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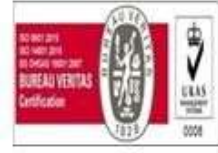


केन्द्रीय भण्डारण निगम  
(भारत सरकार का उपक्रम)

**CENTRAL WAREHOUSING CORPORATION**

(A Govt. of India Undertaking)

जन-जन के लिए भण्डारण/Warehousing for Everyone



No.CWC/CO/Engg/Circular /SOP/TC

3-10-2022

## CIRCULAR

### SUB: Test Checking of Measurements of Engineering works before Payment

Standard Operating Procedure (SoP) as enclosed here is being issued for conducting the test checks before release of payment of the works executed by Contractors.

This SoP bears the approval of Competent Authority (MD) and shall be implemented with immediate effect in all ongoing construction works either awarded by Regional Offices or Corporate office.

This SoP shall be applicable in all engineering works contracts which are live as on date and where Work is in Progress and all Existing guidelines of test checks stand superseded with issue of this SoP.

The responsibility Matrix, Guidelines on Standard checks on quality & workmanship are also enclosed with this SoP.

The Engineers entrusted with responsibility of 1<sup>st</sup> and 2<sup>nd</sup> level test checks shall be nominated by Regional Managers (for the works awarded at RO Level) and by Chief Engineer (for the works awarded at CO Level) before start of work.

The responsibility Matrix including the Engineers nominated for 1<sup>st</sup> and 2<sup>nd</sup> level test checks for the works awarded by CO/Engg Division has been prepared. Accordingly, all regional Managers shall also nominate the engineers under their administrative control for conducting the test checks on the works awarded at Regional Level.

(ROOPENDRA KUMAR SHARMA)  
CHIEF ENGINEER(I/c)

#### Distribution to:

- 1 All concerned Engineers,
- 2 All Regional Managers,
- 3 HoD Vigilance.
- 4 Central Documents: E -office KMS / Engineering Circulars webpage of Corporation.

## SOP: Test Checking of Measurements of Engineering works before Payment

Payment of Engineering works executed by Contractor shall be done by payment approving authority only after ensuring a check on the measurements of works completed to the extent prescribed in this SOP.

There will be a standing nomination of officers assigned with responsibility of 1<sup>st</sup> level and 2<sup>nd</sup> level test check before start of work by Chief Engineer (in case of works awarded at CO) and RM (in case of works awarded at RO). Nomination shall be based on the project location, magnitude and nature of work, posting of officers in the region or corporate office or nearby places from site of work and competency of officers.

These officers shall exercise the test check on the measurement of works completed by contractor after physical inspection of work. Extent of test check and its frequency before release of payment shall be decided as per procedure enumerated in below subclauses.

1. Wherever PMC agency is deployed for day-to-day field supervision of works, all measurement of works shall be recorded by Site Engineers of PMC agency. The measurement of works shall be recorded after a joint measurement by Contractor and Site Engineer of PMC Agency. Engineers shall record all measurement of works when he/they is/are satisfied with quantity and quality of works executed.

Project Manager/Coordinator at site deployed by PMC agency will jointly exercise the test check on measurement recorded by their site engineers and he will certify, approve and present the measurement to CWC AE/EE/SE responsible for test checks on the work (as mentioned in Step 2& 3 below).

2. Concern AE/EE i.e 1<sup>st</sup> level test check officer will exercise the test check to the extent of minimum 50 % on the measurement of work approved and presented by PMC agency for payment. This test check may be exercised on the measurement based on value of work measured, total contract value, physical and financial progress. Officer shall exercise this test check based on guiding principles mentioned in below subclauses.
3. CWC Engineer (in the rank of EE/SE/HOE) entrusted with responsibility of 2<sup>nd</sup> level test check will exercise the test check to the extent of 10% on the measurement of work approved and presented by PMC agency for payment. This test check shall be exercised on the works not checked by CWC 1<sup>st</sup> level Test check officer and it will be an additional check on the measurement of works resulting total check by CWC to the extent of 60 % of completed value of contract works.

2<sup>nd</sup> level test check may be exercised simultaneously of 1<sup>st</sup> level test check to avoid the delay in record or approval of measurement before payment. Guiding principle for 2<sup>nd</sup> level test check are below.

4. Test checks (to the extent of minimum of 50 % of 1st level and 10 % of 2nd level) will mandatorily be required in each of following cases/category of measurement.
  - (i) Foundation works: Work below Plinth such as concrete in footings / Pedestals up to Plinth level beams.
  - (ii) Works in superstructure: Concrete laid in superstructure Column/Beams/Roof slabs and Cement concrete or Masonry in Walls.
  - (iii) Flooring Works: Subbase prepared by GSB or WMM or WBM as the case may be and Cement concrete/ Tiles/ finished floors laid in wearing course of Floor.
  - (iv) Steel works: Roof truss or Structural Steel in PEB/Prefab frame as the case may be.
  - (v) Road works: Subbase laid with GSB/WBM /WMM as the case may be and Cement

## **SOP: Test Checking of Measurements of Engineering works before Payment**

concrete or Bituminous or CC Paver Blocks laid in Road top course (main wearing course).

- (vi) Services like Plumbing, Sewage, water supply works, Rain water drains, electricals, firefighting etc. shall be checked to the prescribed limit to ensure the quality of workmanship and satisfactorily laying, operational requirements etc.
- (vii) Any other special works covered under contract viz Piling, Water Proofing of Terrace, Epoxy Flooring, PA system, Cold storage Plants, HVAC System.
- (viii) Other higher value items in contract which are not covered in this mandatory item list to the extent that prescribed limit of 50 % and 10 % is achieved.

Additionally, 1<sup>st</sup> level test check (to the extent of minimum of 50 %) will mandatorily be required in each of following cases/category of measurement too.

- (i) Ground levels (NGL before and after cutting)
- (ii) Foundation Works: Concrete and Masonry works in Walls.
- (iii) Superstructure Works: Roof sheeting, cladding sheets, valley gutters, Joinery works in Doors windows etc.
- (iv) Finishing Works: Plaster and Painting works.

5. Frequency of test checks shall be as below.

- (i) 1<sup>st</sup> level test check and 2<sup>nd</sup> level test check are not necessarily be applied in each RA Bill.
- (ii) These test check can be exercised at any stage of work before making payment of final bill. These test check shall be independent of each other ie officer entrusted with responsibility of 2<sup>nd</sup> level test check can exercise test check to the extent prescribed for him even if 1<sup>st</sup> level test check could not be applied due to any reason.
- (iii) These test checks shall mandatorily be required in each category of works as mentioned in Subclause 4 above. Additionally, 1<sup>st</sup> & 2<sup>nd</sup> level test check officer may also check any other work executed at site irrespective of minimum prescribed test check responsibility.
- (iv) Payment approving authority may waive off further exercise of 1<sup>st</sup> or 2<sup>nd</sup> level test check, on a particular category of works, if concern officers have already exercised these test checks at any previous stage of work to the extent such that it has crossed the prescribed minimum limit on gross executed value of work of that particular category (mandatory items as per subclause 4).
- (v) Payment approving authority may waive off exercise of 1<sup>st</sup> or 2<sup>nd</sup> level test check before release of any RA Bill if concern officer(s) entrusted with responsibility of 1<sup>st</sup> or 2<sup>nd</sup> level test checks could not exercise the checks but He/They has/ have submitted the measurement for release of payment after recording the fact that “I have preliminarily checked the measurement of works with respect to drawings and approved estimates in technical sanction of works and I found these in order. I am satisfied with the measurement recorded in MB.”

Test checking officer before recording such certificates in any RA Bill shall ensure that sufficient quantum of works is available for exercising test checks up to prescribed limit in future. Moreover, works already measured, recorded and verified by PMC Agency or CFE or CWC AE may be remeasured again by 1<sup>st</sup> or 2<sup>nd</sup> level

## SOP: Test Checking of Measurements of Engineering works before Payment

test checking officer for exercising test check to the extent of their prescribed limit at any stage of work but before release of Final bill payment.

- (vi) Payment approving authority will ensure that payment of works where 50 % of contract value has already been completed is released only after exercising at least 1<sup>st</sup> level test check.
6. Payment approving authority before release of final bill payment will ensure that:
- (a) Test check to the extent of 50 % and 10 % of executed value of items of works in each of above mandatory category has been exercised by 1<sup>st</sup> level and 2<sup>nd</sup> level test check officers respectively.
  - (b) Test check to the extent of minimum 50 % and 10 % of executed contract value has been achieved by 1<sup>st</sup> level and 2<sup>nd</sup> level test check officers respectively.
7. 1<sup>st</sup> Level test check shall be required in each works executed through Contractor while requirement of 2<sup>nd</sup> Level test check by a different officer may be waived off by Payment approving Authority in contract of value less than Rs. 5 Cr if 2<sup>nd</sup> Level test checking officer of adequate competency is not available in the region. In such case responsibility of 2<sup>nd</sup> level test check shall lie with officer exercising 1<sup>st</sup> level test check. Guiding principal of exercising test checks shall remain same as above.
8. The works where PMC agency is not deployed or which are being supervised by CFE or by CWC Engineers directly, The CWC Engineer will satisfy himself/ herself, before submitting the measurement for release of payment, that the work or supply recorded in MB or billed for has actually been carried out/completed in accordance with the terms and conditions of the contract. Test check in such cases shall be done as per below procedure
- i. Any one Engineer of CWC (in the rank of AE /EE/HOE/SE) as the case may be will be in charge of the work and he will personally inspect all such works of any magnitude. He/ She is required to 75 % test check and measure the all item of works irrespective of their cost and place of work when field measurement is recorded/ verified by the CFE deployed for supervision of the work.  
  
No additional test check shall be required beyond above test check by concern Engineer of CWC. Only a certificate to that effect is sufficient that "100 % physical inspection and 75 % test check on measurement is done by me".
  - ii. In case, no CFE is deployed for the work, any one CWC Engineer (in the rank of AE / EE) posted in the region shall record and verify 100 % measurement of work and any other CWC Engineer (in the rank of EE/SE/HOE) as the case may be will exercise the test check of 1st and 2nd level to the prescribed extant and guiding principle as in above subclauses.  
  
No additional test check by third officer of CWC will be required in such case.
9. All kind of works of value up to Rs. 60 lakhs being executed at warehouse or up to Rs. 30 lakhs being executed at RO /Guest House/ Township may be measured and paid without any additional test check by higher official if 100 % physical inspection is done by CWC Engineer of the rank of AE/EE/SE/HOE and 100 % measurement is recorded and verified by CWC Engineer or his authorized representative CFE. Only a certificate to that effect is sufficient that "100 % physical inspection is done by me and I am satisfied with measurement recorded and verified by Sh. ....".

## SOP: Test Checking of Measurements of Engineering works before Payment

10. Items involving the measurement of bought out /supply items towards secured advance in line of terms and conditions of contract will require physical inspection and 100 % test check on quantity of items by CWC Engineer (any of 1<sup>st</sup> level or 2<sup>nd</sup> Level).

### Note:

- (i) An illustrative flow chart is given along with SOP to readily indicate the extent of test check to be performed by nominated officers in different cases of works. Responsibility matrix and minimum parameters to be checked during physical inspection by nominated officers is mentioned in Annexure-I of this SOP.
- (ii) The officer who records/test checks the measurements for an item of work will be responsible for the quality, quantity/ measurements and dimensional accuracy of that item of work.
- (iii) For the purpose of test check, "measurements" means the "corresponding monetary value of measurements of work done." This, however, does not apply to "Levels", in which case the test check has to be based on the number of levels recorded.
- (iv) 1<sup>st</sup> Level Test check of Civil works shall normally be carried out by Civil Engineers and that on E&M Works shall be carried out by Electrical Engineers only.

2<sup>nd</sup> Level test check can be done by civil engineer on all kind of works and by Electrical engineers on Electrical works only. In case, Electrical Engineer is not available for 1<sup>st</sup> level test check on E&M works, 2<sup>nd</sup> level test check officer may carry test check on E&M Works to the extent prescribed for 1<sup>st</sup> level test check officer.

In case, Civil Engineer is not available for carrying out 2<sup>nd</sup> Level test check and Electrical Engineer satisfy him/her self that He/ She can exercise the check on quality and quantity of work, Payment approving authority may also allow the concern Electrical Engineer for exercising 2<sup>nd</sup> level test check on civil works also. Payment approving authority may take decision in such case based on the magnitude /nature of work and competency /knowledge of electrical engineer relevant to work under measurement.

- (v) Computerized measurement book or E MB in CMS will be prepared /uploaded only after exercising test check to prescribed extant as per above SOP. No correction/alteration /modification in Computerized measurement Book or EMB is allowed. In Case, A change in, measurement is required due to erroneous record or due to any update on test check, these will be notified by a separate addendum sheet of CMB/EMB along with reasons, highlighting place of corrections/updating and name & designation of officer updating the measurement.
- (vi) Officers exercising Test check should satisfy them self on the quality of works completed by contractor. They should test check the quality by adopting independent test mechanism like NDT test on structural members of RCC frames, floors etc Core cutting test from CC Roads, Floors etc. Number of tests, frequency of such tests shall be decided by Engineers in line of filed quality plan covering maximum quantity of works measured.

Officers during exercise of test check shall ensure the quality of works during the field checks by them. Parameters for quantity measurement and Minimum parameters of quality to be checked during physical inspection are stipulated in Annexure-I of this SOP. The parameters in Annexure-I are minimum indicative parameters and officers should exercise checks prudently covering all technical aspects stipulated in contract. CPWD specifications, SOPs and Checklist should be used as guidelines for bringing more clarity.

## SOP: Test Checking of Measurements of Engineering works before Payment

Works executed at warehouse and are of value up to Rs. 60 Lakhs

OR

Works executed at RO or Guest House or at Township and are of value up to Rs. 30 Lakhs



- (1) 100 % measurement by CWC Engineer or his representative CFE and
  - (2) 100 % Physical inspection & testing by CWC Engineer as per Annexure- 1
- and  
NO additional test check is required.

# SOP: Test Checking of Measurements of Engineering works before Payment

Works executed at warehouse and are of value more than Rs. 60 Lakhs

OR

Works executed at RO or Guest House or at Township and are of value above Rs. 30 Lakhs

Supervised  
by CFE

- (1) 100 % measurement record by CFE and
- (2) 100 % Physical inspection & testing by one AE/EE/SE/HOE in CWC as per Annexure- 1 and
- (3) 75 % test check by same AE/EE/SE/HOE in CWC

- (1) 100 % measurement & Physical inspection by one AE/EE in CWC and
- (2) 60 % test check by other AE/EE/SE/HOE in CWC

Supervised by  
CWC Engr  
directly

- (1) 100 % measurement & Physical inspection by PMC Agency and
- (2) 60 % test check by any one AE/EE/HOE/SE in CWC \* as per cl 7

Supervised  
by PMC  
agency

Value of  
works up to  
Rs. 5 Cr

- (1) 100 % measurement & Physical inspection by PMC Agency and
- (2) 50 % test check by one AE/EE in CWC and
- (3) 10 % test check by other EE/SE/HOE in CWC

Value of  
works more  
than Rs. 5 Cr

### Responsibility Matrix & Minimum parameters of test checks

<b>Responsibility Matrix</b>	
Site engineers: CWC AE /CFE / PMC agency Deployed for day-to-day supervision at place of work-	<b>Measurement of Quantity</b> -100 % <b>Check on Quality</b> - 100 % in line of Field quality assurance plan.
CWC Engineer-1 <sup>st</sup> level test check officer.	<b>Measurement of Quantity</b> -as per the prescribed limit of test check. <b>Check on Quality</b> - 100 % on the works test checked and ensuring that site engineers are implementing field quality assurance plan at site.
CWC Engineer-2 <sup>nd</sup> level test check officer.	<b>Measurement of Quantity</b> -as per the prescribed limit of test check and ensuring that 1 <sup>st</sup> level test check is being done as per SOP. <b>Check on Quality</b> - 100 % on the works test checked and ensuring that site engineers are implementing field quality assurance plan at site.

<b>S/n</b>	<b>Parameters under test check</b>		
	<b>Work</b>	<b>Test Check on the quantity</b>	<b>Test check on the quality</b>
1	Foundation	Quantity as per unit of measurement including depth, thickness, area in plan.	Visual inspection for: <ul style="list-style-type: none"> <li>• Honey combing, surface smoothness in case of cement concrete and bond, tooth connections, joints in case of masonry.</li> <li>• levels &amp; plumbs,</li> <li>• reinforcement projecting from the pedestals</li> <li>• size of the pit &amp; back filling completion etc.</li> </ul> Physical testing for: <ul style="list-style-type: none"> <li>• as required for concrete works in super structures in case of CC foundation,</li> <li>• as required for masonry works in super structure in case of masonry foundation.</li> </ul>



**Annexure-I**

<b>S/n Parameters under test check</b>			
	<b>Work</b>	<b>Test Check on the quantity</b>	<b>Test check on the quality</b>
2	Masonry works in super structure	Quantity as per unit of measurement including height, thickness & length, measurement of any opening.	<p>Visual inspection for:</p> <ul style="list-style-type: none"> <li>• bond in the masonry,</li> <li>• tooth connections with transverse walls,</li> <li>• thickness of the mortar in bed &amp; joints,</li> <li>• levels &amp; vertical plumbs,</li> <li>• Finishing &amp; racking of joints.</li> </ul> <p>Physical testing for:</p> <ul style="list-style-type: none"> <li>• size of bricks, bricks soundness, compressive strength and water absorption</li> </ul>
3	Concrete works in building super structure frames like beam, columns, slab etc.	Quantity as per unit of measurement including height, thickness, length, width, depth etc. and any opening in the beams/slabs.	<p>Visual inspection for:</p> <ul style="list-style-type: none"> <li>• honey combing surface smoothness</li> <li>• levels &amp; plumbs,</li> <li>• reinforcement projecting from the columns, beam dowels bars, cover to the reinforcement etc. (if any)</li> <li>• quality of scaffolding, centring &amp; shuttering.</li> </ul> <p>Physical testing for:</p> <ul style="list-style-type: none"> <li>• Cube testing for Compressive strength (if any due at the time of test check).</li> <li>• Physical weight of the reinforcement &amp; cement bags.</li> <li>• Rebound hammer test on CC frame at least one time at one site.</li> </ul>
4	Cement Concrete works in floors & pavement roads	Quantity as per unit of measurement like length, width, depth etc. and any opening in the floor/roads.	<p>Visual inspection for:</p> <ul style="list-style-type: none"> <li>• Homogeneity, surface smoothness</li> <li>• Levels, cambers &amp; slopes.</li> <li>• Joint spacing, cutting, filling etc.</li> <li>• projecting reinforcement for the columns, beams, dowels bars, cover to the reinforcement etc. (if any).</li> </ul> <p>Physical testing:</p> <ul style="list-style-type: none"> <li>• Compression strength testing &amp; thickness testing by core cutting method in case of pavement road &amp; rebound hammer testing in case of floor.</li> </ul>

**Annexure-I**

<b>S/n Parameters under test check</b>			
<b>S/n</b>	<b>Work</b>	<b>Test Check on the quantity</b>	<b>Test check on the quality</b>
5	Structural Steel works	Quantity as per unit of measurement (length, width, density & weight etc.)	<p>Visual inspection for:</p> <ul style="list-style-type: none"> <li>• quality of welding, bolting, riveting etc.</li> <li>• surface smoothness, rusting of the steel members, quality of primer etc.</li> <li>• cambers, levels &amp; vertical plumbness.</li> <li>• Use of the cut pieces in the steel members.</li> <li>• Any gap between steel column base plate &amp; concrete columns, purlin &amp; rafter connection, any other places where steel member is inter connected to each other or connected with the cement concrete members.</li> <li>• Arrangement of winch/pully/crane for erection of steel columns, rafter, truss, purlins etc.</li> <li>• Arrangement of welding &amp; cutting of steel, quality of electrodes (grade &amp; make)</li> <li>• Arrangement of site fabrication facility like electrode heating oven, gas cutting, oxygen cylinders, welding rectifier, power connections etc.</li> <li>• Grade, type, make of structural steel brought at site.</li> </ul> <p>Physical testing for: weightment of steel members, their thickness &amp; sizes.</p>

**Annexure-I**

S/n	Parameters under test check		
	Test Check on the quantity	Test check on the quality	
6	Roofing & cladding works with metal sheets.	Quantity as per unit of measurement (length, width etc.) and any opening thereof.	<p>Visual inspection for:</p> <ul style="list-style-type: none"> <li>• Colour &amp; edges of profiled sheets</li> <li>• Surface, smoothness, rusting of the sheet.</li> <li>• Make of the galvalume sheet &amp; stamping of the make, yield strength in MPA, GSM coating.</li> <li>• Make, size &amp; type of screws</li> <li>• Pattern of fixing screws, number of screws per sheet</li> <li>• Overlapping of the sheets at joints/ purlins etc.</li> <li>• Levels &amp; slopes.</li> <li>• Connection at the ridges, at eve, at gables etc.</li> <li>• Fixing of ridges, flashing and minimum projection if there is no flashing.</li> <li>• Unplugged holes &amp; gap, sunlight from joints in roofing &amp; cladding.</li> <li>• Clamping, alignment, slope of valley gutter.</li> <li>• Connection of down take pipe with drains and overhead gutter.</li> <li>• Sealing of joints in gutter/ Down take pipes.</li> </ul> <p>Physical testing for:</p> <ul style="list-style-type: none"> <li>• Thickness &amp; dimensions of the sheets. Valley gutters etc.</li> <li>• Sheet profile.</li> <li>• Water leakage test from gutter and down take pipes.</li> </ul>

**Annexure-I**

S/n	Parameters under test check		
	Test Check on the quantity	Test check on the quality	
7	Finishing works: Plastering, painting, pointing etc.	Quantity as per unit of measurement (length, width, plan area etc.) and any opening thereof.	<p>Visual inspection for:</p> <ul style="list-style-type: none"> <li>• Surface smoothness.</li> <li>• Undulation &amp; unevenness</li> <li>• Levels &amp; plumbness.</li> <li>• Micro Cracks on the surface</li> <li>• Joints, groove cutting, racking, finishing, pointing etc.</li> <li>• Quality of finish, physical appeal, dampness, peeling of surface, fading of paint colour etc.</li> <li>• Arrangement of curing. Extent of curing done.</li> <li>• Colour, age, make of the painting material</li> </ul> <p>Physical test for:</p> <ul style="list-style-type: none"> <li>• Thickness of the plaster work</li> </ul>
8	CC pavement works with paver block	Quantity as per unit of measurement (length, width, plan area etc.) and any opening thereof.	<p>Visual inspection for</p> <ul style="list-style-type: none"> <li>• Finish of paver block, noticeable cracks at the edges.</li> <li>• Levels, cambers &amp; slopes.</li> <li>• Alignment of Joints &amp; filling with fine sand.</li> <li>• Arrangement for edge protection &amp; connection with the drains.</li> </ul> <p>Physical test for:</p> <ul style="list-style-type: none"> <li>• Size of the paver block including thickness.</li> <li>• Thickness of sand bed.</li> <li>• Compressive strength of paver block on randomly selected samples.</li> <li>• Grading of the sand used in the sand bed.</li> </ul>
9	Earth work in plinth filling, Subgrade, GSB, WBM, WMM in floors/roads.	Quantity as per unit of measurement including depth, length, width, etc.	<p>Visual inspection for</p> <ul style="list-style-type: none"> <li>• Camber/levels/slopes</li> <li>• Consolidation,</li> <li>• deleterious content in filling.</li> <li>• Arrangement of stacking of loose aggregates, soil etc.</li> <li>• Water logging, edge/ slope protection of subbase, side slope, shoulder formation etc.</li> </ul> <p>Physical testing for:</p> <ul style="list-style-type: none"> <li>• Field Compaction test</li> <li>• Levels on finished/completed works</li> </ul>

**Annexure-I**

<b>S/n</b>	<b>Parameters under test check</b>		
	<b>Test Check on the quantity</b>	<b>Test check on the quality</b>	
10	Base work with lean concrete: PCC /DLC etc.	Quantity as per unit of measurement including depth, length, width, etc.	Visual inspection for <ul style="list-style-type: none"> <li>• Camber/levels/slopes</li> <li>• Compaction</li> </ul> Physical testing for: thickness
11	Other works: Joinery works, Tile flooring works, stone works, false ceiling works etc.	Quantity as per unit of measurement including depth, length, width, plan area, numbers etc. and opening in part thereof.	Visual inspection for <ul style="list-style-type: none"> <li>• Levels, plumbness.</li> <li>• Clamp support &amp; connections at joints.</li> <li>• Bed firmness.</li> <li>• Quality of surface finish.</li> <li>• Sealing of gaps, joints etc.</li> </ul> Physical testing for: thickness and other parameters required in contract specification/ manufacturer recommendations etc.
12	Building services like water supply, plumbing, sanitary, drainage etc.	Quantity as per unit of measurement in length, numbers, area in plan etc.	Visual inspection for <ul style="list-style-type: none"> <li>• Levels, slopes, plumbness.</li> <li>• Clamp support &amp; connections at joints.</li> <li>• Arrangement of drains &amp; disposal, connections into the chambers.</li> <li>• Filling, covering etc. if required.</li> <li>• Source of leakage, water stagnation etc.</li> <li>• Make, grade, type of the pipe &amp; pipe fitting (faucets etc), ceramic items, plumbing fixtures, man hole covers, traps etc.</li> </ul> Physical testing for: <ul style="list-style-type: none"> <li>• Leakage at joints by water flow test, smoke test etc. as feasible.</li> <li>• Thickness of pipe &amp; fitting used</li> <li>• Weighment of steel man hole covers or similar items brought at site.</li> </ul>

**Annexure-I**

<b>S/n</b>	<b>Parameters under test check</b>		
	<b>Test Check on the quantity</b>	<b>Test check on the quality</b>	
13	Building services like general electrical works	Quantity as per unit of measurement in length, width, numbers, area in plan etc.	Visual inspection for: <ul style="list-style-type: none"> <li>• Levels, plumbness.</li> <li>• Installation, clamping, alignment, any overhanging etc.</li> <li>• Conduit &amp; wire quality, size, make, grade &amp; type.</li> <li>• Make, grade, type, rating &amp; warranty period of electrical fixtures etc.</li> <li>• Arrangement of earthing, safety measures etc.</li> </ul>
			Physical testing for: <ul style="list-style-type: none"> <li>• Thickness of conduit, wires wherever required.</li> <li>• Physical working of electrical installations.</li> </ul>
14	Other special works like E&M works of firefighting, HVAC system, DG set etc.	Quantity as per unit of measurement.	Visual inspection & physical testing as per contract specification & manufacturer recommendation.

**STANDARD CHECKS ON QUALITY & WORKMANSHIP IRRESPECTIVE OF STAGE OF COMPLETION OF WORKS:** *(to be exercised by each officer at site of work):*

It is to be checked physically to confirm that following are in line of contract /technical specifications permitted in relevant IS codes.

- i) Type, grade, age & make of the cement brought by the contractor at site.
- ii) Cement storage arrangement & Quantity of the cement available in the cement store.
- iii) Theoretical consumption of cement viz a viz cement brought to site of work/ issued & consumed in work.
- iv) Physical weight of cement bags selected randomly.
- v) Type of the earth excavated from the foundation & its disposal arrangement. In case of black cotton soil, it is required to be removed without any temporary dumping/stacking at the site.
- vi) Source of earth/ borrowed pit for supply and filling in Plinth, under subgrade etc. check for organic component, garbage, plasticity, colour of such soil.
- vii) Source of water being used in the construction. Collection & storage of the water in UG tank/overhead tank.
- viii) Quality of water used in the construction. It should normally be a potable water.

## Annexure-I

- ix) Quality of bricks, sand, aggregate brought at site. Their source of supply and method of stacking etc. check on grading & deleterious/silt content in coarse & fine aggregates.  
Other than visual inspection, it is to be checked that mandatory field/lab test are being conducted at site regularly and the test results meet the acceptance criteria. Material test register to be checked.
- x) Quality of cement, structural steel, reinforcement steel, metal roofing sheets, round pipes for plumbing/water supply/sanitation/drainage etc brought at site and their arrangement of stacking.  
Other than visual inspection, it is to be checked that mandatory field/lab test are being conducted at site regularly and the test results meet the acceptance criteria. Material test register & manufacturer test certificates to be checked.
- xi) Arrangement of making mortar, soaking the bricks & carriage of material from store to work place.
- xii) Arrangement of batching, weighing & mixing of cement, water & aggregates for making concrete. Arrangement of placing the concrete into formwork. Compaction of concrete etc.
- xiii) Arrangement of Roller for compacting subgrade, earth filling in plinth. Plate vibrators etc as per requirement.
- xiv) Arrangement of pumping of rain water, disposal of surface runoff from construction site. Jungle clearance from work place.
- xv) Arrangement of curing, illumination of work place at site.
- xvi) Facility extended to construction workers at site. Arrangement for their Sanitation, drinking water etc.
- xvii) Arrangement of safety in works. Quality of Scaffolding erected, centring and shuttering for works at height, below roof slab etc. Arrangement of safety shoes & Helmet for working in steel fabrication /erection area. Safety belt /lifelines for working at slope/height etc. Loose or unsafe power connection & water stagnation at site should not be allowed.
- xviii) Installation of CCTV camera at site of construction of building.
- xix) Records being updated/maintained in site register viz Hindrance register, site order book, Material test registers, Cement Register and other important registers as per requirement of contract.
- xx) Contractor All risk Policy, Workman compensation policy is live during construction.
- xxi) All construction drawings & technical specifications, CPWD specification copy (hard binded book) are available at site of work.
- xxii) Filed testing lab is well equipped and is in working conditions.
- xxiii) Deployment of technical staff by contractor is in line of contract.
- xxiv) An overall quality of workmanship, general physical appearance of work.
- xxv) Garbage, dismantled or construction debris at site. Its disposal mechanism, lead etc.