be reconditioned immediately and prevent further damage.

Purpose:

1. Confirm nameplate impedance
2. Detect Winding movement
 - Radial dimensions of winding
 - Distance between inner and outer winding
 - Height of winding

Conditions: Transformer should be fully isolated.

Testing Equipment: Test board, Cables and Multimeter

Time taken: 1 Hour

WINDING RESISTANCE MEASUREMENTS

Winding resistances are measured in the field in order to check for abnormalities due to loose connections, broken strands, and high-contact resistance in tap changers. Interpretation of results is usually based on a comparison of measurements made separately on each phase in the case of a wye-connected winding or between pairs of terminals on a delta-connected winding. Comparison may also be made with original data measured in the factory

Purpose: To check for any abnormalities due to loose connections, broken strands and high contact resistance in tap changers

Conditions: Transformer should be fully isolated.

Testing Equipment: TWRM-10 (Make : ELTEL)

Time taken: 4 Hour

IR & PI MEASUREMENT

Insulation Resistance:

Insulation resistance measurements are usually performed in order to verify that the state of dryness of the insulation of the various windings and the core are of acceptable values. Insulation resistance testing may also reveal important information about concealed damage to bushings.

Polarization index:

The polarization index test is an insulation resistance test that lasts for 10 min. The insulation resistance is recorded after 1 min, then again after 10 min. The polarization index is the quotient of the 10 min and 1 min readings as shown below:

$$PI = R_{10} \div R_1 (\text{dimensionless})$$

Where

PI is polarization index

R is resistance

Purpose: To check insulation condition of transformer

Conditions: The tank and core should be grounded for this test and the windings should be short-circuited. The windings not being tested should be grounded.

Testing Equipment: MIT520 (Make : MEGGER)

Time taken: 1Hour

OIL TESTING

Oil test as per IS 1866:

Mineral oil is used as an insulating fluid in most types of electrical power equipment. Besides acting as an insulating fluid, in many situations it also acts as a heat transfer medium to carry off excess heat generated by the losses of the power equipment. Tests cover the determination of certain qualities, primarily degradation constituents, in service-aged oil and the diagnosis of these results with respect to the condition of the power equipment.

List of tests to be performed on oil to check properties of oil for its proper functioning as a liquid insulation and heat transfer media:

- Dielectric Strength (BDV)
- Water Content
- Neutralization value (total acidity)
- Sediment & sludge
- Dielectric dissipation factor
- Specific resistance (Resistivity)
- Interfacial Tension

- Flash Point

Dissolved Gas Analysis

It is the first indicator of a problem and can identify deteriorating insulation and oil, overheating, hot spots, partial discharge, and arcing. The “health” of the oil is reflective of the health of the transformer itself. Insulating materials within transformers and related equipment break down to liberate gases within the unit. The distribution of these gases can be related to the type of electrical fault and the rate of gas generation can indicate the severity of the fault. The identity of the gases being generated by a particular unit can be very useful information in any preventative maintenance program. Obvious advantages that fault gas analyses can provide are:

- Advance warning of developing faults
- Determining the improper use of units
- Status checks on new and repaired units
- Convenient scheduling of repairs
- Monitoring of units under overload

Fault Gas Obtained on DGA

The causes of fault gases can be divided into three categories; corona or partial discharge, pyrolysis or thermal heating, and arcing. The major (minor) fault gases can be categorized as follows by the type of material that is involved and the type of fault present:

1. Corona
 - Oil -H₂
 - Cellulose -H₂, CO , CO₂
2. Pyrolysis
 - a. Oil
 - Low temperature-CH₄ , C₂H₆
 - High temperature-C₂H₄ , H₂ (CH₄ , C₂H₆)
 - b. Cellulose
 - Low temperature-CO₂ (CO)
 - High temperature-CO (CO₂)
 - c. Arcing-H₂, C₂H₂ (CH₄, C₂H₆, C₂H₄)

Furan Analysis

Furanic compounds are generated by the degradation of cellulosic materials used in the solid insulation systems of electrical equipment. Furanic compounds that are oil soluble to an appreciable degree will migrate into the insulating liquid. The presence of high concentrations of furanic compounds is significant in that this may be an indication of cellulose degradation from aging or incipient fault conditions.

Purpose: To check the condition of oil

Conditions: Oil test cannot be performed on at site; it will be performed on oil test lab. We can take sample on either online or offline condition.

Testing Equipment: NABL Approved laboratory

Time taken: NA

CONDITION MONITORING FOR CURRENT TRANSFORMERS OR CVT OR PT

Following Basic Testing are carried out for Current Transformers or CVT or PT

- **Capacitance & Tan Delta Testing**
- **IR & PI Measurement**
- **Secondary Winding Resistance**
- **Inspection of Secondary Terminal Box**

CAPACITANCE AND TANDELTA TESTING

Basics: Same as Transformers.

Purpose: - To check the insulation condition of Current transformer.

Conditions: - CT should be fully isolated.

Testing Equipment: Doble make M4100 Insulation Analyzer

Time taken: 1 hours

IR & PI MEASUREMENT

Basics: Same as Transformers.

Purpose: To check insulation condition of Current Transformer

Conditions: The tank and core should be grounded for this test and the windings should be short-circuited. The windings not being tested should be grounded.

Testing Equipment: MIT520 (Make : MEGGER)

Time taken: 1Hour

WINDING RESISTANCE MEASUREMENTS

Basics: Same as Transformers

Purpose: To check for any abnormalities due to loose connections, broken strands

Conditions: Current Transformer should be fully isolated.

Testing Equipment: TWRM-10 (Make : ELTEL)

Time taken: 1 Hour

CONDITION MONITORING FOR LIGHTNING ARRESTORS

Following Basic Testing are carried out for Lightning Arrestor

➤ Leakage Current Measurement

LEAKAGE CURRENT MEASUREMENTS

In normal service the MOSAs (metal oxide surge arresters without series gaps) will be exposed to different kinds of stresses such as the normal operating voltage, temporary over voltages, switching over voltages, lightning over voltages and external pollution. All these stress, separately or together in different combinations, may cause an increase of the resistive component of the continuous leakage current through the arrester. This increase may exceed the critical limit and cause arrester failure. This test may be used to record and store the resistive component of the leakage current at the actual operating condition of the arrester either during periodic, transitory inspections or over a long period of time. In this way necessary information to judge the real service condition of the MOSA is made available.

Purpose: To check the condition of metal oxide blocks

Conditions: On Line Test.

Testing Equipment: SA30i (Make: SCOPE)

Time taken: 15 Minutes per LA

CONDITION MONITORING FOR ISOLATORS

Following Basic Testing are carried out for ISOLATORS

- **Contact Resistance Measurement**
- **Checking and setting of Electrical and Mechanical interlock**
- **Setting of alignment**

CONTACT RESISTANCE MEASUREMENT

Purpose: To check the condition of the contacts.

Conditions: Isolator should be fully isolated.

Testing Equipment: CRM Kit (Make: SCOPE)

Time taken: 45 Minutes

CHECKING AND SETTING OF ELECTRICAL AND MECHANICAL ALIGNMENT

Purpose: To ensure engagement of contact and avoid oxidation.

Conditions: Isolator should be fully isolated.

Testing Equipment: Normal spanners, Multimeter, lubrication grease etc

Time taken: Time may vary based on the condition of the isolator

SETTING OF ALIGNMENT

Purpose: To ensure proper engagement of contact.

Conditions: Isolator should be fully isolated.

Testing Equipment: Normal spanners, Multimeter etc

Time taken: Time may vary based on the condition of the isolator

CONDITION MONITORING FOR SF6 CIRCUIT BREAKER

(Operating Mechanism: Pneumatic)

Following Basic Testing are carried out for SF6 Circuit Breaker

- **Close and Trip timing test**
- **Static Contact Resistance Measurement**
- **SF6 Gas Leakage Test**
- **Checking of Trip & Close Coil**
- **Density Monitor Checking**
- **Checking of Pressure Switch Setting**

CLOSE AND TRIP TIMING TEST

Purpose: To confirm that trip & close operation are within set time limits.

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: Timing test Kit (Make: Scope)

Time taken: 3 Hours

STATIC CONTACT RESISTANCE MEASUREMENT

Purpose: To check the condition of the contacts.

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: CRM Kit (Make: SCOPE)

Time taken: 45 Minutes

SF6 GAS LEAKAGE TEST

Purpose: To check leakage of SF6 gas.

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: SF6 Gas Leakage Detector (Make: CPS)

Time taken: 30 Minutes

CHECKING OF TRIP AND CLOSE COIL

Purpose: To check condition of Coil resistance

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: Multimeter

Time taken: 15 Minutes

CHECKING OF DENSITY MONITOR

Purpose: Checking of alarm, trip/close, blocking & tripping of breaker

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: Multimeter

Time taken: 30 Minutes

CHECKING SF6 DEW POINT MEASUREMENT

Purpose: To check the condition of SF6 gas in the pole

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: SF6 Dew point meter (Make: MBW)

Time taken: 30 Minutes

CHECKING OF PRESSURE SWITCH SETTING

Purpose: To confirm that trip & close operation are within set time limits.

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: Multimeter

Time taken: 1 Hours

CONDITION MONITORING FOR SF6 CIRCUIT BREAKER

(Operating Mechanism: Spring Mechanism)

Following Basic Testing are carried out for SF6 Circuit Breaker

- **Close and Trip timing test**
- **Static Contact Resistance Measurement**
- **SF6 Gas Leakage Test**
- **Checking of Trip & Close Coil**
- **Density Monitor Checking**
- **Checking of Operating mechanism**

CLOSE AND TRIP TIMING TEST

Purpose: To confirm that trip & close operation are within set time limits.

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: Timing test Kit (Make: Scope)

Time taken: 3 Hours

STATIC CONTACT RESISTANCE MEASUREMENT

Purpose: To check the condition of the contacts.

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: CRM Kit (Make: SCOPE)

Time taken: 45 Minutes

SF6 GAS LEAKAGE TEST

Purpose: To check leakage of SF6 gas.

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: SF6 Gas Leakage Detector (Make: CPS)

Time taken: 30 Minutes

CHECKING OF TRIP AND CLOSE COIL

Purpose: To check condition of Coil resistance

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: Multimeter

Time taken: 15 Minutes

CHECKING OF DENSITY MONITOR

Purpose: Checking of alarm, trip/close, blocking & tripping of breaker

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: Multimeter

Time taken: 30 Minutes

CHECKING SF6 DEW POINT MEASUREMENT

Purpose: To check the condition of SF6 gas in the pole

Conditions: Circuit Breaker should be fully isolated.

Testing Equipment: SF6 Dew point meter (Make: MBW)

Time taken: 30 Minutes