

STANDARD FIELD QUALITY PLAN

Item	Transmission Line
Applicability	POWERGRID Projects
Date of Issue	03.08.2020
Validity	Till next revision

SFQP No.	DOC No.C/FQA/SFQP/TL/030
REV.	07

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1.	Preliminary /Detailed Survey	a) Route alignment b) Route profiling & tower spotting.	Optimization of route length 1. Ground clearance. 2. Cold wt. Span 3. Hot wt. Span 4. Sum of Adj. Span (wind span) 5. Angle of Deviation. 6. Suitability of Tower spotting in hilly area	a. Preliminary survey. b. Topographical /Digitized maps. c. Tower spotting data given by Engg. a. PLS CADD/Sag template b. Tower Spotting data c. Route alignment	Contractor -do- -do- -do- -do- -do-	100% at Field -do- -do- -do- -do- -do-	100% based on record documents -do- -do- -do- -do- Verification of 100% at Field	Project In-charge in consultation with Regional Engineering
2.	Check Survey	Tower Location & Final Length i) Route alignment ii) Final Length. (Span/Section) iii) Angel of deviation & pit marking		a. Route alignment b. Tower Schedule c. Profile	Contractor -do-	100% at Field -do-	i) All angle towers in plains and 50% in hilly terrains. ii) Final length to be checked on 100% basis based on records/documents. iii) 20 % test check at site for physical verification.	Site Engineer
3.	Detailed Soil Investigation	a) Bore log	1. Depth of bore log 2. SPT Test 3. Collection of samples	As per POWERGRID Specification	Contractor (Soil testing agency approved by POWERGRID)	100% at Field	To witness 20% at Field by site engineer	Site in Charge



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		b) Tests on samples	As per tech. Specs.	As per POWERGRID Specification	Contractor (Testing in Laboratory of soil testing agency approved by POWERGRID)	1. 100% by testing lab (Reports to be signed by Testing agency person. 2. Recommendation part of soil testing report to be signed by contractor 3. Jointly signed field data should be attached with the report.	Review of soil testing report by POWERGRID	Site In-charge based on the guide line issued by CC Engg. as per Annexure-6
		c) Special foundations	As per tech. Specs	As per POWERGRID Specification	Contractor (Testing in Laboratory of soil testing agency approved by POWERGRID)	100% by testing lab (Reports to be signed by Testing person & Checking person)	Review of soil testing report by POWERGRID	Site In-charge based on the guide line issued by CC Engg as per Annexure-6
4	Revetment	RR Masonry	a) Size of Stone	CPWD Specification.	Contractor	100% physical verification	Physical verification on random basis	Site Engineer
			b) Cement : Sand ratio in mortar	As per POWERGRID Specification	Contractor	100%	Physical verification in random	-Do- 

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5	Benching	Checking of Reduced Level	1. Reduced Level 2. Contour map with detailed Calculation	As per approved drawings	Contractor	100%	100% by Site Engineer and 20% by Line In-charge	Site In-charge
6.	Tower Foundation							
		A) Materials 1. Cement	1. Brand approval	Cement of approved brands according to the COV in POWERGRID web site may be procured and validity of BIS license to be ensured.	Contractor	100%	Any new brand cement proposed by Contractor shall be assessed by RHQ-FQA and approved by Regional Head. After approval, details shall be forwarded to CC-FQA for uploading in COV.	FQA-RHQ
			2. Physical tests	As per document at Annexure-I of this FQP	Contractor Samples to be taken jointly with POWERGRID and tested at POWERGRID approved lab	Review of 100% MTC's and one sample for every week number of manufacturer.	100% review of lab test results and MTC. Test results shall be sent by the Lab. by E-mail directly to POWERGRID; further, hard copy of test certificate shall also be sent by the Lab directly to POWERGRID by postal Address.	Site In-charge
			3. Chemical Tests Chemical composition of Cement	-do-	Contractor to submit MTC	Review of all MTC's	100% review of MTC test results	Site In-charge



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		2. Reinforcement Steel	1. Source approval	May be procured either from producers directly or through the authorized dealers who can produce MTC from producers with traceability. Refer COV in POWERGRID web site for list of <u>producers</u> of reinforcement steel and validity of BIS license to be ensured. Also refer approved list of Cut & Bend suppliers	Contractor	As proposed by contractor.	Material shall be supplied from Producers / authorized dealers.	Site In-charge
			2. Physical and Chemical analysis test	As per Annexure-2 of this FQP	Contractor to submit MTC	100% MTC's One sample* / 300MT / Manufacturer shall be jointly sealed by POWERGRID and tested at POWERGRID approved Lab. * Note: All sizes of 10mm and above shall be taken for testing in every 300MT.	100% review of MTC. 1) Review of Lab test results. Test results shall be sent by the Lab. by E-mail directly to POWERGRID; further, hard copy of test certificate shall also be sent by the Lab. directly to POWERGRID by postal Address. 2) Unit weight of three samples to be witnessed. #	Site In-charge



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# # Three samples of each size of Reinforcement steel (all sizes of 10mm & above) out of 100MT steel Lot need to be physically weight at site in presence of POWERGRID to ascertain their acceptance as per technical specification. The weighted samples at site may be kept under custody for three months for further examination by any auditing authority (if required).						
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		3. Coarse Aggregates	1. Source approval	Source with materials meeting POWERGRID Specification	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the test results of Joint samples tested at POWERGRID approved Lab.
			2. Physical tests	As per document at Annexure-3 of this FQP	Samples to be taken jointly and tested in POWERGRID approved lab	One sample per 1000 cum or part thereof per source for 765KV & above TL and One sample per 500 cum or part thereof per source for 500KV & below TL . Samples to be tested by Contractor in POWERGRID approved lab
						100% review of lab test results.
						Site In-charge Once approved, the particular quarry shall be used for all the running contracts under various packages.
						Site In charge.



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	4. Fine aggregate		1. Source approval	Source with materials meeting POWERGRID Specification	Contractor	Proposed by the Contractor, indicating the location of the quarry and based on the results of Joint samples tested in POWERGRID approved lab.	To review the proposal based on the documents.	Site In-charge Once approved, the particular quarry shall be used for all the running contracts under various packages.
			2. Physical test	As per Annexure-4 of this FQP	Samples to be taken jointly and tested in POWERGRID approved lab	One sample per 1000 cum or part thereof per source for 765KV & above TL and One sample per 500 cum or part thereof per source for 500KV & below TL , Samples to be tested by Contractor in POWERGRID approved lab	100% review of lab test results.	Site In charge.
	5. Water		1. Cleanliness (Water shall be fresh and clean)	POWERGRID Specification	Contractor	100% visual check at Field	Verification at random	Site Engineer
			2. Ph Value	- do -	Contractor at site with calibrated Ph meter or any other approved method	One sample per source	100% review of the field test results Ph not less than 6	Site Engineer



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	B) Foundation Classification		1. Visual observation of soil strata 2. Ground water level 3. History of water table in adj. Area/surface water 4. Soil Investigation wherever required	POWERGRID Specification	Contractor	100% at Field	100% at Field	a. [other than b & c locations below] Recommendation by Site Engineer to be approved by Site in-charge after visiting at least 10% locations b. In case of WBC/SFR/FS / ULE / Raised Chimney based on recommendation by Site In-charge, to be approved by Sr DGM/GM/Sr GM after visiting at least 5% locations. *****Project In-charge (Sr GM/Chief GM) shall visit at least 2% locations for Test Check. c. For Spl. Fdns. (shallow depth, pile foundation, well foundation etc.)



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	C) Concrete Works a) Before concreting							
		1. Bottom of excavated pit	Pit dimensions	Construction Drgs.	Contractor	100% at Field	100% check by POWERGRID	Site Engineer
		2. P.C.C Grade, thickness & Size	Completeness	IS 456: 2000, reaffirmed 2016 and POWERGRID approved construction drawings & specification.	Joint Inspection by POWERGRID and CONTRACTOR	For all locations	For all locations	Site Engineer
		3. Stub setting	1) Centre Line 2) Diagonals and back to back 3) Level of stubs	Construction Drgs -do- -do- -do-	-do- -do- -do- -do-	-do- -do- -do- -do-	-do- -do- -do- -do-	-do- -do- -do- -do-
		4. Frustum box quality and measurements 5. Reinforcement steel 6. Rod Type Earthing	Dimensions Placement Dia. and length of the rod.	Bar bending schedule, POWERGRID specification and approved construction drawings. Photograph of GPS enabled camera	Contractor	100%	Checking of record 100% and physical verification in Random	At least 5% locations shall be cross verified by Site In-charge, at random with respect to stub setting and reinforcement steel placement.



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		6. Concrete mix proportion (Applicable for Design Mix)	Ratio of mix proportion	Approval of Design Mix submitted by contractor based on inputs furnished by POWERGRID as per Annexure- 7 of this FQP.	Contractor	100%	100%	Site In charge in consultation with Regional engineering department.
b) During concreting		1. Workability	Slump test as per IS 1199- 1959, Reaffirmed 2013	Range 25 mm to 75 mm refer document at Annexure-5 of this FQP	Contractor	Minimum Two per day per location, preferably one at the start of concreting	check at random	Site Engineer
		2. Concrete Strength	Cubes Comp Strength	As per POWERGRID Specifications & as per Annexure-5 of this FQP	Contractor Casting of cubes at site. Cubes to be tested for 28 days strength at /POWERGRID Lab/At site (if testing machine installed by contractor is duly calibrated by NABL Lab.)/POWERGRID approved Lab. Cubes at 100% location are to be taken in presence of POWERGRID officials. Cubes molds should be of ISI marked.	Nominal Mix One sample of 3 cubes in each tower locations if all the legs are cast continuously without interruption. If otherwise, additional 3 cubes to be taken for every subsequent continuous casting case. It is to be ensured that in every case 3 cubes shall be selected in such a way that one each from start, middle and end of the casting process.	Normally testing shall be carried out at the POWERGRID in-house cube testing facility. Alternatively, samples shall be tested at cube testing facility installed by contractor at POWERGRID premises, in the witness of POWERGRID. Lastly, POWERGRID approved Labs, in this case, test results shall be sent by the Lab, by E-mail directly to POWERGRID; further, hard copy of Test Certificate shall be submitted by Site Engineer and at least 5% samples at	Site Engineer. All cubes shall be tested at In-house testing facilities. However, in case of breakdown of CTM or other force majeure conditions, cubes may be tested at approved TPL. Out of testing on 10% samples to be witnessed at TPL by POWERGRID Site Engineer and at least 5% samples at



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							also be sent by the Lab directly to POWERGRID by Postal Address. NOTE: The efforts shall be made to carry out 100% cube testing in the in-house cube testing facility.	random, shall be witnessed by Site In-charge. In-case of Site/ POWERGRID Lab, 100% witness by POWERGRID Representative.
				IS 456: 2000, Reaffirmed 2016.		<u>Design Mix</u> One sample of 3 cubes in each tower locations if all the legs are cast continuously. If otherwise, additional 3 cubes to be taken for every subsequent continuous casting case. However, in case of concrete supplied by RMC, one set of 3 nos. of cubes for every 50 cum or part thereof for each day of concreting and 28 days compressive strength shall be tested. NOTE: Apart from cube testing, the CORE testing	Further, POWERGRID to witness testing on 20% samples and also to review 100% test results.	Site Engineer



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						on casted foundations shall be carried out on 5% of total locations. For one location, any one leg shall be tested on sampling basis. The sampling should be planned in such a way that the locations are tested within 45 days after casting .Regional FQA has to decide the sample locations to be tested.		
		3. Anti-Corrosive paint on Stubs	Portion of Stubs/Towers to be painted	Technical Specification	Contractor	100% at Field	20% on random basis	Site Engineer
	c) After Concreting	a) Curing, Back filling & leveling of filled up soil b) Back to back, level and diagonals to be checked by Total Station and recorded in JMC c) Application of Bituminous paint on foundation	Compliance & Completeness Dimension Check Visual check and quantity of	As per Specification	Contractor	100%	100%	Site Engineer
				As per Technical Specifications & approved drawings	Contractor	100% at Field	Random check & 100% verification of records	Site Engineer



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		(wherever applicable)	application					
		NDT/Core Tests	UPV and Rebound Hammer /Core	Refer POWERGRID's Standard procedure for Testing/Assessment of compressive strength of casted Concrete				Regional Head
7.	Pile Foundations	Refer FQP OF TRANSMISSION LINE PILE FOUNDATION						
8.	Tower Erection	1. Materials of Tower member/bolts & nuts/washers/accessories 2. Erection of Super-Structure	Visual checking for 1. Stacking 2. Cleanliness 3. Galvanizing 4. Damages 1. Sequence of erection	Appd. Drgs./BOM As per Appd. Drgs./POWERGRID specification	Contractor Contractor	100% at stores 100% at field	100% verification of records Random	Site Engineer Site Engineer
			2. Check for completeness (Missing, hanging, bend etc.)	As per Appd. Drgs./POWERGRID specification	Contractor	100% at field	25% by Site Engr and random by Site Incharge.	Site In charge



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			3. Tightening, Punching, Orientation, Correct size & missing nuts and bolts	As per Appd. Drgs./POWERGRID specification	Contractor	100% at field	25% by Site Engr and random by Site Incharge.	Site In charge
			4. Check for verticality	-do-	-do-	-do-	-do-	-do-
			5. Tack welding & application of zinc rich paint for bolts & nuts	POWERGRID Specification	Contractor	100% at Field	-do-	Site Engineer
		3. Tower footing resistance (TFR) & Impedance	TFR at locations before and after earthing.	POWERGRID Specification	Contractor	100% at Field	20% locations to be verified	Site In-charge
9	Earthing	Pipe Type	Salt & charcoal	As per approved drawings	Contractor	%	Checking of record 100% and physical verification in Random	Site Engineer
		Counterpoise Type	Length & Depth of earth electrode.	As per approved drawings	Contractor	100%	---do---	Site Engineer
		Shield Wire Type	Length of shield	As per approved	Contractor	100%	---do---	Site Engineer



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			Wire	drawings				
	Chemical pipe Type		- Resistivity test using soil box. - Leaching test - Sulphur determination - Corrosion test	As per approved drawings	Contractor	100%	---do---	Site Engineer
10	Stringing	1. Materials						
		a) Insulators	1. Visual check for cleanliness/glazing/cracks/and white spots.	POWERGRID Specification	Contractor	100% at Field	100% verification of records and to carry Physical verification random checks on 10%	Site Engineer
		2. IR Value Only for Disc Insulators	2. IR Value	Minimum acceptable value 2000 Mega ohm	-do-	Test shall be carried on 100% insulators using 5/10 kV (DC) Megger	100 % by Contractor and record review by POWERGRID and joint witnessing by POWERGRID on 05% insulator	Site In-charge
		3. Traceability (Make/batch No./Locations where installed)	3. Traceability	Packing list/CIP	Contractor	100% at field (Details of CIPs has to be recorded in SIV/Delivery challan)	100% Review of records	Site Engineer



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		b) Conductor	On receipt, 1. Visual check of drum. 2. Check for seals and POWERGRID signed sticker on outer end 3. Check depth from top of flange to the top of the outer most layer	Packing list/CIP	Contractor	100% at stores	20% check	Site Engineer
				-do-	-do-	-do-	-do-	-do-
				-do-	-do-	-do-	-do-	-do-
	c) Earth wire/OPGW	Check for seals at both ends	Packing list/ CIP	Contractor	100% at stores In case of OPGW, OTDR test shall be carried on 100% OPGW before stringing	20% check 20% joint witnessing by POWERGRID	-do-	-do-
	2. Field activity							
	a) Before Stringing	Readiness for stringing	Stringing procedures as per POWERGRID specification	Contractor	Readiness certificate to be submitted by the Contractor	Review of Certificate	Site In-charge	



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	b) During stringing		(Conductor/Earth-wire)					
			1. Scratch/cut check (Visual)	Appd. Drawings/ POWERGRID Specn.	Contractor	100% at Field	100% verification of record & 20% Field check	Site Engineer
			2. Repair sleeve	-do-	-do-	-do-	-do-	-do-
			3. Mid span /Dead end joints	-do-	-do-	-do-	-do-	-do-
			4. Guying	Appd. Guying arrangement/POWER GRID Specn.	-do-	-do-	100%	Site Engineer
	c) After stringing		Check for,					
			1. Sag/Tension	Stringing Chart / tower Spotting data	-do-	-do-	100% verification of record & 20% field check	Site Engineer
			2. Electrical clearances	As per Appd. Drgs./POWERGRID specifications	-do-	-do-	-do-	-do-



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			i) Ground clearance	As per Appd. Drgs./POWERGRID Specification	Contractor	100% at Field	100% record & Field Check 20%	Site Engineer
			ii) Live metal clearance etc.	-do-	-do-	-do-	-do-	-do-
			3.Jumpering/Jumper drop check	-do-	-do-	-do-	-do-	-do-
			4. Copper / Aluminum bond	As per Appd. Drgs./POWERGRID Specification	Contractor	100% at Field	100% record & Field Check 20%	Site Engineer
			5a). Placement of spacer/damper	As per Specn./Drgs/ placement chart	-do-	-do-	-do-	-do-
			5b) Tightening of hardware bolts & nuts and fixing of split pins as per manufacturer recommendations.	-do -	-do-	100% with fixed torque wrench.	-do-	-do-
11.	Final Testing a) Pre-commissioning of lines	a) Readiness of lines for pre-commissioning	1. Completeness of line. 2. Meggar test of line	POWERGRID latest pre-commissioning procedures (Doc. No. D-2-01-70-01-02)	Joint inspection by POWERGRID and Contractor	100%	100%	Site In-charge



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	b)Commissioning of line	Readiness of lines for commissioning	1. Geo tagged photograph of each tower after completion of stringing, to ascertain the completeness of tower.	a) POWERGRID latest pre-commissioning procedures (Doc. No. D-2-01-70-01-02) b) Pre-commissioning Report c) CEA clearance	Joint inspection by POWERGRID and Contractor	100%	100%	Site In-charge
	Storage of materials	1)Storage of Tower parts, Conductor drums, Insulators, Hardware fittings, Bolts/Nuts, RF Steel 2) Cement Storage	Visual & Physical check	POWERGRID specifications	Contractor	100%	Random check	Site Engineer



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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CEMENT

ORDINARY PORTLAND CEMENT					
S. No.	Name of the test	Ordinary Portland Cement 33 grade as per IS 269: 2015	Ordinary Portland Cement 43 grade as per IS 269: 2015	Ordinary Portland Cement 53 grade as per IS 269: 2015	Remarks
a)	Physical tests				To be conducted in POWERGRID approved Lab
(i)	Fineness	Specific surface area shall not be less than 225 sq.m. per Kg. or 2250 cm ² per gm.	Specific surface area shall not be less than 225 sq.m. per Kg or 2250 cm ² per gm.	Specific surface area shall not be less than 225 sq.m. per Kg or 2250 cm ² per gm.	Blaine's air permeability method as per IS 4031 (Part-2):1999, Reaffirmed 2013
(ii)	Compressive strength	72 ± 1 hour : Not less than 16 Mpa (16 N/mm ²) 168 ± 2 hour : Not less than 22 Mpa (22 N/mm ²) 672 ± 4 hour : Not less than 33 Mpa (33 N/mm ²), Not more than 48Mpa (48N/mm ²)	72 ± 1 hour : Not less than 23 Mpa (23 N/mm ²) 168 ± 2 hour : Not less than 33Mpa (33 N/mm ²) 672 ± 4 hour : Not less than 43 Mpa (43 N/mm ²), Not more than 58Mpa (58N/mm ²)	72 ± 1 hour : Not less than 27Mpa (27 N/mm ²) 168 ± 1 hour : Not less than 37Mpa (37 N/mm ²) 672 ± 1 hour : Not less than 53 Mpa (53 N/mm ²)	As per IS 4031 (Part-6): 1988, Reaffirmed 2014
(iii)	Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes	As per IS 4031 (Part-5): 1988, Reaffirmed 2014. -do-
(iv)	Soundness	Un aerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Un aerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test	Un aerated cement shall not have an expansion of more than 10mm when tested by Le Chatlier and 0.8% by Autoclave test.	Le Chatlier and Autoclave test as per IS 4031 (Part-3): 1988, Reaffirmed 2014.



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S. No.	Name of the test	Ordinary Portland Cement 33 grade as per IS 269: 2015	Ordinary Portland Cement 43 grade as per IS 269: 2015	Ordinary Portland Cement 53 grade as per IS 269: 2015	Remarks
b)	Chemical composition tests				Review of MTC only
	a)	Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02%	a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.66 to 1.02%	a) Ratio of percentage of lime to percentage of silica, alumina & iron oxide 0.80 to 1.02%	
	b)	Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	a) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	a) Ratio of percentage of alumina to that of iron oxide Minimum 0.66%	
	c)	Insoluble residue, percentage by mass Max. 5.00%	c) Insoluble residue, percentage by mass Max. 5.00%	c) Insoluble residue, percentage by mass Max. 5.00%	
	d)	Magnesia percentage by mass Max. 6%	d) Magnesia percentage by mass Max. 6%	d) Magnesia percentage by mass Max. 6%	
	e)	Total sulphur content calculated as sulphuric anhydride (SO ₃), percentage by mass not more than 3.5%.	e) Total sulphur content calculated as sulphuric anhydride (SO ₃), percentage by mass not more than 3.5%.	e) Total sulphur content calculated as sulphuric anhydride (SO ₃), percentage by mass not more than 3.5%.	
	f)	Total loss on ignition shall not be more than 5 percent	f) Total loss on ignition shall not be more than 5 percent	f) Total loss on ignition shall not be more than 4 percent check	
	g)	Chloride content, percent by mass, max 0.1%	g) Chloride content, percent by mass, max 0.1%	g) Chloride content, percent by mass, max 0.1%	



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S. No.	Name of the test	Remarks
2.	PORTLAND POZZOLANA CEMENT AS PER IS 1489 (Part 1):2015	
a)	Physical tests	To be conducted in POWERGRID approved Lab
	i) Fineness	Specific surface area shall not be less than 300 sq.m. per Kg. or 3000 Cm ² per gm.
	ii) Compressive strength	a) 72 ± 1 hour : Not less than 16 Mpa (16 N/mm ²) b) 168 ± 2 hour : Not less than 22 Mpa (22 N/mm ²) c) 672 ± 4 hour : Not less than 33 Mpa (33 N/mm ²)
	iii) Initial & Final setting time	Initial setting time : Not less than 30 minutes Final setting time : Not more than 600 minutes
	iv) Soundness	Un aerated cement shall not have an expansion of more than 10mm Le chatelier test and 0.8% by Autoclave test as per IS 4031 (Part-3)
b)	Chemical composition tests	
	a) Magnesia percentage by mass Max. 6%	Review of MTC only
	b) Insoluble residue, percent by mass, (a) Maximum {x + 4 (100-x)/100} (b) Minimum 0.6x, where x is the declared % of fly ash in the given Portland pozzolana cement.	-do-
	c) Total sulphur content calculated as sulphuric anhydride (SO ₃), percentage by mass not more than 3.5	-do-
	d) Total loss on ignition shall not be more than 5 percent	-do-
	e) Chloride content, percent by mass, max 0.1%	-do-



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Annexure-2

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR REINFORCEMENT STEEL AS PER IS 1786-2008 (Reaffirmed 2013), Amendment No.- 1

S. No.	Name of the test	Fe 415	Fe 500	Fe 500D
i)	Chemical analysis test			
	Carbon	0.30 Percent Maximum	0.30 Percent Maximum	0.25 Percent Maximum
	Sulphur	0.060 Percent Maximum	0.055 Percent Maximum	0.040 Percent Maximum
	Phosphorus	0.060 Percent Maximum	0.055 Percent Maximum	0.040 Percent Maximum
	Sulphur & Phosphorus	0.11 Percent Maximum	0.105 Percent Maximum	0.075 Percent Maximum
	Carbon Equivalent	0.42 percent Maximum	0.42 percent Maximum	0.42 percent Maximum
ii)	Physical tests			
	a) Tensile Strength/Yield stress ratio,	≥ 1.10 , but tensile strength not less than 485.0 N/mm^2	≥ 1.08 , but tensile strength not less than 545.0 N/mm^2	≥ 1.10 , but tensile strength not less than 565.0 N/mm^2
	b) 0.2% of proof stress/Yield stress Minimum, N/mm^2	415	500	500
	c) Elongation percent , Minimum	14.5	12	16
	d) Total elongation at maximum force, percent, Minimum	--	--	5
	e) Unit weight, Kg/m on sample sent for third party lab	As per IS 1786	As per IS 1786	As per IS 1786
iii)	Bend & Rebend tests	Pass	Pass	Pass



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ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR COARSE AGGREGATES AS PER IS 383:2016

3. Coarse Aggregates											
i) Physical Tests											
a) Determination of particles size	a. IS Sieve Designation	%age passing for Single-Sized Aggregate of nominal size						Percentage Passing for graded Aggregate of nominal size			
		40 mm	20 mm	16 mm	12.5 mm	10 mm	40 mm	20 mm	16 mm	12.5 mm	
	63 mm	100	-	-	-	-	-	-	-	-	-
	40 mm	85 to 100	100	-	-	-	90 to 100	100	-	-	-
	20 mm	0 to 20	85 to 100	100	-	-	30 to 70	90 to 100	100	100	100
	16 mm	-	-	85 to 100	100	-	-	-	90-100	-	-
	12.5 mm	-	-	-	85 to 100	100	-	-	-	90 to 100	-
	10 mm	0 to 5	0 to 20	0 to 30	0 to 45	85 to 100	10 to 35	25 to 55	30 to 70	40 to 85	-
	4.75 mm	-	0 to 5	0 to 5	0 to 10	0 to 20	0 to 5	0 to 10	0 to 10	0 to 10	-
	2.36 mm	-	-	-	-	0 to 5	-	-	-	-	-
b. Combined Flakiness and Elongation index		Not to exceed 40%									
c. Crushing Value		Not to exceed 30%									
d. Presence of deleterious material		Total presence of deleterious materials not to exceed 5% for uncrushed, 2% for crushed and manufactured coarse aggregates as per Annexure- 3A.									
e. Hardness		Abrasion value not more than 50%, Impact value not more than 45%									
f. Soundness test (for concrete work subject to frost action)		Not to exceed 12% when tested with sodium sulphate and 18% when tested with magnesium sulphate									



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Annexure-3A

<i>Deleterious Substance</i>	<i>Percentage by Mass, Max</i>		
	<i>Uncrushed</i>	<i>Crushed</i>	<i>Manufactured</i>
a) Coal and lignite	1.0	1.0	1.0
b) Clay lumps	1.0	1.0	1.0
c) Materials finer than 75 micron	1.0	1.0	1.0
d) Soft fragments	3.0	--	3.0
e) Shale	--	--	--
f) Total of percentages of all deleterious materials (except mica) including S. No. a) to e) for uncrushed and crushed aggregates	5.0	2.0	2.0



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Annexure-4

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR FINE AGGREGATES AS PER IS 383

4. Fine aggregates					
i)	Physical Tests	IS Sieve Designation	Percentage passing for		
	a) Determination of particle size		F.A. Zone I	F.A. Zone II	F.A. Zone III
		10 mm	100	100	100
		4.75 mm	90-100	90-100	90-100
		2.36 mm	60-95	75-100	85-100
		1.18 mm	30-70	55-90	75-100
		600 microns	15-34	35-59	60-79
		300 microns	5 to 20	8 to 30	12 to 40
		150 microns*	0-10	0-10	0-10
	b) Presence of deleterious material	Total presence of deleterious materials not to exceed 5% for uncrushed & 2% for crushed/Mixed and manufactured fine aggregates as per Annexure- 4A.			
	c) Soundness Applicable to concrete work subject to frost action	10% when tested with sodium sulphate and 15% when tested with magnesium sulphate			

*For crushed stone sand the permissible limit on 150 microns IS Sieve is increased to 20 %.



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Deleterious Substance	Percentage by Mass, Max	
	Uncrushed	Crushed/Mixed
a) Coal and lignite	1.0	1.0
b) Clay lumps	1.0	1.0
c) Materials finer than 75 micron	3.0	15.0 (for crushed sand) 12.0 (for mixed sand)
d) Soft fragments	--	--
e) Shale	1.0	1.0
f) Total of percentages of all deleterious materials (except mica) including S. No. a) to e) for uncrushed aggregates and a) & b) for crushed/mixed and manufactured aggregates	5.0	2.0



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Annexure-5

ACCEPTANCE CRITERIA AND PERMISSIBLE LIMITS FOR CONCRETE WORK

1)	Concrete	a) Workability	Slump shall be recorded by slump cone method and it shall be between 25-75 mm depending upon workability requirement as per IS 456: 2000.
		b) Compressive strength	For nominal (volumetric) concrete mixes compressive strength for 1:1.5:3 (Cement : Fine aggregates : Coarse aggregates) concrete 28 days strength shall be min 265Kg/cm ² (26 N/mm ²) and for 1:2:4 (Cement: Fine Aggregate: Coarse Aggregate) nominal mix concrete 28 days strength shall be min 210Kg/cm ² (20.60 N/mm ²)

Notes:

1) ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR NOMINAL MIX CONCRETE: As per clause 5.4.10.4 of CPWD Specifications, Volume 1

- The average of the strength of three specimen be accepted as the compressive strength of the concrete provided the strength of any individual cube shall neither be less than 70% nor higher than 130% of the specified strength.
- If the strength of any individual cube exceeds more than 30% of specified strength, it will be restricted to 130% only for computation of strength.
- If the actual average strength of accepted sample is equal to or higher than specified strength up to 30% then strength of the concrete shall be considered in order and the concrete shall be accepted at full rates.
- If the actual average strength of accepted sample is less than specified strength but not less than 70% of the specified strength, the concrete may be accepted after reconfirmation by NDT/Core test on the location portion represented by the cube samples in line with approved Standard testing procedure of POWERGRID.

- If the actual average strength of accepted sample is less than 70% of specified strength, the Engineer-in-Charge shall reject the defective portion of work represented by sample and nothing shall be paid for the rejected work. Remedial measures necessary to retain the structure shall be taken at



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the risk and cost of contractor. If, however the Engineer-in-Charge so desires, he may order additional tests to be carried out to ascertain if the structure can be retained. All the charges in connection with these additional tests shall be borne by the contractor.

- 2) 53 Grade cement shall be used after obtaining specific approval of the Engineer in charge.
- 3) Portland slag cement conforming to IS 455: 2015 may be used as per Technical Specification.
- 4) All Design Mix concrete shall be as per IS 456: 2000, reaffirmed 2016
- 5) **ACCEPTANCE CRITERIA BASED ON 28 DAYS COMPRESSIVE STRENGTHS FOR DESIGN MIX CONCRETE: As per Table-11, Amendment No. 4 of IS 456: 2000 as given below: Note sheet reference no. CC/FQA/CLA/MIX dated 08/12/16 approved by Competent Authority.**

Specified Grade	Case No.	Sampling	Acceptance Criteria for Mix Design as per Is 456:2000	Remarks
M15 and above	A 1.	Mean of Group of 4 non-overlapping consecutive test results.	Shall greater than or equal to $f_{ck} + 0.825 \times$ established standard deviation (rounded off to nearest 0.5 N/sq. mm)*	
	A 2.	Individual test result out of A 1.	Or $f_{ck} + 3$ N/sq. mm, whichever is greater	Out of four non- overlapping consecutive test results, one individual test result only.
	B 1.	Group of non-overlapping consecutive if test results are less than 4	$f_{ck} + 4$, N/sq.mm, minimum	
	B 2.	Individual test result out of B 1.	$f_{ck} - 2$, N/sq.mm, minimum	Out of less than four non-overlapping consecutive test results, one individual test result only.
	C 1	When number of sample is only one.	$f_{ck} + 4$, N/sq.mm, minimum	

* Established value of standard deviation shall be determined based on Note of Table-11 of IS 456



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6. The test results of the cube samples shall be the average of the strength of the three specimens. The individual variation shall not be more than $\pm 15\%$ of the average.

General Notes:

- 1) This standard Field Quality Plan is not to limit the supervisory checks which are otherwise required to be carried out during execution of work as per drawings/Technical specifications etc.
- 2) All materials under supply contract should have Cat-A CIP before they are erected.
- 3) Contractor shall be responsible for implementing/documenting the SFQP. Documents shall be handed over by the contractor to POWERGRID after the completion of the work.
- 4) Project incharge means over all incharge of work. Site in-charge means in-charge of the line. Site engineer means in -charge of the section. Site Engineer's responsibility may be allocated to Site JE, with the approval of Regional Head, only in such cases where, Site Engineer is not in position.
- 5) In case of deviation the approving authority will be one step above the officer designated for acceptance in this quality plan subject to minimum level of Line incharge.
- 6) Acceptance criteria and permissible limits for tests are indicated in the Annexures. However for further details/tests POWERGRID specification and latest relevant Indian standards shall be referred.
- 7) Tests as mentioned in this FQP shall generally be followed. However E.I.C. reserves the right to order additional tests wherever required necessary at the cost of the agency.
- 8) All counter checks/tests by POWERGRID shall be carried out by POWERGRID's officials' at least at the level of Site Engineer.
- 9) The authorized dealer of reinforcement steel means the dealer whose names are listed in the steel producer's web site or certified by the producers.
- 10) Accepting Authority for testing Laboratory shall be Regional Head.
- 11) READY MIX CONCRETE (RMC) IS ACCEPTABLE FOR USE. HOWEVER, SITE INCHARGE SHALL APPROVE THE SOURCE OF MATERIALS TO BE USED FOR RMC .The documentation to be maintained shall be as per IS 4926:2003, Reaffirmed 2012 i.e.
 - i) Information to be supplied by the purchaser (clause 7)
 - ii) Information to be supplied by the producer (clause 8)
 - iii) Sampling for concrete strength should be one set of 3 nos. of cubes for every 50 cum or part thereof for each day of concreting and 28 days compressive strength shall be tested in line with IS 456:2000, Reaffirmed 2016.



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- 12) The preference shall be given to batching/RMC plants approved by Quality Council of India.
- 13) Epoxy coating on reinforcement steel wherever required shall be done as per IS 13620:1993, Reaffirmed 2015.
- 14) Cement is to be used in the order, it is delivered (i.e. First in First Out). In case the cement remains in storage for more than 3 months, the cement shall be retested before use and shall be rejected, if it fails to conform to any of the requirements given in the relevant Indian Standard. Cement shall be packed in bags and stored in accordance with the provisions in IS 4082:1996, Reaffirmed 2003.
- 15) If e-mail facility is not available in POWERGRID approved Lab, report may be collected directly by POWERGRID/ Speed Post / Registered Post / UPC.
- 16) In case any Laboratory refuses to allow POWERGRID representative for witnessing the test, same shall be taken in writing and approval by Regional Head.
- 17) *Standard marking of ISI mark along with license number (Seven digit no., represented as CM/L-----) should be verified for construction materials and test certificate submitted for review*
- 18) *The mix design shall be approved in line with standard format for mix design concrete and final approval of mix design shall be done in consultation with Regional engineering department. After approval, during first use, design mix shall be verified by testing cube samples for 7 days and 28 days.*
- 19) *Tolerance of cement weight shall be governed by clause no. 10.1.1 of IS 269:2015 for OPC and by clause no. 10.1.1 of IS 1489 (Part 1):2015 for PPC.*
- 20) *Digital Photographs during concreting, erection and stringing for each location shall be taken and kept in record for future reference by high resolution GPS enabled camera.*
- 21) *All the charges in connection with NDT/ Core tests shall be borne by the contractor.*
- 22) *Bituminous paint should be applied wherever required check*
- 23) *The cube testing in in-house Cube testing machine shall be carried out by POWERGRID employee not directly associated with construction activities. The employees associated with O&M works should be preferred for carried out cube test.*



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Annexure-6

ENGINEERING GUIDE LINE FOR CHECKING / ACCEPTING SOIL INVESTIGATION REPORT:

Following are the guide line for checking and accepting the soil investigation report:

The soil investigation shall be carried out in line with the Technical Specification. The detailed soil Investigation Report should be signed by the soil investigating agency, Line Contractor and POWERGRID's Site Engineer/RHQ Engineer and following points should be checked in the soil investigation report:

1) Normal Locations :

- a) Soil investigation report should contain the bore Log sheet indicating the variation of different soil strata.
- b) The Bearing capacity, Bulk density (γ) , Submerged Density(γ_{sub}) , angle of repose (δ) in dry as well as wet condition and Angle of internal friction (ϕ) for different soil layers including at 3m depth shall be indicated in the Soil investigation report.
- c) Present water table and history of variation of water table at the tower location shall be indicated in the soil investigation report.
- d) Classification of foundation should be indicated based on the water table , Bearing capacity, Swelling Index, Soil type and the value of angle of repose (δ) in line with parameters indicated in the standard foundation drawings.

2) River Crossing /Special Locations:

- a) A sketch indicating profile of river crossing locations with borehole positions shall be indicated in the soil investigation report.
- b) Maximum discharge, Maximum velocity and Highest Flood Level (HFL) data (authenticated) of the river shall be enclosed in the Soil Investigation Report.
- c) Comprehensive Bore log Sheet indicating the depth of different Strata, Soil type, SPT value & water table for each bore hole is to be indicated in the soil investigation report.



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- d) Natural Ground Level (GL) for all the locations are to be indicated. **Note that the GL & HFL should be with respect to same reference. For example if HFL is given in RL, the ground level should be in terms of RL only. Mixing of level with respect to MSL (Mean Sea level) & RL should be avoided.**
- e) Whether the river is navigable or not is to be indicated in the soil investigation report.
- f) Silt factor calculation based on the laboratory test results of weighted mean diameter (d_m) of soil for different layers of the soil shall be furnished in the soil investigation report.
- g) Bulk density (γ), Submerged Density (γ_{sub}), Value of Cohesion (C) and Angle of internal friction (ϕ) for different soil layers based on laboratory test results shall be indicated in the soil investigation report.
- h) If Rock is encountered prior to termination of bore hole (40m below existing Ground Level), core drilling should be done. The details of core recovery (Run wise) and calculation of Rock Quality Designation (RQD) together with the photograph of core sample properly placed in a core Box are to be enclosed in the soil investigation report.
- i) If the refusal is not obtained or the type of soil encountered at 40m depth below existing ground level is very poor (like loose clay, organic deposit etc.) further boring should be continued up to a depth of 50m below Ground Level or refusal whichever is earlier and all relevant data upto termination depth of bore holes shall be furnished in the Soil Investigation Report as detailed above.



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CONCRETE MIX PROPORTIONING-MIX DESIGN (to be furnished by site while sending samples for design mix)

S. No.	Design Stipulations	Specified Criteria for Mix Proportion									
A	CONCRETE DETAILS:	M20	M25	M30	M35	M40					
1.	Grade of Concrete (M 20 to M 60- 28 days compressive Strength of 150mm cubes)	☐	☐	☐	☐	☐					
2.	Type of Concrete- Structural Classification	PCC ☐	RCC ☐	PSC ☐	Others ☐						
3.	Placing Conditions of Concrete (Structural Elements)	Building ☐	TL ☐	Pile ☐	S/S ☐	Structure ☐	Road ☐				
B	MIX DESIGN LIMITS:*	0.30	0.35	0.40	0.45	0.50	Others				
4.	Max. Water-Cement Ratio (W/C)- Optional	☐	☐	☐	☐	☐	☐				
5.	Min Cement Content- Optional- Kg/m3*	300 ☐	320 ☐	340 ☐	360 ☐	380 ☐	Others ☐				
C	EXPOSURE CONDITIONS:@	Mild ☐	Mod. ☐	Severe ☐	V. Severe ☐	Extreme ☐					
6.	Type of Environmental Exposure										
7.	Whether Exposed to Sulphate attack from Soil, Water & Containment.	Yes ☐	No ☐	Not Known ☐							
8.	Whether Exposed to Chloride attack from Soil, Water & Containment.	Yes ☐	No ☐	Not Known ☐							



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D	CONCRETE INGREDIENTS:	Ground	River	Pond	Others
9.	Source of Water for Construction	☐	☐	☐	☐
10.	Type of Cement & Strength Grade.	OPC	OPC	OPC	PPC
		Gr.33	Gr.43	Gr.53	BFS
		☐	☐	☐	☐
		☐	☐	☐	☐
11.	Brand, Batch No./Week/Year of Cement(Test Certificate to be sent to Lab)				
12.	Cementitious Materials Proposed for Improvement of Density & Permeability.	Microsilica/ Silica Fume	Slag	Fly Ash	Other
		☐	☐	☐	Pozzolona
		☐	☐	☐	☐
13.	FRESH CONCRETE Properties: Desired Slump of Concrete (mm)#	25-55	25-75	100-150	Others
		☐	☐	☐	☐
14.	QUALITY CONTROL AT SITE: Degree of Quality Control at Project Site (For Standard Deviation)	V.Good	Good	Fair	Std.Lab.
		☐	☐	☐	☐
15.	Max. Size of Coarse Aggregate (MSA)-mm	63	40	20	12.5
		☐	☐	☐	☐
16.	Source of Coarse Aggregate	Name of Quarry Location			
17.	Type of Fine Aggregate	River Sand	Crushed Sand	Others Specify	
		☐	☐	☐	☐



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18.	Source of Fine Aggregate (Sand)	Name of Quarry	Location
19.	Admixture proposed to be Used (Batch MTC to be Submitted to Lab)	Brand Name:	Batch No.:
20.	Type of Compaction Equipment	Plate Vibrator Needle Vibrator Vibro Hyd. Pressure Concrete Piling	
21.	Type of Concrete Placement Facility at Project	Manual Lift Hydraulic Bucket Concrete Pump	
22.	Maximum/Minimum temp. envisaged during placing of concrete		

* Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size- Reinforced Concrete

	Minimum cement content Kg/m ³	Maximum free water cement ration	Minimum grade of concrete
	300	0.55	M20
	300	0.5	M25
	320	0.45	M30
	340	0.45	M35
	360	0.4	M40

Slump Value as per SFQP;

- i. For Switchyard civil works – 25 to 75mm
- ii. For Switchyard pile foundations- 150-180mm
- iii. For Transmission line open cast foundations- 25 to 75mm
- iv. For Transmission line pile foundations- 150-180mm



STANDARD FIELD QUALITY PLAN

Item	Transmission Line
Applicability	POWERGRID Projects
Date of Issue	03.08.2020
Validity	Till next revision

SFQP No.	DOC No. C/FQA/SFQP/TL/030
REV.	07

@EXPOSURE CONDITIONS

ENVIRONMENT	EXPOSURE CONDITIONS
MILD	Concrete surfaces protected against weather or aggressive
MODERATE	- Concrete exposed to condensation and rain - Concrete continuously under water - Concrete surfaces sheltered from rain or freezing whilst wet - Concrete in contact or buried under non-aggressive soil/ground water
SEVERE	- Concrete surfaces exposed to severe rain, alternate wetting and drying or occasional freezing whilst wet or severe condensation - Concrete completely immersed in sea water - Concrete exposed to coastal environment
VERY SEVERE	- Concrete surfaces exposed to sea water spray, corrosive fumes or severe freezing conditions whilst wet. - Concrete in contact with or buried under aggressive subsoil/ ground water
EXTREME	Surface of members in tidal zone, Members in direct contact with liquid/solid aggressive chemicals

Note:- The design mix shall be tested for 7 and 28 days



STANDARD MANUFACTURING QUALITY PLAN (Doc No C/QA&I/MQP/Tower parts/Rev 04)

Manufacturer's Details :-

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INSTRUCTIONS FOR CODE ALLOCATION

Code 1 Indicates place where testing is planned to be performed i.e. Inspection location A At Equipment Manufacturer's works (Fabricator) B At Component Manufacturer's works (Re-roller) C At Authorized Distributor's place D At Independent Lab E At Turn Key Contractor's location F Not specified	Code 2 Indicates who has to perform the tests i.e. Testing Agency J The Equipment Manufacturer K The Component Manufacturer L The Third Party M The Turnkey Contractor
Code 3 Indicates who shall witness the tests i.e. Witnessing Agency P Component Manufacturer itself Q Component Manufacturer and Equipment Manufacturer R Component Manufacturer, Equipment Manufacturer and Contractor S Equipment Manufacturer itself T Equipment Manufacturer and Contractor U Equipment Manufacturer, Contractor and POWERGRID V Third Party itself	Code 4 Review of Test Reports/Certificates W By Equipment manufacturer during raw material / bought out component inspection X By Contractor during product/process inspection Y By POWERGRID during product/process inspection Z By Contractor and/or POWERGRID during product/process inspection
Code 5 Whether specific approval of sub-vendor / Component make is envisaged? E Envisaged N Not Envisaged	Code 6 Whether test records required to be submitted after final inspection for issuance of CIP/MICC Y Yes N No



STANDARD MANUFACTURING QUALITY PLAN (Doc No C/QA&I/MQP/Tower parts/Rev 04)

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A. Raw Material Inspection (Indigenous)

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check/ Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
1.1	Structural Steel (Sections and Plates)												Structural Steel to be procured from Power Grid approved Sources. For re-rollers specific approval of Power Grid is to be ensured and CIP for every lot at re-roller's works.
1.1.1		Mechanical Properties											
(a)		Test For Ultimate Tensile Strength	2 - Samples for cast/heat size up to 100 MT 3 - Samples for cast /heat size between 100-200 MT 4 - Samples for cast/heat size over 200 MT	IS: 2062:2011 Grade E250A Power Grid Specn. IS: 2062:2011 Grade E350A	410 N/mm ² (Min.) 490 N/mm ² (Min)	Manufacturer's format of record (MFOR)	A	J	S	Z		N	
(b)		Yield Stress	2 - Samples for cast/heat size up to 100 MT 3 - Samples for cast/heat size between 100-200 MT 4 - Samples for cast/heat size over 200 MT as per IS 2062:2011	IS: 2062:2011 Grade E250 A & Power Grid Specn.	i) <20mm thick 250 N/mm ² min ii) 20to40 mm thick 240 N/mm ² Min. iii) >40mm thick 230 N/mm ² min.	(MFOR)	A	J	S	Z		N	

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STANDARD MANUFACTURING QUALITY PLAN (Doc No C/QA&I/MQP/Tower parts/Rev 04)

Manufacturer's Details :-

Customer :
POWERGRID

Vendor's
Code :

Item :
Galvanized Tower
Structures / Parts

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Rev. No. :
Date:

Valid from:
Valid to:

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
(c)		Percentage Elongation at 5.65 \ Area	2 - Samples for cast/heat size up to 100 MT 3 - Samples for cast/heat size between 100-200 MT 4 - Samples for cast/heat size over 200 MT as per IS 2062:2011	IS: 2062:2011 Grade E250 A & Power Grid Specn.	below 20 mm min 350 N/mm ² 20-40 mm min 330 N/mm ² above 40 mm min 320 N/mm ²	(MFOR)	A	J	S	Z		N	
(d)		Bend Test	1 Sample for 50 MT per Section per cast or Part thereof as per IS 2062:2011	IS: 2062:2011 Grade E250 A Power Grid Specn.	22% min. Piece at room temp. shall with stand bending through 180 degree to an internal dia i) not greater 2t for ☐ 25 mm, ii) 3t for > 25 mm. with both side parallel, without cracking.	(MFOR)	A	J	S	Z		N	



STANDARD MANUFACTURING QUALITY PLAN (Doc No C/QA&I/MQP/Tower parts/Rev 04)

Manufacturer's Details :-

Customer :	Vendor's Code :	Item :	MQP.No. : Rev. No. : Date:	Valid from: Valid to:
POWERGRID		Galvanized Tower Structures / Parts		

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
1.1.2	Chemical Composition	Chemical Analysis	2 - Samples for cast size up to 100 MT 3 - Samples for cast size between 100-200 MT 4 - Samples for cast size over 200 MT as per IS 2062 :2006	As per Chemistry enclosed for each source	As per Chemistry enclosed for each source	(M/FOR) TPL Reports	A	J	S	Z	-	N	
							/	/	/				
							D	L	V				
1.1.3	Visual Inspection	Visual	One sample for 50 MT / Section or Part thereof	IS 2062:2011 Power Grid specn.	Material to be free from surface defects like laminations, rough/fagged and imperfect edges, cracks, rounded apex, deep roll marks, pipy and any harmful defects	(M/FOR)	A	J	S	Z		N	



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Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check/ Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
1.1.4	Dimensional Inspection	Measurement	One sample for 50 MT / Section or Part Thereof	IS 808/ IS 1730 / IS 1852 & PowerGrid Specn.	Equal (i) Up to 45 mm Leg Length ± 1.5 mm (ii) > 45 to 100 mm Leg Length ± 2.0 mm (iii) > 100 mm Leg Length ± 2.0 % of leg length Difference between Leg Length of Equal Angles shall be limited to 75 % of Total Tolerance (Plus & Minus) Unequal: tolerance as per IS	(MFOR)	A	J	S	Z		N	
	Angle section												
	a) Tolerances For Leg Length of Angles Equal / Un Equal		One sample for 50 MT / Section or Part Thereof	IS 1852/ IS 808	Equal (i) Up to 45 mm Leg Length ± 1.5 mm (ii) > 45 to 100 mm Leg Length ± 2.0 mm (iii) > 100 mm Leg Length ± 2.0 % of leg length Difference between Leg Length of Equal Angles shall be limited to 75 % of Total Tolerance (Plus & Minus) Unequal: tolerance as per IS	(MFOR)	A	J	S	Z		N	
	b) Out of Square ness	Measurement	One sample for 50 MT / Section or Part Thereof	IS 1852 Power Grid Specn.	± 1°	(MFOR)	A	J	S	Z		N	



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		POWERGRID				

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check/ Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
c) Camber		Measurement	One sample for 50 MT / Section or Part Thereof	IS 1852	(i) For Flange Less than 100 mm Reasonably Straight (ii) For Flange 100 mm & above Max 0.2% of length	(MFOR)	A	J	S	Z		N	
d) Root radius		Measurement	-do-	IS 808	IS 808	Test Report	A	J	S	W	-	N	
e) Weight Tolerance For Angle Sections		Unit Weight Test	One sample for 50 MT / Section or Part Thereof	IS 1852 / IS 808	i) Up to 3 mm thick $\pm 5\%$ ii) > 3 mm thick $+ 5\%$ - 3% over weights specified in IS 808	(MFOR)	A	J	S	Z		N	
Plate													
a) Weight Tolerances		Unit Weight Test	One sample for 50 MT / Section or part thereof	IS 1852 / IS 1730	$+5\%$ - 2.5% over weights specified in IS 1730	(MFOR)	B	K	*	Z	-	Y	*P/U as per POWERGRID approval
b) Thickness Tolerance		Measurement	One sample for 50 MT / Section or Part Thereof	IS 2062:2006IS 1730 / IS 1852	< 8 mm thick $+ 12.5\%$ - 5% 8 mm - 12 mm $+ 7.5\%$ - 5% over 12 mm $\pm 5\%$	(MFOR)	B	K	*	Z	-	Y	*P/U as per POWERGRID approval



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Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
1	2	3	4	5	6	E							
1.2	Zinc To be procured from POWERGRID approved sources or Imported LME registered source					Zinc Manufacturer TC	B	K	P	W		N	
	Chemical Composition	Chemical Analysis	Every Consignment	IS 209/IS 13229	IS 209/IS 13229	TPL Reports	D	L	V	W		N	
	Chemical Composition	Chemical Analysis	One sample for 100MT or Part thereof	IS 209/IS 13229	Min Zinc purity 98.5%	TPL Reports	D	L	V	W		N	



STANDARD MANUFACTURING QUALITY PLAN (Doc No C/QA&I/MQPT tower parts/Rev 04)

Manufacturer's Details :-	Customer : POWERGRID	Vendor's Code :	Item : Galvanized Tower Structures / Parts	MQP.No.: Rev. No. : Date:	Valid from: Valid to:
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ANNEXURE - I
Chemical Composition

A) RINL billet/bloom - All values as below are including Tolerance

Element	C18HMn-For HT (E350)	C20 MMn-For MS (E250)
C	0.15- 0.22	0.17- 0.25
Mn	1.1- 1.45	0.6- 1.05
Si	0.10- 0.35	0.10- 0.35
P	0.045 max	0.045 max
S	0.045 max	0.045 max
Cr	0.08 max	0.08 max
Ni	0.03 max	0.03 max
Cu	0.03 max	0.03 max
B	0.004 max	0.004 max
Mo	0.005 max	0.005 max
V	0.030- 0.080 for vanadium base 0.010 max for Titanium base	0.010 max
Ti	0.010 max for Vanadium base 0.028-0.050 for Titanium base	
Al	0.015 min for SMS-1 Heats 0.040 max for SMS 2 Heats	0.015 min for SMS-1 Heats 0.040 max for SMS 2 Heats
CE	0.45 max	0.28- 0.42



STANDARD MANUFACTURING QUALITY PLAN (Doc No C/QA&I/MQP/Tower parts/Rev 04)

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		POWERGRID				

B) SAIL (BSP/DSP)- All values as below are including Tolerance

Element	SAIL Tower Grade VI For HT (E350)	C20 MMn-For MS (E250)
C	0.15- 0.22	0.16 -0.25
Mn	1.25- 1.60 for blooms size 350x150mm 1.20-1.60 for other sizes of blooms & billets	0.6-1.05
Si	0.15- 0.30	0.15- 0.30 for DSP 0.10 max for BSP
P	0.047 max	0.047 max
S	0.047 max	0.047 max
S+P	0.090 max	0.090 max
Cr	0.20 max	0.20 max
Ni	0.05 max	0.05 max
Cu	0.10 max	0.10 max
B	0.005 max	0.005 max
Mo	0.05 max	0.05 max
V	0.03 min for blooms of 160 mm and above 0.025 min for billets and blooms upto 150 mm	As per Test Certificate
Nb	Actual, 0.015 min if added alone	-
	0.36 -0.45 for BSP & 125x125 mm billet of DSP	
CE	0.38-0.47 for DSP billet above 125x125 mm	0.28- 0.42



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C. Jindal :Chemistry of billets (Laddle):

Element	C18 HMn-HT (E350)	C20 MMn-For MS (E250)	C18 MMn-For MS (E250)
C	0.15- 0.20	0.17- 0.23	0.15- 0.21
Mn	1.20- 1.50	0.6-1.0	0.6-1.0
Si	0.15- 0.30	0.10- 0.40	0.10-0.40
P	0.03 max	0.040 max	0.040 max
S	0.03 max	0.040 max	0.040 max
Cr	0.07 max	0.07 max	0.07 max
Al	0.015 min	0.010 min	0.010 min
Ni	0.07 max	0.07 max	0.07 max
Cu	0.10 max	0.10 max	0.10 max
Mo	0.07 max	0.07 max	0.07 max
V or Nb	0.030 min or 0.015 min respectively	-	-
V+Nb+Ti	≤0.25	≤0.25	≤0.25
CE	0.45 max	0.42 max	0.42 max

Permissible variation in Jindal Chemistry in angles specified max or under min limits-

C-0.02, Mn-0.03, S-0.005, P-0.005



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D. Adhunik Metaliks: Chemistry of billets:

Element	C18 HMn-HT (E350)	C20 MMn-For MS (E250)
C	0.15- 0.20	0.17- 0.23
Mn	1.20- 1.50	0.6-1.0
Si	0.15- 0.30	0.10- 0.40
P	0.04 max	0.04 max
S	0.04 max	0.04 max
Cr	0.06 max	0.06 max
Al	0.020 min	-
Ni	0.08 max	0.08 max
Cu	0.07 max	0.07 max
Mo	0.03 max	0.03 max
V	0.030 min	-
Ti	0.01 max	0.01 max
Sn	0.015 max	0.015 max
CE	0.43 max	0.39 max

Permissible variation in Adhunik Metaliks Chemistry in angles specified max or under min limits-

C-0.02, Mn-0.03, S-0.005, P-0.005, Si-0.03



STANDARD MANUFACTURING QUALITY PLAN (Doc No C/QA&I/MQP/Tower parts/Rev 04)

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E. Jayaswal Neco Industries Ltd Chemistry

Element	C18 HMn-HT (E350)	C20 HMn-HT (E350)	C18 MMn MS (E250)	C20 MMn- MS (E250)
C	0.15- 0.20	0.15- 0.20	0.15- 0.20	0.17- 0.23
Mn	1.20- 1.50	1.20-1.50	0.6-1.0	0.6-1.0
Si	0.15- 0.35	0.15- 0.35	0.15-0.35	0.15-0.35
P	0.035 max	0.035 max	0.035 max	0.035 max
S	0.035 max	0.035 max	0.035 max	0.035 max
V	0.030 min	0.030 min	-	-
Al	0.015 -0.035	0.015 -0.035	0.010-0.035	0.010-0.035
CE	0.38-0.42 max	0.38-0.42 max	0.41 max	0.41 max

Permissible variation in Jayaswal Neco Industries Ltd Chemistry in angles specified max or under min limits-

C- 0.02, Mn- 0.05

Max value of Trace Elements-
Cu-0.10, Sn- 0.10, Cr- 0.05, Ni- 0.05, Mo- 0.05



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Manufacturer's Details :-	Customer :	Vendor's Code :	Item :	MQP.No.:	Valid from:
	POWERGRID		Galvanized Tower Structures / Parts	Rev. No. : Date:	Valid to:

F) Visa Steel Limited : Chemical Composition

Element (%)	C18 HMn-HT (E350)	C20 HMn-HT (E350)	C18 MMn-For MS (E250)	C20 MMn-For MS (E250)
C	0.15 - 0.20	0.17 - 0.20	0.15 - 0.20	0.17 - 0.21
Mn	1.20 - 1.50	1.20 - 1.50	0.60 - 1.00	0.60 - 1.00
Si	0.15 - 0.35	0.15 - 0.35	0.15 - 0.30	0.15 - 0.30
P	0.035 max	0.035 max	0.035 max	0.035 max
S	0.035 max	0.035 max	0.035 max	0.035 max
Cr	0.05 max	0.05 max	0.05 max	0.05 max
Al	0.020 min	0.020 min	0.025 max	0.025 max
Ni	0.05 max	0.05 max	0.05 max	0.05 max
Cu	0.05 max	0.05 max	0.05 max	0.05 max
Mo	0.05 max	0.05 max	0.05 max	0.05 max
V	0.030 min	0.030 min	-	-
Ti	0.010 max	0.010 max	0.010 max	0.010 max
V+Nb+Ti	0.15 max	0.15 max	0.15 max	0.15 max
CE	0.44 max	0.44 max	0.39 max	0.39 max

Permissible variation in Visa Steel Limited in angles specified max or under min limits-

C - 0.02, Mn - 0.03, S - 0.005, P-0.005, Si - 0.03



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	POWERGRID				

G. Usha Martin Ltd: Chemistry of MS & HT billets excluding tolerance

Element	C18HMn-For HT (E350)	C20 MMn-For MS (E250)	C18 MMn for MS (E250)
C	0.15- 0.20	0.17- 0.23	0.15- 0.21
Mn	1.20- 1.50	0.6- 1.00	0.6- 1.00
Si	0.15- 0.30	0.10-0.40	0.10-0.40
P	0.03 max	0.04 max	0.04 max
S	0.03 max	0.04 max	0.04 max
Cr	0.07 max	0.07 max	0.07 max
Ni	0.10 max	0.07 max	0.07 max
Cu	0.10 max	0.10 max	0.10 max
Al	0.015 min	0.002 min	0.002 min
Mo	0.010 max	0.010 max	0.010 max
V	0.030 min	-	-
V+Nb+Ti	≤0.25	≤0.25	≤0.25
CE	0.45 max	0.42 max	0.42 max



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H.Electrosteel Steels Ltd: Chemistry of MS & HT billets including tolerance

Element	C18HMn-For HT (E350)	C20 MMn-For MS (E250)
C	0.15- 0.22	0.17- 0.25
Mn	1.2- 1.50	0.6- 1.00
Si	0.10- 0.35	0.10- 0.35
P	0.045 max	0.045 max
S	0.045 max	0.045 max
Cr	0.08 max	0.08 max
Ni	0.03 max	0.03 max
Cu	0.03 max	0.03 max
B	0.004 max	0.004 max
Mo	0.005 max	0.005 max
V	0.030- 0.060	0.005 max
CE	0.36 to 0.45	0.28- 0.42



STANDARD MANUFACTURING QUALITY PLAN (Doc No C/QA&I/MQP/Tower parts/Rev 04)

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I.Monnet Ispat & Energy Ltd: Chemistry of MS & HT billets including tolerance

Element	C18HMn-For HT (E350)	C20 MMn-For MS (E250)	C18 MMn for MS (E250)
C	0.17- 0.21	0.18- 0.22	0.16- 0.20
Mn	1.20- 1.35	0.6- 0.8	0.6- 0.8
Si	0.15- 0.30	0.15-0.30	0.15-0.30
P	0.03 max	0.04 max	0.04 max
S	0.03 max	0.04 max	0.04 max
Cr	0.05 max	0.05 max	0.05 max
Ni	0.05 max	0.05 max	0.05 max
Cu	0.05 max	0.05 max	0.05 max
Mo	0.05 max	0.05 max	0.05 max
V	0.025 min	-	-
V+Nb+Ti	≤0.15	≤0.15	≤0.15
CE	0.45 max	0.42 max	0.42 max

For Al killed- 0.02% Al is maintained



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J.JSW Steel Ltd: Chemistry of MS & HT billets including tolerance

Element	C18 HMn-HT (E350)	C20 MMn-For MS (E250)	C18 MMn-For MS (E250)
C	0.15- 0.21	0.17- 0.23	0.15- 0.21
Mn	1.20- 1.50	0.6-1.0	0.6-1.0
Si	0.10- 0.35	0.10- 0.35	0.10-0.35
P	0.04 max	0.040 max	0.040 max
S	0.03 max	0.040 max	0.040 max
Cr	0.07 max	0.07 max	0.07 max
Al	0.015 min-0.06 max	0.010 min	0.010 min
Ni	0.07 max	0.07 max	0.07 max
Cu	0.10 max	0.10 max	0.10 max
Mo	0.07 max	0.07 max	0.07 max
V /Nb	0.025 min or Nb 0.015min	-	-
V+Nb+Ti	≤0.20	≤0.25	≤0.25
CE	0.45 max	0.42 max	0.42 max



STANDARD MANUFACTURING QUALITY PLAN (Doc No C/QA&I/MQP/T tower parts/Rev 04)

Manufacturer's Details :-	Customer : POWERGRID	Vendor's Code :	Item : Galvanized Tower Structures / Parts	MQP.No.: Rev. No. : Date:	Valid from: Valid to:
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K) Electrotherm India Pvt Ltd

Element	C18 HMn-HT (E350)	C20 MMn-For MS (E250)	C18 MMn-For MS (E250)
C	0.15- 0.21	0.17- 0.23	0.15- 0.21
Mn	1.20- 1.50	0.6-1.0	0.6-1.0
Si	0.10- 0.35	0.10- 0.35	0.10-0.35
P	0.04 max	0.040 max	0.040 max
S	0.04 max	0.040 max	0.040 max
Cr	0.10 max	0.10 max	0.10 max
Al	0.02 min	0.02 min	0.02 min
Ni	0.07 max	0.07 max	0.07 max
Cu	0.07 max	0.07 max	0.07 max
Mo	0.07 max	-	-
V /Nb	0.025 0.050	-	-
V+Nb+Ti	≤0.20	-	-
CE	0.45 max	0.42 max	0.42 max



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L) Shreeyam Power Pvt Ltd

Element	C18 MMn-For MS (E250)
C	0.15- 0.21
Mn	0.6-1.0
Si	0.10-0.30
P	0.040 max
S	0.040 max
Cr	0.07 max
Al	0.015 min
Ni	0.07 max
Cu	0.07max
Mo	0.07 max
V	-
CE	0.42 max



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M) Bhushan Steel Ltd

Element	C18 HMn-HT (E350)	C20 MMn-For MS (E250)
C	0.15- 0.21	0.17- 0.23
Mn	1.20- 1.60	0.6-1.0
Si	0.35 max	0.35 max
P	0.04 max	0.040 max
S	0.04 max	0.040 max
Cr	0.12 max	0.12 max
Al	0.01 min	0.01 min
Ni	-	-
Cu	-	-
Mo	0.07 max	-
V	0.030 min	-
V+Nb+Ti	≤0.20	-
CE	0.45 max	0.42 max



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B. In Process Inspection

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
2.0	INPROCESS INSPECTION Fabrication of Tower Parts			IS 802 Part II/ IS 7215/ Power Grid approved Dwg.. Shop Sketches									
(a)	Straightening	Visual	100%		Length Tolerance ± 2 mm The cut surface to be clean, reasonable square & free from distortion Letter size as per Power Grid Specn. / TPL norms	MFOR							
(b)	Cropping (Cutting)	Dimensional	1st Piece and every 50th Piece				A	J	S	Z	-	N	
(c)	Stamping	Visual	1st Piece and every 50th Piece				-do-	A	J	S	Z	-	N



Manufacturer's Details :-				
Customer :	Vendor's Code :	Item :	MQP.No.: Rev. No. : Date:	Valid from: Valid to:
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(d)	Punching / Drilling	Dimensional	1st Piece and every 50th Piece		-do-	A	J	S	Z	-	N	
				Holes for bolts shall be drilled or punched with a jig but drilled holes shall be preferred. The punching may be adopted for thickness up to 12 mm. Tolerances regarding punch holes should be as follows: a)Holes must be perfectly circular and no tolerances in this respect are possible. b)The maximum allowable difference in diameter of the holes on the two sides of plates or angle is 0,8mm,i.e the allowable taper in a punched hole should not exceed 0,8mm on diameter. c)Holes must be square with the plates or angles and have their walls parallel.								



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B. In Process Inspection

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
(c)	Edge Security	Dimensional	1st Piece and every 50th Piece	IS 802 Part II/ IS 7215/ Power Grid approved Drwg. Shop Sketches		-do-	A	J	S	Z	-	N	
(i)	For 13.5 mm dia Hole				Sheared 20mm Min. Rolled 16mm Min.								
(ii)	For 17.5 mm dia Hole				Sheared 23mm Min. Rolled 20mm Min.								
(iii)	For 21.5 mm dia Hole				Sheared 28mm Min. Rolled 25mm Min.								
(iv)	For 25 mm & 25.5 mm dia Hole				As per approved Drawing								
(f)	Drilling & Punching Hole To Hole Distance		1 st Piece and every 50th Piece		Tolerance cumulative and between consecutive hole shall be within ± 2 mm and ± 1 mm respectively	-do-	A	J	S	Z	-	N	
(g)	Notching Flange Cut Corner Cut Bevel Cut		1 st Piece and every 50th Piece		+ 5mm on specified length of cut operationally shearing up to 12 mm thick by gas cutting for material above 12 mm thick	-do-	A	J	S	Z	-	N	



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B. In Process Inspection

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
(h)	Heel Cutting	Dimensional	1 st Piece and every 50th Piece	Power Grid Approved Drawgs./ Shop Sketches	for members > 12mm thick gas cutting to be adopted followed By grinding/Machine cutting. Tolerance on heel cutting length +10mm (1) HT Sections / Plates All Sections & all plates to be hot bent.	-do-	A	J	S	Z	-	N	
(i)	Bending		100% Pieces	IS 802 (Part II)/ IS 7215/ Power Grid Approved Drawing / Shop Sketches	(2) MS Section i) Cold - Section upto 75X75X6 - Angle Upto 10° ii) Cold - Section upto 100X100X8 - Angle Upto 5° iii) Hot - Section above 75X75X6 - Angle Above 10° iv) Hot - Section above 100X100X8 - Angle Above 5° (3) M. S. Plates i) Cold Upto 12 mm thick Upto 15° ii) Hot - Others	-do-							
						-do-							



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B. In Process Inspection

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
(j)	Welding	(a) WPS Approval (Welding procedure specification) (b) PQR/WQR Approval (Procedure /Welder qualification record)		As per Power Grid Technical specn./approved Dwg./Power Grid approved Welding procedure & Welder's qualification		-do-							WPS approval by POWERGRID
							A	J	U	Y	-	N	CIP at black stage for welded members
	Welding	(1) DP Test (2) Dimensional & visual for welded tower parts	Random Basis	-- do ---		-do-	A	J	U	Z	-	N	CIP
(k)	Final Inspection of Fabricated Parts		Random Basis			-do-	A	J	S	Z	-	N	
(l)	Foundation Bolts i) Cutting & Shearing ii) Chamfering iii) Threading	Physical	1 st piece & every 50 th piece	All parameters from (a) to (j) above are checked and record maintained before releasing the materials for galvanizing. IS 802/Powergrid technical spec./approved drawing		MFOR	A	J	S	Z		N	



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B. In Process Inspection

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
3.0	GLAVANIZING (Surface Preparation Procedure)												
3.1	Degreasing	Chemical	One sample daily	IS 2629	Manufacturer's plant standard/IS	-do-	A	J	S	Z	-	N	
3.2	Pickling	Chemical	One sample daily	IS 2629	Manufacturer's plant standard/IS	-do-	A	J	S	Z	-	N	
3.3	Rinsing	Chemical	One sample daily	IS 2629	Iron contents 100 to 120 gram/litre. Max Manufacturer's plant standard/IS	-do-	A	J	S	Z	-	N	



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B. In Process Inspection

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
3.4	Pre Fluxing	Chemical	One sample daily	IS 2629	IS 2629	-do-	A	J	S	Z	-	N	
3.5	Pre-heating	Measurement	One check per day	IS 2629	IS 2629	-do-	A	J	S	Z	-	N	
3.6	Dipping After drying is over the material is dipped in molten zinc. Following parameters are controlled					-do-	A	J	S	Z	-	N	
	a) Zinc bath temperature Recording is done by graphical manner OR sensors with digital display		Hourly check	IS 2629	450+/-10° C	-do-	A	J	S	Z	-	N	
	b) Immersion & Withdrawal time. Degree of immersion and withdrawal time is decided based on thickness and length of material			IS 2629	IS 2629	-do-	A	J	S	Z	-	N	
3.7	Quenching in Running Water: After dipping the material is quenched in running water			IS 2629	IS 2629	-do-	A	J	S	Z	-	N	
3.8	Dichromating : After quenching, material is dipped in sodium dichromatic solution to avoid the white rust. (Proprietary Chemicals)		One Sample daily	IS 2629	IS 2629	-do-	A	J	S	Z	-	N	



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B. In Process Inspection

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
4.0													
(a)	Galvanizing Checking Visual Checking	Visual	100%	IS 2629	Surface to be free from defects like bare / black spots, (except when small and suitable for patching) heavy ash & flux inclusions, lumps, pimples, runs etc The minimum average zinc coating for all section shall be 87 microns for thickness $\geq$ 5 mm & 65 microns for thickness < 5mm and for plates	-do-	A	J	S	Z	-	N	*For marine mentioned in BPS, $\geq$ 5mm=127 micron, <5mm & plate=87 micron *For marine, $\geq$ 5mm=900 gm/ m ² , <5mm & plate=610 gm/ m ²
(b)	Thickness of Zinc coating	Measurement	8 samples / shift	IS 4759		-do-	A	J	S	Z	-	N	
(c)	Weight of Zinc coating	Measurement	3 samples / shift	IS 4759 / IS 6745	(a) For thickness below 5mm, but not less than 2 mm and for plates- Average Mass of Coating -460gm/m ² (b) For thickness 5mm & above - Average Mass of Coating - 610 gm/m ²	-do-	A	J	S	Z	-	N	
(d)	Uniformity of Zinc coating	Measurement	3 samples / shift	IS 2633	Material to withstand 4 dips of one minute each without showing signs of copper deposits	-do-	A	J	S	Z	-	N	
(e)	Adhesion Tests of Zinc coating	Pivoted Hammer Test	3 samples / shift	IS 2629	No removal or lifting of coating in areas between hammer impressions	-do-	A	J	S	Z	-	N	



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C. Final Inspection & Testing

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
5.0	FINAL INSPECTION & TESTING (Inspection Engineer to Check/ensure compliance to notes/General Requirements given on Notes of MQP.												
(a)	VISUAL & DIMENSIONAL INSPECTION For Fabrication (as per approved dwg.) & Galvanizing	Visual & Measurement	One sample for Every 50 MT/ section/Lot or part thereof	Please refer Sr. No 2(a) to 2(f) & Cl. No. 4.3 (a)	Please refer Sr. No 2(a) to 2(f) & Cl. No. 4.3 (a)	Test Report	A	J	U	Z			Y CIP
(b)	MECHANICAL PROPERTIES	(i) UTS Test (ii) Yield Stress Test (iii) Percentage Elongation Test (iv) Bend Test	One sample for Every 50 MT/ section/Lot or part thereof	Please Refer (for test values) Sr. No. 1.1.1(a), (b) (c), (d)	Please Refer (for test values) Sr. No. 1.1.1(a), (b) (c), (d)	Test Report	A	J	U	Z			Y CIP
(c)	Chemical Properties (only applicable for black angle sections procured from, POWERGRID approved sources on self certification basis (without stage CIP by POWERGRID at source place)	Spectro Analysis	-do-	IS 2062:2011	Chemistry needs to be comparable with approved supplier TC	Test Report	A D	J L	U V	Z			Y CIP



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C. Final Inspection & Testing

Sr. No.	Components/ Operation & Description of Test	Type of Check	Quantum of Check / Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
(c)	GALVANIZING TESTS	i) Thickness of Zinc Coating ii) Weight of Zinc Coating iii) Uniformity of Zinc Coating iv) Adhesion Test of Zinc Coating	One sample for Every 50 MT/ section and part thereof	IS 2629/IS 4759/IS 6745/IS 2633/	Please refer CL 4.0	Test Report	A	J	U	Z	-	Y	CIP
	For Foundation bolt- a) Dimensional test	Measurement	Sampling as per IS 1367/2500	Powergrid Drawing	Powergrid Drawing	Test Report	A	J	U	Z	-	Y	CIP
	b) Mechanical Test UTS, Yield & Elongation	Mechanical	2 sample per heat/cast/lot of 100MT	As per IS 2062/SAE 1018	As per IS 2062/SAE 1018	TPL Report							
	c) Chemical Test	Spectro Analysis	2 sample /heat/cast/lot or part thereof	-do-	Chemistry needs to be comparable with raw material supplier TC								
6.0	Packing, Storing, Bundling and Handling	100 %			IS802/PowerGrid specn./Packing list to be submitted along with dispatch documents	Tower manufacturer's Log Book/Format No							Pieces of light sections to be wire bundled and heavy sections to be supplied loose. Stacking to have proper ventilation and kept inclined. Damage to galvanization coating to be avoided while handling. to ensure sequential supplies and other details as per PowerGrid technical specification.



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NOTES/GENERAL REQUIREMENTS TO BE CHECKED/ENSURED

- (1) The manufacturer if purchasing the steel sections directly from the re-rollers, the POWERGRID approved re-roller MQP to be ensured.
- (2) Nuts & Bolts and Step Bolts & Nuts & other bought out items to be procured from Power Grid approved sources and inspection at sub-vendor's works.
- (3) Welding procedure and Welder's performance qualification approval by POWERGRID is required in case welding is involved at any stage of fabrication/erection.
- (4) All bent pieces shall be checked at the process of bending by a bend gauge made as per bend ratio/degree shown in the sketch of the item/mark no. On the stand one piece is thoroughly checked with bend gauge and all other pieces are checked by comparison method and pieces are cleared for further process. If the holes are to be made near the bend line the same shall be done after bending.
- (5) The sample pieces consumed in a testing shall be replenished by the manufacturer at the time of dispatch. If the offered material meets the quality requirements, CIP/MICC shall be issued for total quantity offered without deducting the weight of materials consumed in testing.
- (6) Power Grid Specification means Power Grid Technical Specification, Approved Drawing, Approved Technical data sheet and LOA provisions applicable for the specific contract.
- (7) Grades of steel used and the standards to which they conform shall be as approved by Power Grid Engineering for the specific contract and shall be indicated in approved Drawings/ BOM/offer list at the time of inspection.
- (8) Steel plates below 6 mm used for packing plates/Packing washers shall be as per POWERGRID specification/ approved drawings by Engineering Department. Produced as per IS 1079 1994 (Grade-O) are also acceptable however if below 6 mm thickness plates are used as load bearing plates viz. gusset plates, Joint splices etc. same shall confirm to IS 2062 or equivalent standard.
- (10) The manufacturer shall maintain proper co-relation of test certificate with respect to the material from raw material stage to finished material stage (whether procured from **POWERGRID approved sources on self certification basis** i.e no stage CIP or POWERGRID approved re-rollers)
- (11) The manufacturer shall strip off galvanizing of rejected material before re-galvanizing in case rejection is due to galvanizing defects.
- (12) The manufacturer shall dispose off entire section rejected in physical testing by gas cutting or by machine cutting from any end of rejected mark number.
- (13) In case of any contradiction between Technical Specification / Approved Drawing and MQP, the details mentioned in the Technical Specification / Approved Drawing shall be final.
- (14) The manufacturer should progressively align their Quality System and sub-vendors Quality System to the requirements of ISO 9000 series Quality Standards and in due course of time should get their quality system certified to ISO 9001.
- (15) The manufacturer to ensure that all measuring & testing equipments is having valid calibration certificate issued by NABL accredited testing agency only.
- (16) Inspection of angle sections at black stage for galvanised tower structures/parts, irrespective of specific contract can be followed as detailed hereunder:



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- (a) The manufacturer may raise inspection call for angle section at black stage at re-roller's work against any one of the ongoing Contract.
- (b) The manufacturer may fabricate the raw material cleared under CAT –A CIP for a particular contractor, for any of your projects under execution. Your fabricator may do so against specific instruction from you in this regard.
- (c) The fabricator (i.e. you) will maintain a separate register indicating splitting and swapping of material between different Projects awarded to same contractor, which can be reviewed by Powergrid inspection engineer, separate register for each Contractor is to be maintained if the fabricator is executing jobs for different contractor.
- (d) The fabricator as a contractor on whom POWERGRID has placed the contract, will only be allowed to split and swap materials in black stage only between your different ongoing contracts with POWERGRID, without any obligation to POWERGRID.
- (e) The final inspection after fabrication and galvanizing, however, will continue to be contract wise and CIPs will be issued for each contract only.
- (17) Pieces of light sections to be wire bundled & of heavy sections to be supplied loose. Stacking to have proper ventilation and kept inclined. Damage to galvanization coating to be avoided while handling. The fabricator to ensure sequential supplies and other details as per POWERGRID Technical Specification
- (18) Prior approval of POWERGRID is required to be taken for any activity or process that is out sourced.
- (19) In case tower part to be used at sub zero temperature, we may carry out Impact testing at -20° C during final inspection in line with IS/ POWERGRID TS.
- (20) All relevant IS standards shall be read along with the latest amendments.
- (21) Dispatch of the inspected towers shall be done with each tower / panel wise bundling in order to ensure availability of complete tower parts without missing of any member at site.

