ANNEXURE-D

L BOX TEST METHOD

Introduction

The test assesses the flow of concrete, and also the extent to which it is subjected to blockage by the reinforcement. The apparatus consists of a rectangular-section box in the shape of an 'L', with a vertical and horizontal section, separated by a moveable gate, in front of which vertical lengths of reinforcement bar are fitted. The vertical section is filled with concrete, then the gate lifted to let the concrete flow into the horizontal section. When the flow has stopped, the height of the concrete at the end of the horizontal section is measured and expressed as a proportion of height that remains in the vertical section (H_2/H_1 in the figure below). It indicates the slope of the concrete when at rest. This is an indication of passing ability, or the degree to which the passage of concrete through the bars is restricted.

The horizontal section of the box can be marked at 200mm and 400mm from the gate and the time taken to reach these points measured. These are known as the T_{20} and T_{40} times and are an indication for the filling ability.

The sections of bar can be of different diameters and spaced at different intervals: in accordance with normal reinforcement considerations, 3x the maximum aggregate size might be appropriate.

The bars can principally be set at any spacing to impose a more or less severe test of the passing ability of the concrete.

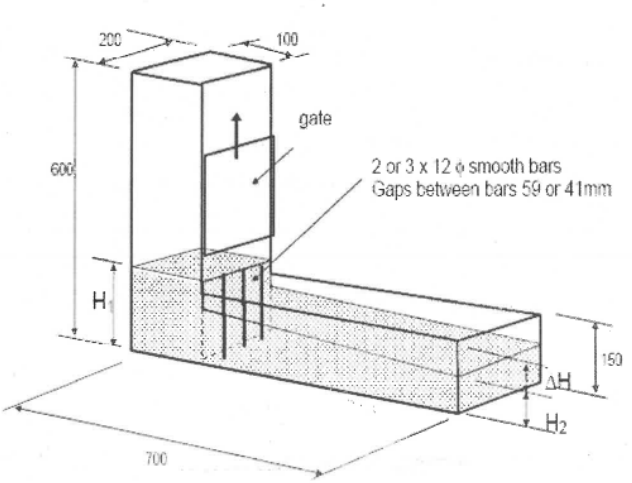
Assessment of test

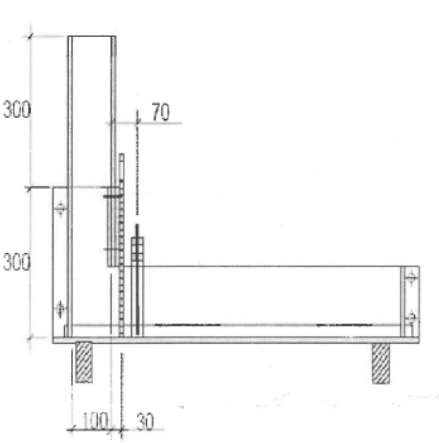
This is a widely used test, suitable for laboratory, and perhaps site use. It assesses filling and passing ability of SCC, and serious lack of stability (segregation) can be detected visually. Segregation may also be detected by subsequently sawing and inspecting sections of the concrete in the horizontal section. Unfortunately there is no correlation between materials, dimensions, or reinforcing bar arrangement, so it is difficult to compare the test results. There is no evidence of what effect the wall of the apparatus and the consequent 'wall effect' might have on the concrete flow, but this arrangement does, to some extent, replicate what happens to concrete on site when it is confined within formwork.

Two operators are required if times are measured, and a degree of operator error is inevitable.

Equipment

- L box of a stiff non absorbing material
- trowel
- scoop
- stopwatch





All dimensions mm

Pr

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- About 14 litre of concrete is needed to perform the test, sampled normally.
- Set the apparatus level on firm ground, ensure that the sliding gate can open freely and then close it.
- Moisten the inside surfaces of the apparatus, remove any surplus water Fill the vertical section of the apparatus with the concrete sample.
- Leave it to stand for 1 minute.
- Lift the sliding gate and allow the concrete to flow out into the horizontal section.
- Simultaneously, start the stopwatch and record the times taken for the concrete to reach the 200 and 400 mm marks.
- When the concrete stops flowing, the heights "H_1" and "H_2" are measured (H_1 and H_2 shall be measured at three positions equally spaced across the width of box and mean value is taken)
- Calculate H_2/H_1, the blocking ratio.
- The whole test has to be performed within 5 minutes.

Interpretation of result

If the concrete flows as freely as water, at rest it will be horizontal, so $H_2/H_1 = 1$. Therefore the nearer this test value, the 'blocking ratio', is to unity, the better the flow of the concrete. However, a minimum value of 0.8 is acceptable. T_{20} and T_{40} times give some indication of ease of flow. Obvious blocking of coarse aggregate behind the reinforcing bars can be detected visually.

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ANNEXURE-E

U BOX TEST METHOD

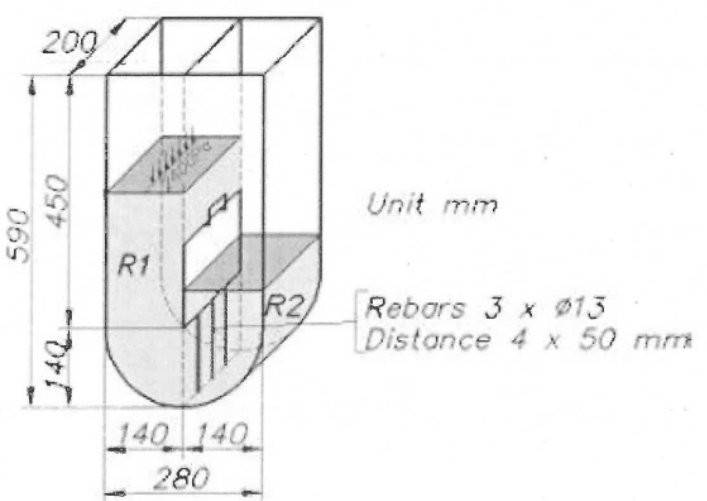
Introduction

Sometimes the apparatus is called a "box-shaped". The test is used to measure the filling ability of self-compacting concrete. The apparatus consists of a vessel that is divided by a middle wall into two compartments, shown by R1 and R2.

An opening with a sliding gate is fitted between the two sections. Reinforcing bars with nominal diameters of 12 mm are installed at the gate with centre-to-centre spacing of 50 mm. The left hand section is filled with about 20 litre of concrete then the gate lifted and concrete flows upwards into the other section. The height of the concrete in both sections is measured.

Assessment of test

This is a simple test to conduct, but the equipment may be difficult to construct. It provides a good direct assessment of filling ability - this is literally what the concrete has to do - modified by an unmeasured requirement for passing ability. The 50mm centre-to-centre spacing of rebars may be considered too close.



Equipment

- U box of a stiff non absorbing material
- trowel
- scoop
- stopwatch

Procedure

- About 20 litre of concrete is needed to perform the test, sampled normally.
- Set the apparatus level on firm ground, ensure that the sliding gate can open freely and then close it.
- Moisten the inside surfaces of the apparatus, remove any surplus water. Fill the one compartment of the apparatus with the concrete sample.
- Leave it to stand for 1 minute.

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- Lift the sliding gate and allow the concrete to flow out into the other compartment.
- After the concrete has come to rest, measure the height of the concrete in the compartment that has been filled, at two places and calculate the mean (H_1). Measure also the height in the other compartment (H2)
- Calculate H_1 - H_2, the filling height.
- The whole test has to be performed within 5 minutes.

Interpretation of result

If the concrete flows as freely as water, at rest it will be horizontal, so H_1 - H_2 = 0. Therefore, the nearer this test value, the 'filling height', is to zero, the better the flow and passing ability of the concrete.

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ANNEXURE-F

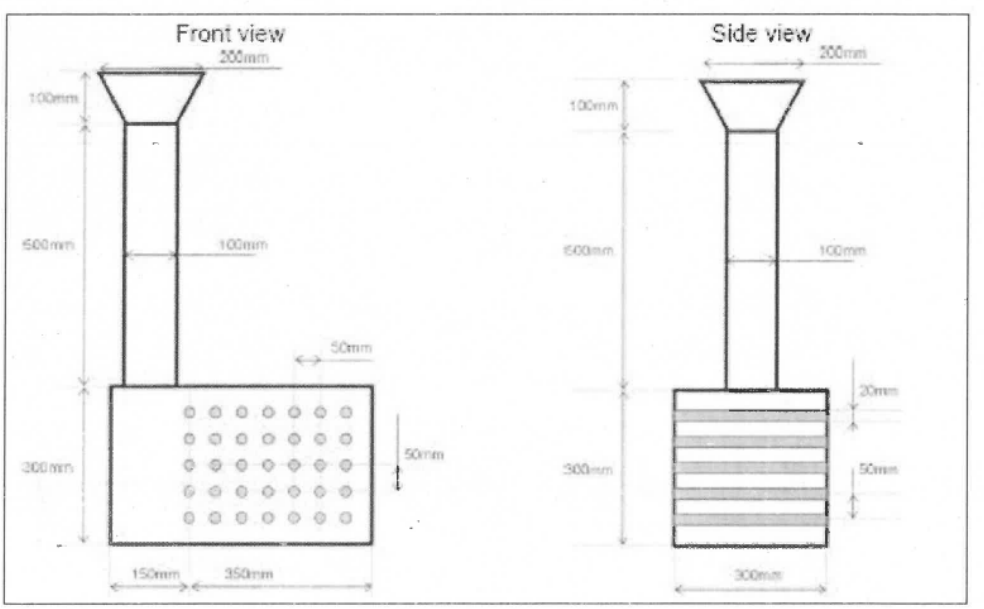
FILL BOX TEST METHOD

Introduction

The test is used to measure the filling ability of self- compacting concrete with a maximum aggregate size of 20mm. The apparatus consists of a container (transparent) with a flat and smooth surface. In the container are 35 obstacles made of PVC with a diameter of 20mm and a distance centre to centre of 50mm. At the top side is put a filling pipe (diameter 100mm height 500mm) with a funnel (height 100mm). The container is filled with concrete through this filling pipe and the difference in height between two sides of the container is a measure for the filling ability.

Assessment of test

This is a test that is difficult to perform on site due to the complex structure of the apparatus and large weight of the concrete. It gives a good impression of the self-compacting characteristics of the concrete. Even a concrete mix with a high filling ability will perform poorly if the passing ability and segregation resistance are poor.



Equipment

- Fill box of a stiff, transparent, non absorbing material
- scoop capacity 1.5 to 2 litre
- ruler
- stopwatch

Procedure

- About 45 litre of concrete is needed to perform the test, sampled normally.
- Set the apparatus level on firm ground.
- Moisten the inside surfaces of the apparatus, remove any surplus water
- Fill the container by adding at every 5 seconds one scoop with 1.5 to 2 litres of fresh concrete into the funnel until the concrete has just covered the first top obstacle.
- Measure after the concrete has come to rest, the height at the side at which the container is filled on two places and calculate the average (h_1).

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- Do this also on the opposite side (h_2).
- Calculate the average filling percentage:
- Average filling %: $F= \{(h_1+h_2)/ 2*h_1\} * 100\%$
- The whole test has to be performed within 8 minutes.

Interpretation of result

If the concrete flows as freely as water, at rest it will be horizontal, so Average filling percentage = 100%. Therefore the nearer this test value, the 'filling height', is to 100%, the better the self-compacting characteristics of the concrete.

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ANNEXURE-G

GTM SCREEN STABILITY OR SIEVE SEGREGATION RESISTANCE TEST METHOD

Introduction

This test has been developed to assess segregation resistance (stability) of SCC. It consists of taking a sample of 10 litre of concrete, allowing it to stand for a period to allow any internal segregation to occur, then pouring half of it on to a 5mm sieve of 350mm diameter, which stands on a sieve pan on a weigh scale. After two minutes, the mortar which passed through the sieve is weighed, and expressed as a percentage of the weight of the original sample on the sieve.

Assessment of test

It is a very effective way of assessing the stability of SCC. However, though simple, it is not a rapid test, and requires an accurate weigh-scale, so may not be too suitable for site use.

Equipment

- 15 litre bucket with lid
- 5 mm square apertures sieve, 300 mm frame diameter and height 40mm
- sieve pan
- balance, accuracy 20g minimum capacity 20 kg
- stopwatch

Procedure

- About 10 litre of concrete is needed to perform the test, sampled normally.
- Allow concrete in the bucket to stand for 15 minutes covered with a lid to prevent evaporation.
- Inspect the surface of the concrete if there is any bleeding water and note it.
- Pour the top 2 litre or approximately 4.8kg ±0.2kg of the concrete sample from the bucket into a pouring container
- Determine the mass of the filled pouring container.
- Determine the mass of the empty sieve pan.
- Pour all the concrete from the pouring container onto the sieve from a height of 500mm in one smooth continuous movement.
- Weigh the empty pouring container.
- Calculate mass of concrete poured onto sieve, $\mathbf{M_a}$ (i.e. the difference between full and empty weights of pouring container).
- Allow the mortar fraction of the sample to flow through the sieve into the sieve pan for a period of 2 minutes.
- Remove sieve and determine mass of 'filled' sieve pan.
- Calculate mass of sample passing sieve, $\mathbf{M_b}$, by subtracting the empty sieve pan mass from the filled sieve pan mass.
- Calculate the percentage of the sample passing sieve, the segregation ratio: $(M_b/M_a) \times 100$.

Interpretation of result

Empirical observations suggest that if the percentage of mortar which has passed through the sieve, the segregation ratio, is between 5 and 15% of the weight of the sample, the segregation resistance is considered satisfactory. Below 5% the resistance is excessive, and likely to affect the surface finish (blow holes likely). Above 15-20%, and particularly above 30%, there is strong likelihood of segregation.

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ANNEXURE-H

ORIMET TEST

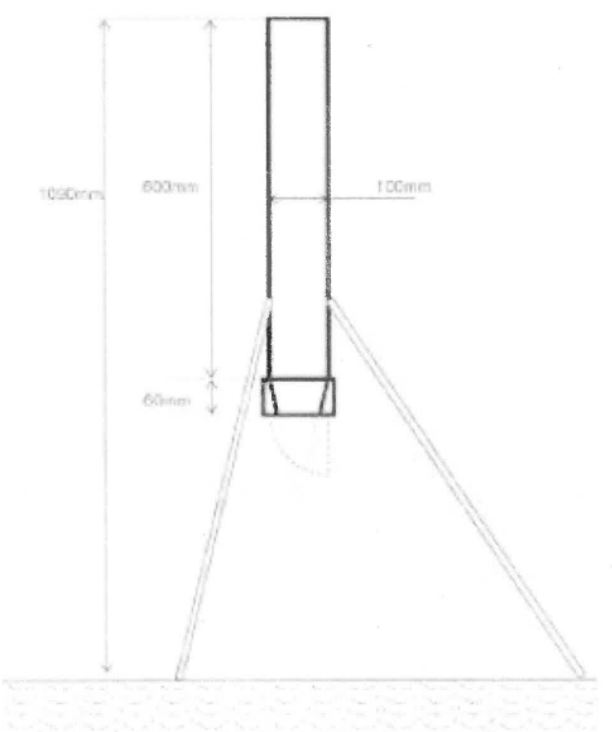
Introduction

The Orimet is used for assessing the workability of SCC. The test is based on the principle of an orifice rheometer. The Orimet consists of a vertical casting pipe fitted with a changeable inverted cone-shaped orifice at its lower, discharge end, with a quick-release trap door to close the orifice. Usually the orifice has an 80 mm internal diameter which is appropriate for assessment of concrete mixes of aggregate size not exceeding 20 mm. Orifices of other sizes, usually from 70 mm to 90 mm in diameter, can also be used.

Operation consists simply of filling the Orimet with concrete then opening the trap door and measuring the time taken for light to appear at the bottom of the pipe (when viewed from above).

Assessment of test

This test is able to simulate the flow of fresh concrete during actual placing on sites. It is a rapid test, and the equipment is simple and easily maintainable. The test has the useful characteristic of being capable of differentiating between highly workable flowing mixes, and therefore, is useful for testing compliance of successive loads at site.



Equipment

- Orimet device of a stiff non absorbing material
- bucket (±10 litre)
- trowel
- scoop
- stopwatch

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Procedure

- About 8 litre of concrete is needed to perform the test, sampled normally.
- Set the Orimet on firm ground.
- Moisten the inside surfaces of the casting pipe and the orifice.
- Keep the trap door open to allow any surplus water to drain.
- Close the trap door and place a bucket underneath.
- Fill the apparatus completely with concrete without compacting or tapping, simply strike off the concrete level with the top with the trowel.
- Open the trap door within 10 seconds after filling and allow the concrete to flow out under gravity.
- Start the stopwatch when the trap door is opened, and record the time for the discharge to complete (**the flow time**). This is taken to be when light is seen from above through the orifice section.
- The whole test has to be performed within 5 minutes.

Interpretation of result

This test measures the ease of flow of the concrete; shorter flow times indicate greater flowability. For SCC a flow time of 5 seconds or less is considered appropriate. The inverted cone shape at the orifice restricts flow, and prolonged flow times may give some indication of the susceptibility of the mix to blocking and/or segregation.

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ANNEXURE-I

PROCEDURE FOR MIX DESIGN IS: 10262 CONCRETE MIXING PROPORTION GUIDELINE.

An example of a procedure for efficiently designing SCC mixes is given below:

The sequence is determined as:

1) Designation of desired air content (mostly 2 %)
2) Determination of coarse aggregate volume
3) Determination of sand content
4) Design of paste composition
5) Determination of optimum water:powder ratio and superplasticizer dosage in mortar
6) Finally the concrete properties are assessed by standard tests.

1) Definition of desired air content (mostly 2 %)

Air content may generally be set at 2 per cent, or a higher value specified when freeze thaw resistant concrete is to be designed.

2) Determination of coarse aggregate volume

Coarse aggregate volume is defined by bulk density. Generally coarse aggregate (Dia > 4 mm) content should be between 50 per cent and 60 per cent.

When the volume of coarse aggregate in concrete exceeds a certain limit, the opportunity for collision or contact between coarse aggregate particles increases rapidly and there is an increased risk of blockage when the concrete passes through spaces between steel bars.

The optimum coarse aggregate content depends on the following parameters:

- Maximum aggregate size. The lower the maximum aggregate size, the higher the proportion of coarse aggregate.
- Crushed or rounded aggregates. For rounded aggregates, a higher content can be used than for crushed aggregates.

3) Determination of sand content

Sand, in the context of this mix composition procedure is defined as all particles larger than 0.125 mm and smaller than 4 mm.

Sand content is defined by bulk density. The optimal volume content of sand in the mortar varies between 40 - 50 % depending on paste properties.

4) Design of paste composition

Initially the water:powder ratio for zero flow (β_p) is determined in the paste, with the chosen proportion of cement and additions. Flow cone tests with water/powder ratios by volume of e.g. 1:1, 1:2, 1:3 and 1:4 are performed with the selected powder composition, see graph below for typical results. The point of intersection with the y - axis is designated the β_p value.

This β_p value is used mainly for quality control of water demand for new batches of cement and fillers.

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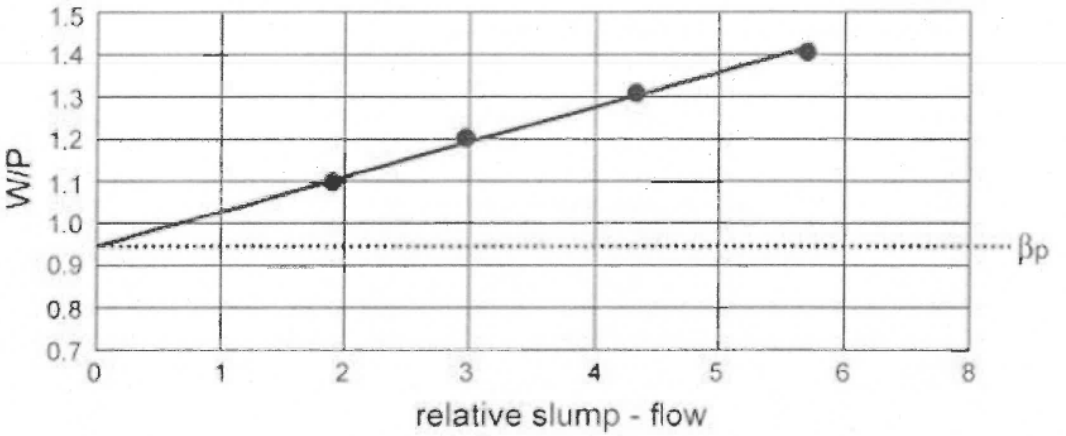


5) Determination of optimum volumetric water/powder ratio and superplasticizer dosage in mortar.

Tests with flow cone and V-Funnel for mortar are performed at varying water/powder ratios in the range of [0.8 – 0.9] βp and dosages of superplasticizer. The superplasticizer is used to balance the rheology of the paste. The volume content of sand in the mortar remains the same as determined above.

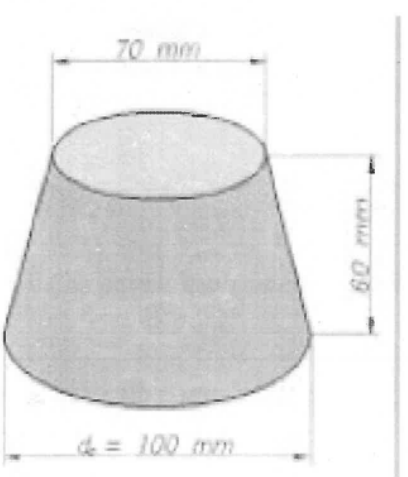
Target values are slump flow of 24 to 26 cm and V-Funnel time of 7 to 11 seconds (refer figures below).

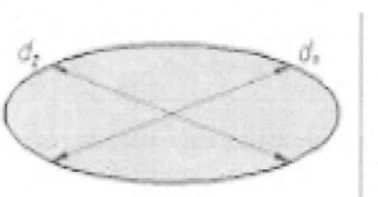
At target slump flow, where V-funnel time is lower than 7 seconds, decrease the water/powder ratio. For target slump flow and V-funnel time in excess of 11 seconds, water/powder ratio should be increased.

If these criteria cannot be fulfilled, then the particular combination of materials is not satisfactory. A trial with a different superplasticizer is the preferred alternative. Second alternative is a new additive, and as a last resort a different cement.

Flow cone for determining the relative slump - flow $T_{p/m}$

$T_{p/m} = (d/do)^2 - 1$; where: $d = {}^1/_2 (d1 + d2)$ and d_0 is the cone diameter at base





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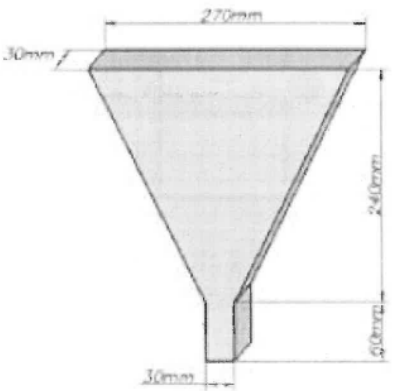
V-funnel to determine the flow time of the mortar



6) Concrete tests

The concrete composition is now determined and the superplasticizer dosage is finally selected on the basis of concrete tests.

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ANNEXURE-J

CHECKLIST

The Checklist has been designed to ensure that all key elements of a SCC application have been considered ahead of starting the work:

Property	Requirement	Validation
MIX CONSTITUENTS		
Cement	Compliance to relevant BIS Standard	
	Control of the cement type	
	Recommended cement amount: 350-450 Kg/CuM	
Aggregates	Compliance to IS:383	
	Control of particles smaller than 0.125 mm	
	Control of moisture content	
	Determination of the sieve curve	
	Compatibility with the space between reinforcement	
Mixing Water	Compliance to IS:456	
Admixtures	Compliance toIS:9103 and/ or EN 934-2	
	Determination of the types needed	
	Determination of the expected dosage	
Additions	Compliance to relevant BIS Standard	
	Determination of the sieve curve	
	Definition of the addition to be used	
	Determination of the increase of the water demand	
Pigments	Compliance to relevant BIS standard or EN 12878	
Raw materials	Definition of all raw materials to be used	
MIX COMPOSITION		
Mix design	Execute the mix design	
	Coarse aggregate < 50%	
	Water powder ratio = 0.8-1.0	
	Total powder content 400-600 Kg /m^3	
	Sand content > 40 % of the mortar (volume)	
	Sand < 50% of paste volume	
	Sand > 50% by weight of total aggregate	
	Free water < 200 litres	
	Paste > 40 % of the volume of the mix	
WORKABILITY TESTS		
Slump flow - Abrams	550 - 850 mm	
T 50cm slump flow	2 - 6 sec	
J Ring	0 - 10 mm	
V Funnel	8 - 12 sec	
V Funnel- T $5_{m,n}$	+ 3 sec.	
L Box	$H_2 / H_1 = 0.8\text{-}1.0$	
U Box	$H_2\text{-}H_1$ = 30 mm max	
Fill Box	90 - 100 %	
Screen Stability	0 - 15 %	
Orimet test	0 - 5 sec	
PROPERTIES OF HARDENED CONCRETE		
Mechanical strength	Achieving the expected values after 24hrs, 7days, 28days	
Shrinkage	As specified	
Mod. of elasticity	Achieving the expected values	
CONFIRMATORY TESTS		
Full scale test	Filling ability	
	Passing ability	
	Segregation resistance	
	Maintenance of the workability > 1 hour	

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सिविल, संरचना एवं वास्तुकला कार्यों के लिए निरीक्षण एवं परीक्षण योजना (आईटीपी) (वर्गीकरण साहितमद्दर संविदा)

INSPECTION & TEST PLAN (ITP) FOR CIVIL, STRUCTURAL & ARCHITECTURAL WORKS (ITEM RATE CONTRACTS-WITH CATEGORIZATION)

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by: Standards Committee Convenor	Approved by: Standards Bureau Chairman
2	08.04.2024	REVISED AND REISSUED	DK	AC	RKS	MN
1	30.01.2019	REVISED AND REISSUED	SKG	RK	AKK	RKT
0	14.01.2014	ISSUED AS STANDARD SPECIFICATION	SM	DJ	RKD	SC

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Abbreviations:

AFC	:	Approved For Construction
BM	:	Bench Mark
CI	:	Cast Iron
CPT	:	Cone Penetration Test
GI	:	Galvanised Iron
IRC	:	Indian Road Congress
JB	:	Junction Box
MS	:	Mild Steel
MPT	:	Magnetic Particle Testing
NDT	:	Non Destructive Testing
PCC	:	Plain Cement concrete
PQR	:	Procedure Qualification Record
PT	:	Penetration Testing
PVC	:	Poly Vinyl Chloride
PWHT	:	Post Weld Heat Treatment
RCC	:	Reinforced Cement Concrete
RF	:	Reinforcement
SPT	:	Standard Penetration Test
U/G	:	Under Ground
WBM	:	Water Bound Macadam
WPS	:	Welding Procedure Specification

Construction Standards Committee

Convenor: Sh. R K Singh, ED (Construction)

Members:
Sh. D S N Murthy, GGM (Projects)
Sh. Chinmoy Kapuria, CGM (SCM)
Sh. Udayan Chakravarty, CGM (Piping)
Sh. Abhijit Chakraborty, GM (Construction)
Sh. Pankaj Kumar Rai, DGM (Construction)
Sh. Dhananjay, AGM (Construction)

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SECTION - A

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GENERAL NOTE

The enclosed ITP's shall be followed for the works to be performed by the contractor. The provisions indicated for stage wise inspection by EIL/Owner (For specific activities), which may be modified in line with EIL scope of services as per the contract between EIL and Owner. Activities for which ITP's are not provided in this specification, contractor to develop and get the same approved by EIL/Owner well before start of the work. In general role of EIL has been specified in the document. The role of owner to be specified during preparation of site specific ITPs.

Contractor to submit job procedures for the jobs for which ITP's are attached & job specific reporting formats with the aid of enclosed sample reporting formats to EIL/Owner for approval, before commencement of the activity. If the contractor has to deviate from the given ITP for a valid reason, he shall obtain prior written approval of EIL/Owner. Contractor to carry out 100% examination of all activities.

LEGEND

HP : **Hold Point ;**

A point which requires witnessing/inspection/verification and acceptance by Owner/EIL before any further processing is permitted.
The Contractor shall not process the activity/item beyond a Hold Point without written approval by Owner/EIL except where prior written permission for further processing is available.

W : **Witness Point ;**

An activity which requires witnessing/inspection/verification by Owner/EIL when the activity is performed.
After proper notification has been provided (notification modalities and period shall be finalized beforehand), the Contractor is not obliged to hold further processing if Owner/EIL is not available to witness the activity or does not provide comments before the date notified. Basis of acceptance shall be as per relevant technical specification.

Rw : **Review** of Contractor's documentation.

S : **Surveillance** Inspection by Owner/ EIL.
Monitoring or making observations to verify whether or not material/items or services conform to specified requirements. Surveillance activities may include audit, inspections, witness of testing, review of quality documentation & records, personnel qualifications, etc.

WC : **100%** Examination by Contractor.

Responsibility for execution of the inspection/testing is with the Contractor; Owner/EIL only verifies examination or testing done by the Contractor at important stages

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LAND & TOPOGRAPHICAL SURVEY

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
1	Boundary markings and submission of drgs./sketches	WC	S	Yes
2	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	Yes/ Format C1
	b) Field calibration, if any	WC	W	Yes
3	Block levels, contour plans, establishing permanent bench marks with ref. to Survey of India B.Ms. by check levels and submission of relevant drgs. & records	WC	W	Format C2
4	Protection of control points, permanent bench marks and regular rechecking	WC	S	-
5	Submission of Master plan showing monuments, structures exposed rocks, weirs, water works, ponds, underground services if crossing that area, etc.	WC	S	Yes
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

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ITP NO.: 3102

SOIL INVESTIGATION

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
1.	Positioning of test location	WC	S	-
2.	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	Yes /Format C1
	b) Field calibration, if any	WC	W	Yes
3.	Boring & sampling	WC	S	-
4.	In-situ testing (SPT, CPT, Plate load test, Soil Resistivity, Block vibration test, etc.)	WC	S/Rw	Yes
5.	Lab testing (as applicable)	WC	W/Rw	Yes
6.	Monitoring of water level	WC	S	-
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

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ITP NO.: 3103

SITE GRADING

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	Clearing and stripping of soil including disposal of unsuitable material	WC	S	-	-
2	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	HP	Yes/Format C1
	b) Field calibration, if any	WC	S	-	Yes
3.	Taking and plotting of initial levels at specified intervals for cutting as well as filling areas	WC	HP	HP	Yes
4.	Classification (Levels of strata) and testing of filling soil for suitability including preparation of Lead Charts to filling/disposal areas.	WC	W/ Rw	-	Yes
5.	Proper warning of explosions, misfires and storage of explosive materials (As applicable).	WC	-	S	-
6.	Breaking up of clods, lumps, etc. at the time of filling and compaction.	WC	S	-	-
7.	Identification and suitability of borrow areas for filling soil/murrum including verification of payments for royalty, etc.	WC	S/Rw	-	Yes
8.	Compaction test for earth filling in specified layers including finished areas.	WC	W/Rw	-	Format C3
9.	Verification of final finished grade levels.	WC	HP	HP	Yes
10.	Computation of Earth works.	WC	Rw	Rw	Yes
11.	a) Record of tree cuttings b) stacking of blasted rocks and other quarry materials including handing over to Owner	WC WC	W S	W S	Yes
12.	Preparation of "As built drawings	WC	Rw	Rw	Yes
13.	Removal of Surplus earth/excavated material and leveling in disposal areas.	WC	S	-	-
14.	Resolutions of obstacles/hindrances	WC	S	-	-
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

CAT A: All fillings
CAT B: All cuttings.

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ITP NO.: 3104

EXCAVATION

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	HP	Yes
	b) Field calibration, if any	WC	W	W	Yes/Format C1
2.	Layout checking	WC	S	S	Format C2
3.	Taking initial levels	WC	W	W	Yes
4.	Slopes of excavation, benching, overburden, shoring & strutting (in case of deep excavation)	WC	S	S	-
5.	Check for sub-soil water, dewatering requirements as per specifications.	WC	S	S	-
6.	Bottom level of excavation and compaction	WC	S	S	-
7.	Stacking of different type of soils separately	WC	S	S	-
8.	List of obstacles encountered (cables, pipes, conduits, etc)	WC	S	S	Yes
9.	Barricading of excavated pits for safety & protection from rain	WC	S	S	-
	FOR HARD ROCK				
1	Obtaining license from district authorities for undertaking blasting operations	WC	Rw	Rw	Yes
2	Storing of explosive materials as per explosive rules	WC	S	S	-
3	Prominent display of red flags around the area to be blasted	WC	S	S	-
4	Check the dimensions of bore holes	WC	S	S	-
5	Stacking of hard rock for useable/non useable including handing over to owner	WC	S	S	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

CAT A: Equipment foundations, Plant buildings, Technological structures, piperacks, etc.
CAT B : Non Plant buildings, Boundary walls, wing walls, manholes, drains, pipe culverts ,bridges, etc

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ITP NO.: 3105

BACK FILLING

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	Selection of materials/selected earth	WC	W	S	Format C4, C5
2.	Check for treatment of soil, if any	WC	S	S	Yes
3.	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	HP	Yes /Format C1
	b) Field calibration, if any	WC	W	W	Yes
4.	Filling in specified layers, consolidating, watering.	WC	S	S	-
5.	Compaction tests for layers	WC	W/Rw	S/Rw	Format C3
6.	Filling to required levels	WC	S	S	-
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

CAT A :Equipment foundations, Plant buildings, Technological structure, Pipe racks, etc.

CAT B :Non Plant buildings, pipe racks ,Boundary walls, wing walls, manholes, drainpipe culverts, bridges etc.

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ITP NO.: 3106

UNDERGROUND PIPING (RCC/ CI)

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	Incoming Material **a) Owner's supply**	Contractor to check all free issue materials and maintain records of MIV for material issued by owner/EIL			
	b) Contractors supply	WC	Note -1		
2.	Adequate slope, benching in excavation for safety purposes (if required)	WC	S	-	-
3.	a) Review of calibration certificates of instruments/ testing equipment's	WC	Rw	Rw	Yes/ Format C1
	b) Field calibration, if any	WC	S	S	Yes
4.	Layout, line & level	WC	S	S	Format C2
5.	Laying & jointing, grouting at manholes/chambers	WC	S	-	-
6.	Check for supports/ firm bed/ sub soil water level	WC	S	-	-
7.	Testing for leakages by blocking pipe ends	WC	W	W	-
8.	Hydro-testing and other tests, Removal of blockages, Cleaning & flushing of system	WC	HP	HP	Format C6
9.	Backfilling in layers	WC	Rw	Rw	Format C3
10.	Check for MS rungs in proper position, inlet/outlet pipe levels in manholes	WC	S	S	-
11.	Preparation of "As-built drawings"	WC	Rw	Rw	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE: 1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: Main plant buildings, Utilities ,offsites, etc.

CAT B: Non plant buildings, technological buildings admn. Buildings, Gate house, security rooms, etc.

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ITP NO.: 3107A

WBM ROADS

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	Rw	Yes /Format C1
	b) Field calibration, if any	WC	W	W	Yes
2.	Layout checking including Road crossings and taking initial levels	WC	W	W	Yes
3.	Approval of source & checking/testing of materials (wherever required)	WC	NOTE 1	NOTE 1	Format C4 Format C5
4.	Filling (if any), compaction, providing cambers in sub-base including levels	WC	W/Rw	W/Rw	Format C3
5.	Spreading metal to required thickness, line & levels, dry rolling including spreading of screening material	WC	S	-	Yes
6.	Check for camber and levels over metalling	WC	S	S	-
7.	Spreading murrum/ sand, watering and rolling	WC	S	-	-
8.	Checking thickness after each layer and rectification thereof (if any)	WC	S	S	Yes
9.	Checking quantity of aggregate by excavation of trial pits as per IRC Code	WC	W	W	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: Roads subjected to heavy loading, connected to main highway, main plant roads,etc

CATB: Balance Roads

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ITP no: 3107 B

WMM for Roads

SL. NO.	ACTIVITY	CONTRACTOR	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	a.) Review of calibration certificates of instruments/testing equipment's.	WC	HP	Rw	Yes /Format C1
	b)Field calibration, if any.	WC	W	W	
2.	Layout Checking including Road Crossing & taking initial levels.	WC	W	W	
3.	Approval of source & checking /testing of materials (wherever required)	WC	NOTE 1	NOTE 1	Format C4 Format C5
4.	Design Mix to fix the properties of Ingredients	WC	HP	HP	
4.	Filling (if any), compaction, providing chambers in sub-base including levels.	WC	W/Rw	W/Rw	Format C3
5	Spreading metal to required thickness, line & levels, dry rolling including spreading of screening material.	WC	S	-	
6.	Check for camber levels.	WC	S	S	
7.	Spreading, watering & rolling.	WC	S	-	
8.	Checking thickness after each layer and rectification thereof (if any).	WC	S	S	
9.	Compaction Test for Each layer	WC	S/Rw	S/Rw	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT- A –Roads subjected to heavy loading connected to main High way, main plant roads etc.

CAT B- Balance roads

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ITP NO.: 3108

BLACK TOPPING (PREMIX CARPETING) & BITUMINOUS MACADAM (BM)

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
1.	Approval of source of materials (aggregate, bitumen, etc.)	WC	Note 1	Format C4
2.	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	Yes /Format C1
	b) Field calibration, if any	WC	S	Yes
3	Design Mix of PC/BC/BM/DBM	WC	HP	Yes
3.	Surface preparation & check for camber/level	WC	S	-
4.	Checking/ testing of material wherever required	WC	W	Format C5, Yes
5.	Tack coat application	WC	S	-
6.	Laying of Premix carpeting/ BM including rolling	WC	S	Yes
7.	Application of Seal coat	WC	S	Yes
8.	Check for camber and levels	WC	S	-
9.	Check for bitumen temperature and consumption	WC	S	Yes
10.	Thickness check (random)of Premix carpet/ BM	WC	W	Yes
11.	Removal of surplus earth	WC	-	-
12.	Berm preparation	WC	S	-
13.	Final Inspection	WC	W	Yes
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT B: All works

Black Topping – Premix Carpeting (PC), Bituminous Concrete (BC), Bituminous Macadame (BM), Dense Bituminous Macadame (DBM)

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ITP NO.: 3109

TANK PADS

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	Approval of source of materials (aggregate, bitumen etc.)	WC	NOTE 1	NOTE 1	Format C4
2.	Stripping the area	WC	-	-	-
3.	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	Rw	Yes/ Format C1
	b) Field calibration, if any	WC	W	S	Yes
4.	Layout and marking of ground level	WC	S	-	Format C2
5.	Excavation to required level, compaction of sub-base	WC	W	S	-
6.	Checking/ testing of materials	WC	W	S	Format C5
7.	Filling selected materials in specified layers, rolling, watering	WC	S	-	-
8.	Compaction tests	WC	W	Rw	Format C3
9.	Gravel filling under annular ring with compaction and adding graded filler material (As applicable)	WC	W	S	Yes
10.	Anti-corrosive layer, consolidation	WC	S	-	-
11.	Premix carpeting on side slopes	WC	S	S	-
12.	Preparation of "As-built drawing" for erection	WC	Rw	Rw	Yes
13.	Check for settlement of pads during hydro testing of tanks	WC	W	W	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: All Site fabricated steel storage tanks for process fluid /Hydrocarbon, floating roof tanks having capacity more than 600cum or 10m dia and 8 m height.

CAT B: Site fabricated steel storage tanks for Raw water, Fire water, waste water, DM water, etc. and all tanks not covered under "CAT A"

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ITP NO.: 3110

MICRO GRADING

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
1.	a) Review of calibration certificates of instruments/ testing equipment's	WC	RW	Yes/ Format C1
	b) Field calibration, if any	WC	-	Yes
2.	Taking initial levels	WC	W	Yes
3.	Clearing/ Removal of extra soil, debris, etc. from site by transportation	WC	S	Yes
4.	Taking final levels	WC	S	Yes
5.	Verification of gradient of ground	WC	S	-
6.	Finishing of ground surface by hand compactor/ Roller (As applicable)	WC	S	-
7.	Final inspection	WC	W	Yes
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

CAT B: All works

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ITP NO.: 3140

FOR UNDERGROUND PIPING (CARBON STEEL/ AS/ SS) (Sheet 1 of 6)

Sl. No	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
A.	**PRIOR TO FABRICATION**				
1	Incoming Material **a) Owner's supply**	Contractor to check all free issue materials and maintain records of MIV for material issued by owner/EIL			
	b) Contractors supply	WC	Note -1		
2.	Welding Filler Material Approval/Qualification				
	i) Review of Manufacturer's Test Certificates/ other documents	WC	Rw	Rw	**Yes**
	ii)Testing, if any	WC	Rw	Rw	**Yes**
3.	WPS/PQR				
	i) Review of proposed Procedure	WC	HP	HP	Yes
	ii) Testing	WC	HP	HP	Yes
	iii) Approval of Final WPS/PQR	WC	HP	HP	Yes
4.	Welder Performance Qualification Test	WC	W	W	Yes
4a.	Certification & approval of welders	WC	W	W	Yes
5.	NDT Procedure Qualification				
	i) Review of proposed Procedure	WC	Rw	Rw	**Yes**
	ii) Testing	WC	Rw	Rw	**Yes**
	iii) Approval of NDT procedure	WC	HP	HP	**Yes**
6.	Preparation of sketches from General Arrangement drawings	WC	Rw	-	**Yes**
7.	Joint numbering	WC	Rw	-	**Yes**
8.	Approval of colour coding scheme	WC	Rw	-	Std spec
9.	Monitoring of colour coding on pipes & fittings	WC	S	-	
B.	**FABRICATION (SHOP & FIELD)**				
1.	Material as per piping class (check w.r.t. approved colour coding procedure)	WC	W		Format P1
	i) Fit-up check ii) Dimensional check	WC WC	S S	Rw Rw	

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ITP NO.: 3140

FOR UNDERGROUND PIPING (CARBON STEEL/ AS/ SS) (Sheet 2 of 6)

Sl. No	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
2.	Pre-heat (if any)	WC	S	-	Yes
3	Check for purity of purging/shielding Gas (if any)	WC	S		
4.	Purging (if any)	WC	S		
5.	Shielding rate (if any)	WC	S	-	--
6.	Baking of Electrodes	WC	S	-	Yes
7.	Inter-pass cleaning & Temperature check.	WC	S		--
8.	Visual check of completed welds - For welds with Random Radiography	WC	W	-	Format P2
	-For welds with 100% Radiography	WC	S	S	Format P2
9.	PT/MPT	WC	S	-	Yes
10.	Radiography marking (for Random Radiography)	WC	W	W	Format P3
11.	Radiography Interpretation	WC	W	W	Format P4
C.	**HYDROSTATIC/ PNEUMATIC TESTING**				
1.	Procedure Review	WC	Rw	Rw	Yes
2.	Correctness of Testing arrangements	WC	S	-	---
3.	Calibration of Pressure Gauges	WC	-	-	Format C1
4.	R.F. Pad testing, if any	WC	W	W	--
5.	Scrutiny of test packs for Mechanical & NDT Clearance (Refer **Annexure-1**)	WC	HP	HP	Annex-1, Format P5, UG1
6.	Air/Water Flushing (preliminary)	WC	S	S	-
6a.	Addition of corrosion inhibitors, if required – Approval of make & quality	WC	S	S	Yes

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ITP NO.: 3140
FOR UNDERGROUND PIPING (CARBON STEEL/ AS/ SS) (Sheet 3 of 6)

Sl. No	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
7.	Pneumatic/ Hydrostatic testing	WC	W	W	Format P6
8.	Draining of water & Air drying	WC	S	S	Format P6
D.	**LAYING**				
1.	Trench excavation and levels	WC	S	-	**Yes**
2.	Cleaning of pipe surface	WC	S	-	-
3	Approval of wrapping/coating material/ epoxy coating manufacturers	WC	Note 1	Note 1	**Yes**
4.	Approval of agency for wrapping & coating /epoxy coating	WC	Rw	Rw	**Yes**
5.	Sample test of coating materials in approved laboratory	WC	Rw	Rw	**Yes**
6.	Procedure qualification for wrapping & coating /epoxy coating	WC	HP	HP	**Yes**
7.	Application of primer	WC	S	S	--
8.	Coal tar temperature	WC	S	-	---
9.	Coating & wrapping /epoxy coating for 3LDPE coated pipes	WC	S	S	---
10.	Check Thickness of coating (if applicable)	WC	S	-	**Yes**
11.	Calibration of Holiday tester	WC	Rw	Rw	Format C1
12.	Holiday testing	WC	W	W	Yes
13.	Peel test	WC	W	S/Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: All pressure lines, Fire Water line, Cooling Water line, CB & ABD.
CAT B: Balance Works

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ITP NO.: 3140

FOR UNDERGROUND PIPING (CARBON STEEL/ AS/ SS) (Sheet 4 of 6)

Sl. No	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
14.	Lifting arrangement	WC	S	-	Yes
15.	Lowering (levels & orientation of branches)	WC	S	-	--
16.	Checking of wrapping & coating for damages during lowering, their repair, Holiday Testing, etc.	WC	W	W	--
17.	Back filling & compaction	WC	S	-	Yes
18.	Location, Brickwork, plaster of valve pit	WC	-	-	Yes
19.	Top cover & Finish of valve pit	WC	S	**S**	--
E.	**SYSTEM COMPLETION**				
1.	Tie in joints (Refer **Annexure-2**)	WC	Annex-2	Annex-2	
2.	Scrutiny of test packs for system testing (Refer **Annexure-1**)	WC	Annex-1	Annex-1	
3.	System testing	WC	W	S/Rw	Format UG2
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

CAT A: All pressure lines, Fire Water line, Cooling Water line, etc.
CATB: Balance Works

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ITP NO.: 3140

FOR UNDERGROUND PIPING (CARBON STEEL/ AS/ SS) (Sheet 5 of 6)

ANNEXURE – 1

Sl. No.	Activity	Contractor	EIL	
			CAT A	CAT B
F.	**MECHANICAL COMPLETION RECORD (U/G Piping)**			
1.	Clearance for flushing & testing	WC	Rw	Rw
1a.	Mechanical clearance			
	- Conformity with drawing	WC	Rw	Rw
	- Material as per Specification	WC	Rw	Rw
1b.	Welding & NDT clearance			
	- Material as per Specification	WC	Rw	Rw
	- Fit-up check record	WC	Rw	Rw
	- Visual check of completed welds	WC	Rw	-
	- PT/MPT	WC	Rw	Rw
	- Radiography	WC	Rw	Rw
	- PWHT & hardness	WC	Rw	Rw
	- RF pad testing	WC	Rw	Rw
2.	Flushing & Pressure testing	WC	Rw	Rw
3.	Coating & wrapping			
	- Surface preparation	WC	Rw	-
	- Primer application	WC	Rw	Rw
	- Coating, wrapping & peel test	WC	Rw	-
	- Holiday check	WC	Rw	Rw
4.	Laying			
	- Trench leveling	WC	Rw	Rw
	- Lowering & checking for damages in wrapping & coating, their repai ; Holiday testing, etc.	WC	Rw	Rw
	- Backfilling	WC	Rw	Rw

CAT B: All pressure lines, Fire Water line, Cooling Water line, etc.

CAT C: Balance works

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ITP NO.: 3140

FOR UNDERGROUND PIPING (CARBON STEEL/ AS/ SS) **(Sheet 6 of 6)**

ANNEXURE – 2

TIE-IN

Sl. No.	Activity	Contractor	EIL
A.	FIT UP	WC	W
B.	ROOT RUN DP	WC	W
C.	FINAL RUN DP	WC	W
D.	RADIOGRAPH REVIEW	WC	HP
E.	PWHT HARDNESS	WC	Rw
F.	RF PAD TESTING	WC	HP
G.	CLEANING & PRIMING	WC	S
H.	COATING, WRAPPING	WC	W
I.	PEEL TEST	WC	HP
J.	HOLIDAY TESTING	WC	HP
K.	CHECKING FOR ANY DAMAGE IN WRAPPING & COATING AFTER LOWERING, THEIR REPAIR HOLIDAY TESTING, ETC.	WC	W
L	BACK FILLING	WC	S

For CAT A as well as CAT B

Note : Job specific ITP to be developed in case of Non-CS/AS/SS MOC of piping materials.

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ITP NO: 3141

PLAIN CEMENT CONCRETE

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ format no.
1.	a) Review of calibration certificates of instruments/ testing equipment's	WC	Rw	Yes /Format C1
	b) Field calibration, if any	WC	S/Rw	Yes
2.	Checking of layout and materials, compaction of sub -grade	WC	S	Format C2, C3, C5, C7
3.	Mix proportion	WC	S	-
4.	Check for shuttering, dewatering if any.	WC	-	Yes
5.	Concreting with proper compaction	WC	-	-
6.	Checking of top level of PCC	WC	Rw	Yes
7.	Curing	WC	-	-
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

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ITP NO: 3142

REINFORCED CEMENT CONCRETE (SUBSTRUCTURE)

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1	Approval of source of materials	WC	HP	HP	Format C4
2.	Approval of agency for providing Ready Mixed Concrete (RMC), as applicable	WC	HP	HP	Yes
3.	a) Review of calibration certificates of instruments/ testing equipment's / Batching Plant	WC	HP	HP	Yes /Format C1
	b) Field calibration, if any	WC	W	W	Yes
4.	Checking of layout & condition of PCC/ leveling course	WC	S	S	Yes
5.	Incoming material checking	WC	NOTE 1	NOTE 1	Format C5 , C7
6.	Design of mix &establishment of strength at site by trial mix	WC	HP	HP	Yes
7.	Check for line & level of shuttering including its condition, quality and rigidity.	WC	S	S	
8.	Check for sub-soil water & dewatering arrangement, if any	WC	S	S	-
9.	Reinforcement & covers to reinforcement	WC	S	S	Yes
10.	Inserts, Anchor bolts and pipe sleeves, pockets, dowels, etc.	WC	W	S	-
11.	Pour Card	WC	W	W	Format C8, C9
12.	Quality Records of RMC like Delivery Ticket Formation, If applicable	WC	Rw	Rw	Yes
12.	Check for obstacles encountered (Electrical conduits, pipe lines, etc.)	WC	S	S	Yes
13.	Concreting, ,compaction & finishing of concrete	WC	W	S	Yes
14.	Casting of cubes/Slump	WC	S	S	Yes
15.	Curing	WC	S	S	
16.	Testing of cubes- 7 days	WC	S/Rw	S/Rw	Format C10
17	Testing of cubes- 28 days	WC	W	W	Format C10
18.	Removal of shuttering	WC	S	-	-
19.	Check for water tightness, rendering, if any	WC	W	W	-
20.	Preparation of As-built drawings	WC	Rw	Rw	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: Critical foundations of equipment's i.e compressors, reactors, columns, stacks, Unit Pipe racks, plant buildings and other equipment foundations with RCC Quantity > 250 Cum, tank foundations

CAT B: Non critical pipe racks(branch pipe, offsite pipe rack, etc.) non plant buildings ,pipe sleepers, manhole, catch pit, pipe culverts ,bridges other equipment foundations not covered in CAT A, and balance works

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ITP NO: 3143

REINFORCED CEMENT CONCRETE (SUPER STRUCTURE)

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CATA	CATB	
1	Approval of source of materials	WC	HP	HP	Format C4
2.	Approval of agency for providing Ready Mixed Concrete (RMC), as applicable	WC	HP	HP	Yes
3.	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	HP	Yes/ Format C1
	b) Field calibration, if any	WC	W	W	Format C1
4.	Checking of layout	WC	S	S	Yes
5.	Incoming material inspection	WC	Note 1	Note 1	Format C5, C7
6.	Design of mix &establishment of strength at site by trial mix	WC	HP	HP	Yes
7	Staging as per Drawing	WC	S	S	
7.	Check for line & level of shuttering and scaffolding/ vertical bracing including hoisting arrangements.	WC	S	S	--
8.	Reinforcement & covers to reinforcement	WC	S	S	Yes
9.	Inserts, bolts, pipe sleeves, MS rungs, concealed electrical conduits, fan hooks, dowels, etc. including welding if any	WC	S	S	Yes
10.	Pockets/ openings	WC	S	S	Yes
11.	Expansion joints, if any	WC	S	S	Yes
12.	Check for water stops, slopes, stoppers, if any	WC	S	S	Yes
13.	Pour Card	WC	W	W	Format C8, C9
14.	Quality Records of RMC like Delivery Ticket Information, if applicable	WC	Rw	Rw	Yes
15.	Concreting, testing, compaction & finishing of concrete	WC	W	S	Yes
16.	Casting of cubes/ Slumps	WC	S	S	Yes
17.	Curing	WC	S	S	-
18	Testing of cubes- 7 days	WC	S/Rw	S/Rw	Format C10
19.	Testing of cubes- 28 days	WC	W	W	Format C10
20.	Removal of formwork/ staging	WC	S	-	-
21.	Verification of dimensions viz AFC drawings and tolerances	WC	S	S	-
22	Check for water tightness, rendering, if any	WC	W	W	--
23	Preparation of As built drawing .	WC	Rw	Rw	Yes-
	INSPECTION & TEST DOCUMENTS				Yes
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: Super structure of foundations for Critical equipment's i.e compressors, reactors, columns, stacks, foundations, Slabs of plant and non plant buildings, tank foundations, Unit Pipe racks, plant buildings and super structure of any other equipment, etc.

CAT B: not covered in category A Non critical pipe racks(branch pipe, offsite pipe rack, etc) non plant buildings other than slab, catch pit and balance works, pipe sleepers, pipe culverts, bridges, manhole etc.

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ITP NO: 3145

RCC PAVEMENT/FLOORING

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
1.	Approval of source of materials	WC	Rw	Format C4
2	Approval of agency for providing Ready Mixed Concrete (RMC), as applicable	WC	HP	Yes
. 3.	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	Yes
	b) Field calibration, if any	WC	S	Format C1
4.	Layout checking/ excavation of all new foundations	WC	-	Yes
5.	Incoming material inspection	WC	NOTE 1	
6.	Design of mix &establishment of strength at site by trial mix	WC	HP	Yes
7.	Check for proper back filling/compaction/ completion of sub - Structure works	WC	S	Format C3, Yes
8.	Check for edges of shuttering, alternate panels	WC	-	-
9.	Check for slopes, thickness of flooring / pavement	WC	S	-
10.	Shuttering, reinforcement (as applicable)	WC	-	-
11.	Check for expansion joints/ Construction joints	WC	S	-
12.	Check for concealed pipe embedment, earthing, if any	WC	- S	-
13.	Check for dividing strips, as applicable	WC	S	-
14.	Concreting, finishing, etc.	WC	S	Format C8, C9
15.	Quality Records of RMC like Delivery Ticket Information	WC	Rw	Yes
16.	Concreting, testing, finishing, test cubes	WC	W	Yes
17.	Checking for line, levels, slopes, joints, thickness of flooring viz. AFC drawings	WC	S	-
18	Curing	WC	S	-
19.	Grinding & polishing, as applicable	WC	S	-
20.	Testing of concrete cubes (as applicable)	WC	W	Format C10
21.	Testing of vacuum dewatering flooring (as applicable)	WC	Rw	Yes
22.	Preparation of "As Built Drawings"	WC	Rw	Yes
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010
CAT B: All works.

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ITP NO: 3146

BRICK MASONARY

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	a) Review of calibration certificates of instruments/ testing equipment's	WC	Rw	Rw	Yes/ Format C1
	b) Field calibration, if any	WC	Rw	Rw	Yes
	c) Field testing of Materials, if any	WC	Rw	Rw	
2.	Incoming material inspection	WC	Note 1	Note 1	
3.	Cleaning of surface	WC	-	-	-
4.	Wetting/soaking of bricks	WC	S	S	-
5.	Cement mortar proportion	WC	S	S	-
6.	Staging & scaffolding	WC	-	-	-
7.	Hacking of adjacent concrete surface	WC	S	S	-
8.	Check for bond/closers, thickness of joints .	WC	S	-	-
9.	Line, level & plumb	WC	S	S	-
10.	Raking out joints, keys in brick work, if any	WC	S	S	-
11.	Check for placement of Reinforcement bars in case of partition brick work	WC	S	S	-
12.	Embedment of fixtures	WC	S	S	-
13.	Curing	WC	-	-	-
14.	Preparation of 'As Built' Drawings	WC	Rw	Rw	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw		Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: Load bearing walls
CAT B: Balance works

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ITP NO: 3147

STRUCTURAL STEEL WORKS

S. No	Activity	Contractor	EIL		Records to be submitted/
A	**PRE – FABRICATION ACTIVITIES**		CAT A	CAT B	
1.	a) Review of calibration certificates of instruments/ testing equipment's	WC	HP	HP	Yes/ Format C1
	b) Field calibration, if any	WC	S	S	Yes
2.	Incoming material inspection	WC	Note 1	Note 1	Yes
3.	Welding Filler material approval/ qualification				
	a) Manufacturing test certificates/ documents	WC	Rw	Rw	Yes
	b) Testing, if any	WC	W	W	Yes
4.	WPS/ PQR	WC	HP	HP	Yes
5.	Welders performance qualification	WC	W	W	Yes
6.	Layout checking	WC	S	-	Yes
7.	Welding equipment and accessories	WC	S	-	-
8.	Preparation and approval of Fabrication drawings	WC	Rw	Rw	Yes
B	**FABRICATION ACTIVITIES**				
1	Materials as per design drawing	WC	Rw	Rw	Format C12
2	Check straightness and non-warping of members	WC	S	S	Format C12
3	Dimensional and fit-up checks including provision of slopes for deflection wherever required	WC	S	S	Format C12
4	Visual check for welding	WC	S	S	Format C12
5	Grinding including surface preparation for painting and application of primer	WC	S	S	Format C12
6	Checking paint as per specs, shelf-life, etc.	WC	S	S	Yes
7	Application of specified paint, painting thickness, etc.	WC	S	S	Format C12
C	**FIELD ERECTION ACTIVITIES**				
1	Lifting arrangements including test certificates of lifting tackles	WC	S /Rw	S/Rw	Yes
2	Correctness of location	WC	S	-	Format C12
3	Orientation of bracing, lugs	WC	S	-	-
4	Alignment & levels	WC	S	-	Format C12
5	Field welding (if any)	WC	S	S	Format C12
6	Grouting	WC	S	S	Format C12
7	Finishing coat of paint, thickness of paint etc.	WC	S	S	Format C12
8	Preparation of As-built drawings	WC	Rw	Rw	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010
CAT A: Steel structures pertaining to equipment site compressors, reactors, columns, Unit Pipe racks, stacks, Technological structures.
CAT B: Steel structures **of** Non critical pipe racks(branch pipe, offsite pipe rack, etc. non plant buildings ,walkways, platforms ,etc.

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ITP NO: 3148

PILING WORKS

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1	Approval of source of materials	WC	Rw	Rw	Format C4
2	Approval of agency for providing Ready Mixed Concrete (RMC), if applicable	WC	HP	HP	Yes
3	a) Calibration certificate of measuring & testing equipment's/ instruments	WC	HP	HP	Yes/ Format C1
	b) Field calibration, if any	WC	W	S	Yes
4	Layout and ground level	WC	S	S	Yes
5	Incoming material inspection	WC	Note 1	Note 1	
6	Design of mix &establishment of strength at site by trial mix	WC	HP	HP	Yes
7	Driving of piles & check for set point	WC	S	S	-
8	Check for depth of bore and lowering of cage measuring	WC	S	-	-
9	Check for cage reinforcement, its length, overlaps	WC	S	S	-
10	Pour Card	WC	HP	HP	Format C8, C9
11	Quality records of RMC like Delivery Ticket Information, if applicable	WC	Rw	Rw	Yes
12	Concreting,	WC	W	S	Yes
13	Casting of cubes/Slumps	WC	S	S	Format C10
14	Testing of cubes- 7 days	WC	S/Rw	S/Rw	Format C10
15	Testing of cubes- 28 days	WC	W	W	Format C10
16	Check for cut off level of concreting & quantity of concrete poured	WC	S	-	Yes
17	Lifting of casing pipe	WC	S	S	-
18	Pile load tests (lateral/vertical/cyclic/pull out)	WC	W	W	Yes
19	Pile Integrity test, If applicable	WC	Rw	Rw	Yes
19	Submission of pile load test report	WC	Rw	Rw	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: Critical foundations of equipment's i.e compressors, reactors, columns, stacks, Technological structures, Unit Pipe racks, plant buildings and other equipment foundations.

CAT B: Non critical pipe racks(branch pipe, offsite pipe rack, etc) non plant buildings

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ITP NO: 3171

ANTITERMITE TREATMENT

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
1.	Testing of material & spraying devices including personal protective equipment's like facemask, gloves, shoes, etc.	WC	HP & Note 1	Yes
2.	Preparation of surface for taking dosage of emulsion by ramming of each layer of soil by roding the earth at specified intervals	WC	-	-
3.	Backfilling and compaction in specified layers along with application of emulsifier along the sides of masonry & RCC structures	WC	S	Format C3
4	Compaction of top surface for taking dosage of emulsifier by roding the earth at specified intervals for the entire floor area before concreting	WC	-	-
5	Check for consumption of emulsifier utilized	WC	Rw	Yes
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT B: All works

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ITP NO: 3172

PLASTERING

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1	Calibration of testing equipment's	WC	Rw		Format C1
2.	Checking/ testing of materials	WC	W		Format C5, C7
3	Check for completeness of all hidden jobs like piping, conduiting, etc.	WC	-	-	-
4	Check for grading of sand, Mix proportion	WC	S	S	-
5.	Sample preparation for finish and its approval	WC	W	S	-
6.	Neeru application on plaster (as applicable)	WC	S	-	-
7.	Chicken Wire Mesh at joints of brick/stone and concrete / steel	WC	S	-	-
7.	Hacking and cleaning the surface, removing loose particles, wetting the surface	WC	-	-	-
8	Checking of plaster thickness, plumb & even surface	WC	S	-	Yes
9	Check for grooves, openings, rounding off the corners, hollowness in plaster	WC	S	S	-
10	Curing	WC	S	S	-
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw		Yes

CAT A: Area requiring special finish

CAT B: Balance works.

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ITP NO.: 3173

DOORS, WINDOWS AND VENTILATORS

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	Incoming material inspection	WC	Note 1	Note 1	
2.	Calibration of testing equipment's	WC	HP	HP	Yes
3.	Check for sections & dimensions	WC	S	-	Yes
4.	Line, level & plumb	WC	-	-	-
5	Section joinery details	WC	Rw	-	-
6	Grouting with lugs/ dash fasteners	WC	-		-
7	Check for fixtures & fittings	WC	S	S	Yes
8	Check for thickness & type of glazing	WC	-	-	Yes
9	Check for rubber gasket, anodizing (as applicable)	WC	-	-	-
10	Brand/ shade of paints, no. of coats including surface preparation	WC	S	Rw	-
11	Final inspection	WC	HP	HP	Yes
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CATA: Main plant buildings

CATB: Balance works

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ITP NO.: 3174

PAINTING (BUILDING WORKS)

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	Completion of surface preparation	WC	-	-	-
2.	Incoming material inspection	WC	Note 1	Note 1	
3.	Confirmation of colour, shade & brand	WC	HP	HP	-
4.	Check for number of coats	WC	S	S	Yes
5	Curing, if any	WC	S	-	-
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: Main plant buildings, Major non plant building (viz: Administrative building, Training center etc

CATB: Balance works

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ITP NO. : 3175

SANITARY FITTINGS

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	Incoming material inspection	WC	Note 1	Note 1	
2.	Checking of sample (as applicable)	WC	S	-	Yes
3.	Check completeness of finishing works w.r.t. line, level & position	WC	S	-	-
4.	Check proper fixing of the sanitary fittings to give aesthetic appeal	WC	S	-	-
5	Check for leakage	WC	S	Rw	-
	INSPECTION & TEST DOCUMENTS				
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

CAT A: Main plant buildings, Major non plant building (viz: Administrative building, Training center etc)

CATB: Balance works

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ITP NO. : 3176

WATER PROOFING (ROOF)

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
1.	Approval of materials	WC	HP	Format C4
2.	a) Calibration certificate of measuring & testing equipment's/application instruments (if applicable)	WC	HP	Yes/ Format C1
	b) Field calibration, if any	WC	W	Yes
3	Surface preparation for screeding/ water proof plastering	WC	W	-
4.	Mix proportion, thickness of screeding/ plastering & slope towards rain water pipes	WC	S	Yes
5.	Formation of groove at specified height on parapet wall	WC	-	-
6.	Incoming material inspection, no. of coats, application procedure and consumption.	WC	Note 1	Yes
7.	Termination of material in groove on vertical plane	WC	S	-
8.	Check for hollowness, bubbles in water proofing, if any	WC	S	-
9.	Conducting a sample of water proofing test by flooding the area for specified interval (as applicable)	WC	W	
10	Cleaning of surface	WC	-	--
11	Submission of Guarantee in the requisite Performa	WC	Rw	Yes
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

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ITP NO: 3177

FALSE FLOORING AND FALSE CEILING

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
	FALSE FLOORING			
1.	Manufacturers Test Certificate	WC	Rw	Yes
2.	Incoming material inspection	WC	Note 1	Yes
3.	Cleaning base floor	WC	-	-
4.	Painting base floor with Polyurethane based paint (as specified)	WC	S	Yes
5.	Check for installation of grid framework	WC	S	-
6	Proper line, level & layout	WC	S	-
7	Final inspection	WC	HP	Yes
	FALSE CEILING			
1.	Manufacturers Test Certificate	WC	Rw	Yes
2.	Incoming material inspection	WC	Note 1	Yes
3.	Surface preparation of panel boards	WC	-	-
4.	Proper line, level & cut-outs	WC	S	-
5.	Painting of panel boards	WC	S	Yes
6	Final inspection	WC	HP	Yes
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

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ITP NO.: 3178

UNDER DECK INSULATION

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
1.	Incoming material checking including density	WC	Note 1	Yes
2.	Checking of adhesive, fasteners for anchorage	WC	S	Yes
3.	Fixing of scaffolding, ladders, platforms	WC	S	-
4	Fixing of under-deck insulation with adhesive	WC	-	-
5	Fixing of dash fasteners at defined spacing	WC	-	-
6	Finishing	WC	S	-
7	Final inspection	WC	W	Yes
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

NOTE :1) For Incoming material Inspection please refer ITP no: 6-82-1010

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ITP NO.: 3179

ROOFING ACCESSORIES

Sl. No.	Activity	Contractor	EIL		Records to be submitted/ Format No.
			CAT A	CAT B	
1.	Incoming material inspection	WC	HP/ Note 1	HP/ Note 1	Yes
2.	Ensure proper sequence of sheeting	WC	W		
3.	Check for mitring, overhang, laps, etc.	WC	S	-	-
4.	Slopes line, level of sheets, barge boards, ridges & gutters, overhang of sheets	WC	S	-	-
5	Bolting by drilling only, length of bolts, nos., anodizing and type of washers	WC	S	-	-
6.	Fixing of Wind Ties at the two caves end of the sheet	WC	S	-	-
6	Check for slopes of rain gutters, down take pipes, north lighting curves/ supports for gutters	WC	S	-	-
7	Check for leakage/ passing of light	WC	S	-	-
8.	Final inspection	WC	W	W	Yes
	INSPECTION & TEST DOCUMENTS				-
	Review Test and Inspection Documents	WC	Rw	Rw	Yes

NOTE : 1) For Incoming material Inspection please refer ITP no: 6-82-1010

2) Fixing arrangement need to be reviewed with respect to contract specifications.

CAT A: Important structures (e.g Compressor House, Ware house, workshop and Pump house etc.), main plant buildings, etc
CAT B: Balance works.

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ITP NO.: 3199

LIGHTING WORKS (NON PLANT BUILDINGS)

Sl. No.	Activity	Contractor	EIL	Records to be submitted/ Format No.
1.	Prepare detailed conduit layout diagram as per the approved electrical drawing	WC	Rw	Yes
2.	Provide GJ/PVC sleeves in columns/beams at identified locations to facilitate laying of conduit on later date.	WC	S	-
3.	Incoming material inspection	WC	Note 1	Yes
4.	Ensure that the conduit is laid in line with execution drawings & provide pull-wires as per requirement.	WC	S	-
5.	Check correctness of drop/JB locations	WC	S	-
6.	Check threaded joints are proper	WC	S	-
7.	Ensure all JB/Fan box are properly stuffed with jute	WC	S	-
8.	Ensure conduits are properly tied to reinforcement bars to prevent floating during concrete	WC	S	-
9.	Ensure proper supporting of conduit lengths wherever required	WC	S	-
10.	Ensure adequate chasing depth for conduit portion coming inside brick walls	WC	S	-
11.	Check workmanship towards joints and presence of any foreign material inside the conduits	WC	S	-
12.	Ensure wiring material is inspected at site before use	WC	W	Yes
13.	Ensure correctness of lighting wire size and no. of wires as per the drawing in each conduit portion	WC	S	-
14.	Preparation of "As Built" drgs.	WC	Rw	Yes
	INSPECTION & TEST DOCUMENTS			
	Review Test and Inspection Documents	WC	Rw	Yes

NOTE : 1) For Incoming material Inspection please refer ITP no: 6-82-1010

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SECTION - B

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FORMATS

FOR

CIVIL, STRUCTURAL &

ARCHITECTURAL WORKS

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FORMAT NO.: C1

RECORD OF CALBIRATION OF MEASURING/TESTING EQUIPMENTS

Project :
Client :
Name of Work :

Job No. :
Contractor :

Sl. No.	Name of Equipment/Apparatus	Model No.	Certificate No.	Calibrated By	Calibration Date	Next Calibration Due on	Remarks	Accepted	
								Contractor	EIL
	Total Station								
	Auto Level								
	Steel measurement tapes								
	Cross staff								
	Distomat								
	All balances								
	Weigh Batcher								
	Cube testing Machine								
	Pressure Gauges								
	Dial gauges								
	Dead weight tester								
	Vernier caliper/ screw gauge								
	Holiday tester								
	Universal Testing Machine								
	Charpy V-notch Impact testing machine								
	Hardness Testing Machine								
	Various Digital and Analog meters								
	Variable current, voltage and resistance generators								
	Temperature/ Pressure Recorders								
	Temperature gauges including RTDs								
	Thermocouples								
	Vibration probes								
	Decibel-meter								
	Any other								

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FORMAT NO.: C2

SURVEYING AND LAYOUT RECORD

Project :

Job No :

Client :

Contractor :

Name of Work :

1. Reference Drawing :
2. Reference Grid Pillars :
3. Reference Bench Mark/Reduced Level :
4. Co-ordinates :
5. Reduced Level :
6. Closing error, if any :
7. Layout Sketch :

(CONTRACTOR) (EIL) (CLIENT)

Date :

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FORMAT NO. : C3

TEST REPORT FOR DETERMINATION OF DRY DENSITY & MOISTURE CONTENT OF SAND/SOIL

Project :
Client :
Name of Work :
Location :

Job No :
Contractor :

Layer No :

S. No.	Description	Relation	Test Nos:						Remarks
			1	2	3	4	5	6	
1.	Wt. of mould + wt. of wet soil/sand	W_1 gm							
2.	Wt. of mould	W_2 gm							
3.	Wt. of wet soil/sand	$(W_1 - W_2)$ gm							
4.	Volume of mould	V cc							
5.	Density of wet soil/sand	$Dw = (W_1 - W_2)/V$ gm/cc							
6.	Wt. of wet sample taken	Ww gm							
7.	Wt. of sample after drying	Wd gm							
8.	Moisture Content (or directly by moisture meter)	Mc = (Ww – Wd)/wd x 100% (or "R" directly by rapid moisture meter)							
9.	Moisture Content after correction (in case of rapid moisture meter)	MC = R/(100-R) X 100							
9.	Dry density	Dd = Dw/(1+Mc) gm/CC							
10.	Laboratory Max dry density	gm/cc							
11.	Degree of Compaction	%							
12.	Required degree of compaction	%							
13.	Obtained degree of compaction	DOC = Dfd / Did X 100							
13.	Optimum Moisture Content (OMC)	%							

(TESTED BY/LAB-IN-CHARGE) (CONTRACTOR) (EIL)

Date :

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FORMAT NO. : C4

RECORD OF APPROVAL OF SOURCE(S) FOR AGGREGATES,SOIL

Project :

Job No :

Client :

Contractor :

Name of Work :

1. Reference :
2. Material :
3. Location of Source :
4. Approx. distance from the site :
5. Physical Properties
   - a) Colour (as applicable) :
   - b) Shape (as applicable) : Rounded/Irregular
   - c) Texture (as applicable) : Glossy/Smooth/Granular
6. Tests conducted at :
7. Code of Conformance :
8. Test Report Reviewed : Satisfactory/Un-satisfactory
9. Remarks : The source is approved/not approved
10. Explanation if any :

Enclosures :
- a) Reviewed Test Reports
- b) Request of contractor, if available

COMMITTEE MEMBERS :

APPROVED :
- i) EIL :
- ii) Client :

Signature of the contractor :

Date :

Place :

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FORMAT NO. : C5

SIEVE ANALYSIS REPORT

Project :
Client :
Wt. of Sample taken :

Job No :
Date :

Name of Work :
Contractor :
Date on which sample taken :

FINE AGGREGATE

S. No.	Sieve Size	Weight Retained (gm)	Percentage Retained	Cumulative % Retained	% Passing	Fineness Modulus	Zone (As per IS:383)	Remarks
1.	4.75mm							
2.	2.36mm							
3.	1.18mm							
4.	600 u							
5.	300 u							
6.	150 u							
7.	Pan							

COARSE AGGREGATE/ROAD METAL		Wt. of Sample taken :					Passed/ Failed (As per IS:383/EIL Spec 6-64-0018)	Remarks
1.	125mm							
2.	90mm							
3.	80mm							90-45 (Gr-I), 63-45 (Gr-II), 13.2mm (screening) for road work
4.	63mm							
5.	53mm							
6.	45mm							
7.	40mm							
8.	22.4mm							
9.	20mm							
10.	16mm							40mm down for PCC
11.	13.2mm							
12.	12.5mm							20mm down for RCC
13.	11.2mm							
14.	10mm							
15.	5.6mm							
16.	4.75mm							
17.	2.36mm							
18.	180 u							

(TEST BY/LAB-IN-CHARGE) (CONTRACTOR) (EIL)

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FORMAT NO. : C6

UNDERGROUND PIPING-TEST REPORT (RCC/CI)

Project :
Client :
Name of Work :

Job No :
Contractor :

1. Reference Drawing :
2. Location :
3. Line Designation :
4. Type of Pipe & System :
5. Specification :
6. Dia of Pipe :
7. Gradient :
8. Type of Manhole :
9. Test (s) Conducted :
10. Date of Testing :
11. Remarks, if any :

CONTRACTOR EIL CLIENT

Date :

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FORMAT NO. : C7

CEMENT TESTING RESULT REPORT

Project :
Client :
Name of Work :
Brand of Cement :
Wt. of sample taken :
Room Temperature :

Job No :
Contractor :

Consignment No. :
Sample Collected on :

A. *CONSISTENCY*

Trial No.	Wt. of Cement (gm)	Wt. of Water Added (gm)	% of Water	Reading on Indicator (mm)	Consistency	Remarks

B. SETTING TIME

Trial No.	Wt. of Cement (gm)	Wt. of Water Added (gm)	W/C Ratio	Time Recorded When Water Added	Time Recorded At set	Initial Set	Final Set	Setting Time	Remarks

C. *FINENESS*

Trial No.	Wt. of Cement *Sample Used*	Retained on 90 µ IS sieve in gm	% Retained	Remarks

D. COMPRESSIVE STRENTH

Cube Size : 7.06X7.06X7.06 cm

Trial No.	Mix Proportion	Date of		Age of Specimen	Crushing Surface Area (Cm^2)	Crushing Load (Kg)	Crushing Strength (Kg/Cm^2)	Remarks
		Casting	Testing					

(TESTED BY)/LAB-IN-CHARGE (CONTRACTOR) (EIL)

Date :

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FORMAT NO. : C8

POUR CARD-I (PROGRAMME OF CONCRETING)

	Contractor :			***Client :***	
	Name of work :				
1.	Reference document :				
2.	Type of structure :		Location :		
3.	Levels From :		To :		
4.	Grade of concrete/ Approved Design Mix				
5.	Brand name, Grade and Consignment no. of cement				
6.	Estimated volume of concrete :				
7.	Quantity of cement required :				
8.	***Reinforcement checking details*** :				
		No.	Dia.	Length	
	a) Laps				
	b) Separators				
	c) Chairs				
	d) Any other				
	Remarks				

9.	**Pre pour inspection details**	**Checked**	**NA**
	a) Survey/ Layout		
	b) Sub soil compaction		
	c) Completion of underground works		
	d) Cleanliness		
	e) Cover to reinforcement		
	f) Anchor bolts/Insert plates		
	g) Sleeves/ pockets		
	h) Water stops		
	i) Formwork		
	j) Slopes		
	k) Construction/ Expansion joints		
	l) Admixtures		
	m) Any other		
	Remarks		

10.	Clearance for Electrical/ Mechanical works required/ not required :	***Electrical***	***Mechanical***
11.	The above structure is finally inspected on at AM/PM and found/ not found satisfactory for concreting.		
	Remarks, if any		

(Contractor)	**(EIL)**	**(Client/ Owner)**
Name	Name	Name
Designation	Designation	Designation
Date	Date	Date

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FORMAT NO. : C9

POUR CARD-II (OBSERVATIONS DURING CONCRETING)

Contractor :				***Client :***	
Name of work :					
1.	a) Quality of coarse aggregates	Satisfactory ☐	Not satisfactory ☐		
	b) Quality of fine aggregates	Satisfactory ☐	Not satisfactory ☐		
	c) Bulkage of sand taken into account	Yes ☐	No ☐		
2.	Quality of water	Satisfactory ☐	Not satisfactory ☐		
3.	***Machinery mobilization***			***Nos.***	***Stand by***
	a) Mixture machine				
	b) Ready mixed concrete dumpers				
	c) Vibrators				
	d) Pumps				
	e) Hoists				
4.	Pour start time :	AM/PM ;	Date :		
5.	Slump				
6.	W/C Ratio				
8.	Type of weather	Normal ☐	Abnormal ☐		
	Details of abnormality : (Precautions taken for <5^{0}C and >40^{0}C, rainy season)				
10.	Number of cubes taken & Cube identification number/marks :				
11.	Quantity of concrete poured :				
12.	Pour completion time :	AM/PM ;	Date :		
13.	Curing method :				
	☐ Traditional	☐ Curing compound			
	☐ Blankets/ foils/ gunny bags	☐ Others (specify)			
14.	Period for removal of form work :				
15.	Any defect(s) observed during concreting :				

(Contractor)	**(EIL)**	**(Client/ Owner)**
Name	Name	Name
Designation	Designation	Designation
Date	Date	Date

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FORMAT NO. : C10

CRUSHING STRENGTH TESTING RESULTS OF CONCRETE CUBES

Project :

Job No :

Client :

Contractor :

Name of Work :

Grade of Concrete :

Type of Cement :

W/C Ratio :

Max. size of Aggregate :

Cube No.	Id. Mark on cube	Type & Location of Structure	Date of		Age (days)	Dimensions of Cube			Vol. of Cube (m^3)	Wt. of Cube (Kg)	Unit WT. (Kg/ m^3)	Surface Area (mm^2)	Crushing Load (Kn)	Crushing Strength (N/mm^2)	Average Compressive Strength	Remarks
			Casting	Testing		L (Cm)	B (Cm)	H (Cm)								

(TESTED BY)/LAB-IN-CHARGE (CONTRACTOR) (EIL)

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FORMAT NO. : C11

DIMENSIONAL, WATER ABSORPTION, CRUSHING STRENGTH & EFFLORESCENCE TESTING RESULTS OF BRICKS

Project :

Job No :

Client :

Contractor :

Name of Work :

S. No.	Frog Mark	Wt.of oven *Dried Brick* (gm)	Absorption Period (hr)	Wt. of wet Brick (gm)	% of Water Absorption	Efflorescence Observed After Drying	Size of Brick (L X B X H) Cm	Crushing Surface Area (Cm^2)	Crushing Load (Kg)	Crushing Strength (Kg/Cm^2)	Remarks

NOTE : i) Water absorption shall not be more than 20% by its dry weight. Bricks should be soaked in cold water for 24 hrs.
ii) Code of conformance shall be IS:3495 (for conducting tests) and IS:5454 (for collecting samples)

(TESTED BY/LAB-IN-CHARGE) CONTRACTOR EIL

Date :

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FORMAT NO. : C12

STRUCTURE FABRICATION & ERECTION SHEET

Project :

Job No :

Client :

Contractor :

Name of Work :

Reference Drawing :

Location/Coordinates/Grids :

Layout Clearance obtained : Yes/ No

S. No.	Item No.	Material & Dimensional clearance	Shop Fit up		Shop welding		Cleaning & primer painting		Erection Fit up		Alignment & leveling		Field welding		Grouting clearance		Final Painting & thickness		Remarks
			Con	EIL	Con	EIL	Con	EIL	Con	EIL	Con	EIL	Con	EIL	Con	EIL	Con	EIL	

Abbreviations:

Con : Contractor's signature with date

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SECTION - C

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FORMATS

FOR

UNDERGROUND PIPING WORKS

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FORMAT NO. : P1

DAILY FIT UP INSPECTION & TRACEABILITY REPORT

Project :
Client :
Name of Work:
Report No. :

Job No :
Contractor :

Date :

Sl. No.	Service/Line No.	Dia.	Joint No.	*Type*	Inch Mtr.	Manufacturers Heat No.	Clearance	Remarks
	TOTAL INCH DIA.				TOTAL INCH MTR.			

Total Inch	Previous	Till Date
Diameter		
Meter		

G – Butt Weld	S – Socket Weld	B – Branch Weld	M – Mitre Weld

(CONTRACTOR) (EIL)

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FORMAT NO. : P2

WELD VISUAL INSPECTION REPROT

Project :

Job No :

Client :

Contractor :

Name of Work :

Report No. :

Date :

WPS No. :

Sl. No.	Service/Line No.	Dia.	Joint No.	Type	Welder No.	Visual Inspection Clearance	*Remarks*
	Total inch Dia						

WORK LOAD =
PREVIOUS =
TILL DATE =
% PROGRESS =

G - BUTT WELD
S - SOCKET WELD
B - BRANCH WELD
M - MITRE WELD

CONTRACTOR EIL

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FORMAT NO. : P3

RADIOGRAPHY OFFERING REPORT

Project :

Job No :

Client :

Contractor :

Name of Work :

Report No. :

Date :

Sl. No.	Service/Line No.	Dia.	Joint No.	Welder No.	Radiography No.	Accepted Date	R.A. Bill No.

CONTRACTOR

EIL

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FORMAT NO. : P4

RADIOGRAPHY INTERPRETATION REPORT

Project : Job No :

Client : Contractor :

Name of Work :

Radiography Technique : SWSI/DWSI/DWDI

Source : Ir192 ☐ , X-Ray ☐ , Cobalt 60 ☐

Film Type &Make :

IQI : Date :

Radiography Procedure No. :

Sl. No.	Service/ Line No.	Dia.	Joint No.	Welder No.	Radiography No.	Segment	Results	Joint Status A/R/H

SWSI - SINGLE WALL SINGLE IMAGE
DWSI - DOUBLE WALL SINGLE IMAGE
DWDI - DOUBLE WALL DOUBLE IMAGE

A - ACCEPTED
R - REPAIR
H - HOLD
S/C - SURFACE CHECK
RT - RETAKE

CONTRACTOR EIL

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FORMAT NO. : P5

PIPING HYDROTESTATIC TEST RELEASE RECORD

Project :

Job No :

Client :

Contractor :

Name of Work :

Plan : _____	Date : _____
Loop No : _____	Area : _____
	REF P & ID No. : _____
	INCH MTR : _____
	From _____ To _____

		Line No. (s)		Isometric No. (s)	P&ID No. (s)	

Test Medium :		Test Duration :	Design/Test Pressure :
Test Pressure Gauge No.	Range	Calibration Certificate No.:	Gauge Calibration Date:

Items to check		Accept		Witness
		Contractor	EIL	
	Field Installation Checklist Prior to Hydrostatic test Signed			
	Punch list Prepared	Yes ☐	No ☐	
	Pre – Hydrostatic test Punch items Cleared			
	Accessibility to Inspection/Witness Locations			
	Capacity of pressurizing pump checked			
	Cordon off area for high pressure testing, as required			
	Pre-hydrostatic test flushing carried out			
	IBR/Others test Witnessing Required Yes No			

System Released for Pressure Testing :

Contractor :	**EIL:**
Sign : Name :	Sign : Name :
Date :	Date :
Designation :	Designation:

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FORMAT NO. : P6

PIPING HYDROSTATIC TEST ACCEPTANCE RECORD

ACTIVITY	Date	Time
Water Filling and Venting started at		
Water Filling Completed		
Vents Closed		
Isolation of Pressurizing pump		
Test completed at :		
- Water drained		
- Air		
- Temp Blinds Removed		
- Checked for reinstallation of a. Valves b. Others		
- Cold setting of spring supports carried out		

Contractor :	EIL :
Sign :	Sign:
Date :	Date:
Name : Designation	Name: Designation:
	Reviewed by EIL Lead Engineer/ Area Coordinator :
	Sign:
	Date:
	Name: Designation:

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FORMAT NO. : UG1

LINEWISE RECORD

Project :

Job No :

Client :

Contractor :

Name of Work:

Plant :

% Radiography :

Loop No. :

Sl. No.	Dia.	Jt. No	Type	Fit-up Clearance Date	Welder No.	Date of Welding	Radiography		Stress Relieve Chart No.	Hardness	Hydro-static test Date	Clearance date for					Remarks
							No.	Result & Date				Cleaning & Priming	Wrapping Coating / Epoxy Coating & repair (if any) for 3LPE Pipe	Trench Level Checking	Holiday Checking	Lowering Back-Filling	

CONTRACTOR
Date:

EIL

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FORMAT NO. : UG2

U/G PIPING SYSTEM TESTING RECORD

ACTIVITY	Date	Time
Air/Water Filling and Venting started at		
Water Filling Completed/Air pressure achieved		
Vents Closed (for water testing)		
Isolation of Pressurizing pump/compressor		
Visual Test/Soap Bubble check completed at :		
- Water drained/Air depressurized		
- Drying, if applicable		
- Temp Blinds Removed		
- Checked for reinstallation of a. Valves b. Others		

Contractor :	EIL :
Sign :	Sign:
Date :	Date:
Name : Designation	Name: Designation:
	Reviewed by EIL EIL Lead Engineer/Area Coordinator :
	Sign:
	Date:
	Name: Designation:

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मानक गुणवत्ता आश्वासन योजना

(आइटम रेट ठेकेदारो के लिये)

STANDARD QUALITY ASSURANCE PLAN
(FOR ITEM RATE CONTRACTORS)

Rev. No.	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
4	29.03.2024	REVISED AND UPDATED	DK	AC	RKS	MN
3	30/03/2019	REVISED AND UPDATED	SKG	AP	AKK	RKT
2	26/02/2014	REVISED AND UPDATED	SM	DJ	RKD	SC
1	23/05/2008	REVISED AND UPDATED	AS	RK	SCB	VC
0	05/12/2002	ISSUED FOR IMPLEMENTATION	AB	MPJ	RSG	GRR

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Abbreviations :

CI	:	Cast Iron
EHT	:	Extra High Tension
EMCC	:	Emergency Motor Control Centre
EOT	:	Electrically Operated Traveling
GI	:	Galvanized Iron
HOT	:	Hand Operated Traveling
HT	:	High Tension
JB	:	Junction Box
M	:	Supervisor (Mechanical)
MCC	:	Motor Control Centre
PCC	:	Power Control Centre
QAP	:	Quality Assurance Plan
RCC	:	Reinforced Cement Concrete
VSD	:	Variable Speed Drives
WBM	:	Water Bound Macadam

Construction Standards Committee

Convenor: Sh. R K Singh, ED (Construction)

Members: Sh. D S N Murthy, GGM (Projects)
Sh. Chinmoy Kapuria, CGM (SCM)
Sh. Udayan Chakravarty, CGM (Piping)
Sh. Abhijit Chakraborty, GM (Construction)
Sh. Pankaj Kumar Rai, DGM (Construction)
Sh. Dhananjay, AGM (Construction)

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2.	Quality Assurance Plan for Structural Works	6-82-6105	7 - 8
3.	Quality Assurance Plan for Architectural Works	6-82-6110	9
4.	Quality Assurance Plan for Mechanical Works	6-82-6115	10
5.	Quality Assurance Plan for Electrical Works	6-82-6120	11
6.	Quality Assurance Plan for Instrumentation Works	6-82-6125	12
7.	Quality Assurance Plan for General Works	6-82-6130	13

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GENERAL NOTE

1. *These are only sample Quality Assurance Plans (QAPs). Contractor to prepare job specific QAP depending upon the contract specification, scope, technology, etc. and submit the same for approval of the Engineer-in-Charge well before commencement of the activity*

2. *Specifications mentioned under 'Code of conformance' column are only for the purpose of illustration. The applicable specification(s) shall be followed by the contractor.*

LEGEND

RE	:	**Resident Engineer / Resident Construction Manager**
SC	:	**Engineer/Supervisor (Civil)**
SM	:	**Engineer/Supervisor (Mechanical)**
SE	:	**Engineer/Supervisor (Electrical)**
SI	:	**Engineer/Supervisor (Instrumentation)**
SQ	:	**Engineer/Supervisor (Quality)**
SS	:	**Engineer/Supervisor (HSE)**
LE	:	**Lead Discipline Engineer**

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QAP No. : 6101

QAP FOR GENERAL CIVIL WORKS

(Sheet 1 of 2)

	ACTIVITY DESCRIPTION	PROCEDURE NO.	CODE OF CONFORMANCE	PERFORMER	CHECKER	APPROVER	RECORDS TO BE SUBMITTED
1.	Survey works	Contractor's Procedure	EIL Spec. No. 6-65-0002	SC	LE/SQ	RE	Yes
2.	Earthwork for underground piping	- Do -	EIL Spec. No. 6-65-0006	SC	LE/SQ	RE	Yes
3.	Compound wall	- Do -	EIL Spec. No. 6-65-0010	SC	LE/SQ	RE	Yes
4.	Classification of soil for Earth Work in site grading	- Do -	EIL Spec. No. 6-65-0016	SC	LE/SQ	RE	Yes
5.	Site grading & rock cutting for site grading	- Do -	EIL Spec. No. 6-65-0017	SC	LE/SQ	RE	Yes
6.	Road & flexible pavements (upto WBM layer)	- Do -	EIL Spec. No. 6-65-0018	SC	LE/SQ	RE	Yes
7.	Road & flexible pavements (upto WMM layer)	- Do -	EIL Spec. No. 6-65-0014	SC	LE/SQ	RE	Yes
8.	Concrete Pavement	- Do -	EIL Spec. No. 6-65-0019	SC	LE/SQ	RE	Yes
9.	Flexible pavements with bitumen premix carpet	- Do -	EIL Spec. No. 6-65-0020	SC	LE/SQ	RE	Yes

Please refer Page 4 of 13 for General Notes and Legend

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QAP No. : 6101

QAP FOR GENERAL CIVIL WORKS

(Sheet 2 of 2)

	ACTIVITY DESCRIPTION	PROCEDURE NO.	CODE OF CONFORMANCE	PERFORMER	CHECKER	APPROVER	RECORDS TO BE SUBMITTED
9.	Tank Pads	Contractor's Procedure	EIL Spec. No. 6-65-0022	SC	LE/SQ	RE	Yes
10.	Underground and above ground G.I. pipeline system (water services)	- Do -	EIL Spec. No. 6-65-0027	SC	LE/SQ	RE	Yes
11.	Fabrication and laying of Underground piping	- Do -	EIL Spec. No. 6-65-0030	SC/SM	LE/SQ	RE	Yes
12.	Corrosion protection tape coating for underground steel piping	- Do -	EIL Spec. No. 6-79-0011	SC/SM	LE/SQ	RE	Yes
13.	Underground C.I. piping system	- Do -	EIL Spec. No. 6-65-0036	SC	LE/SQ	RE	Yes
14.	Underground sewer system - pre cast R.C.C. pipes	- Do -	EIL Spec. No. 6-65-0042	SC	LE/SQ	RE	Yes
15.	Underground sewer system-HDPE Pipes	- Do -	EIL Spec. No. 6-65-0044	SC	LE/SQ	RE	Yes
16.	Film lining covered with concrete lining for earthern reservoir	- Do -	EIL Spec. No. 6-65-0046	SC	LE/SQ	RE	Yes
17.	Plumbing and building drainage	- Do -	EIL Spec. No. 6-65-0053	SC	LE/SQ	RE	Yes

Please refer Page 4 of 13 for General Notes and Legend

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QAP No. : 6105

QAP FOR STRUCTURAL WORKS

(Sheet 1 of 2)

	ACTIVITY DESCRIPTION	PROCEDURE NO.	CODE OF CONFORMANCE	PERFORMER	CHECKER	APPROVER	RECORDS TO BE SUBMITTED
1.	Civil & structural works – materials	Contractor's Procedure	EIL Spec. No. 6-68-0002	SC	LE/SQ	RE	Yes
2.	Earth work	- Do -	EIL Spec. No. 6-68-0003	SC	LE/SQ	RE	Yes
3.	Plain & reinforced cement concrete	- Do -	EIL Spec. No. 6-68-0004	SC	LE/SQ	RE	Yes
4.	Reinforced cement concrete in liquid retaining structures	- Do -	EIL Spec. No. 6-68-0005	SC	LE/SQ	RE	Yes
5.	Structural steel works	- Do -	EIL Spec. No. 6-68-0006	SC/SM	LE/SQ	RE	Yes
6.	Structural steel works (tubular/ hollow sections)	- Do -	EIL Spec. No. 6-68-0007	SC/SM	LE/SQ	RE	Yes
7.	Miscellaneous steel works	- Do -	EIL Spec. No. 6-68-0008	SC/SM	LE/SQ	RE	Yes
8.	Brick masonry	- Do -	EIL Spec. No. 6-68-0009	SC	LE/SQ	RE	Yes

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QAP No. : 6105

QAP FOR STRUCTURAL WORKS

(Sheet 2 of 2)

	ACTIVITY DESCRIPTION	PROCEDURE NO.	CODE OF CONFORMANCE	PERFORMER	CHECKER	APPROVER	RECORDS TO BE SUBMITTED
9.	Demolition and dismantling	Contractor's Procedure	EIL Spec. No. 6-68-0012	SC	LE/SQ	RE	Yes
10.	Miscellaneous items (like Anti-termite treatment)	- Do -	EIL Spec. No. 6-68-0013	SC	LE/SQ	RE	Yes
11.	Fire proofing of steel structures	- Do -	EIL Spec. No. 6-68-0033	SC	LE/SQ	RE	Yes
12.	Shotcreting (guniting)	- Do -	EIL Spec. No. 6-68-0055	SC	LE/SQ	RE	Yes
13.	Vacuum dewatering concrete system	- Do -	EIL Spec. No. 6-68-0062	SC	LE/SQ	RE	Yes
14.	Materials for reinforced concrete piles	- Do -	EIL Spec. No. 6-74-0006	SC	LE/SQ	RE	Yes
15.	Construction and installation of driven cast-in-situ piles	- Do -	EIL Spec. No. 6-74-0010	SC	LE/SQ	RE	Yes
16.	Testing of concrete piles	- Do -	EIL Spec. No. 6-74-0013	SC	LE/SQ	RE	Yes

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QAP No. : 6110

QAP FOR ARCHITECTURAL WORKS

ACTIVITY DESCRIPTION		PROCEDURE NO.	CODE OF CONFORMANCE	PERFORMER	CHECKER	APPROVER	RECORDS TO BE SUBMITTED
1.	Floor finishing	Contractor's Procedure	EIL Spec. No. 6-75-0002	SC	LE/SQ	RE	Yes
2.	Steel/Aluminium Doors, Windows and Ventilators	- Do -	EIL Spec. No. 6-75-0004	SC	LE/SQ	RE	Yes
3.	Plastering and pointing	- Do -	EIL Spec. No. 6-75-0005	SC	LE/SQ	RE	Yes
4.	Roofing Treatment	- Do -	EIL Spec. No. 6-75-0006	SC	LE/SQ	RE	Yes
5.	Whitewashing, Colour Washing Distempering, Painting and Polishing	- Do -	EIL Spec. No. 6-75-0007	SC	LE/SQ	RE	Yes
6.	Roofing	- Do -	EIL Spec. No. 6-75-0008	SC	LE/SQ	RE	Yes
7.	Sanitary Fittings and Fixtures	- Do -	EIL Spec. No. 6-75-0009	SC	LE/SQ	RE	Yes
8.	False Ceiling, False Flooring Under deck Insulation & Partitioning	- Do -	EIL Spec. No. 6-75-0010	SC	LE/SQ	RE	Yes

Please refer Page 4 of 13 for General Notes and Legend

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QAP No. : 6115

QAP FOR MECHANICAL WORKS

	ACTIVITY DESCRIPTION	PROCEDURE NO.	CODE OF CONFORMANCE	PERFORMER	CHECKER	APPROVER	RECORDS TO BE SUBMITTED
1.	Above Ground & Underground Piping	Contractor's/ Vendor's Procedure	EIL Spec. Nos. 6-44-0005, 0012,0013, 0016	SM	LE/SQ	RE	Yes
2.	Column Internals	- Do -	EIL Spec. No. 6-14-0016	SM	LE/SQ	RE	Yes
3.	Fired Heaters	- Do -	EIL Spec. No. 6-17-0001	SM	LE/SQ	RE	Yes
4.	Refractory & Insulation Works-Fired Heaters	- Do -	EIL Spec. No. 6-17-0001, 6-79-0001	SM	LE/SQ	RE	Yes
5.	Equipment Erection (Static)	- Do -	EIL Spec. No. 6-76-0001	SM	LE/SQ	RE	Yes
6.	Equipment Erection (Rotary)	- Do -	EIL Spec. No. 6-76-0001	SM	LE/SQ	RE	Yes
7.	Crane (EOT/HOT)	- Do -	EIL Spec. No. 6-48-0002, 0003	SM	LE/SQ	RE	Yes
8.	Storage Tanks	- Do -	EIL Spec. No. 6-13-0053	SM	LE/SQ	RE	Yes

Please refer Page 4 of 13 for General Notes and Legend

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QAP No. : 6120

QAP FOR ELECTRICAL WORKS

	ACTIVITY DESCRIPTION	PROCEDURE NO.	CODE OF CONFORMANCE	PERFORMER	CHECKER	APPROVER	RECORDS TO BE SUBMITTED
1.	Transformer (Power/Distribution/Lighting)	Contractor's/Vendor's Procedure	EIL Spec. No. 6-51-0081	SE	LE/SQ	RE	Yes
2.	Motor (HT/LT)	- Do -	EIL Spec. No. 6-51-0081	SE	LE/SQ	RE	Yes
3.	Generator	- Do -	EIL Spec. No. 6-51-0035, 0040, 6-51-0081	SE	LE/SQ	RE	Yes
4.	Switch Gears (HV/MV)/ VSD	- Do -	EIL Spec. No. 6-51-0081	SE	LE/SQ	RE	Yes
5.	EHT/HT Main Bus &Allied Equip.	- Do -	EIL Spec. No. 6-51-0081	SE	LE/SQ	RE	Yes
6.	Cable Laying	- Do -	EIL Spec. No. 6-51-0082	SE	LE/SQ	RE	Yes
7.	Lighting	- Do -	EIL Spec. No. 6-51-0083	SE	LE/SQ	RE	Yes
8.	Earthing	- Do -	EIL Spec. No. 6-51-0084	SE	LE/SQ	RE	Yes
9.	Field inspection, testing and commissioning of electrical installations	- Do -	EIL Spec. No. 6-51-0087	SE	LE/SQ	RE	Yes

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QAP No. : 6125

QAP FOR INSTRUMENTATION WORKS (FIELD)

	ACTIVITY DESCRIPTION	PROCEDURE NO.	CODE OF CONFORMANCE	PERFORMER	CHECKER	APPROVER	RECORDS TO BE SUBMITTED
1.	Installation of field instruments including calibration	Contractor's Procedure	EIL Spec. No. 6-52-0060	SI	LE/SQ	RE	Yes
2.	Cable works	- Do -	EIL Spec. No. 6-52-0060	SI	LE/SQ	RE	Yes
3.	Impulse piping/tubing works	- Do -	EIL Spec. No. 6-52-0060	SI	LE/SQ	RE	Yes
4.	Panel/Console works including DCS/PLC works	- Do -	EIL Spec. Nos. 6-52-0049, 6-52-0060	SI	LE/SQ	RE	Yes

Please refer Page 4 of 13 for General Notes and Legend

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QAP No. : 6130

QAP FOR GENERAL WORKS

	ACTIVITY DESCRIPTION	PROCEDURE NO.	CODE OF CONFORMANCE	PERFORMER	CHECKER	APPROVER	RECORDS TO BE SUBMITTED
1.	Painting	Contractor's/Vendor's Procedure	EIL Spec. No. 6-79-0021	SC/SM	LE/SQ	RE	Yes
2.	Insulation	- Do -	EIL Spec. Nos. 6-79-0026, 0027	SC/ SM	LE/SQ	RE	Yes
3.	Refractory Lining	- Do -	EIL Spec. No. 6-79-0001	SC/SM	LE/SQ	RE	Yes
4.	Ceramic Fibre Lining	- Do -	EIL Spec. No. 6-79-0005	SC/SM	LE/SQ	RE	Yes
5.	Incoming material Inspection	- Do -	EIL Spec. No. 6-82-1010	SC/SM/SI/SE	LE/SQ	RE	Yes
6.	Health, Safety & Environmental Management	- Do -	EIL Spec. No. 6-82-0001	SS/SC/SM/SE/SI	LE/SQ	RE	Yes

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प्रबलित कंक्रीट भूस्तंभ की सामग्री हेतु मानक विनिर्देश

STANDARD SPECIFICATION FOR MATERIALS FOR REINFORCED CONCRETE PILES

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
4	22.09.2020	REAFFIRMED & REISSUED	GK	VKP	AS	SM
3	26.09.2014	REVISED & ISSUED AS STANDARD SPECIFICATION	GK	VKP	SD	S Chanda
2	03.03.2008	REVISED & ISSUED AS STANDARD SPECIFICATION	VKP	SDN	VK	VC
1	26.03.1998	REVISED & ISSUED AS STANDARD SPECIFICATION	SDN	UB	ECHGR	ASONI
0	21-05-1985	ISSUED AS STANDARD SPECIFICATION	RKMB	MI	MI	JRP

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Abbreviations:

IS: Indian Standard

Structural Standards Committee

Convenor: Mr. Anurag Sinha

Members:
Mr. C Damodaran
Mr. V.K.Panwar
Mr. Samir Das
Mr. Amitabh Kishore
Mr. Gyasuddin
Mr. Charanjit Singh (Projects)
Mr. Ravindra Kumar (Constn.)

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1.0 GENERAL

1.1 Scope

1.1.1 This specification establishes the material specifications of reinforced cement concrete to be used in pile foundations. Any special requirements as shown or noted on the drawings shall govern over the provisions of these specifications.

1.1.2 For specific work requirements concerning design and construction or otherwise modifying or supplementing the provision of this specification, refer to the specific requirements. In case of conflict between specific requirements and provision of this specification, former shall govern.

1.2 Definitions

1.2.1 Reference to Indian Standard Codes shall always mean reference to the latest issue of the relevant standards including all its amendments up to date.

1.3 Codes

All design and construction shall be performed in accordance with the Indian Standard Code of Practice for Plain and Reinforced Concrete IS: 456.

2.0 MATERIALS FOR CONCRETE

2.1 General

All materials which may be used in the Plain or Reinforced Cement concrete work shall be of standard quality conforming to IS or equivalent and shall have IS certification mark as far as possible unless otherwise approved by the Engineer-in-Charge. The contractor shall get all materials approved by Engineer-in-Charge shall have the right to determine whether all or any of the materials offered or delivered for use in the works are acceptable. Any material brought to site and not conforming to specification and instruction of Engineer-in-Charge shall be rejected and the contractor shall have to remove the immediately from site at his own expenses.

2.2 Cement

2.2.1 General

The cement used shall be ordinary Portland Cement or Portland slag cement conforming to IS: 455 or Portland pozzolana cement conforming to IS: 1489 or as specified and / or directed by the Engineer-in-Charge.

2.2.2 Tests after Delivery

Each consignment of cement, may after delivery on the site and at the discretion of the Engineer-in-Charge , be subjected to any or all of tests and analysis required by the relevant Indian Standard Specifications. Facilities for testing shall be provided by contractor at his own cost.

2.2.3 Storage on the Site

The cement shall be stored in a suitable weather-tight building and in such a manner as to permit easy access for proper inspection to prevent deterioration. Cement of different types and brands shall be kept in separate storage.

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All accepted cement stored on the site shall be arranged in batches and used in the same order as received from the manufacturer. The contractor shall maintain a cement register in which all entries shall be completed day to day showing the quantities received, date of receipt, source of dispatch, type of cement, etc. and also the daily cement consumption on site. The register shall be accessible to the Engineer-in-Charge for his verification.

2.2.4 **Rejection of Cement**

The Engineer-in-Charge may reject any cement as a result of any tests thereof, notwithstanding the manufacturer's certificate. He may also reject cement which has deteriorated owing to inadequate protection from moisture or due to intrusion of foreign matter or other causes. Any cement which is considered defective by the Engineer-in-Charge shall not be used, and shall be promptly removed from the site of the work by the contractor at his own expense.

2.3 Aggregates for Concrete

2.3.1 General

Coarse and fine aggregates for concrete shall conform in all respect to IS: 383, "Specification for Coarse and Fine Aggregates from Natural Sources for Concrete". Aggregates shall be obtained from a source known to produce those satisfactory for concrete. Aggregates shall consist of naturally occurring sand and gravel or stone, crushed or uncrushed, or a combination thereof. They shall be chemically inert, hard, strong, dense, durable, clean and free from veins, adherent coatings and shall be of limited porosity.

Flaky and elongated pieces shall not be used.

The source of aggregates shall be approved by the Engineer-in-Charge and shall not be changed during the course of the job without his approval. Rejected aggregates shall be removed from the work site by the contractor at his own expense.

2.3.2 Deleterious Materials

Aggregates shall not contain any harmful materials such as iron pyrites, coal, mica, shale or similar laminated materials, clay, alkali, soft fragments, sea shells, organic impurities etc. in such quantities as to affect the strength or durability of the concrete. In addition to the above, for reinforced concrete, any material which might cause corrosion of the reinforcement and aggregates which are chemically reactive with the alkalies of cement shall not be used.

The maximum quantities of deleterious materials in the aggregates, as determined in accordance with IS: 2386 (part-II) "Methods of Test for Aggregates for Concrete" shall not exceed the limits given in Table – I of IS: 383.

The sum of the percentages of all deleterious materials shall not exceed five. Deleterious materials also include material passing 75 micron IS sieve.

2.3.3 Coarse Aggregates

Coarse aggregate is aggregate most of which is retained on 4.75mm IS sieve. These may be obtained from crushed or uncrushed gravel or stone as per CL.2.3.1 and may be supplied as single sized or graded aggregates given in Table –II of IS: 383.

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2.3.4 **Fine Aggregates**

Fine aggregate is aggregate most of which passes 4.75mm IS Sieve but not more than 10% pass through 150micron IS Sieve. These shall comply with the requirements of grading zones I, II and III and given in Table – III of IS: 383. Fine aggregate conforming to grading zone IV shall not be normally used in reinforced concrete unless tests have been made by the contractor to ascertain the suitability of the proposed mix proportions and approved by the Engineer-in-charge.

Fine aggregate shall consist of sand resulting from natural disintegration of rock and which has been deposited by streams or glacial agencies, or crushed stone sand or crushed gravel sand.

2.3.5 **Sampling and Testing**

In case of doubt the Engineer-in-Charge may require the contractor to carry out tests, at the contractor's expense in accordance with.

IS: 516 – Method of Tests for Strengths of Concrete; and

IS: 2386 – Method of Tests for Aggregates for Concrete.

2.3.6 **Storage of Aggregates**

The contractor shall at all times maintain at the site of work such quantities of aggregate as are considered by the Engineer-in-Charge to be sufficient to ensure continuity of work.

Each type and grade of aggregate shall be stored separately on hard firm ground having sufficient slope to provide adequate drainage to rain water.

Any aggregate delivered to site in a wet condition or becoming wet at site due to rain shall be kept in storage for at least 24 hrs. to obtain adequate drainage, before it is used for concreting, or the water content of mix must be suitably adjusted as directed by Engineer-in-Charge.

2.4 Water

Water used for concrete shall be clear and free from injurious amounts of Oil, Acid Alkali, Organic matters or other harmful substances in such amount that may impair the strength or durability of structure. Potable water shall generally be considered satisfactory for mixing and curing concrete.

The Engineer-in-Charge may require the contractor to prove at latter's expense, that the concrete mixed with water proposed to be used should not have a compressive strength, lower than 90% of the strength of concrete mixed with distilled water.

The Engineer-in-Charge may require the contractor to get the water tested from an approved laboratory at his own expenses and in case the water contains any sugar or excess of acid, alkali, any injurious salts etc. the Engineer-in-Charge may refuse to permit its use.

3.0 ADMIXTURES

3.1 Admixtures such as CICO grade I or puddlo or equivalent may be used in concrete only with the approval of Engineer-in-Charge.

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4.0 REINFORCEMENT

4.1 Hard-Drawn Steel wire Fabric

4.1.1 When specified on the drawings, hard-drawn steel wire fabric shall be used conforming to IS: 1556; it shall be of an approved type and of the weights and dimensions shown on the drawing.

4.2 High Yield Deformed Steel Reinforcement

4.2.1 Cold twisted high yield deformed steel bars, shall conform to IS: 1786.

4.3 Other Bars & Sections

4.3.1 Any other type of reinforcement bars specified on the drawings shall conform to its respective Indian Standard specification. Medium tensile steel bars when specified on the drawings shall conform to IS; 432.

4.4 Welding

4.4.1 Field welding of reinforcing bars will not be permitted without the written consent of the engineer-in-charge. Where welding is permitted it must be at staggered locations. Tests shall be made to prove that the joints are of the full strength of bars connected. Welding of reinforcement shall be done in accordance with the recommendation of IS: 2751.

4.5 Storage

4.5.1 The steel reinforcement shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion.

4.6 Other Specifications

4.6.1 General construction details and workmanship relative to reinforcement including bars bonds, lap splices and installation shall be in accordance with IS: 2502 – Code of Practice for Bonding and Fixing of Bars for concrete reinforcement, as well as the detailing of reinforcement given in IS:456.

4.6.2 Hot bending of bars shall not be allowed.

4.6.3 The number sizes, shape and position of all the reinforcement shall, unless otherwise directed or authorized by the Engineer-in-Charge, be strictly in accordance with the drawings. The reinforcement shall be adequately secured and held in position by metal chairs and spacers. Ties of inter-sections shall be made with 18 SWG soft black annealed binding wire.

4.6.4 The contractor must obtain the approval of the Engineer-in-Charge for the reinforcement placed, before any concrete is placed in the forms. The reinforcement of this time shall be free from loose rust or scale or other coatings that will des troy or reduce bond.

4.6.5 Concrete spacer blocks of the same strength as parent concrete shall be used to ensure correct cover to the reinforcement. This clear cover shall be as shown on the drawings or as per instructions of the Engineer-in-Charge.

4.6.6 All the reinforcing bars shall be so tied as to form a rigid cage to prevent displacement before or during concreting.

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आर.सी.सी. बोर्ड कास्ट-इन-सिटू पाइलों के डिजाइन, निर्माण तथा अधिष्ठापन के लिए मानक विनिर्देश

STANDARD SPECIFICATION FOR DESIGN, CONSTRUCTION AND INSTALLATION OF RCC BORED CAST-IN-SITU PILES

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
4	23.09.20	Reaffirmed and Reissued	SB	VKP	AS	SM
3	18.06.14	Updated & Reissued	Shobha	VKP	SD	S.Chanda
2	21.04.09	Updated & Issued as Standard Specs.	S.Bhowmik	S.Debnath	V.Kumar	N.Duari
1	23.06.98	Revised & Issued as Standard Specs.	S.Debnath	ECHGR	ECHGR	AS
0	22.12.88	Issued as standard specification	ECHGR	SM	RKMB	AS

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Abbreviations:

IS	:	Indian Standards
RQD	:	Rock Quality Designation
SPT	:	Standard Penetration Test

Structural Standards Committee

Convenor: Mr. Anurag Sinha

Members:
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Mr. V.K.Panwar
Mr. Samir Das
Mr. Amitabh Kishore
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1.0 SCOPE

1.1 This standard specification covers the construction and installation of load bearing reinforced concrete bored cast-in-situ piles.

1.2 For specific work requirements concerning construction or otherwise modifying or supplementing the provisions of this specification, reference may be made to 'Specific Requirements'. In case of any conflict between requirements set forth in 'Specific Requirements' and the provisions of this specification, the 'Specific Requirements' shall govern.

2.0 CODES

2.1 IS:2911 (Part I/Sec.2) - Indian Standard Code of Practice for Design and Construction of pile foundations for Bored Cast-in-Situ Piles, shall be referred to in conjunction with these specifications during the entire design, construction and installation work.

2.2 Reference to any code shall always mean reference to the latest revised edition of the code including all its amendments upto date, unless otherwise specified. In the event of any conflict between the requirements of this specification and those of the referred codes, the former shall govern.

3.0 MATERIALS

3.1 All materials, viz. cement, steel, aggregates, water etc. which are to be used in the construction work, shall conform to EIL Standard Specification for Reinforced Concrete Piles No. 6-74-006.

3.2 Concrete

3.2.1 Methods of the manufacture of cement concrete shall in general, be in accordance with IS:2911 (Part I/Sec.2) and as per following clauses.

3.2.2 The grade of concrete shall be M-25 with a minimum cement content of 400 kg/m³.

3.2.3 **Slump of Concrete**

Slump of concrete shall range between 150 to 180 mm depending on the manner of concreting. The table below gives the general guidance:

PILING	SLUMP (in mm)		TYPICAL CONDITIONS OF USE
	Min.	Max.	
A.	100	180	Poured into water-free unlined bore having widely spaced reinforcement. Where reinforcement is not spaced widely enough, cut-off level of pile is within the casing and diameter of pile is less than or equal to 600mm, higher order of slump within this range may be used.
B.	150	180	Where concrete is to be placed under water or drilling mud, by tremie or by placer.

4.0 DESIGN CONSIDERATIONS

4.1 Structural Design

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The piles shall have necessary structural strength to transmit the loads imposed on it, to soil. Relevant parts of IS:2911 (Part I/Sec.2) and specific requirements shall be considered to apply for assessing the structural capacity of piles.

4.2 Reinforcement

4.2.1 The minimum longitudinal reinforcement shall be 0.4% of the cross sectional area of the pile.

4.2.2 Clear cover to the main reinforcement shall be 50mm. This shall be increased to 75mm in case of aggressive soils and ground water conditions.

4.2.3 The vertical reinforcement shall project 40 times its diameter above the cut-off level.

4.2.4 The minimum clear distance between the two adjacent main reinforcement bars should normally be 100mm for the full depth of cage. The bars shall be so placed as not to impede the placing of concrete.

4.2.5 The lateral ties in the reinforcing cage shall be preferably spaced not closer than 150 mm centre to centre.

4.2.6 The minimum diameter of the lateral ties shall be 8mm.

5.0 EQUIPMENT & ACCESSORIES

5.1 The equipment and accessories for installation of bored cast-in-situ piles shall be selected giving due consideration to the subsoil conditions and the method of installation etc. These shall be of standard type and shall have the approval of the Engineer-in-Charge.

5.2 The capacity of the rig shall be adequate so as to reach the desired depth.

5.3 Provision shall be kept for chiselling within the borehole in case of any underground obstruction/hard strata. However, chiselling shall be carried out only with the approval of Engineer-in-Charge.

5.4 In case pile is required to be socketted in medium or good quality rock strata, the equipment mobilized shall have adequate capability to do so upto the required socket length. For the purpose of classification of rock for the determination of length of socketting, pilot drill holes shall be carried out in the areas to be piled.

5.5 Pilot drill holes shall be of Nx or Bx size as per specific requirements. Rock drilling shall be carried out using double tube core barrel. Drilling and storing of rock cores shall conform to relevant IS codes. Rock quality shall be classified as under depending upon the RQD.

RQD (%)	ROCK QUALITY
<25	Poor
25 to 75	Medium
>75	Good

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6.0 PILING INSTALLATION

6.1 Control of Alignment

6.1.1 The piles shall be installed as accurately as possible as per the designs and drawings. The permissible positional deviations shall be governed by IS: 2911 (Part I/ Sec.2). In case of piles deviating beyond such permissible limits, the piles shall be replaced or supplemented by additional piles, as directed by Engineer-in-Charge.

6.2 Boring

6.2.1 The boring shall be done by one of the following methods:

(a) Direct mud circulation

(b) Reverse mud circulation

(c) Bailer bentonite.

(d) Hydraulic auger bentonite

The actual method of construction to be followed shall be as per specific requirements.

6.2.2 In very soft soil a permanent liner shall be installed to ensure stability of borehole. A liner shall be used to protect the green concrete where a high hydrostatic pressure exists in the subsoil or where an underground flow of water exists and which is likely to damage the concrete on withdrawal of casing.

6.2.3 Use of temporary liner only in lieu of bentonite to stabilise sides of boreholes shall not be permitted.

6.2.4 Properties of bentonite used and quality control shall be as per IS:2911 (Part I/Sec.2).

6.3 Concreting of Piles

6.3.1 Reinforcement

6.3.1.1 The reinforcements shall be made into cages sufficiently rigid to withstand handling without damage. In case the reinforcement cage is made up of more than one segment, the same shall be assembled by providing necessary laps preferably by welding.

6.3.1.2 Stirrups to the main bars shall be tack welded.

6.3.1.3 Care shall be taken to ensure that the reinforcement bars do not come closer while the cage is lowered down the hole.

6.3.1.4 Proper cover and central placement of the reinforcement shall be ensured by use of suitable concrete spacers or rollers, cast specifically for the purpose.

6.3.2 Concreting

6.3.2.1 Concreting shall not be commenced until the Engineer-in-Charge satisfies himself that at final borehole depth the soil is not weaker than that taken as the basis for pile design. If necessary, SPT or similar test shall be conducted to ensure the above.

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6.3.2.2 Borehole bottom shall be thoroughly cleaned to make it free from sludge or any foreign matter before lowering the reinforcement cage. The full length of reinforcement cage shall be in position before start of concreting.

6.3.2.3 Concreting shall be done by tremie method. The operation of tremie concreting shall be governed by IS: 2911 (Part I/Sec.2).

6.3.2.4 The concrete placing shall not proceed if specific gravity of fluid near about the bottom of borehole exceeds 1.2. Determination of the specific gravity of the drilling mud from the base of the borehole shall be carried out by taking samples of fluid by suitable slurry sampler approved by the Engineer-in-Charge, in first few piles and at a suitable interval of piles thereafter and the results recorded. Control of consistency of drilling mud shall be carried out throughout boring as well as concreting operations.

6.3.2.5 Care shall be exercised to preserve correct cover and alignment of reinforcements and avoid any damage to it throughout the complete operation of placing the concrete.

6.3.2.6 The top of the pile shall be brought up above the cut off level minimum by 0.75 m so as to permit removal of all laitance and weak concrete before capping and to ensure good and sound concrete at the cut-off level for proper embedment into the pile cap. Any defective concrete in the head of the completed piles shall be cut-away and made good with new concrete.

7.0 DEFECTIVE PILES

7.1 Defective piles shall be removed or left in place, as judged convenient by the Engineer-in-Charge, without affecting the performance of adjacent piles or capping above and additional piles shall be provided to replace them.

8.0 RECORDING OF DATA

8.1 A competent supervisor shall be present to record the necessary information during the installation of piles. The data to be recorded shall include:

a) The dimensions of the piles, including the reinforcement detail and the mark of the pile.

b) The boring method employed.

c) The type of soil/rock in which pile is terminated.

d) The depth bored.

e) The depth of water table.

f) When drilling mud is used, the specific gravity of the fresh supply and contaminated mud in the borehole before concreting is taken up, in case of first few piles and subsequently at suitable interval of piles.

g) The time taken for concreting.

h) The cut-off level/working level, and

i) The consumption of concrete and cement.

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j) Any other important observations.

8.2 Typical data sheets of recording piling data shall be as given in Appendix - D of IS:2911 (Part I/Sec.2).

8.3 Any deviation from the designed location, alignment or load carrying capacity of any pile shall be noted and promptly reported to the Engineer-in-Charge.

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कंक्रीट पाइलों के परीक्षण के लिए मानक विनिर्देश

STANDARD SPECIFICATION FOR TESTING OF CONCRETE PILES

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
4	22.09.20	Reaffirmed and Reissued	GK	VKP	AS	SM
3	18.06.14	Updated & Reissued	Shobha	VKP	SD	S.Chanda
2	21.04.09	Updated & issued as standard specs.	R.Besra	S Debnath	V.Kumar	N Duari
1	12.06.98	Revised & issued as standard specs.	KRS	AN	ECHGR	AS
0	22.12.88	Issued as standard specification Recomposed March, 1994	SM	ECHGR	RKMB	AS

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Abbreviations:

IS : Indian Standards

Structural Standards Committee

Convenor: Mr. Anurag Sinha

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APPENDIX 1 - PILE LOAD TEST RECORD 11

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1.0 GENERAL

1.1 Scope

1.1.1 This specification covers the requirements and methods of testing of a single pile for evaluating its safe capacity in:

a) Vertical loading (Compression)

b) Lateral Loading

c) Pull Out (Tension)

d) Combined Vertical and Lateral Loading

e) Special type of loading such as vibratory loadings

1.1.2 These specifications shall be applicable for all types of piles in general excepting sheet piles.

1.1.3 For specific work requirements or otherwise modifying or supplementing the provisions of this specification, refer to specific requirements. In case of conflict between requirements set forth in the specific requirements and the provisions of this specification, the specific requirements shall govern.

1.2 Definitions

1.2.1 Reference to Indian Standard Codes shall always mean reference to the latest issue of the relevant standards, including all the amendments upto date.

1.3 Codes

1.3.1 All testing shall be performed in accordance with the following codes and the provisions of these specifications:

IS: 2911-(Part IV) - Code of Practice for Design and Construction of pile Foundations - Load Test on Piles.

1.4 Requirements

1.4.1 The load test shall be required to provide data regarding the load deformation characteristics of the pile up to failure or otherwise specified and the safe design capacity.

1.4.2 Full details of the equipment proposed to be used and the test set up shall be submitted to the Engineer-in-Charge with detailed sketches for approval. Approval of the Engineer-in-Charge shall also be obtained after the test set up is complete, prior to commencement of loading.

1.4.3 All measuring devices shall be calibrated for satisfactory performance and accuracy at an approved institution and a certificate to that effect obtained and submitted to the Engineer-in-Charge prior to use.

1.4.4 The test pile shall be constructed using same equipment and technique as for the job piles.

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1.4.5 A minimum time period of two weeks shall be allowed between the time of installation and testing in case of a precast pile and not less than four weeks from the time of casting in case of a cast-in-situ pile.

1.4.6 **Records**

A full record giving all details of the test in the proforma shown in Appendix-1 shall be submitted in triplicate to the Engineer-in-Charge immediately on completion of each test. The record shall also include the plot of load time settlement characteristics of piles.

2.0 VERTICAL LOADING TESTS

2.1 Equipment and Test Set-up

2.1.1 **Test Pile**

2.1.1.1 The test pile shall be decided by the Engineer-in-Charge. It may be one of the working piles or a separate test pile.

2.1.1.2 The head of the test pile shall be brought to the proper level and provided with a pile cap with a level and plane surface and with adequate space for proper seating of a jack and dial gauges.

2.1.1.3 Test pile surface shall be prepared for testing purposes on the expiry of not before one week after casting the pile and minimum one week before testing of pile.

2.1.2 **Loading Systems**

2.1.2.1 Loading shall be applied by the reaction method consisting of an hydraulic jack centrally against a loaded platform. Supports of the platforms shall be adequately designed. Special anchor piles or any other suitable type of anchorage systems may be used. However, use of the uplift capacity of neighbouring piles for providing the reaction shall normally not be permitted.

2.1.2.2 The loading system shall be adequate to ensure that the test can be carried upto the specified limit. The reaction to be made available for the test shall be atleast 25% greater than the maximum jacking force required.

2.1.3 **Measuring System**

2.1.3.1 **Loading on Piles**

The load applied on the pile shall be recorded on a calibrated pressure gauge mounted on the jack.

2.1.3.2 **Settlement of Pile**

a) Settlement of the pile shall be recorded by dial gauges suspended from datum bars. Four dial gauges of 0.01mm sensitivity shall be positioned on four corners around the pile.

b) The datum bars shall have rigid supports preferably of concrete pillars or steel sections, embedded well into the ground. The supports shall be located more than three times the pile diameter, subject to a minimum of 2.0m, clear away from the pile face and also sufficiently away from the supports of the loaded platform to avoid any disturbance on these accounts. Movements near the supports of the datum bar shall be avoided while the test is in progress.

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2.2 Method of Conducting Test

The test shall be carried out by the direct method of loading in successive increments or by the cyclic loading method as specified and as directed by the Engineer-in-Charge.

2.2.1 Direct Method of Loading in Successive Increments

The test shall be carried out as per the procedure outlined.

a) The load shall be applied to the pile top in increments of about one fifth of the rated capacity of the pile or as specified. Settlement readings shall be taken before and after the application of each new load increment and at 2, 4, 8, 15, 30, 60 minutes and at every two hours until application of the next load increment.

b) Each stage of loading shall be maintained till the rate of movement of the pile top is not more than 0.2 mm per hour or until two hours have elapsed, whichever is earlier subject to a minimum of one hour.

c) Further loading shall then be continued as in (a) above till one of the following occurs :

i) Yield of soil-pile system occurs causing progressive settlement of the pile exceeding a value of one tenth of the pile diameter.

ii) The loading on the pile top equals 2.5 times the rated capacity or as specified in the case of a separate test pile and 1.5 times the rated capacity of the pile in case of a working pile.

d) Where yielding of the soil does not occur, the full test load shall be maintained on the pile head for 24 hours or more if necessary and settlement readings shall be taken at 6 hours interval during the period.

e) Unloading shall be carried out in the same steps as loading. A minimum of half hour shall be allowed to elapse between two successive stages of load decrement. The final rebound shall be recorded 6 hours after the entire test load has been removed.

f) If so directed by the Engineer-in-Charge, loading and unloading cycles shall be carried out for all load stages within the assumed working load.

g) **Assessment of Safe Load**

The safe capacity of the pile shall be the least of the following values

i) Load corresponding to settlement specified in specific requirements which is based on the nature and type of structure.

ii) 50 percent of the final load at which the total displacement equals 10 percent of the pile diameter in case of uniform diameter piles and 7.5 percent of bulb diameter in case of under-reamed piles.

2.2.2 Cyclic Loading Test

The test shall be carried out as per procedure outlined by IS:2911-(Part-IV) and as described below :

a) The load shall be applied to the pile top in increments of about one fifth the estimated safe capacity of the pile or as specified. Settlement readings shall be taken before and

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after the application of each new load increment at 2, 4, 8, 15, 30, 60 minutes and at every one hour till rate of settlement is 0.2mm per hour until application of the next load increment.

b) Alternate loading and unloading shall be carried out at each stage and the total and net settlements recorded as specified. If so directed by the Engineer-in-Charge, more than one cycle of loading and unloading shall be carried out at any or all of the stages.

c) Each stage of loading or unloading shall be maintained till the rate of movement of the pile top is not more than 0.2mm per hour provided that the minimum period is two hours for loading and one hour for unloading. The following load stages shall however be maintained for longer periods as given below:

i) At load of 1.5 times assumed safe capacity (for routine test only) - 24 hrs.

ii) At load of 2.5 times the assumed safe capacity (for initial test only) - 24 hrs.

The loading shall be continued till one of the following occurs :

i) Yield of the soil pile systems occurs causing progressive settlement exceeding one tenth of the pile diameter.

ii) The loading on the pile top equals 2.5times the estimated safe load in case of a separate test pile and 1.5 times the rated capacity of the pile in case of a working pile.

d) **Assessment of Safe Load**

The safe capacity of the pile shall be the least of the following :

i) Load corresponding to settlement specified in specific requirements which is based on the nature and type of structure.

ii) Half of the final load at which the total settlement equals one tenth of the pile diameter.

3.0 LATERAL LOADING TEST

3.1 Equipment and Test Set-up

3.1.1 Test Pile

The test pile shall be decided by the Engineer-in-Charge. It may be one of the working piles or a separate test pile.

The test pile shall be cut off at the proper level and provided with a cap with vertical plane sides having an adequate area for proper seating of the jack and dial gauges.

3.1.2 Loading System

3.1.2.1 Loading shall be applied by an hydraulic jack of adequate capacity, abutting the pile horizontally and reacting against a suitable system. The reaction may be provided by the wall of the excavated pit when the test is being conducted below ground level or by a neighbouring pile in which case thrust pieces shall be inserted on either end of the jack to make up the gap.

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3.1.3 **Measuring System**

3.1.3.1 Lateral load applied on the pile shall be measured by a calibrated pressure gauge mounted on the jack, having a least count of 250 kg.

3.1.3.2 Deflection of the pile head shall be measured by dial gauges, fixed to datum bars and having a least count of 0.01 mm. The datum bars shall be provided with rigid supports as described in Clause 2.1.3.2 (b) above.

3.2 Method of Conducting Tests

The test shall be carried out in accordance with the provisions of IS:2911-(Part-IV) and as detailed below :

3.2.1 Loading shall be applied in increments of one fifth of safe capacity or as specified.

3.2.2 Each stage shall be maintained for a period till the rate of movement of the pile head is not more 0.2 mm/hr or 1 hr whichever is greater.

3.2.3 Loading shall be continued till one of the following occurs:

a) Deflection of the pile head exceeds 12 mm.

b) The applied load on the pile is 2.5 times the assumed lateral load capacity of the pile in case of a separate test pile and 1.5 times the rated capacity in the case of a working pile.

3.2.4 **Assessment of Safe Load**

The safe load shall be the smaller of the following :

i) Half of the final load for which the total deflection is 12 mm.

ii) Load corresponding to 5 mm total deflection

Note: The deflection is at the cut off level of the pile.

4.0 PULL OUT CAPACITY OF PILES

4.1 Equipment and Test Set up

4.1.1 **Test Pile**

4.1.1.1 The test pile shall be decided by the Engineer-in-Charge. The test shall be conducted on separate pile installed specifically for this purpose.

4.1.1.2 The test pile shall be built upto the proper length and the head provided with suitable arrangements for anchoring the load applying system.

4.1.2 **Loading System**

4.1.2.1 Load shall be applied using an approved reaction system. Uplift force on the pile may be applied directly to the test pile or through a lever system. The reaction may be provided by neighbouring piles or blocks may be constructed for the purpose. A hydraulic jack shall be used for load application.

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4.1.3 **Measuring System**

4.1.3.1 Load applied by jack shall be measured by a calibrated pressure gauge with a least count of 500 kgs.

4.1.3.2 Movement of the pile shall be measured by dial gauges, fixed to datum bar and having a least count of 0.01 mm. A minimum of two dial gauges, placed diametrically opposite shall be used. Datum bars shall be provided with rigid supports as described in 2.1.3.2(b) above.

4.2 Method of Conducting Test

The test shall be conducted as outlined below:

4.2.1 Loading shall be applied to the pile top in increments of one fifth the rated capacity of pile.

4.2.2 Each stage shall be maintained for a period till the rate of movement of the pile head is not more than 0.2 mm/hr or one hour, whichever is greater.

4.2.3 Loading shall be continued till one of the following occurs:

a) Yield of soil pile system occurs causing progressive movement of the pile exceeding 12 mm.

b) The applied load on the pile is 2.5 times the estimated safe load for test pile and 1.5 times the rated capacity in case of working pile or as specified.

4.3 Assessment of Safe Load

The safe capacity of the pile shall be the least of the following:

a) Two-thirds of load at which the total displacement is 12 mm or the load corresponding to a specified permissible uplift, and

b) Half of the load at which the load-displacement curve shows a clear break (downward trend).

5.0 COMBINED VERTICAL AND LATERAL LOADING TEST

5.1 Equipment and Test set-up

5.1.1 The equipment and test set up shall be same as described in Clause 3.0. In addition a platform shall be constructed on the pile top, and loaded to 1.0 times the pile capacity in vertical loading.

The pile shall be first subjected to the full vertical load. The lateral load shall commence after all settlements due to the vertical load have ceased and while the full vertical load is in position.

5.1.2 The loading system, measuring system and recording of the results shall be the same as described in clause-3.

5.2 Method of Conducting Test and Assessment of Safe Load

This shall be in accordance with the provision of clause 3.2 above.

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6.0 SPECIAL TYPE OF LOADING

This shall include evaluating the pile response to vibratory loads, both horizontal and vertical in nature. The test set up and method of conducting the test shall be covered under specific requirements.

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APPENDIX-I

PILE LOAD TEST RECORD

Vertical/ Lateral/ Pull Out Test

Pile No.....	Date of.....	WT of Hammer.....
Type.....	Driving.....	AVR. Drop of Hammer.....
Diameter(Cm).....	Casting.....	Total No of Blows.....
Length below G.L(M).....	Commence of Test	Sum of Temporary Compression in cms.....
Location.....	Completion of Test..... . Ground level.....	

Type of Test : Direct/Cyclic Loading

Date	Time	Total Time (Hr.)	Load on (T)	Load off (T)	Total Load (T)	Settlement (Deflection) Gauge mm		AVR. Settlmt (Defl'n) mm		Reb-ound mm	Rem-arks
						I	II	Total	Net		

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औद्योगिक नियंत्रण स्टेशनो
के लिए
निरीक्षण व परीक्षण योजना

INSPECTION AND TEST PLAN
FOR
INDUSTRIAL TYPE CONTROL STATIONS

Rev. No.	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
4	18.05.2020	Revised and Re-issued	NP	RS	RKS	SKS
3	30.01.2014	Revised and Re-issued	MJ	RS	SCG	SC
2	03.10.2012	Revised and Re-issued	RKP	HVJ	AKC	DM
1	28.09.2007	Revised and Re-issued	AKG	PPM	MVKK	VC
0	30.04.2002	Issued for implementation	RG	AKC	AKB	GRR

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Abbreviations

BIS	:	Bureau of Indian Standards	MTC	:	Material Test Certificates
BOM	:	Bill of Material	MFR	:	Manufacturer
CEIL	:	Certification Engineers International Limited	NO.	:	Number
CT	:	Current Transformer	NEMA	:	National Electrical Manufacturers Association
EPC	:	Engineering Procurement Construction	PO	:	Purchase Order
HV	:	High Voltage	PR	:	Purchase Requisition
IC	:	Inspection Certification	PT	:	Potential Transformer/Voltage Transformer
IEC	:	International Electro technical Commission	PVC	:	Poly Vinyl Chloride
IP	:	Ingress Protection	QC	:	Quality Control
IRN	:	Inspection Release Note	TC	:	Test Certificate
ITP	:	Inspection and Test Plan	TPI or TPIA	:	Third Party Inspection Agency
Lab.	:	Third Party Laboratory	UL	:	Under writer Laboratories
MOC	:	Material of Construction	VDR	:	Vendor Data Requirement

Inspection Standards Committee

Convenor : Mr. R.K. Singh

Members :

Mr. Rajesh Sinha	Mr. Himangshu Pal	Mr. Chandrashekhar
Mr. R. Muthuramalingam	Mr. Avdhesh Agrawal	Mr. Mahendra Mittal
Ms. Arvind NP Singh (Engg.)		

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1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of Industrial type control stations.

2.0 REFERENCE DOCUMENTS:

PO/PR & Standards referred there in /Job specifications / Approved documents

3.0 INSPECTION AND TEST REQUIREMENTS:

SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
1.0	**Procedure**	-	-	-	-	-	-
2.0	**Material Inspection**						
2.1	Incoming material : Sheet steel, Circuit Breaker, CT/PT, Ammeter, Voltmeter as applicable	Physical & Chemical Properties for Sheet Steel. Make, Model, Rating, Serial, Accuracy etc. as applicable	100%/	MTC / Mfr's TC / Lab. TC	H	H	R
3.0	**Inprocess Inspection**						
3.1	Fabrication of Enclosure and painting /Powder Coating (as applicable)	Visual, Dimension and Routine tests	100%	Supplier's Test Records	H	H	-
3.2	Assembly/Wiring work	Wiring Check & Routine electrical Tests	100%	Supplier's Test Records	H	H	-

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SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
4.0	**Final Inspection**						
4.1	Acceptance Tests	• Visual Check • BOM Verification. • Dimensional Verification. • Electrical Check/Test : a. Wire Continuity, b. Functional Check of Components and Control Schemes, c. HV Test d. IR Test (before & after HV) • Paint Thickness & Paint Shade	100%	Inspection witness Test Records	-	H	RW
4.2	Submission of Certificates	• Certificate of testing agency for suitability of degree of protection (as specified)	Samples / Prototype	Type Test Certificates	-	H	R
5.0	**Painting and Packing**						
5.1	Painting and Packing	• Visual • Suitable protection to prevent entry of foreign material. • Proper packing to prevent any damage during transportation.	100%	Test records	-	H	-

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SL. NO.	STAGE/ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
6.0	**Documentation**						
6.1	Documentation and IC/IRN	• Review of Internal Test Report • Issuance of IC/IRN	100%	Supplier's Test Records / IC/IRN	-	H	H
6.2	Final Document submission (if applicable)	Compilation of Inspection reports ,drawings, etc as per VDR / PR	100%	Final data folder /Completeness certificate	-	H	H

Legends: H- Hold (Do not proceed without approval,R-Review, RW-Random witness (As specified or 10 %-Samples must include minimum 1 No. of each type) , W-Witness (Give due notice, work may proceed after scheduled date).

NOTES :

1. This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable. (Unless otherwise agreed upon).
2. Acceptance Norms for all the activities shall be as per PO/PR/ Standards referred there in/ Job specifications /Approved documents
3. For EPC Jobs, Scope of Inspection shall be under TPIA only, unless specified otherwise.

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मध्यम वोल्टेज प्रेरण मोटरों
के लिए
निरीक्षण और परीक्षण योजना

INSPECTION AND TEST PLAN
FOR
MEDIUM VOLTAGE INDUCTION MOTORS

Rev. No.	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
6	10.04.26	Revised and Re-issued	RKP	SA	HP	NK
5	06.07.20	Revised and Re-issued	MM	RS	RKS	SKS
4	20.01.20	Revised and Re-issued	MM	RS	RKS	RKT
3	30.01.14	Revised and Re-issued	MJ	RS	SCG	SC
2	29.06.12	Revised and Re-issued	RKP	RJD	AKC	DM
1	24.12.07	Revised and Re-issued	SA	CRM	MVKK	VC

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Abbreviations

BIS	:	Bureau of Indian Standards	MOC	:	Material of Construction
BTD	:	Bearing Temperature Detector	MTC	:	Material Test Certificate
CIMFR	:	Central Institute of Mining & Fuel Research	NDT	:	Non Destructive Testing
CT	:	Current Transformer	NEMA	:	National Electrical Manufacturers Association
EPC	:	Engineering Procurement Construction	No	:	Number
ERTL	:	Electronics Regional Test Laboratory	PO	:	Purchase Order
FM	:	Factory Mutual	PESO	:	Petroleum Explosive Safety Organization
FLP	:	Flame Proof	PQR	:	Procedure Qualification Record
HV	:	High Voltage	PR	:	Purchase Requisition
IC	:	Inspection Certification	PMI	:	Positive Material Identification
IP	:	Ingress Protection	QC	:	Quality Control
IS	:	Indian Standard	RTD	:	Resistance Temperature Detector
ITP	:	Inspection and Test Plan	TC	:	Test Certificate
IEC	:	International Electro Technical Commission	TPI or TPIA	:	Third Party Inspection Agency
JEC	:	Japanese Electro technical Committee	UT	:	Ultrasonic Testing
MCP	:	Magnetic Centre point	VDR	:	Vendor Data Requirement
Min	:	Minimum			

Inspection Standards Committee

Convenor : Himangshu Pal

Members: Mr. G Suresh, Mr. T Kamalakannan, Mr. T Vasu, Mrs. Arvind NP Singh (Electrical), Mr. R Muthuramalingam, Mr V Aravaazhi, Ms. V Rajeshwari

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1.0 SCOPE

This Inspection and Test Plan covers the minimum testing & inspection requirements of Medium Voltage Squirrel Cage Induction Motors.

2.0 REFERENCE DOCUMENTS

PO/PR & Standards referred there in /Job specifications / Approved documents/BIS/IEC

3.0 INSPECTION AND TEST REQUIREMENTS

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
1.0	**Procedures**	--	--	--	--	--	--
2.0	**Material Inspection**						
2.1	Raw Materials- Copper, Frame castings/Fabricated, Terminal Box, Core laminations, Insulation material, Shaft.	• Chemical, Physical properties, finish as per relevant Indian/ International Codes and standards • Shaft – NDT (Ultrasonic)	100%	Material Test Certificates / Test records / NDT reports	H	H	R
2.2	Bought out items, Heat Exchanger (as applicable) , Bearings, CT, and Cable glands, etc	• DP tests, Hydrotest of Heat Exchangers (As applicable) • Physical and Specification Compliance verification. • Functional checks of CTs as per relevant standards.	100%	Material Test Certificates / Test records	H	H	R

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
3.0	**In process Inspection**						
3.1	Motor Assembly	• Bracing of winding, core assembly, Rotor bars and end rings assembly. • Terminal box mounting and clearances in between terminals. • Adequacy of Heat Exchanger type. • Functional verification of Fans and Lubrication system. • Air Gap between stator & rotor. • Machining Quality of Shaft.	100%	Test Records	-	H	-
3.2	Motor Assembly	• Vacuum Impregnation • Rotor Balancing • Tan Delta on stator winding Capsule	100%	Test Records	-	H	R
4.0	**Final Inspection**						
4.1	Motor (Routine Tests)	• Visual check (Terminals type, Direction of rotation, Nameplate verification, Paint shade, Paint thickness, Workmanship etc.) • Dimensional check (Including shaft centre height, Foundation hole dia and distance, Shaft Dia., distance from shaft end to first foundation hole etc.) • Phase sequence. • Winding resistance • Reduced voltage starting • No load test at rated Voltage and measurement of Voltage, Speed, Current, Wattage and no load bearing run	100%	Inspection test records	-	H	H

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
		• Locked Rotor test at rated current and measurement of Voltage, Current and Wattage. • Insulation resistance before and after High voltage (per Phase) • Polarization Index (per phase) • High Voltage(Per phase) • Vibration Measurement (under no-load) • Noise Level (under no-load) • Measurement of Shaft Vibrations in case of sleeve bearing motors (By Vibration probes) • Float measurement and MCP pointer marking verification (in sleeve bearing motors) • Shaft voltage and Shaft Run out. • Resistance measurement of Space heaters, RTD's and BTD's. • High voltage and IR measurement of Space heaters, RTD's and BTD's. • Operation of control panel (in case of Ex-p motors)					
4.2	Motor (Type Tests) $	• Full load test and measurement of Voltage, Current, Power, Slip, Efficiency and Power factor at 100%, 75% and 50% load • Temp Rise test (at rated Power) • Momentary overload test • Over speed followed by Vibration measurement • Measurement of Starting Torque, Starting Current, full Load Torque, Pull out torque by JEC/IEC (Logarithmic proportion Current method I / II).	One no from each type/rating	Inspection test records	-	H	H

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
		• Tan delta test					
4.3	Submission of Certificates/ Documents	• Test certificate from recognized testing laboratory for area classification. • BIS certificate for FLP motors and accessories as applicable. • PESO approved certificates for motors and accessories as applicable. • Fault level Certificate of Terminal Box • Degree of protection of enclosure Certificate as per latest IS/IEC Standards. • Impulse test certificate for coils	1 Machine/ Type/Rating	Statutory Body Test Certificates, Supplier Test Certificates, Inspection Test Records	-	H	R
5.0	**Painting**						
5.1	Painting of Motor Frames	• Visual. • Suitable protection to prevent entry of foreign material. • Proper packing with suitable plugs to prevent Ingress of moisture and any damage during transportation and storage.	100%	Test records	-	H	--
6.0	**Documentation and IC**						
6.1	Documentation and IC	• Review of Internal Test Certificates • IC issuance	100%	Supplier Test Certificates/ Inspection Certificate (IC)	-	H	H
6.2	Final Document submission	Compilation of Inspection reports ,drawings, etc as per VDR / PR	100%	Final data folder /Completeness certificate	-	H	H

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Legends: H- Hold (Do not proceed without approval, R-Review, RW-Random witness (As specified or 10 % - Samples must include min 1 No of each type), W- Witness (Give due notice, work may proceed after scheduled date).

NOTES :-

1. $:- As a minimum, it is mandatory to carry out Temp rise test and Load test (at various load) by direct loading method for following rating :-
   - Up to 1000 KW for 2 pole and 4 pole motors
   - Up to 900 KW for 6 pole motors
   - Up to 750 KW for 8 pole motors
   - Up to 600 KW for 10 pole motors
2. For VFD driven motors where Combined testing is required as per PR, this ITP shall be read along with 6-81-1050 latest revision.
3. This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable
4. Acceptance Norms for all the activities shall be as per PO/PR/ Standards referred there in/ Job specifications /Approved documents.
5. For EPC jobs, Approved Inspection Categorization plan shall be referred for the role of various Agencies in Stage and Final Inspections.
6. Supplier to furnish internal test report before scheduled inspection date.

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मध्यम एवं उच्च वोल्टेज केबल तथा सहायक सामग्री के लिए निरीक्षण व परीक्षण योजना

INSPECTION AND TEST PLAN FOR MEDIUM AND HIGH VOLTAGE CABLES & ACCESSORIES

Rev. No.	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
4	26.05.2020	Revised and Reissued	MM	RS	RKS	SKS
3	30.01.2014	Revised and Reissued	MJ	RS	SCG	SC
2	15.07.2011	Revised and Re-issued	AB	RJD	AKC	DM
1	28.09.07	Revised and Re-issued	AKG	PPM	MVKK	VC
0	30.04.02	Issued for implementation	RG	AKC	AKB	GRR

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Abbreviations:

BIS	:	Bureau of Indian Standard
CEIL	:	Certification Engineers International Limited
Cu	:	Copper
EPC	:	Engineering Procurement & Construction
ERTL	:	Electronics Regional Test Laboratory
FM	:	Factory Mutual
FRLS	:	Flame Retardant Low Smoke
HT	:	High Tension
ITP	:	Inspection and Test Plan
IP	:	Ingress Protection
IC	:	Inspection Certification
IS	:	Indian Standard
IEC	:	International Electro technical Commission
JEC	:	Japanese Electro technical Committee
Min	:	Minimum
MTC	:	Material Test Certificate
NEMA	:	National Electrical Manufacturers Association
No	:	Number
PD	:	Partial Discharge
PO	:	Purchase Order
PR	:	Purchase Requisition
PVC	:	Poly Vinyl Chloride
QC	:	Quality Control
TC	:	Test Certificate
TPI or TPIA	:	Third Party Inspection Agency
VDR	:	Vendor Data Requirement
XLPE	:	Cross Linked Poly Ethylene

Inspection Standards Committee

Convenor : Mr. R.K. Singh

Members: Mr. Rajesh Sinha, Mr. Himangshu Pal, Mr. Chandrasekhar, Mrs. Arvind NP Singh (Electrical), Mr. R Muthuramalingam, Mr Avdhesh Agrawal, Mr. Mahendra Mittal

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1.0 SCOPE

This Inspection and Test Plan covers the minimum testing requirements of PVC/XLPE insulated cables and cable jointing/terminating accessories for high and medium voltage systems.

2.0 REFERENCE DOCUMENTS

PO/PR / Standards referred there in /Job specifications / Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
1.0	**Procedures**	--	--	--	--	--	--
2.0	**Material Inspection**						
2.1	Incoming raw material like Copper, Aluminum, Semi conducting compound PVC, XLPE, Galvanized Armour, Cu tape, as applicable	Purity, Dimensions, Physical and Chemical Properties, as applicable	100%	Material Test Certificates/ Test Records/ Third Party Lab certificates	H	H	R
3.0	**In process Inspection**						
3.1	Inspection during insulation, sheathing	Spark test, thickness of insulation, Conductor Resistance	100%	Test Records	--	H	R
4.0	**Final Inspection**						

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
4.1	Finished Cable	Visual, Drum details, Size, Ends Capping, Marking on outer sheath (such as Incremental Length, Voltage grade, manufacturer's name), Colour coding, etc.	100% for Drum details and Sample drums for balance details	Test Records	-	H	RW/R**
4.2	Finished Cable (Routine Tests)	• Conductor Resistance. • High Voltage • Partial Discharge (for HT cable only)	100%	Supplier's Test Records	-	H	R
4.3	Finished Cable (Acceptance tests)	• Check calibration status of all testing equipment. • Dimension checks – overall dia, over/under armour, thickness of insulation, sheath and semi conducting screen, copper screen, dimension, etc as applicable • Conductor Resistance • Volume resistivity at room temperature and elevated temperature as per IS • Thermal stability test for Insulation (for PVC only) and sheath. • High Voltage tests • Partial Discharge(for HT Cable) • Hot Set (for XLPE insulation) • Tests on Conductor as applicable • Tests on PVC/XLPE Insulation & Sheath * • Armour Galvanization - dip test & coverage • Tensile and elongation (without ageing) • Silicon oil and wafer boil test for insulation and screen (for HT cable).	As per IS sampling plan	Inspection Test Records	-	H	H/R**

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
4.4	Finished Cable (Special tests)	• Flammability test as per IS 10810 part 61 & part 62 / IEC 60332 Part 1 & part 3 • Smoke density test (for FRLS outer sheet) • Acid Gas generation (for FRLS outer sheet) • Accelerated water absorption test as per NEMA(Electrical method) as applicable # • Test for resistance to Ultra Violet Radiation # • Oxygen Index and temperature index test as per ASTM D2863 • Rodent & Termite repulsion check • Test for circuit integrity for fire survival cables as per IEC • Drum length /surface finish/color/marking check by re-winding (1 or 2 drums)	For ladder test (1 sample/order) 1 Sample/Lot	Inspection test records		H	H/R**
4.5.	Finished Cable (Type tests **)	• Dielectric Retention. • Type tests on PVC insulation and Sheath High Voltage test (Water Immersion) for HT cable • Dielectric power factor tests as function of voltage, temperature. (HT cables) • Heating cycle test (HT Cables) • Impulse withstand test (HT Cables) • Short circuit test on conductor and screen (HT Cable)	On Similar type cable	Test Records		H	R

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
4.6	Cable accessories	• Visual • Dimensions • Type tests** as per IS/IEC	Sample	Test Records		H	R
5.0	**Painting**	--	--	--	--	--	--
6.0	**Documentation and IC**						
6.1	Documentation and IC	• Review of Routine, Acceptance, Type test reports. • IC issuance	100%	Supplier TC & IC	-	-	H
6.2	Final Document submission	Compilation of Inspection reports, drawings, etc. as per VDR / PR	100%	Final data folder / Completeness certificate	-	H	H

\# In case TC (not older than one year) from independent test lab is available & type of compound used is same then the same may be accepted.

* Hot deformation, Heat shock and Shrinkage tests on insulation & sheath (One sample/Lot- provided sheath material is from same compound/batch) shall be witnessed by EIL/TPIA, all other tests as per IS/IEC shall be carried out by supplier and test reports shall be reviewed by EIL/TPIA.

** EIL witness for HT cables and EIL surveillance checks on MV Power cable.

Legends: H- Hold (Do not proceed without approval, R-Review, RW-Random witness (As specified or 10 % - Samples must include min 1 No of each type), W- Witness (Give due notice, work may proceed after scheduled date).

NOTES :-

1. This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable. (Unless otherwise agreed upon).
2. Acceptance Norms for all the activities shall be as per PO/PR/ Standards referred there in/ Job specifications /Approved documents.
3. For EPC jobs, all inspection shall be carried out by TPIA, unless notified otherwise.

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संचार और अग्नि चेतावनी केबल के लिए निरीक्षण व परीक्षण योजना

INSPECTION AND TEST PLAN FOR COMMUNICATION AND FIRE ALARM CABLES

Rev. No.	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
4	26.05.2020	Revised and Reissued	MM	RS	RKS	SKS
3	30.01.2014	Revised and Reissued	MJ	RS	RKS	SC
2	29.06.2012	Revised and Reissued	RKP	RJD	AKC	SC
1	28.09.2007	Revised and Re-issued	AKG	PPM	MVKK	VC
0	30.04.2002	Issued for implementation	RG	AKC	AKB	GRR

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Abbreviations:

BIS	:	Bureau of Indian Standard	MTC	:	Material Test Certificate
DOT	:	Department of Telecommunication	NEMA	:	National Electrical Manufacturers Association
EPC	:	Engineering Procurement & Construction	No	:	Number
ERTL	:	Electronics Regional Test Laboratory	PD	:	Partial Discharge
FM	:	Factory Mutual	PE	:	Polyethylene
ITP	:	Inspection and Test Plan	PO	:	Purchase Order
IP	:	Ingress Protection	PR	:	Purchase Requisition
IC	:	Inspection Certification	PVC	:	Poly Vinyl Chloride
IGC	:	Inter Granular Corrosion	QC	:	Quality Control
IEC	:	International Electro technical Commission	TC	:	Test Certificate
IS	:	Indian Standard	TPI or TPIA	:	Third Party Inspection Agency
JEC	:	Japanese Electro technical Committee	VDR	:	Vendor Data Requirement
Min	:	Minimum	XLPE	:	Cross Linked Poly Ethylene

Inspection Standards Committee

Convenor : Mr. R.K. Singh

Members: Mr. Rajesh Sinha, Mr. Himangshu Pal, Mr. Chandrasekhar, Mrs. Arvind NP Singh (Electrical), Mr. R Muthuramalingam, Mr Avdhesh Agrawal, Mr. Mahendra Mittal

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1.0 SCOPE

This Inspection and Test Plan covers the minimum testing requirements of flame retardant type PVC sheathed cables for use in Plant communication, Fire Alarm systems and Jelly filled telecommunication cables.

2.0 REFERENCE DOCUMENTS

PO/PR/ Standards referred there in/Job specifications/Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
1.0	**Procedures**	--	--	--	--	--	--
2.0	**Material Inspection**						
2.1	Incoming raw material like Copper ,Aluminum, PVC, PE, XLPE , Jelly Compound, Armour material, etc. (as applicable)	Dimensional, Purity, Physical, Chemical Properties, Tests on jelly compound as per DOT spec.	Sample	Sub supplier TC/Supplier's Test Records/ Third party Lab	H	H	**R**
3.0	**In process Inspection**						
3.1	Manufacturing Stage	Dimensions at various stages, Spark test, Stage Inspection, pursulphate test for conductor.	100%	Supplier's Test Records	-	H	**R**
4.0	**Final Inspection**						

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
4.1	Final Inspection on completed cable	Visual, Drum details, Size, Ends Capping, Drums Condition, Marking on outer sheath (such as incremental length, voltage grade, manufacturer's name and for jelly filled cables marking as per DOT spec), Color coding/Identification of cores, conductor resistance ,high voltage etc.	100%	Inspection Witness Record	-	H	RW
4.2	Final Inspection on completed Cable(Jelly Filled Cables) Acceptance Test	• Dimension checks. • Test for insulation and sheath. • Continuity of conductors, absence of crossed pairs and absence of contact with poly-al tape • Continuity in poly-al tape and overlap • Color coding • Conductor Resistance, Resistance Unbalance in pair. • Mutual capacitance (pair/average), Capacitance Unbalance (pair to ground and pair to pair) • Cross talk • Attenuation • Drip test • Dielectric Strength/High Voltage test • Insulation Resistance/ Volume resistivity • Conductor Annealing	As per IS sampling plan	Inspection Witness Record	-	H	RW

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
		• Armour Galvanization • Armour coverage • Availability of rip cord • Overall finish and Drum length by re-winding (1 or 2 drum per lot) • Oxygen and temperature index test (1 sample/lot) • Water Penetration test (2 sample per lot) • Cable bend test (1 sample per lot)					
4.3	Final Inspection on completed Cable(Jelly Filled Cables) Type Tests	• Type tests on insulated conductors, compatibility of Insulation and filling compound as per DOT spec. • Type tests on Composite sheath and Jacket as per DOT spec	On Sample	Supplier's Test Records	-	H	R
4.4	Final Inspection on completed Cable(Non Jelly Filled Cables) Acceptance Test	• Dimension checks • Continuity of conductors • Color code • Overlap in poly-al tape and drain wire resistance (if shielding specified) • Conductor Resistance. • Drain wire resistance • Mutual capacitance (pair/average), Capacitance Unbalance (pair to ground and	As per IS sampling plan	Inspection Witness Record	-	H	RW

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
		pair to pair) for communication cables • Dielectric Strength/ High Voltage test • Insulation Resistance • Tensile and Elongation (without ageing) • Conductor Annealing • Armour Galvanization & coverage • Availability of rip cord • Tests on Insulation and sheath as per IS/IEC *					
4.5	Final Inspection on completed Cable(Non Jelly Filled Cables) Special Test	• Oxygen & temperature Index Test • Flammability test as per applicable specification (IS 10810 Part 61 & Part 62, Cat AF) • Smoke density test • Acid gas generation test • Test for Rodent & termite repulsion • Surface finish and drum length check by wiring(Rewinding 1 or 2 drum) • Test for circuit integrity for fire survival cables as per IEC (as applicable	1 Sample/Lot For ladder test (1 sample/order)	Inspection Witness Record	-	H	RW
4.6	Final Inspection on completed Cable (Non Jelly Filled Cables) Type Tests	• Type test on conductor as per spec • Type tests on insulation and Sheath as per spec • Test certificate for circuit integrity as per IEC 60331-21(for fire survival cable)	On Sample	Supplier's Test Records	-	H	R

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
5.0	**Painting**						
6.0	**Documentation and IC**						
6.1	Documentation and IC	• Review of Internal Test Reports and MTCs. • IC issuance	-	Supplier's Test Records / Inspection Certificate (IC)	-	H	H
6.2	Final Document submission	Compilation of Inspection reports, drawings, etc as per VDR / PR	100%	Final data folder / Completeness certificate	-	H	H

* Thermal Stability, Hot deformation, Heat shock and Shrinkage tests on insulation and sheath shall be witnessed by EIL (One Sample/Lot), all other tests as per IS-5831 shall be carried out by supplier and test reports shall be reviewed by EIL.

Legends: H- Hold (Do not proceed without approval, R-Review, RW-Random witness (As specified or 10 % - Samples must include min 1 No of each type), W- Witness (Give due notice, work may proceed after scheduled date).

NOTES :-

1. This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable
2. Acceptance Norms for all the activities shall be as per PO/PR/ Standards referred there in/ Job specifications /Approved documents.
3. For EPC jobs, all inspection shall be carried out by TPIA, unless notified otherwise.

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ऊर्जा दक्ष मध्यम वोल्टेज मोटरों के लिए निरीक्षण व परीक्षण योजना

INSPECTION AND TEST PLAN FOR ENERGY EFFICIENT MEDIUM VOLTAGE MOTORS

Rev. No.	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
					Approved by	
1	15.03.2024	Revised	MM	GS	RK	MN
0	12.11.2018	ISSUED FOR IMPLEMENTATION	MM	RS	RKS	RKT

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Abbreviations

BIS	:	Bureau of Indian Standard	MTC	:	Material Test Certificate
CIMFR	:	Central Institute of Mining & Fuel Research	NEMA	:	National Electrical Manufacturers Association
EIL	:	Engineers India Limited	PO	:	Purchase Order
FM	:	Factory Mutual	PESO	:	Petroleum Explosive Safety Organization
FLP	:	Flame Proof	PR	:	Purchase Requisition
ITP	:	Inspection and Test Plan	QC	:	Quality Control
IP	:	Ingress Protection	TC	:	Test Certificate
IC	:	Inspection Certification	TPI or TPIA	:	Third Party Inspection Agency
IEC	:	International Electro technical Commission	VDR	:	Vendor Data Requirement
JEC	:	Japanese Electro technical Committee	VFD	:	Variable Frequency Drive

Inspection Standards Committee

Convenor : Mr. Rajeev Kumar

Members:

Mr. G Suresh	Mr. Himangshu Pal	Mr. Chandrashekhar	Mr. Avdhesh Agrawal
Mr. Mahendra Mittal	Mr. R Muthuramalingam (RPO Representative)	Mrs Arvind NP Singh (Electrical)	Mr Anil Kumar

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1.0 SCOPE

This Inspection and Test Plan covers the minimum testing & inspection requirements of three phase medium voltage energy efficient squirrel cage induction motors.

2.0 REFERENCE DOCUMENTS

PO/PR & Standards referred therein /Job specifications / Approved documents/ Relevant IEC/IS.

3.0 INSPECTION AND TEST REQUIREMENTS

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
1.0	Procedures	--	--	--	--	--	--
2.0	Material Inspection						
2.1	Raw Material: Body (casting or fabrication), Rotor Shaft, Core Laminations, Copper, Insulation Material, Bearings, Cable Boxes, Cable Glands, etc.	Chemical, Physical Properties, Finish as per Relevant Standard	100%	Material Test Certificates / Test records	H	H	-

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
3.0	**In-process Inspection**						
3.1	Motor Assembly	Vacuum Impregnation and Bracing of Winding, Core Assembly, Rotor Bars and End Rings Assembly, Rotor Balancing, Terminal Box Mounting and Clearances in between, Bearing Setting, etc. as per Supplier's Internal Standards	100%	Test Records	-	H	R
4.0	**Final Inspection**						
4.1	Motor (Routine Tests)	• Visual Check (Nameplate, Terminal Box Location, Terminal Type, Clearances, Size, Entries, Space Adequacy & Gland Size, Direction of Rotation etc.) • Dimensions Check (Including Shaft Height etc., Foundation Hole Dia and Distance, Shaft Dia.) • Cable Glands, Cable Lugs Size and No. of Entries in Terminal Box • Winding Resistance • Space heater resistance & IR check • Accessories (RTD, BTD and Thermistor) Resistance measurement check (as applicable) • No Load Test and Measurement of Voltage, Speed, Current, Power Input • Reduced Voltage Starting and Running • Insulation Resistance before & after High Voltage Test • High Voltage (Per Phase)	100%	Inspection test records	-	H	H See Note 4 & 5

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
		• Vibration at No Load • Noise Level at No load					
4.2	Motor (Type Tests)	• Full Load Test and Measurement of Voltage, Current, Power, Slip, Power Factor, Bearing Noise. • Efficiency and Pf at 100%, 75% and 50% Load • Temp Rise Test • Momentary Overload Test • Vibration before and after over speed test • Over Speed • Measurement of Starting Torque, Starting Current, Full Load Torque, Pull Out Torque by JEC/IEC (By Logarithmic Proportion Current Method II	One Motor from each type/rating	Inspection test records	-	H	H See Note 4 & 5
5.0	**Painting**						
5.1	Painting and Packing	• Visual • Suitable protection to prevent entry of foreign material. • Proper packing with suitable plugs to prevent Ingress of Moisture and any damage during Transportation and Storage.	100%	Packing list / Supplier's Records	-	H	-
6.0	**Documentation and IC**						
6.1	Documentation and IC	• Review of Internal Test Reports • Test Certificate from Recognized Testing	100%	Supplier's Test Records /	-	H	H

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
		Laboratory for Area Classification. • BIS Certificate for FLP Motors and Accessories as applicable. • PESO approved Certificates for Motors and Accessories as applicable. • Degree of Protection of Terminal Box and Body • IC Issuance		Certificates from statutory bodies / Inspection Certificate (IC)			
6.2	Final Document submission	Compilation of Inspection Reports, Drawings, etc. as per VDR / PR	100%	Final data folder /Completeness certificate	-	H	H

Legends: H- Hold (Do not proceed without approval, R-Review, RW-Random witness (As specified or 10 % - Samples must include min 1 No of each type), W- Witness (Give due notice, work may proceed after scheduled date).

NOTES :-

1. For VFD application motors, separate FAT procedure to be submitted for EIL/ TPIA approval.
2. This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable.
3. Acceptance Norms for all the activities shall be as per PO/PR/ Standards referred therein/ Job specifications /Approved documents.
4. Motors up to 55 KW would be accepted based on Manufacturer's test certificates. Higher rating will have witness by TPIA appointed by Main Supplier.
5. Motors ordered with integration test (VFD fed motors) requirement as per PR shall be witnessed by EIL/ TPIA (as applicable) and main supplier for integration test (irrespective of rating) at motor manufacturer's works.

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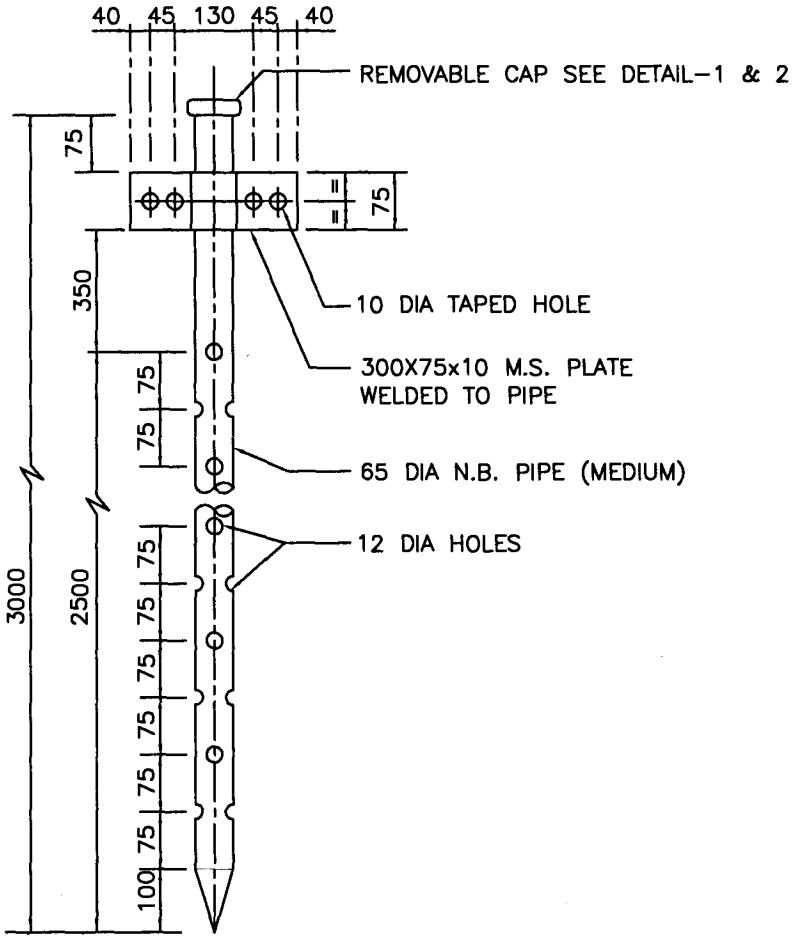
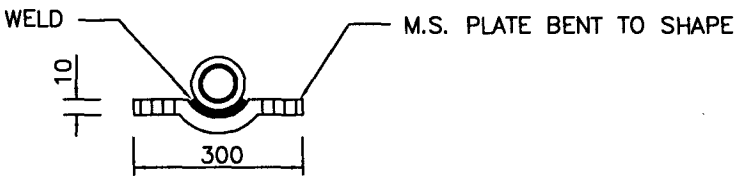
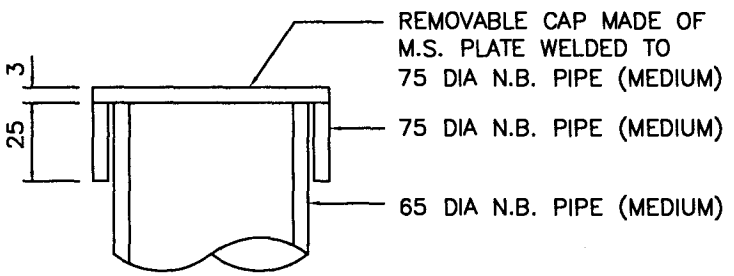
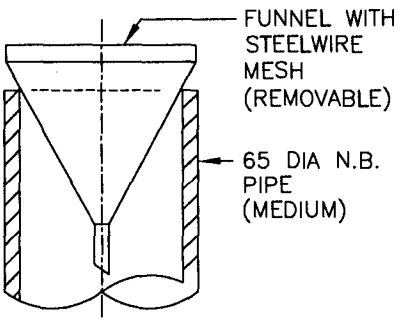






DETAIL–1



DETAIL–2

NOTE:–

1. THE PIPE ASSEMBLY SHALL BE HOT DIP GALVANISED AFTER FABRICATION. AMOUNT OF GALVANISING SHALL BE 150 MICRONS (MIN.) AS PER IS:3043.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
6	29.11.21	UPDATED & ISSUED AS STANDARD	JSK	VKS/HK	PG	SM
5	08.11.16	UPDATED & ISSUED AS STANDARD	BP	FA/HK	BRB	RN
4	27.06.11	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP	DM

Approved by

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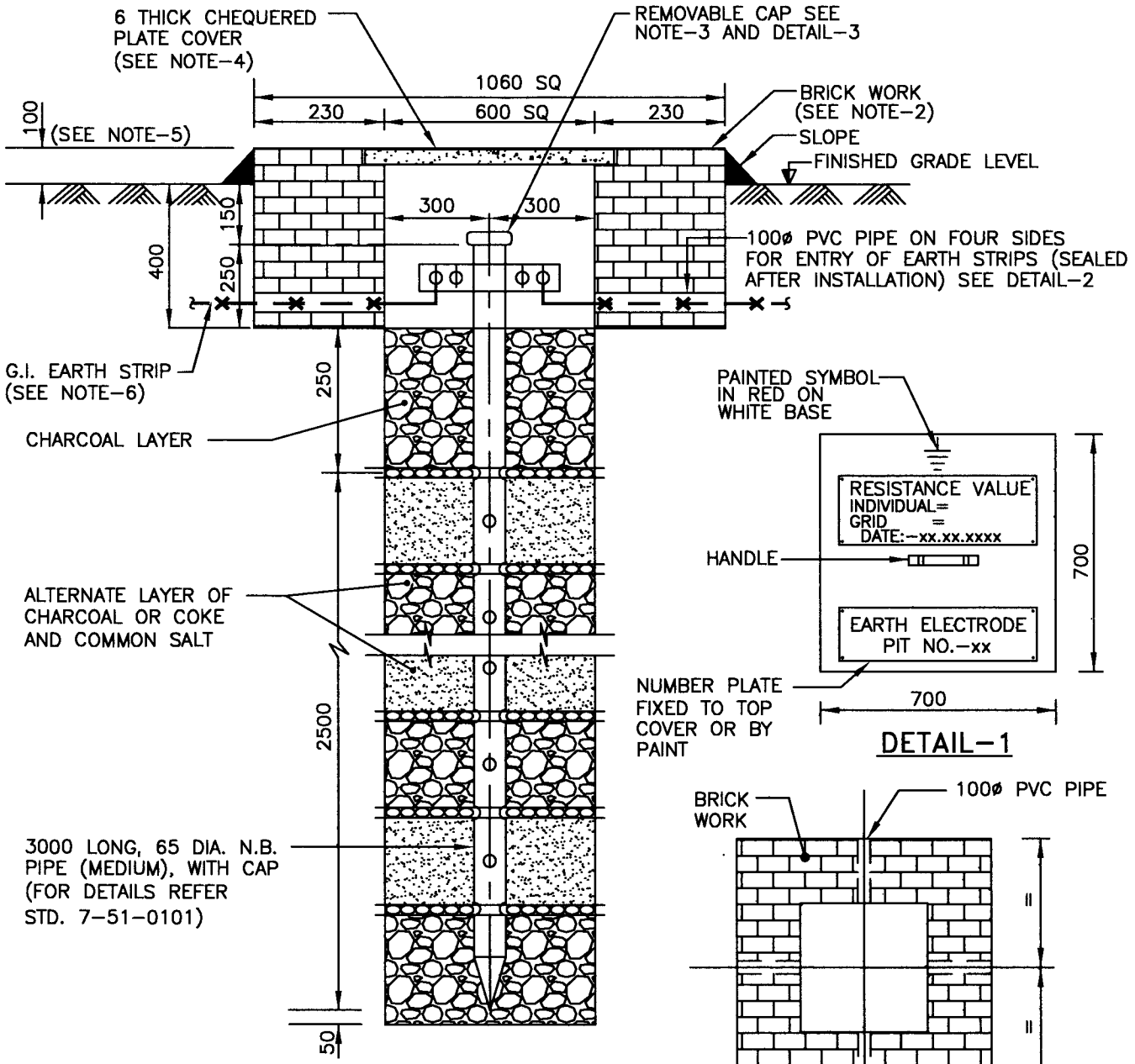
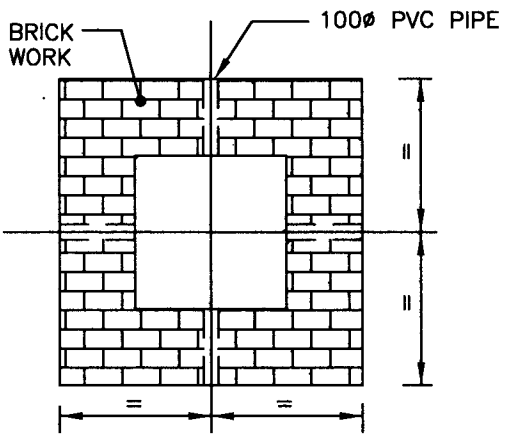
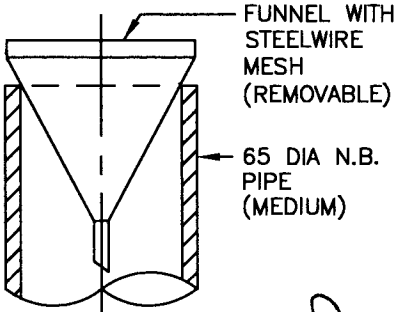


DETAIL-1



DETAIL-2



DETAIL-3

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. BRICK WORK SHALL BE DONE AFTER COMPACTING THE SOIL IN UNPAVED AREA.
3. AFTER REMOVAL OF CAP, OWNER SHALL BE ABLE TO POUR WATER THROUGH HIS OWN FUNNEL WITH STEEL WIRE MESH.
4. COLOUR CODING & PAINTING OF COVERS SHALL BE AS PER PAINTING SPEC. NO. 6-79-0020.
5. IN CASE OF PAVED AREAS, TOP OF PIT SHALL BE FLUSHED WITH FFL, WHEREAS IN UNPAVED AREAS, TOP OF PIT SHALL BE PROJECTED 100MM ABOVE FGL.
6. CONNECTIONS OF G.I. EARTH STRIP TO THE PLATE SHALL BE IN LINE WITH STD. 7-51-0103.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
8	01.11.21	REAFFIRMED & ISSUE AS STANDARD	JSK	VKS/HK	PG	SM
7	22.11.17	UPDATED & ISSUED AS STANDARD	BP	VKS/HK	BRB	RN
6	08.11.16	UPDATED & ISSUED AS STANDARD	BP	FA/HK	BRB	RN

Approved by

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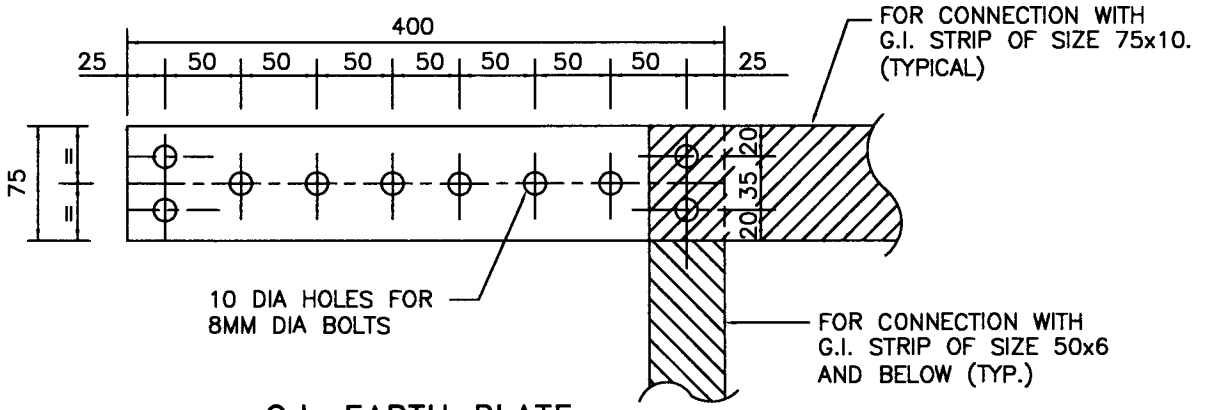
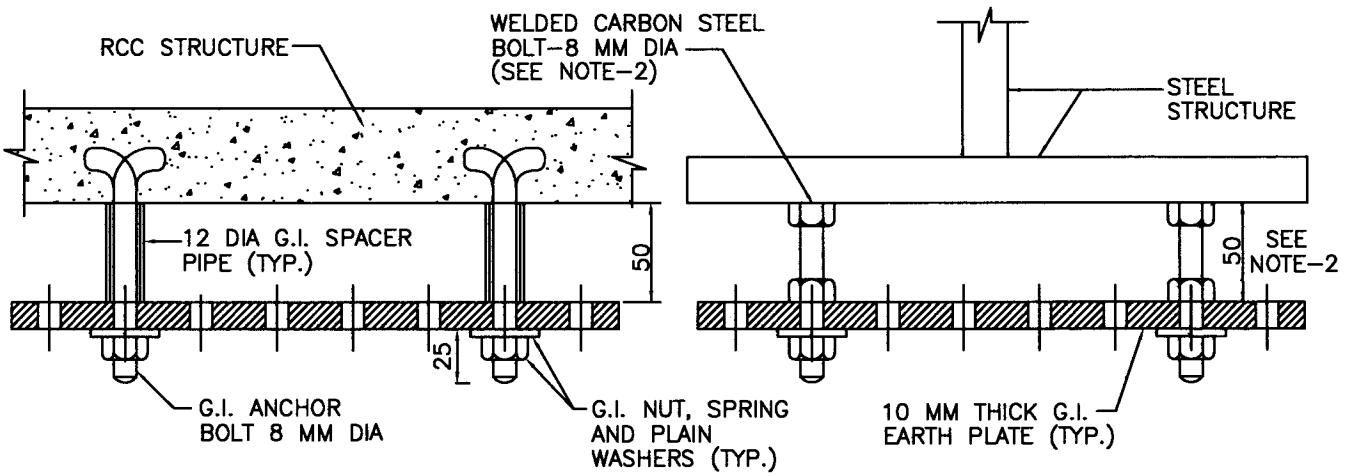
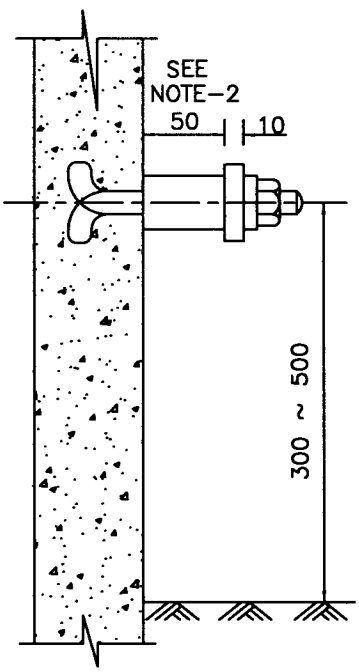
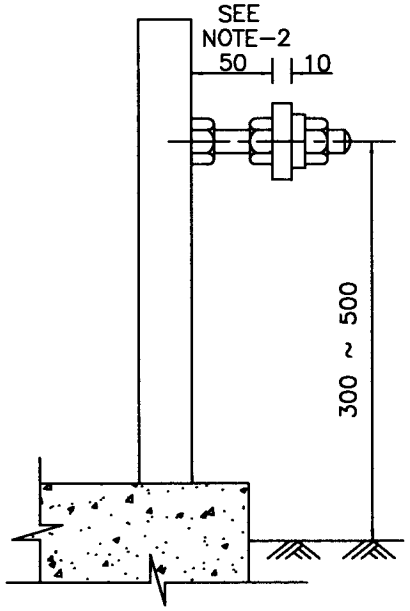


G.I. EARTH PLATE

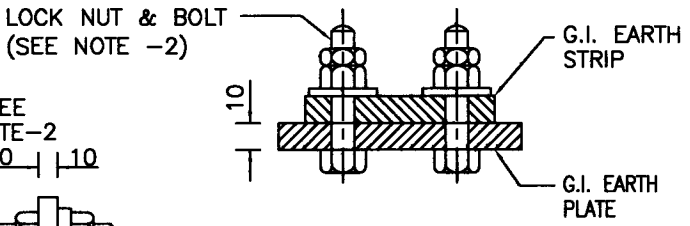




TYPICAL INSTALLATION OF EARTH PLATE ON R.C.C. STRUCTURES



TYPICAL INSTALLATION OF EARTH PLATE ON STEEL STRUCTURES



TYPICAL FIXING DETAIL OF G.I. EARTH STRIP TO EARTH PLATE

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. WHERE FIRE PROOFING OF STEEL STRUCTURES ARE ENCOUNTERED LENGTH OF CARBON STEEL BOLTS SHALL BE SUITABLY INCREASED FOR FIXING OF EARTH PLATE.
3. ALL CONNECTIONS WITH EARTH PLATE SHALL BE MADE WITH 8MM DIA. G.I. BOLT, NUT, SPRING AND PLAIN WASHERS.
4. CRIMP TYPE CABLE LUGS SHALL BE USED FOR CONNECTION WITH G.I. WIRE ROPE/CU/AL CABLES.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
7	01.11.21	UPDATED & ISSUED AS STANDARD	JSK	VKS/HK	PG	SM
6	08.11.16	UPDATED & ISSUED AS STANDARD	BP	FA/HK	BRB	RN
5	27.06.11	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP	DM

Approved by

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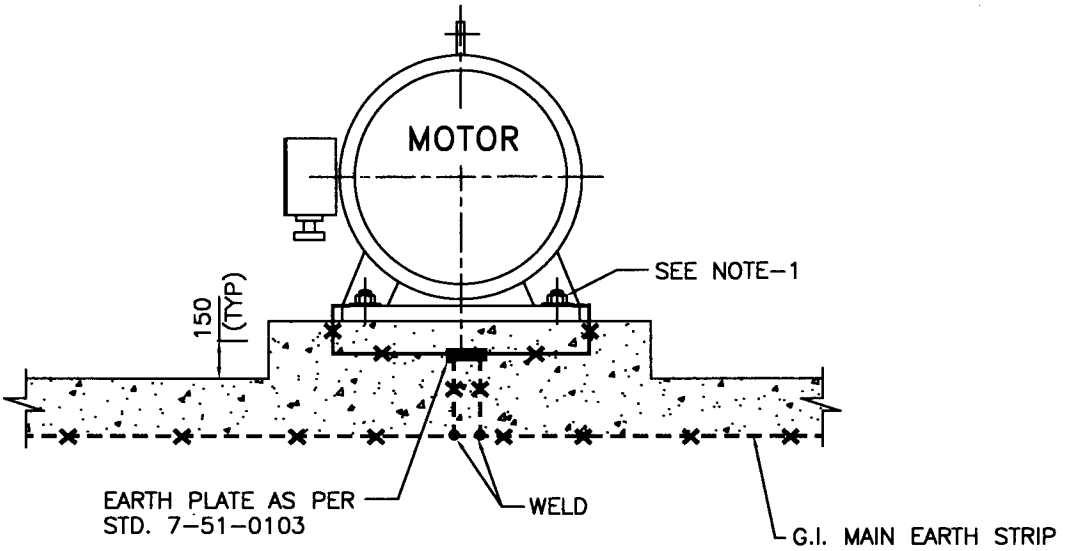
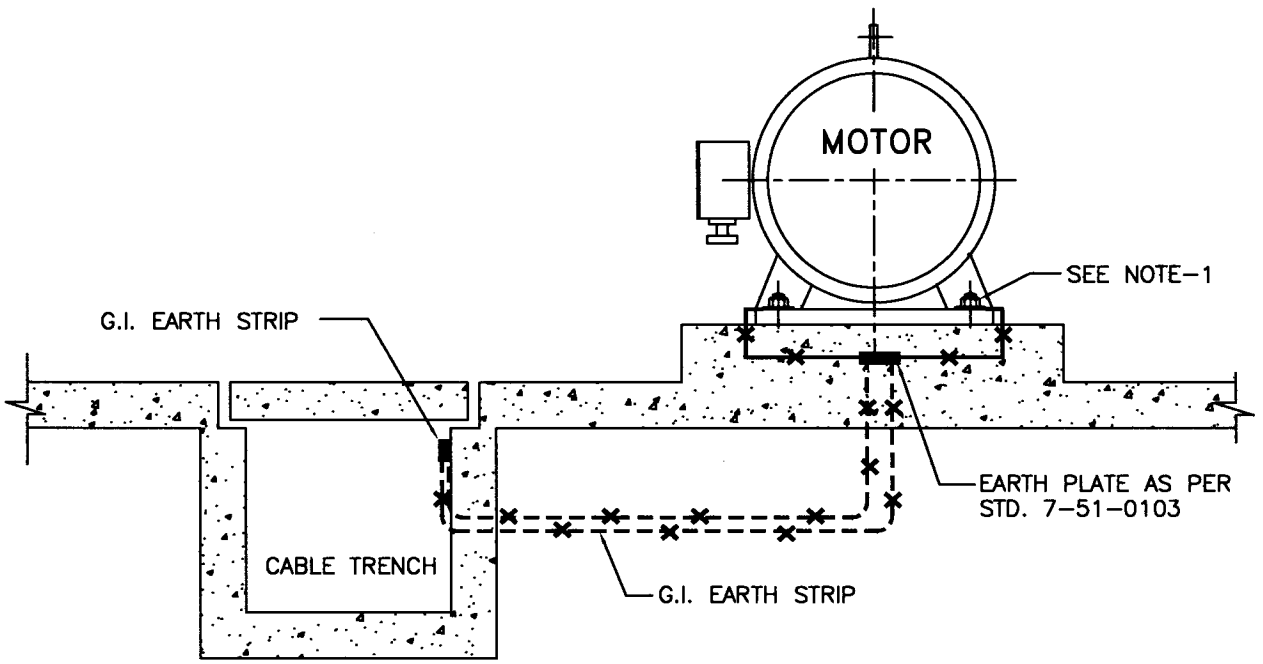


DETAIL-1
CONNECTION WITH BURIED EARTH GRID



DETAIL-2
CONNECTION WITH EARTH GRID IN RCC TRENCH

NOTE:-

1. MOTOR FOUNDATION BOLT SHALL NOT BE USED FOR EARTHING.
2. EARTHING OF P.B. STN. INSTALLED NEAR MOTOR FOUNDATION SHALL BE DONE BY TAPPING 8 SWG G.I. WIRE FROM EARTH PLATE.

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6	01.11.21	REAFFIRMED & ISSUED AS STANDARD	JSK	VKS/HK	PG	SM
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4	27.06.11	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP	DM

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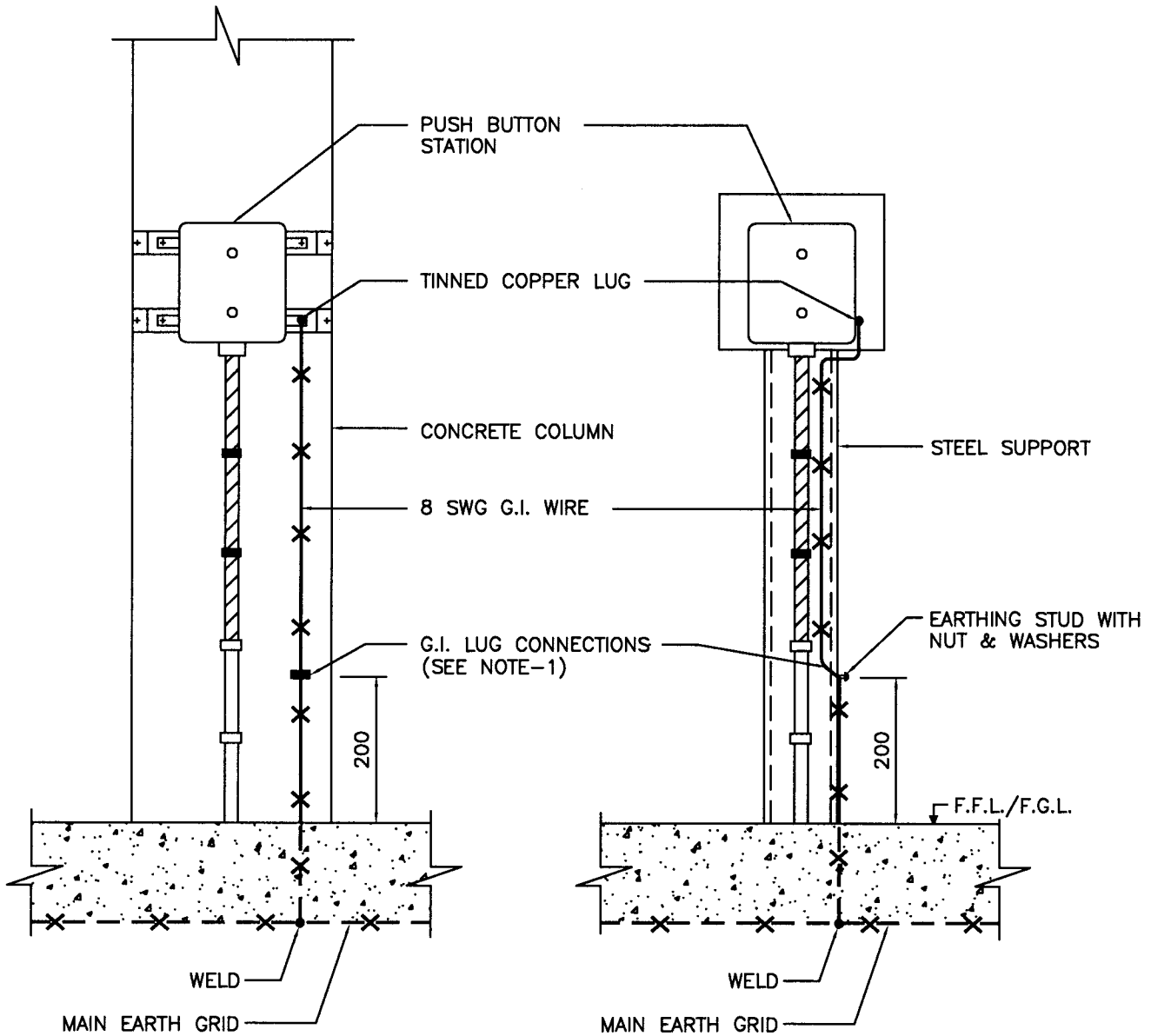

NOTES:-

1. ALTERNATIVELY, CONNECTION SHALL BE TAKEN FROM THE NEAREST AVAILABLE EARTH PLATE.

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6	29.11.21	REAFFIRMED & ISSUED AS STANDARD	JSK	VKS/HK	PG	SM
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4	27.06.11	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP	DM

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TYPE OF EQUIPMENT	EARTH CONDUCTOR SIZE (SEE NOTE–1)
MOTORS UPTO 3.7KW	8 SWG SOLID G.I. WIRE
MOTORS FROM 5.5KW TO 30KW & WELDING RECEPTACLES	10 MM (3/8") DIA G.I. WIRE ROPE
MOTORS ABOVE 30KW INCLUDING HV MOTORS	16 MM (5/8") DIA G.I. WIRE ROPE/ 40x5 MM G.I. STRIP
BUILDING COLUMNS	40 x 5 G.I. STRIP
STORAGE TANKS (VERTICAL & HORIZONTAL)	40 x 5 G.I. STRIP
LOADING RACKS	40 x 5 G.I. STRIP
VESSELS & HEAT EXCHANGERS	40 x 5 G.I. STRIP
SMALL EQUIPMENT & INSTRUMENTS	8 SWG SOLID G.I. WIRE
LIGHTING, POWER & INSTRUMENT PANELS	10 MM (3/8") DIA G.I. WIRE ROPE
MAIN EARTH BUS / MV & HV SWITCH GEAR INTERCONNECTIONS/ POWER TRANSFORMER	AS SPECIFIED
EHV & HV SUB–STATIONS	AS SPECIFIED
PUSH BUTTON STATIONS	8 SWG SOLID G.I. WIRE
STREET LIGHT POLES	10 MM (3/8") DIA G.I. WIRE ROPE
LIGHTING TRANSFORMER	16 MM (5/8") DIA G.I. WIRE ROPE
PIPE RACK	40 X 5 G.I. STRIP
BONDING OF PIPE	25 SQ. MM INSULATED FLEXIBLE CU. CABLE
LIGHTNING PROTECTION	25 X 3 MM G.I. EARTH STRIP
CABLE TRAYS	40 X 5 G.I. STRIP

NOTE:–

1. EARTH CONNECTIONS TO INDIVIDUAL EQUIPMENT FROM NEAREST EARTH PLATE / GRID MAY ALSO BE DONE ALTERNATIVELY USING ALUMINIUM / COPPER CONDUCTOR PVC/XLPE INSULATED CABLE OF SIZE AS MENTIONED IN PROJECT SPECIFICATION EQUIPMENT EARTHING SCHEDULE. CONNECTIONS SHALL BE MADE USING CRIMP TYPE OF LUGS.
2. GREEN COLOUR SLEEVING (ABOUT 50 MM LENGTH) SHALL BE PROVIDED AT BOTH ENDS TO DENOTE EARTHING.

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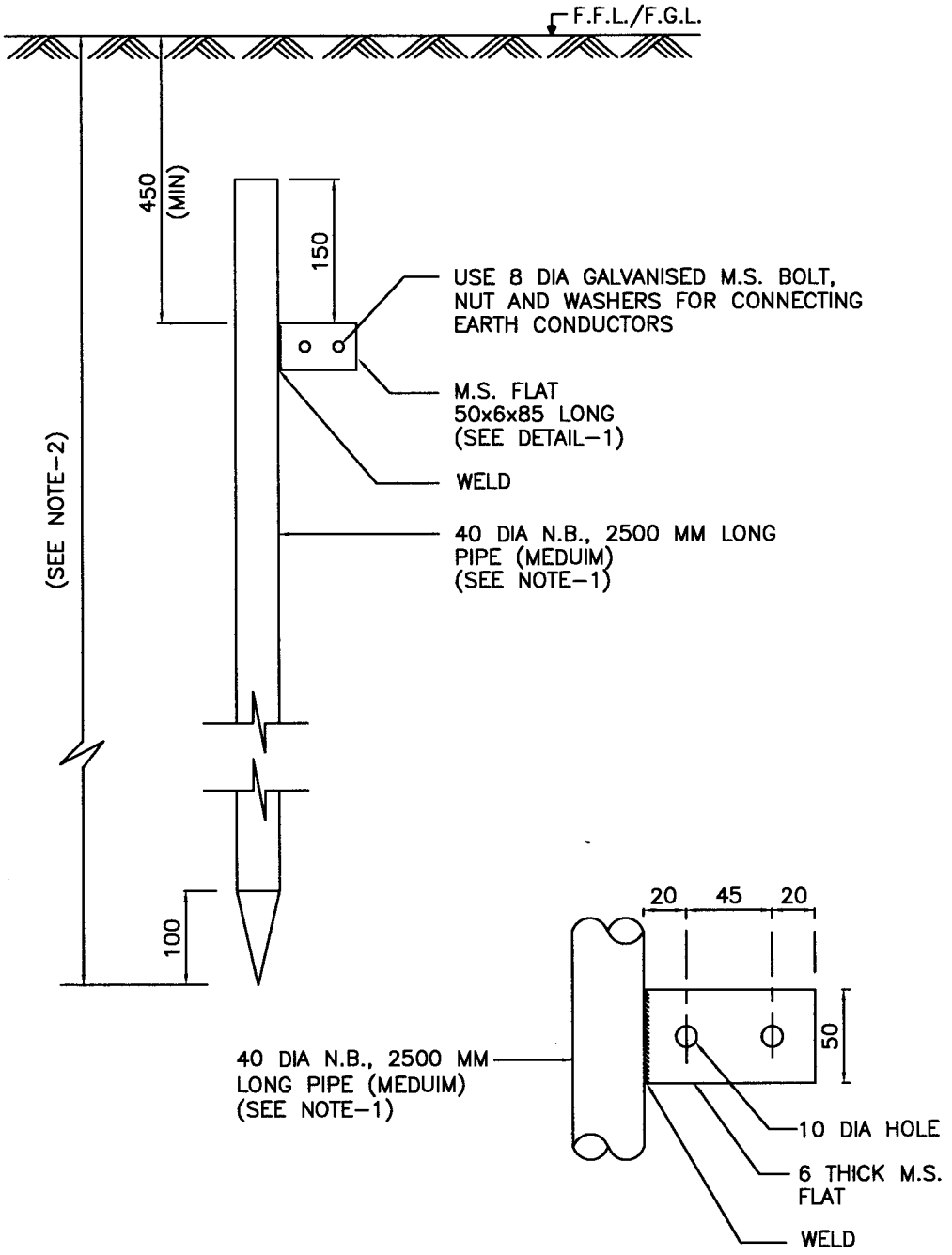

DETAIL-1

NOTES:-

1. PIPE ASSEMBLY SHALL BE HOT DIP GALVANISED AFTER FABRICATION.
2. THE ELECTRODE SHALL BE DRIVEN TO A DEPTH TO REACH PERMANENT MOIST SOIL.

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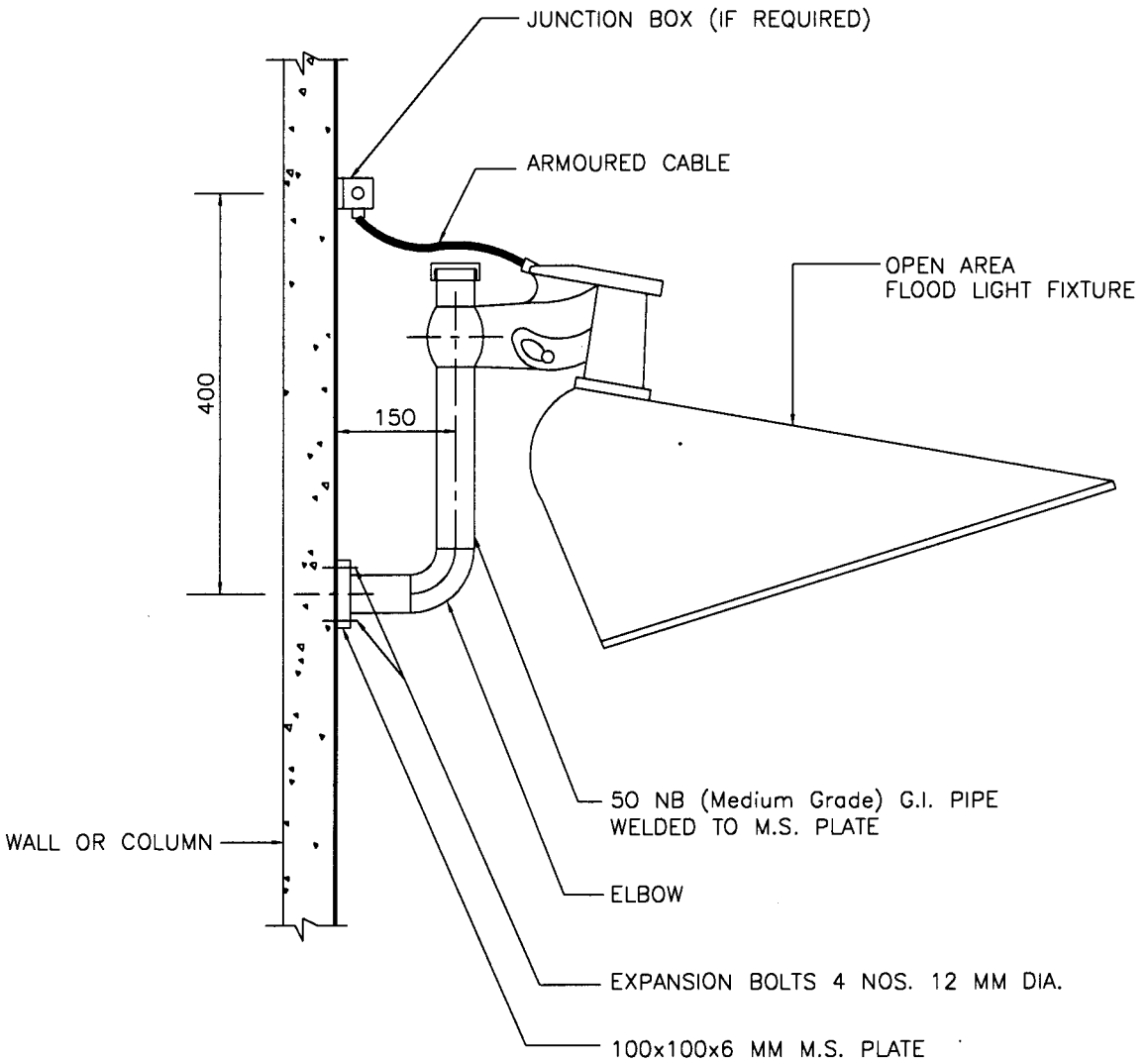

NOTES:–

1. ALL DIMENSIONS ARE IN MM.

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6	29.09.20	UPDATED & ISSUED AS STANDARD	JSK	VKS/HK	SA	SM
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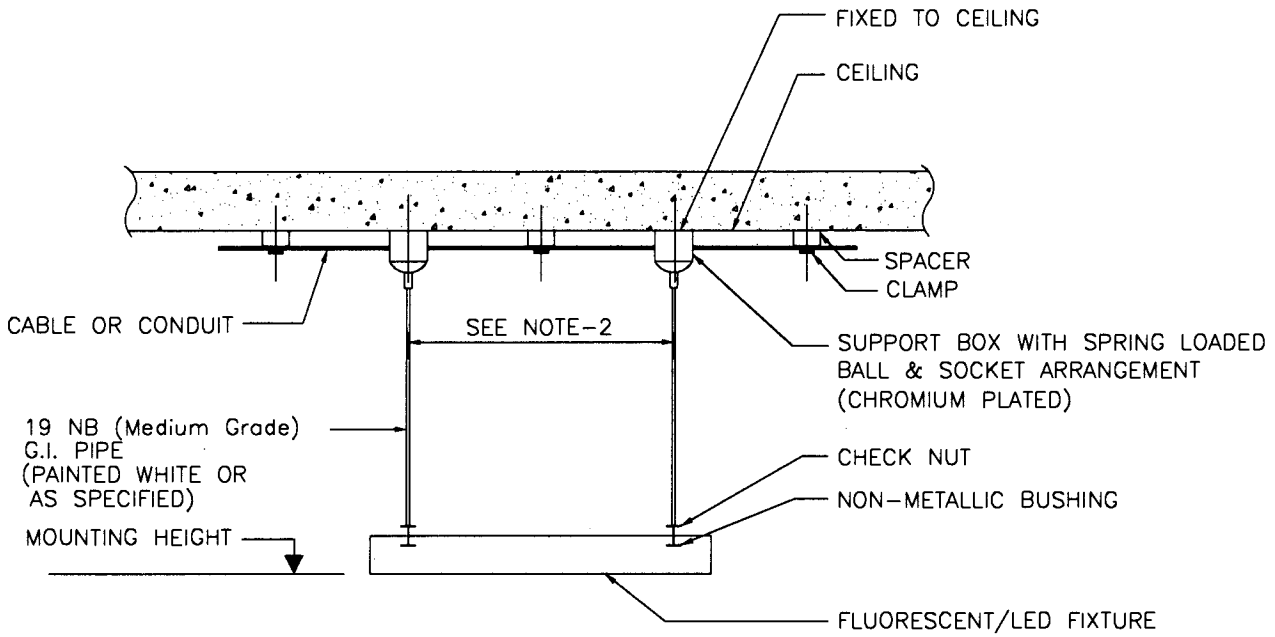
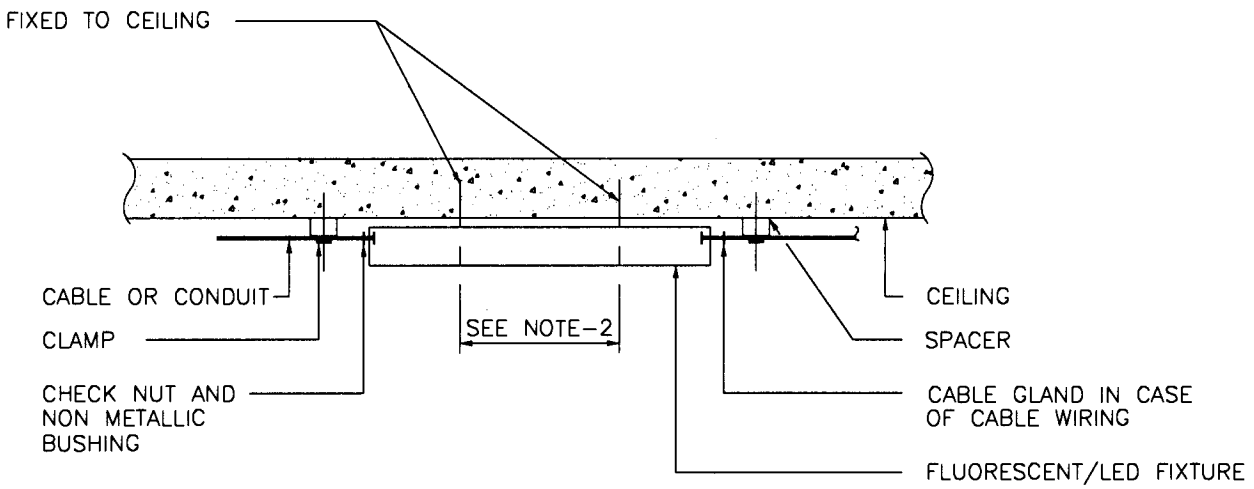


DETAIL-1
SUSPENSION MOUNTING



DETAIL-2
CEILING MOUNTING

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. SUSPENSION/FIXING CENTRES SHALL BE AS PER FIXTURE MANUFACTURER'S DETAILS.
3. IN CASE OF CABLE WIRING ONE NO. JUNCTION BOX COMPLETE WITH CABLE GLANDS SHALL BE PROVIDED NEAR EACH FIXTURE.

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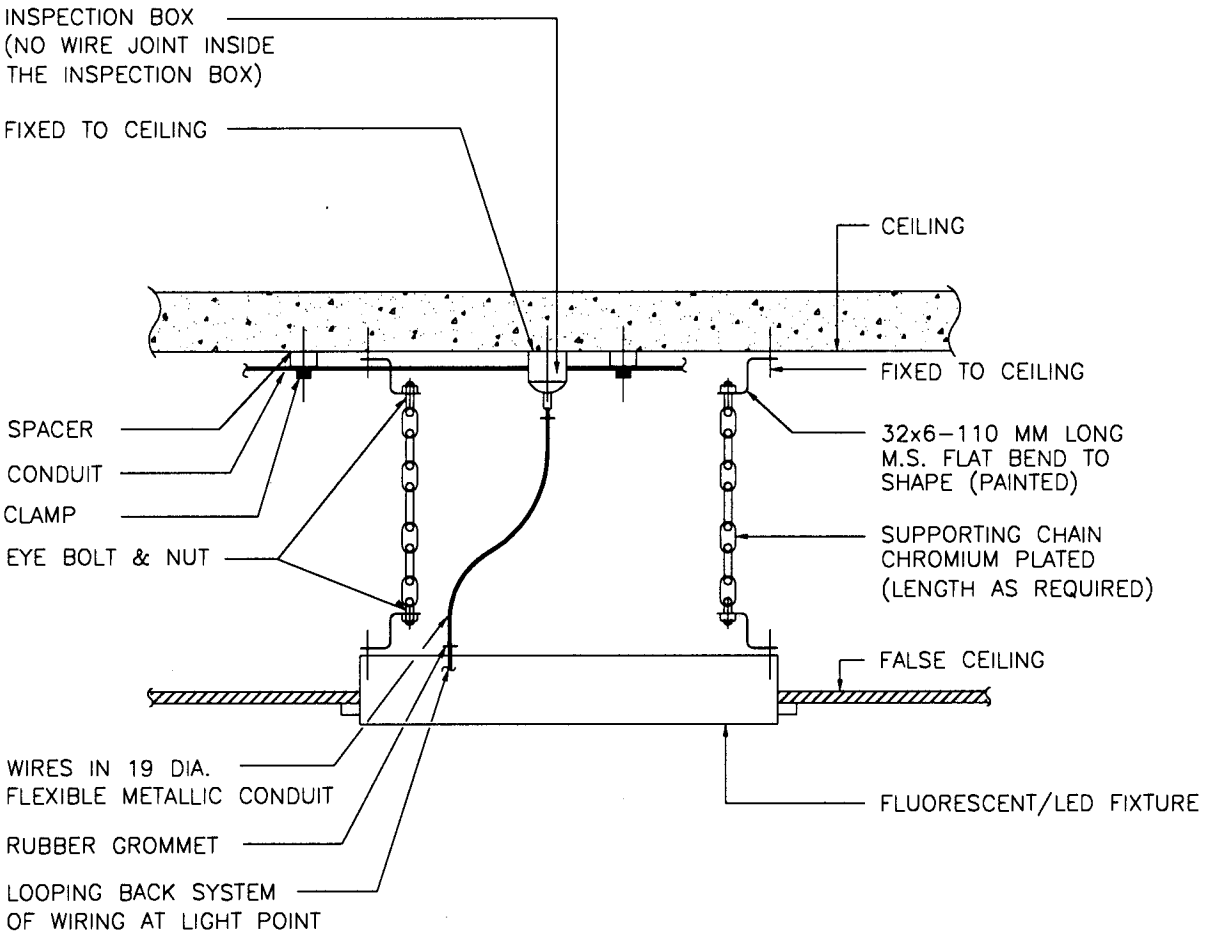

MOUNTING ARRANGEMENT WITH CHAIN SUPPORT

NOTES:–

1. ALL DIMENSIONS ARE IN MM.

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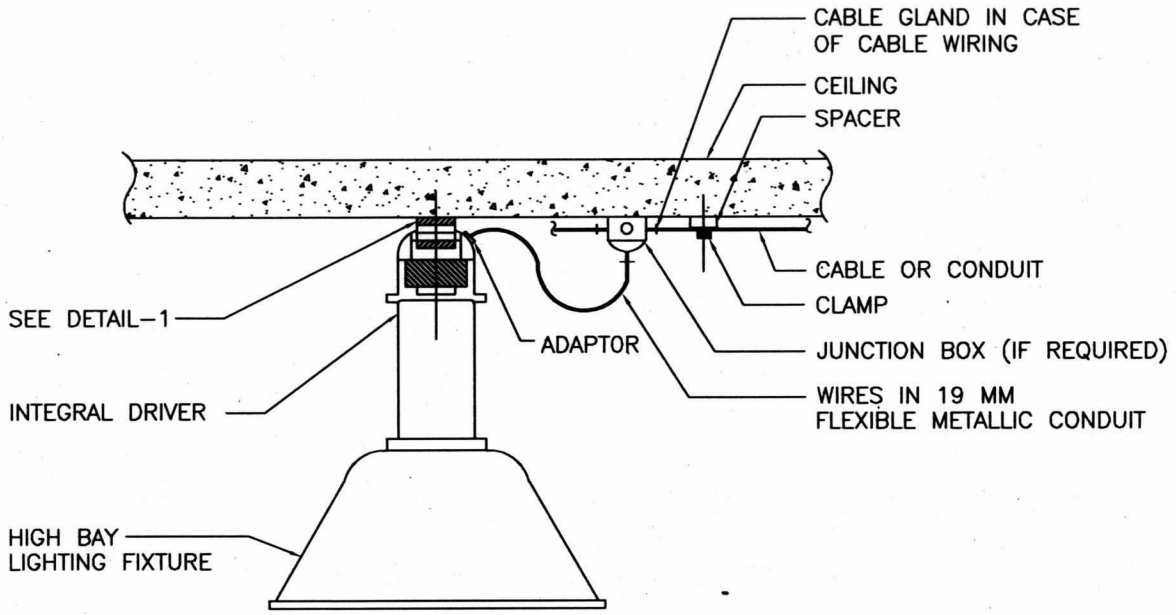

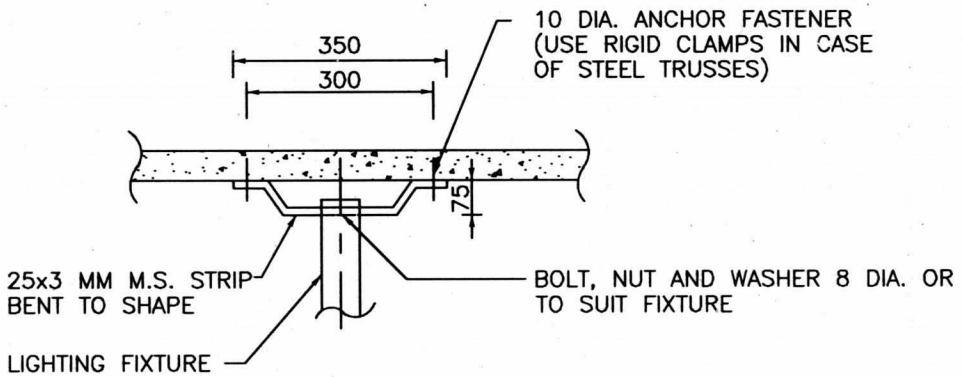

DETAIL–1

NOTES:–

1. ALL DIMENSIONS ARE IN MM.

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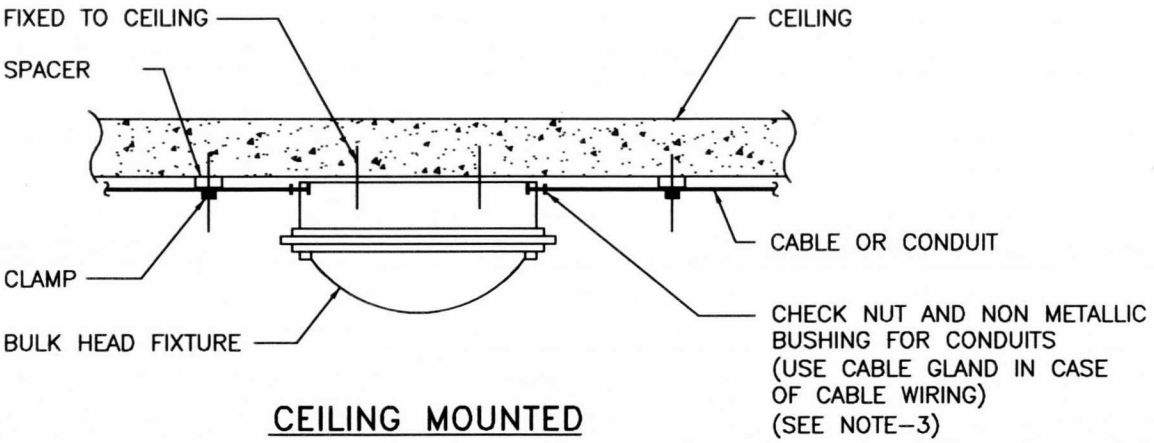
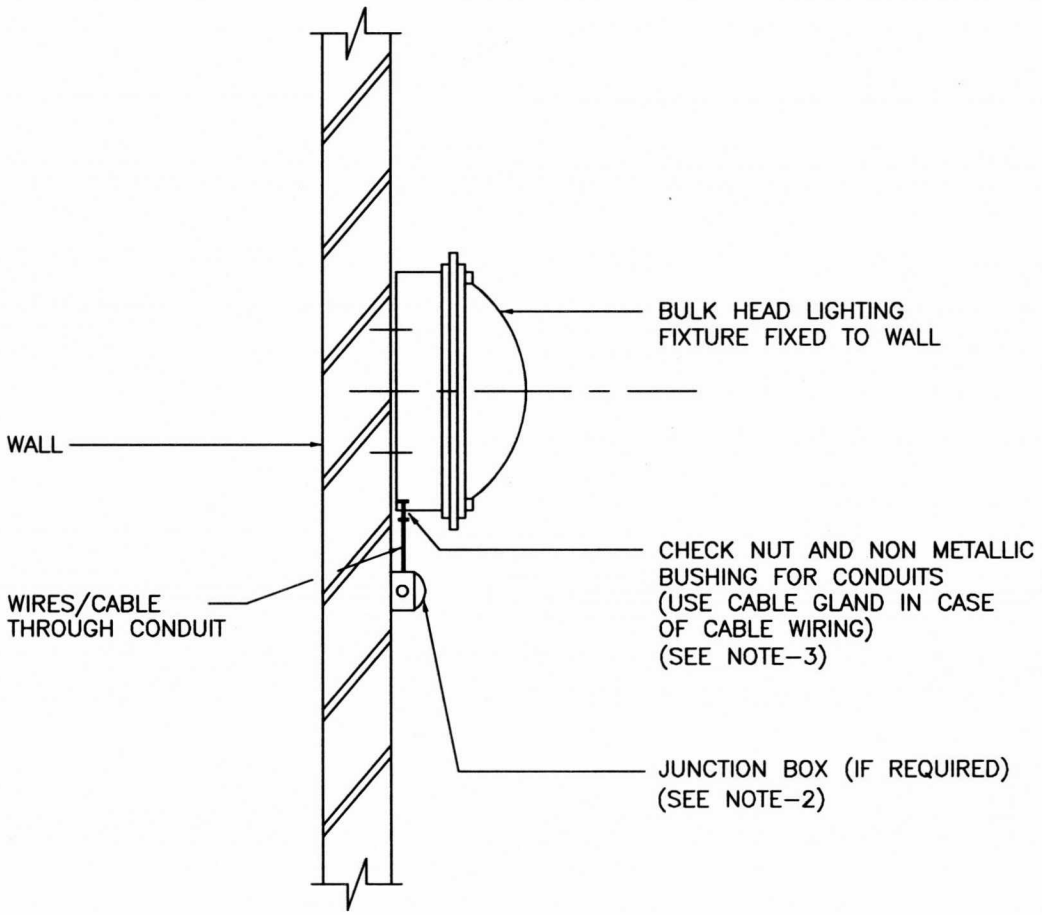


CEILING MOUNTED



WALL MOUNTED

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. FOR INSTALLATION IN OUT DOOR FIXTURES, FIXTURES & JUNCTION BOX SHALL BE IP–55 (WEATHER PROTECTED).
3. PROPER SEALING SHALL BE ENSURED WHEREVER REQUIRED TO PREVENT INGRESS OF WATER.

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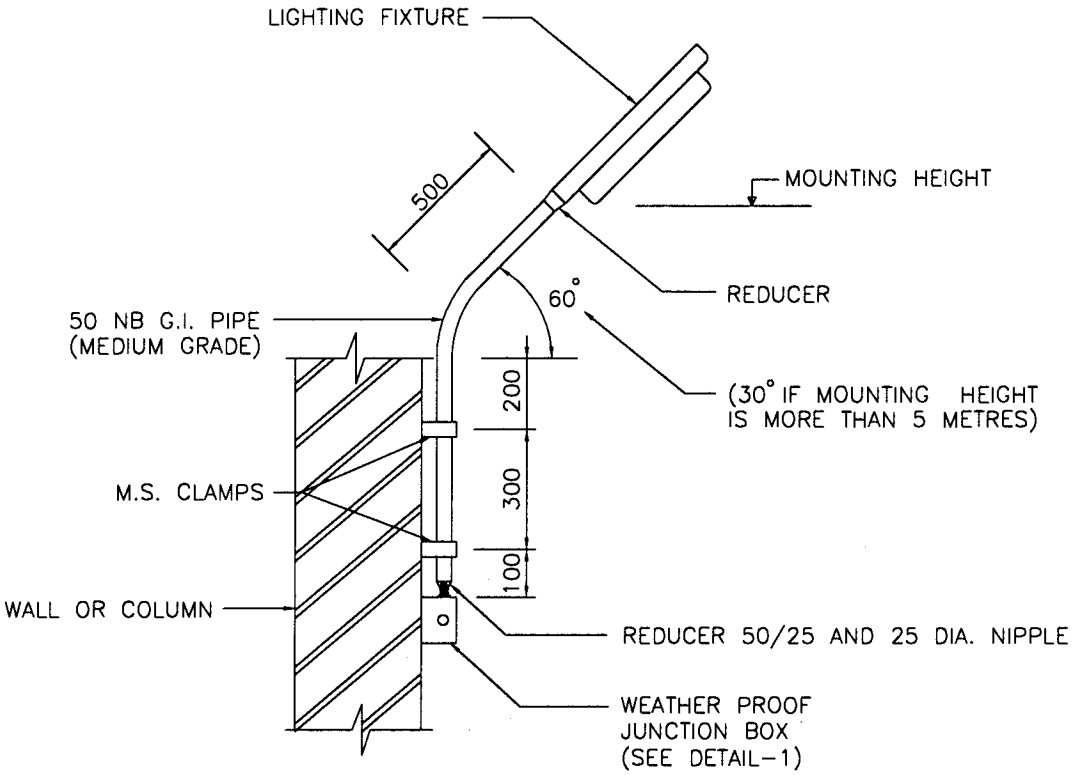
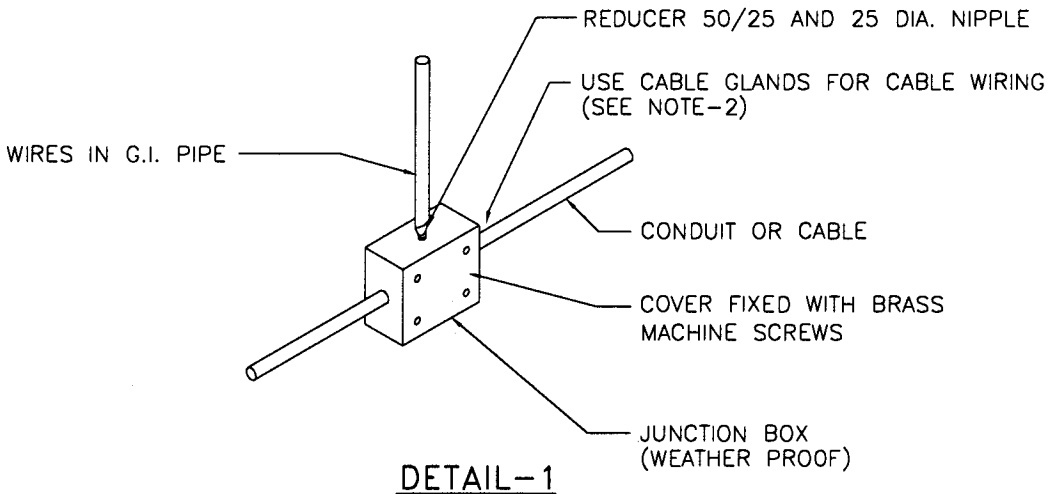


MOUNTED ON WALLS OR COLUMNS



DETAIL-1

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. PROPER SEALING SHALL BE ENSURED TO PREVENT INGRESS OF WATER.
3. WHERE FIRE PROOFING COLUMNS / STRUCTURES ARE ENCOUNTERED FIXTURE/ JUNCTION BOX AND CABLE/CONDUIT SHALL BE INSTALLED ON A SUITABLE DEEP LEGGED ANGLE IRON FRAME / DISTANCE BRACKET.

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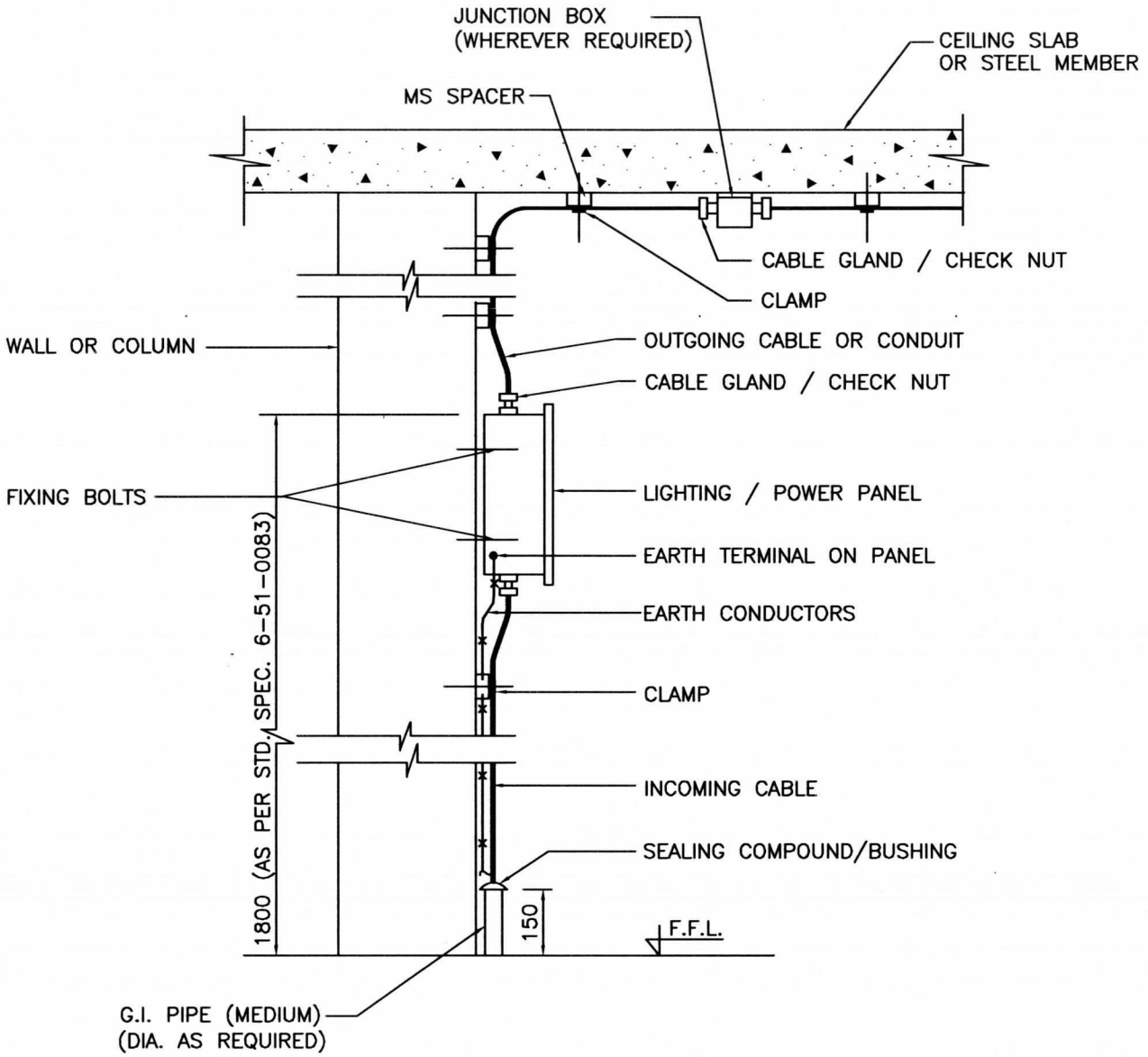

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. WHERE FIRE PROOFING COLUMNS / STRUCTURES ARE ENCOUNTERED FIXTURE/ PANEL/ JUNCTION BOX AND CABLE/CONDUIT SHALL BE INSTALLED ON A SUITABLE DEEP LEGGED ANGLE IRON FRAME / DISTANCE BRACKET.

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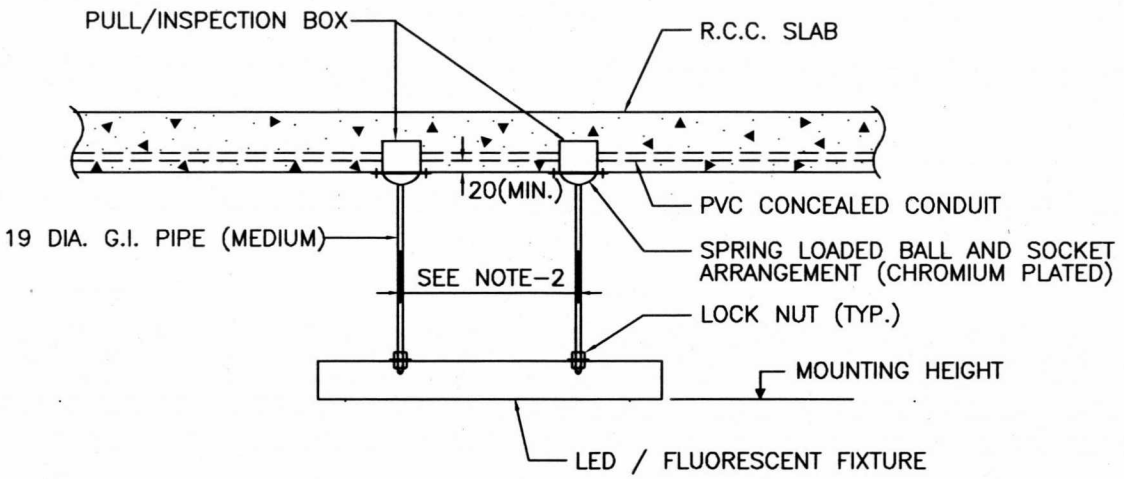
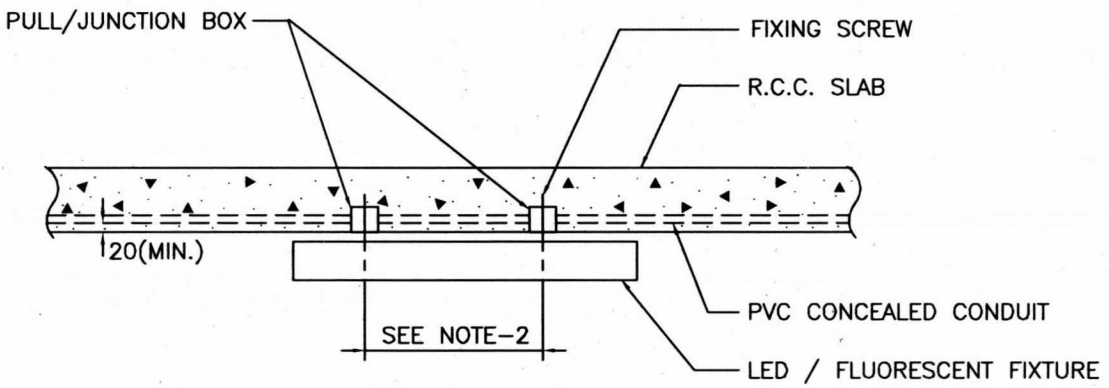


SUSPENSION MOUNTING



CEILING MOUNTING

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. SUSPENSION/FIXING CENTERS SHALL BE AS PER FIXTURE MANUFACTURER'S DETAILS.

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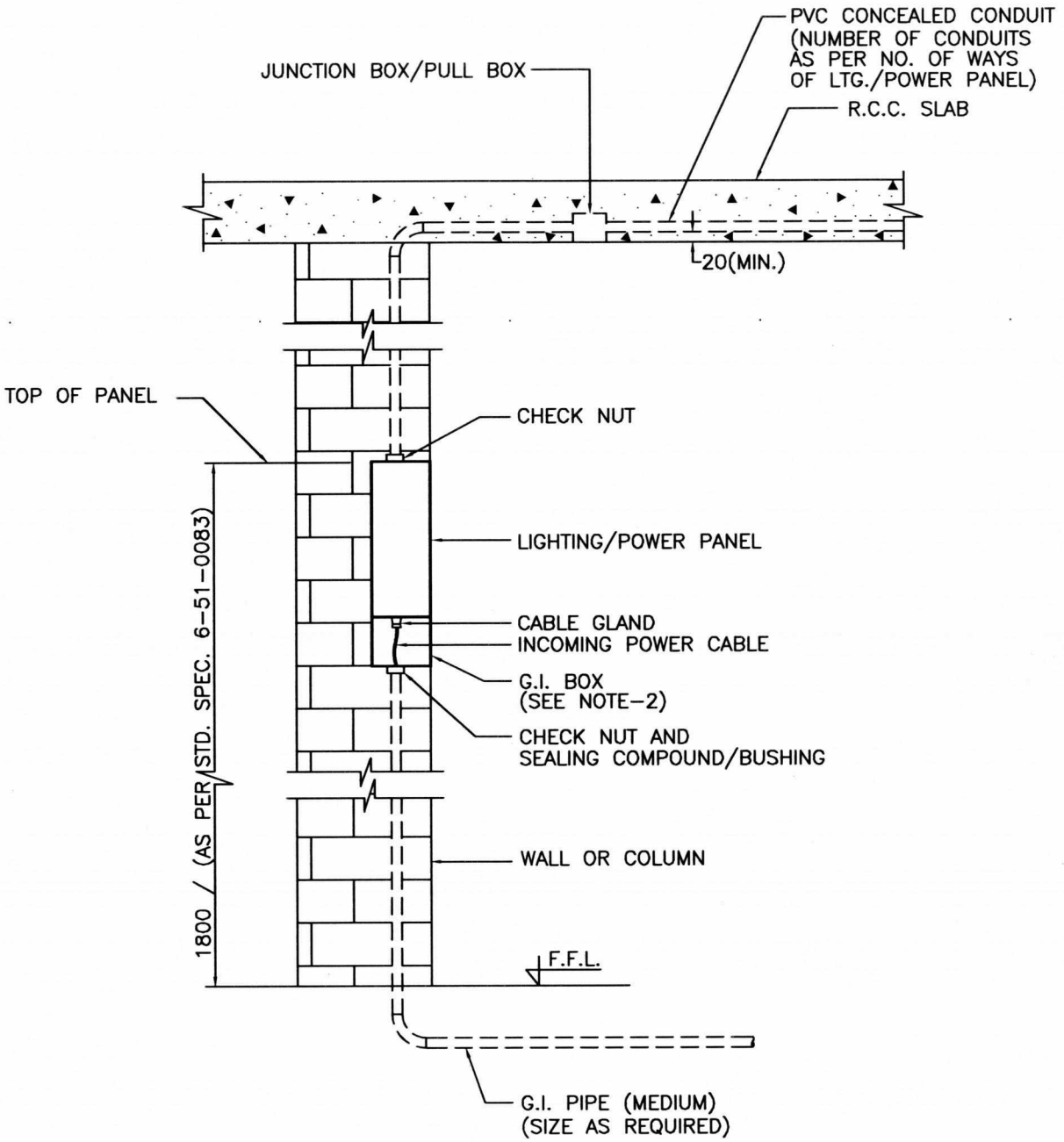

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. G.I. ADAPTOR BOX OF SUITABLE SIZE WITH REMOVABLE COVER SHALL BE PROVIDED BELOW THE PANEL TO FACILITATE CABLE TERMINATION.

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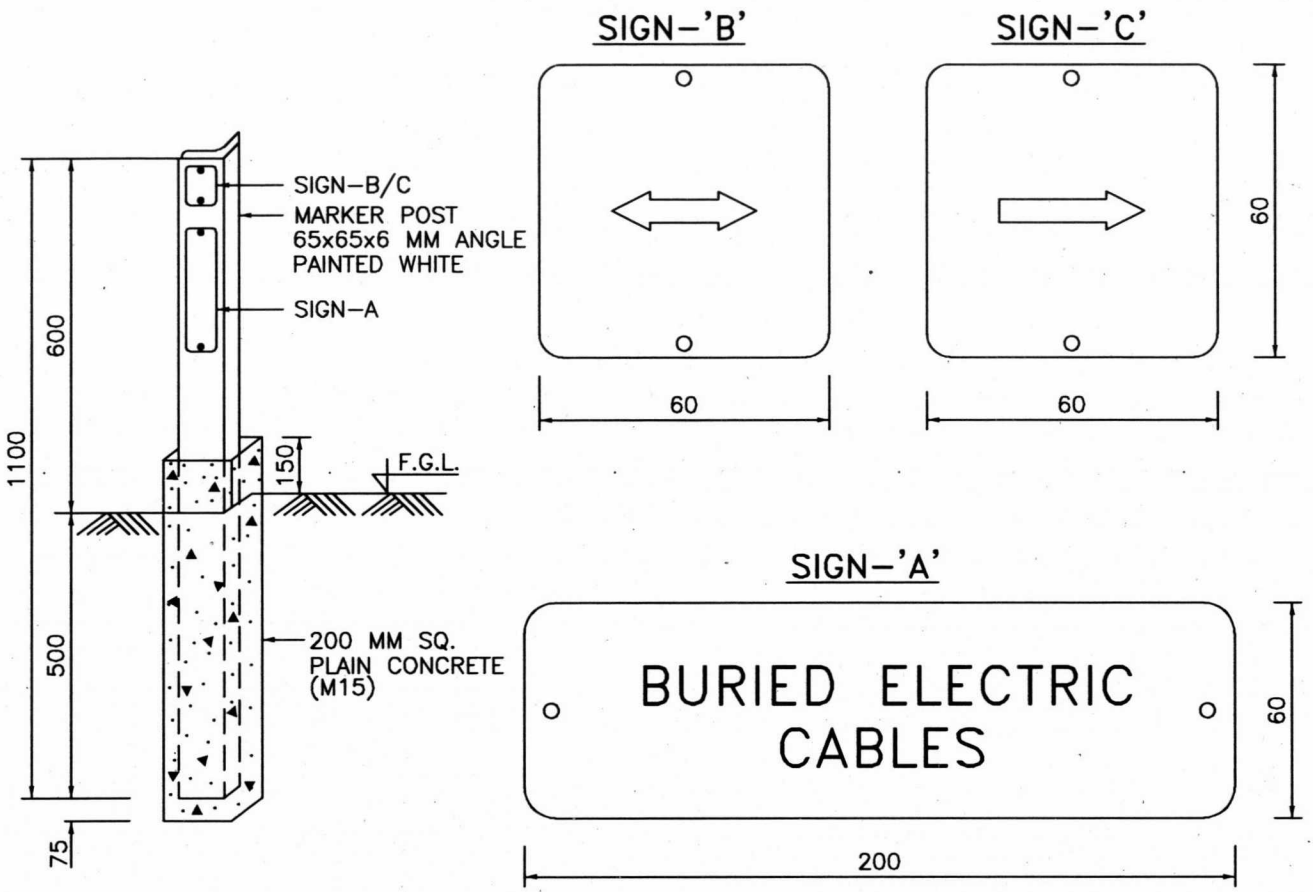
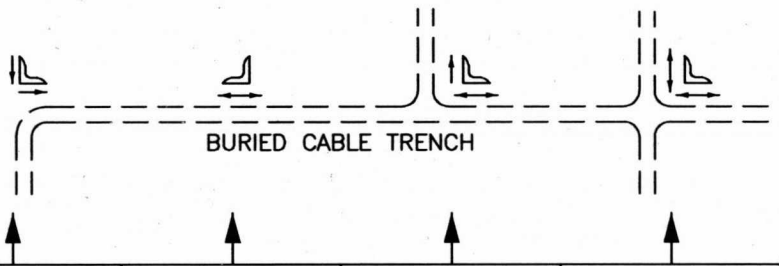


TYPICAL ARRANGEMENT OF MARKER

(SEE NOTE–2)



	ANGLE 65x65x6 1100 MM LONG	ANGLE 65x65x6 1100 MM LONG	ANGLE 65x65x6 1100 MM LONG	ANGLE 65x65x6 1100 MM LONG
ASSEMBLY CONSISTING OF	SIGN.–A–1 NO. SIGN.–C–2 NOS.	SIGN.–A–1NO. SIGN.–B–1NO.	SIGN.–A–1NO. SIGN.–B–1NO. SIGN.–C–1NO.	SIGN.–A–1NO. SIGN.–B–2NOS.

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. TRENCHES SHALL BE MARKED AT ALL DIRECTION CHANGES, INTERSECTIONS AND STRAIGHT RUNS.
3. SIGN BOARDS SHALL BE MADE OF 14 GAUGE ENAMELLED STEEL PLATE. WHITE LETTERING SHALL BE ON JADE GREEN BACKGROUND.

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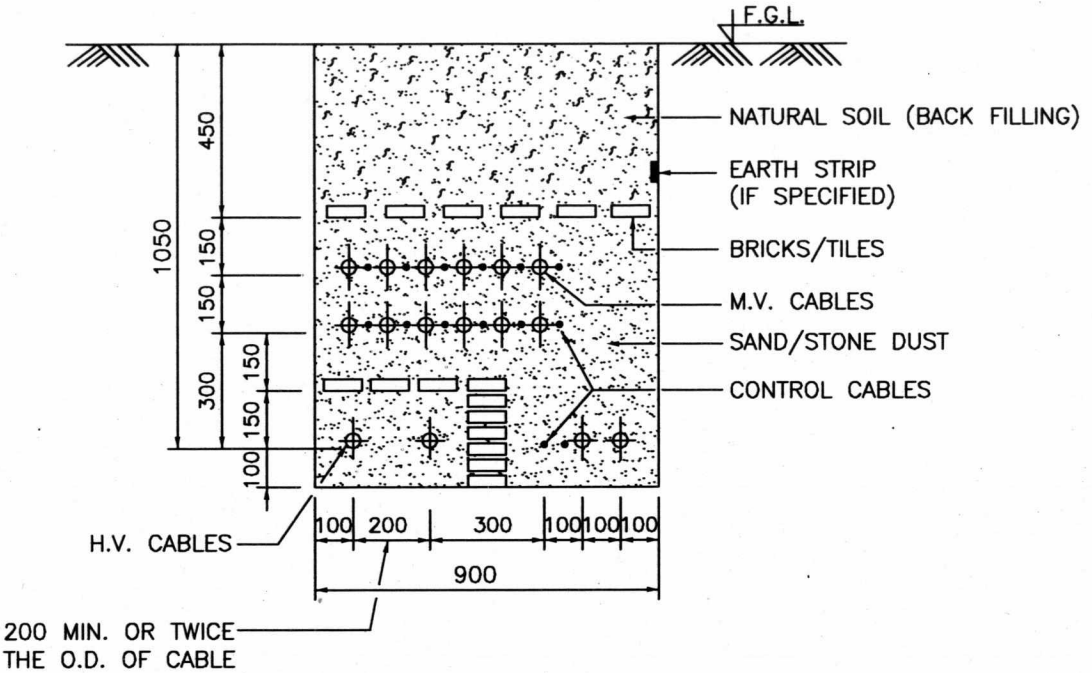
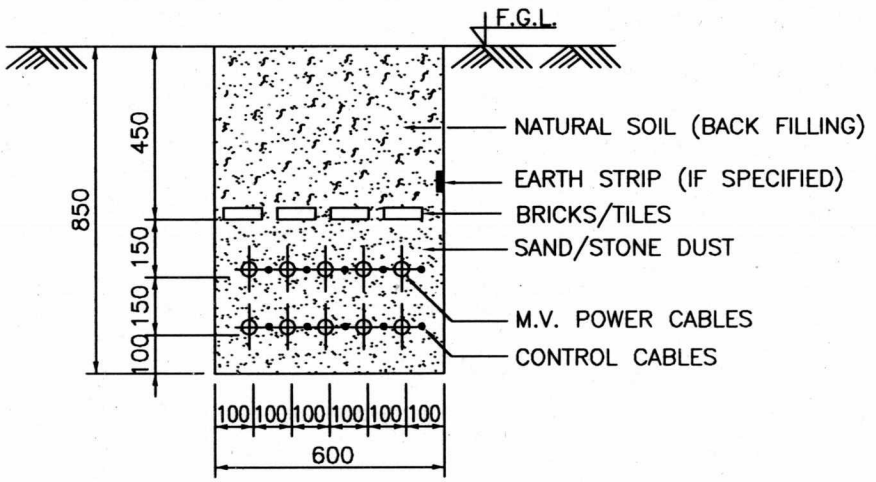


TYPICAL SECTION WITH H.V. AND M.V. CABLES



TYPICAL SECTION WITH M.V. CABLES

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. LEAVE SPACE FOR LATER ADDITION OF AT LEAST 2 CABLES OR 15% AVERAGE SPARE SPACE FOR FUTURE EXPANSION.
3. IF FIRE ALARM AND COMMUNICATION CABLES ARE LAID IN THE SAME TRENCH, A CLEARANCE OF 300 MM (MIN.) FROM ELECTRIC POWER CABLES SHALL BE PROVIDED.

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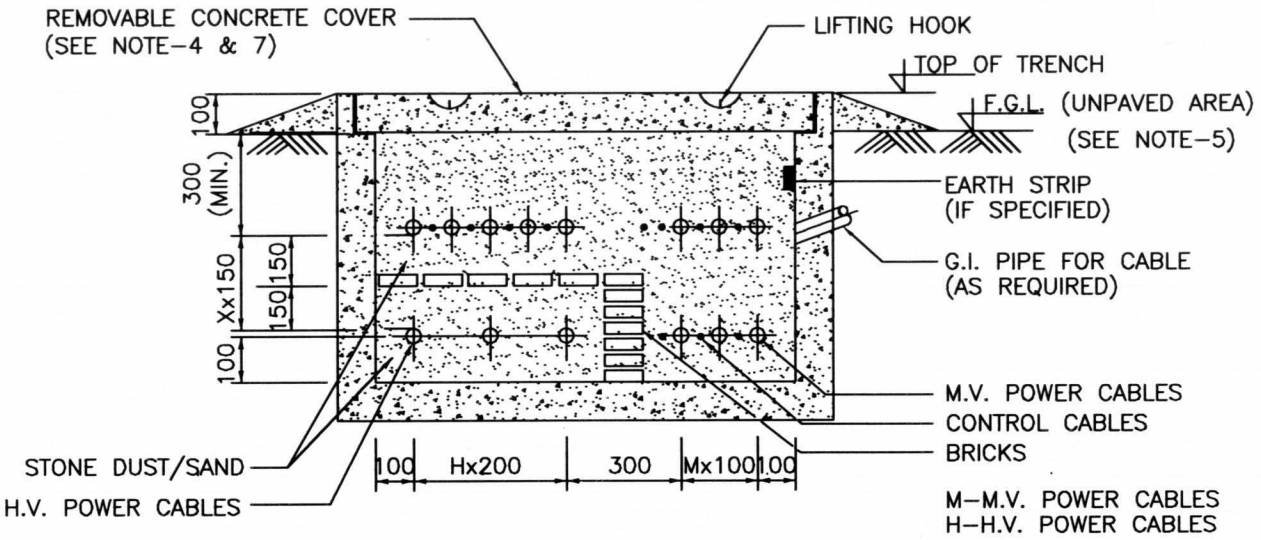
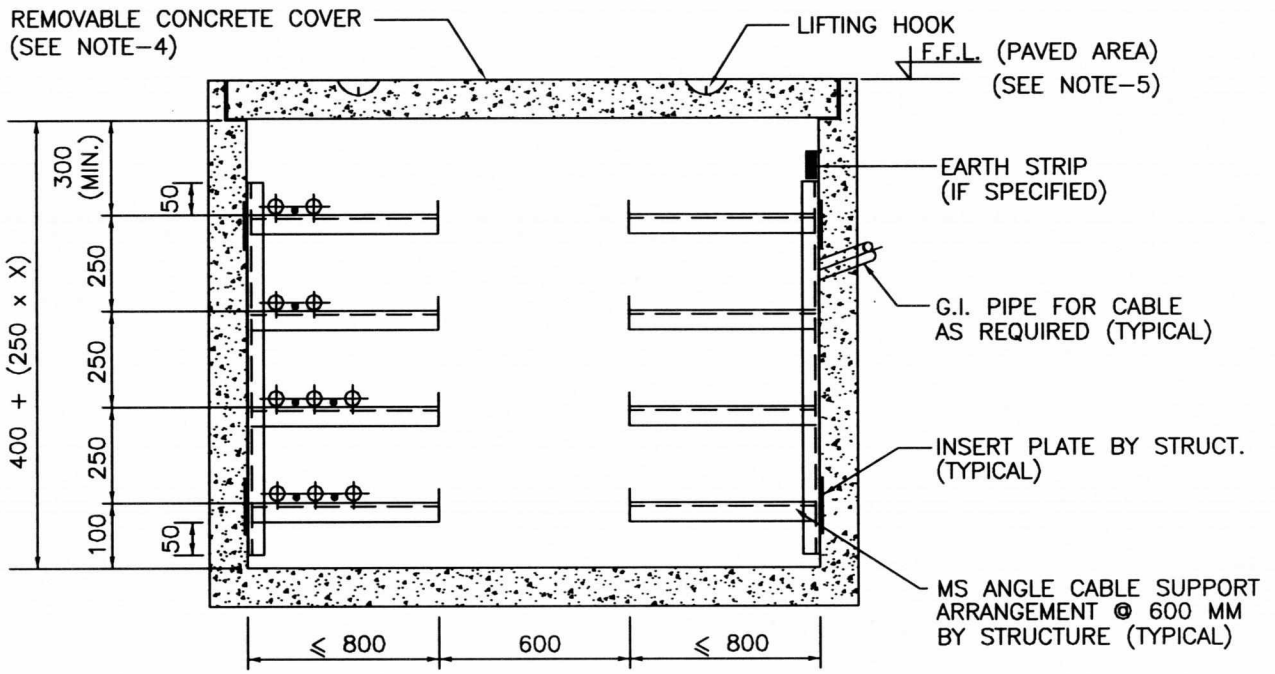


TYPICAL SECTION OF RCC CABLE TRENCH WITHOUT RACKS



TYPICAL SECTION OF RCC CABLE TRENCH WITH RACKS

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. WIDTH OF RACKS ON ONE SIDE OR BOTH SIDES SHALL BE DECIDED AS PER JOB REQUIREMENT.
3. THE EXACT HEIGHT OF OPENING IN TRENCH WALL FOR G.I. PIPE FOR TAKING CABLE SHALL BE SUITABLY DECIDED AT SITE.
4. THE REMOVABLE CONCRETE COVERS SHALL BE SEALED WITH MASTIC ASPHALT FILLER / BITUMEN TO PREVENT INGRESS OF WATER / HYDROCARBONS IN CABLE TRENCH.
5. TOP OF THE TRENCH SHALL BE 100 MM ABOVE FINISHED GRADE LEVEL (F.G.L.) IN CASE OF UNPAVED AREAS AND SHALL BE FLUSHED WITH FINISHED FLOOR LEVEL (F.F.L.) IN CASE OF PAVED AREAS.
6. MINIMUM GAP OF 250MM SHALL BE PROVIDED BETWEEN FA / COMMUNICATION / TELEPHONE CABLES AND ALL OTHER POWER / CONTROL CABLES.
7. INSTEAD OF REMOVABLE CONCRETE COVER, PCC/LEAN CONCRETE SHALL BE PROVIDED IF SPECIFIED IN JOB SPECIFICATION. THE THICKNESS OF PCC SHALL BE MININUM 100mm OR AS SPECIFIED IN STRUCTURAL SPECIFICATION.

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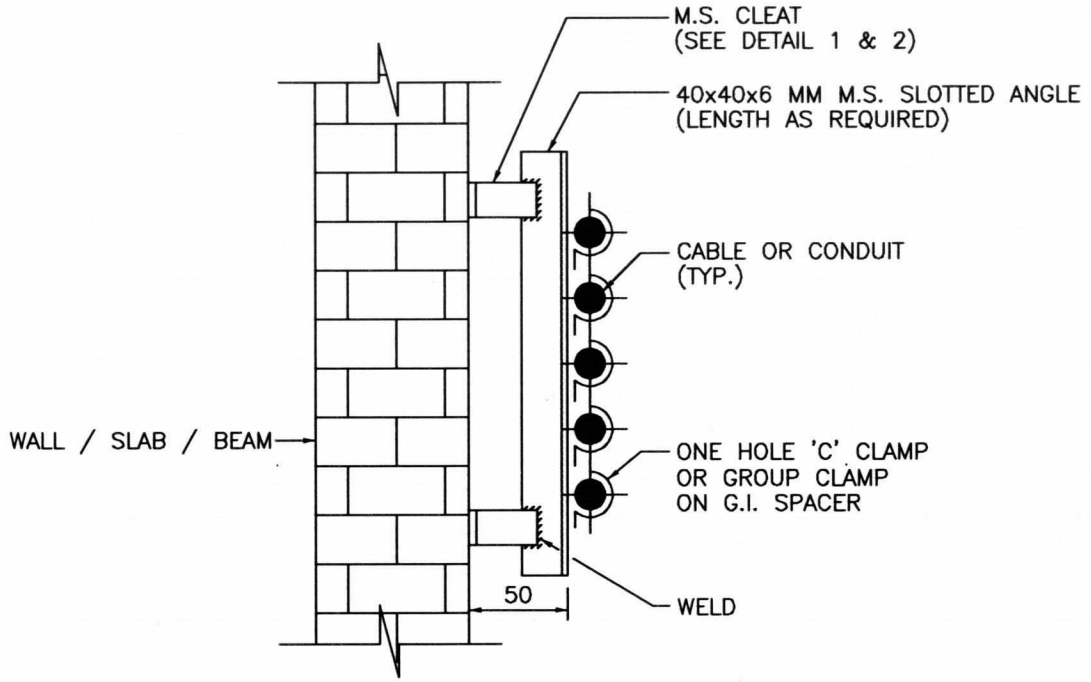
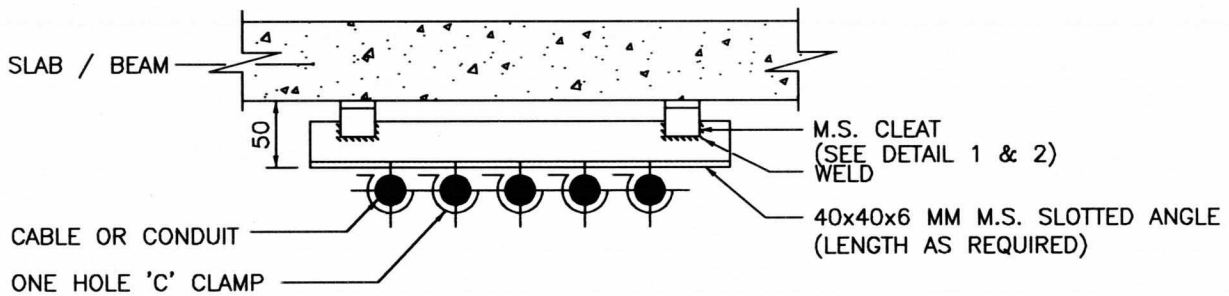
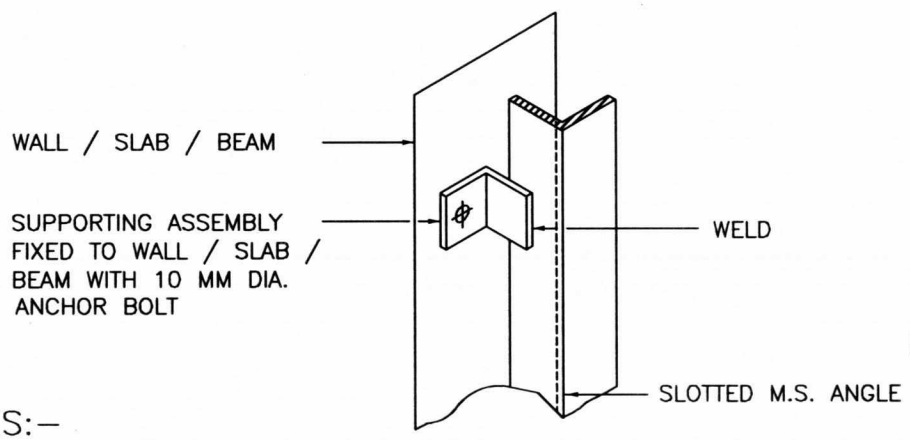


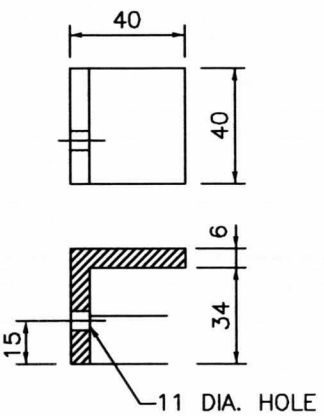
SUPPORT ON WALL



SUPPORT ON SLAB / BEAM



DETAIL–1



DETAIL–2
M.S. CLEAT

NOTES:–

1. ALL DIMENSIONS ARE IN MM.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
6	15.09.22	REAFFIRMED & ISSUED AS STANDARD	JSK	VKS/HK	MKS	SM
5	09.03.18	UPDATED & ISSUED AS STANDARD	RSD	VKS/HK	BRB	RN
4	21.11.13	REAFFIRMED & ISSUED AS STANDARD	BP	FA/SA	UAP/JMS	SC

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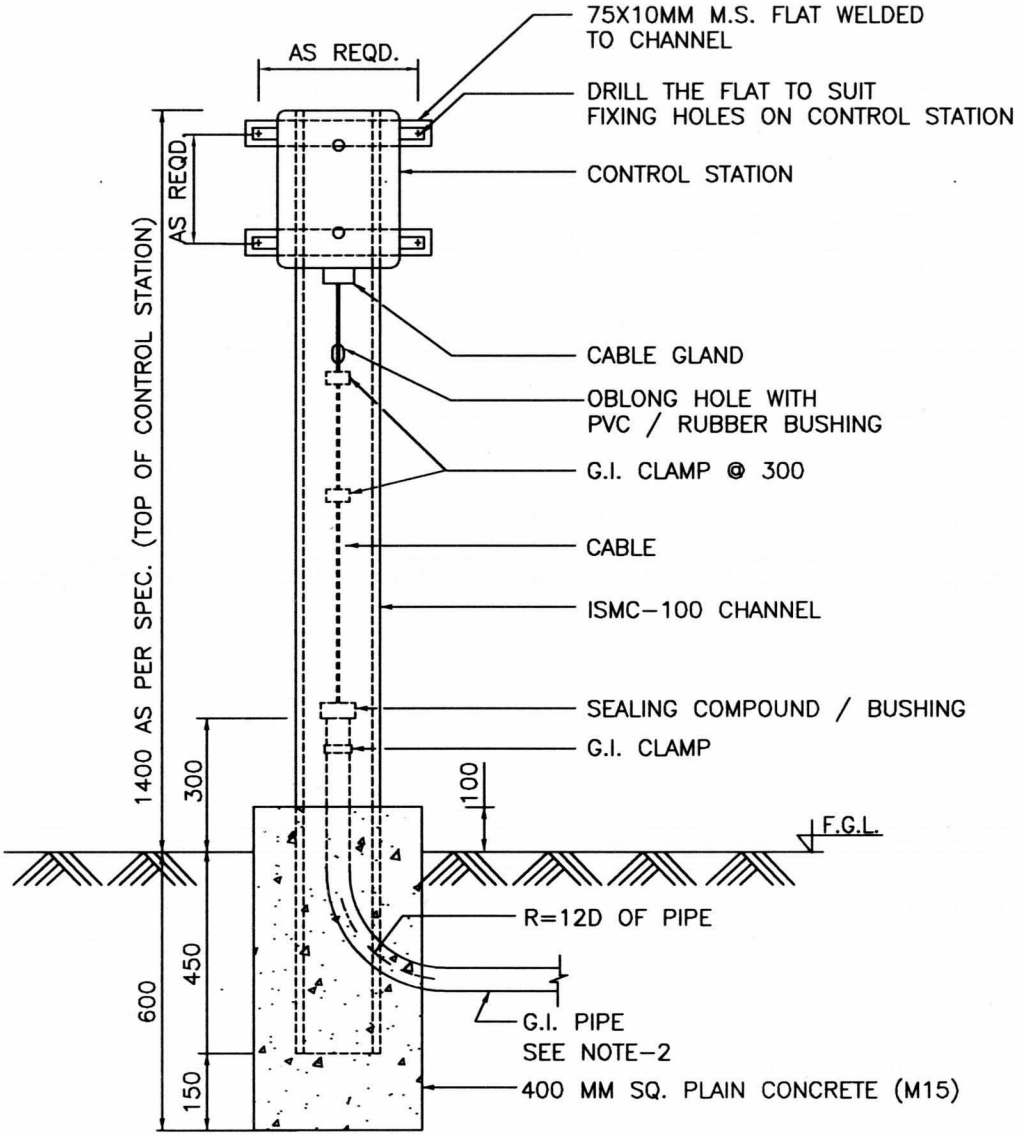

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. SIZE OF PIPE SLEEVE SHALL BE AS PER LAYOUT DRAWINGS.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
6	15.09.22	REAFFIRMED & ISSUED AS STANDARD	JSK	VKS/HK	MKS	SM
5	09.03.18	REAFFIRMED & ISSUED AS STANDARD	RSD	VKS/HK	BRB	RN
4	21.11.13	REAFFIRMED & ISSUED AS STANDARD	BP	FA/SA	UAP/JMS	SC

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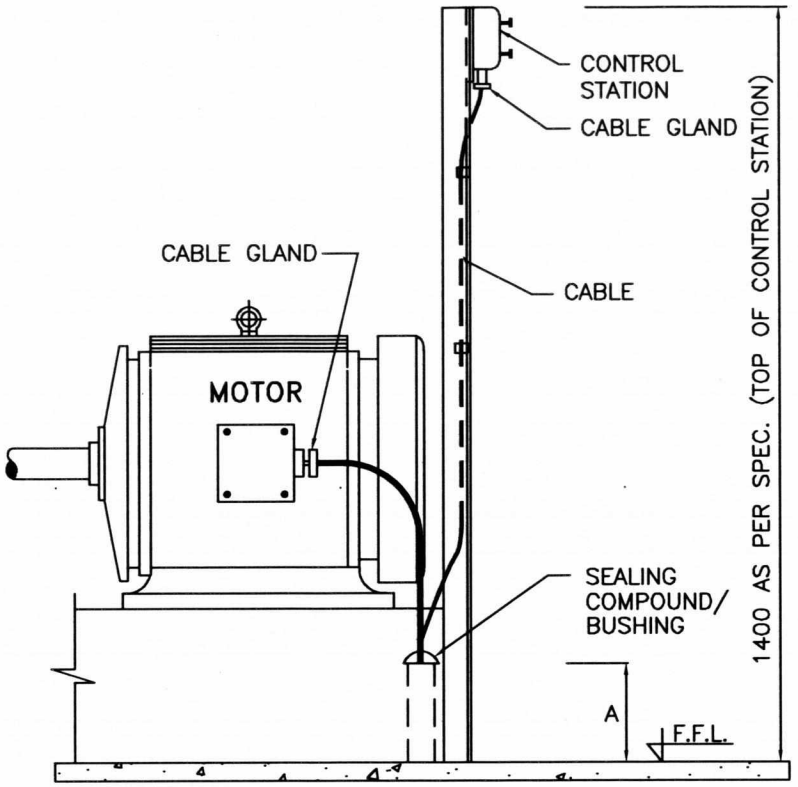
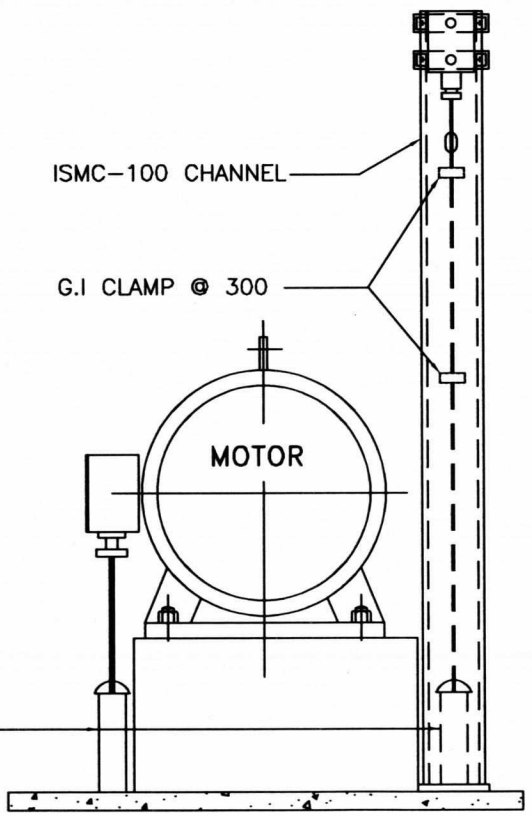


CABLE TO MOTOR TERMINAL BOX (SIDE ENTRY)



A = 150 MM (MIN.) FOR INDOOR LOCATIONS
300 MM (MIN.) FOR OUTDOOR LOCATIONS

CABLE TO MOTOR TERMINAL BOX (BOTTOM ENTRY)

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. QUANTITY AND SIZE OF PIPE SLEEVE SHALL BE AS PER LAYOUT DRAWINGS.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
6	15.09.22	REAFFIRMED & ISSUED AS STANDARD	JSK	VKS/HK	MKS	SM
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4	21.11.13	REAFFIRMED & ISSUED AS STANDARD	BP	FA/SA	UAP/JMS	SC

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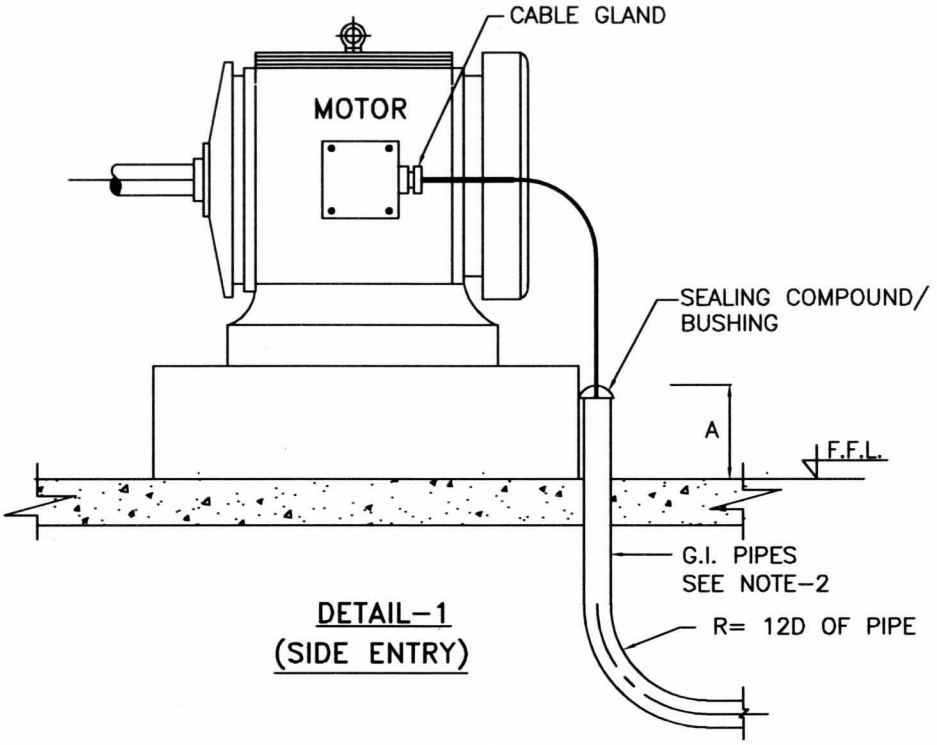
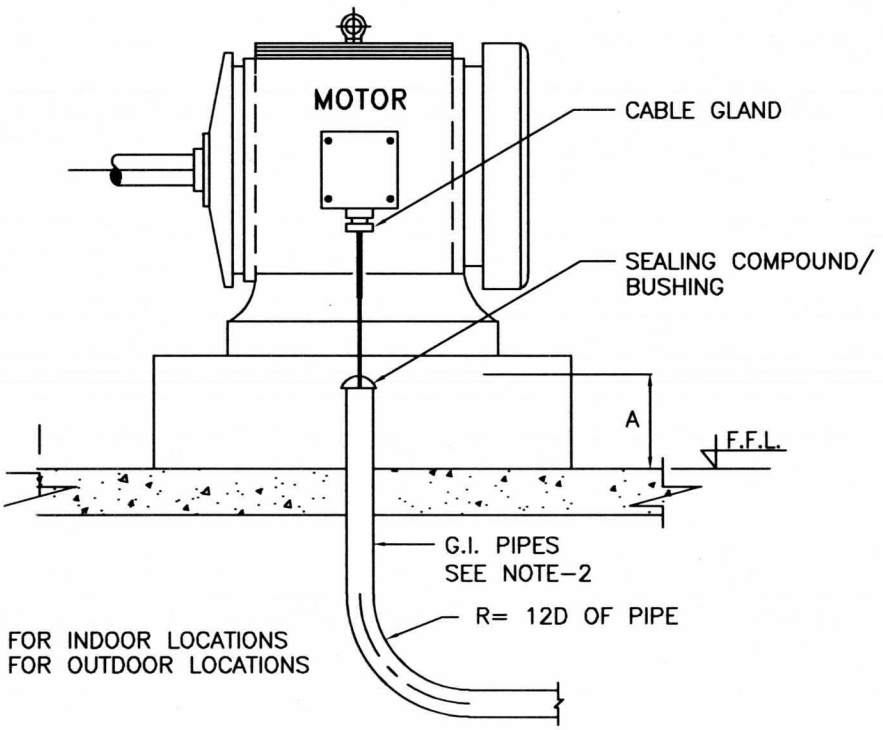


DETAIL-1
(SIDE ENTRY)



A = { 150 MM (MIN.) FOR INDOOR LOCATIONS
300 MM (MIN.) FOR OUTDOOR LOCATIONS }

DETAIL-2
(BOTTOM ENTRY)

NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. QUANTITY AND SIZE OF PIPE SLEEVE SHALL BE AS PER LAYOUT DRAWINGS.
3. UNDER NORMAL CONDITION DETAIL-1 SHALL BE FOLLOWED. ONLY IN EXCEPTIONAL CASES DETAIL-2 SHALL BE FOLLOWED.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
6	15.09.22	REAFFIRMED & ISSUED AS STANDARD	JSK	VKS/HK	MKS	SM
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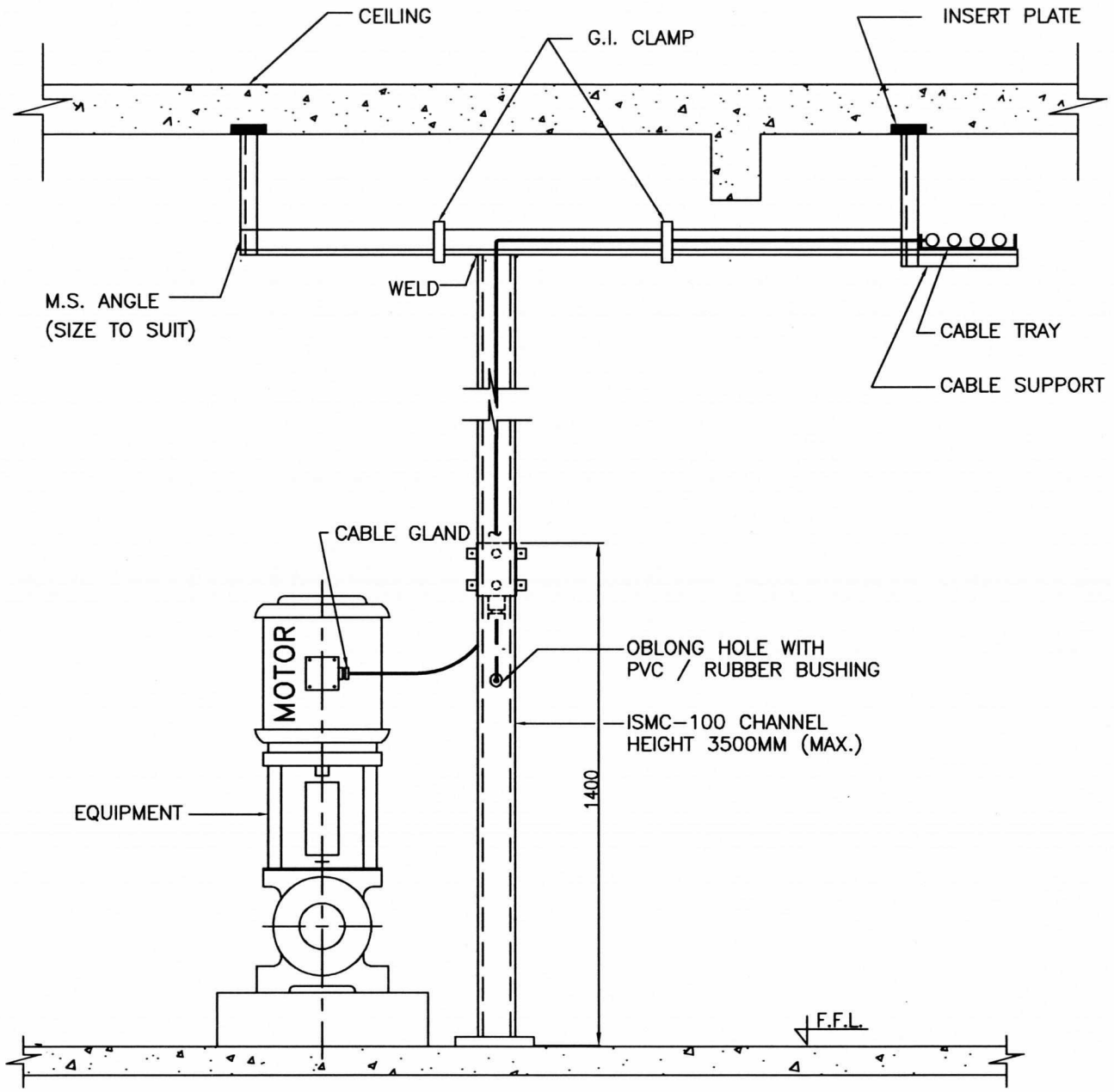

NOTES:–

1. ALL DIMENSIONS ARE IN MM.
2. WHEREVER FEASIBLE, MAIN CABLE TRAY CAN BE ROUTED IN SUCH A WAY THAT ISMC CHANNEL CAN BE DIRECTLY WELDED TO TRAY SUPPORT.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
6	15.09.22	REAFFIRMED & ISSUED AS STANDARD	JSK	VKS/HK	MKS	SM
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4	21.11.13	REAFFIRMED & ISSUED AS STANDARD	BP	FA/SA	UAP/JMS	SC

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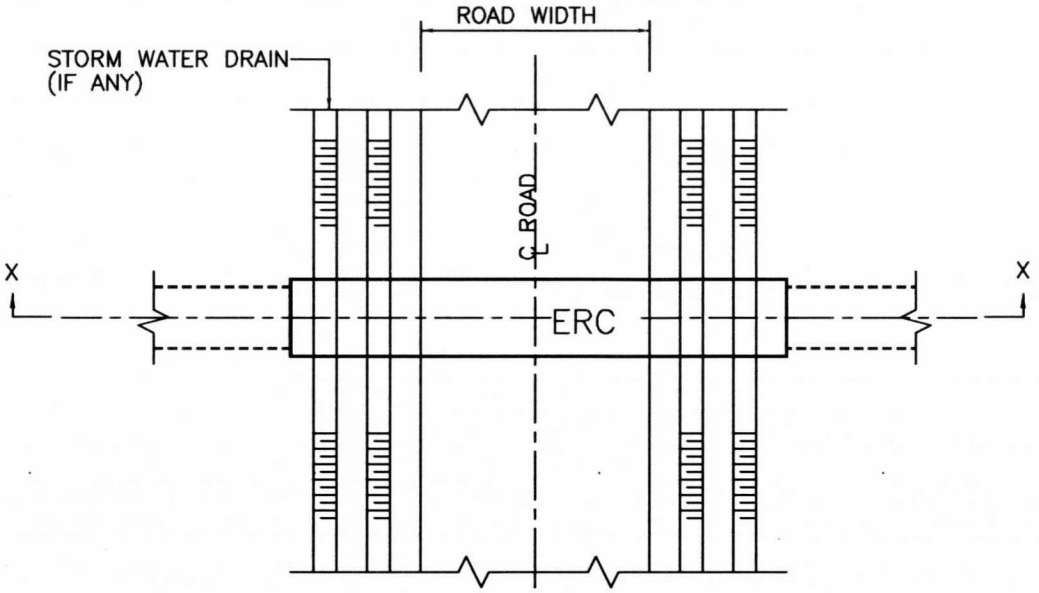
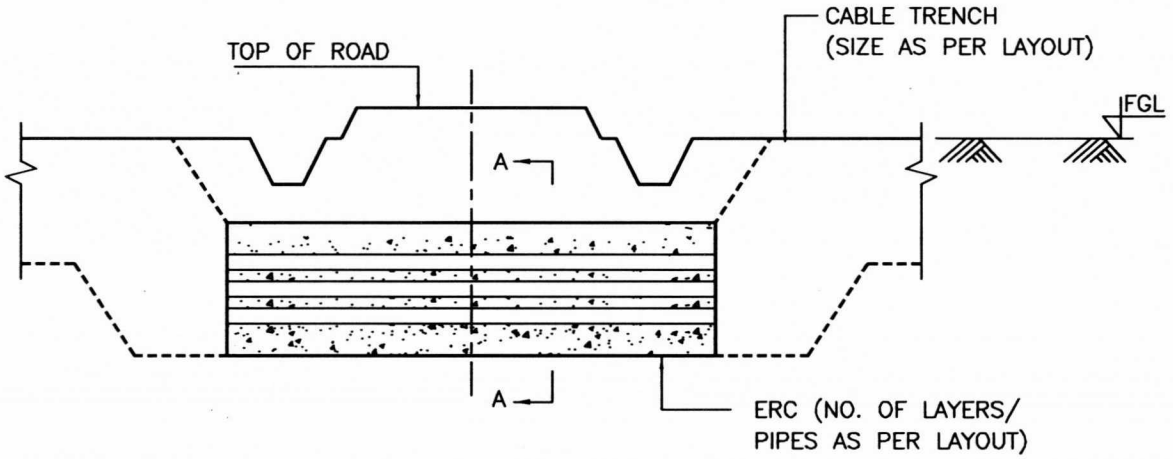
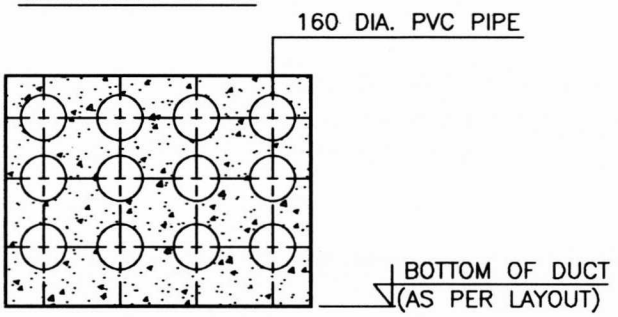


PLAN



SECTION X–X



SECTION A–A (ERC)

(AS PER STRUCTURAL STD.)

NOTES:–

1. ALL DIMENSIONS ARE IN MM.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
5	15.09.22	REAFFIRMED & ISSUED AS STANDARD	JSK	VKS/HK	MKS	SM
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3	21.11.13	REVISED & REISSUED AS STANDARD	BP	FA/SA	UAP/JMS	SC

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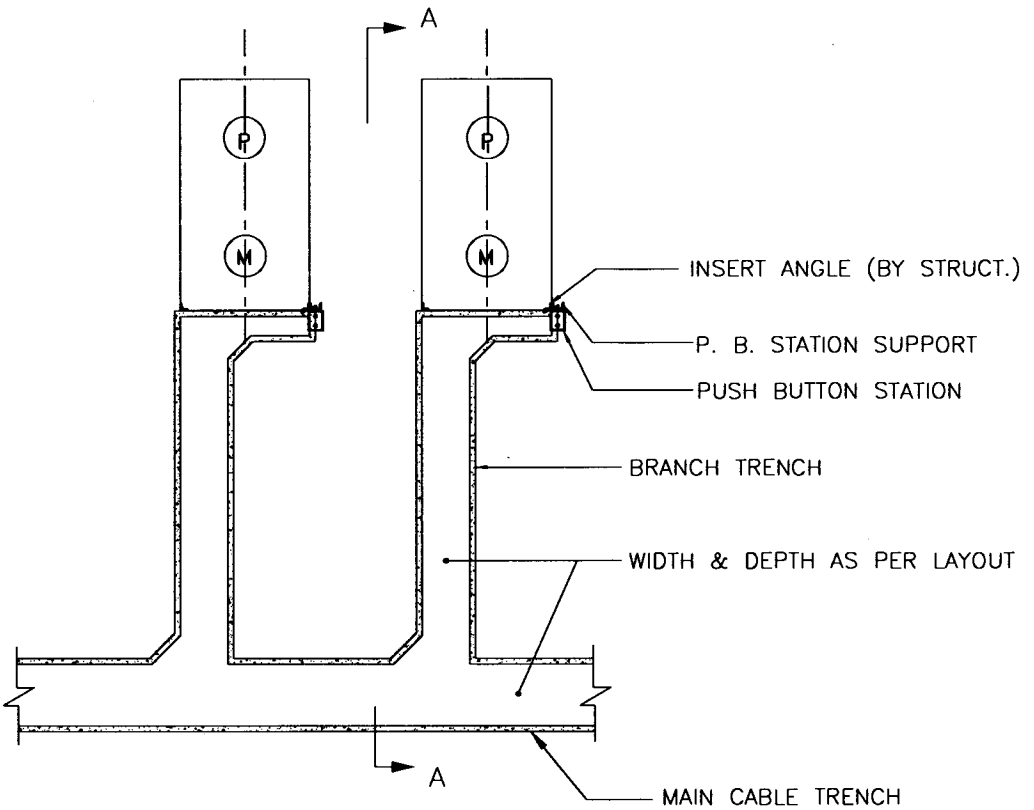
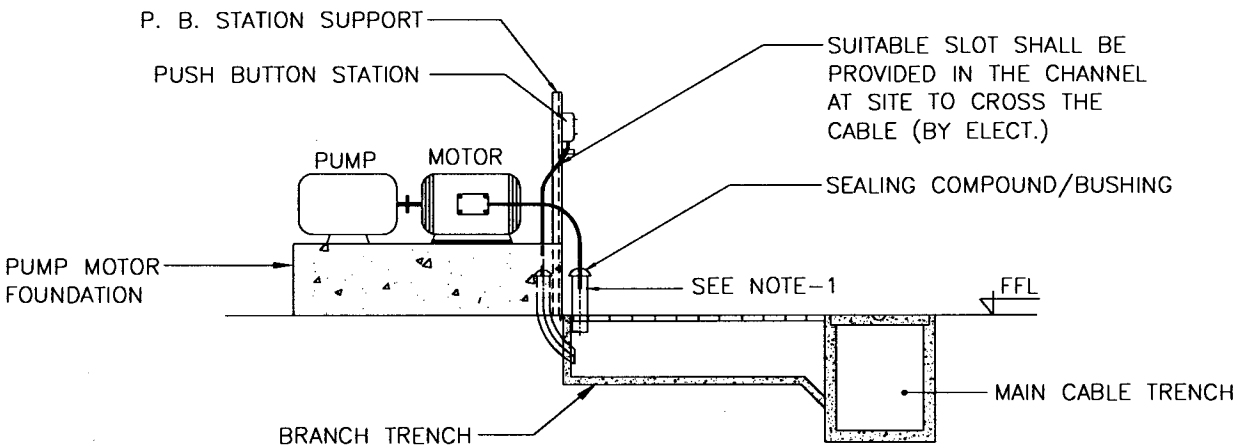


PLAN



SECTION A-A

NOTES:-

1. CABLE SHALL BE LAID IN SUITABLE SIZE OF G.I. PIPES .
2. CABLE TRENCH SHALL BE FILLED WITH SAND AFTER LAYING OF CABLES IN HAZARDOUS AREA (BY THE ELECTRICAL CONTRACTOR).

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
5	29.09.20	UPDATED & ISSUED AS STANDARD	JSK	VKS/HK	SA	SM
4	04.04.16	REVISED & ISSUED AS STANDARD	BP	FA/SA	BRB	RN

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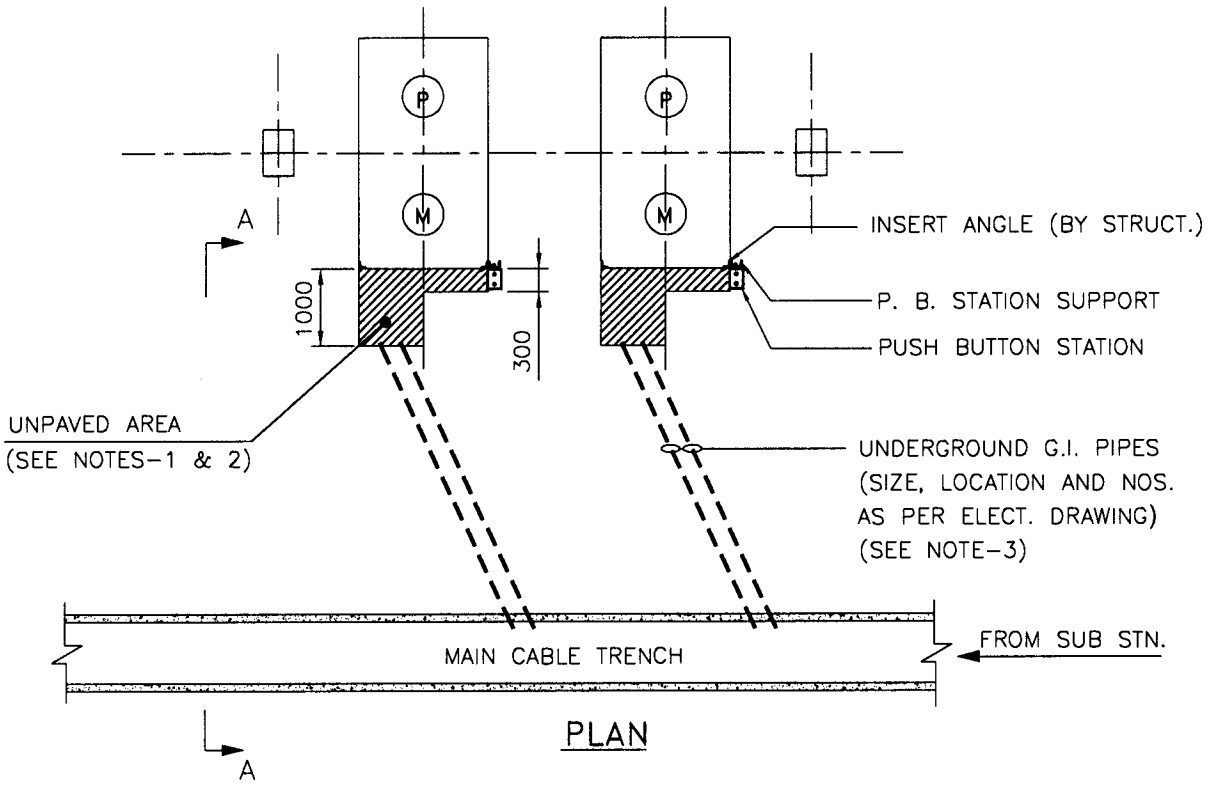
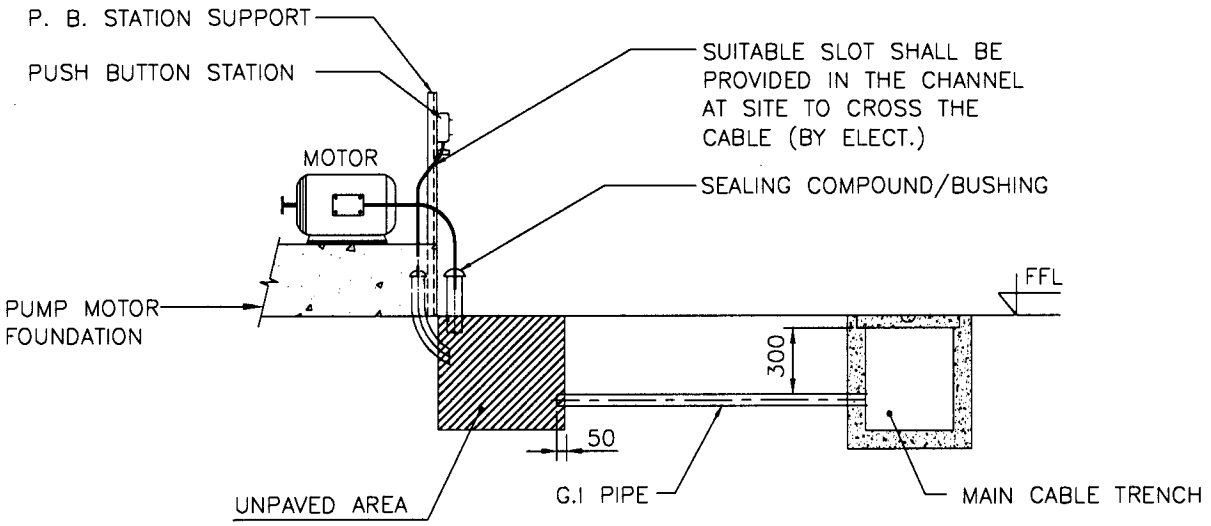


PLAN



SECTION A-A

NOTES:-

1. AREA SHOWN AS HATCHED NEAR EACH PUMP MOTOR FOUNDATION SHALL BE LEFT UNPAVED BY PAVEMENT CONTRACTOR.
2. CABLES LAYING & SAND / LEAN CONCRETE FILLING IN THIS UNPAVED AREA SHALL BE DONE BY ELECTRICAL CONTRACTOR.
3. CIVIL CONTRACTOR SHALL PROVIDE G.I PIPES AND PLUG BOTH ENDS OF THE PIPES WITH PVC BUSHINGS.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
5	29.09.20	UPDATED & ISSUED AS STANDARD	JSK	VKS/HK	SA	SM
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ELECTRICAL POWER IS THE MAINSTAY OF ANY CONSTRUCTION ACTIVITY. AT THE SAME TIME IT REQUIRES UTMOST CARE IN IT'S UTILISATION TO AVOID ACCIDENTS DUE TO ELECTRICAL SHOCK, FIRE INCIDENTS OR ELECTRIC SHORT CIRCUITS. EXPOSURE OF ELECTRICAL INSTALLATION TO ADVERSE ENVIRONMENTAL CONDITIONS INCREASE THE RISK OF SUCH ACCIDENTS. HENCE IT IS NECESSARY TO TAKE EXTRA PRECAUTIONS FOR SUCH INSTALLATIONS TO ENSURE SAFETY OF PERSONNEL AND EQUIPMENT. THIS STANDARD ADDRESSES THE SAFETY MEASURES REQUIRED TO BE ADOPTED FOR THE ELECTRICAL INSTALLATIONS BY ALL CONTRACTORS DURING CONSTRUCTION PHASE.

1. ALL ELECTRICAL CONNECTIONS/WORK FOR ELECTRICAL INSTALLATIONS SHALL BE CARRIED OUT AS PER PROVISIONS OF THE LATEST REVISION OF THE FOLLOWING CODES AND STANDARDS IN ADDITION TO THE REQUIREMENTS OF STATUTORY AUTHORITIES AND CEA REGULATIONS–2010.
   OISD–STD–173 : FIRE PREVENTION AND PROTECTION SYSTEM FOR ELECTRICAL INSTALLATIONS.
   OISD–STD–192 : SAFETY PRACTICE DURING CONSTRUCTION.
   SP–30 (BIS) : NATIONAL ELECTRIC CODE.
   THE INSTALLATION SHALL HAVE APPROVAL FROM CONCERNED STATUTORY AUTHORITIES.
2. ALL ELECTRICAL CONNECTIONS SHALL BE DONE BY AN ELECTRICIAN WITH VALID LICENCE AND TO THE SATISFACTION OF ENGINEER–IN–CHARGE.
3. ONE COMPETENT LICENCED ELECTRICIAN SHALL BE MADE AVAILABLE BY CONTRACTOR AT SITE ROUND THE CLOCK TO ATTEND TO THE NORMAL/EMERGENCY JOBS.
4. ALL SWITCH BOARDS/WELDING MACHINES SHALL BE KEPT IN WELL VENTILATED & COVERED SHED. THE SHED SHALL BE ELEVATED TO AVOID WATER LOGGING. NO FLAMMABLE MATERIALS SHALL BE USED FOR CONSTRUCTING THE SHED. ALSO FLAMMABLE MATERIALS SHALL NOT BE STORED IN AND AROUND ELECTRICAL EQUIPMENT/SWITCHBOARD. ADEQUATE CLEARANCES AND OPERATIONAL SPACE SHALL BE PROVIDED AROUND THE EQUIPMENT.
5. FIRE EXTINGUISHERS AND INSULATING MATS SHALL BE PROVIDED IN ALL POWER DISTRIBUTION CENTERS.
6. TEMPORARY ELECTRICAL EQUIPMENT SHALL NOT BE EMPLOYED IN HAZARDOUS AREAS WITHOUT OBTAINING SAFETY PERMIT.
7. PROPER HOUSE KEEPING SHALL BE DONE AROUND THE ELECTRICAL INSTALLATIONS.
8. ALL TEMPORARY INSTALLATIONS SHALL BE TESTED BEFORE ENERGISING, TO ENSURE PROPER EARTHING, BONDING, SUITABILITY OF PROTECTION SYSTEM, ADEQUACY OF FEEDERS/CABLES ETC.
9. ALL WELDERS SHALL USE HAND GLOVES IRRESPECTIVE OF HOLDER VOLTAGE.
10. MULTILINGUAL (ENGLISH, HINDI AND LOCAL LANGUAGE) CAUTION BOARDS, SHOCK TREATMENT CHARTS AND INSTRUCTION PLATE CONTAINING LOCATION OF ISOLATION POINT FOR INCOMING SUPPLY, NAME & TELEPHONE NO. OF CONTACT PERSON IN EMERGENCY SHALL BE PROVIDED IN SUBSTATIONS AND NEAR ALL DISTRIBUTION BOARDS/LOCAL PANELS.
11. OPERATION OF EARTH LEAKAGE DEVICE SHALL BE CHECKED REGULARLY BY PORTABLE ELCB/RCCB TESTER.
12. THE FOLLOWING DESIGN FEATURES SHALL BE ENSURED FOR ALL ELECTRICAL INSTALLATIONS DURING CONSTRUCTION PHASE.

12.1 EACH INSTALLATION SHALL HAVE A MAIN SWITCH WITH A PROTECTIVE DEVICE, INSTALLED IN AN ENCLOSURE ADJACENT TO THE METERING POINT. THE OPERATING HEIGHT OF THE MAIN SWITCH SHALL NOT EXCEED 1.5 M. THE MAIN SWITCH SHALL BE CONNECTED TO THE POINT OF SUPPLY BY MEANS OF ARMOURED CABLE.

12.2 THE OUTGOING FEEDERS SHALL BE DOUBLE OR TRIPLE POLE SWITCHES WITH FUSES/MCBs. LOADS IN A THREE PHASE CIRCUIT SHALL BE BALANCED AS FAR AS POSSIBLE AND LOAD ON NEUTRAL SHOULD NOT EXCEED 20% OF LOAD IN THE PHASE.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
4	07.12.21	UPDATED & ISSUED AS STANDARD	JSK	VKS/HK	PG	SM
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2	02.03.12	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP/JMS	DM

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12.3 THE INSTALLATION SHALL BE ADEQUATELY PROTECTED AGAINST OVERLOAD, SHORT CIRCUIT AND EARTH LEAKAGE BY THE USE OF SUITABLE PROTECTIVE DEVICES. FUSES WHEREVER USED SHALL BE HRC TYPE. USE OF REWIRABLE FUSES SHALL BE STRICTLY PROHIBITED. THE EARTH LEAKAGE DEVICE SHALL HAVE AN OPERATING CURRENT NOT EXCEEDING 30 mA.

12.4 ALL CONNECTIONS TO THE HANDTOOLS/WELDING RECEPTACLES SHALL BE TAKEN THROUGH PROPER SWITCHES, SOCKETS AND PLUGS.

12.5 ALL SINGLE PHASE SOCKETS SHALL BE MINIMUM 3 PIN TYPE ONLY. ALL UNUSED SOCKETS SHALL BE PROVIDED WITH SOCKET CAPS.

12.6 ONLY 3 CORE (P+N+E) OVERALL SHEATHED FLEXIBLE CABLES WITH MINIMUM CONDUCTOR SIZE OF 1.5 MM^2 COPPER SHALL BE USED FOR ALL HAND TOOLS.

12.7 ONLY METALLIC DISTRIBUTION BOXES WITH DOUBLE EARTHING SHALL BE USED AT SITE. NO WOODEN BOXES SHALL BE USED.

12.8 ALL POWER CABLES SHALL BE TERMINATED WITH COMPRESSION TYPE NICKEL PLATED BRASS CABLE GLANDS. LUGS OF COPPER/ALUMINIUM/BIMETALLIC MATERIAL, AS APPLICABLE SHALL BE USED FOR MULTISTRAND WIRES/CABLES HAVING MUTISTRAND/SOLID CONDUCTOR.

12.9 CABLES SHALL BE FREE FROM ANY INSULATION DAMAGE.

12.10 CABLES SHALL BE LAID IN UNDERGROUND AT A MINIMUM DEPTH OF 750 MM, FOR LV & CONTROLS AND 900MM FOR HV CABLES COVERED WITH SAND, BRICK AND SOIL FOR ENSURING MECHANICAL PROTECTION. CABLES SHALL NOT BE LAID IN WATER LOGGED AREA AS FAR AS PRACTICABLE. CABLE ROUTE MARKERS SHALL BE PROVIDED AT EVERY 25 M OF BURIED TRENCH ROUTE. WHEN LAID ABOVE GROUND, CABLES SHALL BE PROPERLY CLEATED OR SUPPORTED ON RIGID POLES OF ATLEAST 2.1 M HIGH. MINIMUM HEAD CLEARANCE OF 6 METERS SHALL BE PROVIDED AT ROAD CROSSING.

12.11 UNDER GROUND CABLES SHALL NOT BE ALLOWED TO CROSS THE ROADS WITHOUT PIPE SLEEVE.

12.12 ALL CABLE JOINTS SHALL BE DONE WITH PROPER JOINTING KIT. NO TAPED/TEMPORARY JOINTS SHALL BE USED.

12.13 AN INDEPENDENT EARTHING FACILITY SHOULD PREFERABLY BE ESTABLISHED WITHIN THE TEMPORARY INSTALLATION PREMISES. ALL APPLIANCES AND EQUIPMENT SHALL BE ADEQUATELY EARTHED. IN CASE ARMOURED CABLES ARE USED, THE ARMOUR SHALL BE BONDED TO THE EARTHING SYSTEM.

12.14 ALL CABLES AND WIRE ROPE USED FOR EARTH CONNECTIONS SHALL BE TERMINATED THROUGH LUGS OF TINNED COPPER/ALUMINIUM/ BIMETALLIC MATERIAL, AS APPLICABLE.

12.15 IN CASE OF LOCAL EARTHING, EARTH ELECTRODES SHALL BE BURIED NEAR THE SUPPLY POINT AND EARTH CONTINUITY WIRE SHALL BE CONNECTED TO LOCAL EARTH PLATE FOR FURTHER DISTRIBUTION TO VARIOUS APPLIANCES. ALL INSULATED WIRES FOR EARTH CONNECTION SHALL HAVE INSULATION OF GREEN COLOUR.

12.16 SEPARATE CORE SHALL BE PROVIDED FOR NEUTRAL. EARTH/STRUCTURES SHALL NOT BE USED AS A NEUTRAL IN ANY CASE.

12.17 ON/OFF POSITION OF ALL SWITCHES SHALL BE CLEARLY DESIGNATED/PAINTED FOR EASY ISOLATION IN EMERGENCY.

13. ALL INSULATIONS AND ELECTRICAL INSTALLATIONS SHALL BE INSPECTED BY ENGINEER-IN-CHARGE ATLEAST ONCE IN A MONTH.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	
4	07.12.21	UPDATED & ISSUED AS STANDARD	JSK	VKS/HK	PG	SM
3	08.11.16	REVISED & ISSUED AS STANDARD	BP	FA/HK	BRB	RN
2	02.03.12	REAFFIRMED & ISSUED	BP	RKS/RSC	UAP/JMS	DM

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DATASHEET FOR LED LIGHTING FIXTURE SCHEDULE

PROJECT	:	**COMPOSITE WORKS FOR CONSTRUCTION (BOUNDARY WALL**
OWNER	:	**SRI RAM JANMBHOOMI TEERTH KSHETRA TRUST**
CONSULTANT	:	**ENGINEERS INDIA LIMITED**
JOB NO.	:	**C098**

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
1	11.06.25	ISSUED AS STANDARD	AP	GKS	ST
0	25.05.25	ISSUED AS STANDARD	AP	GKS	ST

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S. No.	Light Fixture - Description	Makes & Catalogue Nos.
1.	**LED IND-1**: Surface mounted / Pendant Type LED Tube Lights for Office or Commercial Buildings – completely integral with in-built linear SMD LEDs/ electronic drivers / length of 1200 mm (4 Feet) for a minimum rating of 20 Watts.	• Bajaj : BLRB 18W LED XE • Crompton : LSDL –20- CDL ; • Philips : TMC501 With TLED 1X18W/4FT Master LED Tube • Pyrotech: PC-14-D-L-WXOA/18W Or Equivalent Models.
2.	**LED IND-2**: Surface mounted / Pendant Type Integral LED Tube Lights for Industrial Warehouses /Workshops / Sub-Stations – completely integral with in-built linear SMD LEDs / electronic drivers / length of 1200 mm (4 Feet) for a minimum rating of 36 Watts. An alternative solution for conventional 2x28 W/2x36 W fluorescent Battens.	• Philips : TMC 501 With TLED 2X18W/4FT Master LED Tube • Crompton : LDL -36 – CDL; • Bajaj : BLRB 218W LED XE • Pyrotech: PC-14-D-L-WXOA/36W Or Equivalent Models
3.	**LED IND-3**: Surface mounted / Pendant Type Integral LED Tube Lights for industrial outdoor /weatherproof applications & IP-65 Ingress Protection – completely integral with in-built linear SMD LEDs / electronic drivers / length of 1200 mm (4 Feet) for a minimum rating of 36 Watts.	• Bajaj : Linea Excel {BIPC 40W LED XE}; • Crompton : Shield {IPFC1LT8/16 & 2X LGT8-20-865-2; • Philips : Endura LED Waterproof – 42 Watts; WT550 C LED 40S CW PSU S1 PC; • Pyrotech: Or Equivalent Models.
4.	**LED IND-4**: Surface mounted / Pendant Type Integral LED Tube Lights for Industrial Warehouses /Workshops / Sub-Stations – completely integral with in-built linear SMD LEDs / electronic drivers / length of 1200 mm (4 Feet) for a minimum rating of 36 Watts. An alternative solution for conventional 2x28 W/2x36 W fluorescent Battens.(Suitable for Mounting on Metsec Channel, etc with white enameled reflector)	• Crompton: Master LED tube 1200mm-18W 869 T8 • Bajaj: BLRB 218W LED XE Or Equivalent Models.
5.	**LED-1:** Recess mounted, compact / slim panel / tile light in square shape – suitable for mounting in 2 Feet X 2 Feet Grid type False Ceiling with minimum 35 Watts rating & White Color – with built-in driver & all mounting accessories.	• Bajaj : ""Armstorme" {BZRSQL 36W WH GZi}; • Crompton : LCTLRNI-36-FO-CDL • Philips : RC 420B LED 35S PSU W60L60 • Pyrotech: PB-12-D-L-WXOA/36W Or Equivalent Models.
6.	**LED-2:** Recess mounted, compact / slim panel / tile light in square shape – suitable for mounting in 2 Feet X 2 Feet Grid type False Ceiling with minimum 50 Watts rating & White Color – with built-in driver & all mounting accessories.	• Crompton: LCTLRN-50-FO-CDL • Bajaj: BZRSQL 43W LED GZi WH Or Equivalent Models.

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7.	**LED -3:** Recess mounted, compact / flat, round or square shaped LED down-lighter in white finish – suitable for mounting in gypsum / Armstrong type false ceiling – with minimum 18 Watts rating & White Color – with built-in driver and all mounting accessories.	• Bajaj : SLEEK Round / Square {BGSLO Sleek 18W WH RD / SQ}; • Crompton : QUARTZ Round / Square {LCDE or LSDE-18W-CDL/NW }; • Philips : Green LEDi {DN 195B LED 20S – 6500PSU WHS1}; • Pyrotech: PB-12-D-L-WXOA/18W Or Equivalent Models.
8.	**LED -4:** Recess Mounted Adjustable / Swivel LED spot-light / COB Light with tilting (Gimbal) feature and a minimum rating of 20 Watts & golden yellow / white color light – with white round / square frame, built-in driver, suitable for mounting on gypsum false-ceiling & all mounting accessories.	• Philips : ECO Accent Recessed Adjustable {RS271B LED 20/850 PSU-E WB WH}; • Bajaj : KLASS Series COB {BRDCSL 16 W WW}; • Crompton : AQUA COB LED {LR-RAD-20-CDL/NDL-24/50D}; Or Equivalent Models.
9.	**LED -5:** Surface Mounted – Ceiling Tile LED Fixture of dimensions 2 Feet X 2 Feet – suitable for direct ceiling mounting - with minimum 35 Watts rating & White Color – with built-in driver & all mounting accessories.	• Crompton : ORION-I – LCTLSN-36-CDL • Bajaj : BZSSQL 36W LED • Philips : CIRRUS – SM365C LED33-6500 PSU-OD WH • Pyrotech: PB-12-D-L-WXOA/36W Or Equivalent Models.
10.	**LED -6 :** Surface mounted round or square shaped LED down-lighter in white finish – suitable for direct ceiling mounting – with minimum 18 Watts rating & White Color – with built-in driver and all mounting accessories.	• Crompton : Pearl II – Round / Square {LCDSPLN- R-18-CDL / LCDSPLN-S-18-CDL}; • Bajaj : Sleek – Round / Square– BGSLO Sleek Surface 18 W WH RD / BGSLO Sleek Surface 18W WH SQ}; • Philips : Cirrus Mini {SM5 18C LED 16S 6500PSU OD WH} • Pyrotech: PB-13-D-L-WXOA/18W Or Equivalent Models.
11.	**LED -7:** Surface mounted round or square shaped LED Dome -lights – suitable for direct wall mounting – with minimum 18 Watts rating & White Color – with built-in driver and all mounting accessories.	• Philips : CoreLine Wall-Mounted {WL120V LED12S / 840 PSR WH}; • Bajaj : Sleek – Round / Square– BGSLO Sleek Surface 18 W WH RD / BGSLO Sleek Surface 18W WH SQ}; • Crompton : Orbit {LCDSPLN-R-18-CDL}; Or Equivalent Models.
12.	**LED -8:** Rechargeable Lantern type LED Fixtures of minimum 4 Watts rating - with inbuilt sealed rechargeable Battery / Cell suitable for operation at 240 Volts AC and with a minimum battery back-up time of 2 hours.	• Philips – Ujjwal Plus LED Lantern; • Bajaj LED Glow 648 LR Rechargeable Lantern; • Crompton - CG-LL30 LED Rechargeable Lantern; Or Equivalent Models.

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13.	**LED-RSD-10:** LED Fixture suitable for 110V/220V DC complete with 18W LED Lamp, driver, including other materials as applicable for installation (Recess mounted)	• Pyrotech (PB-13-P-L-WXOA/18W) Or Equivalent Models.
14.	**LED-SFD-12:** LED Fixture suitable for 110V/220V DC complete with 18W LED Lamp, driver, including other materials as applicable for installation (Surface mounted)	• Pyrotech (PB-13-P-L-WXOB/18W) Or Equivalent Models.
15.	**LED -LB–1:** Indoor Industrial Low Bay LED Luminaries - with high pressure die-cast aluminum housing, mirror / lens optics (heat- resistant) for symmetric light distribution and high system efficacy for a rating of 80 Watts up to 100 Watts – complete with integral electronic LED drivers, heat sinks for efficient heat dissipation & all mounting accessories.	• Bajaj : Duranto Highbay Luminaire 100 Watts{BGHB 100W LED GV}; • Crompton : SURROUND -II LHB11-70-CDL/60 - 70Watts; • Philips : GreenPerform Highbay G2 – 80 Watts{BY689P LED 90/NW PSU S-NB}; • Pyrotech: PD-17-D-L-WXOA/90W Or Equivalent Models.
16.	**LED –HB1:** Indoor Industrial Medium Bay LED Luminaries - with high pressure die-cast aluminum housing, mirror / lens optics (heat- resistant) for symmetric light distribution and high system efficacy for a rating of 120 Watts up to 150 Watts – complete with integral electronic LED drivers, heat sinks for efficient heat dissipation & all mounting accessories.	• Bajaj : Duranto Highbay Luminaire 150 Watts{BGHB 150W LED}; • Crompton : : SURROND-II {LHB11-110-CDL/60 -110 Watts}; • Philips : GreenPerform Highbay G2 – 130 Watts{BY688P LED 140/NW PSR S-NB}; • Pyrotech: PD-17-D-L-WXOA/150W Or Equivalent Models.
17.	**LED –HB2:** Indoor Industrial High Bay LED Luminaries - with high pressure die-cast aluminum housing, mirror / lens optics (heat- resistant) for symmetric light distribution and high system efficacy for a rating above 180 Watts – complete with integral electronic LED drivers, heat sinks for efficient heat dissipation & all mounting accessories.	• Bajaj : Duranto Highbay Luminaire 200 Watts{BGHB 200W LED}; • Crompton : Crompton : LHB11-180-CDL/60- 180Watts; • Philips : Green Perform Highbay G2 – 200 Watts{BY687P LED200/NW PSR S-WB L3000}; • Pyrotech: PD-17-D-L-WXOA/180W Or Equivalent Models.

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OUTDOOR LED LIGHT FIXTURES		
18.	**LED BK -1:** Outdoor Surface Mounted Bulkhead LED Lights – with die-cast aluminum housing / toughened glass lens and minimum IP -65 ingress protection of minimum 10 watts rating – complete with integral type electronic drivers & all mounting accessories.	• Bajaj : Wee Plus {BIBWP 10 W LED} Crompton : Sunrise LED Bulkhead {LBH-10- CDL}; • Philips : Vista Glow WT140W LED7S CW PSU S1 PC; • Pyrotech: PP-11-D-L-WXOA/10W Or Equivalent Models.
19.	**LED BK -2:** Outdoor Surface Mounted Bulkhead LED Lights – with die-cast aluminum housing / toughened glass lens and minimum IP -65 ingress protection of minimum 30 watts rating – complete with integral type electronic drivers & all mounting accessories.	• Pyrotech: PP-11-D-L-WXOA/30W Or Equivalent Models.
20.	**LED ST-4 :** LED Street Light Fixtures with Leaf / Sleek Type design & SMD or COB Type LEDs for high system efficacy & rating of 80 Watts to 100 Watts – having powder coated Pressure Die-Cast Aluminum Body & toughened glass visor fitted in a frame & completely integral – with all mounting accessories. The fixture enclosure shall have minimum IP 65 ingress protection.	• Bajaj : EDGE Streetlight – 90 Watts {BRLEP 90W LED}; • Crompton : NEXUS STAR - 90 Watts {LSTP-90-CDL}; • Philips : Green Line V2 BRP410 LED 092 CW HE NR FG S2 PSU GR; • Pyrotech: PP-11-D-L-WXOA/10W Or Equivalent Models.
21.	**LED ST-10 :** LED Street Light Fixtures with Leaf / Sleek Type design & SMD or COB Type LEDs for high system efficacy & rating of 120 Watts having powder coated Pressure Die-Cast Aluminum Body & toughened glass visor fitted in a frame & completely integral – with all mounting accessories. The fixture enclosure shall have minimum IP 65 ingress protection.	• Crompton: LSTP120 CDL • Bajaj:- BRTFG 120W LED Or Equivalent Models.
22.	**LED ST-11 :** LED Street Light Fixtures with Leaf / Sleek Type design & SMD or COB Type LEDs for high system efficacy & rating of 120 Watts to 150 Watts – having powder coated Pressure Die-Cast Aluminum Body & toughened glass visor fitted in a frame & completely integral – with all mounting accessories. The fixture enclosure shall have minimum IP 65 ingress protection.	• Bajaj : Edge Streetlight – 150 Watts {BRTFG 135W LED}; • Crompton : 135 Watts {LSTP-135- CDL};; • Philips : Greenline Extra BRP322 LED 122 CW HE MR PC S3 XT; • Pyrotech: PE-11-D-L-WXOA/150W Or Equivalent Models.
23.	**LED FD-1:** LED Flood-Light Fixtures with COB or SMD Type LEDs and high system efficacy for a rating of 80 Watts up to 110 Watts – complete with integral electronic LED drivers, heat sinks for efficient heat dissipation & all mounting accessories – suitable for outdoor installation & having a minimum IP 65 ingress protection. The Flood-Light fixtures shall have powder-coated pressure die-cast & Aluminum Body & toughened glass front cover.	• Philips : Uniflood 2 Series Flood Light - 110Watts {BVP122 LED110 CW FLNB FG XTFC}; • Crompton : OMEGA LED Flood Light – 110 Watts{LFLN11-110-CDL/60}; • Bajaj : Force Flood Light – 100 Watts {BJFL 100W LED I}; • Pyrotech: PD-17-D-L-WXOA/110W Or Equivalent Models.

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24.	**LED FD-2:** LED Flood-Light Fixtures with COB or SMD Type LEDs and high system efficacy for a rating of 150 Watts up to 200 Watts – complete with integral electronic LED drivers, heat sinks for efficient heat dissipation & all mounting accessories – suitable for outdoor installation & having a minimum IP 65 ingress protection. The Flood-Light fixtures shall have powder-coated pressure die-cast & Aluminum Body & toughened glass front cover.	• Philips : Tempo Series LED Flood Lights – 172Watts { BVP410 LED 172 CW HE NB FG S3 XT}; • Crompton : 200 Watts LED Flood Lights {LFLN11-200-CDL/60};; • Bajaj : Turbo Flood Light – 200 Watts {BJFL 200W LED I}; • Pyrotech: PD-17-D-L-WXOA/200W Or Equivalent Models.
25.	**LED FD-3:** LED Flood-Light Fixtures with COB or SMD Type LEDs and high system efficacy for a rating of 250 Watts & above – complete with integral electronic LED drivers, heat sinks for efficient heat dissipation & all mounting accessories – suitable for outdoor installation & having a minimum IP 65 ingress protection. The Flood-Light fixtures shall have powder-coated pressure die-cast & Aluminum Body & toughened glass front cover.	• Philips : Tempo Series LED Flood Lights – 252Watts {BVP410 LED 252 CW HE AK55 FG S3XTFC}; • Crompton : MAGPIE – 250 Watts LED Flood Lights{LFLPI-250-CDL/60}; • Bajaj : Turbo Flood Light – 350 Watts {BJFL 350W LED I}; • Pyrotech: PD-17-D-L-WXOA/250W Or Equivalent Models.
26.	**LED FD-9:** LED Flood-Light Fixtures with COB or SMD Type LEDs and high system efficacy for a rating of 400 Watt & above – complete with integral electronic LED drivers, heat sinks for efficient heat dissipation & all mounting accessories – suitable for outdoor installation & having a minimum IP 65 ingress protection. The Flood-Light fixtures shall have powder-coated pressure die-cast & Aluminum Body & toughened glass front cover.	• Crompton: MAGPIE+ LFLPI-400-CDL/60 • Bajaj: BJFL 400W LED IP66 • Philips: Tango G3 BVP383 LED450/CW 400W 220-240V SWB IN; • Pyrotech: PD-17-D-L-WXOA/500W Or Equivalent Models
27.	**LED BL-1:** Integral decorative LED Bollard Luminaries with opal acrylic diffusers of minimum 8 Watts rating & suitable for landscape lighting with IP-65 Ingress Protection and anti-corrosive powder-coated die-cast aluminum housing – complete with all mounting accessories (anchor bolts / base-plates)	• Bajaj : Tetris LED Bollard {BGBOS 600 9W LED}; • Crompton : Maya-III COB LED Bollard {LBLA3-10- CDL}; • Philips : City Cube Series LED Bollard - 8.5 Watts{BCP400 LED04 U CW PSU GR S1}; • Pyrotech: PD-15-D-L-WXOA Or Equivalent Models.

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28.	Well Glass Light (35W): LED Well Glass Luminaire with pressure diecast aluminum housing with corrosion resistant powder coating, toughened glass / lens for IP protection and impact protection, proper heat sink arrangement for efficient heat dissipation, with clear lens optics, built-in surge protection, with following parameters: Net system Lumen output: Min. 4200 Lumens Efficacy: >=120 lumen/Watt CRI>=70 CCT of 4000/5700K/6500K as required IP-66 min. IK-07 min. The life shall be 50K Hrs. at L70B50, operating temperature of the luminaire shall be 0°C to +45°C and driver shall comply to the minimum electronic parameter like THD10%, PF @ 0.90, internal surge protection of 4KV, Current Ripple 5%, operating voltage range of 140V - 270V having Class - 1	

Notes:

1. All fixtures shall be latest energy efficient type.
2. All fixtures shall be complete with lamps.
3. Make of fixtures shall be embossed on the body of the lighting fixtures.
4. Make of fixtures shall be embossed on the body.
5. All LED fixtures shall be high power factor (Min. 0.95) type.
6. LED lamps shall be provided with highly translucent diffusers with advance optical system with high internal reflectivity material of excellent and smooth output for glare free light and no visibility of LED to eyes.
7. All lighting fixtures shall be supplied complete with associated LED lamp and driver.
8. All LED fixtures including driver shall be provided with 5 years warranty.
9. Fixture life time (L70) shall be > 50000 hrs. at ambient temp of 45 deg
10. All above Luminaries with controllers & drivers must be suitable for a working voltage range of 150 to 270 Volts – 50 Hz - AC.
11. In case any of the above referred models / makes are discontinued, prior approval from the engineer-in- charge has to be taken for supplying any alternate makes / models.
12. Manufacturers should ensure that all LED panels are sourced from reputed LED manufacturers.
13. The LED light fixtures should be tested for luminous lux level as per IES-LM-79. Type test certificates shall be furnished in compliance to same. Type test certificates for LM-79 for all fixtures shall be from a NABL (National Accreditation Board for Testing and Calibration Laboratories) accredited Lab or UL Laboratory.
14. The LED's used in the lighting fixtures should be tested for the service life as per IES-LM-80. Type test certificates shall be furnished in compliance to same.
15. The LED Driver shall comply with the requirement of IEC 61347-2-13.

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PURCHASER'S DATA

	Project					**Location**	
	Client					**Unit**	
A	**Site conditions**						
1	Max. ambient temp:		°C	4	Relative humidity:		85 %
2	Min. ambient temp:		°C	5	Altitude (above MSL)		<1000m
	Design Temp.		°C				
3	Ground temperature:		°C	6	Environment:		Humid & corrosive
B	**Technical particulars**						
1	System voltage			3	Conductor material		
	Nominal	Highest	Voltage grade		HV Power cable		Aluminium
	415 V	500 V	650/1100V ☑		MV Power Cable		Cu./Al.-As per SOR
	3.3kV(E)	3.6 kV	1.9/3.3kV ☐	4	Insulation		XLPE
	3.3kV(UE)	3.6 kV	3.3/3.3kV ☐	5	PVC Compound type		ST-2
	6.6kV(E)	7.2 kV	3.8/6.6kV ☐	6	Type of conductor		Stranded
	6.6kV(UE)	7.2 kV	6.6/6.6kV ☐	7	Conductor class		As per Spec
	11kV(E)	12 kV	6.35/11kV ☐	8	Type of cable		FRLS
	11kV(UE)	12 kV	11/11kV ☐	9	Armour		Refer SOR
	22kV(E)	24 kV	12.7/22kV ☐		Type		Refer EIL SPEC
	33kV(E)	36 kV	19/33kV		Size of armour		
2	Frequency		50 Hz ± 3%	10	Type of Drum		Steel
				11	Applicable spec.		6-51-0051

MANUFACTURER'S DATA

1	Name of manufacturer		9	Inner sheath	
2	SOR item no.			Type of compound	
3	Cable type/ code			Thickness	mm
4	Conductor material		10	Nominal dia under armour	mm
5	Conductor semiconducting screen (HV cables)		11	Calculated dia under armour	mm
	Material		12	Armour	
	Thickness	mm		Material	
6	Insulation			Type	
	Type of compound			Size	
	Thickness	mm	13	Nominal dia under outersheath	mm
7	Insulation semiconducting screen (HV cables)		14	Calculated dia under outersheath	mm
	Material		15	Outersheath	
	Thickness	mm		Type of compound	
8	Copper tape			Thickness	mm
	Thickness	mm	16	Nominal outer dia of cable	mm
			17	Tolerance on outer dia	%
			18	Weight of cable per km	kg
			19	Maximum drum length	mtr.
			20	Maximum DC resistance of conductor at 20 °C	
			21	AC resistance at 90 °C	
			22	Reactance of cable at 50 Hz	
			23	Capacitance of cable	
			24	Zero sequence impedence of cable	
Notes			25	capacitive charging current per KM	

Rev. No.	Date	Purpose	Prepared by	Checked by	Approved by
A	26.052025	ISSUED WITH TENDER	DR	BD	MKS

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PURCHASER'S DATA

	Project			**Location**	**Bhubaneswar**
	Client			**Unit**	
A	**Site conditions**				
1	Maximum ambient temperature:	°C	4	Relative humidity:	>90 %
2	Minimum ambient temperature:	°C	5	Altitude	< 1000 m
3	Ground temperature:	°C	6	Environment:	
B	**Technical particulars**				
1	Cable type/code	FA/ Comm./ Control	4	Details of pairing	As per cl. 4.3 (6-51-52)
		FR type (Cat-A, Des-F)	5	Standard drum length	1000 mts ± 5% (tol.)
		PVC Insulated	6		
2	Embossing details	Sequential marking/ mtr			
		Yes/ No			
3	Details of colour coding	As per ITD spec. (Yes/ No)		(Note: Fire Alarm Cables shall be RED outer sheath)	

MANUFACTURER'S DATA

A	**Twisted pair unshielded cables**		3	Performance Data	
1	Name of manufacturer		3.1	Rated voltage	660 V
2	Material Specifications		3.2	Max. resistance at 20°C	Ohms
2.1	Conductor dia.	mm dia.(*mm2)	3.3	Max. core-core capacitance	nF
2.2	Insulation thickness	mm of PVC type A	3.4	Max. inductance	mH
2.3	Inner sheath thickness	mm of PVC type ST1	3.5	Nominal impedance	Ohms
2.4	Outer sheath thickness	mm of FR PVC type STI			
4	Technical Particulars				

S.No	No. of pairs									
1	Approx. overall diameter (mm)									
2	Approx. dia. over armour (mm)									
3	Approx. dia. under armour (mm)									
4	Armour galvanised steel wire thickness									
5	Minimum outer sheath thickness (mm)									

B	**Twisted pair shielded cables**				
1	Name of manufacturer		2.3	Inner sheath thickness	mm of PVC type ST1
2	Material specifications		2.4	Outer sheath thickness	mm of FR PVC type STI
2.1	Conductor dia.	mm dia.(*mm2)	4	Shielding data	
2.2	Insulation thickness	mm of PVC type A	4.1	Material of shielding	
3	Performance data		4.2	Minimum thickness	mm
3.1	Rated voltage	660 V	4.3	Coverage and overlap	
3.2	Max. resistance at 20°C	Ohms	5	Drain wire for overall sheath	
3.3	Max. core-core capacitance	nF	5.1	Drain wire material	
3.4	Max. core-screen capacitance	nF	5.2	Area of cross section	mm^2
3.5	Maximum inductance	mH	5.3	No. of strands	
3.6	Nominal impedance	Ohms	5.4	Diameter	mm
6	Technical particulars				

S.No	No. of pairs									
6.1	Conductor size (mm2)									
6.2	Approx. overall dia.(mm)									
6.3	Approx. dia. over armour (mm)									
6.4	Approx.dia. Under armour (mm)									
6.5	Armouring of galvanized steel wire									
6.6	Min. outer sheath thick(mm)									

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A	25.05.2025	ISSUED WITH TENDER	DR	BD	MKS

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Altitude	Cable Type
< 1000 m	Fire alarm
> 1000 m	Communication
	Signal
Environment	
Humid & corrosive	

Signature Not Verified

Digitally signed by NEERAJ SHRIKANT BORGAONKAR
Date: 2026.05.09 18:55:14 IST
Location: eProcure-EPROC

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