**भारत सरकार**
**कार्यालय मुख्य अभियंता, सी.एस.क्यू.(वै.)**
**के.लो.नि.वि. कक्ष संख्या 229,**
**ए. विंग, निर्माण भवन, नई दिल्ली-110011**
**फोन नं. 011-23061697 फैक्स नं.-23061418**

स.51(4)/मु.अं.(वै.)/सीएसक्यू/2016/293-हिं. दिनांक : 31/03/2016

**कार्यालय ज्ञापन**

अपर महानिदेशक (प्रौ.वि) द्वारा दिनांक 22.05.2015 के का.ज्ञा.सं.54(4)मु.अं.(वै.)सी एस क्यू/2015/156 के माध्यम से के.लो.नि.वि. के ई एंड एम कार्य के लिए गुणता नियंत्रण प्रक्रिया और टी.पी.क्यू.ए. के लिए चेक लिस्ट को अंतिम रुप देने हेतु नीति तैयार करने के लिए गठित समिति की रिपोर्ट इस कार्यालय के दिनांक 31.07.2015 के का.ज्ञा. सं. डी. जी./सी. ई.(ई)/सी.एस. क्यू./क्यू/01 के माध्यम से सभी क्षेत्रीय एककों की टिप्पणियों के लिए के.लो.नि.वि. वेबसाइट के माध्यम से परिचालित की गई थी।

क्षेत्रीय एककों की टिप्पणियों पर विचार करने के बाद समिति की अंतिम रिपोर्ट पर महानिदेशक, के.लो.नि.वि ने निर्णय लिया कि गुणता नियंत्रण प्रक्रिया आश्वासन नीति तथा टी.पी.क्यू.ए. के चेक लिस्ट हेतु इसे के.लो.नि.वि. के सभी ई.एंड एम. कार्य में लागू किया जाये। तद्नुसार समिति की रिपोर्ट ई-बुक के रुप में प्रकाशन उप शीर्ष के अंतर्गत वेबसाइट पर उपलब्ध की जा रही है।

इसे महानिदेशक, के.लो.नि.वि. के अनुमोदन से जारी किया जाता है।

**संलग्नक:यथोपरि**

31/3/2016

**कार्यपालक अभियंता (वै.)टी.एल.क्यू.ए.**

सेवा में,

सभी मुख्य अभियंता, केलोनिवि एवं लोनिवि
(राष्ट्रीय राजधानी क्षेत्र, दिल्ली)
(केवल वेबसाइट के माध्यम से)

प्रति:

1. महानिदेशक के प्रधान निजी सचिव, केलोनिवि, निर्माण भवन, नई दिल्ली ।
2. सभी विशेष महानिदेशक/अपर महानिदेशक, के.लो.नि.वि. को उनकी सूचनार्थ।

**कार्यपालक अभियंता (वै.) टी.एल.क्यू.ए.**

# QUALITY ASSURANCE POLICY

# And

# CHECKLIST

# For

# E&M SERVICES



**DIVAKAR GARG**
**Director General**

सत्यमेव जयते
भारत सरकार
Government of India

CPWD
केन्द्रीय लोक निर्माण विभाग
निर्माण भवन, नई दिल्ली – 110011
Central Public Works Department
Nirman Bhawan, New Delhi-110011
Tel. : 23062556/1317, Fax : 23061884
E-mail : cpwd_dgw@nic.in

## FOREWORD

The Government has put great emphasis on economic development, good governance, transformation of the construction and property industries & transparency in public works to make high quality immovable assets. It requires stringent process of quality assurance so that high quality built environment can be made. The concept of third party quality assurance (TLQA) of works has therefore come in forefront where works will be inspected by third party to ensure the quality in the public works. The need of comprehensive quality plan for E&M works to be documented there after arises to ensure the quality in works as well as for monitoring of quality by third party. By technological upgradation, the complexity of the E&M services increased in built environment vis-à-vis man power available at site for execution of works due to which systematic process of quality assurance will help to achieve the desired results.

It will facilitate to field staff for the process to be followed to ensure the quality in E&M works and will also help TPQA to check whether the requisite processes were followed during execution of works to achieve the desired quality. This document consist of 8 chapters such as General guidelines for Quality assurance, Quality Assurance plans for each services ,Testing plans & checklist for TPQA. This book is the crisp document/ready reckoner which gives the detailed information to the field staff what needs to be tested, frequency of testing & the relevant BIS codes to ensure the quality & to keep check on the duplicate and non standard materials not to be used in the buildings. The wide experience of the officers of the committee has helped to formalize this document.

I acknowledge the hard work put in by Sh. S.K.Chawla, Chief Engineer(E),PEWZ, Sh. C. K. Varma, CE(E)CSQ & Sh.C.S.Mittal SE(E) SCEPC under the guidance of Sh. Mukesh Vij ADG(TD) without which the creation of this document would not have been possible. I also acknowledge the valuable suggestions given by Field officers.

I am sure that this document "Quality Assurance Policy For E&M Services" will be useful to all concerned Engineers of CPWD as well as to many other engineering organizations of Central /State Governments, practicing architects, PMC firms and E&M consultants.

**Divakar Garg**
**Director General, CPWD,**

**Place: New Delhi.**
**Dated: March' 2016**



MUKESH VIJ
Additional Director General(TD)

सत्यमेव जयते
भारत सरकार
Government of India

CPWD
Government of India
Central Public Works Department
Additional Director General (TD)
Nirman Bhawan, New Delhi – 110011
Tel. : 23063389, Fax: 23061608
Email : adgtd@nic.in

## PREFACE

Central Public Works Department is executing works of buildings having all the latest services and equipments of Electrical and Mechanical which requires great precision to achieve the desired result. Therefore efforts are made to prepare a comprehensive document of quality assurance policy for E&M services to ensure the quality in E&M works.

**The highlights of this book are :-**

- Quality Assurance Plans for Internal Electrification, Sub-Station, Air Conditioning Systems, Fire Fighting, Fire Alarm, DG Set, Lifts, Street / Compound Lighting and Other Services.
- Each QA Plan consist the broader activities to be done to ensure the quality in E&M Works.
- It includes testing plan for Internal electrification, street/ compound lighting, Sub-Station, DG Set, UPS, Air Conditioning and Fire Fighting.
- Each testing plan give the brief details of frequency of testing and confirmation to which IS Standards.
- Detailed check list for TPQA.

I am grateful to Shri Divakar Garg, DG, CPWD for reposing trust in me to undertake this work. I also express my deep appreciation to Shri S.K. Chawla, CE (E), Shri C.K. Varma CE (E), Shri C.S. Mittal SE (E), Shri D.K. Tulani SE (E) & Shri S.S. Garg SE (E) for preparing quality assurance plan for E&M services.

I complement Shri Omveer Gaur EE(E) & Shri Bhupender Kishore AE(E) who made their sincere efforts to publish this document.

Errors or omissions, and suggestions for improvement, if any, may kindly be brought to the notice of the Superintending Engineer (E) TLQA, Office of the Chief Engineer CSQ (E), CPWD, New Delhi.

**Place : New Delhi**
**Dated: Jan., 2016**

**(Mukesh Vij)**
**Additional Director General (TD)**

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## Chapter 1

## INTRODUCTION

- CPWD decided to adopt 3rd Party Quality Control (TPQA) process in all projects of CPWD costing 5 Crores and above vide OM No. CE CSQ/ SE(QA)/ G-3/ 651 dated 01.01.2015.

- As per the above OM, following 3rd Party Quality Control (TPQA) process are to be followed :-

  i) Social Audit of the projects is to be done by groups of students of nearby reputed Engineering College. These groups will conduct the audit and submit their report which will be uploaded on the CPWD website.

  ii) Comprehensive Technical Audit will be conducted by a group of professors of nearby NIT/IIT or by Professional Bodies like CBRI, CRRI for all the projects above Rs. 5 Crores. The report of this Audit will also be uploaded on the CPWD website.

  iii) TPQA as per para (ii) above shall be engage to check the work during execution for the following purposes.

  a. To ensure that the site is equipped with necessary documents like agreement, CPWD Specification, BIS Codes, Guard file containing inspection reports, list of approved manufacturers, tools for checking quality of work & testing facilities.

  b. To ensure that site records like inspection register, cement register, test register & site order book etc. are being maintained in prescribed forms and under continuous watch of higher officers.

  c. To ensure specific control on various process of execution by controlling various factors such as testing of material & developing check list of important items of work.

  d. Inspection of work during execution for two factors.

  i. Material aspect – Quality & Testing of materials keeping in view the requirement of contract specifications, BIS marked/ CPWD approved products. The agency shall conduct independently at least 10% tests of the total tests as required as per mandatory tests/ contract specifications/ BIS/ IRC/ MORTH requirements.

  ii. Workmanship aspects – to ensure execution of work with sound engineering practice and lay down procedures.

- A draft proforma was prepared for TPQA check list for E&M services and circulated in the department through website for comments of field officers vide OM No. 51(4)/ CE(E)CSQ/ 2015/ 153 dated 21.05.2015.

- CPWD having 8 nos. General Specifications for Electrical Works where the process of execution, testing and commissioning, material specifications, relevant BIS and Codes are documented. However there is no specific mention about the sample size & frequency of testing and methods. It was also felt that the policy for quality control process for E&M Works to be documented for the convenience of field staff and TPQA to ensure the uniformity in works throughout India.

- A committee was constituted by ADG(TD) for preparing Policy for Quality Control Process and Finalizing check list for TPQA for E&M Works in CPWD vide OM no. 54(4)CE CSQ(E)/ 2015/ 156 Dated 22.05.2015.

- The constitution of the Committee is as under:-

| | | |
|---|---|---|
| 1. | Sh. S.K. Chawla, CE (E) PEWZ. | Chairman |
| 2. | Sh. C.K. Varma, CE CSQ (E). | Member |
| 3. | Sh. C.S. Mittal, SE (E) Supreme Court PEC. | Member |
| 4. | Sh. D.K. Tulani, SE (E) TAS. | Member |
| 5. | Sh. S.S. Garg, SE (E) TLQA. | Member –Secretary. |

- The committee members prepared the draft documents, exchanged through e-mails, received suggestions & comments from field formations, and met on 03.06.2015, 15.07.2015 and 27.07.2015 for deliberating and preparing the report.

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Chapter 2

# DEFINITION OF QUALITY ASSURANCE

**Mission Statement of CPWD about QA:-**

The Quality Assurance activity, in order to be truly effective has to ensure a progressively improved and uniform quality of the finished work. Experience gained over years indicate that "Process Control" is essential in building construction to ensure that the work in different phases is executed in a manner pre-determined and laid down in specifications. In order to achieve the above, the pre-requisites cover among other things, an inbuilt provision in the contract for a system of continuous check on quality by the field staff and the contractor for ensuring quality of work; availability of adequately manned and equipped agency for overseeing the quality aspects, and periodical appraisal of quality and a system of feedback for effecting possible improvements.

**Quality Definition:-**

Quality is the totality of features and characteristics of a product for service that bears on its ability to satisfy the projects functional requirements. The quality of output is always agreed upon between the supplier and the client (In project works, Contractor and the Department, respectively), and the quality objective is to achieve zero defects with best quality of the project works. This is possible only by ensuring quality control at every stage during progress of construction. Quality is conformity to standards and requirements to achieve excellence. The following are some definitions pertaining to quality and how to achieve it.

**Quality control (QC):-**
The operational techniques, or a system of maintaining standards by reviewing, checking, inspecting and testing.

**Quality Assurance (QA):-**
The planned and systematic actions, and implementations necessary to provide adequate confidence that the work will satisfy quality requirements.

**Quality System (QS):-**
A set of documented processes, which seek to provide satisfaction that the project outputs will fulfill all the requirements for which it is being planned. The Quality System should fully incorporate the organization, human resources, materials, equipments, processes, inspections, testing and other parameters of the project. A key element of QS is the QA/ QC Manual.

**Quality Surveillance:-**
This normally covers two aspects. At the project level, a review is required to ensure that the quality practices are implemented and documented to ensure in relation to the quality system. At the contract package level, inspection and testing is required to ensure that the works executed meet the required quality standards.

**QA/QC Manual:-**

This QA/ QC Manual focuses on the implementation activities of the project, following award of contract, primarily on supervision and quality control of construction works of E&M Services. The QA/ QC Manual is intended to be used as guide line for supervision of construction activities, primarily by the field staff of the CPWD and the Engineers of contractors. It will provide a base outline towards, procedure, responsibilities, compliance acceptance criteria and documentation for carrying out inspection, testing and reporting on various materials, items involved for the satisfactory execution of the project work. In all cases, somehow, it is most important to understand that the technical specifications as specified in the contract document/ agreement are the guidelines for any construction activity. The QA/ QC Manual for the Construction activity does not attempt to suggest technical specifications, since these are stated in the contract documents. Its aim is to ensure that the works are executed as per specifications to achieve best results. Test results shall be interpreted as applicable for individual package, in accordance with the technical specifications as specified in the conditions of contract.

This Quality Assurance/ Quality Control Manual is prepared for the use of CPWD Engineers. It is based on Various Quality Assurance practices, CPWD specifications, requirement of the tender document for test of materials, Field/ laboratory testing and relevant Indian Standard, codes. This will provide a base document outlining policy, procedure, responsibilities, compliance acceptance criteria and documentation for carrying out tasks related to inspection, testing and reporting on various materials, items involved for the satisfactory completion of the work. In all cases however, it is important to understand that the contract documents including the technical specifications are the basis for execution of the construction. Quality Assurance Quality Control (QA/ QC) Manual provides a guide lines for supervision of construction project. A QA/ QC Manual establishes a standard guideline for enabling supervisory staff to check different activities of construction in respect of technical specifications. Quality assurance plan serve as a road map to supervisory staff to ensure quality of project works.

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Chapter 3

# GENERAL GUIDELINES FOR QUALITY ASSURANCE

i) This policy is meant for guidance of the field officers.

ii) These guidelines are general in nature for guidance of field staff so that quality can be ensured at the execution stage and works to be executed as per contract conditions and CPWD General Specification for Electrical Works.

iii) All the materials, equipments and work shall conform to the Agreement.

iv) Makes of all the material and equipments etc. shall be strictly as per agreement.

v) The model numbers of various equipments and work approved by Engineer-in-charge shall be checked for their conformity to the agreement.

vi) The technical data sheet and manufacturing drawing for all equipments and materials as per contract specifications shall be prepared by the respective manufacturer's and will be submitted by contractor dully signed before placing the order or manufacturing the material. The engineer-in-charge shall approve as per contract conditions.

vii) The NIT approving authority shall define the quality assurance plan explicitly in the tender document including lot size for bringing the material at site. The cost of the tests including TPQA charges shall not be more than 1% of the total cost of the contract.

viii) Generally total quantity of any item in the contract shall be supplied in not more than four lots. However engineer-in-charge can decide number of lots in which quantities to be supplied as per site requirements.

ix) The materials shall be tested from 3rd party laboratories. The laboratories shall preferably be Government Labs/ Government Autonomous bodies or as approved by competent authority.

x) The testing at manufacturer's works shall be clearly specified in the tender documents.

xi) For the tests to be conducted at manufacture's works, the tests shall be conducted in the presence of engineer-in-charge or his authorized representative. The dispatch note shall be issued only after satisfactory completion of the test.

xii) The layout/ working drawings/ shop drawings etc., shall be prepared in AutoCAD or equivalent software by the contractor for all the services as defined in CPWD Specifications and agreement conditions. The engineer-in-charge shall approve all the drawings before start of execution of work. All the drawings of various equipments and works approved by Engineer –in-charge shall be checked for their conformity to the agreement.

xiii) The QA guidelines for various packages are as detailed in Chapter 4.

xiv) The delivery challans of the materials may be checked for ascertaining the genuineness of the material.

xv) The QA plan/ testing etc. for the other works, if required, shall be decided by Engineer-in-charge to ensure quality of materials, equipments and work etc. as per Agreement.

xvi) Testing plan in chapter 5 with policy is for guidance, and can be suitably amended by NIT approving authority.

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Chapter 4

# QUALITY ASSURANCE PLANS

## 1. Internal E.I.

a) The detailed instructions on safety procedures given in BIS code no. 5216:1982 " Code of safety Procedures and Practices in Electrical works" shall be strictly followed.

b) Safety procedures given in Chapter 10 of CPWD General Specifications for Electrical works Part-1(Internal) shall be followed.

c) Safety recommendation as per IE rules 1956 as per Appendix "C".

d) The materials shall be tested from 3rd Party laboratories are conduit, wires, cables etc.

e) Provisions and fixing of check-nuts for conduit work as per CPWD Specifications.

f) No. of wires in one conduit shall be ensure as per CPWD Specifications.

g) Colour coding of wires to be ensure.

h) Lugs and thimbles at cable/ wire ends in switch boxes as per CPWD Specifications.

i) Leveling of switch boxes shall be ensured.

j) Termination of earth terminals in earth pits, switch box, DBs and accessories to be ensured. Earth chamber to be constructed and proper marking to be done.

k) A comprehensive schematic diagram is prepared starting from the main board up to the final DBs. All such boards are duly marked and numbered.

l) The pre commissioning testing of the installation shall be carried out such as
   i) Insulation resistance test.
   ii) Polarity test of switch.
   iii) Earth continuity test.
   iv) Earth electrode resistance test.

m) All the tests at site shall be carried out for the completed installations, in the presence of and to the satisfaction of the Engineer in Charge by the contractor. All the test results shall be recorded and submitted to the Department.

n) On completion of an electrical installation (or an extension to an installation), a certificate shall be furnished by the electrical contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as given in Appendix "E" of CPWD General Specifications for Electrical works Part-1(Internal) in addition to the test certificate required by the local electric supply authorities.

2. **Sub-Station:-**

**a) H.T. Panel:-**

i) HT panel shall be inspected and tested at manufacturer's works as per relevant BIS especially for insulation, operating mechanism, interlocking and contact resistance.

ii) CT ratio and accuracy class shall be checked as per agreement and IS 2705-1992.

iii) Pre Commissioning tests:-

a) Relay calibration and setting tests by both secondary injection method and primary injection methods.
b) Operation checks and lubrication of all moving parts.
c) Interlock function checks.
d) Continuity checks of wiring, fuses etc. as required.
e) Insulation test.
f) Trip test and protection gear tests.
g) Complete panel shall be tested with meggar of voltage for which the panel is rated for insulation between poles and poles to earth. For of CTs and PTs secondary side insulation shall also be tested using meggar of voltage for which it is rated.
h) Any other test as may be required by the License/ inspector shall be conducted.
i) Where specified, the entire switch board shall withstand high voltage test after installation.

**b) Transformer:-**

**i) Pre-dispatch tests at manufacturer's works-**

a) The inspecting officers shall ensure all requisite accessories as per agreement have been provided on the transformers.
b) Test report for explosion vent or pressure relief device shall be taken from the manufacturers.
c) Rating and diagram plate at appropriate location shall be ensured.
d) Functioning of Buchholtz relay shall be checked where it was provided.
e) Transformers shall be inspected and tested at manufacturers works for all routine and other tests prescribed by IS:2026/ IS 11171:1985(whichever applicable), with particular attention to losses meeting ECBC norms given in CPWD Specifications.
f) Type test certificate for exact same design for impulse withstand and short circuit withstand.
g) Temperature rise test of one transformer of each design and capacity shall be done.
h) Copies of the certificate for pressure test, test for bushings shall be supplied to the department.

**ii) Tests at site:-**

All relevant pre commissioning checks and tests confirming to IS code of practice no.10028 (Part II & III) shall be done before energisation. The following tests are to be particularly done before cable jointing or connecting the busbar trunking:-

a. Insulation test between HV to earth and HV to MV.
b. Insulation test between MV to earth.
c. Dielectric strength test on oil.
d. Buchholtz relay operation by simulation tests when fitted.

**iii)** All tests are to be recorded and report should be submitted to the department.

**C ) MV Panel:**

**i) Drawings Stage:-**

Type test certificates to be submitted at the stage of drawing submission/ technical submittal for following:-

a) Verification of degree of protection.
b) Verification of Temperature rise limits.
c) Verification of short circuit strength.

**ii) Test at Manufacturer's Works:** All routine test shall be carried out and test certificates produced to the department. The following tests in particular shall be carried out:

a. Checking of bus bar & its supports for material, dimension and spacing, enclosure size of bus bar chamber etc. w.r.t. the report of independent lab for successful fault withstand test for the specified capacity and time in contract.
b. Metal sheet thickness.
c. Ratings of switchgear and accessories.
d. Compartmentalization of panel

e. Proper earth connection facility as per specifications.
f. Bus bar rating, colour coding and material quality.
g. Insulators and insulating/ shroud sheets of proper quality.
h. Insulation test.
i. Earth test.
j. High Voltage test.
k. Test for proper operation of interlocking as per design.
l. Trip/ operation test of switchgear by secondary injection.
m. Dimensional checking as per approved GA drawing.
n. Phase to Phase & Phase to Earth clearances between links & the nuts & bolts on the links.
o. Visual inspection of paint quality & shade.

iii) **Tests at site:-**

a) All wiring checks and connections.
b) Relay adjustments/ setting.
c) Operation checks and lubrication of all moving parts.
d) Interlock function checks.
e) Continuity checks of wiring, fuses etc. as required.
f) Insulation tests: when measured with 500V meggar insulation resistance shall not be less than 100MOhms.

**IV) Bus Trunking:-**

**a) Drawings Stage:-**

Type test certificates to be submitted at the stage of drawing submission/ technical submittal for following:-

i. Degree of protection.
ii. Temperature rise limits.
iii. Short circuit withstand capacity.
iv. Dielectric Strength.

**b) Test at manufacturer's works:-**

All routine tests shall be carried out and test certificates produced to the department. The following tests in particular shall be carried out:

i. Checking of bus bar & its supports for material, dimension and spacing, enclosure size of bus bar chamber etc. w.r.t. the report of independent lab for successful fault withstand test for the specified capacity and time in contract.
ii. Metal sheet thickness.
iii. Ratings of switchgear and accessories.
iv. Proper earth connection facility as per specifications.
v. Bus bar rating , colour coding and material quality.

vi. Insulators and insulating sheets of proper quality.
vii. Insulation test.
viii. Earth test.
ix. High Voltage test.
x. Dimensional checking as per approved GA drawing.

**c) Pre Commissioning Tests:**

i. Verification of insulation resistance.
ii. Inspection of assemblies, interlocks, locks etc.
iii. Check on wiring if provided.
iv. Dielectric test.

V) **Earthing:-**

a) Earthing materials w.r.t. weight and size shall be checked at site.
b) Termination of earth terminals in earth pits, switch box, DBs and accessories to be ensured. Earth chamber to be constructed and proper marking to be done.
c) Earth electrode resistance to be tested and recorded.
d) Earth continuity.

VI) **Cabling:-**

a) Cable to be tested from 3rd party lab for meeting the relevant BIS and CPWD Specifications.
b) The cable drums shall be stored properly to avoid damages.
c) The cable route drawing shall be approved by Engineer-in-charge.
d) Laying of cable including bends as per CPWD Specifications and necessary protection shall be provided as per agreement.
e) The cable shall be tested for continuity and insulation resistance before laying as well as before covering.
f) Extra loop cable shall be provided on each terminal end of the cable and joints.
g) Suitable protection shall be provided for road crossing and cable entry to the building.
h) Route marker shall be installed.
i) Lugs and thimbles at cable/ wire ends in panels as per CPWD Specifications.
j) Cables shall be tested after laying as per CPWD Specifications.
k) Cables laid on cable trays to be provided with suitable marker tags for cable identification.

VII) **Cable Tray:-**

a) Material to be tested in 3rd party laboratories.
b) Visual inspection for dimensions & perforation area shall be done.
c) Fastener & rods of adequate size and strength.
d) Factory fabricated bends, reducer, tee/cross junctions shall be provided.
e) Cable tray shall be earthed at both ends.
f) Proper painting to be ensured.

VIII) Pre commissioning test such as phase sequence test, polarity test, Hi-pot test and earth resistance test.

IX) Setting of relays, timers, meters, interlocking (mechanical & electrical) etc., selection of tap of CTs in HT & LT Panels as required.

X) The line diagram including schematic scheme and operation logics will be made and displayed in Sub-Station as well as control room.

XI) Shock treatment chart & safety equipment, insulating mats, etc. to be appropriately placed.

**3. Air Conditioning System:-**

a) **Chilling unit (Chiller):-**

i) In case the chiller model is approved after the award of work, the chiller model selection sheet shall be got verified.

ii) One chilling unit of each capacity shall be tested for its capacity as well as IKW/TR at full load and IPLV etc. at contracted parameters at AHRI certified test bed.

b) **AHUs :-** It shall be tested at manufacturers works as per CPWD General Specification for Electrical Works. The factory test of fans w.r.t. Db level, static pressure, CFM and leaving velocity shall be done at manufacturers works. The capacity test of one AHU in lot of 20 units irrespective of capacity shall be done. Engineer in charge shall choose the capacity of AHUs to be tested.

c) MS Pipes shall be tested in respect of thickness and weight at site with respect to relevant BIS standards.

d) Pressure testing of pipes for 1.5 times of working pressure as per CPWD Specifications.

e) Ducting material shall be tested at 3rd Party Laboratories as per relevant BIS. Leakage test in the duct shall be done as per relevant standards.

f) Thermal insulation materials shall be got tested at 3rd Party Laboratories as per specifications mentioned in tender particularly for density and K value.

g) Inspection and testing of LT Panel shall be done as per given in Substation section.

h) Inspection and testing of Bus Trunking shall be done as per given in Substation section.

i) Cables shall be tested as per given in Substation section.

j) Earthing shall be tested as per given in Substation section.

k) Pre commissioning test such as insulation, earth continuity, Valve adjustments etc. shall be done.

l) Post Commissioning tests such as air outlet velocity at grills, capacity test of all the major equipments such as chilling units, cooling towers, AHUs etc. during main season shall be done.

m) Testing of inside condition at various locations achieved as defined in design conditions.

n) Display of schematic with operation logic in AC plant room as well as control room.

4. **Fire Fighting :-**

a) Pipes shall be tested for thickness and weight as per Specifications and tender conditions.

b) Pressure testing of the pipes shall be done as per relevant CPWD General Specification for Electrical Works after installation, welding etc. before commissioning of the system at 1.5 times the working pressure.

c) Cable, LT Panel & Earthing shall be tested as given in Substation section.

d) The auto operation of all pumps shall be tested as per the designed sequence and at required pressure drop.

e) Fire conditions to be simulated and temperature of actuation of sprinkler to recorded.

f) Checks for required Audio video signal as per agreement.

g) The line diagram including schematic and operation logics will be made and displayed in Fire pump room as well as control room.

5. **Fire Alarms:-**

a) Wires as per Section on EI.

b) **Pre commissioning tests:-**
i) Insulation tests.
ii) Fire Alarm Activation and Zone identification on Fire Alarm panel and PC at Fire control room.
iii) On activation, PA System to be tested for annunciation at all Zones and individual zone as defined.
iv) Testing of talk back system for operation and clear communication with fire control rooms.

6. **DG Sets:-**

a) Load testing of DG Set at factory and site shall be done as per relevant CPWD General Specification for Electrical Works.

b) AMF/ Synchronizing panel shall be inspected and tested at manufacturer's works as per MV Panel given in the Sub-Station section.

c) Workmanship of Pipe insulation, length and height of exhaust pipe and silencer type and its certificate as per agreement.

7. **Lifts :-**

a) Controller simulation test at manufacturers works.

b) General inspection as per CPWD Specifications.

c) Post installation testing as per CPWD Specifications.

8. **Street/ Compound Lighting:-**

i) Proper alignment of poles to be ensured.

ii) Cables to be laid as per CPWD Specifications.

iii) Makes and models of poles/ luminary shall confirm to technical specifications etc. as per agreement.

iv) Photometry test of each type of luminary shall be conducted at manufacturer's works.

v) Cables, Feeder Pillar & Earthing shall be done as per sub-station section.

vi) Display of Schematic in control room as well as feeder pillars includes operations and logics etc.

vii) Poles shall be tested at manufacturer's works for the following tests:-

a) Tensile test,
b) Deflection test,
c) Permanent set test,
d) Drop test.
e) Visual inspection for dimensional check & finish.

9. **Other Services:-**

NIT approving authority shall prepare the quality assurance plan for the remaining services and make it part of NIT for strict compliance during execution of work.

_____X____X____X_____

Chapter 5

# TESTING PLANS

The testing plan for quality control for major E&M services is attached as annexure II. These plans are to be read along with following guiding notes:-

1. Lot size sample test and methods etc. prescribed in quality plan are only suggestive in nature. NIT approving shall modified the same to suit the specific requirement of their work and prescribed in the tender accordingly.

2. Whenever items are imported, test shall not be witnessed by the site engineer, this fact shall be especially brought into the NIT.

3. To eliminate the possibility of receiving outdated/ old material/ refurbished equipment at site, it should be mentioned in NIT that the material supply against the contract shall be not older more than 6 months from date of receipt at site.

4. To procure the genuine material from suppliers/ authorized dealer etc shall be the responsibility of contractor who shall preserve copies of invoice/ excise gate pass/ proof of dispatch. And the same shall be made available for especially to engineer-in-charge for examination/ scrutiny/ verification as deemed fit by him.

5. As per guideline only routine test as prescribed in IS/ CPWD specifications shall be carried at manufacture works/ third party labs. Type test/ special test/ optional test shall be carried out only if stipulated in Bid Document/ Contract.

6. All items to be used and workmanship shall be thoroughly checked physically and for their performance as per agreement.

7. Test plan annexed with policy is meant for guidance and can be suitably amended by NIT approving authority.

_____X___X___X_____

**A- Internal EI**

| Stage /Sl no | Material / Process | Standard Applicable/ Test Required to be Done | Total Qty ( each type) reqd. in agreement or lot size whichever is less | Whether Proof of Dispatch required | Whether Manufacturer's test certificates required | Sample Size | Location of Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | At manufacturer works | At third Party Lab. |
| 1 | LT Panels with ACB | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Any | Y | Y | 100% | Y | N |
| 2 | LT Panels with incomer of more than 200 A | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Up to 2 | Y | Y | 0 | N | N |
| | | | >2 and < 10 | Y | Y | 1 | Y | N |
| | | | >10 | Y | Y | 2 | Y | N |
| 3 | Rising Main and Bus Trunking | CPWD specs part IV/QA Plan | Length upto 500 mtr | Y | Y | 10% length and fittings | N | N |
| | | | Length > 500 mtr | Y | Y | 10% length and fittings | Y | N |
| 4 | Rigid MS Conduit | IS 9537 Pt I &2 | up to 2500 mtr | Y | N | N | N | N |
| | | | >2500 mtr | Y | Y | 1 piece of 1 mtr for every 1000 mtr | N | Y |

| Stage /Sl no | Material / Process | Standard Applicable/ Test Required to be Done | Total Qty ( each type) reqd. in agreement or lot size whichever is less | Whether Proof of Dispatch required | Whether Manufacturer's test certificates required | Sample Size | Location of Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | At manufacturer works | At third Party Lab. |
| 5 | Rigid PVC Conduit | IS 3419 :1989 | up to 2500 mtr | Y | N | N | N | N |
| | | | >2500 mtr | Y | Y | 1 piece of 1 mtr for every 1000 mtr | N | Y |
| 6 | Cable Tray | CPWD Spec. Part-I/II: Check for perforation area, paint/Galvanising thickness and Material Composition | Length upto 500 mtr | Y | Y | N | N | N |
| | | | Length > 500 mtr | Y | Y | One piece for every 500 Mtr | N | Y |
| 7 | DWC/ Corrugated HDPE Pipe | IS 14930 , Check for thickness, material, Mechanical Strength and smoothness | Length upto 500 mtr | Y | N | N | N | N |
| | | | Length > 500 mtr | Y | Y | One piece for every 500 Mtr | N | Y |
| 8 | Wire | IS 694:1990 | up to 10000 mtr | Y | N | N | N | N |
| | | | >10000 mtr | Y | Y | 1 piece for every 10000 mtr or less | N | Y |

Y Stands Yes
N Stands No/Not applicable

_____X___X___X_____

## B- Street /Compound Lighting

| Stage /Sl no | Material / Process | Standard Applicable/ Test Required to be Done | Total Qty ( each type) reqd. in agreement or lot size whichever is less | Whether Proof of Dispatch required | Whether Manufacturer's test certificates required | Sample Size | Location of Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | At manufacture works | At third Party Lab. |
| 1 | LT Panels with ACB | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Any | Y | Y | 100% | Y | N |
| 2 | LT Panels with incomer of more than 200 A | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Up to 2 | Y | Y | 0 | N | N |
| | | | >2 and < 10 | Y | Y | 1 | Y | N |
| | | | >10 | Y | Y | 2 | Y | N |
| 3 | Poles | Whether in conformity with tender specs | up to 100 | Y | Y | N | N | N |
| | | | >100 | Y | Y | 2% | Y | N |
| 4 | LT Cable | IS 1554 Part 1 | up to 2500 mtr | Y | N | N | N | N |
| | | | >2500 mtr | Y | Y | 1 piece for every 2500 mtr | N | Y |
| 5 | DWC/ Corrugated HDPE Pipe | IS 14930 , Check for thickness, material, Mechanical Strength and smoothness | Length upto 500 mtr | Y | N | N | N | N |
| | | | Length > 500 mtr | Y | Y | One piece for every 500 Mtr | N | Y |
| 6 | Fittings | Whether in conformity with tender specs | >100 | Y | Y | NA | N | N |

## C- Sub Station, DG Set, UPS

| Stage /Sl no | Material / Process | Standard Applicable/ Test Required to be Done | Total Qty ( each type) reqd. in agreement or lot size whichever is less | Whether Proof of Dispatch required | Whether Manufacturer's test certificates required | Sample Size | Location of Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | At manufacture works | At third Party Lab |
| 1 | HT Panel | CPWD specs part IV/QA Plan: CT ratio and accuracy Class should be invariably checked | Any | Y | Y | 1 | Y | N |
| 2 | HT Panel: metering and protection devices | Check CT ratio and accuracy Class , Relays and Meters | Any | Y | Y | 1 | Y | N |
| 3 | LT Panels with ACB | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Any | Y | Y | 1 | Y | N |
| 4 | LT Panels with incomer of more than 200 A | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Up to 2 | Y | Y | 0 | N | N |
| | | | >2 and < 10 | Y | Y | 1 | Y | N |
| | | | >10 | Y | Y | 2 | Y | N |
| 5 | Capacitor Panel | CPWD specs part IV/QA Plan: Check for type of capacitors used, operation of relay, settings. Change the load and its type and check functionality | Any | Y | Y | 1 | Y | N |
| 6 | Rising Main and Bus Trunking | CPWD specs part IV/QA Plan. | Length upto 500 mtr | Y | Y | 10% length and fittings | N | N |
| | | | Length > 500 mtr | Y | Y | 10% length and fittings | Y | N |

| Stage /Sl no | Material / Process | Standard Applicable/ Test Required to be Done | Total Qty ( each type) reqd. in agreement or lot size whichever is less | Whether Proof of Dispatch required | Whether Manufacturer's test certificates required | Sample Size | Location of Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | At manufacture works | At third Party Lab |
| 7 | Cable Tray | CPWD Specs. Part I/II: Check for perforation area, paint/Galvanising thickness and Material Composition | Length upto 500 mtr | Y | Y | N | N | N |
| | | | Length > 500 mtr | Y | Y | One piece for every 500 Mtr | N | Y |
| 8 | DWC/ Corrugated HDPE Pipe | IS 14930 , Check for thickness, material, Mechanical Strength and smoothness | Length upto 500 mtr | Y | N | N | N | N |
| | | | Length > 500 mtr | Y | Y | One piece for every 500 Mtr | N | Y |
| 9 | Transformer | CPWD Specs. Part IV/QA Plan: Physical verification of accessories as per agreement and Routine tests as per IS:2026/IS 11171:1985(whichever applicable), with particular attention to losses meeting ECBC norms / as per agreement,<br>Type test certificate for exact same design for impulse withstand and short circuit withstand shall be made available by Manufacturer ,<br>Temperature rise test of one transformer of each design shall be done. Copies of the certificate for pressure test,test for bushings shall be supplied to the department. | Any | Y | Y | 100% | Y | N |

| Stage /Sl no | Material / Process | Standard Applicable/ Test Required to be Done | Total Qty ( each type) reqd. in agreement or lot size whichever is less | Whether Proof of Dispatch required | Whether Manufacturer's test certificates required | Sample Size | Location of Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | At manufacture works | At third Party Lab |
| 10 | DG set | Load testing as per CPWD specs | Any | Y | Y | 100% | Y | N |
| 11 | UPS | Load testing and operation logic as per CPWD specs , Check for input and output power quality as per agreement | Any | Y | Y | 100% | Y | N |
| 12 | HT Cable | IS 1554 Part II | Up to 500 mtr. | Y | Y | 1 | N | N |
| | | | >500 mtr | Y | Y | 1 Piece for every 500 mtr | N | Y |
| 13 | LT Cable | IS 1554 Part I | up to 2500 mtr | Y | N | N | N | N |
| | | | >2500 mtr | Y | Y | 1 piece for every 2500 mtr | N | Y |

Y Stands Yes

N Stands No/Not applicable

_____X____X____X_____

## D- Air Conditioning

| Stage /Sl no | Material / Process | Standard Applicable/ Test Required to be Done | Total Qty ( each type) reqd. in agreement or lot size whichever is less | Whether Proof of Dispatch required | Whether Manufacturer's test certificates required | Sample Size | Location of Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | At manufacturer works | At third Party Lab. |
| 1 | Chiller | CPWD specs part VI/ECBC Code/Agreement/QA Plan: COP, Capacity, IKW/TR, IPLV/ NPLV | Any | Y | Y | 1 | Y* | N |
| 2 | Package AC Unit | CPWD specs part VI/ECBC Code/Agreement/QA Plan: COP, Capacity, IKW/TR | Any | Y | Y | 1 | Y* | N |
| 3 | Split/WT AC | As per tender specs. and BEE ratings. | upto 50 | Y | Y | NA | N | N |
| | | | >50 | Y | Y | 1 for every 50 | Y* | N |
| 4 | Pumps | As per tender specs. | Any capacity | Y | Y | 100% | N | N |
| 5 | MS Pipes | To be tested for thickness and weight as per applicable IS | Any | Y | Y | 1 for every 100 mtr | N | N |
| 6 | Insulation / Acoustics material | To be tested for Density and K value as per tender specs. | up to 1000 Sq mtr | Y | Y | NA | N | N |
| | | | >1000 Sqmtr | Y | Y | 1 Sample for every 1000 Sqmtr | N | Y |
| 7 | Fans for AHU ,Ventilation and Pressurization | CPWD specs. part VI/QA Plan: Fans to be tested for Db level, static pressure, CFM and leaving velocity | up to 20 fans | Y | Y | NA | N | N |
| | | | >20 fans | Y | Y | 1 for every 20 fans | Y | N |
| 8 | AHU's | CPWD specs. part VI/QA Plan: To be tested for capacity in assembled condition, Fabrication, Cooling coil and filters material & workmanship to be inspected critically. | up to 20 AHU's | Y | Y | NA | N | N |
| | | | >20 | Y | Y | 1 for every 20 AHU's | Y | N |

| Stage /Sl no | Material / Process | Standard Applicable/ Test Required to be Done | Total Qty ( each type) reqd. in agreement or lot size whichever is less | Whether Proof of Dispatch required | Whether Manufacturer's test certificates required | Sample Size | Location of Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | At manufacturer works | At third Party Lab. |
| 9 | Ducting material | As per relevant BIS | up to 1000 Sq mtr | N | N | NA | N | N |
| | | | > 1000 Sq mtr | Y | Y | 1 Sample for every 1000 Sqmtr | N | Y |
| 10 | Valves | Flow and controls as per data sheet | up to 20 | Y | N | NA | N | N |
| | | | >20 | Y | Y | 1 for every 20 | N | Y |
| 11 | LT Panels with ACB | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Any | Y | Y | 1 | Y | N |
| 12 | LT Panels with incomer of more than 200 A | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Up to 2 | Y | Y | 0 | N | N |
| | | | >2 and < 10 | Y | Y | 1 | Y | N |
| | | | >10 | Y | Y | 2 | Y | N |
| 13 | Cable Tray | CPWD Specs. Part I/II: Check for perforation area, paint/Galvanising thickness and Material Composition | Length upto 500 mtr | Y | Y | N | N | N |
| | | | Length > 500 mtr | Y | Y | One **piece** for every 500 Mtr | N | Y |
| | Y* Tested for its capacity at AHRI certified test bed (either at manufacturer's work or at IIIrd Party) | | | | | | | |

_____X____X____X_____

# E- Fire Fighting

| Stage /Sl no | Material / Process | Standard Applicable/ Test Required to be Done | Total Qty ( Each type) reqd. in agreement or lot size whichever is less | Whether Proof of Dispatch required | Whether Manufacturer's test certificates required | Sample Size | Location of Test | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | At manufacturer works | At third Party Lab. |
| **i. Before dispatch of material at factory or before use at site** | | | | | | | | |
| 1 | Pumps | As per tender specs. | Any capacity | Y | Y | 100% | N | N |
| 2 | MS Pipes | To be tested for thickness and weight as per applicable IS | Any | Y | Y | 1 for every 100 mtr | N | N |
| 3 | Valves | Flow and controls as per data sheet | up to 20 | Y | N | NA | N | N |
| | | | >20 | Y | Y | 1 for every 20 | N | Y |
| 4 | LT Panels with ACB | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Any | Y | Y | 1 | Y | N |
| 5 | LT Panels with incomer of more than 200 A | CPWD specs. part IV/QA Plan: Construction, Ratings of SWG, air gaps between phases , phase to body ,IP rating, Short Circuit ratings etc. | Up to 2 | Y | Y | 0 | N | N |
| | | | >2 and < 10 | Y | Y | 1 | Y | N |
| | | | >10 | Y | Y | 2 | Y | N |
| 6 | Cable Tray | CPWD Specs. Part I/II: Check for perforation area, paint/Galvanising thickness and Material Composition | Length upto 500 mtr | Y | Y | N | N | |
| | | | Length > 500 mtr | Y | Y | One piece for every 500 Mtr | N | |

Chapter 6

# FUNCTIONS OF TPQA

When a Third Party Quality Assurance agency is engaged, it shall carry out the following functions –

1. TPQA agency shall do their job by field visits, arranging the necessary quality assurance tests for materials and the construction works, analysing the test results and furnishing the comments/ observations thereon and providing general observations on construction materials and work. The TPQA agency shall submit their report to CPWD at various stages/ as and when needed.

2. TPQA agency shall check and report whether work is being executed according to the drawings, designs and specifications of the agreement and in accordance with the approved drawings.

3. The TPQA agency shall be responsible for bringing-out in writing, to the notice of CPWD any instances of deviations from accepted quality of construction materials, workmanship and general quality of works at appropriate stages of construction.

4. TPQA agency shall inspect the construction site during the works under progress frequently, to achieve the stipulated standards of quality in the project. If there is any discrepancy/ error/ omission, the team shall point out the same with suggestions and remedial measures with codal provisions.

5. TPQA agency shall, highlighting the problem area if any, and also suggest steps/ solutions to rectify the same so as to achieve the overall target of quality assurance.

6. TPQA agency shall arrange testing of materials used in construction work for ascertaining their quality through reputed laboratories/ institutions preferably Government testing Centres. All standard tests shall be arranged. TPQA agency shall report the results of testing to CPWD with their suggestions and remedial measures.

_____X____X____X_____

Chapter 7

# CHECKLIST FOR TPQA

The following Checklist for TPQA prepared for quality assurance of E&M works in CPWD as per above quality control process and testing plans.

## CHECK LIST PROFORMA FOR 3RD PARTY TPQA FOR E&M WORKS

| | |
|---|---|
| 1.0 | **Particulars of Work** |
| 1.1 | a) Name of work<br>b) Description of work |
| 1.2 | a) Sub-Division and Name of Assistant Engineer<br>b) Division and Name of Executive Engineer<br>c) Circle and Name of Superintending Engineer<br>d) Zone and Name of Chief Engineer |
| 1.3 | **Agency/ Contractor**<br>a) Name<br>b) Registration Class & Category.<br>c) Details of associate contractors if any for specialized works.<br>d) Whether associate contractors conform to agreement requirements. |
| 1.4 | Agreement No. |
| 1.5 | Stipulated time & date of start |
| 1.6 | Stipulated Date of Completion |
| 1.7 | Extended date of completion |
| 1.8 | Estimated Cost put to tender |
| 1.9 | Accepted tendered cost with overall percentage |
| 1.10 | Percentage progress at the time of inspection via-a-vis expected as per contract and reasons for delay if any. |
| 1.11 | Inspecting officer<br>(Name & Designation ) |
| 1.12 | Officers and contractor present during the inspection<br>(Name & Designation ) |
| 1.13 | Date of Inspection and it's sequential number |
| 2.0 | **Quality Controlling aids** |
| 2.1 | Is site equipped with<br>a) Copy of agreement<br>b) CPWD specifications /along with upto date correction |

| | |
|---|---|
| | c) List of ISI marked / approved materials to be used<br>d) Guard file containing inspection reports of CTE/ QCTA/ AE(QC)/ CE/ SE etc.<br>e) Relevant BIS to check confirmation for acceptance criteria.<br>f) QACW circulars on quality control |
| 2.2 | Whether addresses/ phone nos./emails of various recognized laboratories are available for material testing? |
| 3.0 | **Departmental procedure aspects** |
| 3.1 | Maintenance of inspection register |
| 3.2 | Highlights of Inspection by CE,SE,AE(P) requiring compliance |
| 3.3 | Are test registers maintained in standard forms given in CPWD General Specification for Electrical works. |
| 3.4 | Are test registers reviewed by EE/ SE with dates. |
| 3.5 | Site order book and schedule of defects<br>a) Is site order book properly maintained<br>b) Is the site order book reviewed by EE and SE?<br>(Mention details)<br>c) Have timely notices been issued to the contractor with the schedule of defects/ damages and date of compliance?<br>In case of failure to recently defects /damages whether action under clause 14/17 initiated? |
| 4.0 | **Process control aspects** |
| 4.1 | a) Whether shop drawings/ manufacturer drawings/ technical submittal approved by the department.<br>b) Whether there is stipulation of testing of equipments at manufacturer works in the agreements.<br>c) Are inspections carried out at manufacturer's work.<br>d) Give brief details.<br>e) Test results during inspection comply relevant BIS/CPWD General Specification for Electric works/ technical specifications mentioned in tender.<br>f) Routine acceptance test certificates whether submitted (in case the inspections at works was not stipulated in the agreements).<br>g) What precautions taken to ensure the genuineness (material's originality) of the materials supplied at site. |
| 4.2 | a) Whether lot size for bringing of the materials at site in view of tendered quantity/ required at site mentioned in the agreement.<br>b) If not whether engineer-in-charge has defined the lot size.<br>c) Are the samples of following materials got tested from 3rd party laboratory after taking samples from each lot at the site only.<br>(i) Conduit<br>(ii) wires |

| | | | | |
|---|---|---|---|---|
| | (iii) Insulation<br>(iv) Metal sheets<br>(v) Cables etc.<br>d) Are test results given by 3rd party laboratory meets BIS/ Technical Specifications etc of tender for the material supplied at site.<br>e) If the materials not tested from 3rd party laboratory then the manufacturer's test certificate submitted meets agreement requirements.<br>f) Delivery challan of all the materials submitted. | | | |
| 4.3 | Are all mandatory tests at site carried out at stipulated frequency? | | | |
| 4.4 | Are materials approved by Engineer-in-charge?<br>If so, are samples available at site? | | | |
| 4.5 | Are sample units/ Items completed and approved by EE (E) before start of mass work? | | | |
| 4.6 | Any other particular comments on adequacy of process control. | | | |
| 5.0 | **Site Inspection for observation and comments on quality control system in place;** | | | |
| 5.1 | Sub- head of work in progress | Whether in progress (If so, tick mark) | Whether inspected (If so, tick mark) | Location |
| | 1 **ELECTRICAL WORKS** | | | |
| | a Conduit work | | | |
| | b Wiring work | | | |
| | c Switch Boxes | | | |
| | d Distribution boards & floor panel | | | |
| | e Fittings and fixtures | | | |
| | F Earthing Work | | | |
| | g Rising mains | | | |
| | 2 **SUB STATION** | | | |
| | a Transformer | | | |
| | b HT Panel | | | |
| | c LT Panel | | | |
| | d Cabling | | | |
| | e Earthing System | | | |
| | 3 **COMPOUND LIGHTING/STREET LIGHTING** | | | |
| | a Poles | | | |
| | b Fittings | | | |
| | c Cabling | | | |
| | d Earthing | | | |
| | e Feeder Pillar | | | |
| | 4 **LIGHTENING ARRESTER** | | | |

| | | | | | |
|---|---|---|---|---|---|
| | 5 | **FIRE ALARM** | | | |
| | a | Panel | | | |
| | b | Detector | | | |
| | c | MCP | | | |
| | 6 | **FIRE FIGHTING** | | | |
| | a | Piping | | | |
| | b | Pumps | | | |
| | c | MV Panel | | | |
| | 7 | **AIR CONDITIONING WORK** | | | |
| | a | Ducting | | | |
| | b | Piping | | | |
| | c | Insulation work | | | |
| | d | Grills, Diffuser | | | |
| | e | Chiller/Out door unit/package unit | | | |
| | f | AHUs, | | | |
| | g | Pumps & Cooling Tower | | | |
| | 8 | **DG SET** | | | |
| | **a** | **Load Testing at manufacturer's works** | | | |
| | **b** | **AMF/Essential Panel/ Synchronising panel** | | | |
| | **c** | **Exhaust System** | | | |
| | 9 | **LIFTS** | | | |
| | | | | | |

| | |
|---|---|
| 5.2 | Observations on electrical fixtures<br>a) Levelling of switch boxes & DB's<br>b) Levelling of electrical fixtures<br>c) Levelling of all accessories such as detector, grills, diffuser, Sprinkler etc.<br>d) Red oxide paint on threaded conduit ends<br>e) Laying of fish wire in laid conduits<br>f) Earthing of SDB's, DB's, fans and fittings, poles, rising mains.<br>g) Earthing of Sub-station systems.<br>h) Provision and proper fixing of check nuts<br>i) Lugs at cable ends in switch boxes<br>j) Makes of the materials supplied w.r.t. approved makes in the agreement.<br>k) Pressure testing of pipes. |
| 5.3 | Observation on QC for earthing /earth leakage prevention.<br>If leakage noticed, state locations and probable reasons |
| 5.4 | Samples ordered by QC core / cell for lab inspection |
| 5.5 | Whether testing and commissioning of all equipments, complete system as per CPWD Specifications / agreement conditions are done. |

| | |
|---|---|
| | If yes (a) Whether results conform to requirements as per agreement<br>(b) Proper documentation are done. |
| 5.6 | In built drawing/maintenance manual for all services prepared. |
| 6.0 | Observations on site material QC aspects.<br>(Keeping in view the requirements of contract specifications: BIS marked/ CPWD approved products etc.)<br>(Attach separate sheet, if required) |
| 7.0 | Observation on workmanship QC aspects.<br>(Attach separate sheet, if required). |
| 8.0 | |
| 8.1 | Deviation in quantities.(Modified vide OM/DG/MAN/290 dated 01.10.2013 |
| 8.1 | a) Whether deviation in quantities noticed? |
| | b) If so, state reasons thereof and whether prior approval of competent authority has been obtained before allowing deviations? |
| | c) Whether revised T/S is required due to these deviations?<br>If yes, the action taken. |
| 8.2 | Items not conforming to specifications:<br>(a) Whether notice was issued as specified in contract?<br>(b) Whether approval in principle was obtained from competent authority before acceptance of sub- standard work? |
| 8.3 | Extra/ substituted items: (Modified vide OM: DG/MAN/290 dated 10.10.2013 |
| | a) Are Justification of item in remark column of EI/SI proper? |
| | b) Whether proper approval of competent authority for execution of EI/SI has been obtained before execution? |
| | c) Whether sanction of competent authority issued? |
| 8.4 | Part Rates- whether rates held back are adequate? |
| 8.5 | Comments on secured advance paid with reference to materials lying at site. |
| 8.6 | Test check by AE/ EE<br>(a) Critical item:<br>(b) Hidden items:<br>(c) Extent (Whether Satisfactory?) |
| 8.7 | Any other observation?<br>[The observation made about quality of material and workmanship relate to only what could be randomly seen at locations specified. Executive Engineer and supervisory staff shall thoroughly inspect the entire work for such defects as observed as well as for other defects and take suitable remedial measures properly. The Executive Engineer shall be responsible for accepting any defective work that went unnoticed but pointed out during such inspection.] |
| 8.8 | Progress of work and programme chart(modified vide OM DG/MAN/290 dated 01.010.2013) |

| | |
|---|---|
| | (a) Whether progress of work is as per stipulated milestone/ approved revised milestone? If no action taken by EE.<br>(b) Whether Contractor has submitted the programme to complete various activities of work within stipulated date of completion as per contract as per contract condition duly accepted by EE?<br>(a) Whether Contractor has submitted the programme to complete various activities of work within stipulated date of completion as per contract as per contract condition duly accepted by EE?<br>(c) Any notice under clause 3 (a), (b) or (c) for inordinate delays has been issued or not. If yes, the action taken by EE. |
| | |

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Chapter 8

# REFRENCES

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|---|---|
| 1. SE (QA) issued OM No. CE(CSQ)/SE(QA)/G-3/651 | Dated 01.01.2015 |
| 2. SE (QA) issued OM No. CE(CSQ)/SE(QA)/G-3/02 | Dated 02.01.2015 |
| 3. CPWD General Specifications for Elect. Works. | Part I to VIII |

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