

# COMMISSIONING OF HT ELECTRICAL SYSTEM

## **1.0 Purpose:**

The objectives of the Commissioning works are:

- (i) To verify proper functioning of the equipment/system after installation
- (ii) To verify that the performance of the installed equipment/systems meet with the specified design intent through a series of tests.
- (iii) To capture and record performance data of the HT installation as the baseline for future operation and maintenance.

## **2.0 Scope:**

The objective of this document is to provide a structure for the commissioning of the HT electrical services included within the sub-contract including the following:

- (i) Ht Switchgear & Panel
- (ii) Current Transformer
- (iii) Potential Transformer
- (iv) Relay
- (v) Power Transformer

## **3.0 References**

Below Indian standard were referred to prepare this document

Power Transformer (IS 2026 & IS 10028)

Current transformer (IS 2705)

Potential Transformer (IS 3156)

Protection Relay (IS 3231)

HT Cable (IS 1255 & IS 10810)

HT Switchgear (IS 3427)

## **4.0 Resources:**

### **4.1 Testing Equipment (Appendix A)**

### **4.2 Hand Tools Set**

### **4.3 Safety Equipment (Appendix B)**

### **4.4 Man Power**

2 x Commissioning Engineer

2 x Testing Engineer

1 x Safety Engineer

3 x Technician

## **5.0 Procedure for Commissioning:**

The purpose of electric systems commissioning is to increase the reliability of electrical power systems after installation by identifying problems and providing a set of baseline values for comparison with subsequent routine tests.

### **5.1 Safety Considerations:**

Statutory and Company legislation relating to safety must be followed. During testing hazardous voltages will be present, only qualified personnel are allowed operate the equipment with hazardous voltages present.

### **5.2 Pre-Test Inspection:**

Before commencing the pre-commission tests, it is necessary to visually inspect various parts, components and accessories of the HT electrical system and also to conduct operational checks for various equipments associated with the electrical system. Check lists may be followed for the visual inspection and the operational checks so that the pre-commission checks are conducted in a systematic manner. Appendix C contains the pre-commissioning installation checklist.

## 5.3 Outline of tests to be performed:

### 5.3.1 HT Switchgear & panel

#### (i) ***Insulation Resistance Test***

The Insulation-resistance shall be taken with all the winding earthed, except, the one being tested. While checking the value, external line, cable and lightning arresters shall be isolated from the H.T Switchgear. The entire terminal shall be cleared thoroughly, with clean cotton cloth. A 5000/2500V Megger should be used in the measurement. Care should be taken that the lead wires of the megger do not have joints or come in contact with each other or with H.T Switchgear. It is known that the value of Insulation Resistance is continuous to increases initially, with the duration of measurement and hence for the purpose of comparison, the reading is normally taken at the end of 1 minute

*Minimum Insulation Resistance after 1 minute is Rated Voltage + 1 Mega Ohms.*

#### (ii) ***Circuit breaker time-travel analysis***

This test, used on medium and high-voltage circuit breakers provides information as to whether the operating mechanism of the circuit breaker is operating properly. This test can be used to determine the opening and closing speeds of the breaker, the interval time for closing and tripping, and the contact bounce. The

test provides information that can be used to detect problems such as weak accelerating springs, defective shock absorbers, dashpots, buffers, and closing mechanisms. For performing this test we use Time Interval Meter – SCOT M3K, The following show the connection drawing of testing equipment with H.T Switchgear. Using the connecting probe the R terminal of Breaker is connected to the R terminal of Timer kit the same is done for all the other terminals(Y & B). The trip coil & closing coil connection are also brought to the Timer Kit. Before conducting the test the spring has to be charged by manual or using spring charging motor. And the rated control supply (A.C/ D.C) will be given to the panel. Using the timer kit close the charged circuit breaker. Now record the time (mill second) displayed in the timer kit. The same is performed for opening of circuit Breaker. The recorded millisecond value will be compared with the manufacture data sheet.

### ***(iii) Contact-resistance testing***

This test is used to test the quality of the contacts on switches and circuit breakers. In this test a known amount of D.C current will be supplied to the equipment to be tested and by means of Ohm's law the resistance was measured. In this measurement the kit measures the mill volt drop across the contact and measure the resistance. For measuring the contact resistance initially the spring must be charged and the breaker must be in closed condition. After closing the Circuit breaker the

Contact resistance will be measured between the terminals R-R', Y-Y', B-B'. And the measured milliohms value will be compared with the manufacturer's data sheet.

### 5.3.2 Current Transformer

#### (i) ***Insulation Resistance Test***

The Insulation-resistance shall be taken with all the winding earthed, except, the one being tested. The entire terminal shall be cleared thoroughly, with clean cotton cloth. A 5000/2500/1000V Megger should be used in the measurement. Care should be taken that the lead wires of the megger do not have joints or come in contact with each other or with current transformer. It is known that the value of Insulation Resistance is continuous to increases initially, with the duration of measurement and hence for the purpose of comparison, the reading is normally taken at the end of 1 minute

*Minimum Insulation Resistance after 1 minute is Rated Voltage + 1 Mega Ohms. The 5000/2500V Megger is used for Primary connection and 1000V megger is used for secondary connection.*

#### (ii) ***Polarity Test***

The main objective of the test is to check the polarity of the C.T; the polarity may be changed due to the connection made in the

circuit. Change in polarity may lead to malfunction of the equipment which is connected to the current transformer. To conduct this test we connect a voltage source to the primary of current transformer (P1-P2), in secondary we connect a Galvanometer and look for the deflection. If it's in positive then the polarity is satisfactory for connecting the equipment, if negative deflection is observed necessary action should be taken.

### **(iii) Ratio Test**

The objective of test is to check the C.T ratio transformation. The Current transformer primary was excited by means of High current low voltage injection test. We inject about 50% to 75% of rated current in the primary and check the current in the secondary, if the ratio of change is as per the rated ratio, C.T operation is satisfactory. The ratio was calculated using the formula,

$$\text{Actual Ratio} = (\text{Rated primary current} / \text{Rated secondary current})$$

$$\text{Measured Ratio} = (\text{Applied primary current} / \text{measured secondary current})$$

Then these two ratios are compared to identify the error.

### 5.3.3 Potential Transformer

#### **(i) Insulation Resistance Test**

The Insulation-resistance shall be taken with all the winding earthed, except, the one being tested. The entire terminal shall be cleared thoroughly, with clean cotton cloth. A 5000/2500/1000V Megger should be used in the measurement. Care should be taken that the lead wires of the megger do not have joints or come in contact with each other or with current transformer. It is known that the value of Insulation Resistance is continuous to increases initially, with the duration of measurement and hence for the purpose of comparison, the reading is normally taken at the end of 1 minute

*Minimum Insulation Resistance after 1 minute is Rated Voltage + 1 Mega Ohms. The 5000/2500V Megger is used for Primary connection and 1000V megger is used for secondary connection.*

#### **(ii) Polarity Test**

The main objective of the test is to check the polarity of the P.T; the polarity may be changed due to the connection made in the circuit. Change in polarity may lead to malfunction of the equipment which is connected to the potential transformer. To conduct this test we connect a voltage source to the primary of current transformer (P1-P2), in secondary we connect a

Galvanometer and look for the deflection. If it's in positive then the polarity is satisfactory for connecting the equipment, if negative deflection is observed necessary action should be taken.

### **(iii) Ratio Test**

The objective of test is to check the P.T ratio transformation. The potential transformer primary was excited by means of 3 phase voltage source (415V/433V). The voltage supply will be connected to the primary and check the voltage in the secondary, if the ratio of change is as per the rated ratio, C.T operation is satisfactory. The ratio was calculated using the formula,

$$\text{Actual Ratio} = (\text{Rated primary Voltage} / \text{Rated secondary voltage})$$

$$\text{Measured Ratio} = (\text{Applied primary voltage} / \text{measured secondary voltage})$$

Then these two ratios are compared to identify the error.

## **5.3.4 Relay**

### **(i) Secondary Injection Test**

Before conducting the test C.T terminal connected to the relay has to be opened. We inject the current in the relay terminal using the secondary injection kit. Open all the terminals of the relay that are connected to the C.T and connect any one current injecting terminal to the secondary injection kit, and also connect the common

to the kit. Then connect the NO terminal of the relay to kit NO terminal, for timer operation. Now set the PSM (plug setting multiplier) and TSM (Time setting multiplier) in the relay. This setting shall be half of the rated current transformer secondary. Now using the injection kit inject about 2 times/ 5 times / 10times of the PSM setting. Operating time of the relay is displayed in the kit timer. And the value was noted, the same was carried out for various PSM and TSM setting, the final result was compared with the manufacturer's data sheet.

### **5.3.5 Power Transformer**

#### ***(i) Insulation Resistance Test***

The Insulation-resistance shall be taken with all the winding earthed, except, the one being tested. While checking the value, external line, cable and lightning arresters shall be isolated from the transformer. The entire terminal shall be cleared thoroughly, with clean cotton cloth. A 5000/2500V Megger should be used in the measurement. Care should be taken that the lead wires of the megger do not have joints or come in contact with each other or with transformer. It is known that the value of Insulation Resistance is continuous to increases initially, with the duration of measurement and hence for the purpose of comparison, the reading is normally taken at the end of 1 minute

*Minimum Insulation Resistance after 1 minute is Rated Voltage + 1 Mega Ohms.*

## **(ii) Polarization Index Test**

The polarization index is a specialized application of the dielectric absorption test. The index is the ratio of insulation resistance at two different times after voltage application, usually the insulation resistance at 10 minutes to the insulation resistance at 1 minute. The use of polarization-index testing is usually confined to rotating machines, cables, and transformers. A polarization index less than 1.0 indicates that the equipment needs maintenance before being placed in service.

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

Where:

PI = polarization index

R = resistance.

For polarization indexes in transformers an acceptable value would be 3 or higher, values between 3 and 2 indicate marginal condition, and values below 1 indicate poor condition. After insulation resistance readings have been made, the test voltage is returned to zero and the insulation is discharged.

**(i) Magnetic Balance Test**

This test is done to find out the balancing of the core present in the transformer. The HV and LV sides are isolated by removing the external connections. A 3 phase supply of nearly 415V is applied between two phases of the primary winding and the induced voltages in other two phases are measured. The voltage may preferably be applied on the HV winding, as applying voltage to LV winding may induce very high voltage in the HV winding. When the voltage is applied to the middle phase, the induced voltage measured on the two other phases should be approximately equal. Where the voltage is applied to an extreme phase, the induced voltage on the middle phase should be substantially high when compared to the voltage induced in the other extreme phase. In each test, the sum of the induced voltages in two phases should be nearly equal to the applied voltage. For measuring the voltages, high impedance voltmeter like digital multimeter should be used. The test may be repeated by applying voltage to the other phases and measuring the induced voltages in remaining phases. When the magnetic circuit is balanced, there would be symmetry in the value of measured induced voltages.

**(ii) Magnetizing Current Test**

The magnetizing current is measured to test any fault in the magnetic circuit and winding. The measured values are compared with the factory test values. A balanced three phase 415V ac

supply is applied to the HV winding and the simultaneous current readings of the three phases are taken using low range A.C ammeters. For a core type transformer, the middle phase magnetizing current will be approximately half that in other windings. In YyO, Dy1 and Dy11 connections, the currents in 'u' and 'w' phases will be nearly double the current in 'v' phase. In an Yd1 connected transformer, currents in 'v' and 'w' phases will be nearly equal and the current in 'u' phase more than that in 'v' and 'w' phases. In an Yd11 connection, currents in 'u' and 'v' phases will be nearly equal and the current in 'w' phase more than that in 'u' and 'v' phases. If the measured values widely differ from the above values or from the factory test values, there is reason to suspect some defect in the transformer core and the manufacturer may be consulted. The measured values of magnetizing current may be used as bench marks for the service life of the transformer

### ***(iii) Transformer turns-ratio***

Ratio between all the corresponding HV & LV phase is to be measured on all taps. It is desirable to do the test with a Ratio-Meter. If it is not available, a simple test of measuring voltage and current can also serve the purpose. Referring to rating & terminal marking plate, identify the H.V and L.V terminal, which corresponding to one phase. E.g. For a vector Group of Dyn-11, H.V Terminal 1U, 1V & L.V terminal 2U, 2N correspond to U phase. Apply 415V AC, 50Hz supply to H.V side and measure the voltage on the L.V side. Measure these voltages on all taps and note them

in the 'pre-commissioning report'. Repeat for the other two phase. These observations should indicate a consistent trend of variation. Numerical values should approximately tally with voltage ratio.

#### (iv) **Vector Group Test**

The 3 phase voltage (415V/433V) will be applied to the transformer primary with the two phases (Normally 1U & 2U) short. And the below condition will be checked for the proper vector group.

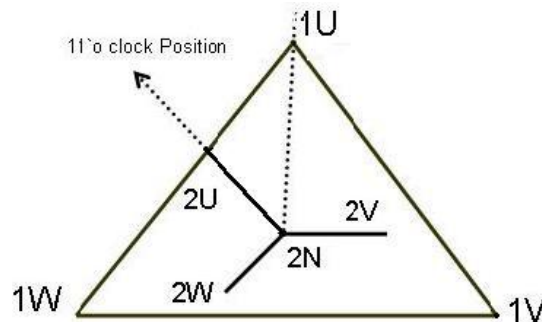
Condition for the Dyn11 transformer vector group

$$1U2U=0$$

$$1U1V=1U2N + 1V2N$$

$$1W2W < 1W2V$$

$$1V2W=1V2V$$



If the result found satisfactory the transformer vector group was correct.

**(v) Winding Resistance Test**

Winding resistance shall be measured on all winding and tap winding, preferably with a Micro Ohm Meter. The Micro Ohm Meter is connected in between the HV terminal it is between Two Phase say (U-V, V-W, and W-U) and the corresponding resistance will be measured. The same is conducted on the secondary terminal. The value is verified with the manufacturer's data sheet.

**(vi) Short Circuit Test**

For the rated HV voltage and the % Impedance, it would possible to calculate the current, which would flow to the LV-side with 415V applied to HV side, while keeping the LV-side shorted. If the 415V source can feed the current, then short- circuit test can be carried out. This test would conform proper conduct engagement at all tap position. Apply a 3-phase 415V, 50Hz to HV-side, keeping LV-side shorted. Measure the 3-line currents at all tap position. If the tap-switch is an Off-Circuit tap-switch, the supply has to be disconnected before changing the tap. A consistent trend in the increase or decrease of current, as the case may be, confirms the healthiness of the transformer.

### 5.3.6 High Voltage Cable

#### (i) *Insulation Resistance Test*

This test most often conducted to determine the quality of High voltage cable insulation is the insulation resistance test. It is performed as a routine maintenance test for cables already in service or as an acceptance test for new cables. DC over potential testing is another way of testing cable insulation. This test is performed primarily on medium and high voltage cables to test their dielectric strength and is not recommended for routine maintenance testing of low voltage cables. It is a simple, quick, convenient and nondestructive test that can indicate the contamination of insulation by moisture, dirt or carbonization. Before testing any cable, the circuit must be de-energized. Once that is done, it is usually best to disconnect the cable at both ends in order to test only the cable, and to avoid error due to leakage across or through switchboards or panel boards. For an acceptance test, cable less than or equal to 300 V may be tested at 500 V and cable greater than 300 V but less than 600 V may be tested at 1,000 V. For a routine maintenance test, test voltage should be restricted to 80 percent of the factory test voltage. The test voltage should be applied from phase to ground on each conductor with the shielding tapes and metallic jackets also connected to ground. While no general standard exists for minimum acceptable insulation resistance values for cables in

service, a “rule-of-thumb” of one mega ohm of resistance (minimum) per 1,000 V of applied test voltage is accepted.

## **(ii) High Potential Test**

The objective of the test is to ensure the insulation level of cable. For conducting the test any Two Phase are short using 4sqmm and it is earthed, another one terminal is connected to the test kit , From the test kit one terminal is connected to the earth. Before conducting the test Insulation Resistance test has to be conducted to ensure the insulation resistance of the cable In the DC test, the voltage is quickly raised from zero to the specified level. The test is usually held for one minute. The current is measured in mill amperes. The reading of current is provided so that the person running the test can determine if the particular test set has sufficient capacity for the task at hand. If the cable withstands the one minute application, the test has been passed. Failure results in short circuit and a ruined portion of the cable. The test set is designed to trip off immediately upon detection of the fault current. After conducting the HIPOT test, the cable has to be re-checking the Insulation Resistance, to conform the cable has no damage due to HIPOT test. The same test has to be conducted on all the terminal of the cable.

### 5.3.7 High Voltage Bus Duct

#### (i) *Insulation Resistance Test*

This test most often conducted to determine the quality of High voltage bus duct insulation is the insulation resistance test. It is performed as a routine maintenance test for bus ducts already in service or as an acceptance test for new bus ducts. DC over potential testing is another way of testing bus duct insulation. This test is performed primarily on medium and high voltage bus ducts to test their dielectric strength and is not recommended for routine maintenance testing of low voltage bus ducts. It is a simple, quick, convenient and nondestructive test that can indicate the contamination of insulation by moisture, dirt or carbonization. Before testing any bus duct, the circuit must be de-energized. Once that is done, it is usually best to isolate the bus duct in order to test only the bus duct, and to avoid error due to leakage across or through switchboards or panel boards. For an acceptance test, bus duct less than or equal to 300 V may be tested at 500 V and bus duct greater than 300 V but less than 600 V may be tested at 1,000 V. For a routine maintenance test, test voltage should be restricted to 80 percent of the factory test voltage. The test voltage should be applied from phase to ground on each conductor with the shielding tapes and metallic jackets also connected to ground. While no general standard exists for minimum acceptable insulation resistance values for bus ducts in service, a “rule-of-

thumb” of one mega ohm of resistance (minimum) per 1,000 V of applied test voltage is accepted.

## **(ii) High Potential Test**

The objective of the test is to ensure the insulation level of bus duct. For conducting the test any Two Phase are short using connecting probe and it is earthed, another one terminal is connected to the test kit , From the test kit one terminal is connected to the earth. Before conducting the test Insulation Resistance test has to be conducted to ensure the insulation resistance of the bus duct In the DC test, the voltage is quickly raised from zero to the specified level. The test is usually held for one minute. The current is measured in mill amperes. The reading of current is provided so that the person running the test can determine if the particular test set has sufficient capacity for the task at hand. If the bus duct withstands the one minute application, the test has been passed. Failure results in short circuit and a ruined portion of the bus duct. The test set is designed to trip off immediately upon detection of the fault current. After conducting the HIPOT test, the bus duct has to be re-checking the Insulation Resistance; to confirm the bus duct has no damage due to HIPOT test.

### 5.3.8 Operational & Functional Checkup of HT Panel

The main objective of the test is to check the proper operation function of the Breaker; in this test we do the following:

#### ***A. Close Operation Test – Local—Remote***

This test is conducted by manual, Local & Remote. For the manual Operation test, we will charge the spring manual and breaker is also closed my manual and opening also done. For the Local operation we give Control supply and A.C supply for spring charge motor. We close the Breaker using the TNC switch. We observe for the closing coil function and spring charging of motor operation. For remote operating is the site is ready (such as plc or BMS) then remote operation is done using the remote system. If its site is not ready for this, we provide a local signal to the remote terminal and observe the operation of breaker.

#### ***B. Trip Operation Test – Local—Remote***

This test is conducted by manual, Local & Remote. For the manual Operation test, The manually charged breaker is opened using the Trip switch.. For the Local operation we give Control supply and A.C supply for spring charge motor. We open the Breaker using the TNC switch. We observe for the tripping coil function. For remote operating is the site is ready (such as plc or BMS) then remote operation is done using the remote system. If its

site is not ready for this, we provide a local signal to the remote terminal and observe the operation of breaker.

### ***C. Protection Trip***

For this test the breaker has in closed position at initially. We provide an auxiliary rated voltage to Master trip relay, and observe the opening of the breaker and the position of the trip coil.

### **Functional Check:-**

#### ***A. Emergency Trip:--***

For this test the breaker has to be in charged or ON position, we operate the emergency push button. We observe the operation of circuit breaker opening.

#### ***B. Aux. Switch Operation:-***

When the breaker is in open condition we check the Aux. contact of the breaker using continuity tester, to conform the contact is in NO /NC. Then we close the Circuit Breaker and check the same contact with continuity tester, to conform the contact is in NC /NO.

#### ***C. On-Off Indications (Lamp + Flag)***

When the breaker is in open condition we check the Lamp + Flag of the relay. Then we close the Circuit Breaker and check the same Lamp operation.

#### ***D. Trip / Trip circuit healthy Lamp Indication***

The relay is operated and we observe the Trip lamp indication.

#### ***E. Limit Switch for spring charge motor***

On this test we observe the operation of the limit switch of the spring charging motor. We give an A.C power to motor and observe the operation of motor and charging of spring, on the indication of fully charged spring the motor operation has to get stopped.

#### ***F. Test / Service Limit Switch***

This test is conducted to check the Test / Service Limit Switch Operation. During rack out the Breaker we observe the indicator to change to test position & during rack in the breaker we observe the indicator to change to service

#### ***G. Operation Counter***

This test is conducted if operational counter provision is available in breaker. We operated the breaker and look for the change in counter for counting the operation.

#### ***H. Heater / Heater Switch / Thermostat***

The control A.C supply is given for heater and we look for heater operation.

#### **I. Function of illumination & socket switch**

In this test we look for the panel internal illumination & socket switch operation. We operate the limit switch manually and observe the operation of illumination circuit.

*Appendix D contains the detailed pre-commissioning test report.*

### **5.4 Commissioning Procedure before & after Power Up**

- All the protective relays and circuit breakers are tested for proper working.
- The relay settings are kept at a low value so that the transformer will get isolated if there is any internal fault.
- Now the transformer may be test charged from the incoming side on no-load and operated for about two hours.

- Observe the transformer hum for any abnormality.
- Any vibration or abnormal magnetizing current may also be observed.
- After continuous operation for about two hours, isolate the transformer and check for abnormality.
- If there is no abnormality in transformer charged again on no-load.
- All connected instruments may be checked for any abnormal indication.
- Now gradually load the transformer to full capacity and keep it under constant observation for at least 24 hours of operation.
- Check the winding temperature at full load and compare with factory test values.
- If the test results and observations are found normal, the transformer may be cleared for regular service.
- After the transformer is put in service for some weeks with normal working temperature, all sealed joints shall be re-tightened.
- The results of the various tests shall be recorded and kept in the station as a permanent record for future reference. Details such as place of erection, date of commissioning, protection given to the transformer etc. may be furnished to the manufacturer after commissioning.
- Appendix E contains the commissioning checklist and has to be completed before commissioning.

# APPENDIX A

|  <b>Sterling And Wilson LTD , Chennai</b> |                                      |             |              |                            |
|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------|--------------|----------------------------|
| SI No                                                                                                                      | Equipment Detail                     | Make        | Model Number | Eqpt .SI.no                |
| 1                                                                                                                          | Dimmerstat -3 ph (15A)               | AE          |              | 1208/502511                |
| 2                                                                                                                          | Megger 5Kv                           | Motwane     | B50K         | 372208                     |
| 3                                                                                                                          | Multi Meter                          | Motwane     | DM352        | 484908                     |
| 4                                                                                                                          | Clamp Meter                          | Motwane     | DCM39A       | T864308                    |
| 5                                                                                                                          | AC Leakage Meter                     | Iutron      | DL-6054      | I.28706                    |
| 6                                                                                                                          | Megger 2.5 KV                        | Motwane     | D20K         | T840008                    |
| 7                                                                                                                          | Micro OHM Meter                      | Motwane     | LR2065       | 472108                     |
| 8                                                                                                                          | Digital Earth Tester                 | Motwane     | DET20        | 407708                     |
| 9                                                                                                                          | Relay Test Kit                       | AnandaJothy | RLY - 108    |                            |
| 10                                                                                                                         | Phase Sequence Meter                 | KYORITSU    | 8031         | Wo220846                   |
| 11                                                                                                                         | Dimmerstat -1 ph (15A)               | AE          |              | 502027/8                   |
| 12                                                                                                                         | Loading Transsformer                 | AnandaJothy |              |                            |
| 13                                                                                                                         | HV Test Kit(70 KV)                   | Elsytec     |              | EepI/036--<br>EepI/HT/0036 |
| 14                                                                                                                         | Clamp Meter                          | Motwane     | DCM39A       | T864208                    |
| 15                                                                                                                         | AC Leakage Meter                     | Iutron      | DL-6054      | i.28710                    |
| 16                                                                                                                         | Megger 1 KV                          | Motwane     | D2K-M        | 245508                     |
| 17                                                                                                                         | Megger 5Kv (Motorised/ Hand Opeated) | WACO        |              | 853413                     |
| 18                                                                                                                         | Phase Sequence Meter                 | KYORITSU    | 8031         | Wo222295                   |
| 19                                                                                                                         | 3 Pole Time Interval Meter           | Scope       | scot M3K     | 2100/02 V.409              |
| 20                                                                                                                         | Dimmerstat -1 ph (15A)               | AE          |              | 502079/13                  |
| 21                                                                                                                         | Multi Meter                          | Motwane     | DM352        | 479608                     |
| 22                                                                                                                         | Digital Earth Tester                 | Motwane     | DET20        | 407808                     |
| 23                                                                                                                         | HV Test Kit 30Kv/40 kV Dc            | Elsytec     |              | TP/006                     |
| 24                                                                                                                         | Loading transformer                  | Elsytec     | LTR - 10     | 9139                       |
| 25                                                                                                                         | Relay Test Kit                       | Elsytec     | SL-C100      | 08/136                     |
| 26                                                                                                                         | Galvanometer                         |             |              |                            |

# APPENDIX C

|                                                                                   |                                                                         |                |                      |        |  |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------|----------------------|--------|--|
|  | STERLING AND WILSON LTD                                                 |                | REFNO:               |        |  |
|                                                                                   | Chenn                                                                   |                | FORMAT REV. NO       |        |  |
|                                                                                   | CHECK SHEET FOR INSTALLATION OF TRANSFORMER                             |                | DATE OF INSPECTION : |        |  |
| Building Reference :                                                              |                                                                         |                | Location :           |        |  |
| Reference Drawing :                                                               |                                                                         |                | Rev. :               |        |  |
| S.NO.                                                                             | INSTALLATION CHECKS                                                     | S&W            | Const.               | Clie   |  |
| 1                                                                                 | Check the name plate details as per specification                       |                |                      |        |  |
| 2                                                                                 | Check the location and level; insert plate, foundation of area.         |                |                      |        |  |
| 3                                                                                 | Check that the rollers are properly locked in their permanent location  |                |                      |        |  |
| 4                                                                                 | Check that all the accessories are mounted properly                     |                |                      |        |  |
| 5                                                                                 | Check that the fans are erected at correct location                     |                |                      |        |  |
| 6                                                                                 | Check the HT & LT bushings are erected properly                         |                |                      |        |  |
| 7                                                                                 | Check that the conservator is mounted properly at the appropriate place |                |                      |        |  |
| 8                                                                                 | Check the earthing of transformer body & marshalling box                |                |                      |        |  |
| 9                                                                                 | Check all bolt & nuts are tightened properly                            |                |                      |        |  |
| 10                                                                                | Check transformer neutral earthing is completed as per drawing          |                |                      |        |  |
| 11                                                                                | Check cleanliness of the transformer                                    |                |                      |        |  |
| REMARKS :                                                                         |                                                                         |                |                      |        |  |
|                                                                                   | S&W<br>ENGINEER                                                         | S&W<br>QUALITY | CONSULTANT           | CLIENT |  |
| Name                                                                              |                                                                         |                |                      |        |  |
| Signature                                                                         |                                                                         |                |                      |        |  |
| Date                                                                              |                                                                         |                |                      |        |  |

|                      |                                                                                  |                      |                      |        |
|----------------------|----------------------------------------------------------------------------------|----------------------|----------------------|--------|
|                      | STERLING AND WILSON LTD                                                          |                      | REFNO:               |        |
|                      | Chennai                                                                          |                      | FORMAT REV. NO       |        |
|                      | CHECK SHEET FOR INSTALLATION OF HV / LV PANEL                                    |                      | DATE OF INSPECTION : |        |
| Building Reference : |                                                                                  | Location :           |                      |        |
| Reference Drawing :  |                                                                                  | Rev. :               |                      |        |
| S.NO.                | INSTALLATION CHECKS                                                              | S&W                  | Conslt.              | Client |
| 1                    | Location & clearance as per GA drawing                                           |                      |                      |        |
| 2                    | Check the name plate details according to the specification                      |                      |                      |        |
| 3                    | Check for any Physical damage                                                    |                      |                      |        |
| 4                    | Dimensions of cable alley                                                        |                      |                      |        |
| 5                    | Dimensions of Bus bars & no. of runs as per dwg                                  |                      |                      |        |
| 6                    | Check for correct use & proper size pipes /cross bars etc. during shifting       |                      |                      |        |
| 7                    | Check correct alignment of panels & also it sequence                             |                      |                      |        |
| 8                    | Check the panel are assembled as per Drg.                                        |                      |                      |        |
| 9                    | Check Cleanliness and dryness inside panel                                       |                      |                      |        |
| 10                   | Whether tools and foreign equipments removed                                     |                      |                      |        |
| 11                   | whether all temporary connections made during installation work has been removed |                      |                      |        |
| 12                   | Physical check for all the components for any damage                             |                      |                      |        |
| 13                   | Check mounting of circuit breaker ,MCCBs, switches and switchgears               |                      |                      |        |
| 14                   | Rating of major components as per dwg                                            |                      |                      |        |
| 15                   | Check for major components as per approved list                                  |                      |                      |        |
| 16                   | Check for door alignment                                                         |                      |                      |        |
| 17                   | Check spacing between the bus bars                                               |                      |                      |        |
| 18                   | Interconnection of bus bar and joints                                            |                      |                      |        |
| 19                   | Trial operation of all switchgears including circuit breakers                    |                      |                      |        |
| 20                   | Alignment of draw out switch gears                                               |                      |                      |        |
| 21                   | Check tightness of bus bar joints and supports                                   |                      |                      |        |
| 22                   | Whether name / identification tags provided for feeders                          |                      |                      |        |
| 23                   | Check panel Base bolt are fixed properly                                         |                      |                      |        |
| 24                   | Check the earthing of the panel                                                  |                      |                      |        |
| 25                   | Check the sealing of spare gland holes                                           |                      |                      |        |
|                      |                                                                                  |                      |                      |        |
| REMARKS :            |                                                                                  |                      |                      |        |
|                      | S&W ENGINEER INCHARGE                                                            | S&W QUALITY ENGINEER | CONSULTANT           | CLIENT |
| Name                 |                                                                                  |                      |                      |        |
| Signature            |                                                                                  |                      |                      |        |
| Date                 |                                                                                  |                      |                      |        |

|                                                                                   |                                                                                                                    |                      |                      |        |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|--------|
|  | STERLING AND WILSON LTD                                                                                            |                      | REFNO:               |        |
|                                                                                   | Chennai                                                                                                            |                      | FORMAT REV. NO       |        |
|                                                                                   | CHECK SHEET FOR INSTALLATION OF CABLE TERMINATION                                                                  |                      | DATE OF INSPECTION : |        |
| Building Reference :                                                              |                                                                                                                    | Location :           |                      |        |
| Reference Drawing :                                                               |                                                                                                                    | Rev. :               |                      |        |
| S.NO.                                                                             | INSTALLATION CHECK                                                                                                 | S&W                  | Constt.              | Client |
| 1                                                                                 | check for the cable continuity before Terminating the cables                                                       |                      |                      |        |
| 2                                                                                 | Check for the cables dressing throughout the length before terminating                                             |                      |                      |        |
| 3                                                                                 | Check that double compression glands are properly tightened                                                        |                      |                      |        |
| 4                                                                                 | Check that proper crimping tools are used for crimping                                                             |                      |                      |        |
| 5                                                                                 | Check that loop which is enough for a re-termination is kept near panel                                            |                      |                      |        |
| 6                                                                                 | Check the cables are glanded properly to the gland plate with correct gland size                                   |                      |                      |        |
| 7                                                                                 | Check the cable termination                                                                                        |                      |                      |        |
| 8                                                                                 | Check the terminations of cables to the terminals is done by using correct size of lugs                            |                      |                      |        |
| 9                                                                                 | Check the cables inside the panels properly bunched and dressed neatly                                             |                      |                      |        |
| 10                                                                                | Check the Gland earthing for all the ends                                                                          |                      |                      |        |
| 11                                                                                | Check all unused opening in gland plates are closed with gourmets/sealing compound                                 |                      |                      |        |
| 12                                                                                | Check for proper supporting of cable at both ends                                                                  |                      |                      |        |
| 13                                                                                | Check the termination of the HT cables is done as per the procedures specified by the termination kit manufacturer |                      |                      |        |
| REMARKS :                                                                         |                                                                                                                    |                      |                      |        |
|                                                                                   | S&W ENGINEER INCHARGE                                                                                              | S&W QUALITY ENGINEER | CONSULTANT           | CLIENT |
| Name                                                                              |                                                                                                                    |                      |                      |        |
| Signature                                                                         |                                                                                                                    |                      |                      |        |
| Date                                                                              |                                                                                                                    |                      |                      |        |

# APPENDIX D

|                                                                                   |                                  |  |          |
|-----------------------------------------------------------------------------------|----------------------------------|--|----------|
|  | <b>STERLING &amp; WILSON LTD</b> |  | Ref.No : |
|                                                                                   |                                  |  | Page.No: |
|                                                                                   |                                  |  | Date :   |
|                                                                                   | CLIENT :                         |  |          |
| PROJECT :                                                                         |                                  |  |          |

| <u>INDEX</u> |                                  |            |       |
|--------------|----------------------------------|------------|-------|
| SL.NO.       | DESCRIPTION                      | FORMAT NO. | PAGES |
| 1            | Transformer                      |            |       |
| 2            | HT Cable                         |            |       |
| 3            | HT Switchgear                    |            |       |
| 4            | HT Panel HV Test                 |            |       |
| 5            | Current Transformer              |            |       |
| 6            | Voltage Transformer              |            |       |
| 7            | Over Current & Earth Fault Relay |            |       |
| 8            | Overall Commissioning Report     |            |       |



|                                                                                   |                                  |  |  |  |  |  |                |  |  |
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|  | <b>STERLING &amp; WILSON LTD</b> |  |  |  |  |  | Ref.No : _____ |  |  |
|                                                                                   |                                  |  |  |  |  |  | Page.No: _____ |  |  |
|                                                                                   | CLIENT : _____                   |  |  |  |  |  | Date : _____   |  |  |
|                                                                                   | PROJECT : _____                  |  |  |  |  |  |                |  |  |

**TEST REPORT FOR POWER TRANSFORMER-PRE COMMISSIONING**

**6. Voltage Ratio/Turns Ratio Test**

Date: \_\_\_\_\_

| Tap<br>Position | Applied Voltage (V) |      |      | Measured Voltage (V) |      |      | Ratio Calculated    |                     |                     | Actual<br>Ratio |
|-----------------|---------------------|------|------|----------------------|------|------|---------------------|---------------------|---------------------|-----------------|
|                 | 1U1V                | 1V1W | 1W1U | 2U2V                 | 2V2W | 2W2U | $\frac{1U1V}{2U2V}$ | $\frac{1V1W}{2V2W}$ | $\frac{1W1U}{2W2U}$ |                 |
|                 |                     |      |      |                      |      |      |                     |                     |                     |                 |

|                                                    |                              |                          |
|----------------------------------------------------|------------------------------|--------------------------|
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer) | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |
|----------------------------------------------------|------------------------------|--------------------------|

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|                                                                                   |                                  |  | Page.No: _____ |
|                                                                                   |                                  |  | Date : _____   |
|                                                                                   | CLIENT : _____                   |  |                |
| PROJECT : _____                                                                   |                                  |  |                |

**TEST REPORT FOR POWER TRANSFORMER-PRE COMMISSIONING**

**7. Magnetizing current test (At Normal tap)** Date: \_\_\_\_\_

| Voltage applied |       | Current measured |           |
|-----------------|-------|------------------|-----------|
| Terminal        | Volts | Phase            | Milliamps |
| 1U1V            |       | 1U               |           |
| 1V1W            |       | 1V               |           |
| 1W1U            |       | 1W               |           |

**8. Vector group test (At Normal tap)** Date: \_\_\_\_\_

Terminals Shorted: 1U & 2U

Applied Volts:

1U1V : 1V1W: 1W1U :

Measured Volts:

1U2U : \_\_\_\_\_

1U2N : \_\_\_\_\_

1V2N : \_\_\_\_\_

1V2V : \_\_\_\_\_

1V2W : \_\_\_\_\_

1W2W : \_\_\_\_\_

1W2V : \_\_\_\_\_

Inference:

1U2U = 0

1U1V = 1U2N+1V2N

1V2V = 1V2W

1W2W<1W2V

|                                                    |                              |                          |
|----------------------------------------------------|------------------------------|--------------------------|
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer) | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |
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|  | <b>STERLING &amp; WILSON LTD</b>  |  | Ref.No : _____ |  |
|                                                                                   |                                   |  | Page.No: _____ |  |
|                                                                                   |                                   |  | Date : _____   |  |
|                                                                                   | CLIENT : _____<br>PROJECT : _____ |  |                |  |

**TEST REPORT FOR POWER TRANSFORMER-PRE COMMISSIONING**

9. Short circuit test (At Normal tap) Date: \_\_\_\_\_

| Applied voltage (V) |      |      | Current measured (A) |    |    |    |    |    |
|---------------------|------|------|----------------------|----|----|----|----|----|
| 1U1V                | 1V1W | 1W1U | 1U                   | 1V | 1W | 2U | 2V | 2W |
|                     |      |      |                      |    |    |    |    |    |

5. Magnetic Balance Test (At normal tap) (Pry/Sec)

| Applied voltage (V) |      |      | Measured voltage (V) |      |      |
|---------------------|------|------|----------------------|------|------|
| 1U1V                | 1V1W | 1W1U | 1U1V                 | 1V1W | 1W1U |
|                     |      |      |                      |      |      |

|                                                    |                              |                          |
|----------------------------------------------------|------------------------------|--------------------------|
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer) | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |
|----------------------------------------------------|------------------------------|--------------------------|

|                                                                                   |                                  |                              |    |                          |    |    |
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|  | <b>STERLING &amp; WILSON LTD</b> |                              |    | Ref.No : _____           |    |    |
|                                                                                   |                                  |                              |    | Page.No: _____           |    |    |
|                                                                                   |                                  |                              |    | Date : _____             |    |    |
|                                                                                   | CLIENT : _____                   |                              |    |                          |    |    |
| PROJECT : _____                                                                   |                                  |                              |    |                          |    |    |
| <b>TEST REPORT FOR POWER TRANSFORMER-PRE COMMISSIONING</b>                        |                                  |                              |    |                          |    |    |
| 11. Winding Resistance Test (in milliohm/ohm)                                     |                                  |                              |    | Date: _____              |    |    |
| Tap                                                                               | HV winding                       |                              |    | LV winding               |    |    |
|                                                                                   | 1U                               | 1V                           | 1W | 2U                       | 2V | 2W |
|                                                                                   |                                  |                              |    |                          |    |    |
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer)                                |                                  | <b>STERLING &amp; WILSON</b> |    | <b>CLIENT/CONSULTANT</b> |    |    |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>STERLING &amp; WILSON LTD</b> |                              | Ref.No :                 |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------|--------------------------|--|-----|-----|--------|--|--|-------|--|--|---------------------|--------|-------|-------|--------|-------|-------------|--------|--|--|-------|--|-----------------|--------|--|--|-------|--|-------------------------|--------|--|--|-------|--|------------------|--------|--|--|-------|--|--------------------|--------|--|--|-------|--|--------------------------|--------|--|--|-------|--|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                  |                              | Page.No:                 |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                  |                              | Date :                   |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | CLIENT :                         |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| PROJECT :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                  |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| <p align="center"><b>TEST REPORT FOR POWER TRANSFORMER-PRE COMMISSIONING</b></p> <p><b>12. Setting of Alarm/Trip and Cooler contacts</b> <span style="float: right;">Date:</span></p> <table border="0" style="width: 100%;"> <thead> <tr> <th></th> <th align="center">OTI</th> <th align="center">WTI</th> </tr> </thead> <tbody> <tr> <td>Alarm:</td> <td></td> <td></td> </tr> <tr> <td>Trip:</td> <td></td> <td></td> </tr> <tr> <td>Cooler control fan:</td> <td>Start:</td> <td>Stop:</td> </tr> <tr> <td>Pump:</td> <td>Start:</td> <td>Stop:</td> </tr> </tbody> </table> <p><b>13. Alarm and Trip device operation check</b></p> <table border="0" style="width: 100%;"> <tbody> <tr> <td>a) Oil temp</td> <td>Alarm:</td> <td></td> </tr> <tr> <td></td> <td>Trip:</td> <td></td> </tr> <tr> <td>b) Winding temp</td> <td>Alarm:</td> <td></td> </tr> <tr> <td></td> <td>Trip:</td> <td></td> </tr> <tr> <td>c) Buchholz (Main Tank)</td> <td>Alarm:</td> <td></td> </tr> <tr> <td></td> <td>Trip:</td> <td></td> </tr> <tr> <td>d) Low oil level</td> <td>Alarm:</td> <td></td> </tr> <tr> <td></td> <td>Trip:</td> <td></td> </tr> <tr> <td>e) Buchholz (OLTC)</td> <td>Alarm:</td> <td></td> </tr> <tr> <td></td> <td>Trip:</td> <td></td> </tr> <tr> <td>f) Pressure relief valve</td> <td>Alarm:</td> <td></td> </tr> <tr> <td></td> <td>Trip:</td> <td></td> </tr> </tbody> </table> |                                  |                              |                          |  | OTI | WTI | Alarm: |  |  | Trip: |  |  | Cooler control fan: | Start: | Stop: | Pump: | Start: | Stop: | a) Oil temp | Alarm: |  |  | Trip: |  | b) Winding temp | Alarm: |  |  | Trip: |  | c) Buchholz (Main Tank) | Alarm: |  |  | Trip: |  | d) Low oil level | Alarm: |  |  | Trip: |  | e) Buchholz (OLTC) | Alarm: |  |  | Trip: |  | f) Pressure relief valve | Alarm: |  |  | Trip: |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | OTI                              | WTI                          |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| Alarm:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                  |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| Trip:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| Cooler control fan:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Start:                           | Stop:                        |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| Pump:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Start:                           | Stop:                        |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| a) Oil temp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Alarm:                           |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Trip:                            |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| b) Winding temp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Alarm:                           |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Trip:                            |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| c) Buchholz (Main Tank)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Alarm:                           |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Trip:                            |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| d) Low oil level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Alarm:                           |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Trip:                            |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| e) Buchholz (OLTC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Alarm:                           |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Trip:                            |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| f) Pressure relief valve                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Alarm:                           |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Trip:                            |                              |                          |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                  | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |  |     |     |        |  |  |       |  |  |                     |        |       |       |        |       |             |        |  |  |       |  |                 |        |  |  |       |  |                         |        |  |  |       |  |                  |        |  |  |       |  |                    |        |  |  |       |  |                          |        |  |  |       |  |

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| PROJECT :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                  |                          |
| <p align="center"><b>TEST REPORT FOR POWER TRANSFORMER-PRE COMMISSIONING</b></p> <p align="right">Date:</p> <p><b>14. Check for Cooler control</b></p> <ul style="list-style-type: none"> <li>a) All components are installed properly and earthed as per relevant drawings</li> <li>b) All control cables are laid &amp; terminated properly as per schemes</li> <li>c) Checking the Insulation resistance of all control cables and Fan / Pump, motors</li> <li>d) Direction of rotation of Fans &amp; Pumps</li> <li>e) Operation check                      <u>Pumps</u>                      <u>Fans</u> <ul style="list-style-type: none"> <li>Manual (Local):</li> <li>Remote:</li> <li>Automatic:</li> </ul> </li> </ul> <p>Running/Stand-by change over:</p> <ul style="list-style-type: none"> <li>f) Fan failure alarm</li> <li>g) Pump failure alarm / Trip</li> <li>h) Auto change over occurred alarm</li> <li>i) Auto change over fail alarm</li> <li>j) Functional Checks of Fan / Pump Starters, Contactors, Timers etc...</li> </ul> <p><b>15. Remarks</b></p> |                                  |                          |
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>STERLING &amp; WILSON</b>     | <b>CLIENT/CONSULTANT</b> |

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|  | <b>STERLING &amp; WILSON LTD</b>  |  | Ref.No : _____ |  |
|                                                                                   |                                   |  | Page.No: _____ |  |
|                                                                                   |                                   |  | Date : _____   |  |
|                                                                                   | CLIENT : _____<br>PROJECT : _____ |  |                |  |

**TEST REPORT FOR HT POWER CABLES-PRE COMMISSIONING**

1. **Location** \_\_\_\_\_ Date: \_\_\_\_\_  
 From : \_\_\_\_\_ To: \_\_\_\_\_

2. **Cable details**  
 Make : \_\_\_\_\_ Rated Volts: \_\_\_\_\_  
 Size : \_\_\_\_\_ Type: \_\_\_\_\_  
 System : \_\_\_\_\_ Ref.Std: \_\_\_\_\_

3. **General inspection & Erection completion ad per check list:**

4. **Insulation Resistance Test** (values in mega Ohms) Date : \_\_\_\_\_  
 Using ..... kV megger Temp: \_\_\_\_\_

| Before HV test | After HV test |
|----------------|---------------|
| R-Y            | R-Y           |
| Y-B            | Y-B           |
| B-R            | B-R           |
| R-E            | R-E           |
| Y-E            | Y-E           |
| B-E            | B-E           |

5. **DC High Voltage Test**

| Ref.code          | Duration<br>(minutes) | Voltage<br>applied<br>AC/DC | Rated<br>voltage<br>AC | Leakage<br>current (mA) |        | Result |
|-------------------|-----------------------|-----------------------------|------------------------|-------------------------|--------|--------|
|                   |                       |                             |                        | Start                   | Finish |        |
| Rph-<br>Y+B+Earth |                       |                             |                        |                         |        |        |
| Yph-<br>B+R+Earth |                       |                             |                        |                         |        |        |
| Bph-<br>R+Y+Earth |                       |                             |                        |                         |        |        |

6. Check proper straight through joints if any:  
 Check cable termination at breaker, transformer, generator ends, etc.:  
 Check cable support is adequate for CB Genr.end and Tr. End:

7. **Remarks**

|                                                    |                              |                          |
|----------------------------------------------------|------------------------------|--------------------------|
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer) | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |
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|  | <b>STERLING &amp; WILSON LTD</b>  |  | Ref.No : _____ |  |
|                                                                                   |                                   |  | Page.No: _____ |  |
|                                                                                   |                                   |  | Date : _____   |  |
|                                                                                   | CLIENT : _____<br>PROJECT : _____ |  |                |  |

**TEST REPORT FOR HT SWITCHGEAR-PRE COMMISSIONING**

**1. Designation**

Location \_\_\_\_\_

**2. Name plate details**

Make: \_\_\_\_\_

Type: \_\_\_\_\_

Sl.No: \_\_\_\_\_

Rated V : \_\_\_\_\_

Rated I : \_\_\_\_\_

Making capacity : \_\_\_\_\_

Breaking capacity : \_\_\_\_\_

Operating coil voltage: \_\_\_\_\_

**3. Check for completeness of installation as per check list:**

Date: \_\_\_\_\_

Temp: \_\_\_\_\_

**4. Insulation Resistance Test (In Mega Ohms)**

| Megger Used (V) | Circuit Ref.                            | R   | Y   | B   |
|-----------------|-----------------------------------------|-----|-----|-----|
|                 | Pole to earth<br>(C.B. Closed)          |     |     |     |
|                 | Across contact<br>(C.B. Open)           |     |     |     |
|                 | Pole to pole<br>(C.B. Closed)           | R-Y | Y-B | B-R |
|                 | Operating<br>motor &<br>Control circuit |     |     |     |

**5 Contact Resistance Test (In Micro Ohms)**

R phase: \_\_\_\_\_

Y phase: \_\_\_\_\_

B phase: \_\_\_\_\_

Date: \_\_\_\_\_

Temp: \_\_\_\_\_

|                                                    |                              |                          |
|----------------------------------------------------|------------------------------|--------------------------|
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer) | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |
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|  | <b>STERLING &amp; WILSON LTD</b> |  | Ref.No : _____ |
|                                                                                   |                                  |  | Page.No: _____ |
|                                                                                   |                                  |  | Date : _____   |
|                                                                                   | CLIENT : _____                   |  |                |
| PROJECT : _____                                                                   |                                  |  |                |

**TEST REPORT FOR HT SWITCHGEAR-PRE COMMISSIONING**

**6. Pick - Up voltage of operating coils** Date: \_\_\_\_\_

Closing coil: 70% of rated volts

Tripping coil: 50% of rated volts

**7. Operating time at rated coil voltage (in milli seconds)**

R
Y
B

|               |  |  |  |
|---------------|--|--|--|
| Closing time  |  |  |  |
| Tripping time |  |  |  |

**8. Operational Checks** Date: \_\_\_\_\_

Close:

Trip:

Anti Pumping:

Protection Trip:

Auto Reclose if any:

Others:

| Local | Remote/Auto |
|-------|-------------|
|       |             |

**9. Functional Checks**

- a) Emergency Trip : \_\_\_\_\_
- b) Aux. Switch Operation : \_\_\_\_\_
- c) On-Off indication (lamp + Flag) : \_\_\_\_\_
- d) Trip / Trip circuit healthy lamp indication : \_\_\_\_\_
- e) Limit Switch for Spring charge motor : \_\_\_\_\_
- f) Test / Service Limit Switch : \_\_\_\_\_
- g) Operation Counter : \_\_\_\_\_
- h) Heater / Heater Switch / Thermostat : \_\_\_\_\_
- i) Function of illumination, socket switch : \_\_\_\_\_

**10. Remarks**

|                                                    |                              |                          |
|----------------------------------------------------|------------------------------|--------------------------|
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer) | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |
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|  | <b>STERLING &amp; WILSON LTD</b>  |  | Ref.No : _____ |  |
|                                                                                   |                                   |  | Page.No: _____ |  |
|                                                                                   |                                   |  | Date : _____   |  |
|                                                                                   | CLIENT : _____<br>PROJECT : _____ |  |                |  |

**TEST REPORT FOR HV / LV SWITCHGEAR PANEL--HV TEST –  
PRE COMMISSIONING**

Date : \_\_\_\_\_

1. Location : \_\_\_\_\_
2. Name plate details
 

|                       |                    |
|-----------------------|--------------------|
| Make : _____          | Rated Volts: _____ |
| Rated Current : _____ | Type : _____       |
| Panel Ref. No : _____ | Ref. Std : _____   |
3. General inspection & erection completeness as per check list
4. Insulation Resistance Test (Values in Mega ohms)
 

|                       |              |
|-----------------------|--------------|
| Using ..... KV Megger | Date : _____ |
| Temp: _____           |              |

|                |               |
|----------------|---------------|
| Before HV test | After HV test |
| R-Y            | R-Y           |
| Y-B            | Y-B           |
| B-R            | B-R           |
| R-E            | R-E           |
| Y-E            | Y-E           |
| B-E            | B-E           |
5. Ac High Voltage Test
 

| Ref. Code           | Duration<br>minutes | Voltage<br>Applied AC | Rated Voltage AC | Leakage current |        | Result |
|---------------------|---------------------|-----------------------|------------------|-----------------|--------|--------|
|                     |                     |                       |                  | Start           | Finish |        |
| <b>HT panel</b>     |                     |                       |                  |                 |        |        |
| R+Y+B to<br>Earth   |                     |                       |                  |                 |        |        |
| <b>LT panel</b>     |                     |                       |                  |                 |        |        |
| R+Y+B+N to<br>Earth |                     |                       |                  |                 |        |        |
6. Physical Checks
 

Check Breaker & busbar tightness : \_\_\_\_\_

Check busbar clearance is adequate : \_\_\_\_\_
7. Remarks

|                                                    |                              |                          |
|----------------------------------------------------|------------------------------|--------------------------|
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer) | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |
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|-----------------------------------------------------------------------------------|-----------------------------------|--|----------------|--|
|  | <b>STERLING &amp; WILSON LTD</b>  |  | Ref.No : _____ |  |
|                                                                                   |                                   |  | Page.No: _____ |  |
|                                                                                   |                                   |  | Date : _____   |  |
|                                                                                   | CLIENT : _____<br>PROJECT : _____ |  |                |  |

**TEST REPORT FOR PANEL MOUNTED CT-PRE COMMISSIONING**  
 Date : \_\_\_\_\_

1. Designation  
Location : \_\_\_\_\_
2. Name plate details
 

| CT Ref.           | R | Y | B |
|-------------------|---|---|---|
| Make : _____      |   |   |   |
| Ratio : _____     |   |   |   |
| Class : _____     |   |   |   |
| Burden : _____    |   |   |   |
| Serial No : _____ |   |   |   |
3. Check for completeness of installation as per check list
4. Insulation Resistance Test (Values in Mega Ohms)      Date : \_\_\_\_\_
 

With ..... KV Megger for Primary      Temp: \_\_\_\_\_  
 With ..... KV Megger for Secondary

|                                | R | Y | B |
|--------------------------------|---|---|---|
| i) Primary to Secondary      - |   |   |   |
| ii) Primary to Earth      -    |   |   |   |
| iii) Secondary to Earth      - |   |   |   |
5. Polarity Test      -
6. Ratio Test
 

| CT Ref | Primary Current (A) | Terminal | Secondary Current (A) |
|--------|---------------------|----------|-----------------------|
|        | Rated      Tested   |          | R      Y      B       |
|        |                     |          |                       |
7. Remark s

|                                                    |                              |                          |
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| <b>STERLING &amp; WILSON</b><br>(Testing Engineer) | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |
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|-----------------------------------------------------------------------------------|----------------------------------|--|----------------|--|
|  | <b>STERLING &amp; WILSON LTD</b> |  | Ref.No : _____ |  |
|                                                                                   |                                  |  | Page.No: _____ |  |
|                                                                                   |                                  |  | Date : _____   |  |
|                                                                                   | CLIENT : _____                   |  |                |  |
| PROJECT : _____                                                                   |                                  |  |                |  |

**TEST REPORT FOR PANEL MOUNTED VT-PRE COMMISSIONING**  
Date : \_\_\_\_\_

**1. Designation**  
Location : \_\_\_\_\_

**2. Name plate details**  
Serial No. : \_\_\_\_\_ Make : \_\_\_\_\_  
Voltage Ratio : \_\_\_\_\_ Burden: \_\_\_\_\_

**3. Check for completeness of installation as per check list**

**4. Insulation Resistance Test** (in Mega Ohms) Date : \_\_\_\_\_  
Amb. Temp : \_\_\_\_\_

| Meggar used | Circuit Ref.          | R | Y | B |
|-------------|-----------------------|---|---|---|
|             | Primary to Earth      |   |   |   |
|             | Primary to Sec. Cores |   |   |   |
|             | Secondary to Earth    |   |   |   |
|             | Control Cables        |   |   |   |

**5. Polarity Test**  
All secondary : R ph: Y ph: B ph:

**6. Voltage Ratio Test** Date : \_\_\_\_\_

| Actual Ratio | Primary Voltage (V) |        | Core/Terminal Ref | Secondary measured voltage (V) |    |    |
|--------------|---------------------|--------|-------------------|--------------------------------|----|----|
|              | Rated               | Tested |                   | RY                             | YB | BR |
|              |                     |        |                   |                                |    |    |

**7. Functional Checks**  
a) All Primary / Secondary Fuses : \_\_\_\_\_  
b) Heater/Heater Switch / Thermostat : \_\_\_\_\_

**8. Remarks**

|                                                    |                              |                          |
|----------------------------------------------------|------------------------------|--------------------------|
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|-----------------------------------------------------------------------------------|-----------------------------------|--|----------------|--|
|  | <b>STERLING &amp; WILSON LTD</b>  |  | Ref.No : _____ |  |
|                                                                                   |                                   |  | Page.No: _____ |  |
|                                                                                   |                                   |  | Date : _____   |  |
|                                                                                   | CLIENT : _____<br>PROJECT : _____ |  |                |  |

**TEST REPORT FOR OVER CURRENT / EARTH FAULT RELAY-  
PRE COMMISSIONING**

Date : \_\_\_\_\_

**1. Designation**  
 Location : \_\_\_\_\_

**2. Name plate details**  
 Make : \_\_\_\_\_ Type : \_\_\_\_\_  
 Serial No. : \_\_\_\_\_ Model: \_\_\_\_\_  
 CT Sec Current (A) : \_\_\_\_\_ Aux. Volts : \_\_\_\_\_  
 Available Setting : \_\_\_\_\_ O/C \_\_\_\_\_ E/F \_\_\_\_\_  
 P.S (A) : \_\_\_\_\_  
 Inst. (A) : \_\_\_\_\_  
 Op. Time (Sec) at PS X 10 with TMS 1: \_\_\_\_\_

**3. General Inspection:**

**4. Secondary injection test** Date : \_\_\_\_\_

| Phase / Unit | PS (A) | T.M.S | Starting Current (A) | Closing Current (A) | Operating time (sec) at multiples of P.S |
|--------------|--------|-------|----------------------|---------------------|------------------------------------------|
|              |        |       |                      |                     | 2      5      10                         |
|              |        |       |                      |                     |                                          |

|                                                    |                              |                          |
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| <b>STERLING &amp; WILSON</b><br>(Testing Engineer) | <b>STERLING &amp; WILSON</b> | <b>CLIENT/CONSULTANT</b> |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  |                   | Page.No:                   |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  |                   | Date :                     |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CLIENT :                         |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| PROJECT :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| <p align="center"><b>TEST REPORT FOR OVER CURRENT / EARTH FAULT RELAY-<br/>PRE COMMISSIONING</b></p> <p align="right">Date :</p> <table border="1"><thead><tr><th>Phase/<br/>Unit</th><th>PS<br/>(A)</th><th>T.M.S.</th><th>Starting<br/>Current<br/>(A)</th><th>Closing<br/>Current<br/>(A)</th><th colspan="3">Operating time (Sec) at<br/>multiples of PS</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td>2</td><td>5</td><td>10</td></tr></thead><tbody><tr><td colspan="8" style="height: 100px;"></td></tr></tbody></table> |                                  |                   |                            | Phase/<br>Unit            | PS<br>(A)                                  | T.M.S. | Starting<br>Current<br>(A) | Closing<br>Current<br>(A) | Operating time (Sec) at<br>multiples of PS |  |  |  |  |  |  |  | 2 | 5 | 10 |  |  |  |  |  |  |  |  |
| Phase/<br>Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | PS<br>(A)                        | T.M.S.            | Starting<br>Current<br>(A) | Closing<br>Current<br>(A) | Operating time (Sec) at<br>multiples of PS |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  |                   |                            |                           | 2                                          | 5      | 10                         |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| <b>5. Operating Current Check</b> (For instantaneous unit)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| i) O/C Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| Setting Current (A)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| Operating Current (A)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | R Phase           |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  | Y Phase           |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  | B Phase           |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| ii) E/F Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| Setting Current (A)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| Operating Current (A)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| <b>6. Operational Check</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| a) Correct operation of appropriate indicator / Aux. relay :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| b) Correct initiation of alarm contacts :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| c) Correct circuit breaker tripping contacts :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| <b>7. Service setting</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  | O/C(R)            | O/C(Y)                     | O/C(B)                    | E/F                                        |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| P.S. (A)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | :                                |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| T.M.S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | :                                |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| Instantaneous unit (A)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | :                                |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| <b>8. Remarks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                  |                   |                            |                           |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |
| STERLING & WILSON<br>(Testing Engineer)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                  | STERLING & WILSON |                            | CLIENT/CONSULTANT         |                                            |        |                            |                           |                                            |  |  |  |  |  |  |  |   |   |    |  |  |  |  |  |  |  |  |

# APPENDIX E

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |                          |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | Page. No:                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | Date :                   |
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| PROJECT :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  |                          |
| <p align="center"><b>COMMISSIONING REPORT FOR ELECTRICAL SYSTEM</b></p> <p><b>1. System Ref.</b> _____ <b>Date:</b> _____</p> <p>Location _____</p> <p><b>2. Check for completeness of installation of Electrical system</b> _____</p> <p><b>3. Check the following points before charging the system</b></p> <p>Clean the entire system which is going to be charged _____</p> <p>Plug the extra holes properly _____</p> <p>Physical checks for all doors covers, bus bars, cables etc., are in place _____</p> <p>Check the relay setting and keep minimum for initial charging _____</p> <p>Check the IR value for the system which is going to be charged _____</p> <p>HT system _____ LT system _____</p> <p>Phase to Earth - _____ Phase to Earth - _____</p> <p>Phase to Phase - _____ Phase to Phase - _____</p> <p>Check the HT PT is in position and fuse is fixed if available _____</p> <p>Keep the Transformer's tap position in lower side ie.2/3 _____</p> <p>Check the HT voltage and Close the HT breaker to charge the Transformer _____</p> <p>HT side Voltage: _____</p> <p>Check the Transformer parameters and other conditions _____</p> <p>Check the LT side voltage _____</p> <p>Phase to Phase - _____</p> <p>Phase to Earth - _____</p> <p>Check the phase sequence _____</p> <p>If possible keep the Transformer in charging for 8 Hrs. (without Load) _____</p> <p>After load test and check the Transformer Temp. and other parameters _____</p> <p>Close the LT breaker of Transformer and check the LT panel Bus section is charged _____</p> <p>Load the Transformer slowly and check all the parameters are OK _____</p> <p>Check the Load manager and other meters are functioning properly _____</p> <p>Check the relay setting for all outgoing feeders and keep it minimum _____</p> <p>Close the balance out going feeders and give the power to all panels _____</p> <p>Load all sub panels and check the function of all equipment which is mounted on the panels: _____</p> <p>Check overall operation and function of equipment which is mounted on panels _____</p> <p><b>4. Remarks</b></p> |                                  |                          |
| <b>STERLING &amp; WILSON</b><br>(Testing Engineer)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>STERLING &amp; WILSON</b>     | <b>CLIENT/CONSULTANT</b> |